Progress Report to NOAA
November 2007 – October 2008

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Director-General Statement

The past year has seen several accomplishments for the IRI. We were pleased to receive support from Google to develop a project focused on improved practices in the health community of East Africa, based on use of climate information. This project allows for significant stakeholder engagement in climate and health communities, a process that will allow demands for climate information to be articulated, and then capacity developed within national and regional meteorological institutions for the delivery of that information. We hope this will serve as a model for subsequent projects throughout the region.

IRI formalized a partnership with the International Federation of the Red Cross and Red Crescent Societies this past year. Our engagement has been at both the global and also regional levels. On the global scale, IRI is helping to collect, process, and provide additional tailoring of forecast information at the weather as well as seasonal timescale. The information is being delivered through the IRI Data Library and Map Room facilities that we have been developing over recent years. The International Federation is utilizing the information to provide alerts and early warnings to regional and national offices, in order to prepare for possible disaster events in advance. The Federation has, through this process, launched the program "Early Warning, Early Action", which represents a fundamentally new mode of operation - one that can utilize climate information to improve outcomes and increase effectiveness in the management of weather and climate related natural disasters. In addition, programs developed with regional/national offices of the International Federation in West Africa and Central America have built awareness and capacity, and set the stage for improved decision making at these levels. Internships for several of the Columbia University Climate and Society Master's students were provided within the IFRC settings, an arrangement that has been hugely successful from all perspectives. This partnership is of enormous value for IRI's mission, to enable the design of improved practices, and the widespread dissemination of new knowledge and information to vulnerable communities at scale throughout the world.

A third arena of major activity this year is that of weather index insurance. Index insurance is being rapidly recognized as a potentially valuable tool to help manage climate related risk, particularly in the agriculture sector. Working with Swiss Re, and in association with the Global Humanitarian Forum, IRI hosted a high level Roundtable on Index Insurance last June. The event brought global leaders together to discuss some of the key questions surrounding the use of index insurance as a tool for improving development outcomes in less developed countries - including priorities for further research. Subsequently, IRI hosted a more technical workshop to further delve into these research questions, and articulate needs. The second edition of our flagship publication the Climate and Society series will focus on the issue of index insurance, and bring together the outputs from these events and additional forums. In addition to all of this IRI continues with a variety of projects investigating index insurance, working together with the World Bank, Oxfam America, and others.

Two other highlights of the period are the initiation of activities to increase our capacity in the area of project impact evaluations, and the design of several prototype knowledge management
platforms in the areas of health, agriculture, water, and fire management. The former is being addressed through a seminar series and subsequent workshop that we are planning now, as well as analysis of selected ongoing projects from an impact evaluation perspective. The latter represent initial efforts toward building platforms to assist in capturing, distilling, and disseminating relevant knowledge, information, and tools to support climate risk management practices within sectoral communities - an important part of the goal IRI has set for itself in the area of global outreach.

These, and many other activities and accomplishments are highlighted in the following pages. Overall, they point to continued progress in targeted research and demonstrations, and new opportunities in partnerships, outreach and awareness raising that help us toward the most challenging part of our mission - contributing to improved policy and practice of climate risk management at the scale of societies. We look forward to building on these successes in the future.

Stephen E. Zebiak

Outreach

The IRI is committed to raising awareness about practical ways decision makers use climate information as well as communicating emerging innovations in research areas at the IRI. One area of effort involves the regular publication of features available at http://iri.columbia.edu. We have seen growing interest in these stories, which are now linked to a number of humanitarian and relief oriented news organizations. Another area of effort involves the creation of publicly available resources called ‘map rooms’ incorporating sets of information derived from the IRI data library and tailored to the needs of specific user groups. Examples of these products follow.
The award is part of Google.org’s Predict and Prevent program, which funds projects and technologies that help map “hot spots” of global emerging infectious diseases and develop improved early-warning systems that predict potential disease outbreaks. By arming resource-poor countries with the information to protect themselves from often fatal but preventable infectious diseases, communities can better prevent both illness and death.

“Google.org recognizes just how important the climate-disease connection is to preventing illnesses, saving lives and protecting livelihoods,” said Stephen Zebiak, the IRI’s director-general. “The IRI, a leader in the use of climate information in disease prevention, is committed to putting this generous grant to critical use in vulnerable areas.”

Climate plays a critical role in determining the distribution of many of Africa’s epidemic diseases, such as malaria and meningitis. Their transmission is dependent on prevailing environmental conditions such as rainfall and temperature. Year-to-year variations in the amount of rainfall and temperature can therefore change the pattern and timing of epidemics. This makes it difficult for poor countries to plan their public health strategies.

But the link between climate and some diseases means that seasonal forecasts, satellite measurements and other data can be useful in making decisions about how much resources to allocate for an upcoming epidemic season, and when and where to allocate them. “IRI’s work has shown that climate information is a vital tool to helping identify hot spots where diseases may emerge. We’re thrilled that they’ll link climate and health specialists in the effort to predict and prevent the next pandemic,” said Frank Rijsberman, program director at Google.org.

The IRI will launch its newly-funded project in Ethiopia, where it will focus initially on malaria and meningitis-two diseases of particular concern to the country’s Ministry of Health. The work builds on the IRI’s experience in developing a malaria early-warning system for Southern Africa, in partnership with the World Health Organization. The institute has worked closely with state meteorological and health agencies to use seasonal forecasts, satellite measurements and other data to inform resource allocation decisions for preventing and treating disease outbreaks.

“The first step is to bring the climate and health communities together in an ongoing fashion,” says Stephen Connor, a lead scientist on the project. “The National Meteorological Agency in Ethiopia needs to provide usable information to the health specialists, and the health specialists have to be trained to understand this information, as well as be in a position to ask for other types of information they might need.”

With this in mind, the IRI has helped facilitate a Climate and Health Working Group in Ethiopia, chaired by the Ministry of Health and the National Meteorological Agency. The group organized a scientific and technical workshop last month in Addis Ababa, bringing together climate and health professionals from different parts of the country. More than 70 people attended, representing both health and climate communities. They reviewed the types of climate information health professionals currently use, as well as the information they desperately need to make their prediction and prevention capabilities stronger. Similar meetings are planned for the future.

“This meeting served to bridge the gap between data providers and users,” says IRI scientist Tufa Dinku, who helped organize the meeting. “The meteorological community heard the needs of the health community, and the health professionals realized how useful climate information could be for their activities. Some health professionals didn’t even know their regions had meteorological offices that could have been providing them useful climate information,” he said.

A key component of the grant is to fund two scientists from Ethiopia’s National Meteorological Agency to receive six months of training at the University of...
Reading to improve Ethiopia’s rainfall data sets. Another scientist will come to the IRI to develop forecasting tools for seasonal climate variability tailored to the needs of the health community.

The project will ultimately lead to the development of disease-mapping tools and other applications. These will be housed in the IRI’s open-access Data Library and Map Rooms, and can be readily viewed and queried in web-browser platforms such as Google Earth.

The first phase of this project includes collaboration with numerous partners, including the IGAD Climate Prediction and Application Center (ICPAC), the World Health Organization, the Ethiopian Anti-Malaria Association, The World Agroforestry Centre (ICRAF) and The Liverpool School of Tropical Medicine.

The IRI will also be a technical consultant on another Google.org Predict and Prevent grant, awarded to the University Corporation for Atmospheric Research (UCAR) and the National Center for Atmospheric Research (NCAR). This project aims to build a decision support system that public health workers can use to anticipate and respond to meningitis epidemics in Africa. The UCAR project is seeking to build a partnership with the Meningitis Environmental Risk Information Technologies (MERIT) project consortium currently supporting the deployment of the new conjugate A vaccine in Africa.

Torrential rains lashed West and Central African countries this rainy season, setting off flooding and causing considerable damage. On the evening of June 26th alone, nearly 200 millimeters of rain fell on the villages of Malem Hoddar and Malem Thierigne in eastern Senegal. The ensuing flash floods killed at least one person, displaced dozens of families and destroyed hundreds of homes and livestock. As usual, the regional Red Cross office in Dakar mobilized its vast network of donors and volunteers to respond to this and other events. But this season, the organization also did something fundamentally different in its operations.

Rather than wait for the flooding to happen, the International Federation issued an appeal for supplies weeks before any event occurred. It based the appeal on seasonal rainfall forecasts that showed a strong chance of above-average precipitation for the area for the upcoming rainy season.

“It’s a revolution,” says Pablo Suarez, Associate Program Director at the Red Cross/Red Crescent Climate Center. “Not only was this the first time a particular zone in West Africa used a particular forecast, it was the first time in the history of the Red Cross/Red Crescent movement that science-based information about something likely to happen was used to ask for aid,” he says.

A key player in this transformation was an IRI intern and Climate and Society masters student named Arame Tall. In early June, Tall went to work with the Disaster Management Unit of the Red Cross office for West and Central Africa (IFRC-WCAZ), based in Dakar, to find
ways to incorporate forecasts and other climate information into Red Cross decision making.

Halfway across the globe, Tall’s classmates, Sarah Abdelrahim and Lisette Braman, were on a similar mission in Panama, working with forecasters at the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC).

The internships were the latest example of the ongoing, expanding partnership between the International Federation of Red Cross and Red Crescent Societies and the IRI.

Flooding: A recurring menace

In recent years, West and Central African countries have been devastated by severe, deadly floods. In 2007, they affected more than 800,000 people in the region. They destroyed homes and infrastructure, devastated crops and left thousands homeless.

That’s why a tool that could alert users about upcoming flood risks would be immensely helpful to both communities and response organizations such as the Red Cross.

Prior to starting her internship, Arame Tall attended the annual meeting of Previsions Saisonnieres en Afrique de l’Ouest (PRESAO) in Niamey, Niger. PRESAO issues climate forecasts for West Africa and is coordinated by the African Centre of Meteorological Application for Development (ACMAD). As it happened, the forecast for the July-August-September rainy season predicted high probabilities of wet and very wet conditions for the region.

Tall and her new colleagues at IFRC-WACZ immediately saw the utility in such a forecast and they used it as the basis to draft a donor appeal for buying and stockpiling relief supplies for 47,500 people in case floods did occur.

As it turns out, floods have already hit the region numerous times this rainy season, resulting in at least seven deaths and the displacements of hundreds of families.

“The appeal constitutes a major achievement and constitutes a positive instance of climate information duly transmitted and acted on,” Tall writes in her final report to the IRI and IFRC. “It also proves that finding donors to fund preparation may not be as difficult as we think, and debunks the idea that the donor community is insensitive to preparation efforts.”

During her internship in Dakar, Tall helped the IFRC-WACZ leadership develop a list of climate products that, if made readily available, could potentially increase disaster preparedness. These include the PRESAO forecasts, the IRI 6-day rain anomalies forecast, daily ACMAD bulletins and others. She then assisted the organization to formalize relations with both ACMAD and other forecasting agencies in the region.

“In just two months, the IFRC-WCAZ went from using no climate information to obtaining a whole suite of climate products systematically transmitted by its new regional climate partners,” says Tall, who is currently working as a consultant to the Red Cross Climate Centre.

Bolstering Disaster Preparedness in Central America

In terms of land area, Central America makes up a small portion of the Latin American and Caribbean region. But more than a third of emergency appeals to the Red Cross’s Pan-American Disaster Response Unit (PADRU) come from Central America and Mexico. Between 2001 and 2007, PADRU responded to more than 100 disasters, half of which were floods. Floods occur with significantly less forewarning than hurricanes, which are the region’s other major weather threat and are well-tracked. Advanced warning of heavy rainfall and flooding could provide the opportunity to evacuate communities, preposition supplies, mobilize volunteers and save lives. As of now, this kind of monitoring isn’t widely practiced in the region.

Lisette Braman and Sarah Abdelrahim went to Panama hoping to help change the situation. They spent the summer assessing disaster-response operations in the region. Their goals were not only to review the climate and weather monitoring and forecasting tools made available by CATHALAC and other agencies, but also to understand the structure and decision-making process of the Red Cross so that these tools could be tailored to the organization’s specific needs.

» Communication is in Spanish.

» High resolution flood forecast and landslide information available alongside other severe weather/climate information pertinent to disaster management.

» Offer forecasts at multiple time scales, (e.g., 3 days, 2 weeks, 6 months).

» Alerts of severe weather events distributed through an e-mail/text message system.
» Place names are included on the map.

» All information is displayed in one printable map for volunteers to take into the field.

» No jargon.

» Forecast skill and data limitations explicitly and intuitively communicated.

“Hurricanes seem to be the only phenomena which are tracked before causing destruction,” writes Abdelrahim, who is now a program manager at NOAA. “Operations with respect to flooding and landslides are for the most part concentrated in the response and recovery phase.”

The two interns found that forecasts are rarely used to help decision makers plan for potential flooding or landslides.

They concluded that while the tools would give some benefit to the regionally-focused PADRU, they would be even more effective if they were designed for the individual national societies, where decisions regarding disaster preparedness and response are made. This was an important finding, because it contrasts with the situation that Arame Tall faced in West Africa, where decisions and action plans tend to come from the regional offices rather than the individual societies.

“This is why it is so important for the IRI to have expertise and good collaborators in the place in which we work,” says Walter Baethgen, who heads the IRI’s regional program for Latin America and the Caribbean. “The institutional arrangements and their needs for climate information are quite different among the regions where we work, and even very different among countries within the same region.”

Abdelrahim and Braman provided recommendations (see box) and an action plan for how the IRI and CATHALAC could tailor climate tools to better satisfy the Red Cross’s needs, as well as how the Red Cross might best adopt these tools and benefit from their use. The students also worked with CATHALAC on a work plan to provide the Red Cross with high-resolution 48-hour flood forecasts and the ability to anticipate the timing and location of landslides using NASA satellite information.

Climate/Weather Tool Checklist for Disaster Prevention Ideally, a staff member would know within seconds of reading a map or advisory whether the information contained therein is cause for concern. Specific recommendations include:

“A potential next step would be to overlay spatial dis-plays of forecasts with demographic information related to vulnerability and community features, such as hospitals and roads,” writes Braman, who is now working as a technical advisor to the Red Cross Climate Centre.

“These three interns basically parachuted into unfamiliar territory and had to navigate through complex network of organizations, with very limited resources and guidance,” says Suarez. “What they were able to accomplish in just a little over two months is astounding. It’s remarkable how little climate information was being used before they arrived, and how that has changed because of their efforts.”

Inspired by the successes of Tall, Braman and Abdelrahim, the IRI, IFRC and Columbia University are currently trying to find ways to continue to incorporate a humanitarian dimension of student work into the Climate and Society masters program.

09/10/2008
Making Forecasts Friendlier

Flood water on the 80-kilometre gravel road to Buzi off the main high leading from Beira to Harare, Zimbabwe. Alex Wynter/International Federation

A telling forecast can influence decisions on budgeting for mosquito nets and spray, investment in drought resistant crops, and allocation of water resources for an up-coming season. But how are people using forecasts to make decisions? How do they interpret the probabilities presented in each forecast? IRI scientists are constantly thinking of these and other issues to increase the usefulness of their forecasts.
IRI publishes forecasts of seasonal precipitation and temperature for every region of the world. The forecasts are designed as a resource to help developing nations make informed decisions about water, agriculture and disease management. But the uncertainty inherent to climate prediction, plus the probabilistic nature of the forecasts can get in the way of maximizing their utility.

Currently, forecasts are presented as percent likelihoods that a region will experience dryer, wetter and normal rainfall, or hotter, cooler, and normal temperatures during a given season (see Q&A box). This information can be extremely valuable to regions that are prone to drought and flooding, are vulnerable to epidemics of temperature- and humidity-dependent diseases such as malaria, or whose economies depend on small-scale agricultural productivity.

But seasonal forecasts must not only meet the needs of a diverse set of individuals, groups and governments, they must also communicate probabilistic information to a multitude of people who may interpret it in different ways.

“The same forecast may be part of the decision of one farmer to do one thing, and another farmer to do the opposite. There is no simple threshold where one must act in a certain way based on a forecast’s results. One must consider what has been happening in the region recently and other non-climatic factors as well,” says Simon Mason, who runs the IRI’s Climate Program.

On the level of individuals, there may be further ambiguities to consider, says Sabine Marx, associate director at the Center for Research on Environmental Decisions (CRED) and adjunct research scientist at IRI. “There are psychological factors users face in dealing with this information and its uncertainty. This is a cross-cutting issue- finance, health, climate, and all of the fields which involve hedging risk deal with individuals and how they react to risk in different ways. This can factor into any decision made by government leaders or even individual farmers. Some people are risk takers, others are not. It’s hard to control for that human element,” she says.

“Even if you had perfect information and perfect understanding of information, the decision on how to act on a forecast would still not always be clear,” say Marx.

In a recent paper published in the journal Global and Environmental Change, Marx and her colleagues delve into this issue and offer an example: a farmer experienced loss of an early-planted maize crop a few years ago, when the rainy season stopped abruptly for three weeks, causing the entire crop to die. This farmer will be extremely wary and anxious when contemplating whether to plant the current year’s crop early. Even if probabilistic information presented by a forecast suggests that the crop-loss episode was rare, and that early planting makes sense this year, “the negative effect stemming from the previous experience may nonetheless prevail,” the authors write.

This is a result of what Marx refers to as experiential processing, when one “relates current situations to memories of one’s own or others’ experience.” Education and training on how to use and interpret forecasts could help users better manage decisions. “There might be a need for a separate entity altogether that does this...whose goal it is to train those in developing worlds and here in the U.S. to understand and manage forecast information,” says Marx.

IRI is making strides toward these goals by tailoring forecasts to specific needs of individuals and small groups, but individual psychology and inherent uncertainty in climate prediction may never be fully overcome.

A major complaint about the way in which seasonal forecasts are typically presented is that the three categories (see Q&A box) do not give a very clear indication of whether the coming season is likely to be extremely unusual, with potentially large impacts, says Mason.

“’Below-normal’ rainfall, for example, represents a one-in-three-year drought, which in many cases may not be severe enough to take any drastic mitigating action. We are busy implementing a new forecasting system that can provide indications of the possibility of more extreme climate conditions.”

Another complaint is that seasonal forecasts provide information only about average conditions over a certain period. But for many applications, such as agriculture, it can make a big difference if the season’s total rainfall occurs only on a few days when rainfall is very heavy, or over a much larger number of days when rainfall is moderate.
“To address this, the IRI has developed some experimental forecasts that provide information about the expected frequency of rainfall, as well as the total amounts,” Mason says.

Visit the IRI’s Climate Program pages to learn more about forecasts.

08/20/2008
Index Insurance for Ethiopian Farmers

Oxfam America has enlisted the International Research Institute for Climate and Society’s expertise on index insurance to design contracts for poor farmers in a remote village in the Ethiopian highlands. The goal of the project is to improve farmers’ ability to manage drought risks and subsequently gain better access to credit. If all goes well, the two organizations and their local partners hope to export the success to other villages and potentially scale up the program to cover entire districts.

Agriculture accounts for 47 percent of Ethiopia’s gross domestic product, 80 percent of its exports, and 80 percent of its work force, according to the U.S. State Department. Many other economic activities depend on agriculture, including marketing, processing, and export of agricultural products. Small-scale rainfed farming is the dominant form of production and an important subsistence activity.

“Precipitation plays a pivotal role in the country’s welfare. With 98% of its cropland on seasonal rains for irrigation, and so much of the population engaged in farming, a highly susceptible dependence is in effect,” says IRI scientist Paul Block, who is part of the project. “Add in significant year-to-year variability in rainfall, and it becomes clear why farming in Ethiopia has proven to be a difficult livelihood. Unfortunately most farmers have little choice.”

Properly managing the risks of this climate variability is therefore crucial, says IRI’s International Development Officer, Haresh Bhojwani. “A single poor season can force farming families to sell off their productive assets, and it can severely weaken their financial and social networks,” says Bhojwani. “Fear of droughts and losses prevents investment in agriculture even in the good years.”

Oxfam has had longstanding agricultural-development projects in Ethiopia. As a continuation of this commitment, the organization wants to work with local microlending and other companies to provide farmers in Adi Ha (see map) the opportunity to buy index insurance contracts to help reduce their vulnerability to climate shocks.

“With support from the IRI, we are testing ambitious innovations, including new techniques to overcome weather data barriers, meaningful engagement of farmers in contract design, and community-based distribution of payouts in a way that minimizes contract basis risk,” says Raymond C. Offenheiser, president of Oxfam America.

Index-based insurance products for agriculture represent an attractive alternative for managing weather risk. Such products use a weather index such as rainfall, rather than a possible consequence of weather, such as crop failure, to determine payouts to farmers. This subtle distinction resolves a number of fundamental problems that make traditional insurance unworkable in rural parts of developing countries. Unlike traditional crop insurance against crop failure, the insurance company doesn’t need to visit farmers’ fields to determine premiums or to assess damages. Instead, if the rainfall recorded by gauges is below an earlier agreed-upon threshold, the insurance pays out. Such a system significantly lowers transaction costs and makes it viable for insurance companies to sell to small farmers. Having insurance allows those farmers
to apply for and receive bank loans and other types of credit previously unavailable to them.

Pilot programs conducted in several developing countries have proven the feasibility and affordability of such products. They may be able to dramatically reduce climate vulnerability and enable investment and growth. But a critical component to a successful index insurance program lies in the design of the contracts.

“This project provides us with the opportunity to address some of the more challenging issues in index insurance that will need to be addressed to be able to use it as a tool to address poverty at large scales,” says Dan Osgood, who leads IRI’s index insurance research.

“One of these challenges is to have an efficient process through which farmers can identify, develop, and validate the most valuable product with technical and financial partners.”

Another challenge, says Osgood, is that there is very limited data for Adi Ha. “So the process must be refined in order to develop robust products that aren’t sensitive to data limitations and to validate the quality of these products. These issues must be addressed if the tool is to be applied at large scales,” Osgood says.

This work builds on IRI’s past successes in using index insurance to reduce drought risks for farmers in eastern and southern Africa and in Central America. IRI also recently co-hosted a policy roundtable with Swiss Re on the potential for index insurance to help countries meet development challenges and adapt to climate change. This fall, IRI will hold a workshop on the role of climate science for index insurance applications and will dedicate its next issue of Climate and Society to the topic.

Governments, development organizations and other entities spend billions each year on programs aimed at improving the lives of poor people in developing countries. But have these interventions actually made a difference? That’s difficult to answer, says one IRI researcher, because many programs haven’t been rigorously evaluated. She hopes to incorporate impact evaluations into some of IRI’s climate-risk management projects.

“Science-based methods are used in impact evaluations to enable us to learn what worked, for what purpose, under what conditions, and why,” says IRI economist Malgosia Madajewicz.

“Impact evaluations can help us understand, for example, how an early warning system for drought can improve child nutrition and thereby educational outcomes, or what mix of programs can help farmers adopt sustainable practices, manage climate risks and spur growth in agriculture.”

Consider the use of crop insurance to hedge against drought or other disasters. “It’s easy to say that this many people signed contracts, this many people received payouts. But it’s much harder to say what effect the insurance had on outcomes we ultimately care about, such as improving living standards and reducing vulnerability to disasters,” says Madajewicz.
The reason is that crop insurance isn’t the only factor that determines any of the above. “It may be that people who sign contracts happen to be more entrepreneurial. They may have had good outcomes anyway,” she says.

Teasing apart these factors means that evaluation can’t be an afterthought. “The best assessments happen when they are planned carefully into the program or project from the beginning, something which most development and donor organizations haven’t been doing,” says Madajewicz.

In the last decade, innovations in statistical methods have allowed researchers to better evaluate impacts, to get better at identifying causal effects as opposed to correlations.

In 2006, the Center for Global Development published an important report, When Will We Ever Learn? Improving Lives Through Impact Evaluation.

The authors write that after decades of spending billions for social programs, “It is deeply disappointing to recognize that we know relatively little about the net impact of most of these social programs... No responsible physician would consider prescribing medications without properly evaluating their impact or potential side effects. Yet in social development programs... no such standard has been adopted. While it is widely recognized that withholding programs that are known to be beneficial would be unethical, the implicit corollary—that programs of unknown impact should not be widely replicated without proper evaluation—is frequently dismissed.”

As a result of this report and others, there’s now a big push to conduct impact assessments more systematically.

In an effort to incorporate such assessment into IRI’s climate-risk-management projects, Madajewicz is organizing a seminar series to introduce evaluation methods to IRI staff and other members of the Earth Institute. “We’ll illustrate the methods and examine case studies of how they were applied,” she says.

“We are anxious to support this research and to bring impact evaluation into the mainstream of IRI’s work, which, in the end, is targeted toward improving outcomes on the ground,” says IRI Director-General Steve Zebiak.

Development organizations such as the World Bank, the U.K.’s Department for International Development (DFID) and many governments are taking impact evaluations more seriously in their process for allocating funds, says Madajewicz. Many policy makers now believe they can’t afford not to carry out rigorous impact evaluations, since they can’t afford to spend money on ineffective programs. “They can’t make decisions based on anecdotal evidence or people’s opinions of what works and doesn’t,” she says.

Two of Madajewicz’s current projects, still under development, try to understand what types of climate information can improve climate risk management in the agricultural systems of Uruguay and Uganda. “Under what conditions do farmers use climate information, such as seasonal forecasts and rainfall trends,” she asks, “and what policies make climate information most effective in improving livelihoods under different types of conditions?”

Conducting impact evaluation in situations in which climate influences the impacts of the project present special challenges. Ideally, one would need to compare farmers’ livelihoods when farmers use the climate information and when they don’t over a long period of time. Of course, waiting long periods of time isn’t useful to policy makers, who need to make decisions in the short term.

“For the evaluation, we would need to make do with a few seasons of observations perhaps, and available historical records. The fundamental questions here is, How can we project what the effects of the intervention will be in climate scenarios we haven’t observed?” says Madajewicz.

“Existing methods do not offer sufficient guidance. We need innovative, creative ways of combining theory and data in order to learn about impacts in circumstances which may not be random draws from the data we have.”

Later this year, the IRI will bring together experts from both the research and practice side to take part in a workshop on impact evaluation which will advance the needed innovations in methods.
The International Research Institute for Climate and Society and Swiss Re jointly hosted a high-level policy roundtable on the use of index insurance for poverty reduction at the annual meeting of the Global Humanitarian Forum in Geneva. Kofi Annan, the president of the GHF, made mention of the roundtable’s conclusions in his closing statement of the meeting. He expressed enthusiasm about the idea of providing insurance to poor farmers. “Farmers in Africa take all the risks but have no support from outside. This insurance could make the difference between survival and catastrophe,” Mr. Annan said.

The roundtable, which took place on June 24, included leaders from fields as diverse as reinsurance, climate science, economics and food security, in an effort to gain insight on how index insurance can best serve today’s development needs.

“We are pleased to have partnered with Swiss Re in sponsoring this important forum,” says IRI Director-General Steve Zebiak. “Swiss Re is one of the world’s largest and most diversified reinsurers. Its presence at the roundtable lent credibility, expertise and insight to the discussion of how best to scale up the use of index insurance to help the poor.”

Climate variability has tremendous impacts on rural and urban people in developing countries. It tends to be the dominant source of risks to livelihood and consumption. Fluctuations in climate can reduce people’s access to food, safe drinking water, health services and transportation. Droughts, floods and other climate shocks have direct, destructive impacts which are easy to imagine. But there are also indirect impacts. A climate shock may happen only one year in five, but the threat of one is enough to impede economic vitality, growth and wealth generation during all years, good and bad, because people are conditioned to be risk-averse. For example, farmers won’t chance spending more on fertilizers or improved seeds in the face of uncertainty, and thus miss out on the increased yields that could have resulted. Together, climate uncertainty and responses to it are major contributors to the perpetuation of poverty, conning people in so-called poverty traps. Climate change and continued population growth stand to dramatically worsen the situation.

The policy roundtable addressed the numerous challenges that need to be overcome if index insurance is to contribute to the eradication of poverty at large scales.

Index insurance is insurance linked to a weather index such as rainfall, rather than a possible consequence of weather, such as crop failure. “This subtle distinction resolves a number of fundamental problems that make traditional insurance unworkable in rural parts of developing countries,” says IRI scientist Dan Osgood, one of the roundtable’s organizers. “Unlike traditional crop insurance, the insurance company doesn’t need to visit a farmer’s field to determine premiums or to assess damages.”

Instead, the insurance is designed around weather data such as rainfall: if the rainfall amount is below an earlier agreed-upon threshold, the insurance pays out. Basing the contracts on an index also eliminates a ‘moral hazard problem’. “People don’t have an incentive to misrepresent their claims or to destroy their crops in order to get a payout,” Osgood says. “The farmer has the incentive to make the best decisions for crop survival.”

Recent case studies and pilot programs show that index insurance has the potential to help protect people and livelihoods against climate shocks and climate risk, thereby reducing vulnerability and enabling investment and growth.
To be sure, index insurance isn’t suited to cover the entire range of risks faced by agriculture or other sectors, and it doesn’t supplant the need for good policy and practice. But it could, if negotiated and managed properly, provide a missing piece of the puzzle in the global effort to eradicate extreme poverty.

The key questions on which participants focused on during the roundtable were:

» What kinds of index insurance are necessary to span the range of poverty problems and assist development?

» Can index insurance overcome hurdles in scale-up to cover the risks it must address?

» What are the roles of governments, NGOs and donors in scaling up index insurance for poverty reduction?

*For more information, download the agenda and discussion paper.

The roundtable’s conclusions were formally presented at the Global Humanitarian Forum’s afternoon session, ‘Are the Right Risks Insured?’, and fed into the GHF’s declaration and outcomes.

The event also jump started the process for the next Climate and Society publication, which will take a fresh look at the effectiveness of index insurance for reducing poverty and better managing climate risk. Climate and Society No. 2 will capture the key questions listed above, examine the current case studies, and rely on expert scientific opinion to delineate the advances, opportunities and pitfalls faced in scaling up index insurance.

“‘There’s no doubt that index insurance has shown promise in practice,’” says Molly Hellmuth, the editor of Climate and Society. “But there are very real constraints that need addressing if we want index insurance to fulfill its potential. This next issue will hopefully help policy makers, researchers, donors and practitioners gain a better sense of what needs to be done to move forward.” More information on the upcoming issue can be found here.

Fourteen professionals from nine countries recently completed an intensive two-week course on ways to use climate knowledge to make better decisions for health-care planning and control of climate sensitive diseases. They are the first graduates of the Summer Institute 2008 on Climate Information for Public Health organized by the IRI, the Center for International Earth Science Information Network (CIESIN) and the Mailman School of Public Health at Columbia University.

“We see this as the beginning of longer term partnerships, not only among the institutions but also among all the participants,” said Madeleine Thomson, who runs IRI’s Africa and Health programs and who was a principal organizer of the course.

IRI’s Director-General, Steve Zebiak, called the intersection of public health and climate “critical”. “Climate events are exacting very heavy tolls on society, not only in terms of disasters such as epidemics, but also in terms of missed opportunities because we couldn’t take advantage of things we know are likely to happen in climate,” he said.

The information exists, he continued, but often times isn’t utilized because people who are in positions to make decisions or alter policy don’t know it exists, don’t know how it can help their sector, or don’t have the technical resources to use or view it.
“IRI is a research-based institution, but we define our work based on practice. We try to figure out with our stakeholders and partners how we can make new knowledge and new information usable and useful. It’s very easy to produce numbers, graphs and maps, but the challenge is to have an instrument that is actually useful in day-to-day practice in decision making and policy making,” he said.

Part of the motivation behind the Summer Institute was to engage decision makers directly, not just through expert lectures, but also through focused discussions and practical training sessions. These sessions will introduce the participants to geographical information system (GIS)-based computational tools for analyzing epidemiological data with climate, population and environmental data.

“We envision the participants putting what they learn into practice by developing better surveillance systems that make full use of the power of climate information for epidemiological monitoring and risk assessment,” said Marc Levy, who is CIESIN’s Deputy Director. “Because the impact that climate has on health is always mediated by social structures and human behavior, it is important to develop a capacity for integrating climate information with socioeconomic data,” he said.

During the course, the students created disease risk maps, learned the pros and cons of using different data sources, including remotely sensed data and explored ways that climate forecasts can be relevant to epidemiology. (A full agenda and list of lecturers can be found here.)

Participants spent the last day of the course giving final presentations about the data sets and analyses they worked on for their course assignments. They discussed the use of climate information in relation to malaria distribution and incidence in countries such as Colombia, Eritrea, Ethiopia and Niger. One participant, Tinni Seydou Halidou, will start a Climate Information for Public Health Bulletin upon his return to Niger.

Another, Jari Vainio, from the International Federation of Red Cross and Red Crescent Societies, looked into the possibility of developing an early-warning system for yellow fever, which is transmitted by certain species of Aedes mosquitoes. “Yellow fever is considered so dangerous that if we find one case, an epidemic is declared,” he said during his presentation.

The learning experience will continue as the participants return to their home countries and try out some of the training examples in their own environments. “We hope to maintain longer term collaborations with all the participants as part of our effort to evaluate the course,” said IRI researcher Judy Omumbo, one of Summer Institute’s organizers and lecturers.

Responses to the workshop have been positive, she said. “Already, we have been approached, by this year’s participants, to replicate similar institutes in Spanish and French-speaking countries.”

Patrick Kinney, an environmental epidemiologist from the Mailman School of Public Health and another of the Summer Institute’s lecturers, concurred. “I’m very happy with the way this has turned out and I look forward to one every year.”

05/28/2008
Agricultural Water Management and Climate Risk

Feasible investments in agricultural water management are likely to bring the greatest livelihood benefit to the rural poor of sub-Saharan Africa and parts of South Asia if they are part of a comprehensive
approach to managing climate risk, according to a new report from the International Research Institute for Climate and Society.

“Despite the known impacts of current climate risk and growing concern about future climate change, climate risk management remains conspicuously absent from many analyses and regional development strategies,” write Casey Brown and James Hansen, the authors of the report, called Agricultural Water Management and Climate Risk (download it here). The report was commissioned by the Bill & Melinda Gates Foundation and will help guide the foundation’s investment strategy in agricultural and water development in the face of climate variability.

“We need to take a more holistic view of the risks that farmers face. We’ve found that conventional agricultural water management in combination with other climate risk management strategies can be a much more powerful engine of development than just the water management alone,” said Casey Brown, who leads IRI’s Water program.

Climate change is expected to exacerbate many development challenges in Africa and South Asia, but in ways that can only be partially anticipated. A growing body of evidence links climate-based water variability to poor economic growth in developing countries. For example, in sub-Saharan Africa, agriculture accounts for 70% of employment and 35% of the region’s gross domestic product. Of the 183 million hectares of agricultural land there, only about 9 million are under some form of water management—mostly small-scale approaches, such as irrigation systems and farm ponds. Most farmers depend solely on rainwater to grow their crops.

Future efforts to increase agricultural productivity in the region will most likely center on more of these small-scale water management and storage strategies, note Brown and Hansen. While these provide mitigation of slight or moderate departures from normal rainfall, they are less capable of managing climate extremes such as droughts and floods, which threaten to reverse years of development gains.

The authors recommend that a strategy for investing in agricultural water management should include a multipronged approach to dealing with the full range of climate variability.

The authors propose three specific areas of investment that are timely, feasible and target a different layer of risk:

» Don’t assume climate is static. Develop a climate-informed investment strategy for water management.

» Support rural climate information services. Invest in climate data sets, work with national meteorological services to produce tailored seasonal forecasts, train employees of agriculture extension services and nongovernmental organizations to communicate climate information and risk, etc.

» Create integrated early warning systems. These support more timely and better coordinated response to climatic shocks such as droughts and floods that exceed the coping capacity of rural communities.

Malaria affects between 300 and 500 million people every year, according to the WHO. It causes two percent of all deaths worldwide—among them 3,000 children a day, mostly in sub-Saharan Africa. Complications from malaria, such as severe anemia, account for at least a million additional deaths. Most of the countries where endemic and epidemic malaria occurs are among the poorest on Earth. Because the
disease causes widespread illness and death, it is a great drain on many national economies, consuming as much as 40% of their public-health expenditures.

April 25 marked the first World Malaria Day, created by the World Health Organization to raise global awareness of this devastating but preventable infectious disease. As a PAHO-WHO Collaborating Centre, the IRI has long provided countries the technical support needed to develop early warning systems for malaria and other climate sensitive diseases.

“Having this relationship with PAHO and WHO is important to the IRI because it gives us more legitimacy and credibility to work in epidemic prone countries,” says Stephen Connor, who is the Collaborating Centre’s director. “Through the global network of these organizations, we are able to disseminate our knowledge and training, and can line up with their larger-scale policy developments.”

IRI’s diverse set of experts demonstrates ways in which climate information, such as historic variability, real-time monitoring and seasonal forecasting, improves decision making in health, agriculture and other climate-sensitive sectors.

“For example, climate information enhances malaria prevention and control in a number of ways,” says Madeleine Thomson, who runs IRI’s Africa Program. “It improves our ability to both predict year-to-year variations of epidemics and to more accurately assess the impact of interventions.” In addition, Thomson says climate information also improves:

» Understanding of host, vector and parasite biology/ecology,

» Accuracy of surveillance systems, including estimating populations at risk, and

» Understanding of the long-term implications of global climate change for malaria control.

Here are some of IRI’s ongoing efforts to help countries combat malaria:

Disease early-warning systems in Colombia: IRI is advising the government of Colombia on using climate risk management in an ongoing project to improve its early-warning system for malaria and dengue fever. The work is overseen by the World Bank, and funded by Global Environmental Facility and Colombia. (more)

Malaria Early Warning Systems in Africa: The MEWS interface facilitates understanding of the current rainy season by providing a seasonal and historical context. It displays the most recent rainfall estimates and generates custom time-series graphs, which provide an analysis of recent rainfall compared to that of recent seasons and the short-term historical average. The MEWS has been introduced over the past few years in African countries with epidemic-prone areas, including Eritrea, Botswana, Madagascar, Mozambique, Namibia, South Africa, Swaziland, and Zimbabwe. (more and more)

Malaria Outlook Forums in Africa: The MALOFs provides the opportunity for malaria-control services to review the regional climate forecasts, examine vulnerability factors and map vulnerable areas for the purpose of developing action plans for epidemic preparedness over the coming season. (more)

Malaria and Sri Lanka: In collaboration with the Sri Lanka Ministry of Health and other government research partners, IRI and the International Water Management Institute have undertaken a project to characterize climate and malaria linkages in Sri Lanka. The goal is to develop models to forecast malaria risk and a prototype early warning system for the Uva Province. (more)

Climate Matters in Health workshop: The Anti Malaria Association of Ethiopia and IRI held a one-day workshop in February on how climate information could be used in malaria early warning. Representatives from the Ethiopian Ministry of Health, National Metrological Agency and others participated. As a result a working group was formed to develop and oversee better climate-health knowledge coordination among government agencies and other organizations. (more)
The theme of this year’s World Health Day is “protecting health from climate change”. In support of this, the IRI helped convene more than 70 high level experts from public health agencies, private institutions and corporations to brainstorm ways to overcome the challenges climate change poses to global health. Participants recognized that the breadth and severity of these impacts remain largely unknown and understudied, and they proposed a number of possible actions to take.

The meeting was hosted by Jeffrey Sachs, the Director of the Earth Institute at Columbia University, and was organized by The International Research Institute for Climate and Society and The Center for Global Health and Economic Development. (To see the meeting’s agenda, participant list and featured presentations, please scroll to the end of this story.)

“What we are trying to do with the incredible leadership assembled here is talk about creating a more integrated and sustained intellectual agenda on the intersection of climate and health, and what this means for public policy, research, and adaptation strategies,” Sachs said in his opening remarks.

Mary Robinson, the former president of Ireland and current director of Realizing Rights, put forward the notion that climate change must be fundamentally understood as an ethical issue and that the need to address it presents a unique combination of ethical and practical challenges.

“Access to a functioning health system has been acknowledged as a fundamental human right,” she said. “To guarantee this right, we must therefore be interested in how governments intervene in matters of health.”

“I think one of the big gaps at the moment is particularly the poorest countries’ capacity to address this issue. They’re already struggling to strengthen their health systems, and they’re going to be facing severe and complex challenges from climate change,” she said.

Paulo Teixeira, an official from the Pan American Health Organization, echoed this sentiment. “The capacity of ministries of health and other national institutions to address the impacts of climate on health isn’t keeping up with increases in populations and national budgets in our region.” He said they needed to be more empowered vis-a-vis human and financial resources as well as cooperative governmental policies.

Private institutions may also need to shift resources to help fill gaps in knowledge about climate-health interactions. Such understanding, said Alice Dautry, is needed across the range of both chronic and infectious diseases. Dautry is the director of the Institut Pasteur, one of the world’s largest health research organizations.

By the end of a day’s worth of presentations and ensuing discussions, participants had identified a set of key areas they felt needed developing in order for climate change to be adequately factored in global-public-health policy planning and practice.

Among them, the need for more and better climate information tailored to the requirements of health, agriculture and other sectors.

“This type of information, which includes forecasts, models and satellite data, can help mitigate risks as well as take advantage of opportunities across a range of decision-making time scales, from seasons to decades,” said IRI director, Stephen E. Zebiak, who gave the first presentation of the meeting.
“But climate information in its raw form is useless. We can’t just produce it and hand it over. We need to first identify the needs of the sector, to understand the context and learn how to feed the information in the right way to move forward the decision-making process,” he said.

Sara Sievers, a senior program officer at the Bill and Melinda Gates Foundation, agreed, noting that innovations won’t be effective unless they trickle down to the people on the ground or are driven by real needs and demands.

“There are research questions policy makers are desperately looking for answers on. Researchers need to find their local partners at the outset because policy makers go to them first to see what actions to take.”

Madeleine Thomson noted that malaria, meningitis and many other infectious diseases are climate-sensitive and that climate information can be used to improve the outcomes of mass health interventions.

“We can use it to help our partners identify populations most at risk, predict epidemics and assess the impacts of the interventions themselves,” she said during her presentation.

Thomson, who runs both the Africa and Health programs at the IRI, also suggested that building the health community’s capacity to use climate information would also improve its capacity to understand the underlying mechanisms of diseases.

Another priority area identified by the participants was the need to share knowledge, good practice and policy in order to get a better understanding of what is and isn’t effective.

“One way is to look for and package success stories—where have countries, through intersectorial cooperation made the best use of climate in health policy?” said Chad Gardner, an advisor to the World Health Organization.

IRI’s Molly Hellmuth agreed, and noted how the first issue of the Climate and Society Series tried to do just that. It details five case studies in Africa where climate-risk-management practices were shown to be effective in disaster-risk reduction and development activities.

“Documenting what has and hasn’t worked gives us a way forward on how to tackle some of these climate-related challenges,” said Hellmuth.

By the meeting’s end, participants had agreed on a number of immediate actions that could be taken, including:

- Promoting health-climate understanding and action within the office of the U.N. Secretary General and those of other global institutions.
- Building an academic and operational agenda for a new discipline that is at the interface of health and climate, with curricula for practitioners and policy makers.
- Supporting developing-country governments in the formation of high-level health-climate task forces that address the issues across relevant disciplines.

Jeffrey Sachs concluded the meeting by inviting the participants to join a virtual network, based on email correspondence and ultimately a web site, to share resources and links with the goal of creating a road map that builds on the expertise and knowledge of core individuals and key institutions represented.
In many regions of the developing world, there is a scarcity of ground-based measuring stations to record environmental conditions such as rainfall and temperature. These data are desperately needed to inform decision making in agriculture, water resource management, energy generation and other sectors.

In the last three decades, institutions have relied increasingly on satellite-derived estimations of environmental conditions. While these data sets are a welcome alternative in areas that have little or no ground-based coverage, their accuracy has not been evaluated properly.

“Take a fairly simple application like measuring rainfall,” says Steve Connor, who heads the IRI’s Environmental Monitoring group. “Satellite-derived rainfall products have been available for 20-plus years. They’re used for food security, famine early-warning systems and now there’s an interest to use them for malaria early warning. But what we really don’t know is how well these products represent actual rainfall.”

So in 2005, Connor brought in Tufa Dinku, an expert on remote-sensing, to evaluate and validate the satellite estimates. Before coming to the U.S. for graduate school, Dinku worked in the Satellite Unit of the National Meteorological Agency of Ethiopia.

Ethiopia relies on a network of stations for rainfall data. But its network, one of the best in Africa, is nevertheless seriously flawed, Dinku says. The country doesn’t have enough stations, and the available ones tend to be located in cities, not in rural areas, where their data are most needed.

“This is why satellite data is so important for Ethiopia,” he says.

With the cooperation of his former colleagues at the met service, Dinku compared rainfall measurements from 150 stations throughout Ethiopia with that of ten different satellite-based products— including those from NOAA, NASA and the University of Reading in the U.K.

His results show that, while different products vary, satellite estimates for 10-day and monthly rainfall are relatively more accurate than those for daily rainfall. “At the daily scale, the products didn’t perform so well,” says Dinku, “They’re good enough to detect the occurrence of rain, but not very good at indicating the amount of rainfall,” he says.

He found a similar relationship for spatial scales. The satellites more closely matched ground measurements at 100- and 200 square-kilometer grids than at 50 square-kilometer grids.

Dinku’s work also shows that accuracy is affected by the way in which satellites are calibrated. “The NOAA product, for example, uses the same calibration parameters for all of Africa. But the one from the University of Reading uses different parameters for each region of the continent, and so it performs much better. I’ve been discussing this with colleagues at NOAA and in the long run, they might try to improve it,” he says.

Dinku’s work has interested researchers at The Famine Early Warning Systems Network (FEWS NET), which uses satellite and other types of data to identify potential threats to food security around the world. Because of Dinku’s results, the organization is considering changing the rainfall estimation products it uses to a TRMM product, says Connor.

Dinku is currently working on developing a 30-year time series for all of Ethiopia that blends rain-gauge and satellite data. “This will give us a strong historical record for the whole country and provide a method to use going forward.”
His ultimate goal is to do this for all of Africa, particularly in the central and sub-Saharan regions, where historical records are patchy at best.

02/28/2008
Online Resources for Uruguayan Agriculture

One of IRI’s goals for its work in South America is to bring state-of-the-art climate information into the hands of people and groups who can make immediate use of it. In Uruguay, the IRI has teamed up with the country’s agriculture research institute to develop a comprehensive online resource for farmers, farming cooperatives and policy makers to help them gauge climate risks and make decisions on where, when and how to grow crops.

The resource, called an Information and Decision Support System, gives users relevant information on expected crop yields, pasture production, current climate conditions, climate forecasts and areas at risk for drought and pests. Users can access the IDSS from the web pages of the Uruguay’s Instituto National de Investigacion Agropecuaria (INIA).

“The IDSS brings together results from many disciplines and presents them in a format that is easy to use and understand,” says Walter Baethgen, who directs IRI’s Latin America and the Caribbean Regional Program. “We developed it in order to overcome certain obstacles to the flow of information,” he says.

One obstacle was an inability of nontechnical people to understand certain types of information. “Crop simulation models are a perfect example of this,” says Baethgen. “These have been around for decades, but farmers and policy makers generally don’t have the technical skills to run them or even understand their outputs, and they’re the ones who can actually act on the information provided by the models.”

Crop models simulate how plants behave under a set of environmental conditions—for example, how they use energy from the sun, take up water from the soil and transition from one growth stage to another.

“The beauty of some models is that they not only allow us to study the impacts of rain and temperature on crop yields, but also the impacts of technological interventions such as using fertilizers, growing different cultivars and changing planting dates,” says Baethgen. All this information is crucial for making decisions in the agriculture sector, he says.

The second obstacle was a lack of communication of relevant and potentially useful research. “In the developing world especially, there’s a lot of valuable work that isn’t published,” says Baethgen. “So it ends up staying in desk drawers and filing cabinets, when it could be put to good use.”

Instead of trying to bring complicated technology and training to all possible end users, IRI and INIA have chosen to do something far simpler and more effective: they’re doing the hard work by running the crop simulation models for each type of crop, using hundreds of possible combinations of environmental conditions. They publish the results online, in the form of easy-to-understand maps, charts and bulletins. INIA estimates the system draws approximately 400,000 web hits annually from a variety of users.

“For example, an agronomist advising a farming cooperative can use the IDSS to find out what would happen if farmers planted a certain type of corn in a certain type of soil during an El Niño year and compare that to planting a different type of corn under the same conditions,” Baethgen says, “all without having to know anything about how to run a model.”

Policy makers can use the IDSS as well. “Let’s say they want to use insurance programs or credit programs in rural areas to stimulate sustainable practices, such as growing wheat only in those areas best suited...
for the crop. Using the IDSS, they can view maps which show precisely that,” he says. Rural credit providers can use this kind of information to help estimate the cost of insurance, charging higher premiums to farmers who want to grow crops not ideally suited to their locale.

The IRI is also exporting the successful IDSS model to neighboring Paraguay and Chile.

“But it’s our Uruguayan colleagues who are using their experience to now teach their counterparts in Paraguay,” says Baethgen. “IRI is a relatively small institute. Since we can’t directly train thousands of people, our approach is to ‘train the future trainers’. We organize our educational activities with the hope that some of the students go back to instruct others in their own countries and regions. And in this respect, the IRI is helping to stimulate south-south cooperation.”

01/24/2008
IRI’s Climate Risk Management Work in Andean River Basins

Andean societies rely heavily on glacial runoff for their drinking water, agriculture and hydropower production. The possible disappearance or shrinking of glaciers in coming decades because of global warming would have grave consequences for the region. Recognizing this, the International Research Institute for Climate and Society and its partners have just started on a two-year project to characterize how climate change will impact water resources and the people who rely on them in three major Andean river basins.

The work, funded by the Inter-American Institute for Global Change Research (IAI), centers on the Elqui watershed in Chile, the Mendoza basin in Argentina and the Huayna Potosi in Bolivia.

“These basins are prime examples of areas considered vulnerable to climate change because of their geography and because they are dependent on climate-sensitive sectors such as agriculture,” says Casey Brown, who is the principal IRI scientist on the project.

A region’s vulnerability to climate change certainly depends on environmental factors, such as changes in the frequency and severity of droughts or shifts in rainfall patterns, he says. But it also depends on social factors--how well do the communities understand the risks involved? Are governments and institutions well adapted to absorb, cope with, manage and recover from those risks?

Brown and his IRI colleague, Paul Block, hope the study will shed light on these kinds of vulnerabilities.

IRI is working with Canada’s University of Regina, which is coordinating and administering the project. The first phase will involve sending out local teams in each basin to identify and collect sociological data on the major agronomic groups--groups such as herders, farmers and vintners--that rely on stable water supplies. The researchers will also canvas decision makers and policy makers in local government and non-governmental organizations.

“The goal is to try to characterize their current dependence on water resources,” says Block, a postdoctoral research scientist who studies water-resource management.

Brown and Block will combine the sociological data with historical data and 20-year projections of climate variability for the region to see how the vulnerabilities of these different identified groups change. The climate projections will come from a much larger IAI-funded study--in which the IRI isn’t involved--that is attempting to characterize the hydrology of glacially-fed basins throughout the entire mountainous “backbone” of the Americas.
“Combining the two different kinds of data allows us to determine which groups become more or less vulnerable, and how resilient each group is to different climate-change scenarios,” says Block.

Armed with this IRI-based analysis, the local teams of sociologists would then revisit the groups with new questions, such as, ‘How would your current practices change, given a 5%, 10% or 15% decrease in water supply?’

“The ultimate goal is enable the parties responsible for water-allocation, such as governments or private water groups, to design better policy and climate-adaptation strategies in the region,” says Brown.

01/03/2008
IRI Plug-In for NASA/USAID’s SERVIR

Users of IRI’s Malaria Map Room and desert locust monitoring tools for Africa can now take advantage of SERVIR, NASA/USAID’s high-tech satellite visualization system, thanks to a new plugin developed by scientists at the Institute for the Application of Geospatial Technology [IAGT] and IRI.

In helping to port over the data sets to SERVIR, IRI researchers have also expanded the capabilities of the tool: the ability to click on any point on the map to get detailed time series of rainfall and other data. (see accompanying screenshot)

“We wanted to show that NASA’s system could not only access our maps, but also allow users to extract and download data, as they can in our Data Library Map Rooms,” says IRI’s Pietro Ceccato, who helped develop the plugin.

As with other mapping browsers such as Google Earth, SERVIR allows users to zoom from satellite altitude to any place on Earth, and even tilt their viewing angle so that they can “fly” across a 3-D terrain.

What’s more, the software taps into dozens of high-resolution satellite-image sources such as MODIS and Landsat. Users can add layers that show temperature, rainfall, cloud cover over the entire globe. They can even overlay animated weather events, such as hurricanes.

Not only is SERVIR very user-friendly and easy to navigate, says Ceccato, but it gives Map Room users the opportunity to explore data sets not currently available in IRI’s Data Library, such as fire activity, volcanoes and floods.

The ability to render a terrain in 3-D is extremely useful for some societal applications. For example, a pilot who uses the desert-locust monitoring maps to determine which areas to spray can first make a virtual flight, to see exactly where those areas fall in the local topography.

This is only the first step, says Ceccato. “Now that we know it can be done, the next step is to further the collaboration with SERVIR to provide access to all the environmental, climate and forecasting products developed at IRI.
The IRI Map Rooms contain more than 250 maps and analyses of current and historical climate conditions. In the last few years, the IRI has developed an increasing number of map rooms to serve climate-sensitive sectors. These interactive tools are tailored to the needs of the public health and food security communities and facilitate the use of climate information in their decision-making and planning operations.

This section provides an overview of some of the map rooms, as well as how to access them on the IRI web site.
**Fires Map Room**

**Why is it important?**

Research on peatland fires in the Indonesian province of Central Kalimantan has uncovered a close correlation between satellite rainfall data and fire hotspot activity. In particular, rainfall during the dry season from June to October is critical in determining fire incidence. This finding means such data can help indicate whether an upcoming fire season will be more or less intense than usual, and can help authorities take preventive measures to avoid impacts to biodiversity, public health and global greenhouse gas emissions.

**What does it show?**

Ten-day precipitation estimates for Indonesia; graphs that show relationship between the number of fires and the NINO4 index in the previous month for the four Kalimantan provinces. Information also available in Indonesian Bahasa.

**Who uses it?**

Provincial environment, forestry and meteorological agencies.


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**Desert Locusts Map Room**

**Why is it important?**

Swarms of desert locusts can travel thousands of miles and can threaten the food security and livelihoods of up to a fifth of the world’s population. Recent plagues caused an estimated $400 million in damages and affected 8.4 million people. Knowing when and where environmental conditions are right for these insects to multiply helps authorities control their numbers.

**What does it show?**

The maps and analysis products illustrate recent climate conditions, such as rainfall and vegetation growth, which provide ideal breeding conditions for the locusts.

**Who uses it?**

U.N. FAO
Regional locust-control workers

**MENINGITIS MAP ROOM**

**Why is it important?**

Epidemics of meningitis occur worldwide. The “meningitis belt” in the Sahel region of Africa, however, has the greatest incidence of the disease. Epidemics occur throughout the belt in the dry season. They typically coincide with periods of very low humidity and dusty conditions and disappear with the onset of the rains, suggesting that these environmental factors may play an important role in the occurrence of the meningitis.

**What does it show?**

Observed distribution of meningitis epidemics during 1841-1999; and a meningitis risk map derived from an environmentally-driven model of predicted probability of epidemic experience, based on absolute humidity profiles and land-cover type.

**Who uses it?**

- Disease-monitoring and surveillance staff
- Health researchers


**MALARIA MAP ROOM**

**Why is it important?**

Economic development has played an enormous role in shaping the current global distribution of malaria. Where malaria is not adequately controlled, however, its distribution and seasonality are driven by various climate factors such as temperature, humidity and rainfall. By knowing when conditions are suitable for transmission of malaria, health officials are granted several weeks, sometimes months of warning to apply insecticides, stockpile medicines and alert hospitals.

**What does it show?**

The maps illustrate models of climate suitability for seasonal endemic malaria, and recent climate conditions, such as rainfall anomalies, which may be associated with epidemic malaria in warm semi-arid regions of Africa.

**Who uses it?**

- National malaria-control program personnel in Africa

Why is it important?

Having free access to reliable climate data and mapping products enables researchers, professionals and students to carry out their work. These comprehensive climate-information map rooms are intended to serve both the national and international climate and meteorological community.

What does it show?

Global and regional precipitation and temperature anomalies, atmospheric temperature and circulation, ocean temperatures, political maps, and many others.

Who uses it?

Researchers  
Educators  
Journalists  
Graphic Designers  
Students

Education and Training

Over the reporting period, the IRI engaged a number of technical training events aimed at transferring knowledge to enhance the uptake of climate risk management. Targeted audiences include students, researchers, technical professionals, and policy makers. One goal is to enable problem solving incorporating climate information to affect better management practices. Another goal is to create learning opportunities for researchers and educators at IRI who are committed to documenting and sharing ‘good practices’ for learning and uptake by others.

In this section, we provide a summary of technical training and an update on the MA Program in Climate and Society.

Technical Training Overview: A summary of Events and Contributions from the IRI Staff

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<td>2-16 November</td>
<td>Palisades, NY</td>
<td>Training in Malaria Early Warning Systems</td>
</tr>
<tr>
<td>L. Zubair</td>
<td>L. Zubair</td>
<td>Senarath Bandara and P.H.D. Kusumawathie (Kusum), Regional Malaria</td>
</tr>
<tr>
<td></td>
<td>Palisades, NY</td>
<td>Officers for Sri Lanka's North-Western District and the Central Districts, respectively, with funding from the Global Fund on AIDS, TB and Malaria</td>
</tr>
<tr>
<td>19-23 November</td>
<td>Brasilia, Brazil</td>
<td>Training course on &quot;Climate Information, Approaches and Tools for Assessing and Managing Climate Risks&quot;</td>
</tr>
<tr>
<td>A. Barnston</td>
<td>Brasilia, Brazil</td>
<td>A. Barnston (Main instructor), W. Baethgen (General coordination)</td>
</tr>
<tr>
<td></td>
<td>Brasilia, Brazil</td>
<td>Sponsored by the Brazilian National Institute of Meteorology (INMET), IRI, WMO; in collaboration with Centro de Previsão do Tempo e Estudos Climáticos (CPTEC) and Instituto Nacional de Pesquisas Espaciais (INPE) for staff members from Meteorological Services, Universities and other institutions working in Seasonal Climate Forecasts from Brazil and other countries in LAC</td>
</tr>
<tr>
<td></td>
<td>Brasilia, Brazil</td>
<td>Web link: <a href="http://www.inmet.gov.br/documentos/cursol_INMET_IRI/">http://www.inmet.gov.br/documentos/cursol_INMET_IRI/</a></td>
</tr>
<tr>
<td>26-30 November</td>
<td>San Salvador, El Salvador</td>
<td>Training course on Climate Predictability Tool for Central America Climate Outlook Forum</td>
</tr>
<tr>
<td>A. Barnston</td>
<td>San Salvador, El Salvador</td>
<td>Funding for this activity was provided by the regional met and hydro agencies of Central America, Comite Regional de Recursos Hidraulicos (CRRH) and Sistema de la Integracion Centroamerica (SICA) with participants from all Central American countries (Mexico through Panama), with most countries represented by two meteorologists</td>
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<tr>
<td>Date</td>
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<tr>
<td>2008</td>
<td></td>
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</tr>
<tr>
<td>11-16 February</td>
<td>Nairobi, Kenya</td>
<td>Pre-GHACOF training</td>
</tr>
<tr>
<td>S. Mason</td>
<td></td>
<td>Verification training provided</td>
</tr>
<tr>
<td>3-7 March</td>
<td>Brasilia, Brazil</td>
<td>IRI-INMET training course: Climate Risk Management in Agriculture</td>
</tr>
<tr>
<td>W. Baethgen</td>
<td></td>
<td>54 participants from Brazil, Argentina, Paraguay, Peru and Uruguay</td>
</tr>
<tr>
<td>3-14 March</td>
<td>Trieste, Italy</td>
<td>4th ICTP Workshop on the Theory and Use of Regional Climate Models</td>
</tr>
<tr>
<td>A. Robertson &amp; L.</td>
<td></td>
<td>8th International Regional Spectral Modeling Workshop</td>
</tr>
<tr>
<td>Sun</td>
<td></td>
<td>Sponsored by ICTP and WMO/WRCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ Robertson, A: Climate Risk Management and the Use of Regional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ Sun (workshop co-director; and trainer): Regional Climate Modeling in</td>
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<td></td>
<td></td>
<td>◦ Regional Climate Model Simulations in Developing Nations</td>
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<tr>
<td></td>
<td></td>
<td>◦ Seasonal Prediction: Advances and Future Directions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Web link: <a href="http://cdsagenda5.ictp.trieste.it/full_display.php?ida=a07143">http://cdsagenda5.ictp.trieste.it/full_display.php?ida=a07143</a></td>
</tr>
<tr>
<td>13 May-26 May</td>
<td>Niamey, Niger</td>
<td>Pre-PRESAO training</td>
</tr>
<tr>
<td>S. Trzaska</td>
<td></td>
<td>Capacity building in seasonal forecasting</td>
</tr>
<tr>
<td>20-21 May</td>
<td>Bogor, Indonesia</td>
<td>Fire Early Warning and Response in Central Kalimantan: Workshop on</td>
</tr>
<tr>
<td>P. Ceccato, J. Qian, S. Someshwar</td>
<td></td>
<td>early warning tool and approaches to incentive systems</td>
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<tr>
<td></td>
<td></td>
<td>Organized by IRI and IPB in partnership with CARE Indonesia as part</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of IRI's contributions to the Central Kalimantan Peatlands Project, to</td>
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<tr>
<td></td>
<td></td>
<td>help relevant stakeholders to use the fire early warning tool developed</td>
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<td></td>
<td></td>
<td>by IRI, approaches to seasonal climate forecasting over the Central</td>
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<tr>
<td></td>
<td></td>
<td>Kalimantan region, and the potential for integration of climate</td>
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<tr>
<td></td>
<td></td>
<td>information into decision-making.</td>
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<tr>
<td></td>
<td></td>
<td>IRI lectures:</td>
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<tr>
<td></td>
<td></td>
<td>◦ P. Ceccato: Hands-on introduction to Indonesia Rainfall Analysis Tool</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ J. Qian: Approaches to seasonal forecasting of fire activity in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>◦ S. Someshwar: Integration into current forecasting/decision-making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and development of incentive systems</td>
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<tr>
<td>Date</td>
<td>Place</td>
<td>Event</td>
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<td>-----------------------------------------------------------------------</td>
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<tr>
<td>2-14 June</td>
<td>Palisades, NY</td>
<td>Summer Institute 2008 course on ‘Climate Information for Public Health’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A collaboration of IRI, CIESIN and the Mailman School of Public Health</td>
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<tr>
<td></td>
<td></td>
<td>Fourteen professionals from nine countries completed an intensive two-</td>
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<td></td>
<td></td>
<td>week course on ways to use climate knowledge to make better decisions</td>
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<td></td>
<td></td>
<td>for health-care planning and control of climate sensitive diseases</td>
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<tr>
<td>16-20 June</td>
<td>Palisades, NY</td>
<td>CPT and Climate Information for Risk Management</td>
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<tr>
<td></td>
<td></td>
<td>A CPC-IRI collaboration with Africa Desk climatologists, to present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRI work, CPT training and IRI's CRM approach</td>
</tr>
<tr>
<td>21 June</td>
<td>Palangkaraya, Central</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kalimantan, Indonesia</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Using the Fire Early Warning Tool at the District Level in Central</td>
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<tr>
<td></td>
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<td>Kalimantan</td>
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<tr>
<td></td>
<td></td>
<td>IRI, CARE Indonesia, and Department of Environment, Provincial</td>
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<tr>
<td></td>
<td></td>
<td>Government of Central Kalimantan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participants: 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This event, co-sponsored by IRI, CARE Indonesia, and the Dept. of</td>
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<tr>
<td></td>
<td></td>
<td>Environment of Central Kalimantan, trained district-level staff from</td>
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<tr>
<td></td>
<td></td>
<td>relevant government departments in the use of the seasonal fire early</td>
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<tr>
<td></td>
<td></td>
<td>warning tool.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRI lectures: Discussion of seasonal fire early warning tool and its</td>
</tr>
<tr>
<td></td>
<td></td>
<td>use</td>
</tr>
<tr>
<td>23-27 June</td>
<td>Palisades, NY</td>
<td>Training course: &quot;Climate Modeling Focusing on the NCAR CAM3&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sponsored by CCA-UNAM-IRI, with participants:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Katiusca Briones Estebañez Fundacion El Universo, Ecuador</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angel Muñoz Solorzano Universidad del Zulia, Venezuela</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jose Juis Perez Lopez Instituto Mexicano de Tecnologia del Agua, Mexico</td>
</tr>
<tr>
<td></td>
<td></td>
<td>David Maximiliano Zermeno Diaz Centro de Ciencias de la Atmosfera,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Universidad Nacional Autonoma de Mexico, Mexico</td>
</tr>
<tr>
<td>24-31 August</td>
<td>Lima, Peru</td>
<td>Training in CPT and collaboration on climate prediction for the region</td>
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<tr>
<td></td>
<td></td>
<td>with particular focus on extreme weather events within an anomalous</td>
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<tr>
<td></td>
<td></td>
<td>climate episode; hosted by SENAMHI (Peru national met/hydro service)</td>
</tr>
<tr>
<td>Date</td>
<td>Place</td>
<td>Event</td>
</tr>
<tr>
<td>--------------</td>
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<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>22-26 Sept</td>
<td>Palisades, NY</td>
<td><strong>CPT and Climate Information for Risk Management</strong></td>
</tr>
<tr>
<td></td>
<td>S. Mason</td>
<td>A CPC-IRI collaboration to present Africa Desk climatologists with IRI work, CPT training, and IRI's CRM approach</td>
</tr>
<tr>
<td></td>
<td>O. Ndiaye</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N. Ward</td>
<td></td>
</tr>
<tr>
<td>22 Sept-3 Oct</td>
<td>Bogota, Colombia</td>
<td><strong>XV Basic and Advance Course in Epidemiological and Public Health Surveillance with Emphasis in Climate and Health</strong></td>
</tr>
<tr>
<td></td>
<td>W. Baethgen</td>
<td>Sponsored by Colombia’s National Institute of Health, National Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), Pan-American Health Organization (PAHO), Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET), with 70 participants from 10 countries</td>
</tr>
<tr>
<td></td>
<td>G. Mantilla (co-organizer)</td>
<td>Presentations:</td>
</tr>
<tr>
<td></td>
<td>M. Thomson</td>
<td>• W. Baethgen: Climate Risk Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G. Mantilla (co-organizer): Use of Climate information in Public Health; and, Climate Change Impacts in Public Health</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• M. Thomson: Climate and Public Health</td>
</tr>
<tr>
<td>22-26 Oct</td>
<td>Bangui, Central African Rep.</td>
<td><strong>Training activities at the PRESAC-Climate Outlook Forum for Central Africa</strong></td>
</tr>
<tr>
<td></td>
<td>S. Trzaska</td>
<td>Capacity building in seasonal forecasting</td>
</tr>
<tr>
<td>28-30 Oct</td>
<td>Passo Fundo, Brazil</td>
<td><strong>Modeling Applications for Decision Support in Agriculture</strong></td>
</tr>
<tr>
<td></td>
<td>W. Baethgen</td>
<td>Sponsored by Inter-American Institute for Global Change (IAI) and Brazilian Agricultural Research Corporation (EMBRAPA), with the goal of introducing participants to the application of crop modeling and climate forecasting to mitigate production risks associated with climate variability. 72 participated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W. Baethgen:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Basics of crop modeling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Modeling Applied to Decision making in Agriculture: The IRI Experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Web link to programme:</td>
</tr>
</tbody>
</table>
The MA Program in Climate and Society at Columbia University

In September 2008, the MA Program in Climate and Society launched its 5th year with a class size of 39, by far the largest class to date. This intensive twelve-month program was established with the objective of training professionals and academics to understand and cope with the impacts of climate variability and climate change on society and the environment. Drawing on the superb educational and research facilities of the University, the M.A. Program in Climate and Society combines elements of established programs in earth sciences, earth engineering, international relations, political science, sociology, and economics with unique classes in interdisciplinary applications specially designed for the program’s students. This program is the first to incorporate the great scientific advances that have been made in the understanding and prediction of climate from the past twenty years, and to make those advances applicable to the concerns of developing societies. The program has an intrinsic interest in recruiting outstanding applicants from the developing world who will return to advance climate-informed development in their own societies.

The goals of MA Program in Climate and Society are to impart students with an understanding not only of the dynamics of climate events, but also of how to reliably communicate the climate prediction to those who are in the most need of it, such as farmers, governments, and environmental offices. Students are given the science and analytical skills to decipher complex climate information and communicate it to decision makers on a regional level, enhancing society’s ability to plan and respond to climate events. The core curriculum, developed in partnership with IRI, gives students a firm understanding of the global and regional dynamics of climate change, knowledge of statistical methods for evaluating the impacts of climate change, as well as a familiarity with stakeholder politics and the policymaking process to implement change. Students engage directly with IRI faculty and lecturers who teach in the program, and have opportunities also to participate in work study and project intern opportunities to extend their academic learning to real world experiences.

<table>
<thead>
<tr>
<th>Name</th>
<th>Prior Institution</th>
<th>Degree</th>
<th>IRI Supervisor/Mentor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oluseyi Fayanju</td>
<td>Harvard College</td>
<td>Economics</td>
<td>A. Giannini/M. Thomson</td>
</tr>
<tr>
<td>Masahiko Haraguchi</td>
<td>Hiroshima University</td>
<td>M.A., International Relations/Development</td>
<td>E. Conrad/S. Someshwar</td>
</tr>
<tr>
<td>Ryan Hottle</td>
<td>Naropa University</td>
<td>BA Interdisciplinary Studies/Env. Studies</td>
<td>P. Ceccato</td>
</tr>
<tr>
<td>Amir Jina</td>
<td>University of Dublin</td>
<td>BA Mathematics</td>
<td>M. Madajewicz</td>
</tr>
<tr>
<td>Caitlin Kopcik</td>
<td>Ithaca College</td>
<td>BA Environmental Studies/Music</td>
<td>C. Mutter/R. Fullon/F. Fiondella</td>
</tr>
<tr>
<td>Mary Mwangi</td>
<td>University of Nairobi</td>
<td>Meteorology</td>
<td>S. Mason/A. Robertson</td>
</tr>
<tr>
<td>Sreeja Nair</td>
<td>University of Delhi</td>
<td>BS Biomedical Science</td>
<td>E. Conrad/S. Someshwar</td>
</tr>
<tr>
<td>Allison Sail</td>
<td>University of Rochester</td>
<td>Geological Sciences</td>
<td>A. Greene</td>
</tr>
<tr>
<td>Scott Seliers</td>
<td>University of Utah</td>
<td>BA Atms. Science/Physical Oceanography</td>
<td>L. Goddard</td>
</tr>
</tbody>
</table>
The success of the program is evident in the success and accomplishments of its 74 graduate alumni (see also table of selected alumnae that follows), continuing a trend they established as students. Upon graduating, students have gone on to work in organizations such as the Environmental Protection Agency, The Rainforest Coalition, California Climate Action Registry, United Nations Development Programme (UNDP), the National Meteorological Agency of Ethiopia, and the Lesotho Meteorological Service. To date, fifteen students from the developing world have attended the program on full scholarships and many others have been awarded partial funding. Past funding for scholarships has come from private foundations, the World Bank, Columbia University’s Earth Institute, IRI, NOAA, and Pulitzer.

The need for professionals who understand the links between climate and society is acute, and grows ever more so as human activity alters the global atmosphere. The Columbia M.A. Program in Climate and Society gives students the knowledge and skills to meet this need. Advances in climate modeling and prediction have changed the landscape of human knowledge. For drought-stricken farmers of the developing world, for shantytown dwellers at the mercy of hurricanes and mud slides, for governments trying to make the most of limited resources as they strive for development, and for the multibillion dollar insurance and food industries, this new scientific knowledge can offer better ways to respond to the problems and opportunities created by a varying climate – as long as they understand how to use this knowledge effectively.

Selected Alumnae, MA Program in Climate and Society

**2005**

**Ms. Jessica Bolson**  
PhD Student: Interdisciplinary climate studies, University of Miami, Rosensteil School of Marine and Atmosphere Science

**Mr. Diriba Dadi**  
PhD Student - Norway  
Team Leader, Weather Forecasting and Early Warning Team, National Meteorological Agency of Ethiopia

**Ms. Tara DePorte**  
Liason and Regional Coordinator, Program Director at the United Nations: Women’s Global Green Action Network

**Ms. Lauren Faber**  
Climate Change Advisor, British Embassy

**Mr. Akong (Charles) Ndika**  
Member of Advisory Board and Consultant for Global Village Energy Partnership (GVEP)

**Ms. Sibyl Nelson**  
Project Manager, Food and Agriculture Organization (FAO) in Rome  
Communications Associate, Pew Center on Global Climate Change

**Ms. Kareff May Rafisura**  
Institutions and Policy Specialist, Climate Risk Management, Asian Disaster Preparedness Centre

**Ms. Samyukta Ranganathan**  
Process Consultant, Proudfoot Consulting, and Private Musician

**Ms. Melissa Stults**  
Program Officer, ICLEI, Local Governments for Sustainability USA

**Ms. Abigail Tinker**  
Analyst, La Capra Associates (electricity policy issues)
2005, cont.
Ms Jessica Weinkle
PhD Candidate, Center for Science and Technology Policy Research, University of Colorado, Boulder

2006
Ms. Brittany Chamberlin
Intern, Ocean Foundation and International Economic Consulting Firm

Mr. Simbarashe Chidzambwa
Africa Climate Outlook Forecast Verification Project, African Center of Meteorology for Application and Development

Mr. Andrew Crane-Droesch
Consultant, UNDP Environment Facility

Ms. Dinali Nelun Fernando
PhD Candidate, Rutgers, The State University of New Jersey

Ms. Allison Hannon
Researcher, The Climate Group

Ms. Rachel Harris

Mr. Eric Holthaus
Staff Associate, IRI

Ms. Kuena Morebotsane
Meteorologist in the Climate Change Office, Lesotho Meteorological Service

Mr. Ivan Ramirez
PhD Student, Geography, Michigan State U

Mr. Asher Siebert
Staff Associate, IRI

Ms. Briane Sorice
Middle School and High School Math and Science Teacher, Professional Children’s School

Mr. Niels Tomijima
PhD Student, Energy Resources Group, UC Berkeley

Ms. Kristin Underwood
Writer, Treehugger.com

2007
Ms. Sandra Ashhab
Faith Popcorn Marketing

Ms. Shannon Buckley
NYS Department of Environmental Conservation

Mr. Ben Chou
Drinking Water Specialist, Arizona Department of Environmental Quality

Mr. Daniel Ruiz Carrascal
PhD student, IRI; Earth and Environmental Science, Columbia University

Ms. Daniela Domeisen
PhD student, Massachusetts Institute of Technology, Cambridge, MA

Ms. Emily Firth
Group on Earth Observations (GEO) Secretariat, Geneva, Switzerland
2007, cont.
Mr. Josh Gellers
PhD student, Political Science, UC Irvine

Mr. Kenneth Derry Hunu
PhD student, U Mass Amherst

Mr. Kenny Liu
CleanTech Group, LLC

Mr. Syd Partridge
California Climate Action Registry, Los Angeles

Mr. Luis Poza
Harlem Success Academy, Teacher

Ms. Stefanie Spayd
Earth and Environmental Sciences Teacher, Hunterdon Central Regional HS, Flemington, NJ

2008
Ms. Sarah Abdelrahim
Program Manager, National Oceanic and Atmospheric Administration (NOAA)

Mr. Daniel Bader
Training for Olympics in Holland

Mr. Wyatt Boyd
EPA, Presidential Management Fellow

Mr. Colin Kelley
PhD student, Earth and Environmental Science, Columbia University

Mr. Arron Layns
NOAA, Presidential Management Fellow

Ms. Lisette Braman
Technical Advisor, Red Cross/Red Crescent Climate Center

Ms. Allison Leighton
Consultant, New York State Energy Research and Development Authority

Dr. Gilma Mantilla
Senior Staff Associate, IRI

Ms. Christina Brelsford
PhD student, Sustainable Development, Arizona State University

Ms. Arame Tall
PhD Student, African Studies, Johns Hopkins University

Mr. Maurizio Di Battista
Analyst, Rainforest Coalition
Internship: Rainforest Coalition

Ms. Catherine Vaughan
Development Researcher, IRI/World Bank

Mr. Gang He
Researcher, Stanford University
(Sustainable Development in China)

Ms. Kalpana Venkatasubramanian, 2008
Staff Associate, IRI

Ms. Nishita Islam
Internship: Clinton Foundation (Clinton Climate Initiative)

Mr. Alexander Zvoleff
PhD student, Department of Geology, UC Santa Barbara/UC San Diego
### Project Tables

The below pages summarize projects, providing brief descriptions, linkages with IRI topics and regions, project partners, and the IRI project lead. Projects can also be viewed on line at http://iri.columbia.edu/projects.

<table>
<thead>
<tr>
<th>Topic/Region</th>
<th>Project Title</th>
<th>Description</th>
<th>Partners</th>
<th>Project Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Climate Risk Management Training</td>
<td>Climate risk management in the agricultural sector through training workshop and training materials designed to empower agriculture technical professionals to interface better with policy makers and agriculture extension service</td>
<td>Empresa Brasileira de Pesquisa Agropecuária; Centro Internacional de Investigaciones para el Fenomeno El Niño (Ecuador); Instituto Nacional de Investigacion Agropecuaria (Uruguay); Universidad Federal de Vicos</td>
<td>N. Ward</td>
<td></td>
</tr>
<tr>
<td>Analysis of Impacts of Climate Variability on Malaria Transmission in Sri Lanka and the Development of an Early Warning System (Completed)</td>
<td>Develop models to forecast malaria risk and a prototype early warning system for the Uva Province in Sri Lanka</td>
<td>International Water Management Institute; Anti-Malaria Campaign (Sri Lanka); Foundation for Environment, Climate and Technology; University of Peradeniya</td>
<td>L. Zubair</td>
<td></td>
</tr>
<tr>
<td>Building Capacity to Produce and Use Climate and Environmental Information for Improving Health in East Africa</td>
<td>Building capacity in the climate and health community-both individuals and institutions-to produce and use climate knowledge and information in routine health decision-making; beginning with an initiative in Ethiopia and a potential follow-on phase that scales up to the broader region of East Africa</td>
<td>Anti-Malaria Association (Ethiopia); Ethiopia Ministry of Health; IGAD Climate Prediction Centre; National Meteorological Agency of Ethiopia; World Health Organization (WHO) Eastern and Southern African Malaria Control; International Council for Research in Agroforestry; Liverpool School of Tropical Medicine; University of Reading, Department of Meteorology (UK)</td>
<td>S. Connor</td>
<td></td>
</tr>
<tr>
<td>Building Index-Based Weather Insurance Contract Design Software: A Prototype for an Education Tool - Phase 1 and 2</td>
<td>The contract design process piloted by World Bank CRMG and IRI in Africa and Central America has proven to be a robust and flexible approach to designing standardized contracts that balance simplicity that famers understand with the complex dynamics that characterize water stress impact on crop yields. In the shift from pilot testing to local ownership, IRI is creating a user-friendly web-based tool using this methodology for contract design, to be used as the basis for local training and knowledge transfer for stakeholders within the insurance and financial sector.</td>
<td></td>
<td>D. Osgood</td>
<td></td>
</tr>
<tr>
<td>Challenge Program on Climate Change, Agriculture and Food Security (Completed)</td>
<td>Serving on the Leadership Group appointed by the Consultative Group on International Agricultural Research (CGIAR) Alliance and the Earth System Science Partnership (ESSP) to write a CGIAR Global Challenge Program proposal entitled “Climate Change, Agriculture and Food Security” in consultation with a range of research and development stakeholders</td>
<td></td>
<td>J. Hansen</td>
<td></td>
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<tr>
<td>CIESIN-Risk Assessment and Mitigation Measures for Natural and Conflict-Related Hazards in the Asian Region</td>
<td>IRI collaborates with the Center for International Earth Science Information Network and the Center for Hazards and Risk Research, forming part of an international team led by the Norwegian Geotechnical Institute in addressing the risks of natural hazards and civil conflict in Asia</td>
<td>Center for Hazards and Risk Research, Center for International Earth Science Information Network (CIESIN)</td>
<td>B. Lyon</td>
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<td>CIESIN/LDEO-Data Development and Improvement for the 2009 Global Risk Update: Earthquakes, Drought, and Population Exposure</td>
<td>IRI collaborates with the CIESIN and the Center for Hazards and Risk Research, supporting the effort to improve the evidence base for disaster risk assessment at global, regional, national and subnational scales and its applicability to disaster risk management through contributions on the subject of drought to the 2009 Global Risk Update</td>
<td>Center for Hazards and Risk Research, CIESIN</td>
<td>B. Lyon</td>
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<tr>
<td>[Image]</td>
<td>Climate Information-Based Water Allocation with Decision Analyses on Multi-Sectoral Applications Research and Tool Development</td>
<td>Integrating rainfall forecasts and climate information to inform and optimize decision systems for improved water resource allocation.</td>
<td>University of Nairobi Dept. of Meteorology, Columbia University Dept. of Earth and Environmental Engineering, Fundação Cearense de Meteorologia e Recursos Hídricos, Philippine Metropolitan Waterworks and Sewerage System, Philippine National Water Resources Board</td>
<td>N. Ward</td>
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<tr>
<td>[Image]</td>
<td>Climate Predictability Tool (CPT) Development</td>
<td>The Climate Predictability Tool (CPT) has been designed for producing tailored seasonal climate forecasts using model output statistic corrections to climate predictions from general circulation model, or for producing forecasts using purely empirical approaches, such as from fields of sea-surface temperatures. It can also be used in more general settings to perform canonical correlation analysis, principal components regression, or multiple linear regression on any data, and for any application. In addition to achieving CPT platform independence, we will enhance availability by the incorporation of dynamic link libraries to create version 10 of the software.</td>
<td>World Meteorological Organization (WMO)</td>
<td>S. Mason</td>
</tr>
<tr>
<td>[Image]</td>
<td>Climate Predictability Tool Training</td>
<td>Foster a network of expertise for improved understanding of climate predictability.</td>
<td>WMO, Climate Prediction Center, Climate Service Division, International Centre for Theoretical Physics, Météo-France</td>
<td>S. Mason</td>
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<tr>
<td>[Image]</td>
<td>Climate Risk Assessment and Risk Management in the Agricultural and Forestry Sectors of Uruguay</td>
<td>Characterize climate variability at different temporal scales (from interseasonal to longer term climate change), assess its impacts on food and forest production, and explore responses that result in improved planning and decision-making.</td>
<td>Instituto Nacional de Investigacion Agropecuaria (INIA, Uruguay)</td>
<td>W. Baethgen</td>
</tr>
<tr>
<td>[Image]</td>
<td>Climate Risk Management in Southeast Asia: Indonesia, Philippines, and Vietnam</td>
<td>Helping to develop sustainable end-to-end institutional systems in Indonesia, Philippines and Vietnam that demonstrate improvements in the performance of climate-sensitive sectors at the community level with the capacity to achieve similar success nationally in other locations.</td>
<td>National Power Corporation; National Irrigation Administration; MWSS; CARE International Indonesia; Republic of Indonesia Ministry of Agriculture; Bogor Agricultural University; University of the Philippines Los Baños (UPLB); National Hydro-Meteorological Service of Vietnam; Asian Disaster Preparedness Center (ADPC); Office of the Mayor, Iloilo Municipio; Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA); Philippine National Water Resources Board</td>
<td>S. Someshwar</td>
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<tr>
<td>[Image]</td>
<td>Climate Risks and Agricultural Planning in Indonesia: Indramayu District</td>
<td>We work with the Office of the Bupati (district leader), and other key stakeholders to understand water use decision-making processes, and collaborate with Bureau of Meteorology and Geophysics and Bogor Agriculture University to build upon efforts to develop appropriate climate information for agricultural planning.</td>
<td>Center of Agricultural and Rural Development Studies; Bureau of Meteorology and Geophysics (BMG, Indonesia); Asian Disaster Preparedness Center; CARE International Indonesia; Bogor Agricultural University</td>
<td>S. Someshwar</td>
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<tr>
<td>[Image]</td>
<td>Climate Risks and Food Security in Indonesia: Nusa Tenggara Timur Province</td>
<td>Working with key government agencies and CARE Indonesia to develop strategies for using climate information to enable earlier action to help prevent food-security crises.</td>
<td>Bogor Agricultural University; BMG (Indonesia); ADPC; CARE International Indonesia</td>
<td>S. Someshwar</td>
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<td>Climate and Development in Africa</td>
<td>Partnering in this African Union-led project, we seek to strengthen the resilience of the hunger and health MDGs across the four Sub-Saharan Africa regions through improvements in policy, practice, and climate services and observations. The purpose of the first phase is to provide credible, quantitative assessment of the incremental development benefit of climate risk management and associated climate information services, within ongoing initiatives relating to the hunger and health MDG targets. Major areas of activity are expected in health (including malaria), food security and water.</td>
<td>African Union; Global Climate Observing System Secretariat; African Development Bank; UN-Economic Commission for Africa</td>
<td>M. Thomson</td>
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<td>Climate and Malaria in Niger</td>
<td>Develop and predict new abilities for improved stratification of climate-sensitive disease outcomes (malaria, meningitis) through the creation of tools involving remote sensing, geographical information systems and climate information.</td>
<td>Regional Training Centre for Agrometeorology and Operational Hydrology and Their Applications; African Center of Meteorological Applications for Development; Centre de Recherche Médicale et Sanitaire</td>
<td>M. Thomson</td>
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<td>Climate and Society Publication 2: Index Insurance for Climate Risk Management and Poverty Reduction</td>
<td>Through the Climate and Society platform, we examine the use of index insurance to help reduce vulnerability and poverty and adapt to climate change with a focus on capturing the questions, examining current case studies, and relying on expert scientific opinion to delineate the advances, opportunities, pitfalls and limitations faced in scaling up index insurance</td>
<td>Oxfam America; Swiss Reinsurance Company; National Oceanic and Atmospheric Administration (NOAA); International Fund for Agricultural Development; United Nations Development Programme; World Bank; World Food Programme (WFP)</td>
<td>M. Hellmuth</td>
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<td>Climate-Based Crop Forecasting Methodology Development and Intercomparison</td>
<td>Contribute to welfare of rural communities dependent on crop production by advancing the use of dynamic climate forecasts for prediction of crop production at multiple scales, and quantitative analyses of crop and farm management responses to forecasts</td>
<td>International Crops Research Institute for the Semi-Arid Tropics; National Centers for Environmental Prediction; University of Florida's Agricultural and Biological Engineering Department; La Recherche Agronomique au Service des Pays du Sud; Queensland Department of Natural Resources and Water</td>
<td>N. Ward</td>
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<td>Climate-Related Decision Support Research, Development and Implementation for the Millennium Villages</td>
<td>Evaluate climate variations and trends that are important to achieving and evaluating the Millennium Development Goals (MDG) at Millennium Villages in eastern Africa</td>
<td>The Earth Institute at Columbia University; MDG Technical Support Center, Kenya; World Agroforestry Centre (ICRAF)</td>
<td>N. Ward</td>
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<td></td>
<td>Coming Down the Mountain: Understanding the Vulnerability of Andean Communities to Hydroclimatologic Variability and Global Environmental Change</td>
<td>We characterize current climate conditions and trends impacting people of the Andean watershed basins, particularly in Argentina, Bolivia and Chile. This work is IRI's contribution to the University of Regina-led project (funded by the Inter-American Institute for Global Change Research) that studies the impact of climate variability and environmental change on communities living in glacier-fed settings.</td>
<td>Canadian Plains Research Center; University of La Serena; University of Chile; Institute for Political Ecology; Instituto de Ciencias Humanas, Sociales y Ambientales (Argentina); Agua Sustentable (Bolivia); Centro del Agua para Zonas Aridas y Semiariadas para America Latina y el Caribe (CAZALAC); Centro de Estudios Avanzados en Zonas Aridas (CEAZA); Centro de Agricultura y Medioambiente (AGRIMED, Universidad de Chile); Climate Change Unit, Environment and Sustainable Development Secretariat (Argentina); Prairie Adaptation and Research Collaborative (PARC); Centro Regional de Estudios en Desarrollo Humano (Universidad Católica del Norte); National Commission of the Environment (Chile); University of Regina</td>
<td>C. Brown</td>
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<td></td>
<td>Contributing to an OPeNDAP/OCG Gateway to Support Regional IOOS Interoperability</td>
<td>Contribution to overall design of OPeNDAP/OCG Gateway to Support Regional IOOS Interoperability, with particular focus on semantic mapping necessary to translate data through different interfaces, and the designing of a framework that allows semantic mapping without interfering with or changing the data transport.</td>
<td>Open-source Project for a Network Data Access Protocol</td>
<td>B. Blumenthal</td>
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<td>Data Library Collaborations: External User Support</td>
<td>Insure that external Data Library users have access while maintaining security for restricted data sets</td>
<td>Central Weather Bureau (Taiwan); European Centre for Medium-Range Weather Forecasts; WHO</td>
<td>B. Blumenthal</td>
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<td>Data Library Collaborations: Interconnectivity</td>
<td>Maintain currency and leadership in data exchange</td>
<td>Geophysical Fluid Dynamics Laboratory (GFDL); Massachusetts Institute of Technology (MIT); CIESIN</td>
<td>B. Blumenthal</td>
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<td>Data Library Collaborations: Partnerships</td>
<td>Maintain collaborative partnerships</td>
<td>CARE Indonesia; CIESIN; Center for Ocean-Land-Atmosphere Studies; CWB; Center for Research on the Changing Earth System; Climate Central; Earth Institute, Food and Agriculture Organization of the UN; Google; Inter-American Development Bank; Institute for Latin American Studies (CU); International Consortium for Agricultural Systems Applications; JAXA Office of Space Applications; LDEO Climate Group; Lancaster University; MIT; NASA; NOAA Climate Program Office; NOAA National Climate Data Center; GFDL; Observatoire du Sahara et du Sahel; International Federation of Red Cross and Red Crescent Societies; University of California Santa Barbara; U.S. Geological Survey (USGS); WMO; World Food Program; WHO</td>
<td>B. Blumenthal</td>
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<td>Data Library Enhancements: Climate data tools, analysis and documentation</td>
<td>Improve the Data Library utility and ease of use.</td>
<td>WHO; CIESIN; Columbia University Center for Research on Environmental Decisions</td>
<td>B. Blumenthal</td>
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<td></td>
<td>Data Library Enhancements: Environmental data access, display and tools</td>
<td>Provide frequently updated, near real-time information on those various environmental processes that are considered useful to the IRI's regional programs</td>
<td>NASA; USGS</td>
<td>S. Connor</td>
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<td>Data Library Enhancements: Holdings and Materials</td>
<td>Provide for the basic climate and environmental data needs of the IRI and its partners.</td>
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<td>B. Blumenthal</td>
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<td>Data Library Enhancements: Optimization and Hardware/Software</td>
<td>Ensure that Data Library hardware and software are able to keep pace with the demands of IRI Projects and Programs and the Data Library functions are optimized for maximum efficiency.</td>
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<td>B. Blumenthal</td>
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<td>Data Library Operations</td>
<td>Facilitate data exchange by providing an WWW data library that provides multi-disciplinary access to data needed to study short-term climate change and its impact.</td>
<td>Thematic Realtime Environmental Distributed Data Services; OPeNDAP Distributed Ocean Data Sets</td>
<td>B. Blumenthal</td>
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<td>Decentralization and Local Public Goods: How does allocation of decision-making authority affect provision?</td>
<td>To determine under what conditions community participation in projects designed to raise living standards improves project outcomes. We are carrying out a field experiment in Bangladesh to collect rigorous evidence about the effect which different types of participation have on outcomes under different physical and socio-economic conditions.</td>
<td>NGO Forum for Drinking Water and Sanitation</td>
<td>M. Madajewicz</td>
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<td>Designing Index-Based Weather Insurance Contracts for Farmers in Central America</td>
<td>Piloting innovative insurance products based on weather index variables to support the World Bank Commodity Risk Management Group pilot in Central America that seeks to improve the standardization of index insurance contract models for small and medium-sized farmers, which is part of a worldwide upscale for standardizing agricultural insurance contracts in emerging markets</td>
<td>Seguros Atlantida, S.A.; Instituto Nicaragunse de Seguros y Reaseguros; Inter-American Development Bank; Zamorano University; Central American Bank for Economic Integration; World Bank; Latin American Financial Services; Inter-American Federation of Insurances Companies; Equidad Cia de Seguros S.A.</td>
<td>N. Ward</td>
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<td>Designing a weather insurance contract for farmers in Adi Ha, Ethiopia</td>
<td>Enhancing the ability of Adi Ha farmers to manage drought risk and gain better access to credit, with particular focus on precipitation and data quality assessment and verification, draft contract design and stakeholder education.</td>
<td>D. Osgood</td>
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<td>Determinants of Meningitis in Ethiopia</td>
<td>Develop forecasting models to predict meningitis epidemics within sub-Saharan Africa by incorporating epidemiological, weather and environmental information at the local level; improve epidemic meningitis control through a better understanding of the etiology of the disease in its epidemic form and the local environmental determinants.</td>
<td>Liverpool School of Tropical Medicine; Ethiopia Ministry of Health</td>
<td>M. Thomson</td>
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<td>Developing and Evaluating Methodologies to Create Information about Land-Surface Characteristics that are Influenced by Hydroclimatic Variability</td>
<td>Improve our ability to develop decision support information where detailed knowledge of land surface characteristics are needed</td>
<td>Foundation for Environment, Climate and Technology; NASA/Goddard Space Flight Center; NASA; Mahaweli Authority of Sri Lanka</td>
<td>L. Zubair</td>
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<td>Development of Coupled Model Products</td>
<td>This project aims to implement and develop real-time coupled model forecasts in-house; integrate ECMWF and CFS forecast more fully into real-time products; develop a suite of multi-coupled model forecast products; provide diagnostics of coupled models to partners (NCEP, ECMWF); and, assist in implementation of the first operational African coupled seasonal forecasting model.</td>
<td>European Centre for Medium-Range Weather Forecasts; Center for Ocean-Land-Atmosphere Studies; National Centers for Environmental Prediction</td>
<td>D. DeWitt</td>
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<td>Development of Model Systems for Prediction and Predictability Studies</td>
<td>Improve predictive skill and understanding of predictability limits by improving some aspect of global models, including numerics, physics, or boundary conditions.</td>
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<td>L. Sun</td>
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<td>Development of a Fire Early Warning System Using Climate Information and Institutional Mapping toward Fire Early Response</td>
<td>Contribute to the development of early action systems for improved fire management in the peatlands of Central Kalimantan, Indonesia, including the identification of how climate information could be best integrated into decision-making</td>
<td>Remote Sensing Affairs, National Institute of Aeronautics and Space; Provincial Government of Central Kalimantan; CARE International Indonesia; National Oceanic and Atmospheric Administration; Bogor Agricultural University; BMG (Indonesia)</td>
<td>S. Someshwar</td>
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<td>Development of an Information and Monitoring System to Evaluate Risks in Agricultural Production in Paraguay and Uruguay (Completed)</td>
<td>Establish an information and monitoring system based on historic records, satellite images and simulation models integrated in a GIS for the evaluation of risks in agricultural production, associated with climate variability and technology levels in Paraguay and Uruguay. The participation of IRI involves assisting in: training activities for national staff members (GIS, database construction and management, simulation models), and incorporation of climate information (including seasonal climate forecasts) in the information systems.</td>
<td>Instituto Nacional de Tecnología Agropecuaria (Uruguay, Paraguay); Inter-American Development Bank; Universidad Católica Nuestra Señora la Asunción</td>
<td>W. Baethgen</td>
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<td>Development of dynamic risk assessment models (DRAMS) for mass health intervention programmes</td>
<td>Developing a methodology for routine mapping of infectious disease using health surveillance data</td>
<td>Lancaster University</td>
<td>M. Thomson</td>
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<td>Downscaling methods intercomparison project</td>
<td>Provide an assessment of the pros and cons of various GCM downscaling methodologies, particularly dynamical vs. statistical; provide answers to the question &quot;What can statistical and dynamical downscaling of seasonal forecasts offer?&quot;</td>
<td>PAGASA</td>
<td>J. Qian</td>
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<td>Dynamical Downscaling Training</td>
<td>Foster a network of expertise for cutting-edge issues and methods in downscaling.</td>
<td>Experimental Climate Prediction Center; NOAA Office of Global Programs</td>
<td>N. Ward</td>
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<td>Dynamical Regional Model Development and Downscaling</td>
<td>Improve understanding of the physical mechanisms of regional predictability, underpin statistical downscaling methods, and construct downscaled climate information for regional projects.</td>
<td>Intergovernmental Authority on Development Climate Prediction and Applications Centre; Beijing Normal University; Centro de Previsão de Tempo e Estudos Climáticos; Fundação Cearense de Meteorologia e Recursos Hídricos; Central Weather Bureau (Taiwan); South African Weather Service</td>
<td>A. Robertson</td>
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<td>ENSEMBLE-based predictions of climate changes and their impacts</td>
<td>The ENSEMBLES project is supported by the European Commission's 6th Framework Programme as a 5 year Integrated Project from 2004-2009 under the Thematic Sub-Priority &quot;Global Change and Ecosystems&quot;. IRI is a no-cost partner reporting activities carried out as part of the regional programmes including those related to Malaria Early Warning Systems for Southern Africa.</td>
<td>Liverpool School of Tropical Medicine</td>
<td>M. Thomson</td>
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<td>Enhancing Climate-Based Food Security Early Warning in West Africa</td>
<td>Bring seasonal forecasts and improved assimilation of rainfall monitoring into an operational food production forecasting system, contributing to capacity to anticipate and manage climate impacts on food security in West Africa.</td>
<td>Regional Training Centre for Agrometeorology and Operational Hydrology and Their Applications; World Food Program</td>
<td>J. Hansen</td>
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<td>Enhancing Malaria Early Warning System (MEWS) with Earth Observation and Modeling Results</td>
<td>With demand growing for Malaria Early Warning Systems, there are calls for more timely, localized and accurate monitoring information to indicate changes in epidemic potential among vulnerable communities. Collaborative work with FEWS-NET aims to develop and test practically useful information products appropriate to improving epidemic malaria control and make these products available through FEWS-NET's Africa Data Dissemination Service.</td>
<td>USGS; World Health Organization; Pan American Health Organization; National Aeronautics and Space Administration</td>
<td>S. Connor</td>
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<td>Epi-Meteorology-Towards a New Discipline in the Service of Global Public Health</td>
<td>Setting in motion a new interdisciplinary teaching and research discipline at Columbia on the complex influences of climate on human health at the population level</td>
<td>Columbia University Mailman School of Public Health</td>
<td>M. Thomson</td>
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<td>Evaluating Impacts of Sustainable Development Projects</td>
<td>Informing the practice of promoting sustainable development by using impact evaluations. This phase involves a workshop series to bring together expertise from several social sciences and statistics to produce new approaches.</td>
<td>Columbia University Applied Statistics Center and Departments of Statistics and Political Science, Department of Mechanical Engineering; CIESIN; Tropical Agriculture and Rural Environment Program of the Earth Institute</td>
<td>M. Madajewicz</td>
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<td>Exploring the Properties of Market Mechanisms (including Insurance) for Managing Climate Risk</td>
<td>Improving management of climate risk through market/insurance mechanisms. In particular, we explore the theoretical properties of different market mechanisms intended to trigger positive outcomes in the presence of climate risk information, including seasonal forecasts; and, provide guidance on the effectiveness of different approaches.</td>
<td>The Commodity Risk Management Group; World Bank; Columbia University Center for Research on Environmental Decisions</td>
<td>N. Ward</td>
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<td>Extended Range Forecasting and Agriculture Risk Management, India (ERFARM)</td>
<td>Through a consortium of India's leading institutions in climate research and agricultural management, IRI and other international partners, this project integrates risk management and climate science research to improve both forecasting capacity and the understanding of climate risks in the context of rural livelihoods.</td>
<td>India Meteorological Department; Government of India Ministry of Agriculture; Indian Council of Agriculture Research; Indian Institute of Technology Delhi</td>
<td>S. Someshwar</td>
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<td>Forecast improvement: Regional Climate Outlook Forum, Africa; Training for Climate Forecasters</td>
<td>Improve climate variability management at the national level in Africa by enhancing the capacity of climate forecasters to implement approaches and evaluate the expected skill when applied in real time.</td>
<td>ICPAC; African Center of Meteorological Applications for Development; Southern African Development Community Drought Monitoring Centre; ICRAF</td>
<td>N. Ward</td>
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<td>Forecasting Cholera in Africa (In Development)</td>
<td>The Cholera Forecasting Project aims to establish the potential of an environmental approach to cholera epidemic forecasting in Africa. This would ultimately be intended to increase knowledge for governments and relief organisations at the national and local levels, which may be used to improve epidemic preparedness and timely response strategies, thereby mitigating the impact of epidemic events.</td>
<td>Mozambique Ministry of Health; WHO Regional Office For Africa</td>
<td>M. Thomson</td>
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<td>Forecasting Tropical Cyclone Activity Using Atmospheric General Circulation Models</td>
<td>Develop and improve operational tropical cyclone forecasts products, increasing coastal societies’ preparedness for tropical cyclone impacts.</td>
<td>Max Planck Institute for Meteorology; South African Weather Service</td>
<td>S. Camargo</td>
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<td>Hydroclimate Risks to Water Management for Agricultural Development (Completed)</td>
<td>A summary of the state of knowledge of the effect of hydrologic variability on agricultural development and economic growth, and recommendations for investing in water management for agricultural development within a variable and changing climate</td>
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<td>C. Brown</td>
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<td>IRI CSL Computing Project: Development and Application of Seasonal Climate Predictions</td>
<td>Investigates the potential to predict and thus anticipate extreme seasonal and sub-seasonal climate variability. Similarly, this work will contribute to better estimates of the skill realizable by real-time forecasts of climate and thus the sectoral forecasts that incorporate those climate predictions.</td>
<td>Max Planck Institute for Meteorology; The National Center for Atmospheric Research</td>
<td>D. DeWitt</td>
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<td>Identification, access, handling and analysis of remote sensing data products</td>
<td>An activity to engage in further interaction with UA/RP groups to identify data needs and information output requirements.</td>
<td>United States Geological Survey Center for International Earth Science Information Network National Aeronautics and Space Administration</td>
<td>S. Connor</td>
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<td>Impact of Increased Model Resolution on Predictive Skill in Tier-2 Integrations Using Prescribed Sea Surface Temperature</td>
<td>Assess the impact of increased model resolution on seasonal forecast skill, and evaluate the potential benefit to the IRI real-time forecast system from increasing resolution.</td>
<td>Max Planck Institute for Meteorology; The National Center for Atmospheric Research</td>
<td>L. Goddard</td>
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<td>Implementation of New or Improved Systems, Tools, Software and Products</td>
<td>Implementation of new or improved components into the forecast operations for the production of the global &quot;net assessment&quot; forecasts is considered an essential step in the completion of a successful research activity on forecast combination and/or recalibration. The transition into &quot;real-time&quot; forecasting products and tools is an integral component of predictability research at the IRI.</td>
<td>Max Planck Institute for Meteorology; Experimental Climate Prediction Center; Climate Prediction Center; Queensland Climate Change Centre of Excellence; GFDL; Center for Ocean-Land-Atmosphere Studies; NASA/Goddard Space Flight Center; National Centers for Environmental Prediction; Environmental Modeling Center</td>
<td>A. Barnston</td>
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<td>Improved SST Prediction</td>
<td>Provide the most accurate and reliable predictions possible of global SSTs and of ENSO probabilities</td>
<td>European Centre for Medium-Range Weather Forecasts; National Centers for Environmental Prediction</td>
<td>M. Tippett</td>
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<td>Improving Locusts Outbreak Forecast in Africa and Asia using Climate Forecast Products (Pilot Project) (Completed)</td>
<td>Seeks to understand the relationship between meteorological/climatic factors and the outbreak of Desert Locust by analyzing the historical data available (1930 to present) on Desert Locust outbreak and climatic factors; and potentially, to improve and tailor forecasting products.</td>
<td>The Food and Agriculture Organization of the United Nations</td>
<td>P. Ceccato</td>
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<td>Improving Water Management and Energy Pricing in Hydroelectric Power Generation in Colombia Using Seasonal Climate Forecasts</td>
<td>Improve the reliability and efficiency of hydroelectric power generation using seasonal climate forecasts. In particular, the goals are: to identify climate variables that are key to the electricity market and to the electricity production and costs based on predictability (e.g. projections of future inflows), and to identify ways for improving “operational strategy” (shorter timescale) as well as its “planning strategy” (longer time scale, e.g. 2 years).</td>
<td>Empresas Publicas de Medellin S.A. ESP</td>
<td>U. Lall</td>
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<td>Integrating Local Knowledge Systems and Scientific Information for Climate Change Risk Management of Vulnerable Andean Sectors</td>
<td>This project seeks to build centers of information on climate change (CICC) in three Andean countries (Ecuador, Peru and Bolivia), each with two main programs: (1) a program on climate change scenarios that can help farmers and other vulnerable social groups to enhance their local knowledge systems of risk management; (2) a sustainable governance program that can facilitate the processes of adaptation of rural Andean societies to climate change. CICCs will begin by identifying, documenting and studying atmospheric, hydrological, ecological and sociological issues emerging due to climatic events. The project team will work in partnership with local research experts from the three countries to design and establish the CICCs.</td>
<td>Columbia University Department of Ecology, Evolution, and Environmental Biology; and Center for Environmental Research and Conservation</td>
<td>W. Baethgen</td>
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<td>Investigating Some Practical Implications of Uncertainty in Observed SSTs</td>
<td>This project evaluates the impact of uncertainty in observed SSTs on seasonal-to-interannual prediction. One of the important goals of the Sustained Ocean Observing System for Climate is to improve the SST accuracy over the global ocean. Project activities are intended to provide feedback to the climate observing community on the apparent impact of that improvement for seasonal climate simulations and predictions.</td>
<td>National Oceanic and Atmospheric Administration</td>
<td>L. Goddard</td>
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<td>Large Ensemble Impact on Predictive Skill in Tier-2 Integrations Using Prescribed Sea Surface Temperature</td>
<td>(i) Assess the impact of ensemble size on seasonal forecast skill, and (ii) assess parameterization of the forecast probability distribution function as a function of ensemble size.</td>
<td>Max Planck Institute for Meteorology; The National Center for Atmospheric Research</td>
<td>L. Goddard</td>
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<td>Malaria Climate Risk Knowledge Systems</td>
<td>Developing training materials and courses designed to empower public health professionals in the use of climate knowledge and information in routine health decision-making</td>
<td>CIESIN; Mailman School of Public Health; World Health Organization</td>
<td>M. Thomson</td>
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<td>Malaria Early Warning System: Building on Botswana Work and Scaling Up to Other Epidemic-Prone Countries in Africa</td>
<td>Provide the evidence of the role of climate in disease dynamics in African countries; assess the value of such evidence to improving epidemic prevention and control; and, provide tools and training in order to develop the capacity of disease control staff to use the information created in improving malaria control decision-making in Africa.</td>
<td>La Recherche Agronomique au Service des Pays du Sud; World Health Organization</td>
<td>M. Thomson</td>
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<td>Malaria control decision support: Malaria Outlook Forum for Southern Africa</td>
<td>Develop malaria early warning systems for epidemic-prone areas using vulnerability assessment, seasonal climate forecasts, climate/environmental monitoring and health surveillance</td>
<td>Southern African Development Community Drought Monitoring Centre; Southern Africa Malaria Control/WHO</td>
<td>S. Connor</td>
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<td>Managing climate risk for agriculture and water resources development in southern South Africa: Quantifying the costs, benefits and risks associated with planning and management alternatives</td>
<td>A Climate Change Adaptation in Africa (CCAA) project collaboration with three South African universities and the UNEP-Risoe Center to engage government (water and agricultural departments) and private sector stakeholders to identify and test the feasibility of alternative management options in light of development and climate change in the Western Cape, South Africa (CCAA is funded by IDRC/DfID)</td>
<td>Climate Systems Analysis Group; University of KwaZulu Natal, School of Bioresources Engineering and Environmental Hydrology; UNEP Risoe Centre on Energy, Climate and Sustainable Development; University of the Free State</td>
<td>M. Hellmuth</td>
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<td>Managing Competing Water Uses in the Philippines:</td>
<td>Demonstrating improvements in managing climate risks in the context of water management, through tool development, capacity building of key sectoral agencies and the national meteorological service.</td>
<td>National Power Corporation; Institute of Strategic Planning and Policy Studies; National Irrigation Administration; Metropolitan Waterworks and Sewerage System; PAGASA; Philippine National Water Resources Board</td>
<td>S. Someshwar</td>
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<td>Angat Reservoir</td>
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<td>Map Rooms - Capability Enhancements</td>
<td>Enhance society's ability to understand climate variability and its synergistic relationships with other environmental factors for applications in various sectors and decision systems.</td>
<td>WMO; USGS; CIESIN</td>
<td>B. Blumenthal</td>
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<td>Mapping Institutions and Policy Responses</td>
<td>Develop and pilot methodologies to map institutions and policy processes to manage climate-related problems, initially in the context of diverse demonstration sites in Southeast Asia, including: 1) managing competing water uses for the Angat Reservoir, Philippines; 2) Food security in Nusa Tenggara Timur, Indonesia; 3) Integrated water resources management in Bali, Indonesia.</td>
<td>Center of Agricultural and Rural Development Studies; Udayana University; Institute of Strategic Planning and Policy Studies (UPLB)</td>
<td>S. Someshwar</td>
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<td>Masters Program in Climate and Society</td>
<td>Enable numerous IRI staff in teaching, mentoring, and/or course curricula development; to educate diverse population of master students in climate-informed approaches to problem solving; to stimulate faculty recognition of the importance of climate informed development training at Columbia University.</td>
<td>The Earth Institute at Columbia University</td>
<td>C. Mutter</td>
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<td>Meningitis (In development)</td>
<td>Project domain covering all aspects of the development of meningitis early warning systems—a series of interlinked but distinct research activities for planned outputs, including: creation of improved environmental data sets and predictive skills for significant environmental data; improved understanding of the aetiology of the disease; creation of improved model structures for the prediction of epidemics, and creation of improved decision making tools using cost-effectiveness and systems analysis</td>
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<td>M. Thomson</td>
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<td>Methodologies to Analyze Policy Responses and Development Outcomes</td>
<td>Analyze policy responses to climate-related problems on two fronts: (1) using Bayesian modeling to investigate development outcomes of drought and policy responses, and (2) analyzing rice production data in Indonesia and the Philippines to identify the role of climate variability, and assess the potential for integrating climate information into rice import decision making.</td>
<td>Udayana University; Bureau of Agricultural Statistics, Philippine Dept. of Agriculture; Institute of Development Studies, Jaipur; Republic of Indonesia Ministry of Agriculture</td>
<td>S. Someshwar</td>
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<td>Methodologies to Analyze the Institutional Utility of Climate Information</td>
<td>Investigate current and past uses of climate information, via a literature review and focused country/regional case studies, and to assess the benefits and costs of climate information use by institutions.</td>
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<td>S. Someshwar</td>
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<td>Monitoring Air and Land Surface Temperature using Satellite Derived Products</td>
<td>An analysis of the air and surface temperature derived from satellite images to monitor temperature conditions favorable to vector-borne disease transmissions.</td>
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<td>P. Ceccato</td>
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<td>Near Term Climate Change (NTCC)</td>
<td>The project is aimed to increase understanding and anticipation of lower frequency climate.</td>
<td>Lamont-Doherty Earth Observatory; BMG (Indonesia); Centro de Previsão de Tempo e Estudos Climáticos; GFDL</td>
<td>L. Goddard</td>
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<td>New Tools for North American Drought Prediction</td>
<td>Work will develop and test best new tools for drought prediction based on empirical-dynamical forecasting approaches. The goal is to enhance real-time, seasonal drought assessment and prediction capabilities for the U.S. and Mexico.</td>
<td>Universidad Nacional Autonoma de Mexico</td>
<td>B. Lyon</td>
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<td>Provision of Common Baseline Information on Observed Climatic Variability in Support of Climate and Water Work in Africa</td>
<td>Developing a knowledge base characterizing climate variability in Africa, and a review of methodologies to translate climate change and variability data to the water and land management sector that can be used in common in all the regions where the World Bank conducts its work</td>
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<td>C. Brown</td>
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<td>Real-Time Dynamically Based Climate Diagnostics of Observations and Forecasts</td>
<td>Improve understanding and attribution of real-time observed and forecasted climate anomalies via use of dynamical techniques.</td>
<td>Lamont-Doherty Earth Observatory; Center for Ocean-Land-Atmosphere Studies</td>
<td>D. DeWitt</td>
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<td>Regional Climate-Change Projections Through Next-Generation Empirical and Dynamical Models</td>
<td>Use of hidden Markov models, empirical mode reduction and intermediate coupled ocean-atmosphere models to further the dynamical understanding of decadal-to-interdecadal oscillations and their predictability, and to develop downsampling techniques for GCM climate change projections.</td>
<td>UCLA, UC Irvine, U Wisconsin Milwaukee</td>
<td>A. Robertson</td>
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<td>Refining Weather Insurance Contracts for Farmers in Malawi, Tanzania and Kenya (Completed)</td>
<td>Design and evaluate weather index insurance contracts for smallholder farmers in Malawi, Kenya and Tanzania for the World Bank Commodity Risk Management Group in its effort to upscale for standardizing agricultural insurance contracts in emerging markets</td>
<td>FSD Kenya; International Crops Research Institute for the Semi-Arid Tropics; Pride Tanzania; Opportunity International Bank Malawi Ltd.; Malawi Meteorological Services; National Smallholder Farmers Association of Malawi; Malawi Rural Finance Company Limited; World Bank; Tanzania Meteorological Service; Kenya Meteorological Department; Chitedze Agricultural Research Station</td>
<td>N. Ward</td>
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<td>Regional Climate Outlook Forums (SE S Am, Western S Am, NE Brazil, Central Am)</td>
<td>Contribute to the Regional Climate Outlook Forums of southeast South America, western South America, northeast Brazil and Central America by: a) providing climate information (model runs, Data Library, IRI forecasts), b) organizing short courses for researchers on the use of CPT, IRI data library, c) presenting educational material to stakeholders on probabilistic climate forecasts and their applications in decision making.</td>
<td>WMO; Centro de Previsão de Tempo e Estudos Clárnicos; International Crops Research Institute for the Semi-Arid Tropics</td>
<td>W. Baethgen</td>
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<td>Retrospective Forecasts Made Using Retrospectively Forecast SST</td>
<td>Estimate real-time forecast skill from two of the operational IRI forecast models using hindcasted SST</td>
<td>Max Planck Institute for Meteorology; The National Center for Atmospheric Research</td>
<td>L. Goddard</td>
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<td>Routine Forecasts</td>
<td>Routine forecast production consists mainly of the scheduled forecast production process itself, but also includes the closely related maintenance of the software and data sets that support the operation, handling public inquiries related to a current forecast, and creating special versions of a current forecast upon request.</td>
<td>Max Planck Institute for Meteorology; Environmental Modeling Center; Experimental Climate Prediction Center; Queensland Climate Change Centre of Excellence; Geophysical Fluid Dynamics Laboratory; Center for Ocean-Land-Atmosphere Studies; NASA/Goddard Space Flight Center</td>
<td>A. Barnston</td>
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<td>SGER: Diagnosing El Nino-induced tropical droughts in seasonal forecasts and climate change projections</td>
<td>This research considers the strengths and weaknesses of seasonal predictions and climate change drought predictions, in particular how the models respond to large scale changes in sea surface temperature such as those due to ENSO or to climate change</td>
<td>Centro de Previsión de Tempo e Estudos Climáricos</td>
<td>L. Goddard</td>
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<td>SGER: Investigating the joint occurrence of summer drought and heat waves in</td>
<td>This project will quantify the joint behavior of summer heat waves and drought in coupled models and observations over the last half of the 20th century and will examine changes in these relationships in climate projections. Emphasis will be on the drought-prone region of Southern Africa although some global analyses will also be performed.</td>
<td>Lamont-Doherty Earth Observatory; Ocean Data Assimilation for Seasonal-to-Interannual Prediction; Center for Ocean-Land-Atmosphere Studies; Tel Aviv University; Texas A&amp;M University</td>
<td>B. Lyon</td>
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<td>SST Prediction and Predictability Systems</td>
<td>Exploring the improvement of SST forecasts on the 1 to 6 month timescale to understand better the deficiencies in the current approaches to tropical SST prediction.</td>
<td>Restricted to the Southern Hemisphere</td>
<td>D. DeWitt</td>
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<td>SeasonSmart: multi-disease transmission seasonality</td>
<td>This initiative is based on the premise that seasonality matters in terms of improving resource management and health care delivery. Many diseases in many parts of the world are known to exhibit strong seasonality with patients appearing at health facilities in increasing numbers during certain favourable seasons.</td>
<td>Liverpool School of Tropical Medicine; Columbia University Mailman School of Public Health</td>
<td>M. Thomson</td>
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<td>Social Meanings of Climate Information</td>
<td>Investigate meanings attributed to climate information, derived from the social embeddedness of the institutions that generate them, via: Climate Outlook Forums, and indigenous forecasting methods.</td>
<td>Restricted to the Southern Hemisphere</td>
<td>S. Someshwar</td>
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<td>South Atlantic Ocean-Atmosphere Interaction (Completed)</td>
<td>Investigating ocean-atmosphere interactions over the South Atlantic to achieve a better understanding of their role in determining the seasonal cycle and interannual variability in the tropical Atlantic, and the ENSO teleconnection in particular.</td>
<td>Lamont-Doherty Earth Observatory; University of California, Los Angeles</td>
<td>A. Robertson</td>
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<td>Supporting Colombia's National Integrated Dengue and Malaria Surveillance and</td>
<td>IRI support is in providing evidence of the role of climate in disease dynamics, assessing the value of such evidence to improve disease prevention and control, and providing tools and training to develop capacity of disease control staff to use information in improving malaria control decision-making. This is the health component of the World Bank-GEF-funded project, &quot;Integrated National Adaptation Plan (INAP): High Mountain Ecosystems, Caribbean Islands and Human Health&quot; implemented by IDEAM, and coordinated by the National Institute of Health and the Ministry of Health.</td>
<td>Instituto Nacional de Salud de Colombia; Conservacion Internacional Colombia; Instituto de Hidrología, Meteorología y Estudios Ambientales</td>
<td>W. Baethgen</td>
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<td>Control System</td>
<td>Improved management of climate risks can necessitate consideration of new or innovative products that bring climate information into the risk consideration at the appropriate temporal or spatial scale. In this project, real time forecasts of meteorological quantities will be produced using seasonal and daily weather statistic. Examples include rainfall frequency and/or dry-spell risk at fine spatial scales.</td>
<td>European Centre for Medium-Range Weather Forecasts; CEREGE - Centre Europeen de Recherche et d'Enseignement des Geosciences de l'Environnement; Centro de Previsão de Tempo e Estudos Climáticos; Climate Prediction Center</td>
<td>A. Robertson</td>
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<td>Tailored forecast and monitoring products</td>
<td>Producing training materials and courses in managing hydroclimatic risk for water resource professionals</td>
<td>Restricted to the Southern Hemisphere</td>
<td>N. Ward</td>
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<td>Training in Water and Climate Risk Management</td>
<td>This project compares the performance of various satellite-derived and other climate data sets over different parts of the world, with more of a focus on Africa.</td>
<td>Restricted to the Southern Hemisphere</td>
<td>T. Dinku</td>
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<td>Verification of Seasonal Climate Predictions</td>
<td>The project involves the definition and implementation of international standards for the verification of seasonal climate forecasts, as defined (as a minimum) by the WMO, for the purpose of accurately and simply communicating forecast quality. Demonstration of the benefits of best practices in a prototype operational setting will enable operational forecasting centers to assess and adopt appropriate best practices for their systems also.</td>
<td>ICPAC; African Center of Meteorological Applications for Development; MeteoSwiss - Federal Office of Meteorology and Climatology; Drought Monitoring Centre</td>
<td>S. Mason</td>
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<td>Visitors Program</td>
<td>Build a global network of resource managers, innovative senior scientists, and policy leaders dedicated to collaboration in the search for development solutions.</td>
<td>The Earth Institute at Columbia University</td>
<td>S. Zebiak</td>
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<td>Water, Growth and Poverty in Africa - A Water Security Index (WSI) Completed</td>
<td>Exploring the integrated impact of hydroclimatic variability and associated economic vulnerability in Africa and determining what constitutes water security, and how it differs from country to country</td>
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<td>C. Brown</td>
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<td>Weather Risk Transfer for Climate Impacts-Millennium Villages Project</td>
<td>The Millennium Villages Project seeks to design and implement a comprehensive package of interventions intended to help break the poverty trap in rural Africa. Part of this program recognizes a need for financial risk transfer instruments of climate impacts, particularly that of drought. In response to this need, the IRI is performing research and analysis relevant to Swiss Re's development and offer of weather risk transfer products for villages that are part of the MVP.</td>
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<td>N. Ward</td>
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A Coupled Atmosphere-Ocean General Circulation Model for Inclusion in the IRI Multi-Model Ensemble Prediction System

The IRI produces seasonal forecasts on a monthly basis using the multi-model ensemble (MME) method. Up until now these forecasts have used outputs only from so-called Tier-2 forecast systems which utilize prescribed sea surface temperature (SST) and do not allow coupled interaction between the atmosphere and the ocean. Recent research has shown that although there are many desirable properties to the Tier-2 type approach there are also limitations associated with the lack of coupling to the ocean. IRI had previously built a directly coupled atmosphere-ocean general circulation model (CGCM) as part of a NOAA Applied Research Centers (ARCs) project. The CGCM component models are the Max-Planck Institute (MPI) ECHAM4.5 atmospheric general circulation model (AGCM), and the Geophysical Fluid Dynamics Laboratory (GFDL) Modular Ocean Model Version 3 (MOM3) ocean general circulation model (OGCM). One deficiency of that forecast system was the method chosen for ensemble member generation in the AGCM component model. Another deficiency is the presence of fairly large climate drift especially in the equatorial cold-tongue region of the Pacific. These two issues have been ameliorated in a second generation of the CGCM that utilizes a better method for AGCM ensemble member generation and by developing an anomaly coupled version of the CGCM.

Ultimately, the goal of any model included in the IRI MME is to contribute to skillful predictions of near-surface air temperature and precipitation over land on the seasonal time-scale. Retrospective ensemble forecasts using both the direct and anomaly coupled versions of the CGCM have been made for the 1982-2006 period for initial condition months of February, May, August and November. The figure above shows an example of the skill of precipitation forecasts for the October-November-December season starting from August 1 initial conditions. Upper: Tier-2 ECHAM4.5 using Constructed Analog SST forecast. Center: Tier-1 ECHAM4.5-MOM3 anomaly coupled. Lower: Tier-1 ECHAM4.5-MOM3 directly coupled.
(GHA) and South America both versions of the CGCM have substantially higher skill than the Tier-2 system.

It should be noted that we are here highlighting a positive result from the CGCM. The Tier-2 type forecast using the ECHAM4.5 AGCM is found to produce superior forecast skill than either version of the CGCM for other IC months, leads and regions. Such a complimentary aspect to model skill should enable improvement in the MME forecast skill by inclusion of one or both versions of the CGCM. Also, despite the large equatorial Pacific cold-tongue bias, the directly coupled CGCM is similarly found to produce superior forecast skill for other IC months, leads and regions compared to the anomaly coupled CGCM.

*Contributed by D. G. DeWitt.*

**Can Climate Forecast Models Improve the Livelihoods of Smallholder Farmers in Kenya?**

Information that reduces climatic uncertainty is expected to enable dryland farmers to improve their livelihoods, yet few studies have attempted to quantify the value of seasonal climate forecasts for smallholder farmers in high risk, high predictability environments, and none that we know of have quantified the value of forecasts from a general circulation model (GCM). We estimated the potential value of seasonal forecasts for maize planting and fertilizer management decisions at two semi-arid locations in southern Kenya, using downscaled rainfall forecasts from a GCM run with both observed and persisted sea surface temperatures (SST) – representing upper and lower bounds of predictability – combined with a crop model and enterprise budgeting to identify profit-maximizing management strategies.

Perfect information about growing season weather was worth an estimated 15-30 % of the average gross value of production and 24-69% of average net income (after subtracting variable production cost; see also figure at right. GCM predictions based on observed SSTs increased average net income 24% at Katumani and 9% at Makindu when labor cost was included, allowing a farmer to recover up to about a third of the benefit from perfect foreknowledge of the upcoming season’s weather. Predictions based on persisted SSTs did not show significant skill or value. Results estimated for the GCM run with observed SSTs appear to be plausible for the best operational seasonal forecasts in light of reported improvements in prediction skill that can be achieved from combining SST
forecast methods and from combining multiple GCMs – both implemented routinely at the IRI and other climate prediction centers.

We tested whether there is a basis for concern that risk-averse smallholder farmers would not be able to respond to seasonal forecasts under the conditions of the study because they cannot bear the risk of a “wrong forecast.” Stochastic dominance analysis showed that farmers who use forecasts to optimize their management would not increase their risk exposure, and that the substantial chance of reducing income in a given year (25% at Katumani, 34% at Makindu) would not be a disincentive for the rational risk-averse farmer to base management on forecasts regardless of her degree of risk aversion. Given assumptions of rationality and unbiased perception, our assumption of profit maximization represents a worst-case scenario. The rational risk-averse farmer who understands the uncertainty of a forecast would never select a forecast-based management strategy with a risk-return balance that is inferior to the climatology-based strategy.


**Climate Impact on Malaria and Development of an Early Warning System**

IRI scientists, in conjunction with colleagues at Sri Lanka’s Ministry of Health Anti-Malaria Campaign, the Sri Lankan Foundation for Environment, Climate and Technology, and the International Water Management Institute in India, have completed a study on the association between historic malaria epidemics in Sri Lanka and El Niño. The team was able to confirm a relationship between El Niño and epidemics and was also able to demonstrate that decadal changes in El Niño’s influence on regional rainfall modulated this relationship. These findings are contributing to the development of methodologies for Malaria Early Warning Systems for Sri Lanka and elsewhere. A training workshop on the use of climate information for malaria risk management for academics, disease control managers and researchers was conducted in the fall of 2007 in Sri Lanka to relay these new findings and ways to use them in practice.

Morbidity, mortality, and total hospital returns due to malaria in Sri Lanka are plotted on a log scale. Few cases were reported during the DDT spraying periods. Malaria incidence is characterized by inter-annual fluctuations and decadal changes. Malaria Epidemics coincided with El Niño events up to 1930 and since 1980.
Climate Information for Public Health: Summer Institute 2008

The IRI, working in partnership with the Center for International Earth Science Information Network (CIESIN) and the Mailman School of Public Health, conducted for the first time a two-week training course, entitled, *Summer Institute: Climate Information for Public Health*. This course was held at Columbia University’s Lamont-Doherty Campus in Palisades, New York from June 2-13, 2008. In attendance at the Summer Institute were thirteen participants from ten different countries: Botswana (1), Ethiopia (1), Zimbabwe (1) Kenya (1), Nigeria (1), Niger (1) United Kingdom (2), Switzerland (1), Colombia (1) and the United States (3). Five of the course participants work in the climate or meteorological sector, and the remaining eight in the health sector or health research fields.

The objective of the course was to offer public health and climate professionals the opportunity to learn practical methods for integrating climate knowledge and information into health decision-making processes. The course was designed to help participants not only enhance their knowledge of climate-sensitive diseases, such as malaria and meningitis, but also to foster and develop the use of climate information in the management of climate-sensitive diseases programs. Over the course of two weeks, participants were exposed to methodologies and tools developed by IRI and partner institutions. Learning opportunities included presentations, seminars, small group discussions, case studies and hands-on exercises, including the use of the IRI data library, and were offered to participants in an integrated work environment facilitated by leaders in their respective fields of research. At the conclusion of the course, participants were then required to present a final report on potential applications of the tools and methods studied at the Summer Institute to their geographic regions of expertise. These provided participants an opportunity for the applied analysis and synthesis of the course material. The excitement of the course is captured in an audio slide show available in the ‘features’ section of the IRI web portal.

The combination of lectures and practical, hands-on training sessions of the Summer Institute enabled participants to acquire in-depth knowledge and skills in decision-making for health-care planning of climate-sensitive diseases. Evaluations from both participants and facilitators
indicate that course objectives were largely achieved, and provide key recommendations for the implementation of future Summer Institutes at Columbia University. Immediate next steps include the capture of material in an integrated Climate Risk Knowledge System, and working with participants at the Summer Institute in extending a network of trainers. Following the summer institute 3 alumni have helped create national working groups on Climate and Health in Ethiopia, Kenya and Madagascar. A regular newsletter, ‘Climate Matters in Health’ designed to keep alumni and others informed of progress in this area is under development.


Climate Risk Management in Semi-Arid Regions of Latin America and the Caribbean: A Drought Early Warning System for the Coquimbo region of Chile

Variability is a characteristic of climate in arid zones, influencing dry land management and causing climatic uncertainty and vulnerability for water users. The latter is especially true for populations that depend on rainfall, such as farmers practicing rain fed agriculture and livestock producers that rely on natural grasslands. In the Coquimbo Region (Central-Northern Chile), where rainfall amounts often drop under below the limit for of crop requirements for growth, drought hazard has contributed to the decline of rural population and the rise of urbanization. Up to 80% of urban population increase in the last 20 years is attributed to uncertainty about climate.

The Chilean Government initiated a Drought Alleviation Plan to improve access to water resources, increase water storage capacities, encourage efficiencies in water use for households, agriculture and livestock, conserve energy, and address health problems associated with limited water resources. US$2.63 million was spent in support of affected families and farmers in the Coquimbo Region to damages, repair soils, and increase in irrigation programs associated with the drought of 2007. While these actions greatly reduced negative impacts of that drought, they did not significantly lessen vulnerability to future droughts. A common problem is the lack of preparedness for such natural events, making governmental actions less cost effective.
The IRI is working with CAZALAC (Center for Arid Zones of Latin America and the Caribbean) to improve management of risks associated with droughts in ENSO influenced regions of Chile. Climate variability in much of the Coquimbo region is demonstrably correlated with El Niño and La Niña phases of the El Niño Southern Oscillation (ENSO). By monitoring changes in the sea surface temperature (SST) of the Tropical Pacific and regularly assessing outputs of predictions from General Circulation Models (GCMs) it is possible to anticipate possible developments associated with an El Niño or La Niña year. At present, the work focuses on the statistical evaluation of the links between ENSO and precipitation in the Coquimbo Region that in turn influences the river stream flow. We are evaluating the skill of drought and stream flow prediction models that use statistical downscaling of the GCMs. The preliminary results show that droughts and stream flow in the Coquimbo region have good predictability with a lead time of 6-12 months. Because of this, the statistical models can form the basis of an Early Warning System (EWS) for droughts in the region. This EWS in turn forms a promising strategy for the mitigation of and adaptation to climate change effects, and may contribute to improved Climate Risk Management (CRM) strategies for use in other arid regions of the LAC Region. More information is available (in Spanish) at: http://www.cazalac.org/riesgos_climaticos.php.

Correlation between rainfall & ENSO during the time series of May-Aug rainfall averaged over stations within the 4th region.

Diagnosing the Uncertainty in Projections of Climate Change in the Sahel

Recent years have witnessed a resurgence in climate studies related to the semi-arid Sahel, which have tilted the balance in favor of a non-local explanation for drought, with origins in the global tropical oceans: warming of the Indian Ocean, accompanied by differential warming between the northern and southern hemisphere most prominent in the Atlantic Ocean both contributed to drying of the Sahel. If the warming of the oceans played such a significant role in determining past drought, why are projections of future change in this region so uncertain?

This question is one worth answering specifically because the Sahel has already undergone significant climatic change, and adaptation to it. Understanding of the more plausible climatic outcome could inform strategies for sustainable development, based on lessons learned from coping with past drought.

On-going research exploits the archive of coupled ocean-atmosphere simulations made available to the scientific community by the premier climate modeling groups worldwide through the World Climate Research Programme (WCRP) in preparation of the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Our analysis of the response of 20th and 21st century climates to anthropogenic influences is progressing along two parallel directions:

- In one, we investigated the relationship between large-scale indices of SST and Sahel rainfall, and concluded that the same relationships that explain the recent past are not predictive of the models' future behavior.

- In the other, we are analyzing the local land-atmosphere interaction between precipitation and terms in the net surface energy budget. Preliminary results point to differences in the models’ representation of feedbacks between the long-wave component of surface radiation (directly impacted by an increase in greenhouse gases), low-level moisture and temperature that may explain why continued oceanic warming results in a drying of the Sahel in some models, but not in others.

*Contributed by A. Giannini.*

Decentralization and Local Public Goods: How does allocation of decision-making authority affect provision?

Decentralization has received much attention as an approach to improving the performance of various types of organizations, from social service providers to computer networks. Many policy makers, like the World Bank, have embraced the view that participation by beneficiary communities in decision making is necessary to improve the performance of all development projects. However, much remains to be understood about the conditions under which community participation improves outcomes. Lack of data has been a significant obstacle to testing any hypotheses. Evidence regarding the effect of community participation on outcomes under different conditions is needed to design effective development projects in general, and it is needed to design effective interventions to improve climate risk management in particular.
We are investigating the effects of community participation on outcomes in the particular case of access to safe drinking water, which is one of the channels through which climate variability and change affect livelihoods. In the theoretical component of the project, we are modeling the effect of conditions such as wealth and its distribution, size of the community, and characteristics of social networks, on access to safe water attained under institutional structures which vary with respect to the way in which they engage the community of water users.

The empirical component is taking place in Bangladesh, where we are conducting a randomized field trial in partnership with a Bangladeshi non-profit, non-government organization (NGO). We have collected baseline data and we have randomly allocated villages to receive either one of three different models of intervention designed to improve access to safe water or to be in the control group. The three different models differ in the way in which the villagers participate in decision making. Next year, we will collect follow-up data, which will allow us to understand the differences in the effects of the three approaches. This unique data set will enable us to understand how differences in community participation caused differences in outcomes, since assignment to different community participation regimes has been random. In other words, villages which received different interventions and those which were assigned to the control group look identical to each other ex ante. We can then interpret any differences in outcomes of the interventions as being due to differences in the interventions. We will use the data to test predictions derived from the theoretical work. The project is a first step toward systematically understanding the conditions under which community participation improves outcomes.

Contributed by M. Madajewicz.

Early Warning and Response to Peatland Fires in Indonesia

Peatland fires are an increasing problem in Indonesia, where over 80% of Southeast Asia’s peatlands are found. These fires lead to major economic losses, widespread health problems, increased local poverty, and biodiversity losses. They are also a significant contributor to global carbon emissions. In Indonesia’s Central Kalimantan province, millions of hectares of forest have been logged, and peat swamps drained and converted for agriculture. Drained peatlands are at greater risk of fire – especially when rainfall is below normal.
Building upon research results from 2007 showing a close correlation between satellite rainfall data and fire hotspot activity in Central Kalimantan and neighboring provinces, IRI produced a preliminary online seasonal fire early warning tool, freely available in IRI’s Data Library (see also Map Room section of this report). This tool includes: 1) map of satellite-derived rainfall estimates (CMORPH) over all of Indonesia, updated every dekad (10 days), enabling users to view rainfall anomalies at the district level; and 2) a 1-2 month ahead forecast of fire activity, based on correlations between NINO4 and fire hotspots. To improve accessibility to stakeholders, the tool is also available in Indonesian.

IRI scientists have also tested two other forecasting methodologies, including forecasting of rainfall anomalies based on global circulation models (IRI global forecast products), and forecasting rainfall anomalies via dynamical regional models (ECHAM4-RegCM3 model, at 60km resolution). Rainfall forecasted through these additional methods is also conversely related to the number of fire hotspots. Work is now underway in cooperation with BMG to validate these findings against observed rainfall data.

In addition, IRI scientists conducted institutional landscaping research to identify opportunities and constraints to using seasonal early warning to help reduce fire risk. This has included mapping of critical institutions responsible for fire risk, and investigation of currently available alternatives to fire use for land clearing. Current institutional structure related to fire management is largely focused on responding to fire risk in the short-term (1-2 days). The use of seasonal-scale early warnings will require involvement from a broader set of institutions. In addition, given the dependence of many farmers on fire for land clearing, and the lack of feasible alternatives in the immediate term, a system of incentives should accompany the use of seasonal fire early warning.

In August 2008, a new regulation was passed regulating the use of fire for land clearing in Central Kalimantan. The new policy will see IRI’s work put into practice: provincial government officials now plan to utilize seasonal climate information, as indicated through IRI’s fire early warning tool, to assess the likelihood of fires and decide whether or not burning should be allowed. The inclusion of seasonal fire risk information in the new law came following two IRI workshops, held with key government stakeholders in Indonesia to discuss the forecasting potential.

*Contributed by S. Someshwar, P. Ceccato, M. Bell, B. Blumenthal, E. Conrad, J. Qian, A. Robertson, and M. Tippett.*
El Niño-Induced Tropical Droughts in Seasonal Forecasts and Climate Change Projections

El Niño brings widespread drought to the tropics. Stronger or more frequent El Niño events in the future are likely to exacerbate drought risk in highly vulnerable tropical areas. Even if the frequency and intensity of El Niño events do not increase in the 21st century, more generalized warming of the tropical Pacific may still produce a tropical teleconnection resembling that associated with present-day El Niño conditions. This study investigates the patterns, magnitude, range of variability and spatial extent of El Niño induced tropical droughts during a control period in the 20th century in seasonal forecasts, which have updated realistic initial conditions but fixed greenhouse gases, and in climate change simulations, which have realistic greenhouse gases evolution but no observational updates. El Niño-induced droughts for the 21st century are investigated using climate change projections and compared to 20th century simulations.

Consistent with previous studies, seasonal forecast models produce El Niño-induced precipitation teleconnection patterns in the 20th century in good agreement with the observations, including droughts over northern South America, parts of southern Africa, Indonesia and north Australia. This study finds that the climate change models that produce oceanic ENSO variability
exhibit realistic El Niño-induced drought patterns in the 20th century, and these teleconnections are not projected to change in the 21st century (see cluster of figures on prior page). Due to the precipitation trends associated with global warming, the 21st century climate change projections investigated suggest a slight probabilistic shift towards a reduction in the spatial extent of El Niño-induced tropical droughts compared to those of the 20th century. Regionally, the interaction between precipitation trends and El Niño teleconnections leads to exacerbation of drought conditions in some regions and amelioration in others (see cluster of figures below). Finally, spatial calibration of 21st century projections of ENSO teleconnections using 20th century information offers a potentially more reliable estimate of drought risk patterns projected for the 21st century.

This work was made possible in part by a small grant for exploratory research (SGER) from NSF under the US CLIVAR DRought In COupled Models Project (DRICOMP). This work will be submitted to a special issue of Journal of Climate on drought, encompassing the findings of the US CLIVAR Drought Working Group and the DRICOMP PIs.

Contributed by L. Goddard and C.A.S. Coelho.
**ENSO Influence on Sri Lanka Rainfall Patterns**

The influence of El Nino-Southern Oscillation (ENSO) on Sri Lanka rainfall for the October-December season was established about two decades ago. We were motivated by the need in practical use of climate information for a more comprehensive accounting of the ENSO influence in applications such as hydrology, malaria, rice and coconut production. This study presents the details of the ENSO influence for all seasons, accounts for regional difference and for decadal modulation. We establish a seasonally reversing character to the El Nino influence with rainfall likely to decrease during the summer (July to September), increase in early winter (October-December) and decline in the late winter from January to March.

This study is an output of the collaboration of the IRI with the Foundation for Environment, Climate and Technology at the Mahaweli Authority of Sri Lanka which commenced with the Mahaweli River Basin project and extended to the project on Climate and Malaria in Sri Lanka.

![Rainfall graph](image)

*This rainfall when each of the three ENSO phases was prevalent was identified starting from April until the ENSO phase ended (but no further than 24 months). Thereafter the climatology of each of these phases from April of the start year to 24 months on was computed.*

Evaluation of High-Resolution Satellite Rainfall Products Over Regions Frequent by Desert Locusts

The Desert Locust Information Service of the UN Food and Agriculture Organization (FAO) provides a decision support system for monitoring the desert locust. The region of interest covers desert areas from northwestern Africa to East Asia. Rainfall data is one of the main inputs to DLIS. And satellite rainfall estimates are the only source of rainfall information over the remote areas. However, the accuracy of the satellite rainfall estimates over these regions is not well known. The current investigation has been performed with the request of FAO, who has provided the gauge data.

The study area covers the region between 15°W to 55°E, and 10°N to 35°N. FAO provided data from 1992 to 2006, which are over 30 thousand observations. The current evaluation uses data from 2003 to 2006. Most of the data are removed owing to uncertainties in time/location of some of the observations. Still over 19 thousand observations were used for this analysis. The evaluated satellite rainfall products are the NOAA-CPC African rainfall estimation algorithm (RFE), TRMM-3B42, and the CPC morphing technique (CMORPH). The gauge-satellite comparisons are done for daily accumulations at quarter-degree spatial resolution. The results show that the performance of the satellite products is very poor over most of study region. The main problem is that the satellite estimates significantly overestimate the occurrence of rainfall with false alarm ratio as high as 90%.

As depicted in the above figure, the validation region is divided into five boxes based on climatology and/or distribution of gauges. The gauge data was obtained from FAO. The performance of the different products is worst in Region-1 (with false alarm rate above 90%) and relatively better over Region-3 (false alarm rate just 30%).

*Contributed by T. Dinku, P. Ceccato and S. J. Connor.*
Evaluation of Remotely Sensed and Modeled Rainfall and Temperature Estimation Products as Inputs to Epidemic Malaria Early Warning Systems

Malaria is a major public health problem in the developing world. This is especially true in sub-Saharan Africa where more than 80% of malaria cases and 90% of malaria deaths have typically occurred. The World Health Organization recently argued that six out of the eight Millennium Development Goals cannot be achieved without effective malaria control in place.

Following growing demand for Malaria Early Warning Systems, there are calls for more timely, localized and accurate monitoring information to indicate changes in epidemic potential among vulnerable communities. Collaborative work with FEWS-NET aims to develop and test practically useful information products appropriate to improving epidemic malaria control and make these products available through FEWS-NET’s Africa Data Dissemination Service.

A variety of satellite derived Rainfall-Estimation and Temperature-Estimation products have been tested against ground observations. These studies will inform the development of integrated vectoral capacity anomaly maps (the environmental driving force of malaria transmission) which will be provided routinely through the FEWS-NET Africa Data Dissemination Service.

Contributed by C. Vancutsem, T. Dinku, P. Ceccato and S. J. Connor.
Food Security in Nusa Tenggara Timur, Indonesia: Using Climate Information to Trigger Early Action

Nusa Tenggara Timur, a remote province in eastern part of Indonesia, is among the poorest in the country with over 35% of the population living below the national poverty line. Rainfed agriculture is the primary source of livelihoods, and food insecurity is a persistent problem, even in good rainfall years. In years with poor harvests, acute malnutrition rates may reach 20-25%. A number of government agencies and humanitarian organizations are involved in responding to food insecurity problems, but food aid is often slow to arrive. IRI has been working with CARE Indonesia, Bogor Agriculture University, and the NTT provincial government to identify opportunities for early action that could be triggered by climate information indicating likelihood of a poor harvest.

In order to identify these opportunities, IRI and its partners have conducted institutional landscaping research, which has yielded an in-depth understanding of the roles of critical institutions in managing food security in NTT. The Food Security Agency, known as B2KP, manages food security at the provincial level in partnership with district offices. Each year, it monitors crop, livelihood and malnutrition data and rates districts according to their risk of food insecurity, and these ratings are used to determine which districts need assistance. However, this analysis occurs after the harvest in March, when food insecurity problems are already setting in. B2KP also works with the planning agency (BAPPEDA) to develop and allocate budgets for both routine programs, such as food storage programs, and emergency response, such as emergency aid to buy rice or seeds. Analysis of the annual budget process suggests that there are several opportunities for earlier intervention if an earlier assessment of food insecurity risk can be made.

IRI has undertaken research in partnership with BMG, the Indonesian meteorological service, to investigate in detail the nature of seasonal predictability of rainfall over NTT in order to improve seasonal forecasts for the rainy season. Our research has shown that year-to-year changes in the onset date of the rainy season may be partly predictable a month or two in advance in certain years (see “Monsoon onset predictability research over Indonesia”). In addition, regional modeling

El Niño – Climatology composite of NCEP-reanalysis-driving RegCM3 simulated rain (mm/day). El Niño developing and decline years are denoted by (0) and (1), respectively. (Res. 25km; El Niño years: 72/73, 82/83, 91/92, 94/95, 97/98). El Niño reduces rainfall in NTT in Sept-Nov, with complex impacts over highlands in Dec-Feb.
simulations have yielded an improved understanding of the complex climate features of this region. For example, regional model simulations show differing patterns in ENSO years in highland and lowland regions of NTT; reports from stakeholders indicate that such patterns do exist and do affect crops.

Work to date suggests that a delayed monsoon increases the risk of crop failure, which may be associated with food security problems. Thus, if a forecast is available in October that the monsoon’s normal November arrival will be delayed, provincial and district-level expenditure plans could incorporate funds to support farmers and increase food stocks. In addition, provinces have an opportunity to modify their budgets mid-year in August-September. IRI and its partners have discussed these opportunities with relevant provincial agencies as well as the Governor of NTT, and a provincial-level task force has been formed to further this work. Analysis of the specific relationships between monsoon onset, crop production, and food security are on-going, and work is continuing with BMG to improve forecasting capacity.

Contributed by S. Someshwar, A. Robertson, E. Conrad, V. Moron, and J. Qian.

Helping the Red Cross to Improve Flood Risk Management by Tailoring Climate/Weather Tools to Meet their Needs

In 2008 a collaborative project was established between the International Federation of Red Cross and Red Crescent Societies (IFRC), the IRI, and the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC). The purpose of this collaboration has been to assist the Red Cross’ disaster mitigation and response efforts in Mesoamerica to benefit from the most recent advances in climate science and early-warning technologies.

During June and July 2008 two graduate students from Columbia University’s Climate and Society program, Sarah Abdelrahim and Lisette Braman, devoted summer internships in Panama to support the collaboration. The two primary objectives of their internships were to review the available climate/weather monitoring and forecasting tools in the region; and, to understand the structure and decision-making processes of the Red Cross so that the tools could be enhanced and tailored to their needs. The students found that while the Red Cross’ Regional Office and Pan-American Disaster Response Unit could benefit greatly from the use of improved climate/weather monitoring and forecast tools, it is even more important that these tools are designed for and provided at the National Society level, where actionable decisions regarding disaster preparedness and response are made. The assessment of available climate/weather monitoring and forecasting tools involved an evaluation of the IRI’s Federation Map Room and CATHALAC’s SERVIR-Viz, as well as development of an inventory of additional weather/climate tools available in the region.
Analysis of the IRI’s Federation Map Room and CATHALAC’s SERVIR-Viz led to numerous recommendations as to how the user-friendliness of the tools could be improved. However, it was concluded that following these recommendations would still not address three fundamental challenges: i) National Societies require higher spatial resolution of the forecast information than is now being provided by the IRI Federation Map Room; ii) the information in SERVIR-Viz that is relevant to disaster managers is mixed in with non-relevant and out-of-date information, making its use difficult and unfeasible for the National Societies; and iii) both tools are fundamentally too technical for use at the National Societies level. Analysis of additional climate and weather monitoring and forecast tools available in the region showed that each National Society uses different subsets of the available tools. Among National Societies in the region, hurricane tracking and forecast systems were well established. However, landslides were found to occur without warning, and flood warnings were found to be commonly disseminated just 6-10 hours in advance. Most National Societies rely heavily on their National Meteorological Services (NMS) for advisories. However, NMS’ flood warnings are often based exclusively on rain gauge observations with uneven geographical distribution, which creates great potential for improving accuracy and establishing earlier warnings by complementing these observational data with satellite information from NASA instruments.

Based on the existing tools and the needs of the Red Cross, the students provided recommendations and an actionable plan for how the IRI and CATHALAC could tailor climate tools to better meet the needs of the Red Cross, as well as how the Red Cross might best adopt these tools and benefit from their use. The students worked with CATHALAC on a work plan to provide the Red Cross with high-resolution, 48-hour flood forecasts, as well as the ability to anticipate the timing and location of landslides using NASA satellite information. It was also found that an ideal Red Cross product would contain additional information relevant to disaster managers beyond floods and landslides, such as hurricanes and volcanoes for “one-stop-shop” natural hazard monitoring convenience. Currently, CATHALAC is working to produce a Red Cross-specific website that would include this information, as well as seasonal (3 month) probabilistic forecasts for precipitation, information on El Niño Southern Oscillation (ENSO), and IRI’s forecasts for the spread and intensity of climate related vector-born diseases such as malaria and dengue. To address the needs for the National Societies further, CATHALAC has also agreed to establish an e-mail/SMS/fax alert system to disseminate advisories in Spanish.
As a long-term goal, the Red Cross could also better prioritize their resources and target relief efforts, by incorporating layers of high-resolution demographic data related to vulnerability into the monitoring/forecast tools. It was identified that the best source of relevant vulnerability data is from the Red Cross itself, through their Vulnerability and Capacity Assessments. The Red Cross is currently developing software to centralize data gathered from their community-level VCAs, and is interested in a future collaboration with CATHALAC to overlay this data with satellite information.

*Contributed by S. Abdelrahim, L. Braman, W.E. Baethgen and E. Andrade.*

**High Resolution Land Surface Model forced by Meteorological Reanalyses**

Real-time information about land surface hydrologic features enters into a range of decision support settings where interventions to reduce the vulnerability of societies to climate risks are possible. One is information to support malaria early warning systems. Others include flood and land slides risk.

This study is an output of collaboration with the Land Surface Modeling group at NASA Global Modeling and Assimilation Office at Greenbelt, MD over the last several years. The results establish the viability of using global meteorological reanalyses products to simulate land surface hydrological properties such as streamflow, soil moisture and various fluxes accurately under significant variation in hydromorphology, topography and land use. The streamflow that was generated matches well with 18 streamflow observation sites. Accurate simulation of streamflow is important as global meteorological reanalyses are routinely updated in near real time whereas hydrological estimates are rarely available in real time. The work also shows that previous month's soil moisture may be used to estimate up to 20-60% of the variability of the next seasons streamflow - with predictability being higher in dry seasons.

*The Mahaweli River*

Improving the Flexibility and Reliability of Seasonal-to-Interannual Forecast Information

The needs of climate risk management continue to shape IRI’s approach to probabilistic climate forecasting, primarily on the seasonal-to-interannual timescale. Our prediction research focuses considerable effort on estimating the uncertainty in predictions. The better quantified the uncertainty in climate forecasts, the more reliable the forecasts will be, and hence the more potential value the information has. Uncertainty in seasonal forecasts can arise both from model errors, which one wishes to minimize, and from the uncertainty inherent in the climate system, which one wishes to capture faithfully. Proper identification and treatment of errors, together with the use of multiple models, can greatly reduce the impact of model error on forecast uncertainty.

We have been developing a comprehensive approach to minimizing errors in the boundary-forced component of the climate variability (i.e. in the ensemble mean or model 'signal'). Our approach involves both correction of systematic spatial biases and the localized signal biases. Spatial biases, arising from inadequate resolution of terrain and coastlines, constitute one of the main sources of error for local and regional climate prediction. Systematic spatial errors in the forecast distribution mean are corrected using pattern-based model output statistics (MOS). The spatial MOS corrections effectively re-map aspects of variability in the model that are spatially misplaced relative to the verification data. Spatial corrections applied to simulation data fixes the systematic model errors that degrade skill; applied to forecast data, they further correct the implied systematic errors in the SST predictions that further degrade skill (see figure, next page).
Once spatial biases are minimized, the local signal is recalibrated through linear regression of the ensemble mean to the verification data. The final remaining mean squared error (MSE) approximates the forecast variance, which other studies have shown can be considered as approximately constant from year to year for a given season.

To date, this approach has been applied to retrospective forecasts of AGCMs. We have a pending funded NOAA-CTB proposal to apply this also to CGCMs, such as CFS, and to expand the methodology to consider covariance between temperature and precipitation.

Minimizing model biases allows for much more reliable and flexible probabilistic forecasts, as desired by decision makers in climate risk management, from malaria early warning to water resource managers to agricultural insurance markets. We are near completion in our goal of providing a full forecast distribution. This will allow for forecast probabilities for arbitrary, user-defined categories in addition to those for tercile categories.

*Contributed by L. Goddard, M. Tippett, S. Mason and D. DeWitt.*
Integrated Malaria and Dengue Surveillance and Control System in Colombia

The purpose of the Integrated National Adaptation Pilot Project *Health Component* is to design, implement and evaluate through a period of 5 years, an Integrated System of Control and Surveillance for Malaria and Dengue. The foreseen goal at the end of the Project is reducing the infection rate in 30% of current levels in the selected areas of a group of pilot municipalities. During an initial phase, with an estimated duration of 18 months, five municipalities will be gradually incorporated with their corresponding pilot areas and the needs of information and infrastructure for the Early Warning System (EWS) will be identified.

As a contributor to this project, the IRI is advising the Institute of Hydrology, Meteorology and Environmental Studies of Colombia and the National Institute of Health in the design, implementation and evaluation of the Surveillance and Integrated Control System for malaria, including an EWS framework. The IRI is also contributing to the evaluation of the global circulation models, near term climate change scenarios and techniques for downscaling global circulation models.

The projects seeks to improve the prevention and control of malaria and dengue in Colombia by: (i) providing the evidence of the role of climate in disease dynamics, (ii) assessing the value of such evidence to improve disease prevention and control, (iii) providing tools and training in order to develop the capacity of disease prevention and control staff to use the information for improving malaria and dengue control decision-making, (iv) performing vulnerability analyses to identify populations at risk of malaria, (v) defining statistical and dynamical models for the Integrated System of Control and Surveillance for Malaria and Dengue (SIVCMD), and (vi) implementing and evaluating the use of SIVCMD in the pilot areas.

Within the malaria component, we have contributed an epidemiological, entomological and serological characterization. The data collected will be used to feed the dynamical models. Examples of findings specific to malaria include:

1. Two states concentrate 50% of malaria cases, 44 municipalities concentrate 75% of malaria cases, and the Pacific Coast concentrates 51% of the cases by Plasmodium Falciparum (PF). Based on these results, we selected 5 municipalities and 6 pilot areas among them where we made a more detailed epidemiological description with local data.

2. Using the immunity of the community as one of the factors in the transmission of malaria, Colombia could be classified as an epidemic country. However, the community has not reached high immunity levels, as in Africa, due to the low transmission rates as compared to Africa and Brazil, and also due to the higher prevalence of Plasmodium Vivax (PV) compared to PF. We are still discussing the following questions to define the vulnerability assessment in Colombia:
   a. Should we use cases or Parasite Index or reported cases?
   b. What is the minimum difference between age groups to define epidemic or endemic scenarios?
   c. Is it valid for Colombia to use the immunity of the community as criteria to define vulnerability?
3. According to the entomological characterization, the breeding sites at the pilot areas are frequently human made or associated to human activities (roads, crops, fishponds).

4. The Anopheles mosquitoes captured at the pilot sites do not correspond to the vectors commonly described as primary vectors in the country. However, it is important to point out that so far we have made only one visit to the pilot areas.

5. With the serological studies we found possible asymptomatic patients at all pilot areas. We also found some failures in diagnostics.

Within the Dengue component, and based on our field and laboratory work we propose the following hypotheses:

1. Infrequent use and replenishment of water storage vessels favors the productivity of *A. aegypti* by optimizing the relationships between mortality, larval input, food availability and habitat stability in comparison to frequently used vessels or discarded, unused vessels.

2. *A. aegypti* pupal productivity is more sensitive to nutrient availability on the Caribbean coast (0-10m) whereas in the Andean region (1000-1600m) average larval development is longer and therefore production is more sensitive to household water replenishment frequency. Also emerged adult vectors are more often food-deprived in the Andean region.

3. Increases in temperature of 1-2ºC favor productivity in the Andean region by increasing both larval development rate and reducing competition through mortality. On the other hand, the same temperature increase may decrease productivity in the Caribbean coast by increasing larval mortality.

Integrating Seasonal Forecasts and Insurance for Adaptation among Smallholder Farmers: The Case of Malawi

Climate risk is a major obstacle to efforts to sustainably intensify agricultural production and enhance rural livelihoods in much of southern Africa. Climate shocks, such as drought, lead not only to loss of life, but also long-term loss of livelihood through loss of productive assets, impaired health and destroyed infrastructure. For the risk-averse farmer, the threat of drought is a disincentive to investment and adoption of higher-return but riskier agricultural technologies and market opportunities, thereby contributing to poverty traps. Interventions for dealing with climate risk and adapting to anticipated climate change for smallholder agriculture include seasonal climate forecasts and innovative financial instruments such as weather index insurance. While there may be benefits to smallholder farmers from integrating seasonal forecasts with weather index insurance, this has not yet happened in practice in part because of non-trivial hurdles to implementing integrated products and lack of demonstrated benefits in the smallholder farming context.

Within the context of a Malawi index insurance pilot project, we examine whether there may be real-world benefits from incorporating simple forecasts based on ENSO conditions into an insurance scheme. Using the data, prices, and implementation constraints faced by the Malawi implementation, we compare simulated gross revenues for a hypothetical maize farmer, from packages that integrate the forecast against packages that are unchanging and finalized before the forecast has skill.

Simulation results suggest that the integration of forecasts and the financial package substantially increases cumulative gross revenues. The resulting wealth accumulation can reduce long-term vulnerability, supporting adaptation to climate variability and change. Basing insurance price on ENSO state more than doubled mean gross margins, and increased the maximum gross margin by a factor of more than five relative to fixed insurance pricing. The figure below illustrates the differences across seasons in gross margins between one ENSO-adjusted and the fixed price package, showing that the gains result from very high gross margins in a small number of La Niña years (shaded light blue in the figure). In El Niño years, the gross margin is slightly smaller for the ENSO-adjusted scheme because of the smaller area planted. The variability of annual gross margin that the farmer faces is much higher because the farmer has the opportunity to earn substantially more in years with abundant rains.

Integration of Climate Forecast Information into Model for Angat Reservoir, Philippines

The Angat Reservoir in the Philippines provides 97% of the water supply for metro Manila, home to 11 million people. Water from Angat also provides irrigation for about 30,000 hectares of rice in Bulacan Province over two seasons, supplies 248 MW of hydropower for the island of Luzon, and provides flood protection. The region is strongly affected by inter-annual climate variability, particularly related to the El Niño Southern Oscillation (ENSO) cycle. In dry years, there is insufficient water for all uses; in wet years, careful management is required to avoid serious floods. Over the past 5 years, IRI has worked closely with the National Water Resources Board (NWRB), the national meteorological service (PAGASA), and other stakeholders on strategies to better manage these risks.

Institutional landscaping research, undertaken in partnership with the University of the Philippines Los Baños, has led to an understanding of both formal and informal institutional arrangements for deciding water allocations across all users of the Angat Reservoir. In particular, informal arrangements – such as “technical working group meetings” hosted by NWRB that evaluate water allocation scenarios on a monthly basis – are crucial entry points for the integration of improved climate information. To date, PAGASA has contributed regular rainfall forecasts in these monthly meetings, but these forecasts have not been specific to Angat.

IRI has completed and delivered to NWRB a revised version of their own reservoir model that quantitatively incorporates seasonal climate forecasts of inflow to the system. The forecasts are made via multiple regressions between three empirical orthogonal functions (EOFs) of the tropical Pacific and Indian Ocean sea surface temperature field and historical inflows to Angat. Forecasts with good skill can be made in September for the months of October – February, which are critical months for ensuring adequate water availability throughout the year. Through capacity building efforts over the past 5 years, PAGASA now has the capacity to produce and deliver the downscaled forecast required to run the model.
IRI has worked closely with NWRB to create an interface that allows them to create the scenarios they need for their decision-making process, while offering a clear way to visualize the underlying probabilities associated with the scenarios. Options allow them to choose the months they wish to forecast, whether to use a climate forecast or climatology, and adjust allocation amounts across users. The model also allows users to view retrospective forecasts, as well as indicative economic valuations of allocation choices. The model has been presented to all Angat stakeholders, and NWRB plans to begin using it in an experimental uptake phase shortly. In addition to hands-on training, IRI has also prepared a users’ guide to help facilitate uptake.

![View of water allocation scenario, given forecast and water allocation choices above](image)


**Moisture Fluxes Associated with Heavy Rainfall Events during the Indian Summer Monsoon**

Heavy regional rainfall events over India during the summer monsoon in 1-degree gridded gauge-based data are investigated in terms atmospheric moisture fluxes computed from daily reanalysis data. Analysis is focused over the Godavari river basin in central peninsula India, and the state of Gujarat in the northwest. Westward propagating monsoon synoptic depressions during the active phase of the monsoon are found to be associated with heavy 3-day rainfall events in both cases. Fluxes of moisture appear to derive from both the Bay of Bengal and the Arabian Sea during events over the Godavari basin, while fluxes from the Arabian Sea dominate events over the state of Gujarat. The seasonal frequency of events over Gujarat is found to be more closely related to seasonal all-India rainfall and monsoon shear indices, making their frequency of occurrence more potentially predictable than over Godavari. Some sub-weekly potential predictability over Gujarat may also derive from the westward propagating character of the monsoon depressions.
Monsoon Onset Predictability Research over Indonesia

The seasonal potential predictability of monsoon onset during the August–December season over Indonesia is studied through analysis of the spatial coherence of daily station rainfall and gridded pentad precipitation data. Onset date, defined using a local agronomic definition, exhibits a seasonal northwest-to-southeast progression from northern and central Sumatera (late August) to Timor (early December). South of the equator, interannual variability of the onset date is shown to consist of a spatially-coherent large-scale component, together with local-scale noise. The high spatial coherence of onset is similar to that of the September–December seasonal total, while post-onset amounts averaged over 15–90 days and September–December amount residuals from large-scale onset show much less spatial coherence, especially across the main islands of monsoonal Indonesia. This implies that seasonal potential predictability over monsoonal Indonesia during the first part of the austral summer monsoon season is largely associated with monsoon onset, and that there is much less predictability within the rainy season itself. A cross-validated canonical correlation analysis using July sea surface temperatures over Tropical Pacific and Indian Oceans (80°–280°E, 20°S–20°N) as predictors of local-scale onset dates exhibits promising hindcast skill (anomaly correlation of 0.82 for the spatial average of standardized rain gauges; see also figure on following page).

Composites of vertically-integrated moisture flux and its divergence anomaly (shaded) for days -3 - -1, preceding 99%-ile heavy rainfall events over the Godavari basin in central peninsula India. Divergence anomalies are relative to the JJAS mean divergence, and only anomalies that are statistically significant at the 99% significance level are plotted.

Contributed by A.W. Robertson.
In a follow-up study, the monsoon onset and post-onset rainfall and their associated low-level winds are analyzed using surface and satellite products as well as reanalyses and regional climate model simulations. The leading empirical orthogonal function of onset date is found to exhibit a large-scale spatially-coherent signal across “monsoonal” Indonesia, i.e. mostly south of the Equator, with an asymmetric temporal behavior, such that delayed onsets are more intense than early ones. Associated anomalies in rainfall tend to weaken quickly after mid-to-late November or early December, especially over land, while they tend to persist over ocean. This weakening is shown to be associated with the evolution of distinct weather types revealed by a k means clustering. In particular, late onsets—usually related to warm El Niño/Southern Oscillation (ENSO) events—are found to be accompanied by an increased prevalence of a weather type characterized by weak low-level daily averaged winds across monsoonal Indonesia and increased (decreased) rainfall over most of the islands (seas). This land-sea rainfall contrast is shown to be associated with an enhanced diurnal sea-land breeze circulation.

Contributed by V. Moron, A.W. Robinson, R. Boer and J. Qian.
Monsoon Onset Predictability Research over the Philippines

In this contribution, the spatio-temporal variability of boreal summer monsoon onset over the Philippines is studied through the analysis of daily rainfall data across a network of 76 gauges for the period 1977 to 2004 and in gridded datasets. The onset date is defined using a local agronomic definition, namely the first wet day of a 5-day period receiving at least 40 mm without any 15-day dry spell receiving less than 5 mm in the 30 days following the start of that period. The onset is found to occur rather abruptly across the western Philippines around mid-May on average and is associated with the set-up of a “classical” monsoonal circulation with low-level easterlies subsequently veering to southerly, and then southwesterly. The onset manifests itself merely as a seasonal increase of rainfall over the eastern Philippines, where rainfall occurs throughout most of the year. Interannual variability of the onset date is shown to consist of a spatially coherent large-scale component, rather similar over the western and eastern Philippines, with a moderate to high amount of local-scale (i.e. station scale) noise. In consequence, the large-scale signal can be easily retrieved from any sample of at least 5–6 stations across the network. The seasonal predictability of local onset is analyzed through a cross-validated canonical correlation analysis using tropical Pacific and Indian Ocean sea surface temperature in March and the 850 hPa May wind field from dynamical forecast models as predictors. The regional-scale onset, defined as the average of standardized local-scale anomalies in onset date, shows good predictive skill ($r \approx 0.8$). Moreover, most of the stations shows weak to moderate skill (median skill = 0.28-0.43 depending on the scheme) and any even weak spatial average across islands increases skill usually $> 0.6$.

Contributed by V. Moron, A. Lucero, F. Hilario, B. Lyon, A.W. Robertson and D. DeWitt.
Coconut cultivation sustains the livelihood of large numbers in the tropics and is the most important crop for food security after rice in Sri Lanka. Coconut is vulnerable in particular to drought and there is concern as to how coconut plantations can cope with climatic variability and adapt to climate change. These issues were addressed by a team of scientists including meteorologists, agricultural economists, crop scientists and statisticians drawn from Sri Lanka’s Department of Meteorology and Coconut Research Institute in collaboration with IRI scientists from 2002 to 2005. The project was undertaken with funding from the Adaptation and Impact Assessment to Climate Change (AIACC) program administered by global change SysTem for Analysis, Research and Training (START).

Forecasting of Annual National Coconut Production (ANCP) is important for agricultural planning. Climate and the long term trends (attributed to “technology”) are major factors that determine ANCP. In this paper, the climate effect was estimated by regressing production data that had been de-trended to remove the “technology effects” with quarterly rainfall in the year prior to harvest. The technology effect was estimated from the historical log-linear trends. A regression model that integrates both climate and technology effects developed to predict ANCP with high accuracy and is now in operation at the Coconut Research Institute (http://www.cri.lk/yield.html) and is provided to other government agencies.
The 1997-98 Summer Rainfall Season in Southern Africa. Part II: Model Simulations and Coupled Model Forecasts

This study is the second of a two-part investigation of rainfall in southern Africa during the strong El Niño of 1997-98. It was previously shown that widespread drought in southern Africa, typical of past El Niño events occurring between 1950 and 2000, generally failed to materialize during the 1997/98 El Niño, most notably during January – March (JFM) 1998. In this study, output from three AGCMs forced with observed SSTs, and seasonal forecasts from three coupled models are examined to see to what extent conditions in JFM 1998 could have potentially been anticipated.

All three AGCMs generated widespread drought conditions across southern Africa similar to those during past El Niño events, and did a generally poor job in generating the observed rainfall and atmospheric circulation anomaly patterns, particularly over the eastern and southern Indian Ocean. In contrast, two of the three coupled models showed a higher probability of wetter conditions in JFM 1998 than for past El Niño events with an enhanced moisture flux from the Indian Ocean, as was observed. However, neither the AGCMs nor the coupled models generated anomalous stationary wave patterns consistent with observations over the South Atlantic and Pacific. The failure of any of the models to reproduce an enhanced Angola low (favoring rainfall) associated with an anomalous wave train in this region suggest that the coupled models that did indicate wetter conditions in JFM 1998 compared to previous El Niño episodes may have done so, at least partially, for the wrong reasons. The general inability of the climate models used in this study to generate key features of the seasonal climate over southern Africa in JFM 1998 suggests that internal atmospheric variability contributed to the observed rainfall and circulation patterns that year. With the caveat that current climate models may not properly respond to SST boundary forcing important to simulating southern Africa climate, this study finds that the JFM 1998 rainfall in southern Africa may have been largely unpredictable on seasonal timescales.

Contributed by B. Lyon and S.J. Mason.
The Need for National Centers for Climate and Development in Africa

Climate change and variability have been a major challenge to sustainable growth and development in Africa. High dependence on natural resources, and limited capacity to manage climate variability and adapt to a changing climate make Africa the most vulnerable region to negative impacts of climate. Integration of climate issues into development activities is critical for managing negative climate impacts and making the best of favorable climate conditions. One of the problems in integrating climate and development in Africa has been the lack of effective institutional leadership. There is an urgent need for national institutions that provide the leadership needed in the area of climate and development. Creation of national centers for climate and development is proposed here in response to this need. We propose the creation of a National Center for Climate and Development (NCCD), a multi-disciplinary institution that will facilitate the integration of climate issues into development activities. It will define the requirements for decision-relevant climate information, and will facilitate the generation, delivery and use of the information. NCCD will have three major objectives: (i) define requirement for the generation of decision-relevant climate information and services, and help the national climate institution(s) to acquire the capacity needed to generate the required information; (ii) provide leadership in the integration of climate and sustainable development; and (iii) lead in the design and implementation of national climate-related policies. To be effective, NCCD should be located within the Office of the Prime Minster or in the Ministries of Planning and Finance.

Contributed by T. Dinku.

The Simulation Skill of Dynamical Real-Time Seasonal Forecasts of Tropical Cyclone Activity

Since early 2003, IRI has issued experimental seasonal forecasts of tropical cyclone activity for five ocean basins during their respective peak cyclone seasons. The forecasts have been based on tropical cyclone-like features detected and tracked in a low-resolution dynamical climate model, namely the ECHAM4.5 model, developed in Hamburg, Germany. The simulation skill of the model using historical observed sea surface temperatures (SSTs) over several decades, as well as using SST anomalies persisted from the previous month’s observations, had been determined to be adequate or better prior to the decision to begin putting out real-time forecasts.

Performance evaluation has recently been carried out for the first five years of real-time forecasts. Despite variations from one basin to another, the real-time forecasts have been found to have information value at levels consistent with those estimated from the longer historical simulations. These levels are best described as fairly modest but statistically significant and economically useful over an extended time period if interpreted properly with respect to their substantial uncertainty. The dynamical forecasts require statistical post-processing (calibration) to be competitive with, and in some circumstances superior to, statistical models for prediction of tropical cyclone activity. Skills decrease only slowly with increasing lead time up to 2 to 3 months. During the recent period of real-time forecasts, the issued forecasts have had higher probabilistic skills than those of the raw model output, due to the forecasters’ subjective elimination of an “overconfidence” bias in the model’s forecasts. This calibration could in principle be done objectively and automatically in a post-processing step.
The six-year record of probability forecasts for number of tropical cyclones (NTC) and accumulated cyclone energy (ACE) is shown in the following figure for five ocean basins considered. Evident in the figure are the modest, but consistent tendency toward the correct probability shift direction, and the probabilistically “overconfident” raw model forecasts as compared to the more probabilistically conservative forecasts actually issued.

Contributed by S. Camargo and T. Barnston.
Thermodynamically Coupled Forecast Systems for the Tropical Atlantic and Indian Oceans

Seasonal forecasting systems can be described as either Tier-2 in which the SST used to force the atmospheric model is non-interactive with the atmospheric model or Tier-1 in which the forecast SST interacts and evolves through interactions with the atmospheric model. Both approaches to seasonal forecasting have advantages and disadvantages. The advantages of Tier-2 forecast systems include the ability to use SST forecasts from multiple sources and the lack of climate drift in the mean state. On the other hand, in regions where the atmosphere drives the ocean as opposed to being driven by it as expected for much of the tropical oceans away from the equator the use of a Tier-2 type approach may be sub-optimal. Tier-1 forecast systems have the advantage of explicitly representing coupled atmosphere-ocean processes. However, there is no guarantee that the modeled atmosphere-ocean interaction will faithfully reproduce that expected from nature. The net result of inaccurate atmosphere-ocean interaction in Tier-1 forecast systems leads to climate drift.

IRI has been experimenting with partially coupled forecast systems which allow for thermodynamic feedback in the Tropical Atlantic, Indian, and Western Pacific oceans while prescribing the SST in the Central and Eastern Pacific oceans. Such an approach, like a Tier-2 system, allows for multiple SST forecast inputs to be used in the region dominated by ENSO SST variability while also allowing for coupled atmosphere-ocean thermodynamic feedbacks. The atmospheric model used here is the ECHAM4.5 AGCM which is coupled to a thermodynamic ocean model which has its mean state maintained with a Q-flux type parameterization. The AGCM supplies anomalous heat fluxes to the thermodynamic ocean model while the ocean model provides the total SST field to the AGCM. Here we show results from 3 prototype systems. These systems differ only in the heat fluxes used to force the ocean. The first system, ECHAMSW, uses all 4 anomalous surface heat flux components from the AGCM (sensible, latent, solar, and longwave). The second system, ECHAM, differs from the first in not using the anomalous solar flux. This is done because the anomalous solar flux for this AGCM in the Tropical Oceans is known to be much too large. The third system, Seager, also does not use the anomalous solar flux and further the latent, sensible and longwave fluxes are computed using daily mean AGCM fields. Such an approach removes the ventilation of the atmospheric boundary layer by convection which can lead to errors due to erroneous precipitation simulation in the AGCM. The experiments shown here use the observed SST in the Central and Western Tropical Pacific Ocean.

The anomaly correlation for the SST forecast from these different coupled models is compared with that from persistence and from a statistical forecasting technique, the Constructed Analog (CA) method (figure on left, following page) These forecasts are for the May-June-July (MJJ) season starting from April initial conditions (IC) for 1980-2004. It can be seen that for this season in the Tropical Atlantic the Seager system is the most skillful of the 3 coupled systems and is also more skillful than either persistence or the CA forecasts. In the northern tropical Indian Ocean, all 3 of the coupled forecast systems have approximately the same skill level which is better than persistence and about the same as that from the CA forecasts. The evolution of the anomaly correlation skill for SST forecasts from the 3 coupled systems, persistence, and CA for several key regions and 4 initial condition months (figure on right, following page).
These regions are Northern Tropical Atlantic (80°W-10°E, 5°N-28°N), Southern Tropical Atlantic (60°W-20°E, 20°S-5°N), Equatorial Atlantic (20°W-0°, 3°S-3°N), and Indian Ocean Dipole (difference between 60°E-80°E, 10°S-10°N and 90°E-110°E, 10°S-0°S). The coupled forecast systems generate better results than persistence for most of seasons and regions. Seager system produces the best results among the coupled forecasts. Compared to the CA forecasts, the coupled forecasts yield higher anomaly correlations in the seasons of strong local impact and weaker remote influence of the Eastern Tropical Pacific. The partially coupled systems explored here will now be tested with forecasted as opposed to prescribed SST in the central and eastern Pacific.

The monthly evolution of the anomaly correlation coefficients for the forecasts of FMA, MJJ, ASO and NDJ for a) Equatorial Atlantic, (b) North Tropical Atlantic, (c) South Equatorial Atlantic, and (d) Indian Ocean Dipole. CASST (dashed orange); ECHAMSW (green); Seager (blue); ECHAM (red); Persistence (black).

Contributed by D.E. Lee and D.G. DeWitt.
Timescale Layering as an Initial Approach to Near-Term Climate Change Information

The IRI is experiencing increasing demand for information on climate change and variability extending 10-20 years into the future. The approach currently being developed for meeting this demand involves “layering” of information from different sources for different timescales: seasonal-to-interannual, anthropogenic climate change, and soon, decadal-scale variability. As dynamical decadal forecasts are currently lacking, we are developing outlooks based on statistical projections, paying heed to uncertainty ranges associated with particular timescales (e.g. typical range of variability for a decadally-averaged period). Those uncertainties will be provided on top of best regional estimates of anthropogenic climate change. Seasonal-to-interannual information will be incorporated as an additional range of uncertainty, based on the characteristics of variability on that timescale or as a risk of extremes over a given period.

The model data presently utilized are those from the IPCC coupled model projections, for which internal variability and trend biases have been minimized through regression-based multi-model ensembling (Greene et al, 2006). A few approaches to characterizing and/or projecting the natural decadal-scale variability are being explored, including singular spectrum analysis (SSA), ensemble empirical mode decomposition (EEMD) and wavelets. Given the research effort required to determine an effective methodology for analyzing regional low-frequency variability, we have chosen to focus first on two pilot regions: Indonesia, whose 20th-century climate exhibited trends but little decadal variability, and Southeast South America, whose climate exhibited both strong trends and substantial variability. Although the final approach to projecting natural variations and the format for how the layered information will be communicated has not been finalized, the adjacent figure shows an example of the concept. Dynamical decadal prediction experiments have started to emerge from the climate community and more are being coordinated for the IPCC AR5. These experimental predictions, which are intended to predict both climate change and climate variability, could enter the near-term climate change informational product in two possible places. They could (1) improve information on anthropogenic climate change, and/or (2) they could potentially provide predictive information on the decadal variability. This decadal-scale information then informs climate risk management and decisions not just on the average climate over the next 10-20 years, but also on risks of year-to-year extremes.

Contributed by L. Goddard and A. Greene.
Verification of IRI’s Seasonal Climate Predictions, 1997-2008

The IRI has produced seasonal forecasts of near-global precipitation and temperature since October 1997, using primarily a dynamical two-tiered prediction system. The first tier, SST prediction, uses both persistence of recently observed SST anomalies, and one or more scenarios of evolving SST predictions based on a combination of dynamical and statistical models. Ensembles from several atmospheric general circulation models are then allowed to respond to the predicted SSTs, resulting in the climate forecasts. The forecasts are probabilistic with respect to the occurrence of the three climatological tercile-based categories of seasonal mean temperature and total precipitation—below-, near-, and above normal with respect to a 30-year base period of observations. The forecasts were issued quarterly from October 1997 to June 2001, and monthly since that time. Issued one-half month prior to the beginning of the first 3-month period being forecast, the forecasts have included four overlapping 3-month periods, ending with the second consecutive season into the future.

Among other measures, the IRI’s probability forecasts are verified using the ranked probability skill score (RPSS). Although skills are generally somewhat higher and more spatially uniform for temperature than for precipitation, precipitation skills attain useful levels during specific times of the year in specific regions, often coinciding with the rainy season of the given region. For example, as shown in the below figure, anomalies of rainfall total have been predicted with some probabilistic skill for the July to September season in the African Sahel, parts of Indonesia, tropical South America, and equatorial Pacific islands.

Geographical distribution of RPSS (level of probabilistic forecast skill) for IRI’s one-half month lead precipitation forecasts over the globe for the July to September season, 1998-2007. Areas colored white over land have so little precipitation during this season that forecasts are not issued for them.
As levels of climate forecast accuracy are known to be modest to moderate due to the generally limited signal-to-noise ratios inherent in seasonal climate, special effort has been devoted to making the forecasts probabilistically reliable—whereby the relative frequencies of occurrence of the climate observations correspond well with the given forecast probabilities over a large set of forecasts having such probabilities. As shown in the figure below, probabilistic reliability is seen to have been favorable for precipitation forecasts for the tropical belt over the course of the 12 years that IRI has been issuing forecasts.

Reliability diagram for precipitation forecasts for all seasons and regions from late 1997 to mid-2008. Reliability is shown for probabilities for below normal (orange), above normal (green), and near normal (gray) rainfall. Perfectly reliability forecasts are represented by the steeper dotted diagonal line. Below- and above-normal forecast reliabilities are fit with linear regression, with points weighted by their frequencies of forecast issuance. Lower panel shows frequency of issuance of forecast probabilities for each of the three tercile-based rainfall categories.

Contributed by T. Barnston, S. Li and S. Mason.
Verification of Multi-Model ENSO Predictions

The IRI has compiled a plume of ENSO predictions produced by a number of dynamical and statistical models since February 2002. An example of a recent such plume is shown below. Most, but not all, of these predictions are provided to us from outside of the IRI. In the plume, 3-month averages of the NINO3.4 SST index (5N – 5S, 120 – 170W) are predicted, representing the oceanic component of the ENSO state. The set of individual models has expanded and changed to some extent since 2002, with a current volume of 23 models (15 dynamical, 8 statistical)—all documented by refereed journal papers, and many produced at today’s leading global forecast producing centers.

Now that nearly 7 years of forecast data is verifiable, IRI has begun to estimate how skillful the forecasts are for different seasons at several lead times. In view of the changing set of models, evaluation of such basic aspects of skill is carried out for the multi-model mean. Additional analyses include whether the inter-model disagreement is related to the multi-model mean error, and whether a skill difference between statistical and dynamical models is discernible. Because

Forecasts of SST anomalies for the NINO3.4 region (5°N-5°S, 120°W-170°W), with predictions from mid-September, 2008.
of the short period, estimation of the relative skill of one model relative to another, or of conditional biases of individual models, is not attempted.

The basic data is highlighted in the figure at right, showing the multi-model mean anomaly forecast for the NINO3.4 SST index in comparison with the observed NINO3.4 SST anomaly for four lead times, for multi-model means over all models and over for dynamical and statistical models alone. Skills implicit in Fig. 2 appear much the same as has been seen in previous ENSO skill evaluations, with modest to moderate skills depending on lead time, but with many forecasts appearing to follow an already observed direction of change. A possible new outcome is that the dynamical models appear to be at least as skillful, if not more skillful, than the statistical models, as for example in the case of the 2007-08 La Niña.

**Verification of the African Regional Climate Outlook Forum Forecasts**

In collaboration with ACMAD, ten years of Regional Climate Outlook Forecasts for the Greater Horn of Africa and West Africa, and eleven years of forecasts for Southern Africa have been verified using satellite derived and rain-gauge precipitation data. For Southern Africa, forecasts are verified for the October – December (early-season) and January – March (late-season) summer rainfall season. The early-season forecasts were produced in the immediate one or two months prior to October, while the late-season forecasts contain a mixture of forecasts produced...

*Contributed by M.K. Tippett, A.G. Barnston and T. DelSole.*
at the same time as those for October-December, with a few mid-season updates produced in December. For the Greater Horn, the target seasons are March – May and September – December, with all forecasts made in the immediately preceding month. All the forecasts for West Africa were made in May for the following July – September.

All three regions show some evidence of positive skill. However, the forecasts do show clear evidence of systematic errors, and in some cases the positive skill with some of the best results being achieved by SARCOF for the January - March season. The reliability diagram for this season is shown in the adjacent figure, and indicates generally increasing occurrences of the rainfall category as the forecast probability increases with only minor over-confidence. will not be immediately apparent to users. The most ubiquitous error is for the forecasters to hedge the forecasts towards high probabilities on the normal category. The probabilities for the normal category are therefore consistently higher than they should be, and the normal rainfall occurred notably much less frequently and extensively than implied by the forecasts. In addition to this over-forecasting of the normal category, there is little or no evidence of any skill in forecasting increased probabilities for this category (normal rainfall is not more frequent when its probabilities are increased above about 35 to 40%) at any of the RCOFs. More generally, the probabilities for all categories typically show poor reliability: in most cases the poor reliability reflects over-confidence (increases and decreases in probabilities are too large).

A disappointing result is that the RCOFs did not provide any clear indications of observed trends. Over the 10 year verification period, below-normal rainfall was predominant in the Greater Horn in both seasons, while above-normal rainfall occurred much more frequently than over the climatological period in West Africa.

The verification results provide clear indications of how to effect immediate improvements in the forecasts, and also point to the need to implement more objective schemes for estimating forecast probabilities and reaching consensus. It should be emphasized that these verification results are preliminary, and that plans are being implemented to conduct more detailed verification analyses within each of the RCOFs.

*Contributed by S.J. Mason and S. Chidzambwa.*
Weather-Within Climate Predictability Research over Indramayu District, Indonesia

The seasonal predictability of rainfall over a small rice-growing district of Java, Indonesia is investigated in terms of its daily characteristics during the September–December monsoon-onset season. The seasonal statistics considered include rainfall frequency, mean daily intensity, median length of dry spells, as well as the onset date of the rainy season. General circulation model retrospective seasonal forecasts initialized on August 1 are downscaled to a set of 17 station-locations using a non-homogeneous hidden Markov model. Large ensembles of stochastic daily rainfall sequences are generated at each station, from which the seasonal statistics are calculated and compared against observations using deterministic and probabilistic skill metrics. The retrospective forecasts are shown to exhibit moderate skill in terms of rainfall frequency, seasonal rainfall total, and especially monsoon onset date. Some skill is also found for median dry-spell length, while mean wet-day persistence and daily rainfall intensity are not found to be predictable.

Correlation skills of rainfall hindcasts for Sept-Dec season, from August 1: (a) seasonal rainfall total; (b) rainfall frequency; (c) mean daily intensity; (d) median length of dry spells; (e) mean wet-day persistence; (f) monsoon onset date. Circle diameter is proportional to magnitude of the correlation. Negative correlations omitted.

Contributed by A.W. Robertson, V. Moron, and Y. Swarinoto.
Update on High Performance Computing

In August 2008, we installed an IBM BladeCenter Linux cluster, at a cost of $244,000. The IBM BladeCenter cluster is to replace the existing HP ES-40 Alpha cluster, installed in March 2001. The specifications for the new Linux cluster are:

- One management/storage node with two 3.0 GHz quad-core Intel E5450 processors, 16 GB RAM, attached fibre-channel storage (6.1 TB available), GB Ethernet and Infiniband interfaces.
- 24 compute nodes (model IBM BladeServer HS21) in 2 IBM BladeCenter H chassis. Each BladeServer has 2 quad-core 2.8GHz Intel E5440 processors, 16 GB RAM, GB Ethernet and Infiniband interfaces.
- 6.1 TB available storage via attached IBM DS3400 array, mounted via NFS to the compute nodes
- Voltaire Infiniband DDR interconnect across nodes (Voltaire 9024D-M), for parallel message passing.

A picture of the cluster is shown at left. All the equipment is in a single IBM rack.

Benchmark results on the new cluster (for ECHAM 4.5), provided by Dave Dewitt, can be found in a table at the end of this update. The multi-core configuration of the compute nodes (8 cores per node) results in excellent speed and throughput when compared to the Alpha cluster it replaces.

There is a single GB Ethernet interface to the public LAN from the management node. All compute nodes are on a private network, with all services and storage to the compute node provided by the management server. However, the network routing is set up so that the compute nodes can access external resources like shared file systems. This is done via firewall IP masquerading on the management node.

Because of our single GB Ethernet interface to the public LAN, we are somewhat limited in our transfer rate to copy data from the storage/management node to the mass storage system. We may in the future install additional GB Ethernet interfaces in the management node, and “trunk” multiple interfaces to the public LAN for additional bandwidth. We did not have sufficient Ethernet interfaces in the management node to accomplish this upon initial installation.
Alternatively, we can take advantage of a second GB Ethernet interface on the individual compute nodes to provide outgoing connections to a GB switch on the public LAN. We may opt to do this for a subset of nodes that we may designate as “IO nodes”.

The cluster is managed via IBM’s “xcat” version 2 software. “xcat” provides a command-line interface to configure and operate the compute nodes. The batch system in place is the open source “Torque” server (based on OpenPBS), and the open source “Maui” scheduler. We also have the open source “Ganglia” software suite available to monitor performance and behavior of the compute nodes.

The Torque PBS server integrates with the OpenMPI suite to simplify PBS job submission, so this is currently the preferred PBS implementation for the cluster. There is an API between OpenMPI and PBS that eliminates the need for special “wrapper scripts” to translate PBS node requests to comparable MPI requests. OpenMPI also does not require special daemons to be run for message passing.

We have other MPI implementations installed (such as MVAPICH), but using the other MPI implementations does force the use of MPI daemons, and also wrapper scripts to translate PBS requests to MPI requests (as well as start and stop any needed messaging daemons).

We have had some difficulty in running the ECHAM 5 model across nodes. Because there are 8 processors per compute node, it has not hampered operations so far. Running the ECHAM 5 MPI jobs with 8 processors per job still allows for good runtimes with excellent overall throughput. We will continue to work on the cross-node problem for this model.

The cluster nodes are booted via PXE from a “stateless” image on the cluster management node. This ensures that the same software and operating system configuration is in place on each node. It also allows the nodes to be flexibly booted with different system configurations for different purposes. Using “stateless” images on the compute nodes also allows us to rapidly implement changes and keep all the nodes in sync, making system management much less time consuming and ensuring that all nodes operate the same way.

The boot images are mounted to a RAM drive on the compute nodes, using about 940 GB of RAM. The RAM use for the file system increases if we install more software in the node images (the test nodes use about 1.1 GB of RAM for the file system). We also have a large “/tmp” (32 GB) mounted to the local hard drive in each compute node, which may also be used for scratch space. There is also a 16 GB swap space mounted to the internal disk of each compute node. We currently have an operational image (“compute2”) installed on 20 nodes, from which the operational runs are completed. We also have 4 nodes in a test configuration (“comp3”). This setup allows us to test software and system upgrades before making the upgrades operational. We are going to continue working on the cross-node problem with ECHAM model on the test nodes.

Since installing the new cluster, we have had to replace two Blade Servers due to hardware faults, but have had no other major problems with the cluster. The PBS software has “hanged” at times when some jobs have failed to complete, so we have had to reboot some nodes when this occurs. This problem hasn’t been reported in about 4 weeks, so it may be resolved. Overall, we are pleased with the performance, capabilities, and features of this new system.
The existing SGI Origin 3400 servers are also past due for replacement. Our goal is to replace the Origin 3400’s with an IBM Blade Center system comparably configured to the Blade Center system that we recently installed. The Blade Center will be installed in the same location as the current Origin 3400’s.

Timings for ECHAM4.5 T42L19
July 15, 2008

Timings are in seconds for 1 simulated month, January 1980. For more recent chips, the modifier socket is used. The more recent chips have multiple-cores or CPUs per socket. Older chips had 1 CPU or core per socket.

<table>
<thead>
<tr>
<th>Machine (Compiler)</th>
<th>CPU (Sockets)</th>
<th>Timing in seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mako (DEC F95)</td>
<td>4(4)</td>
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<tr>
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<tr>
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<td>277</td>
</tr>
</tbody>
</table>

System Information:
Mako – 0.667GHz Alpha Single Core, 1GB RAM per socket, DEC MPI done within node
Manta – 2.0GHz Xeon Single Core, 0.5GB RAM per socket, Myrinet, MPI: MPICH
Dell – 2.66GHz Xeon Dual (Quad) Core, 4GB (8GB) RAM per socket, Infiniband, MPI: MVAPICH
SGI – 2.83 GHz Xeon Quad Core, GB RAM per socket, Infiniband, MPI : Intel MPI
IBM – 2.83 GHz (*2.33GHz) Xeon Quad Core, 8GB RAM per socket, Infiniband, MPI: MVAPICH (*Intel MPI)
Bluefin – 2.83GHz Xeon Quad Core, 8 GB RAM per socket, Infiniband, MPI: OpenMPI

Contributed by L. Ostwald.
Governance At-a-Glance

The Board of Overseers consists of distinguished individuals who have held leadership roles in government, academia, and national or international scientific and development organizations. The Board advises on matters of institutional development, and promotes IRI and its programs internationally.

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Gilbert Butler Professor of Environmental Studies, Harvard University

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Chair, OECD Round Table on Sustainable Development
Dr. Stephen E. Zebiak  
Director-General, IRI

The International Science and Technical Advisory Committee advises the Board of Overseers and the Director-General on relevant issues of science and technology, including: IRI’s research strategy and research priorities; the quality of IRI’s scientific capability; the current status and future plans for the Institute’s scientific activities and operations; the Institute’s scientific and technical policies and procedures; the Institute’s relationships with other scientific organizations and programs; and other specific scientific and technical problems and issues as identified by the Board.

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Emeritus Professor of Atmospheric Science, University of Washington

ISTAC Members
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G. Unger Vetlesen Professor of Earth and Climate Sciences; Director, Climate and Society Masters Program, Columbia University
Dr. Sulochana Gadgil  
Professor, Center for Atmospheric Science, Indian Institute of Science, India
Prof. Graeme Hammer  
Professorial Research Fellow, University of Queensland, Australia
Prof. James W. Jones  
Distinguished Professor, University of Florida, Gainesville, Florida
ISTAC Members, cont. (pending official Columbia appointment)

Dr. Francisco de Assis de Souza Filho  Former President, FUNCEME; IRI Visiting Scientist
Dr. R. Wayne Higgins  Director, Climate Prediction Center, NOAA
Dr. Shubham Chaudhuri  Senior Economist, World Bank
Prof. Ulisses Confalonieri  National School of Public Health, FIOCRUZ, Brazil

Personnel at a Glance – November 2007 through October 2008

Office of the Director-General

Stephen E. Zebiak  Director-General, Senior Research Scientist
Haresh Bhojwani  Institutional Development Officer
Ann K. Binder  Manager, Staff and Operations
Molly Hellmuth  Director, Climate and Society Publication Secretariat, Associate Research Scientist
Carolyn Z. Mutter  Assistant Director for Science Management
Carlos Perez  Senior Analyst for Sustainable Development
Maria Salgado  Executive Assistant to the Director-General

Program Leaders

Walter Baethgen  Director, Latin America and Caribbean Program, Research Scientist
Stephen Connor  Program Leader, Environmental Monitoring Research; Director, PAHO/WHO Collaborating Centre on early warning systems for malaria and other climate sensitive diseases; Research Scientist
Simon Mason  Program Leader, Climate; Research Scientist
Shiv Someshwar  Director, Asia and Pacific Regional Program; Director, Institutions and Policy Systems Research; Research Scientist
Madeleine Thomson  Chair, Africa Regional Program Committee; Director, Impacts Research; Senior Research Scientist
M. Neil Ward  Director, Decision Systems Research

Senior Research, Information Technology, and Data Library Staff

Anthony Barnston  Head, Forecast Operations
M. Benno Blumenthal  Data Library Manager
David DeWitt  Research Scientist
Lisa Goddard  Research Scientist, Adjunct Professor, DEES
James Hansen  Research Scientist
Upmanu Lall  Senior Research Scientist, Professor, DEEEE
Bin Li  Senior Analyst/Programmer
Bradfield Lyon  Research Scientist
Leo Ostwald  Manager, IRI Computing
Senior Research, Information Technology, and Data Library Staff, continued
Andrew Robertson  Research Scientist
Adam Sobel  Research Scientist, Associate Professor, DEES/APAM
Liqiang Sun  Research Scientist
Michael Tippett  Research Scientist
Jeff Turmelle  Lead Analyst/Programmer
Jian-Hua (Joshua) Qian  Research Scientist

Research Staff
Kye Mesa Barnard  Staff Associate (left 8/31/08)
Haimanti Bhattacharya  Postdoctoral Research Fellow (left 5/31/08)
Michael Bell  Senior Staff Associate
Paul Block  Postdoctoral Research Scientist (USA)
Casey Brown  Associate Research Scientist (left 8/31/08)
Daniel Ruiz Carrascal  Graduate Research Student
Pietro Ceccato  Associate Research Scientist
Esther Conrad  Senior Staff Associate
Remi Cousin  Staff Associate
John del Corral  Senior Staff Associate
Tufa Dinku  Associate Research Scientist
Alessandra Giannini  Associate Research Scientist
Arthur Greene  Associate Research Scientist
Eric Holthaus  Staff Associate
Kenneth Hunu  Research Staff Assistant (left 8/31/08)
Amor Ines  Associate Research Scientist
Yasir Kaheil  Postdoctoral Research Scientist
Juergen Kröeger  Associate Research Scientist
Dong Eun (Donna) Lee  Staff Associate
Shuhua Li  Senior Staff Associate
Haibo Liu  Staff Associate
Megan McLaurin  Research Staff Assistant
Malgosia Madajewicz  Associate Research Scientist
Gilma Mantilla  Senior Staff Associate
Ousmane Ndiaye  Graduate Research Assistant
Judith Omumbo  Associate Research Scientist
Daniel Osgood  Associate Research Scientist
Asher Siebert  Staff Associate
Christelle Vancutsem  Senior Staff Associate
Sylwia Trzaska  Associate Research Scientist
Kalpana Venkatasubramanian  Senior Research Staff Assistant
Tsegay Wolde-Georgis  Senior Staff Associate (left 12/12/07)
Lareef Zubair  Associate Research Scientist

Adjunct Research Staff
Francisco de Assis de Sousa Filho  Research Scientist, University Sao Paulo, Brazil
Sankar Arumugam  Associate Professor, NC State University
Adjunct Research Staff, continued
Kenneth Broad  Assistant Professor, University of Miami
Casey Brown  Assistant Professor, University of Massachusetts
Matayo Indeje  Associate Research Scientist, Climate Downscaling and Application, IRI/MDG Technical Support Centre, UN Millennium Project
Richard Kleeman  Professor, NYU
Ben Orlove  Professor, University of CA, Davis
Vincent Moron  Research Scientist, CEREGE, UMR 6635 CNRS and Université d’Aix-Marseille, France

Affiliates
Mohammed Boulayha  Senior Advisor (Africa)
Suzana Camargo  Associate Research Scientist, LDEO
Mark Cane  Vetlesen Professor, Columbia University, Earth and Environmental Sciences, Applied Physics and Applied Math
Roberto Lenton  Technical Committee Chair (TEC), Global Water Partnership Organization
Sabine Marx  Associate Research Scholar, Columbia University, Center for Research on Environmental Decisions (CRED)
Cheryl Palm  Senior Research Scientist, Tropical Agriculture Program, Columbia University
Pedro Sanchez  Director, Tropical Agriculture Program, Columbia University
Renzo Taddei  Visiting Professor, Yale University
Jim Williams  Consultant, European partnerships and mobilization

Visiting Research Scientists
Caio Coelho  CPTEC, Sao Paolo,
Simone da Costa  CPTEC, Sao Paolo, Brazil
Alejandro Castellanos  Professor, University of Sonora, Mexico and Columbia University Institute of Latin American Studies (ILAS) O’Gorman Program Fellow
Ferdinand Mawunya  START Fellow from Soil Science Department, University of Ghana
Jean-François Pekel  Researcher, Environmetry and geomatic unit, Université Catholique de Louvain, Belgium
David Watkins  Associate Professor, Department of Civil and Environmental Engineering, Michigan Technological University
Andreas Weigel  Postdoctoral Research Fellow, Swiss Federal Office of Meteorology and Climatology (MeteoSwiss)

Visiting Student
Nicolas Dietenbeck  Ecole Polytechnique, France
Institutional Support

Office of the Director General
Esteban Andrade
  Latin American & Caribbean Program Coordinator
Francesco Fiondella
  Communications Officer
Maria Risë Fullon
  Project Coordinator
Althea Murillo
  Administrative Assistant
Barbara Platzker
  Africa Program Coordinator
Jason Rodriguez
  Production Aide
Lori Scally
  Project Finance Manager
Megan Sheramata
  Education Coordinator
Catherine Vaughan
  Project Coordinator
Sandra Vitelli
  Administrative Assistant
Christine Walkuski
  Administrative Coordinator (also GWPO/TEC)

Computer Systems
Baaba Baiden
  Web Manager
Sara Barone
  Analyst/Programmer
Mike Dervin
  Analyst/Programmer
Lulin Song
  Analyst/Programmer

Part-Time Research Assistants
Kye Barnard
Peter Epilla
Rebecca Fried
Habibatu Jalloh
Sriramany Sritharan
Sarah Wishnek
Daniel Yeow
Selected Publications

Peer-Reviewed Publications


Zhang, R.H., A.J. Busalacchi, and D.G. DeWitt, 2008: The Roles of Atmospheric Stochastic Forcing (SF) and Oceanic Entrainment Temperature ($T_e$) in Decadal Modulation of ENSO. J. Climate, 21, 674–704.


Other Reports


Camargo, S., and A. Barnston, 2008. Description and Skill Evaluation of Experimental Dynamical Seasonal Forecasts of Tropical Cyclone Activity at IRI. *IRI Technical Report 08-02*. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.


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Visitors to the IRI

7 Nov Senarath Bandara and P.H.D. Kusumawathie Sri Lanka
Presentation: An overview of malaria transmission and control in Sri Lanka's North-Western and Central Districts

26 Nov Sheshagiri Rao Chennakeshava Trust, Karnataka, India
Seminar: Design and experience of Adaptive farming in a high climate risk region of South India

26 Nov-23 Dec Caio Coelho and Simone da Costa CPTEC, Sao Paolo, Brazil
Caio Coelho is investigating ENSO and tropical drought within climate change. Simone Costa is conducting agricultural research, linking the GLAM crop simulation model with IRI's seasonal climate forecasts.

26-28 Nov Peter Rees-Gildea, Jari Vainio, Frederic Zanetta IFRC, Geneva, Switzerland and Pablo Suarez Red Cross/Red Crescent Climate Centre
Collaborative meetings, presentations on approaches and potential synergies

29 Nov Colin Jones Canadian Regional Climate Modeling and Diagnostics Network, University of Quebec at Montreal, Montreal, QC, Canada
Seminar: Simulating ENSO related precipitation variability over the tropical Americas with a Regional Climate Model: Seasonal Mean and Subseasonal anomalies

10 Dec Yves M. Tourre Adjunct Senior Scientist, LDEO and Jean-Pierre Lacaux, Professor, UPS, to present an IRI seminar, "High Resolution Remote Sensing, Risks Mapping and Public Health."

18 Dec Chet Ropelewski NOAA CPO, Diana Perfect CSD, Marina Timofeyeva CSD
NOAA NWS - IRI Meeting

20 Dec David Watkins Hydrologic Engineering Center of the US Army Corps of Engineers in Davis, California
Culminates a 4-month visit, contributing to IRI's work on NOAA-funded projects on the Delaware River Basin in NY/NJ, work in Burkina Faso, and the development of training material for water managers

12-31 Jan Alejandro Castellanos Professor, University of Sonora, Mexico and Columbia University Institute of Latin American Studies (ILAS) O'Gorman Program Fellow
Areas of interest: the impact of drought on water availability for human/animal consumption and irrigation in NW Mexico; the general impact of land use changes and climate change in NW Mexico.
17 Jan IRI Seminar: Ecological Consequences of Land Use Changes in the Sonoran Desert (NW Mexico)

14-15 Jan Ben Orlove, Department of Environmental Science and Policy, University of California, Davis, CA
14 Jan IRI Seminar: Limits to Adaptation: Some Results and Reflections from a Study of Response to Glacier Retreat in the Peruvian Andes

21 Jan-3 Feb Emily Firth, Coordinator, Meningitis Environmental Risk Information Technologies (MERIT) Project (based in GEO), Geneva, Switzerland,
MERIT project meetings
21 Jan-3 Feb Isabelle Jeanne, CERMES, Niamey, Niger
MERIT project meetings and analytical work on malaria and rainfall in Niger

31 Jan IRI Seminar: Health and climate in CERMES, Niger - meningitis and malaria, tools and field studies

11-15 Feb Chet Ropelewski NOAA CPO

11 Feb - Pablo Suarez International Federation of Red Cross Red Crescent Societies

22 Feb Guleid Artan, USGS
Meeting: Scoping of flood forecasting system for Africa

1 Mar-30 Jun Ferdinand Mawunya, START Visiting Scientist Fellow and Post-Doctoral Student, University of Ghana
Work on climate-based crop yield prediction and analysis of climate-informed crop management in Ghana.

3 March Colin Chartres Director-General, International Water Management Institute
IRI seminar: Tackling the impacts of climate change and other factors on water resources and food production

5 March South Korean journalists visit
Interviews on climate change and IRI's work in Asia and the Pacific region with A. Barnston, C. Mutter, S. Mason, E. Ebrahimian, H. Bhojwani, D. Lee and F. Fiondella.

10 March Yasir Kaheil University of Western Ontario, Canada
Water team seminar speaker: Data fusion for decision support systems

25-26 March Fredrick Semazzi North Carolina State University
IRI seminar: Detection, Projection, Attribution, and Impacts of the Eastern Africa Climate Dipole Mode

27 March Huug van den Dool Climate Prediction Center, NOAA
IRI Seminar: Experimentation with Methods for the Multi-Model Ensemble Approach for Seasonal Prediction

31 March-11 April Ed Sarachik ISTAC Board Chair

31 March-2 April Koen Verbist CAZALAC (Centro del Agua para Zonas Áridas y Semiáridas de América Latina y El Caribe) and the University of Gent, Belgium
Work Areas:
- Improving the downscaled regional climate forecast for Northern Chile, and
- CRM in the Water Resource Management of the Semiarid Regions of LAC
Host: W. Baethgen/E. Andrade and A. Robertson

9 April-29 June Nicolas Dietenbeck Ecole Polytechnique
Internship; focus on quantifying the connection between climate and the frequency of floods. Mentors: U. Lall and A. Robertson
16 April Kevin Krajick *Senior Science Writer, Earth Institute*
IRI Special Seminar: Media and Science - Why You Should Care

21 April Dr. Yasushi Horikawa *Executive Director-Office of Space Applications*
Takayuki Kawai *Deputy Manager-Satellite Applications and Promotion Center*
Japan Aerospace Exploration Agency visit with CIESIN and IRI

23 April Peter Schlosser *Director, Columbia Climate Center; Vinton Professor of Earth and Environmental Engineering, Faculty of Engineering and Applied Science; Professor, Earth and Environmental Sciences; Associate Director, Earth Institute*
IRI Seminar: The Columbia Climate Center

30 April-1 May Dr. R. Jagannathan *Head, Agro-Climate Research Centre, Tamil Nadu Agriculture University, Coimbatore, India*
Discussions on climate and crop modeling to address agricultural risks in India
Host: E. Conrad, S. Someshwar

1 May-30 April 2009 Christelle Vancutsem and Jean-François Pekel *University of Louvain-la-Neuve, Belgium*
Applying expertise in remote sensing to monitoring temperature, vegetation and water bodies

5 May Mamadou Diouf *Director of Columbia University's Institute of African Studies*
An information exchange on earth sciences research in and about Africa
Various IRI staff

19 May-14 June Vincent Moron *CEREGE (Le Centre Européen de Recherche et d'Enseignement des Géosciences de l’Environnement) and Université Aix-Marseilles, France*
Work on downscaling and seasonal predictability of weather-within-climate, in collaboration with A. Robertson, B. Lyon, J. Qian and others

21 May Carlos Lima *PhD Candidate, Department of Earth and Environmental Engineering, Columbia University*
IRI Seminar: Statistical Prediction of ENSO from Thermocline Data Using a Nonlinear Dimensionality Reduction Method

12 May Chet Ropelewski *Program Manager, Climate Dynamics/Experimental Prediction (CDEP)*
An update on recent actions of, and planning by, the NOAA Climate Program Office (CPO); follow-up on topics discussed at the April IRI-NOAA CPO meeting in Silver Springs; planning for the Summer Institute 2008

14 May Pablo Suarez *International Federation of the Red Cross and Red Crescent Societies*
A meeting to discuss ongoing and future collaborations with the IFRC. Red Cross/Red Crescent Climate Centre at global, regional and national scales, including joint capacity building activities, upcoming joint workshops, and the way forward

14 May Martin Walshe, Simon Thuo *Global Water Partnership* and Roberto Lenton *GWP Technical Committee*
IRI-GWP collaborative meeting
19 May-4 June Meshack Malo FAO's Eastern Africa Sub-regional Office Addis Ababa, Ethiopia Training and exchange, collaborative exploration in climate change adaptation and climate risk management for agriculture and natural resource management with J. Hansen

4 June IRI Seminar: Enhancing Operational Use of Climate Prediction in Agriculture and Food Security

19 May-14 June Vincent Moron CEREGE (Le Centre Européen de Recherche et d'Enseignement des Géosciences de l’Environnement) and Université Aix-Marseille, France Work on downscaling and seasonal predictability of weather-within-climate, in collaboration with A. Robertson, B. Lyon, J. Qian and and others

21 May Carlos Lima PhD Candidate, Department of Earth and Environmental Engineering, Columbia University IRI Seminar: Statistical Prediction of ENSO from Thermocline Data Using a Nonlinear Dimensionality Reduction Method

27 May Dr. Keiki Takahashi, Dr. Swadhin Behera, Dr. Ryo Onishi, and Noriyuki Yamashina JAMSTEC, Tokyo, Japan

2-6 June Rafael Terra and Alvaro Diaz University of Uruguay Collaborations with Near Term Climate Change Working Group on the development of proto-type information for near-term climate change for the SE South American region

11 June Pablo Valdivia and Joanna Syroka World Bank Commodity Risk Management Group, Washington, DC Project Meeting: Designing Index-Based Weather Insurance for Farmers in Central America

12 June Vincent Moron Centre Europeen de Recherche et d’Enseignement des Geosciences de l’Environnement (CEREGE) and Universite d’Aix-Marseille, France IRI Seminar: Local vs large scale variability of monsoon onset: the example of Western Sahel

13-27 June Mesho Radithupa Botswana Meteorological Service Collaboration on the influence of temperature on malaria in Botswana

16-20 June Nakoulma Guillaume and Sekou Sissoko CPC Africa Desk CPC-IRI collaboration to present the Africa Desk climatologists with IRI work, primarily on CPT training, and IRI's CRM approach

19 June Frank Rijsberman Director of Programs, Google.org Collaborative discussion (with Africa RP Committee)

23-27 June Katiusca Briones Estebanez Fundacion El Universo, Ecuador Angel Muñoz Solorzano Universidad del Zulia, Venezuela Jose Juis Perez Lopez Instituto Mexicano de Tecnologia del Agua, Mexico David Maximiliano Zermeno Diaz Centro de Ciencias de la Atmosfera, Universidad Nacional Autonoma de Mexico, Mexico CCA-UNAM-IRI training course "Climate Modeling Focusing on the NCAR CAM3"
30 June Hugo Berbery *Research Professor, University of Maryland*
Discussion of potential collaboration in the La Plata Basin, SE South America (LPB) Continental Scale Experiment, coordinated jointly by GEWEX and CLIVAR, through the GEWEX Hydrometeorological Panel (GHP) and the Variability of the American Monsoons Panel (VAMOS). Work will involve developing climate information for La Plata Basin using Data Library tools.

30 June William Gutowski, Jr. *Department of Geological and Atmospheric Sciences, Iowa State University*
IRI Seminar: Precipitation Changes in Future Climate: Extreme Events and Constraints.

7-8 July Mohammed Sadeck Boulahya (*former Director General of the African Centre of Meteorological Application for Development*)
Continuing IRI collaborations, including engagement in ClimDev Africa initiatives.

9 July Antony Millner *Magdalen College, Oxford University*
IRI Seminar: Behavior, environments, and decisions: Putting the human actor into forecast valuation models.

10 July Inge Sandholt *University of Copenhagen*

10 July Reid Basher *Senior Coordinator of the Policy Development Unit, UN Secretariat for International Strategy for Disaster Reduction*
Collaborative discussions (with Africa RP Committee).

23 July Wanqiu Wang *Climate Prediction Center, NCEP/NOAA, Maryland*
IRI Seminar: An assessment of the CFS real-time forecast.

16 July - 4 Aug Laurence Cibrelus *Mailman School of Public Health, Columbia University*
Collaborative work with S. Trzaska and M. Thomson in preparation for MERIT project work in Niger.

5 Aug Marjorie Victor *Oxfam America*
Discussion of collaborations in climate risk management.

7 Aug Pablo Suarez *IFRC*
Collaborations on seasonal extreme rainfall forecasting, planned October training and education materials, and IFRC internship presentations of Climate and Society Masters Program students.

11-15 Aug Angelica Giarolla *CPTEC/INPE, Brazil*
Meetings on her work focus: monitoring and forecasting crop productivity in southern Brazil using remote sensing, climate models, soil water balances and crop simulation models.

20-21 Aug Zhaohua Wu *Center for Ocean-Land-Atmosphere Studies (COLA), Calverton, MD*
Conducted IRI seminars:
- Ensemble Empirical Mode Decomposition - A Noise Assisted Data Analysis Method, and
- Modulated Annual Cycle - An Alternative Reference Frame for Climate Anomalies;
and collaborated on methodologies for characterizing climate variability and change with the Near Term Climate Change group.

25 Aug Chet Ropelewski *Program Manager, Climate Dynamics/Experimental Prediction (CDEP)*
3-5 Sept Josef Syktus Queensland Climate Change Centre of Excellence, Queensland, Australia
Collaboration on climate prediction, monitoring and applications

4 Sept Presentation: A Continent Under Stress: Interactions, Feedbacks and Risks Associated with Impact of Modified Land Cover on Australia's Climate

10 Sept William Dougherty Stockholm Environment Institute - US Center IRI Seminar: Poverty Reduction at Risk in Ethiopia

17 Sept Dan Levy John F. Kennedy School of Government, Harvard University
IRI Seminar Series on Impact Evaluation for Development Projects: Introduction to impact evaluation practice and methods

22-26 Sept Clobite Bouka Biona (Congo), Joseph Mutemi (Kenya) NOAA-CPC Africa Desk
Collaborative visit to exploring the potential of CPT and other techniques for tailoring climate prediction information and risk management applications

25 Sept Pasquale Steduto Food and Agricultural Organization (FAO)
IRI Seminar: The FAO Crop Water Productivity Programme with Emphasis on the AquaCrop Model

6-7 October Sergey Kirshner Department of Statistics, Purdue University
IRI Special Seminar (6 Oct): Graphical Models with a Bayesian Twist for Modelling of Rainfall

6 October Chris Funk University of California Santa Barbara
FEWS and work on climate change scenarios addressing changes that threaten eastern and southern African food security

7 October Climate & Society Publication 2: Index Insurance Palisades, NY

9 October Paul Garner Professor of International Health; Director, Effective Health Care Research Programme Consortium
IRI Special Seminar: Food security policies-how could we apply the principles of research synthesis?

9 October Fiona Johnson University of New South Wales, Sydney, Australia
IRI Seminar: A Nesting Model for Bias Correction of General Circulation Model Precipitation Simulations

10 October Reza Khanbilvardi and others NOAA-Cooperative Remote Sensing Science and Technology Center (NOAA-CREST Center) at The City University of New York
IRI Special Seminar: Using Satellite Remote Sensing for Land-cover, Hydro-climate, and Health Impact Estimation

20–24 Oct Sergey Varlamov and Yasunori Hanafusa Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Visit to learn about IRI’s approach to climate risk management and related climate research, and to explore opportunities for collaboration with JAMSTEC’s new Applications Laboratory

28 October Markus Goldstein Research Group at the World Bank
IRI Seminar Series on Impact Evaluation for Development Projects: Exploiting panel data for ex-post impact evaluation
29 October Nick H. Ogden *Foodborne, Waterborne & Zoonotic Infections Division, Public Health Agency of Canada*
IRI Special Seminar: Vector-borne disease and climate change: the example of Lyme disease in Canada

31 October Jonathan Patz *MD, MPH, Professor of Environmental Studies & Population Health Sciences and director of a university-wide Global Environmental Health Initiative at the University of Wisconsin-Madison; Adjunct Associate Professor, Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health; Affiliate Scientist, National Center for Atmospheric Research (NCAR)*
Meeting to discuss developments in the climate change and health international and national agenda and training issues

**Representing the IRI Around the World**

**Africa**

29 Oct-7 Nov M. Thomson *Niamey, Niger*
CERMES Scientific Review Committee meeting
Visits to collaborating institutes: ACMAD, AGHRYMET, MDSC)

30 Oct-6 Nov S. Mason *Tunis, Tunisia*
CLIPS Focal Point Training Workshop

14-17 Nov P. Block *Addis Ababa, Ethiopia*
Technical scoping mission to determine the feasibility of insurance opportunities at the village/rural level, especially considering the weir structure originally constructed by Oxfam in AdiHa, Tigray region

18-21 Nov M. Hellmuth *Tunis, Tunisia*

15-18 Dec J. Hansen, S. Trzaska *Dakar, Senegal*
Joint presentation (invited), "Climate Risk Management, Food Security at the IRI" at the International Federation of Red Cross and Red Crescent Societies West & Central Africa Partnership Meeting on Climate Change and Food Security

20-27 Jan J. Hansen *Addis Ababa, Ethiopia*
Develop regional partnership strategy, explore governance models and advance proposal at the Climate Change, Agriculture and Food Security Challenge Program Stakeholder Workshop

22 Feb-9 Mar S. Connor, T. Dinku *Addis Ababa, Ethiopia*
Collaborative Meetings: Anti-Malaria Association, National Meteorological Association, Center for National Health Development, Nile Basin Initiative
27-29 Feb J. Omumbo Entebbe Uganda
Participated in 21st Greater Horn of Africa (GHA) Climate Outlook Forum (COF21) and the 2nd Malaria Outlook for the GHA Region and presented "Integrated Malaria Early Warning and Response Systems: rationale and components" and "Climate monitoring products appropriate for changes in malaria epidemic risk"

28 Feb S. Connor, T. Dinku Addis Ababa, Ethiopia
Climate Matters In Health, a workshop organized by the IRI and Ethiopia's Anti-Malaria Association
S. Connor presented "Climate Sensitive Diseases" and "Use of Climate Information for Malaria Early Warning," and served as a panelist, "Panel Discussion and Way Forward"
T. Dinku served as a conference moderator and panelist, "Panel Discussion and Way Forward"

1-8 March M. Hellmuth Pietermaritzburg, South Africa
CCAA (Climate Change Adaptation for Africa) meeting

3-7 March S. Connor, T. Dinku Addis Ababa, Ethiopia
Science with Africa, a conference sponsored by UNECA and the African Union
T. Dinku served as panelist for the Global Knowledge Partnership Regional Network for Africa (GKP Africa) session on "Climate Change Adaptation at Grassroots Level and Role of ICT"

8-24 March S. Trzaska Niamey, Niger
ACMAD and AGHRYMET collaborative meetings

9-12 March M. Hellmuth Lilongwe, Malawi
Red Cross and Met Service meetings

14-20 March M. Thomson Addis Ababa, Ethiopia
Climate for Development Stakeholder Meeting

25 March–1 April W. Baethgen Nairobi, Kenya
9th Meeting of the CGIAR Science Council

26-28 March C. Brown Arusha, Tanzania
World Bank Workshop on Integrated Water Resources Management in River & Lake Basins

5-10 April C. Brown Addis Ababa, Ethiopia
Africa Economic Research Consortium: Senior Policy Symposium on Climate Change and Development; Invited speaker on “Climate Change and Economic Growth in Sub-Saharan Africa”

5-9 May H. Bhojwani, M. Indeje Tunis, Tunisia
Joint Africa Institute “Course on the Economics of Climate Change” (sponsored by a partnership of the African Development Bank, IMF and World Bank)

9-22 May S. Mason Pretoria, South Africa
CPT and verification consultancy with the South African Weather Service

13 May-26 May S. Trzaska Niamey, Niger
Meetings: Pre-PRESAO training, PRESAO
17-24 May P. Block, D. Osgood *Adiha, Ethiopia*
Workshop to elicit feedback on index insurance contract design from Adiha (Tigray region) community members; interviews and discussions with local relief society (REST), microfinance groups (Decsi), insurance companies (Nyala), and Adiha farmers

26-29 May M. Thompson, S. Trzaska *Niamey, Niger*
AMMA-Ensembles Meeting

16-19 June T. Dinku *Addis Ababa, Ethiopia*
Regional Nile Hydrology and Ecology under Extreme Conditions Workshop invited participant and presenter: Evaluation of Satellite Rainfall Estimates and Gridded Gauge Products over the Upper Nile Region (Dinku, T., S. Connor, P. Ceccato)
Visits to the National Meteorological Agency, Anti-Malaria Association/Climate and Health Working Group, National Malaria and Other Vector-borne Diseases Prevention & Control Team of the Federal Ministry of Health, Center For National Health Development, FEWS-NET Ethiopia, and other regions to advance work with Google

18-20 June T. Dinku *Dar Es Salaam, Tanzania*
WHO-WMO Workshop on Climate Change and Variability and Health in Africa invited presenter and participant
Visit to the Tanzania Meteorological Agency and presentation of work on the validation of satellite rainfall estimates over different parts Africa

26-27 June T. Dinku *Nairobi, Kenya*
Somalia Water And Land Information Management technical consultative workshop on drought assessment methodologies, invited presenter and participant

19-30 Aug P. Block
1/ *Koraro, Ethiopia* Assess progress of community water storage scheme/design in Koraro
2/ *Entebbe, Uganda* Participated in “Climate Change Adaptation Strategies for Transboundary River Basin Organizations in Africa” and gave a talk on climate risk management with contextual examples from Angat and Ethiopia

26-28 Aug M. Thomson *Nairobi, Kenya*
AWEPA (European Parliamentarians for Africa) and African Union meeting on sustainable development

27-28 Aug L. Zubair *Pretoria, South Africa*
12th Southern Africa COF (SARCOF-12) meeting and presentations: "The Use of Climate Information in the Tropics: Learning from Practice" and "Current Global Climate Conditions"
Meeting and presentation to the South African Weather Service and SARCOF-12

28-29 Aug 1/J. Omumbo, 2/ L. Sun 3/M. Thomson *Nairobi, Kenya*
1/2/ Third Malaria Outlook Forum; 1/2/3/ GHACOF-22; 2/ Climate and health meeting

1-8 Sept L. Zubair *Gaborone, Botswana*
Meetings with Botswana Meteorological Services, Health Ministry, SADC office, Water Affairs Department, Department of Surveying and Mapping, and visits to northern malarious regions; presentation at the Botswana Meteorological Services

28 Aug-8 Sept S. Mason *Nairobi, Kenya*
Meetings with S. Chidzambwa, ACMAD on verification of the African RCOF forecasts
3-5 Sept S. Connor, T. Dinku, B. Platzer, J. Omumbo *Addis Ababa, Ethiopia*
Climate and Health Working Group-IRI workshop: Science and Technical Meeting; and meetings with regional partners

9-11 Sept S. Connor, S. Mason, B. Platzer *Nairobi, Kenya*
Climate Health Challenge Dialogue Workshop organized by Google and International Livestock Research Institute

15-19 Sept T. Dinku *Addis Ababa, Ethiopia*
Third Regional Conference on Agricultural Water Management in Eastern & Southern Africa, and meetings with regional partners

18 Sept T. Dinku *Addis Ababa, Ethiopia*
Third Africa Drought Adaptation Forum of the African Drought Risk and Development Network, and meetings with regional partners

30 Sept-1 Oct D. DeWitt *University of Pretoria, South Africa*
South African Society for Atmospheric Sciences (SASAS) 2008 Conference; delivered keynote address on 30 Sept:
• Tropical SST Biases in Coupled Atmosphere-Ocean GCM’s. How Important are Marine Stratus Clouds?

2 Oct D. DeWitt *University of Pretoria, South Africa*
Centre for High Performance Computing Workshop, invited presentation:
• Experience with Various Coupled Models at IRI
Southern Africa Weather Service invited talk and discussion on plans for SAWS implementation of ECHAM-MOM coupled model

12-18 Oct A. Greene, M. Hellmuth *Wellington and Capetown, S. Africa*
Managing climate risk for agriculture and water resources development in south-western South Africa project meetings: with collaborators from the Universities of Cape Town, The Free State and KwaZulu-Natal and the UNEP-Risoe Centre on Energy, Climate and Sustainable Development, Danish Technical University.
A. Green's presentations:
• "Near-term" climate change: Mechanisms, evidence, prediction
• Downscaling forecasts of Indian monsoon rainfall using a nonhomogeneous hidden Markov model, and a first decomposition of rainfall in the Western Cape region of South Africa

14-16 Oct P. Ceccato *Antananarivo, Madagascar*
Kick-off meeting for the WMO-sponsored “Learning through Doing Project: Public Weather Services and Health Sector”; presentations made on research and projects developed by IRI on Climate and Health in Africa; and research on Malaria and Climate in Madagascar (clustering analysis-correlations between malaria and environmental factors, temperature retrieval using satellite data, data library and training activities)
Europe

5-13 Nov M. Hellmuth Paris, France
UN Water Development Report meetings

7-8 Nov M. Thomson Barcelona, Spain
WMO/GEO Expert Meeting on an International Sand and Dust Storm Warning System
Presentation (with I. Jeanne and M. Djingarey): Dust and Epidemic Meningitis in the Sahel: a Public Health and Operational Research Perspective

10-15 Nov J. Hansen Amsterdam, Netherlands; Rome, Italy; Montpellier, France
Participate in Elsevier Publishing's Agricultural Systems editorial team meeting; discuss IRI collaboration in West Africa and French science interests in CCCP with CIRAD, initiate CGIAR Climate Change Challenge Program (CCCP) proposal development, explore with Holger Meinke possible Wageningen University collaboration, courtesy visit and seminar to CGIAR Science Council Secretariat/FAO "Innovations in Climate Risk Management: Protecting and Building Rural Livelihoods in a Variable and Changing Climate" (with Walter Baethgen, Dan Osgood, Pietro Ceccato, Robinson Ngugi) presentation made

12-16 Nov S. Mason London, UK
ECMWF 11th Workshop on Meteorological Operational Systems presentation: International Research Institute for Climate and Society Conditional exceedance probabilities and the prediction of extreme events

14-15 Nov M. Hellmuth Vienna, Austria
IIASA 35th Anniversary Conference: "Global Development: Science and policies to the future"

20-21 Nov S. Connor, J. Omumbo Bergen, Norway
Workshop on Climate and Health in the Nile Basin Area, Nile Basin Research Programme, Global Challenges Centre at the University of Bergen
S. Connor, facilitator and presenter; and J. Omumbo presented "Data needs for malaria stratification: progress and gaps"

26-30 Nov S. Trzaska Karlsruhe, Germany
2nd International AMMA Conference on the West African Monsoon

3-5 Dec S. Connor Geneva, Switzerland

13-15 Dec D. Osgood Zurich, Switzerland
SwissRe roundtable and collaboration planning

4-6 Feb H. Bhojwani, S. Zebiak Geneva, Switzerland
International Organizing Committee planning meeting for World Climate Conference

7 Feb H. Bhojwani, S. Zebiak Rome, Italy
Meet officers of World Food Programme
3-14 March A. Robertson, L. Sun *Trieste, Italy*
4th ICTP Workshop on the Theory and Use of Regional Climate Models
8th International Regional Spectral Modeling Workshop
L. Sun, ICTP workshop co-director, trainer, presenter: Regional Climate Modeling in Seasonal Prediction: Advances and Future Directions; and RSM Workshop chair
A. Robertson, ICTP workshop participant and presenter: Climate Risk Management and the Use of Regional Climate Model Simulations in Developing Nations

2-4 April J. Hansen, D. Osgood *University of Oxford, UK*
Food Security and Environmental Change: Linking Science, Development and Policy for Adaptation Conference
• D. Osgood: Climate information, index insurance, and climate risk management
• J. Hansen: Bridging the climate change adaptation and climate-sensitive development challenges in rural Africa

13-18 April P. Ceccato, J. del Corral, T. Dinku *Vienna, Austria*
European Geosciences Union General Assembly, with presentations by:
• T. Dinku: Comparison of Global Gridded Gauge Products over Complex Terrain in Africa (T. Dinku, S.J. Connor, P. Ceccato) at the session on "Observation, Prediction and Verification of Precipitation"
• J. del Corral poster: A GIS Enabled Data Library (J. del Corral, B. Blumenthal, M. Bell) at the "GIS in Meteorology and Climatology" session
• P. Ceccato: Climate forecast, early warning and response to peatland fires in Central Kalimantan, Indonesia (P. Ceccato, S. Someshwar, I. Nengah Surati Jaya, J. Qian, E. Conrad) at the session on "Wildfires, Weather and Climate"

14-20 April B. Lyon *Geneva, Switzerland*
Project meetings on drought hazard mapping with the UNDP Global Risk Identification Programme and the Norwegian Geophysical Institute

17 April P. Ceccato, J. del Corral *Geneva, Switzerland*
WHO meeting on shared map services

18 April P. Ceccato *Geneva, Switzerland*
Global Earth Observation System of Systems (GEOSS) secretariat for a presentation on IRI Remote Sensing activities

19-25 April M. Hellmuth *Perugia, Italy*

30 May S. Trzaska *Paris, France*
Laboratoire d'Oceanographie et du Climat: Experimentation et Approches Numeriques (LOCEAN) collaborative meeting

2-6 June A. Giannini *The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy*
Conference on African Drought: Observations, Modeling, Predictability, Impacts; and invited presenter, "Oceanic forcing of Sahel rainfall"
6 June B. Lyon Kiev, Ukraine
Special Workshop on Sensor Web and Flood Monitoring (organized by the National Space Agency of Ukraine, NASA, CEOS Working Group on Information Systems and Services, International Federation of Red Cross/Red Crescent)

11-12 June S. Mason Zagreb, Croatia
First Session of the Southeast European Climate Outlook Forum (SEECOF-1)
Session chair; and presenter, "Downscaling of seasonal predictions/Climate Predictability Tool," "IRI's GPC predictions of rainfall and temperature over Southeastern Europe for JAS 2008"

Swiss Re-IRI's Index Insurance for Climate Risk Management & Poverty Reduction Roundtable at the Global Humanitarian Forum

3 July J. Kroeger Trieste, Italy
Collaborative meeting, and invited presenter, "Interannual variability in the tropical Atlantic in different ocean state estimates "

4-15 Aug S. Trzaska ICTP, Trieste, Italy
Lectures: 1/ West African Climate Variability and Predictability; 2/ Intraseasonal Characteristics of West African Monsoon

7-12 Aug M. Thomson Liverpool, UK
Collaborations with colleagues in Liverpool School of Tropical Medicine and Lancaster University on MERIT activities, including Ethiopia analysis and Health-Climate curriculum

17-20 Aug C. Brown, J. Hansen, B. Platzer Stockholm, Sweden
World Water Week participation, and meetings with the Bill & Melinda Gates Foundation, Global Water Partnership and International Water Management Institute

2-5 Sept H. Bhojwani, S. Zebiak Geneva, Switzerland
Second Meeting of the World Climate Conference 3 International Organizing Committee

29 Sept-1 Oct P. Ceccato Rome, Italy
Invited expert to the FAO-WHO Brainstorming Workshop on Rift Valley Outbreaks Forecasting System

29 Sept-3 Oct M. McLaurin Amsterdam, Netherlands
European Meteorological Society Annual Meeting; presented:
Using index-insurance to manage climate risk: issues in scale up and capacity building (Osgood, D.; McLaurin, M.)

10 Oct S. Connor, M. Hellmuth London, UK
Planning meeting for the formulation of a DFID Climate Change Network organized by the International Institute for Environment and Development (IIED) at the London Centre for International Development (LCID)
22-23 Oct T. Dinku *Ispra, Italy*
1st Workshop on “Rainfall Estimates for Crop Monitoring and Food Security” organised by the Agriculture Unit of Joint Research Center, in collaboration with the GEO Global Agricultural Monitoring and in the framework of the support of JRC to the Food Security Information Systems in the Horn of Africa; invited presentation:
• Validation of satellite rainfall estimates over Africa and South America

23-24 Oct J. del Corral *Geneva, Switzerland*
Discussions with the WHO GIS and Malaria groups regarding the integration of IRI Data Library climate datasets with their activities

22-24 Oct M. Hellmuth, D. Osgood *Brussels, Belgium*
Climate and Society Publications 2 discussions; and Meeting of the International Task Force on Commodity Risk Management (sponsored by the The World Bank, CTA, Swiss Secretariat for Economic Affairs, Netherlands Ministry of Foreign Affairs, and the EU All ACP Commodities Program):
• Hellmuth moderated "How can we improve coordination among various initiatives?"
• Osgood presented "Managing Weather Risk for Agricultural Development – Ethiopia"

**Australia, Asia and the Pacific Islands**

14-20 Nov B. Lyon *Quezon City, Philippines*
PAGASA collaborative meetings

14-20 Nov B. Lyon *Quezon City, Philippines*
PAGASA collaborative meetings

21 Nov A. Giannini *Dubai, UAE*
The Drylands Challenges - Strategic Meeting (co-hosted by HRH Princess Haya Bint Al Hussein and Prof. Jeffrey Sachs, under the auspices of the Global Humanitarian Forum) presentation: "Climate change and the drylands"

22-24 Nov J. Hansen *Hyderabad, India*
Represent IRI at ICRISAT/CGIAR 35th Anniversary Symposium, "Climate Proofing Innovation for Poverty Reduction and Food Security"
“Innovations in Climate Risk Management: Protecting and Building Rural Livelihoods in a Variable and Changing Climate” (with Walter Baethgen, Dan Osgood, Pietro Ceccato, Robinson Ngugi) presentation made

24 Nov-2 Dec P. Ceccato, E. Ebrahimian, J.-H. Qian, S. Someshwar *Palangka Raya, Indonesia*
Managing Fire Risks in Central Kalimantan: Seasonal Early Warning and Response
Kalimantan forest fire workshop organized by IRI, CARE Indonesia and Central Kalimantan Province's Department of Environment

30 Nov-3 Dec C. Brown *Phuket, Thailand*
NOAA Indian Ocean Observations High Level Panel
3-12 Dec H. Bhojwani, C. Brown, E. Ebrahimian, M. Hellmuth, S. Someshwar, S. Zebiak *Nusa Dua, Bali, Indonesia*
UN Climate Change Conference (COP-13)
S. Someshwar, panelist at IRI Side Event (5 Dec), "Managing climate risks for adaptation and mitigation: new initiatives in SE Asia"
M. Hellmuth, AFDB side event panelist (8 Dec)

17-21 Dec E. Ebrahimian, S. Someshwar, A. Robertson *Hyderabad, India*
International Seminar on "Extended Range Forecast and Agriculture Risk Management" (ERFARM), hosted by Indian Institute of Technology Delhi
A. Robertson presentation: Seasonal climate forecasts for risk management applications
S. Someshwar presentation: Institutions and climate risk management

27-31 Jan E. Ebrahimian *Los Baños, Philippines*
Invited speaker on "Institutionalizing Climate Risk Management for Development" at the University of the Philippines College of Public Affairs Symposium, "The Changing Role of Applied Social Science in Agriculture and Community Development"

1 Jan-2 Feb E. Ebrahimian *Manila, Philippines*
• Meeting with Metro-Manila urban stakeholders, School of Planning, University of the Philippines, Diliman, Metro-Manila
• Meeting with National Water Resources Board, Metro-Manila

24-30 March E. Conrad, S. Someshwar *Indonesia (Kupang, Denpasar, Bogor)*
Project Meetings:
• Food security in Nusa Tenggara Timur; with provincial government, Bogor Agriculture University (IBP) and CARE
• Water management and climate change in Bali
• Fire response for Central Kalimantan, Indonesia
• IBP Climate Risk Management Center

31 March-6 April E. Conrad, S. Someshwar *India (Delhi, Bangalore)*
Project Meetings:
• Risk management work for agriculture in India
• Demonstrations sites in South India for agriculture in India

6-14 April L. Sun *Beijing, China*
4th Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia Session 1 Chair - Prediction of East Asian Summer Monsoon and Summer Climate 2008
Invited presentations on “Dynamical Downscaling Forecasts: A Review” and “IRI seasonal climate forecasts for summer 2008 over Asia”

8-10 April A. Barnston *East-West Center, Honolulu, Hawaii, U.S.*
WMO/CLIPS Workshop on Communicating about ENSO: Toward Developing a Common Understanding;
Invited presentation: "Communication Strategies: Science Perspectives"
21 May P. Ceccato, J. Qian, S. Someshwar *Bogor Agriculture University, Indonesia*
Fire Early Warning and Response in Central Kalimantan: Meeting on early warning tool and approaches to incentive systems
Presentations:
S. Someshwar: Overview of meeting objectives
P. Ceccato: Weather-scale forecasting: validating FDRS over Central Kalimantan
J. Qian: Approaches to seasonal forecasting of fire activity in Central Kalimantan
P. Ceccato: Hands-on introduction to Indonesia Rainfall Analysis Tool and Experimental Forecasts of Fire Activity in Central Kalimantan
P. Ceccato and S. Someshwar: Discussion on possible integration into current forecasting/decision-making

22-23 May Shiv Someshwar *Palangkaraya, Indonesia*
Meetings with the Central Kalimantan Dept. of Environment, University of Palankaraya, and CARE Indonesia

22-23 May P. Ceccato, J. Qian *Bogor, Indonesia*
Meetings with the Indonesia Meteorological and Geophysical Agency (BMG) and the Indonesia Remote Sensing Agency (LAPAN)

June 4-24, July 18-19 A. Ines *Bangkok, Thailand*
Asian Institute of Technology visit

18 June E. Conrad, S. Someshwar *Ahmedabad, India*
Meeting with All-India Disaster Mitigation Institute

21 June E. Conrad, S. Someshwar *Palangkaraya, Indonesia*
Workshop on the Use of Early Warning for Peatland Fires at the District Level in Central Kalimantan

22-28 June B. Lyon *Metro Manila, Philippines*
Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) meetings

23 June E. Conrad, S. Someshwar *Indonesia, Jakarta*
CARE Indonesia meeting

24-25 June E. Conrad, S. Someshwar *Philippines*
Meetings with the Philippine National Disaster Coordinating Council, Philippines Red Cross, University of the Philippines Los Baños

1 July A. Ines *Los Baños, Philippines*
International Rice Research Institute talk on the applications of advanced climate information to agriculture and water management, and discussion of possible applications of seasonal climate forecasts to IRRI research

3 July A. Ines *MetroManila, Philippines*
Seminar conducted on the use of advanced climate information in agriculture and water to PAGASA and DOST scholars

14 July A. Ines *Batac, Philippines*
Mariano Marcos State University meetings
21-23 July C. Brown Manila, Philippines
Water Resources Risk Management for Manila Water Supply

29 July-1 Aug L. Zubair Cairns and Melbourne, Australia
July 26-Aug 15 L. Zubair Cairns and Melbourne, Australia
Participation in Western Pacific Geophysics Meeting, and presentations on:
• Soil Moisture Memory and Predictability of Seasonal Streamflow in Sri Lanka
• Inter-Annual Variability and Decadal Change of the North-East Monsoon Rainfall over South Asia
Visit to the Bureau of Meteorology (Melbourne) and presentation: The Use of Climate Information in the Tropics: Learning from Practice

22-27 Aug E. Conrad, F. Fiondella, K. Barnard Manila and Bulacan, Philippines
Interviews with key Angat Reservoir stakeholders to develop stories/communication materials on Angat project work, and to present revised reservoir model including climate forecasts

28 Aug–2 Sept E. Conrad, F. Fiondella, S. Someshwar
1/ Kupang, Nusa Tenggara Timur (NTT), Indonesia
Meeting with stakeholders and Governor of NTT to discuss research progress and integration of improved forecasting capacity into food security decision-making; documentation of climate risks and project work in NTT
2/ Bogor, Indonesia
Meeting with Vice-Rector of IPB regarding the new CRM Center; meeting with Ministry of Agriculture staff regarding collaboration climate risks and food security
3/ Central Kalimantan, Indonesia
Interviews with key stakeholders to develop communication materials on fire project work; and to discuss with CARE Indonesia and Central Kalimantan provincial government

3–4 Sept E. Conrad, S. Someshwar Jakarta, Indonesia
Presentation at Red Cross/Red Crescent SE Asia meeting, and discussions with AusAID and other partners regarding Central Kalimantan fire work

8-16 Sept A. Robertson New Delhi, India
Attend NOAA- Indian Ministry of Earth Sciences Science Colloquium and participate in ERFARM project meetings

17-19 Sept L. Sun Kunming, China
CAS-TWAS-WMO Forum 2008 "Development of Regional Earth System Model and Its Applications" Kunming, China, and invited presentation on "The Prospects for Seasonal Forecasting Using Regional Climate Models"

15-17 Oct S. Connor Phuket, Thailand
2nd International Conference on Dengue and Dengue Haemorrhagic Fever

13-17 Oct T. Dinku Beijing, China
4th Workshop of the International Precipitation Working Group; presentations:
• Validation of daily satellite rainfall estimates over South America (oral)
• Evaluation of high-resolution satellite rainfall products over regions frequented by desert locusts (poster)
24 Oct Shiv Someshwar Delhi, India
Meetings with the Indian Meteorological Department regarding the Extended Range Forecasting for Agriculture Risk Management Project

27 Oct H. Bhojwani, Shiv Someshwar Delhi, India
Meetings with The Energy Resources Institute (TERI) to discuss potential areas of collaboration

28-29 Oct H. Bhojwani, S. Zebiak Busan, Korea
Meetings with APCC leaders

30-31 Oct H. Bhojwani, S. Zebiak Changwon, Korea
International Consultation Meeting on the Development of the Global Climate Change Adaptation Network

30 Oct–1 Nov Shiv Someshwar Jakarta, Indonesia
Meetings with AusAID to discuss the Kalimantan Forest and Climate Partnership

North America

1 Nov H. Bhojwani, S. Connor, M. Hellmuth, S. Zebiak New York, NY
Climate Change and the Millennium Development Goals: Meeting the Development Challenge (co-sponsored by the UN Permanent Mission of Denmark and the Earth Institute Columbia Climate Center) Presentations at Session 1: Adaptation and MDGs - Impacts, Responses, and Gaps): S. Connor: Health H. Bhojwani for S. Zebiak: Connecting Science and Practice: Challenges and Opportunities

6 Nov S. Connor Philadelphia, PA
Invited speaker, NASA Public Health Program Symposium, Annual Meeting of the American Society for Tropical Medicine and Hygiene Presentation: "Malaria Early Warning System (MEWS) - experience in getting research into policy and practice"

5 Nov H. Bhojwani, New York, NY
Climate risk strategy meeting with S. Bird, OXFAM International

13 Nov D. Osgood New Haven, CT
Yale University course guest lecturer: Climate Change Adaptation and Mitigation in Developing Countries

18-20 Nov H. Bhattacharya New Orleans, LA
Presented "Environmental Quality, Resource Rents and Property Rights" at the Southern Economic Association Annual Conference

19-20 Nov S. Someshwar New York, NY
Presented "Climate-Smart Development: Reconciling Time Scales as well as Vulnerabilities" at the UN-Department of Economic and Social Affairs Expert Group Meeting: Strengthening international cooperation for development to address the climate change challenge
2-4 Dec S. Mason *Silver Spring, MD*
NOAA Climate Prediction Program for the Americas FY08 Proposal Review Panel

5-7 Dec P. Block *Boulder, CO*
Training session on WatBal, a global rainfall-runoff water balance model, operated by Kenneth Strzepek at the University of Colorado-Boulder

10-14 Dec B. Blumenthal, F.d.A. Souza-Filho, L. Goddard, A. Greene, S. Li, A. Robertson *San Francisco, CA*
2007 AGU Fall Meeting contributions:
- Blumenthal, B., J. del Corral, M. Bell: Using Multiple Metadata Standards to Describe Climate Datasets in a Semantic Framework
- Block, P.J., F.d.A. Souza Filho, L. Sun, H. Kwon: Accounting for Uncertainty Propagation: A Streamflow Forecasting Framework using Multiple Climate and Hydrological Models
- Brown, C., F.d.A. Souza Filho: Risk and Reward: Adaptive Reservoir Operations using Seasonal Climate Forecasts
- Goddard, L., C.A. Coelho: Diagnosing El Niño Induced Drought in Seasonal Forecasts and Climate Change Projections
- Greene, A.M., L. Goddard: Regional Climate Projections Utilizing Multimodel Ensembles: Some Stationarity Considerations
- Li, S., L. Goddard, D.G. DeWitt: Advantage of Multi-scenario Ensembling for AGCM Seasonal Climate Forecast
- Robertson, A.W., V. Moron, Y. Swarinoto: On the seasonal predictability of daily rainfall characteristics over Indonesia
- F.d.A. Souza-Filho, U. Lall, R. Porto: The role of price and enforcement in water allocation: insights from Game Theory

10 Dec M. Thomson *Washington D.C.*
David E. Barnes Global Health Lecture given by Dr. Margaret Chan, WHO Director-General

11-13 Dec J. Hansen *Washington DC*
(Invited) CGIAR Climate Change, Agriculture and Food Security Challenge Program proposal writing workshop

2-4 Jan H. Bhattacharya *New Orleans, LA*
Annual Meeting of the Allied Social Science Associations

8-10 Jan B. Blumenthal *Washington, DC*
Winter 2008 Meeting of the Federation of Earth Science Information Partners: - The Changing Climate: Making Earth Science Relevant Again in Light of Global Warming

15-16 Jan M. Madajewicz *Washington, DC*

17 Jan J. Hansen *Washington, DC*
Panelist for the "Climate Change Adaptation for the Developing World: Expanding Africa's Climate Change Resilience" session at the 8th Annual National Council for Science and Environment (NCSE) - Climate Change: Science and Solutions
20 Jan A. Giannini, S. Trzaska New Orleans, LA

88th AMS Annual Meeting
IRI Presentations:
• A. Giannini: The relationship between temperature and precipitation in the Sahel as a diagnostic of land-atmosphere feedbacks of relevance to climate change
• A. Greene (with D. Osgood, L. Goddard): Refinements in index insurance pricing via dendroclimatology, in the context of a nonstationary background state
• A. Greene (with A.W. Robertson): Downscaling forecasts of Indian monsoon rainfall using a nonhomogeneous hidden Markov model
• D. Lee (with D. DeWitt): An assessment of ENSO-driven potential predictability implied by coupled GCM experiments with prescribed Eastern Tropical Pacific SSTs
• B. Lyon (with S.J. Mason): Why did the southern Africa teleconnection “hang up” during the 1997-98 El Niño?
• E. M. Holthaus (with N. Ward and A. Siebert) poster: Index insurance for drought in the Millennium Villages Project
• A.F. Kamga (with A.D. Niang, E. Afiesimama, A. Diedhiou, B. L. Lamptey, O. Ndiaye, M. Kamara, and R. Roehrig): Towards the development of a revised Thorpex Africa science plan
• A. Siebert (with N. Ward, O. Ndiaye, P. Kangah): Statistical characterization of the dry spell risk during the west African monsoon from meteorological station data
• F.d.A. Souza Filho (with A. M. Greene, U. Lall) poster: A global assessment of the joint distribution of twentieth-century temperature and precipitation in the CMIP3 coupled climate models
• F.d.A. Souza Filho (with C. Brown): Dynamic risk management in water systems - new methodology for reservoir operation
• F.d.A. Souza Filho (with U. Lall, H. H. Kwon): Multi-decadal Climate Variability or Change and Reservoir Performance: The Colorado River Compact
• S. Trzaska, (with D. Dewitt, D. Lee): Simulation of West African Monsoon in a set of atmospheric general circulation model uncoupled/ coupled to ocean models of varying complexity

23 Jan A. Barnston New Orleans, LA
NOAA planning and design meeting -for better assessment of the state of ENSO through an improved Multivariate ENSO Index (MEI)

26 Jan C. Brown New York, NY
Invited panelist on "China’s Three Gorges Dam Project and Its Global Impact," in conjunction with the American Museum of Natural History's exhibition "Water: H2O = Life"

28 Jan H. Bhojwani, S. Zebiak Silver Spring, MD
NOAA CPO meeting

31 Jan C. Brown, L. Goddard New York, NY
Invited panelists at the Columbia Climate Center-sponsored Focus the Nation Teach-In on climate change/variability impacts
30-31 Jan H. Bhojwani, P. Ceccato, D. Osgood Boston, MA
OXFAM America private sector retreat, a discussion of activities in climate-sensitive areas

31 Jan-1 Feb J. Hansen Washington, DC
Representative of the Climate Change, Agriculture and Food Security Challenge Program Leadership Group at the CGIAR Dialog/Workshop on Development of Cycle 2 Challenge Programs

31 Jan-1 Feb N. Ward Washington, DC
Climate Prediction Center collaboration meetings

4 Feb E. Ebrahimian Stanford, CA
Meetings at Stanford University's Center for Environmental Sciences and Policy, on agriculture and climate in Asia

6-8 Feb D. Osgood University Park, PA
Invited Pennsylvania State presentation, "Drought, Poverty Traps, and Index Insurance"

12-13 Feb D. Osgood, S. Zebiak Columbia University, NY
5th Global Roundtable on Climate Change
S. Zebiak: Climate Information for Development (Adaptation in Practice session)
D. Osgood: Index Insurance (Financial Flows for Adaptation Session)

12-16 Feb A. Robertson Los Angeles, CA
Department of Energy project collaborative meetings

21 Feb L. Goddard Columbia University, NY
Columbia Climate Center launch speaker on "Climate Prediction: Present & Future"

22 Feb A. Giannini Atlanta, GA
Invited speaker, Georgia Tech School of Earth and Atmospheric Sciences 2008 Seminars; presented: Climate change in the African Sahel: what role for land-atmosphere feedbacks?

26-29 Feb N. Ward Gainsville, FL
Invited presentation, "Climate Variability and Climate Change: Seeking the Meaning for Water Resources Management," at the University of Florida Water Institute Symposium, "Sustainable Water Resources: Florida Challenges, Global Solutions"

4-7 March L. Goddard, M. McLaurin, D. Osgood Chapel Hill, NC
6th Annual Climate Prediction Applications Science Workshop (CPASW)
L. Goddard presented: Climate Prediction Applications Postdoctoral Program (CPAPP); and Experiment in Interfacing Climate and Society
D. Osgood presented: Using index insurance to manage climate risk: Issues in scale up and capacity building

13 March S. Mason Washington DC
CPC Meeting

24-28 March L. Goddard Miami, FL
11th Annual Meeting of the WCRP/CLIVAR/VAMOS Panel, and pre-meeting; presented: IASCLIP (Intra America Studies of Climate Processes) Regional Applications and Outreach
Climate Knowledge for Global Health, a brainstorming session co-sponsored by IRI and Center for Global Health and Economic Development (CGHED)

26-27 March B. Lyon Washington, DC

27-28 March H. Bhojwani, S. Zebiak Columbia University, NY
State of the Planet 08

27-28 March L. Sun Rutgers University, New Brunswick, NJ
Invited speaker, Greater Horn of Africa Regional Model Intercomparison Project (AFRMIP); presented: Application of RSM for seasonal prediction over the Greater Horn of Africa

31 March-2 April D. DeWitt Camp Springs, MD
Visits: NCEP, COLA, University of Maryland

7 April J. Omumbo Washington, DC
Invited panelist at USAID's World Health Day panel discussion, "Protecting health from climate change," sponsored by the Economic Growth, Agriculture and Trade Bureau

9 April S. Li Stony Brook, NY
SUNY Stony Brook School of Marine and Atmospheric Sciences invited seminar speaker on "Multi-Model Ensembles in Seasonal Climate Forecasts at the IRI"

16 April H. Bhojwani, S. Zebiak Washington, DC
NOAA CPO and NWS International Program meetings

28 April-1 May D. DeWitt Champaign, IL
9th Linux Cluster Institute International Conference on High-Performance Clustered Computing

1-2 May A. Greene Roanoke, Virginia
University of Roanoke "Science Seminarian"
Invited presentation entitled "Applied Climate Science at the IRI: Intersection of Climate and Society," and serve as moderator for student poster and oral presentations

5 May S. Connor UN Headquarters, NY
Invited presenter and panelist for the session on Ethical Dimensions of Climate Change: Implications for Africa's Agricultural and Rural Development. Commission on Sustainable Development

8-9 May E. Conrad UN Headquarters, NY
Expert Meeting and Seminar on “Climate Change, Environmental Degradation, and Migration: Preparing for the Future”

8-10 May S. Connor, M. Thomson Harvard School of Public Health, Boston, USA
15-16 May B. Blumenthal *Greenbelt, MD*
NCAR-sponsored Data-type and Service Ontology Workshop

20-23 May S. Connor *Boulder, CO*
NASA-USGS Project Workshop

27-30 May A. Ines *Fort Lauderdale, FL*
AGU The Meeting of the Americas 2008 Joint Assembly
Presentation: Ines, A., and J. Hansen. Bias correction and stochastic disaggregation of GCM rainfall for decision support in agriculture and water management.
Awardee: 2007 Editors Citation for Excellence in Refereeing for Water Resources Research

29 May-1 June D. Osgood *Boston, MA*
NBER Climate Economics Conference

29-31 May L. Zubair *Johns Hopkins University, MD*
Symposium on Fluid Science and Turbulence

10-13 June W. Baethgen *St. Pete Beach, FL*
Climate Information for Managing Risks: Partnerships and Solutions for Agriculture and Natural Resources, and presented "Climate Risk Management in the Agricultural Sector: IRI Experience Over the Past Decade"

17 June B. Platzer *Washington, DC*
“Public Health Management after Natural Disasters: Preparation, Response & Recovery” at the Woodrow Wilson International Center for Scholars, Global Health Initiative

18 June M. Thomson, B. Platzer *Washington, DC*
"Changing Climate, Changing Health Patterns—What will it take to predict and protect," a forum sponsored by the World Federation of Public Health Associations, the American Public Health Association and the U.S. Group on Earth Observations
• M. Thomson, panelist

18-20 June C. Brown *Boston, MA*
Environmental and Water Resources Systems Workshop

22-28 June L. Goddard, A. Greene *Aspen, CO*
Aspen Global Change Institute's workshop on decadal prediction, “Climate Prediction to 2030: Is it possible, what are the scientific issues, and how would those predictions be used?”
• L. Goddard, keynote (Walter Orr Roberts Memorial Lecture) speaker, “Planning for a changing climate: The roles of natural variability and human-driven change in near-term climate prediction;” workshop presentation, "Decadal Information for Applications;” and workshop organizing committee member
• A. Greene presented "Statistical description and prediction(?) of decadal variability"

23-26 June H. Bhojwani, S. Zebiak *Vail, CO*
NOAA Climate Working Group Retreat
6-7 July P. Ceccato *Boston, MA*

14-16 July P. Ceccato *Edmonton, Canada*
International Workshop on Advances in Operational Weather Systems for Fire Danger Rating, and presentation, "Climate Forecast, Early Warning and Response to Peatland Fires in Central Kalimantan, Indonesia"

14 July L. Goddard *Irvine, CA*
US CLIVAR Science Symposium on Decadal Prediction, and presentation, "Model Predictions/Projections for 2018: What is Being Planned and What Could They Tell Us? (Summary of the AGCI Workshop)"

15-17 July L. Goddard *Irvine, CA*
Participation in the US CLIVAR Summit as a member of the Predictability, Prediction and Applications Interface Panel

6-7 Aug H. Bhojwani *Washington, DC*
NOAA visit

7-8 Aug S. Connor *St. Augustine, FL*
Invited to the Changing Environment and Emerging Infectious Diseases Retreat, held at the University of Florida’s Whitney Laboratory, presented "Integrated early warning and response systems;" and meeting with University faculty involved with the new Emerging Pathogens Institute (Gainesville, Florida) and its Director

11-15 Aug A. Robertson *UCLA, Los Angeles, CA*
Department of Energy project collaborations with M. Ghil, P. Smyth and S. Kravtsov

28 Aug T. Dinku *Camp Springs, MD*
NOAA-CPC visit to present validation work on satellite rainfall estimates and discuss ways to improve CPC satellite rainfall products

5 Sept M. Thomson *Washington, DC*
NOAA climate services roundtable meeting on public health aspects of climate information and delivery needs

8-15 Sept P. Block *Estes Park, CO*
Attend Interagency conference on research in the watersheds, "Planning for an Uncertain Future: Monitoring, Integration, and Adaptation"
Workshop presentation: Does Climate Matter? Evaluating the effects of climate change on future Ethiopian hydropower (P. Block and C. Brown)

9-10 Sept J. Qian *Ames, IA*
2008 Corn and Climate Conference; invited speaker on "Seasonal Forecasts"

10-11 Sept A. Barnston *College Park, MD*
4th Annual Climate Test Bed Science Advisory Board meeting
17 Sept H. Bhojwani, S. Zebiak *Washington, DC*
2008 Arizona State University Sustainability Solutions Summit

17-19 Sept B. Blumenthal *Seattle, WA 7th*
GO-ESSP (Global Organization for Earth System Science Portal) Community Workshop; presented
"Connecting netCDF/CF to a Semantic Framework"

17-19 Sept S. Connor *Biloxi, MI*
NASA Public Health Program Review participation and presentation of project progress, "Progress in enhancing Malaria Early Warning Systems (MEWS) with earth observation and modeling results"

23-26 Sept S. Mason *Washington, DC*
Meeting of the WMO Commission for Climatology Expert Team on Research Needs for Intraseasonal, Seasonal and Interannual Prediction, including the Application of these Predictions
WMO/CPC Open Seminar, Recent Advances in Seasonal to Interannual Prediction: Regional and Applications Perspectives (23 Sept ); presented "Evaluation and verification of seasonal to interannual prediction products"

6 Oct S. Zebiak *Columbia University, Morningside*
Water Center Strategic Meeting

8-10 Oct L. Goddard *Las Vegas, NV*
MDA EarthSat Weather, 7th Annual EarthSat Conference for Weather Analysts; invited speaker,
"Uncertainties Associated with Seasonal Prediction"

14 Oct S. Someshwar *Washington, DC*
World Bank's Climate Investment Funds Partnership Forum, led the discussion on the 3rd Session:
Adaptation: the Challenge of Scaling Up

20-24 Oct A. Barnston, L. Goddard, B. Lyon *Lincoln, NE*
33rd Climate Diagnostics and Prediction Workshop/CLIVAR Drought Workshop
• Barnston/S. Li presentation: Verification of IRI's seasonal climate forecasts, 1997 to present
• Goddard/Coelho poster presentation: El Niño-induced tropical droughts in seasonal forecasts and climate change projections
• Lyon poster presentation: The Joint Occurrence of Summer Drought and Heat Waves in Coupled Models: Case Study in Southern Africa

27-29 Oct J. del Corral *Boulder, CO*
3rd NCAR Community Workshop on GIS in Weather, Climate and Impacts; presentation 'Spatial Averaging Over GIS Features of Time Dependent Climate Data to Evaluate Societal Risk', and workshop working groups participation

**Central America, South America and the Caribbean**

6-13 Nov W. Baethgen, H. Bhojwani, S. Zebiak *Brasilia and Sao Paolo, Brazil; Montevideo, Uruguay*
Meetings with EMBRAPA, CPTEC, INPE, INIA, National University of Uruguay, UNDP-Uruguay, IICA-Uruguay, PROCISUR, and UNESCO
7-9 Nov P. Block Santiago, Chile
"Coming Down the Mountain: Understanding the Vulnerability of Andean Communities to Hydroclimatologic Variability and Global Environmental Change" IAI project meeting

19-23 Nov A. Barnston Brasilia, Brazil
Deliver training/capacity building on "Climate information to manage climate risk"

26-30 Nov A. Barnston San Salvador, El Salvador
Deliver training in seasonal climate prediction and use of CPT, sponsored by Comite Regional de Recursos Hidricos and Sistema de la Integracion Centroamerica (Central America Met and Hydro organizations)

14-20 Jan L. Sun Fortaleza, Brazil
• Invited speaker , “Seasonal climate prediction using RCMs” at the 3rd International Conference on Climate Studies in Northeast Brazil;
• Presentation of the IRI seasonal climate forecasts and FUNCEME downscaling forecasts for the 2008 rainy season for the Nordeste, and chair of the forecast discussion at the 10th Semi-Arid Northeast Brazil Climate Outlook Forum;
• Interview for Brazilian television on 2008 forecasts and IRI-FUNCEME collaborations

21-23 Feb W. Baethgen Panama City, Panama
Inter-American Institute for Global Change meeting of the principal investigators of the Collaborative Research Network (CRN-II) Programs

24-29 Feb C. Brown Panama City, Panama
American Institute for Global Change Research, PI meeting of the Small Grants Program for Human Dimensions

3-7 March W. Baethgen Brasilia, Brazil
IRI-INMET Training course: Climate Risk Management in Agriculture; main instructor, with 54 participants from Brazil, Argentina, Paraguay, Peru and Uruguay

10-12 March M. Madajewicz Port of Spain, Trinidad and Tobago
UNFCCC expert meeting on socio-economic information under the Nairobi work programme on impacts, vulnerability and adaptation to climate change

11 March W. Baethgen La Serena, Chile
Workshop to plan research activities for the CAZALAC-IRI project on Climate Risk Management in the Water Resource Management of the IVth Region of Chile

12 March W. Baethgen Santiago, Chile
Ministry of Agriculture of Chile meeting to discuss the establishment of a Drought Early Warning System for the agricultural sector of Chile in collaboration with the IRI; and presentation: Early Warning Systems in the context of Climate Risk Management

13 March W. Baethgen Santiago, Chile
CAZALAC-UNESCO annual workshop to discuss 2009-2011 workplan including CAZALAC-UNESCO-IRI collaboration

18 March W. Baethgen Buenos Aires, Argentina
IAI meeting: Making current La Plata Basin projects (IAI, IDRC) relevant for stakeholders
10-11 April L. Goddard *Ensenada, Baja California, Mexico*  
Regional Climate Forum for Northwest Mexico and the Southwest United States, Centro de Investigación Científica y de Estudios Superiores de Ensenada (CICESE)  
Invited talks: "Climate Forecasting and Applications at IRI" and "IRI climate forecast for the region"

23 April W. Baethgen *Buenos Aires, Argentina*  
Global Knowledge Partnership, LAC Regional Meeting; Invited speaker: “Role of ICT in Climate Risk Management at the Grassroots Level”

25 April W. Baethgen *Montevideo, Uruguay*  
Consejo de Cooperativas Agrarias Federadas, invited speaker to the Council on "Managing climatic risks, with particular application to agriculture"

25-29 May L. Goddard *Guayaquil, Ecuador*  
Collaborative visit to CIIFEN coincident with their workshop on dynamical downscaling.  
Presentation: 'Incertidumbre en los Prognósticos de Estacionales' (Uncertainty in Seasonal Forecasts)

3-5 June W. Baethgen, H. Bhojwani *Panama City, Panama*  
Central America and the Caribbean IFRC 2008 Pre-hurricane season meeting

6 June H. Bhojwani *Panama City, Panama*  
Co-host for the CATHALAC/IRI/IFRC capacity building on potential uses of integrated climate information for disaster risk reduction in Central American and Caribbean National Red Cross Societies

28-30 July W. Baethgen *Montevideo, Uruguay*  
FORAGRO, Forum for the Americas on Agricultural Research and Technology Development (http://www.iica.int/foragro/); guest speaker: “Institutional Innovations: Technological Demands in Emerging Issues: Climate Change”

19-21 Aug S. Mason *Lima, Peru*  
APEC Climate Center 2008 Annual Symposium on APCC for Climate Information Services to Society; presented "Seasonal climate forecasting for natural disaster risk management" and "Presenting forecast verification information to user communities"

24-31 Aug A. Barnston *Lima, Peru*  
Hosted by SENAMHI (Peru national met/hydro service) for training in CPT and collaboration on climate prediction for the region with particular focus on extreme weather events within an anomalous climate episode

2-3 Sept W. Baethgen, A. Robertson *La Serena, Chile*  
Workshop on Advances in the IRI-CAZALAC project on climate risk management in the water resources of region IV in Chile; and EU proposal working meeting at CAZALAC

5 Sept Walter Baethgen *Santiago, Chile*  
Meeting at the Ministry of Agriculture of Chile with the Undersecretary and technical staff to discuss establishing an information and decision support system for Chile in an IRI and Ministry of Agriculture collaboration
8-12 Sept W. Baethgen, S. Zebiak *Montevideo, Uruguay*
UNESCO International Hydrological Programme Meetings
8-10 Sept: Conference on “Global Change and Water Resources (S. Zebiak, keynote speaker, W. Baethgen, panel member)
10-12 Sept: Coordination meeting of UNESCO International Hydrology Programs of the LAC region (W. Baethgen)”

10-12 Sept H. Bhojwani *San Salvador, El Salvador*
American Red Cross meeting on better climate change adaptation practices

22 Sept-3 Oct W. Baethgen, G. Mantilla, M. Thomson *Bogota, Colombia*
XV Basic and Advance Course in Epidemiological and Public Health Surveillance with Emphasis in Climate and Health, co-organized by G. Mantilla
Presentations:
- W. Baethgen: Climate Risk Management
- G. Mantilla: Use of Climate information in Public Health; and, Climate Change Impacts in Public Health
- M. Thomson: Climate and Public Health
Meetings with: the Ministry of Agriculture, Department of National Planning, IDEAM, Ministry of Social Security, University of Los Andes, where M. Thomson conducted a brown-bag seminar on “Climate and Public Health” to professors and graduate students

29-30 Sept W. Baethgen *Montevideo, Uruguay*
Participate in First Workshop of the World Bank Project: "Regional Vulnerability to Climate Change in Agricultural Systems in LAC: Building Response;" presented "Enfoque local del Proyecto" (framing the vulnerabilities associated with climate variability in the scale of days to months to “near-term” climate change)

23 Oct S. Mason *Guayaquil, Ecuador*
Ibero American Workshop on Seasonal Prediction: the Modeling sciences and its contribution to development (CIIFEN Verification Workshop); presentation:
- Verification of seasonal forecasts

28-30 Oct W. Baethgen *Passo Fundo, Brazil*
Training Course: Modeling Applications for Decision Support in Agriculture Sponsored by Inter-American Institute for Global Change (IAI) and Brazilian Agricultural Research Corporation (EMBRAPA), with the goal of introducing participants to the application of crop modeling and climate forecasting to mitigate production risks associated with climate variability. 72 participated. W. Baethgen's lectures:
- Basics of crop modeling
- Modeling Applied to Decision making in Agriculture: The IRI Experience
Meeting to discuss extension of IAI project in Brazil and Paraguay and participation of IRI