WORKSHOP REPORT

Improving Resilience to Climate Impacts in Ethiopia through Improved Availability, Access and Use of Climate Information: Dialogue With Users

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IRI

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

NMA ብሔራዊ ሚቲዎሮሎጂ ኤጀንሲ NATIONAL METEOROLOGY AGENCY

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Acronyms

AAU	Addis Ababa University
ACPC	African Climate Policy Centre
AfDB	African Development Bank
AGRHYMET	Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle
APCC	APEC Climate Center
APEC	Asia-Pacific Economic Cooperation
CRM	Climate Risk Management
DRMFSS	Disaster Risk Management and Food Security Sector
EIA	Environmental Impact Assessment
ENACTS	**E**nhancing **Na**tional **C**lima**t**e **S**ervices
ESRC	Economic and Social Research Council
EPA	Environmental Protection Agency (Ethiopia)
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSSDD	Food Security and Sustainable Development Division
GCOS	Global Climate Observing Systems
GEO	Group on Earth Observations
GGW	Great Green Wall
GIS	Geographic Information System
IPCC	Intergovernmental Panel on Climate Change
IRI	International Research Institute for Climate and Society, Columbia University
NGO	Non-Governmental Organization
NMA	National Meteorology Agency
NOAA	National Oceanic and Atmospheric Administration, USA
SADC	Southern Africa Development Community
SEA	Strategic Environmental Assessment
TAMSAT	Tropical Applications of Meteorology using SATellite data and ground-based observations
UNDP	United Nations Development Programme
UNDP-AAP	UNDP - Africa Adaptation Programme
UNECA	United Nations Economic Commission for Africa
WFP	World Food Programme
WMO	World Meteorological Organization

Executive Summary

Ethiopia's National Meteorological Agency (NMA) is transforming its climate information services in a way that is unprecedented in Africa, and in many parts of the world.

NMA's new innovative products include a 30-year time series of ten-daily rainfall and temperature data for every 10 km grid across Ethiopia, created by combining station measurements and satellite proxies; and an online mapping service providing user-friendly tools for visualization, querying, and accessing information.

The workshop presented these tools to a range of users and potential users in order to:

- provide an overview of the themes of climate risk management;
- make participants aware of the information and products that already exist
- train them in the use of the tool
- solicit feedback regarding improvements and/or other climate information products that could assist in risk management practices within the country

Workshops participants represented agriculture, water, food security, and disaster risk management, and provided feedback regarding how the tool could be improved.

Key recommendations included:

1. Make information available by administrative boundary and/or catchment.
2. Ensure the tool is available in local languages.
3. Reconsider the color conventions so as to be clearer to the audience.
4. Make raw data available in specific formats and/or geographic locations for students, others.
5. Present monitoring data in terms of months and seasons, not just dekads.
6. Present derived products, including soil moisture maps, water satisfaction indices, etc.
7. Present 3-day, 5-day and 15-day weather forecasts.
8. Present thresholds.
9. Present information on analogue years.

Organization and Sponsorship

This training workshop was convened by the NMA, in collaboration with the International Research Institute for Climate & Society. Funding was provided by the National Oceanic and Atmospheric Administration and United Sates Agency for International Development (USAID)

Day 1: June 3, 2013

Session I: Opening remarks

E. Alemayehu Tegenu
Minister of Water and Energy
Ethiopia

Minister Tegenu welcomed participants to the workshop and reviewed the need to engage with users in order to better understand and meet their needs for climate information. He also discussed the link between climate and a range of sectors including water and energy, and stressed the need for climate and weather information to be used in order to improve decision-making in these sectors. Minister Tegenu highlighted the role that the user dialogue stood to plan in articulating the extent to which users are able to use the Climate Analysis Tools developed by the National Meteorological Agency and the International Research Institute for Climate & Society in order to access data and make decisions. This feedback is also essential for the improvement of tools in the long term. The entire speech is included in

Jim Hansen
Theme Leader
CGIAR Climate Change Agriculture & Food Security

Jim Hansen, a research scientist at the International Research Institute for Climate and Society and a theme leader of the CGIAR Climate Change, Agriculture and Food Security, provided opening remarks.

The IRI, through Tufa Dinku and in collaboration with the University of Reading, has had the privilege of working with NMA over the past few years as it has worked to strengthen its products and services. What we now know as ENACTS started with a Google.org – funded project, oriented toward the health sector. This resulted in a high-resolution historic rainfall climatology, and maprooms that provide various decision-makers with analyses of those data.

Hansen mentioned that he was excited when he realized what was possible. Through CCAFS, he had the opportunity to provide some modest additional support for methodology to do this on a daily time step, quality control of historic rainfall records at NMA, processing and accessing the raw satellite date at the IRI, and testing feasibility of doing something similar for the other meteorological variables that are important for agriculture.

Smallholder agriculture in Africa is becoming more data- and knowledge-intensive because:

- Persistent problems are complex and multi-dimensional;
- The pace of change is pushing against the limits of farmers' traditional knowledge; and
- The information revolution (computing capacity, remote sensing, internet, mobile phones) makes it feasible.

Some of the most promising things that could be done to build the resilience of rural communities to climate-related risk depend on historical climate records.

- Selecting crop cultivars or developing agricultural technologies that are appropriate for a given environment.
- Detecting climate change.
- Supporting local response to seasonal climate forecasts, particularly by smallholder farmers.
- Forecasting crop production early in the growing season for agricultural planning and food security management.
- Designing effective index-based agricultural insurance.

Where data are not available, these options are severely constrained. With ENACTS Ethiopia has become the leader in Africa in addressing this problem. If the data are used to their full potential, the benefits to the economy of Ethiopia, and to the welfare of its most vulnerable populations, could be huge. Hansen's wish for the future is to continue to collaborate with the NMA, and to encourage other countries to follow the lead of the NMA in developing this sort of dataset.

Introduction to the meeting
Tufa Dinku, IRI

The National Meteorology Agency is transforming its services in a way that is unprecedented in Africa, and in fact many parts of the world.

The National Meteorology Agency is transforming its services in a way that is unprecedented in Africa, and in fact many parts of the world. This includes:

- A 30-year time series of ten-daily rainfall and temperature data for every 10 km grid across Ethiopia, created by combining station measurements and satellite proxies; and
- An online mapping service providing user-friendly tools for visualization, querying, and accessing information.

Stakeholders need to be engaged on the generation and application of such information products, which will require ongoing interactions with different user groups. Facilitating this kind of dialogue is an objective of this workshop, with specific goals including:

- Enable participants to understand and use NMA's new data, tools and information products;
- Enable participants to understand the basic concepts of climate risk management in their respective sectors;
- Solicit critical feedback from stakeholders in order to improve the existing information products and/or develop new ones.

Session II: Climate data and information products from NMA

Kiremt Forecast*, Diriba Korecha, NMA*

Diriba Korecha, director of Meteorological Forecasts and Early Warning at the National Meteorological Agency, provided the seasonal Kiremt (June to September) forecast for the country.

This began with a description of the 2013 Belg season, which included normal onset and normal cessation, but was marked by below-normal rainfall in the northeast, central, and southeast parts of the country.

The talk also described the methodology used to produce seasonal forecasts, and confirmed that the seasonal forecast have shown more skill, in the last decade, than climatology. The methodology presents ENSO analogue years, and compared current La Niña-like conditions to three similar years, including 1980-81, 1995-95, 2000-2001.

A summary of the forecast considered three topics:

***Onset and cessation*:** The seasonal rain is expected to start within the normal onset periods over the most parts of the country, although the rain has already started over the western half and central regions.

Normal cessation of Kiremt rain is expected over most of the Kiremt rain benefiting areas.

Seasonal rainfall anomaly: Near-normal rainfall is predicted over the northern half of the country, with slightly below-normal conditions over the northwest. Normal to above-normal rainfall is anticipated over the eastern , central-western, and southwestern regions of the country.

In general, normal kiremt rainfall is highly likely to prevail over the major portions of Kiremt rain benefiting areas of the country.

***Extreme rains*:** Heavy rains are likely over various portions of Ethiopia. Consequently, flood calamity is anticipated along the river banks and low-lying areas of the country.

Dr. Diriba Korecha also considered the impact of the kiremt forecast on agriculture and water resources, predicting that dams including the Koka, the Fincha, the Tara Beles, the Gilgel Gilgel, and the Tekeze, would experience relatively high water levels. He also forecasted that normal to above-normal rainfall over the eastern, central, western, and southwestern part of the country would be conducive for agricultural and pastoral activiites in these regions.

Introduction to NMA's merged climate time series
Melesse Lemma, NMA

Mr Melesse Lemma, director of Meteorological Data and Climatology Directorate, began his talk by discussing the need and potential uses of climate information in Ethiopia, specifically the extent to which improved climate information could assist in decision making, protecting lives and livelihoods and contributing to sustainable development.

Mr. Melesse Lemma also described the shortcoming of only using station data; while the number of stations is reasonably good, coverage is not even and the lowlands, in particular, lack coverage. In some cases, stations are marked by data gaps; in addition, data is often not entirely accessible.

Combining station observations with globally available products, such as satellite proxies and model reanalysis data, resolves problems of data availability, providing supplemental information with excellent spatial and temporal coverage.

The project has involved work conducted by the NMA, in conjunction with the IRI, along with the Tropical Application of Meteorology using Satellite data (TAMSAT), at the University of Reading. It has involved a number of steps, including quality control; obtaining and organizing the satellite information; and merging it with station data.

The combined rainfall dataset draws on more than 600 rain gauge stations merged with 30 years of satellite-derived rainfall estimates. For temperature, data from over 300 stations are combined with Moderate Resolution Imaging Spectroradiometer (MODIS) satellite land surface temperature estimates.

The main problem with the gridded data is that values over the southeastern and northwestern lowlands, where there are few or no gauges, are significantly overestimated or underestimated.

The satellite estimate depicts the spatial structure of the rainfall very well, but significantly underestimates high rainfall values. The combined product overcomes, to a degree, the shortcomings of both the interpolated gauge and satellite estimates.

Introduction to NMA's website & map rooms ***Kinfe Hailemariam and Diriba Koricha, NMA***

Mr. Kinfe Hailemariam, Director of Meteorological Instruments and ICT Directorate, provided an introduction to the NMA website (www.ethiomet.gov.et), and its newly launched Climate Analysis and Application Map Rooms.

Kinfe described that the website is fully bilingual, providing products and services (minus raw data) by means of a dynamic tools which link to Google-based maps and animated satellite images. The website also include a search engine, a discussion forum, and decentralized content management.

The website also distributes daily and three-day weather reports, seasonal forecasts, and information on regional meteorological stations, the climate of particular cities. The Climate Analysis and Applications Maproom displays a range of different kinds ways to examine historical, monitoring, and forecast information.

Mr. Diriba Korecha, director of Meteorological Forecast and Early Warning Directorat***e,*** also presents on the underlying role of the El Nino Southern Oscillation in the tools presented in the Climate Forecast Map Room. This is possible as the correlation between the ENSO state and the all-Ethiopian JJAS rainfall is relatively high, with La Nina events contributing to enhanced rainfall and El Nino events suppressing rainfall throughout Ethiopia. In this context, current neutral ENSO conditions are a potential pre-indicator of kiremet rainfall.

Dr. Diriba also described improvements that NMA is planning to make, including

- Exceedence probabilities conditioned on ENSO (i.e., what is the probability of rainfall being greater than 100 mm at a point?)
- Terciles and monthly rainfall distributions of the analogue years (to help users have an understanding of what to expect)
- Comparison of past terciles forecasts with actual rainfall terciles for the last 15 years at any point (to help users understand the quality of the forecast)

Discussion session

Ato Workneh Degefu (president of Ethiopian Meteorological Society)

- **Comment**: Presenters should clearly state the months involved in referring the seasons in Ethiopia, like Belg (FMAM) and Kiremt (JJAS), as some participants may not know these local terminologies.
- **Question**: In areas of Ethiopia, where there are very scarce stations, like southeastern Ethiopia, how is the merging done? Is it only satellite data for those areas? How accurate the merged product is?
- **Question**: Is NMA producing the merged data produced and updated regularly or it is done only for past climatology data?

Mr Shemeles Tadess (EPA)

- **Comment**: The NMA digital maproom should have climate vulnerability assessment tools as one of its application.
- **Question**: What are the resolutions of this new gridded-merged dataset? Spatial and temporal? Satellite vs. gauge?
- **Question**: in the NMA website introduction, online data request form has been introduced. Why don't NMA make the data available for all freely? Why do we need to make a request?

Ms Almaz Tadesse (DRMFSS)

- **Comment**: It was difficult to access the maproom information easily
- **Question**: Is the map room sustainable?

Mr Kedir Shemsu (WFP)

- **Question**: In the merged satellite with ground station data, Kriging method is used. Why Kriging? LEAP software uses SEDI, which is much better for Ethiopia.

Mr Wudneh (Addis Ababa University, Geography Department)

- **Comment + question**: He said that his students have been asked to pay for data and asked if NMA has changed its data policy.
- **Question**: Since the ground station data has a lot of missing data, the merged dataset is good to fill the data gap, but questioned the dependability of the gridded-merged data. To what extent the data is reliable?
- **Question**: To what extent we can go in terms of processing data to a smaller area of interest, e.g., smaller area than a Woreda?
- **Question**: There is a lot of data processing now a day's using different techniques. What is the future trend in general? Is point data became out of use?
- **Comment**: the colors used in the digital maproom maps don't follow the conventional color codes. This has to be corrected. For example blue are cold colors and red are hot colors. The color NMA uses in TV weather briefing also has to be standardized. It shouldn't be changed that frequent. NMA may need to arrange for a short-term training on this issue.

Response: Tufa Dinku, IRI

To the question of merged data reliability/accuracy:

- At a point, ground station data the most accurate one.
- The ENACTS/NMA satellite rainfall estimation has been calibrated by using a good number of ground station data especially for Ethiopia, which makes the satellite data itself a good one. There is a paper to be published soon on the product reliability.
- Regarding the trend of point to spatial data. Dr. Tufa said, we always prefer the ground station data as far as their density and representativeness dependable.
- The resolution for the gridded and merged data is 10km grid.

- The merged data in the NMA maproom is best when it is used as a spatial average, e.g., Woreda or Zone than using it as a grid point.
- In response to Almaz (MRMFSS), Tufa said that he can access NMA's Map Rooms from New York, so it should be a specific problem to Almaz's computer.
- Dr Tufa also responded to the question from WFP with regards to the interpolation methodology. He said that he tested different methodologies and there is no big difference among different approaches. Thus, he selected a simple approach, which is somewhat similar to SEDI.

Response: Getachew Abate Mussa (FEWSNET)

- **Comment**: In the NMA digital maproom, the representing of tercile probability product into equivalent mm of rainfall is a very good work. It would be good if we get map of probability in mm instead of point information, as it is in the forecast maproom.
- **Comment**: It would also be useful if the maproom add some more tools to give us indication that which crops are at risk and which crops are benefiting from the forecasted season.

Session III: Examples of sectoral use of climate information

Climate information for the water sector
Mrs Semunesh Gola, Ministry of Water and Energy

The Hydrological Service engages in a range of activities, detailed by Mr. Gola at the start of his presentation – particularly with respect to hydrological stations, data collection, and data processing and analysis. Other activities include flood forecasting, early warning, monitoring, and decision-making.

In this regard, climate information is used for water resources management specifically in terms of:

- Surface and ground water assessment
    - Historical and seasonal forecast data is used to quantify the surface and ground water resources
- Water sector development activities
    - Historical data is used to study, design, implement, and engage in operational areas.
- Reservoir management, in which meteorological data is sued to predict reservoir levels

With respect to disaster risk management (specifically droughts and floods), climate information is used in the following ways:

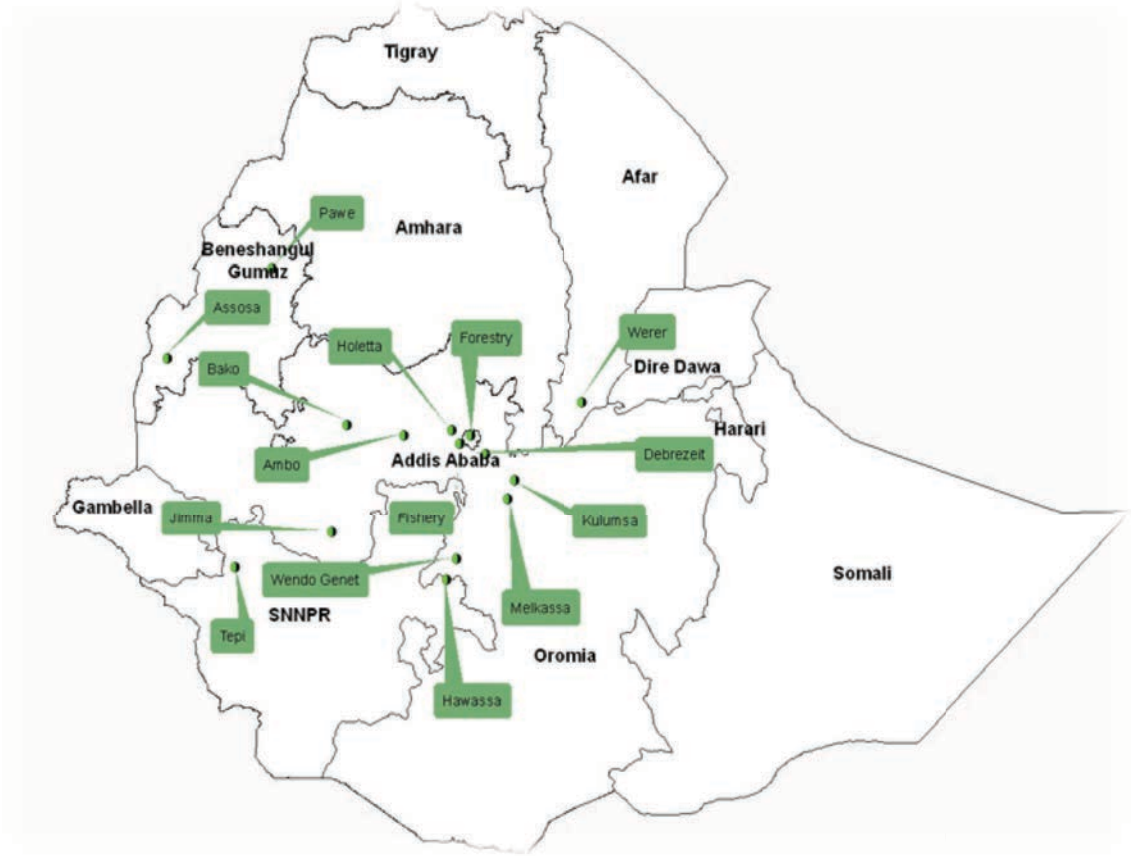
- Analogues based on historical rainfall data are used to predict the runoff
- Near-real time station-based data used for flood and drought monitoring
- Three day forecasts, seasonal forecasts and satellite images are used for flood prediction and management

Users are able to access climate information via seasonal forecast reports, which are provided in PDF and on the website. They may also request daily and monthly historical data and near real time station data. Users can also take advantage of the map room and/or ask for specific analysis, if needed.

Climate information for agricultural decision-making
Dr Fikadu Getachew, Ethiopian Institute for Agricultural Research

Ethiopia relies to a large extent on rainfed subsistence agriculture, and as such the agricultural sector is sensitive to local natural resources including soil, water, and climate.

The National Agricultural Research System (NARS), first established in the 1940s, has evolved over the years into the Ethiopian Institute for Agricultural Research, which conducts and coordinates research of national interest. Of EIAR project focused on climate information, topics of specific interest include agrometeorological advisory service field experiment and climate change impact assessment.



The NARS **mages 63** research centers across various agro-ecological zones

In addition to NMA, the EIAR accesses climate information from IRI, KNMI, APCC. In terms of using this information, Dr. Fikadu Getachew explained that issues of particular concern are:

- Famers always need a point specific forecast where they want to check the forecast in there door step, however still the NMA forecast is at large domain of interest

- Data quality is always the problem of doing some modeling analysis (like DSSAT, APSIM, ArcSWAT) where they need continuous many years daily data
- They data-use policy of NMA is formulated to the best benefits of users but it is always hard to find the data
- The gap of information communication and feed back collection mechanism
- Synergy and integrity of NMA with there stakeholders (like EIAR/NARS, higher institutes, NGOS…)

Climate-informed disaster risk management and food security monitoring
Mrs Almaz Demissie, Disaster Risk Management and Food Security Sector, Ministry of Agriculture

Mrs. Almaz Demissie began his talk by stressing that the appropriate use of weather and climate information is an important part of effective disaster risk management.

The traditional reactive method of disaster response has been effective at saving lives, but less effective at protecting livelihoods. Proactive disaster risk management involves early warning systems, which are built on the timely provision of effective information through identified institutions that allow individuals/communities at risk to take action or to reduce their risk and prepare of effective response.

In Ethiopia, data is provided by a number of different agencies, including the National Meteorological Agency, the Ministry of Water Resources, the Ministry of Agriculture, and others. Gaps in data stems from a number of other factors, including:

- inattention to timeliness of information
- poor data quality
- lack of human resources

These gaps could be over come to some extent if meteorologist and agricultural experts worked together to develop useful early warning information. The ENACT tool is a first step.

Discussion

Mr. Shimeles Tadesse From the Federal Environmental Agency (EPA)

- **Question**: The National Meteorological Agency (NMA) of Ethiopia, Disaster Risk Management and Food Security Sector (DRMFSS) and universities have installed and are using the Geonet cast system. What synergy among the institutions exists in using the Geonetcast system with regard to experience sharing, data archive and the like?

Almaz Demssie from DMRFSS

- **Answer**: The Geonetcast system has enormous data sources. For example NDVI is provided by spot and Meteosat. It has also other products like Dray Matter Productivity (DMP), leaf Area Index and Soil water balance. Area of interest of one institution differs from the other. The data need of one might not be similar with the other. We use specific information for our area of specialization. In fact creating synergy among users of Geonetcast system is a good idea. It has not yet started. This is a great idea I think all the institutions who have installed the Geonetcast system and using will consider the point and think about future collaboration.

Mr. Teshome Workeneh from Geosat Consulting

- **Question**: From the presentations made we can understand that the issue of real time data, data quality and the like got the highest priority and also the limitation with merged satellite and gauge data its reliability. Number of institutions does have their own data. To what extent we are ready to see data of other institutions?

Mr. Workeneh Degefu from Ethiopian Meteorological Society

- **Answer**: Thank you users of meteorological data and stakeholders for the useful information you provided and the interactions you made.

- **Question**: There is a long lasting question with the EIAR service provision. Is the farmer getting the information in real time basis? Are you actually reaching the farmer?

Mr. Fekadu Getachew from Ethiopian institute of Agricultural Research (EIAR)

- **Answer**: The real time we provide to the farmer is agro meteorological information. We are using farmers training centers to verify that the information we are really providing to the farmer is brings measurable value. We check what yield improvement results from our intervention.

Mr Getachew Abate from FEWS NET

- **Question**: Flood forecasting is given in numerical figures. The seasonal forecast issued by NMA in tercile probability. How could you use tercile seasonal forecasts in issuing flood forecasting.

Mrs. Semounesh Gola from Ministry of Water and Energy (MoWE)

- **Answer**: We do not use NMA probabilistic forecast when we issue flood forecasting as it entails numerical solutions. In case of water balance model

we take the seasonal analogue year declared at each seasonal forecast by NMA as one input.

Mr. Workeneh Degefu from Ethiopian Meteorological Society (ETMS)

- **Question**: World Meteorological Organization (WMO) has reach sources of guide lines that are sector specific. There is a guide line for the water resource sector. Do you use WMO guide lines for you work?

Mrs. Semounesh Gola from Ministry of Water and Energy (MoWE)

- **Answer**: We are familiar with WMO guide lines and actually using them.

Mr. Tafesse Regassa from NMA

- **Question**: EIAR has agreed with NMA to send the data collected from its station regularly. As NMA is a mandated Agency to collect meteorological data collected anybody in the country you are suppose to send your stations data NMA. Are you committed to send those data to NMA?

Ato Fekadu Getachew from Ethiopian Institute of Agricultural Research (EIAR)

- **Answer**: We have an open data exchange system. As far as I know EIAR is sending all data collected from its station to NMA. We are also using NMA data. There may be some implementation problems. But we are willing to send data to NMA and work together.

Session IV: Climate and climate risk management

Climate variability and change over Ethiopia
Diribia Koricha, NMA
Alessandra Giannini, IRI

This presentation discussed climate variability and change from a regional perspective, beginning with long-term climate change trends.

The talk also stresses the ocean's influence on regional climate, including

- The ocean's influence on past persistent drought
- The ocean's influence explains attribution of drought to emissions of greenhouse gases and sulfate aerosols from industrialization
- The ocean's influence explains projections of rainfall change

The talk also discussed rainfall characteristics of Ethiopia, the country's

intraseasonal variability, and its climate change signal. The presentation also discussed the associated social and economic impacts, related to the Belg, Kiremet, Bega, and Remark.

Climate risk management and the CGIAR
James Hansen, IRI/CCAFS

Climate Change Agriculture and Food Security, is a research theme of the Consultative Group on International Agricultural Research (CGIAR), with activities in Africa, Asia, and Latin America. CCAFS objectives are to:

- Identify and develop pro-poor adaptation and mitigation practices, technologies, and policies for agriculture and food systems
- Support the inclusion of agricultural issues in climate change policies and of climate issues in agricultural policies, at all levels

CCAFSS focuses activities on four activities, including:

1. Adaptation to progressive climate change
2. Adaptation through managing climate risk
3. Pro-poor climate change mitigation
4. Integration for decision making

CCAFS sees climate risk as a source of chronic poverty and vulnerability. Under the "Adaptation through managing climate risk" theme, CCAFS focuses on managing local risk, managing risks in food systems, and climate information services. In this sense, CCAFS targets emerging climate riks management opportunities via seasonal forecasts for adaptive management; index-based agricultural insurance; and climate information for risk management.

CCAFS has also experience on how to bridge the gap between seasonal forecasts and farmers needs, including the design scaling, and timing of the forecast, the communication of material and associated training, delivery mechanisms, etc. The program is also working now to identify gaps related to salience, legitimacy, access, and equity, making climate information more useful for everyone involved.

CCAFS also works to translate climate information into metrics that are more useful to farmers, conducting integrated food security modeling, etc., in order to transfer climate forecasts into agricultural forecasts.

Access to climate information to address bottlenecks in climate risk management
Kevin Coffey, IRI/CCAFS

This presentation provided examples of how climate information is being to improve agricultural decision making used in other parts of the world, with a goal of opening a discussion regarding options that might be useful in Ethiopia as well.

Examples provided in detail include:

- Seasonal Forecasts for Farmers
- Planning and Decision-Making Analysis
- CCAFS Regional Agricultural Forecasting Toolbox

Climate risk management applications in water resources
Paul Block, Drexel University

Climate information at multiple scales can be useful for water risk management; this includes sub seasonal, to seasonal, the interannual and decadal information. In this context, it's important to employ a range of different kinds of climate information for decision-making. The presentation talked through a number of these different kinds of information -- including probabilistic forecasts – and how they can be incorporated into water risk management decisions, specifically in the Ethiopian context (e.g., dams in the Blue Nile Basin, etc.).

Dr. Paul Block also stressed that the goal of water risk management is to prepare, not react – this involves both information and better risk management practice.

Day 2: June 4, 2013

Session V: Hands-on training on use of NMA map rooms

Introduction to the IRI DL
Remi Cousin, IRI

Remi Cousin provided an overview of the IRI Data Library.[1] The Data Library is a powerful and freely accessible online data repository and analysis tool that allows a user to view, manipulate, and download the world's broadest collection of curated climate data together.

The Data Library contains a wide variety of publicly available data sets, including station and gridded atmospheric and oceanic observations and analyses, model-based analyses and forecasts, and land surface and vegetation data sets, from a range of sources. It also has a suite of analytic tools and an unmatched ability to transform and integrate that data with sectoral data to meet user needs. The Data Library facilitates data exchange between systems and communities – and its use specifically in epidemiological research and public health planning was demonstrated.

Climate Analysis/Monitoring/Forecast Map Rooms
Remi Cousin, IRI

Remi Cousin talked through the various tools available through NMA's Climate Analysis, Monitoring, and Forecast Map Rooms. This involved providing participants with a short tutorial on how to use the maprooms to answer specific questions.

Session V: Group discussion on map rooms

A discussion session was structured around the following questions

- What actions/decisions do you make over the course of the year?
- How does climate impact these actions/decisions?
- How can the ENACTS dataset and maprooms help with these actions/decisions?

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[1] http://iridl.ldeo.columbia.edu

- How can the ENACTS dataset and maprooms be improved to better meet your needs?

A timeline of activities, which address the first two questions, is found below:

January – February – March

January and February are the dry and relatively cold season with frost in morning especially in January. During this period, information is needed on climate extremes. During this period, people will need advisories on fire hazards and fog.

Farmers can also begin preparing land during this period, and thus need advisories to prepare for planting. This includes information on temperature and precipitation, etc., which are useful for the normal growth and development of crops.

Water managers can use climate information to make decisions regarding dam management, hydropower, drinking water availability, irrigation, and environmental management. Between February and May there is also a risk of flood in the Somali region.

Food security experts, including government officials, also need information on current and future climate to understand current and evolving food security situations. In the case of a negative outlook, officials can activate contingency plans, etc.

April – May – June

April and May are marked by occasional showers. These months are the hottest months over most of Ethiopia. During this time, people are planting long-cycle crops and monitor weather conditions on these crops.

Farmers use climate information to make choices regarding crop selection, pest control and fertilizers, etc. Topics that are of interest include the onset of the rainy season; the cessation of the rainy season; and the distribution of rainfall.

Pastoralists also find climate information important in this time, particularly with regards to water harvesting, the migration of animals, and animal disease outbreaks.

During this period, ***food security experts*** want to know to what extent the surface water, pasture, and milk production is improved because of current rainfall, temperature.

W***ater managers*** monitor dams, particularly in La Niña years, when lower-than-average rainfall is expected.

July – August – September

These months mark the kiremt season, with heavy rains. It is also the maize flowering season, and a time in which wheat is particularly vulnerable to yellow rust. Climate information can help ***farmers*** with decision-making in both regards.

Water managers are also interested in flood monitoring in July and August in the high lands.

October – November – December

During this harvest season in the high lands, ***farmers*** use advisories regarding unseasonal rainfall and/or frost to help avoid crop loss. ***Pastoralists*** also need to know about the amount and distribution of rainfall, in order to help them make management decisions.

Food security experts also assess current conditions and the overall performance of the nation, and use information on how future climate may affect future food consumption.

Water managers are particularly interested in flood forecasting. Real-time monitoring of the levels of lakes and rivers is also important.

Issues of particular concern are

1. **Migratory pests**. Specifically the desert locust, quela quela bird, and army worm – all of which appear during the rainy season between July and September. Climate information may help with forecasting of these pests (as with the Desert Locust Monitoring Tool).
2. **Year-long agrometeorology.** Because Ethiopia's seasonal calendar is very full, monitoring and forecasting throughout the year are very important. This also includes monthly early warning bulletins from the Ministry of Agriculture, etc.)

How can the ENACT dataset and maprooms help with these actions/decisions?

The ENACT tool is found to be very useful and will help with many of the decisions articulated above; providing historical climate information; real-time monitoring; and seasonal forecasts.

How can the ENACT dataset and maprooms be improved to better serve the community?

While the tool has been found to be very useful, a few suggestions were made in order to improve the tool so as to better serve community needs. These requests are detailed below.

◊ ***General improvements to the dataset and/or maprooms***

Requests for improvements related to **presentation** include:

1. Make information available by administrative boundary and/or catchment
2. Ensure the tool is available in local languages
3. Make information available by administrative boundary and/or catchment
4. Ensure the tool is available in local languages
5. Include a video-format maproom tutorial
6. Reconsider the color conventions so as to be clearer to the audience
7. Provide information directly to tourists and/or members of the tourism sector
8. Include links to useful statistical software

Requests for improvements related to **data sharing and/or tailoring** include:

1. Better tailor the information, by combining it with socioeconomic, demographic, agroeconomic, and biophysical data, and providing more derived products (precipitation concentration index, etc.)
2. Ground truth historical data with communities
3. Provide a link to GEONETCast (and other sources of information) so that users can find other relevant information
4. Link with soil maps provided by FAO
5. Make raw data available in specific formats and/or geographic locations for students

◊ **Improvements related to the presentation of historical information**

Requests related to the historical information include:

1. Presentation of data from individual meteorological stations

◊ **Improvements related to the presentation of real-time monitoring**

Requests related to real-time monitoring include:

1. Present monitoring data in terms of months and seasons, not just dekads
2. Present derived products, including soil moisture maps, water satisfaction indices, etc.
3. Include real-time crop calendars for major cereals (when did this season start in comparison to other years, etc.)
4. Include minimum and maximum temperature for human/stock comfort, forest fire risk, heat waves and frost

◊ ***Improvements related to the presentation of climate forecasts***

Requests related to the climate forecasting include:

1. Presentation of 3-day, 5-day and 15-day weather forecasts
2. Presentation of thresholds
3. Presentation of information on analogue years

Conclusions and priority actions

A number of suggestions were made as to how to improve the tool to better meet stakeholder needs. Among these, priorities are:

1. Make information available by administrative boundary and/or catchment.
2. Ensure the tool is available in local languages.
3. Reconsider the color conventions so as to be clearer to the audience.
4. Make raw data available in specific formats and/or geographic locations for students, others.
5. Present monitoring data in terms of months and seasons, not just dekads.
6. Present derived products, including soil moisture maps, water satisfaction indices, etc.
7. Present 3-day, 5-day and 15-day weather forecasts.
8. Present thresholds.
9. Present information on analogue years.

Appendices

Appendix 1: Agenda

Improving Resilience to Climate Impacts in Ethiopia Through Improved Availability, Access and Use of Climate Information: Dialogue With Users

Addis Ababa, Ethiopia

3-4 June 2013

Location: UNECA Conference Center

Program

RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security

Monday, June 3rd

Session I (9:00 to 10:00): Opening

1. *Ato Fetene Teshome, DG, NMA*
2. *Dr James Hansen, IRI,*
3. *Guest of honor*

Coffee break

Sessions II (10:30 to 12:15): Presentations and discussion on climate data and information products from NMA

Chair: (MWE, TBD)

***Raporteurs*: Kinfe Haiemariam(NMA), Kevin Coffey(IRI)**

10:30 to 10:45: Introduction to the workshop (IRI)

10:45 to 11:00: Kiremt Forecast (Diriba Koricha, NMA)

11:00 to 11:15: NMA's new merged 30-year climate time series (Melesse Lemma, NMA)

11:15 to 12:00: Introduction to NMA's new Web Page and Map Rooms (Kinfe Hailemariam and Driba Koricha, NMA)

12:00 to 12:15: Discussion (all)

Session III (12:15 to 1:00): Example Uses of Climate information by Different Sectors

Chair: Ato Duka Shanko, DDG, NMA

Raporteurs:: Remi Cousin (IRI), Melesse Lemma (NMA)

12:15 to 12:25: Water resources (W/O Semunesh Gola, MWE)

12:25 to 12:35: Agriculture (Dr Girma Mamo, EIAR)

12:35 to 12:45: Disaster risk management and food security (W/O Almaz Demissie, DRMFSS)

12:45 to 01:00: Discussion

01:00 to :02:00: Lunch Break

Session IV (02:00 to 05:30): Climate and Climate Risk Management

Chair, Mr* Jeffrey Reid, *Agricultural Transformation Agency

***Raporteurs:* Kinfe Haiemariam(NMA), John Del Corral (IRI)**

02:00 to 02:45 Climate Variability and Change Over Ethiopia (Diriba Koricha, NMA)

02:45: to 03:10: Climate risk management and the CGIAR (James Hansen, IRI/CCAFS)

03:10 to 03:30: Improved Climate Information and Its Role in Effective Climate Risk Management (Kevin Coffey, IRI/CCAFS)

03:30 to 04:00: Discussion

04:00 to 04:30: Coffee Break

04:30 to 05:00: Climate risk management application in Water (Paul Block, Drexel University)

05:00 to 05: 30: Discussion and day's summary

Tuesday, June 4th

***Session V (09:00 to 01:00): Hands-on* Training on the Navigation and Use of NMA's Climate Analysis and Applications Map Room**(two groups, two class rooms)

Facilitators: John Del Corral, Remi Cousin, Tufa Dinku, Kinfe Halimariam

- Introduction IRI Data Library
- Climate Analysis Map room
- Climate Monitoring Map room
- Climate Forecast Map room

Lunch Break

Session VI (02:00 to 4:00): Group Discussion (Break up into two groups)

Open discussion: feedback on the existing information products and defining requirements for new data and information products

Group 1: Agriculture

Facilitators: **Dr. Tom Owiyo, *ACPC***

Raporteurs: Melesse Lemma (NMA), Kevin Coffey (IRI)

Group 1: Water and Disaster Early Warning

Facilitators: Dr Seleshi Bekele, ACPC

Raporteurs: Kinfe Hailemariam(NMA) , Cathy Vaughan (IRI)

Coffee break

Session VII (04:30 to 5:30) Group report, general discussion and closing

Chairs: Dr Seleshi Bekele and Dr **Tom Owiyo, *ACPC***

Raporteurs: Melesse Lemma (NMA), Cathy Vaughan (IRI)

04:30-05:15 Reporting back by raporteurs and discussion

05:15-05:30 Closing, Ato Fetene Teshome, (NMA)

Appendix 3: Speech by H.E. Alemayehu Tegenu, Minister of Water and Energy Ethiopia

Dear Participants

Invited Guests

Ladies and Gentlemen;

It gives me a great pleasure to welcome you all to this very important workshop on Improving Resilience to Climate Impacts in Ethiopia Through Improved Availability, Access and Use of Climate Information: Dialogue With Users.

Dialogue with users is critical, as climate change and natural hazards continue to threaten the most vulnerable. Getting improved climate information to those who need it most is a priority. Climate information is an invaluable input to all walks of life. In this era of extreme climate threat we cannot live without monitoring, studying and anticipating the current and future state of the weather and climate. The impact of climate positively or -negatively in all socio-economic sector is immeasurable.

For example, the energy sector has diverse requirements for meteorological services to support decision-making for both day-to-day operations and for longer term strategic planning. This requirement is motivated in part by the natural climate variability (including extreme weather events) and increasingly by climate change as manifested through the physical climate and through policy responses to the issue. The required meteorological services can be broadly categorized in two ways.

Those that support decision making concerning the implementation and operation of new technologies for energy production; and Those that support decision making for reducing greenhouse gas and polluting emissions by existing energy sector infrastructure.

Dear Participants

Invited Guests

Ladies and Gentlemen;

There is a strong link between weather and water resources management that tends to be operational in nature. Dams can be operated on the basis of inflows, which are forecast using predicted rainfall amounts; irrigation systems can be optimized based on weather parameters such as evaporation, wind speed, soil moisture and temperature data. The agricultural sector is the most vulnerable to climate change

and variability. The droughts and floods that occur alternatively in nature have threatened the agricultural product which caused world food crises in human history. In this short speech I can enumerate all the use and application of climate data and information.

These climate data and information can only be appropriate if they reach the user effectively. Climate data and information can be disseminated in various ways and means. One of the recent means of communicating information to wider user is the web-based services.

The National Meteorological Agency of Ethiopia in collaboration with the International Research institute of Climate and Society at Colombia University has been putting great effort to improve climate data availability, access and use of climate information. It became possible to present conventional and satellite based meteorological data of Ethiopia in more easy, understandable and user friendly value added form on a web based climate service.

I hope this user dialogue can have the effect to the National Meteorological Agency and the International Research Institute of show how the user access those information and get a feedback from the user community in further improving the services available.

I would also like to pay tribute to and encourage fruitful cooperation among the Ethiopian Ministry of Water and Energy, the National Meteorological Agency, the International Research Institute of Climate and Society, all partners and the Meteorological data user community. I will be assure you that the Ethiopian government will be always by your side whenever and wherever the need arise.

I would like to take advantage of this platform to make thankful remarks for the sponsor of the workshop the International Research Institute (IRI), the National Meteorological Agency for organizing the workshop and all who directly or indirectly take part for this to happen and the participants for coming.

Finally, I would like to wish you every success in your work and declare the workshop is open officially.

Thank you.

Appendix 3: Participant List

No	Participant name	Organization	No. days
1	Ato Shimeles Tadess	Environmental Protection Agency	2
2	Ato Asay Ketema	Environmental Protection Agency	1
3	Ato Alemu Asfaw	KIMETRICA	2
4	Ato Yared Lemma	KIMETRICA	2
5	Ato Shimeles Fikadu	UNDP	1
6	Ato Getachew Abate	FEWS NET	2
7	Ato Awle Adem	Nyala Insurance Share Campany	1
8	Ato Andualem Shimeles	Ethiopian Institute of Agricultural Research	1
9	Ato Abebe Diriba	Oromia Regional State Agricultural Bureaue	1
10	Dr. Alemseged Tamru	International Water Management Institute	1
11	Dr. Tracy Baker	International Water Management Institute	1
12	Dr. Girma Mamo	Ethiopian Institute of Agricultural Research	2
13	Ato Robel Tekele	Ethiopian Institute of Agricultural Research (Melkassa Branch)	2
14	Ato Teshome Erkneh	Geosat	2
15	Ato Lulseged Asfawe	Irish Aid	2
16	Ato Kedir Shemsu	World Food Programme	2
17	Catherine Vaughan	International Research Institute	2

18	Tufa Dinku	International Research Institute	2
19	James Hansen	International Research Institute	2
20	John Del Corral	International Research Institute	2
21	Remi Cousin	International Research Institute	2
22	Kevin Coffey	International Research Institute	2
23	Ato Kibret Mamo	Ethiopian Agricultural Transformation Agency (ATA)	2
24	Mr. Jeffrey Reid	Ethiopian Agricultural Transformation Agency (ATA)	1
25	Ms. Alison Greenberg	Ethiopian Agricultural Transformation Agency (ATA)	1
26	W/ro Almaz Demissie	DRMFSS	2
27	Ato Tamirat Tsegaye	DRMFSS	2
28	Ato Megersa Miresa	Oromiya Insurance Share Company	1
29	Dr. Muluneh W/Tsadik	AAU Geography and Environmental Department	1
30	Ato Belete Birhanu	AAU Civil Engineering Department	1
31	Ato Geremame Garuma	SNNPR Agricultural Bureau	2
32	Ato Tadele Kibru	SNNPR Water Bureau	2
33	Ato Tsegaw	CRDA	1
34	Ato Gashaw Tadele	Ministry of Culture and Tourism	1

35	Dr. Kebede Kachula	Member of Parliament	1
36	Ato Alemayehu Tegenu	Minister, MoWE	1
37	Ato Asefa Kebede	Ministry of Water and Energy	2
38	Ato Mohammed Hassen	Ministry of Water and Energy	2
39	W/ro Semonesh Gola	Ministry of Water and Energy	1
40	Ato Surafeal Mamo	Ministry of Water and Energy	2
41	Ato Bahailu Sintayehu	Infowords	1
42	Ato Girmaw Gezahegn	ACPC	2
43	Dr. Seleshi Bekele	ACPC	1
44	Dr. Micheal Menker	ACPC	1
45	Dr. Tom Owiyo	ACPC	1
46	Ato Workneh Degefu	Ethiopian Met. Society	1
47	Mr. Ben Siddle	Irish Aid	1

List of participant from National Meteorological Agency

No.	Name	Organization	**No. days**
1	Ato Feten Teshome	NMA	2
2	Ato Dula Shanko	NMA	2
3	Ato Amare babu	NMA	2
4	Ato Diriba Korecha	NMA	2
5	Ato Kinfe Haile Mariam	NMA	2
6	Ato Melesse Lemma	NMA	2
7	Ato Tafesse Regassa	NMA	2
8	Ato Tsegaye Ketema	NMA	2
9	Ato Abate Getachew	NMA	2
10	Ato Ahmedin Abdulkerim	NMA	2
11	Ato Ferew Dereje	NMA	2
12	Ato Yoseph Tesfaye	NMA	2
13	Ato Asamenew Teshome	NMA	2
14	Ato Jemal Gebeyehu	NMA	2
15	Ato Kassahun Bezabih	NMA	2
16	Ato Bahiru Maregn	NMA	2
17	Ato Mesfin Ibrahim	NMA	2
18	Ato Liyuneh Gebre	NMA	2
19	Ato Shemsu Mubarek	NMA	2
20	Ato Zerihun Walelgn	NMA	2
21	Ato Admasu Kassa	NMA	2
22	Ato Tadesse Beyene	NMA	2
23	Ato Jemal Mohammed	NMA	2

24	W/rt Kidist Mekonnen	NMA	2
25	W/ro Mulumebet habtamu	NMA	2
26	W/ro Aberash Erchafo	NMA	2