What Question, Which Data and Why it Matters to Ask

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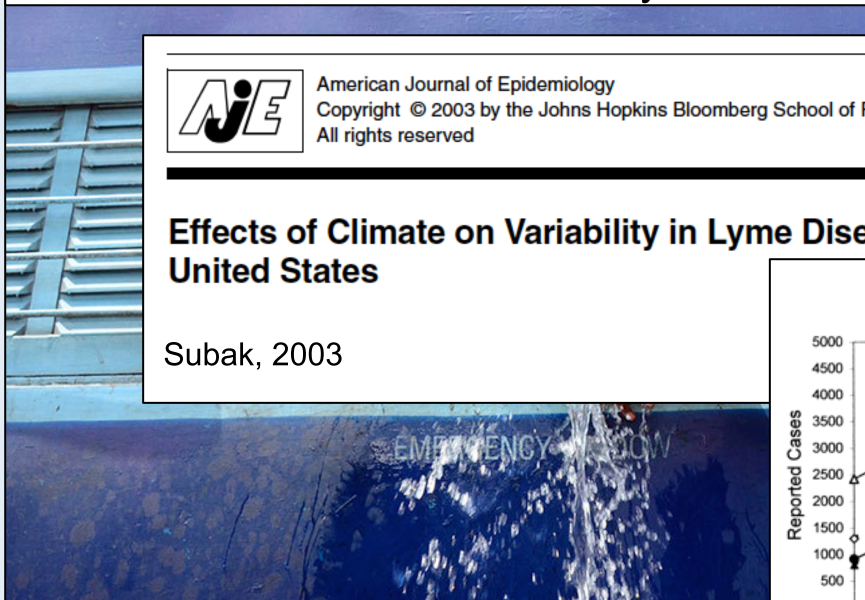
THE UNIVERSITY OF MAINE

What Question?

The Telegraph **India Heat Wave**
May 2016



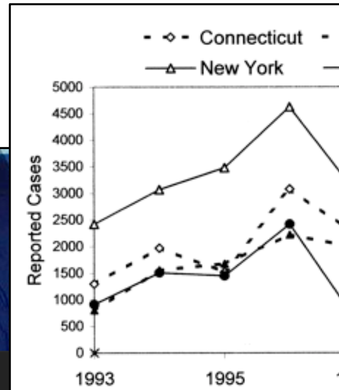
An Indian commuter uses the train water pipes to bath at railway station in Allahabad

Picture: Corbis http://www.telegraph.co.uk

AJE
American Journal of Epidemiology

Effects of Climate on Variability in Lyme Disease Incidence in the Northeastern United States

Subak, 2003



The Link Between Zika and Climate Change

Researchers are beginning to tease out the environmental factors that play a role in helping the virus to spread.

602 TEXT SIZE

GREG MERCER | FEB 24, 2016 | HEALTH *The Atlantic*

"Changes in temperature, precipitation, and humidity can alter how long the mosquitoes live, how often they bite, how many offspring they have."

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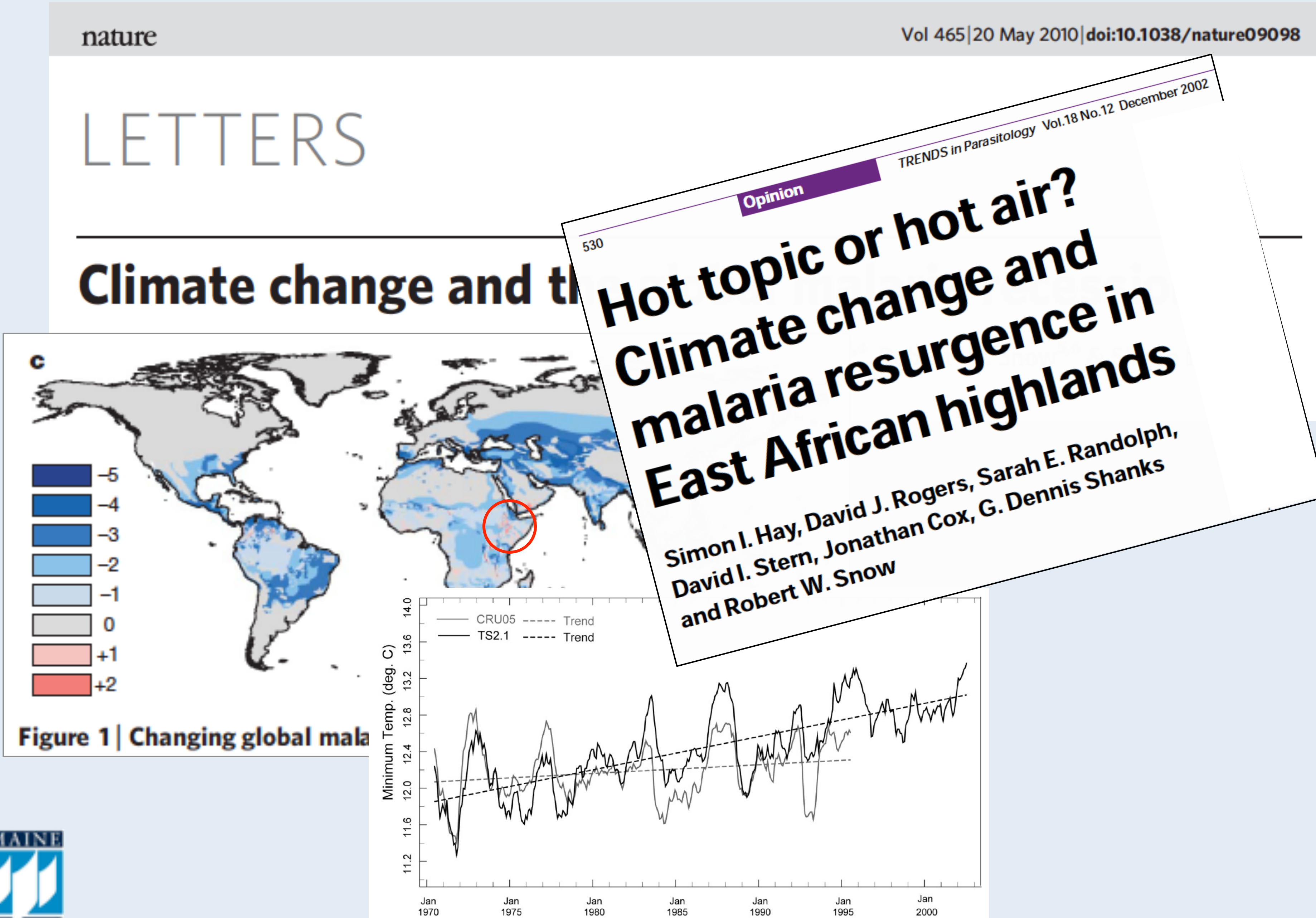
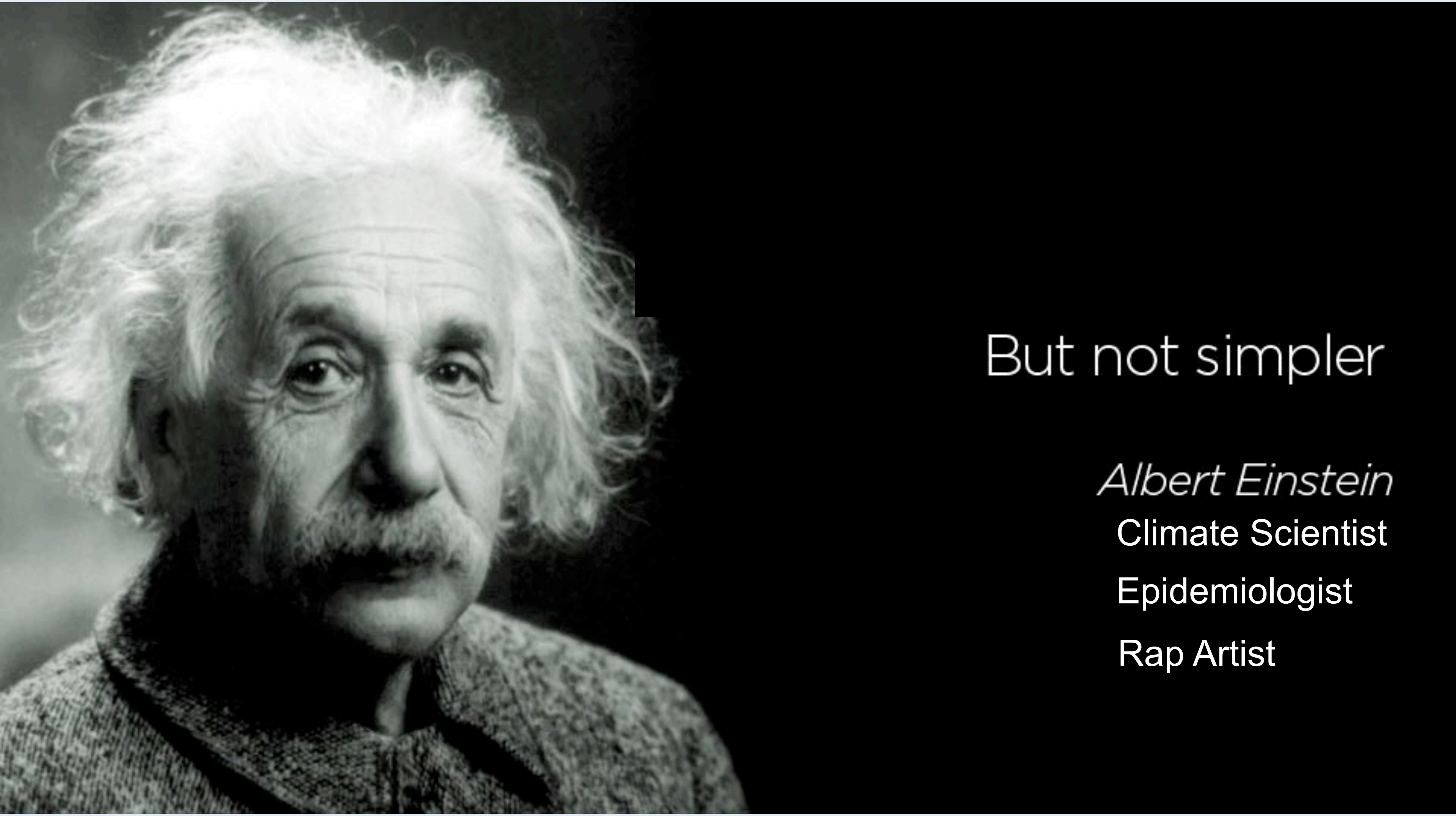
Which Data? Example 1

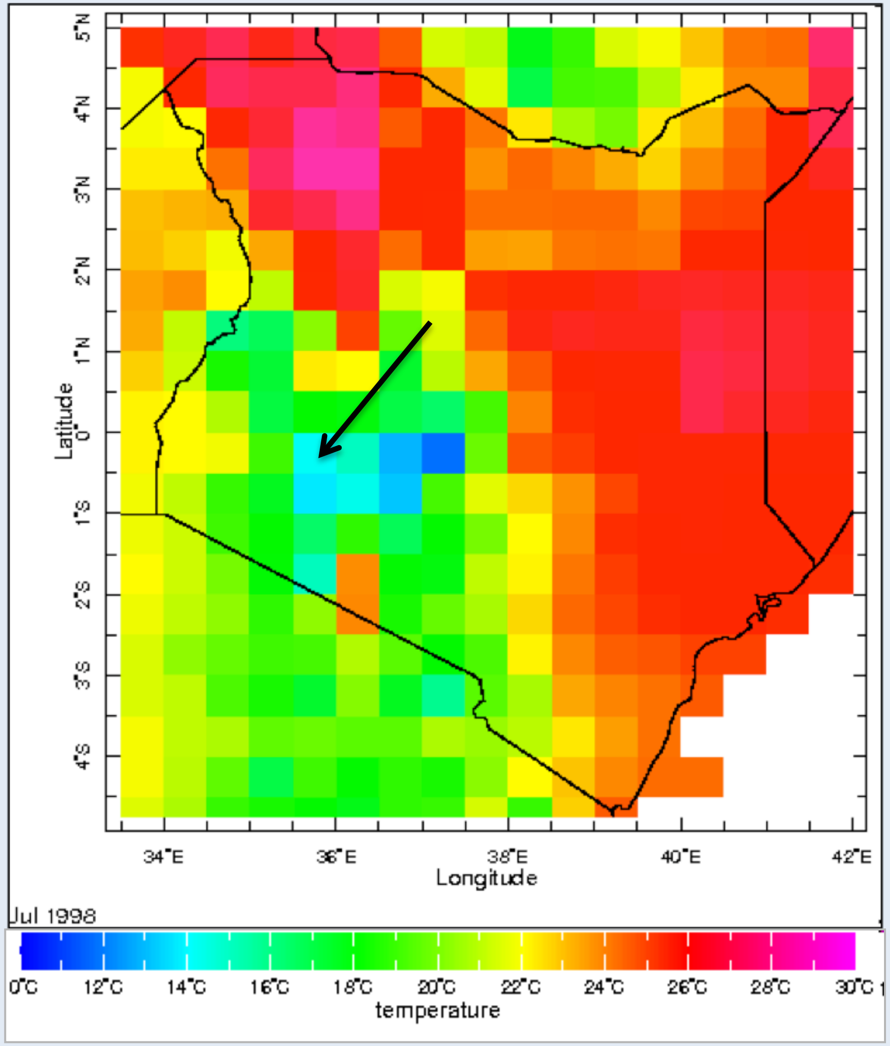


Simple Questions with Difficult Answers

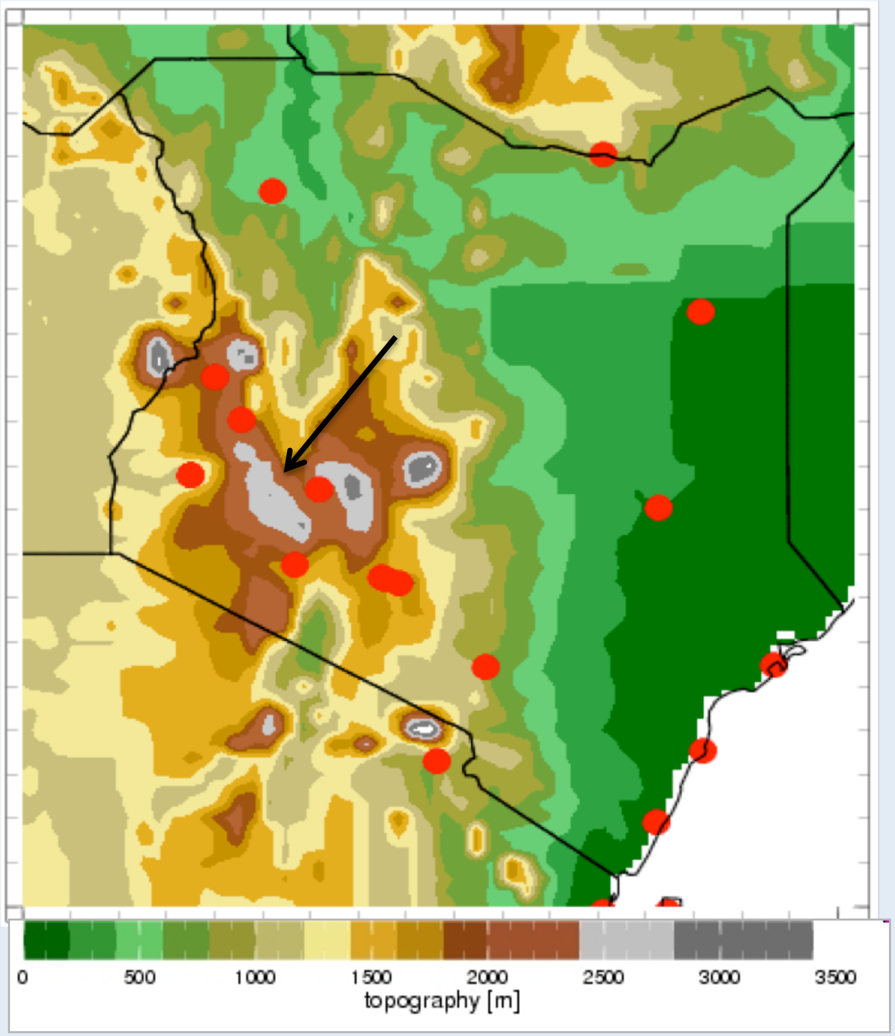


Which Data?

Temperature JULY 1998



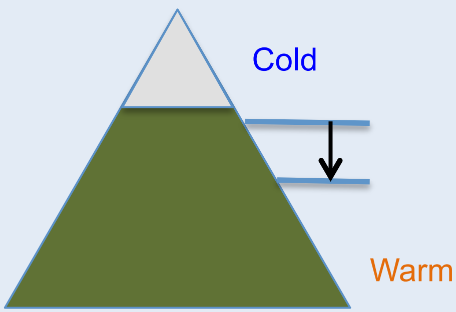
● Publically Available Stations

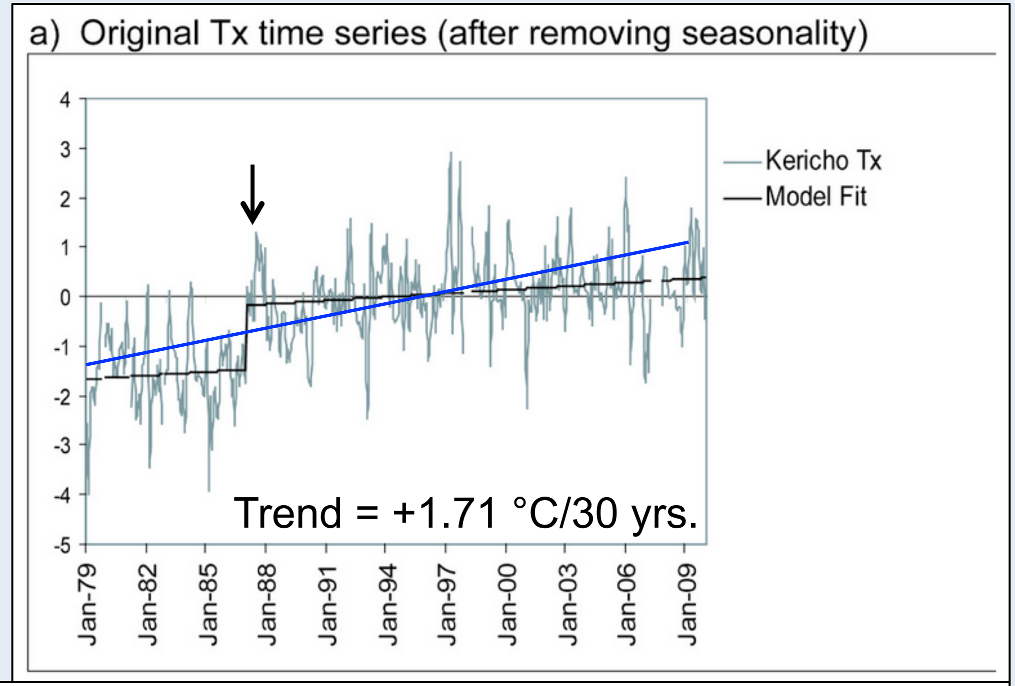


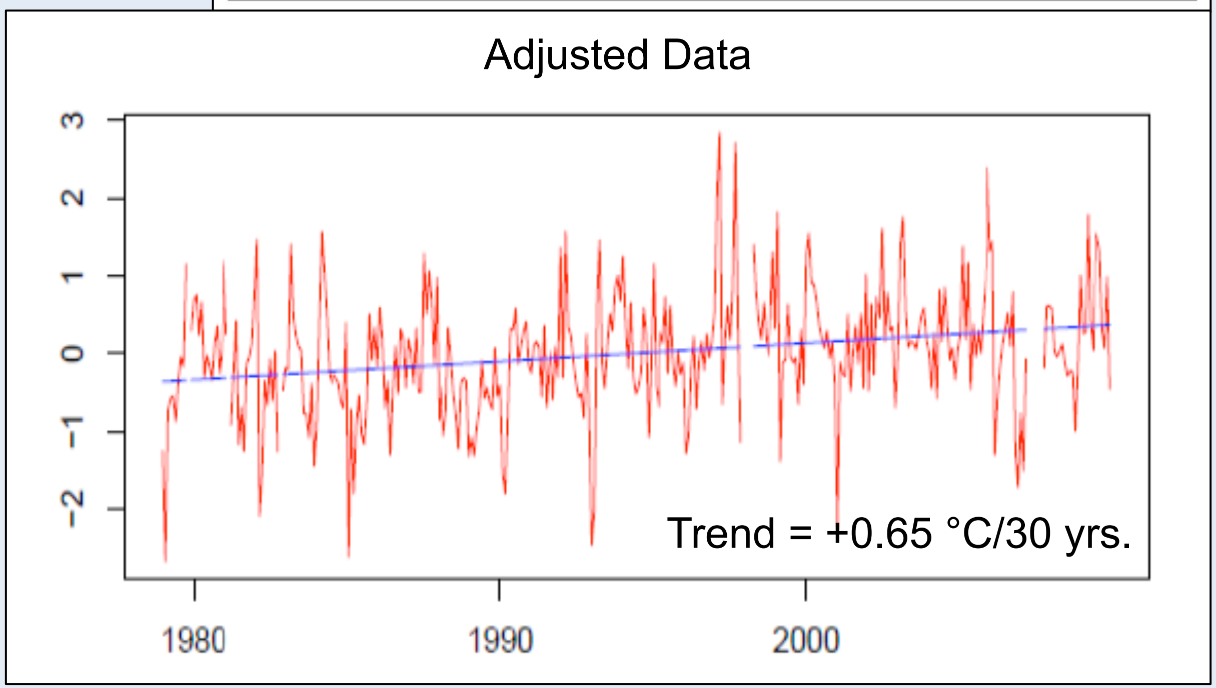
Which Data?

Kericho Station Observations

Maximum Temperature







Omumbo et al., 2012

Which Data?

“Temperature” is Not a Single Variable…

Differing values when using mean temp., maximum temp. and minimum temperature.

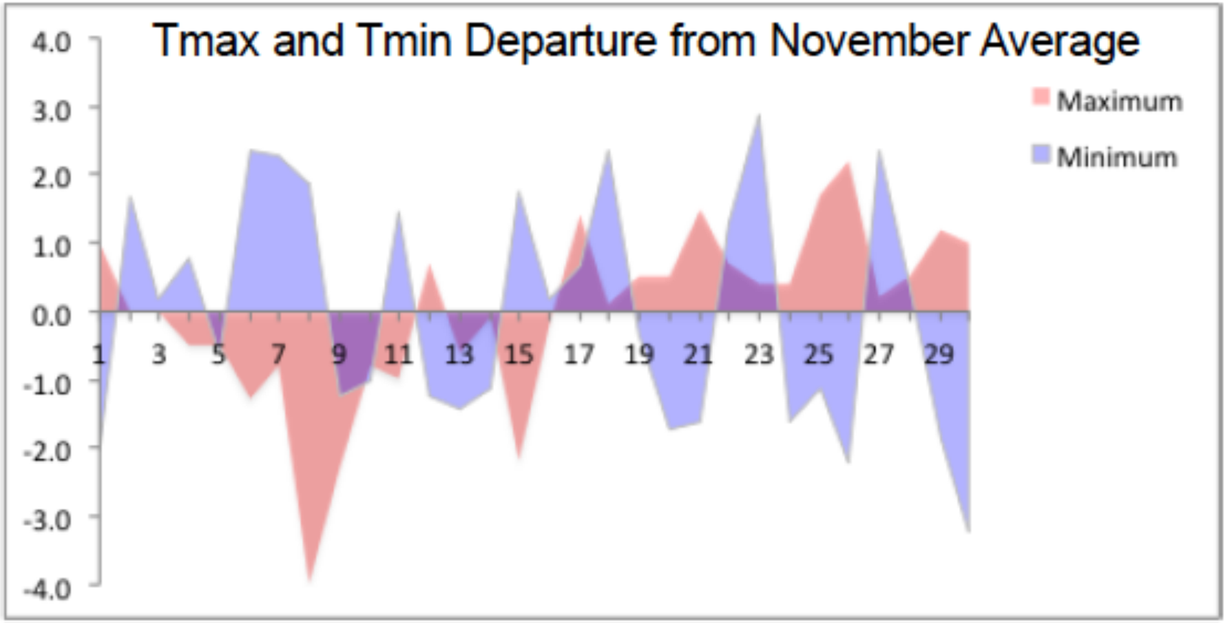
Example for Nov. 2008 at Kericho, Kenya

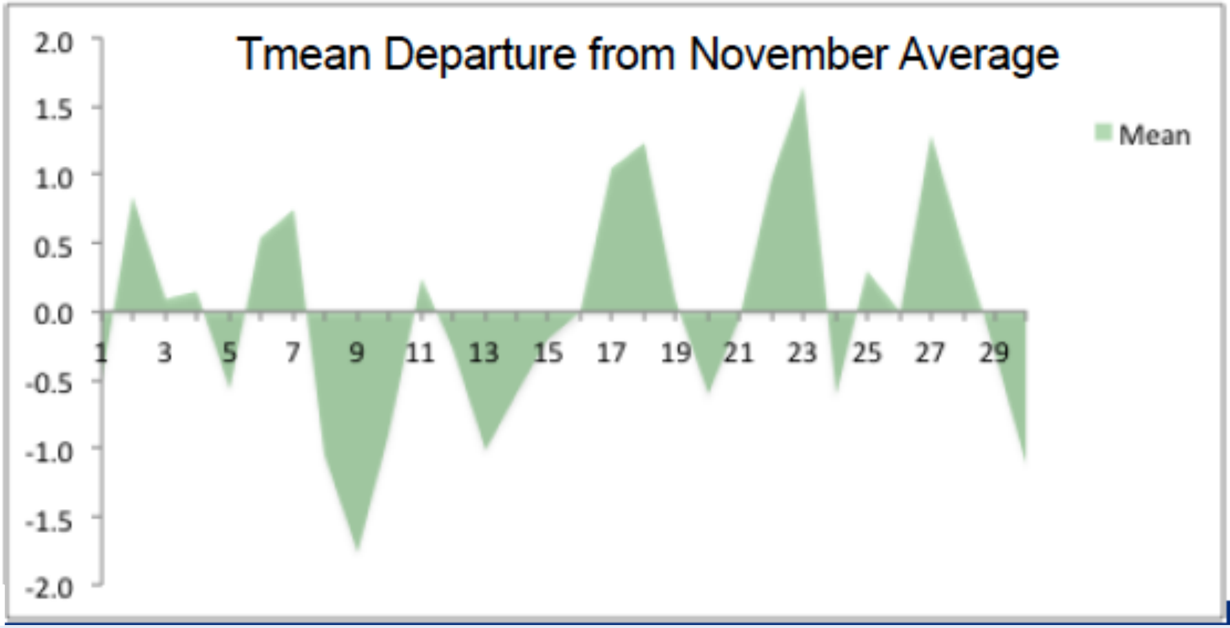
Correlations:

r (Tmax, Tmin) = -0.44

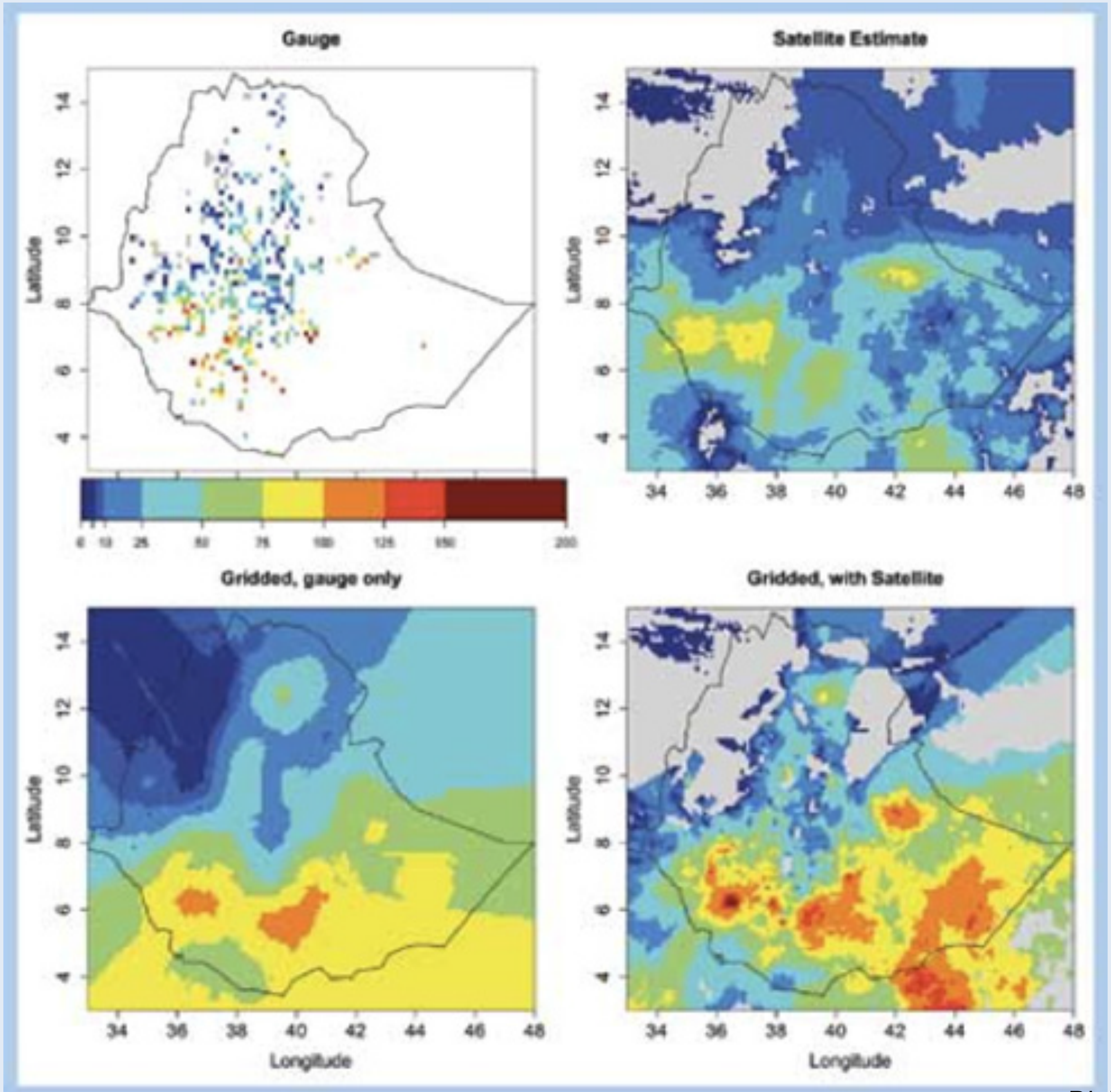
r(Tmean, Tmin) = +0.70

r(Tmean, Tmax) = +0.32





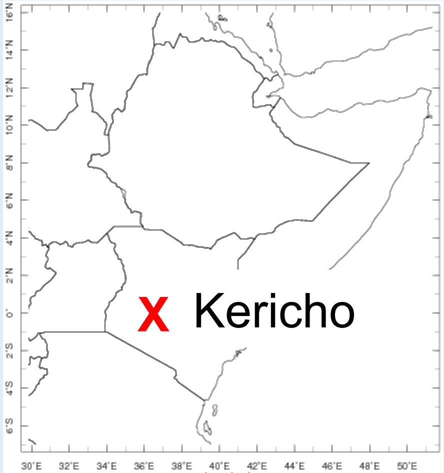
Which Data?

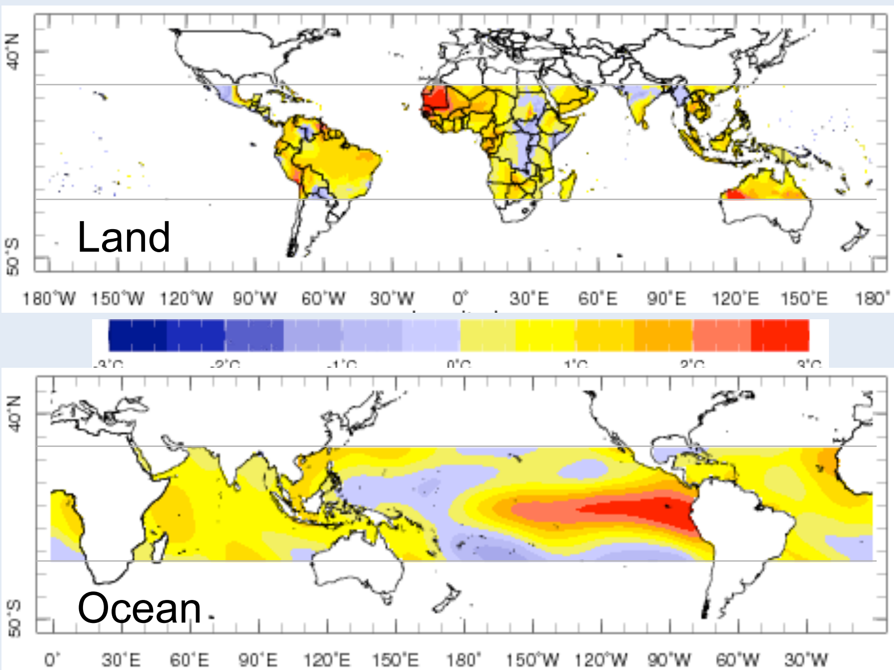


Dinku, T. et al., 2011

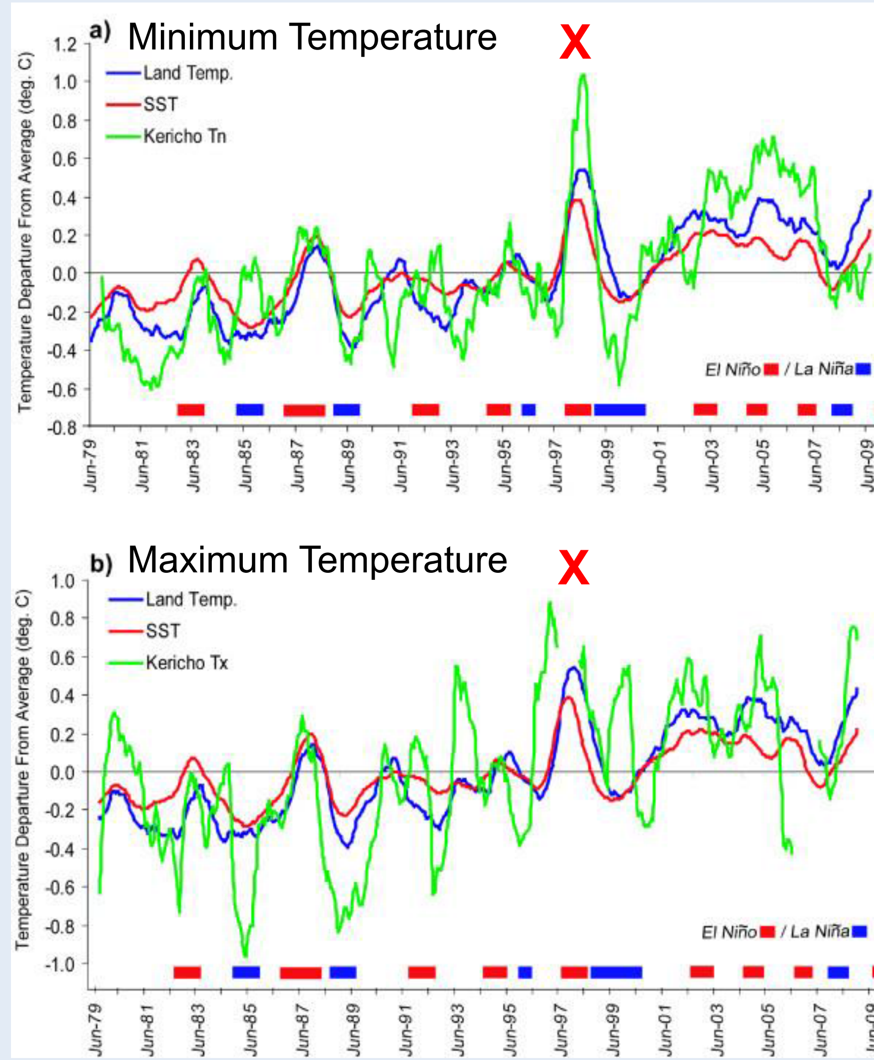
What Scale(s)?

Global Changes in Local Places





Land and ocean temperature departures from average, February 1998

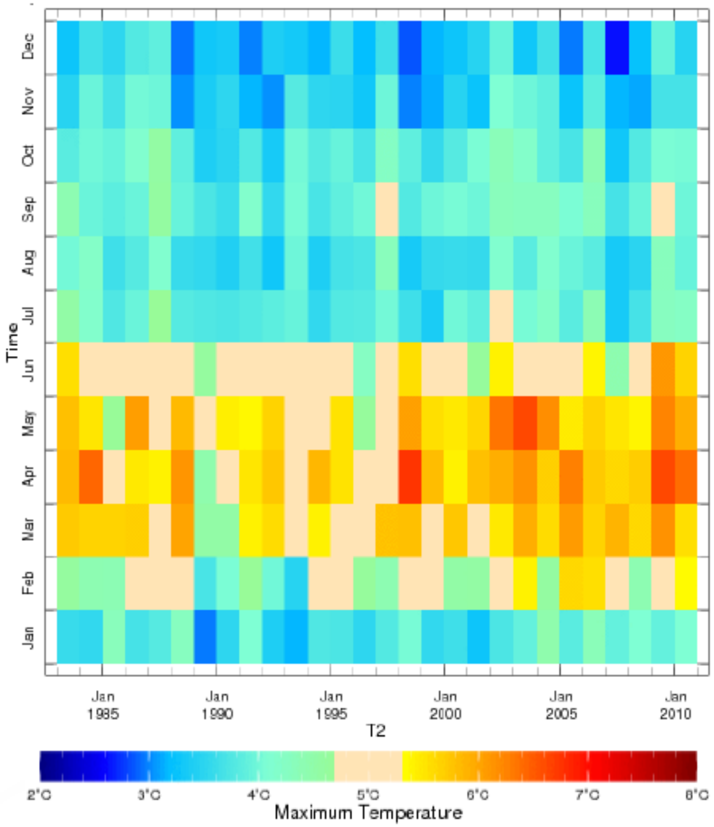


Omumbo et al. (2012)

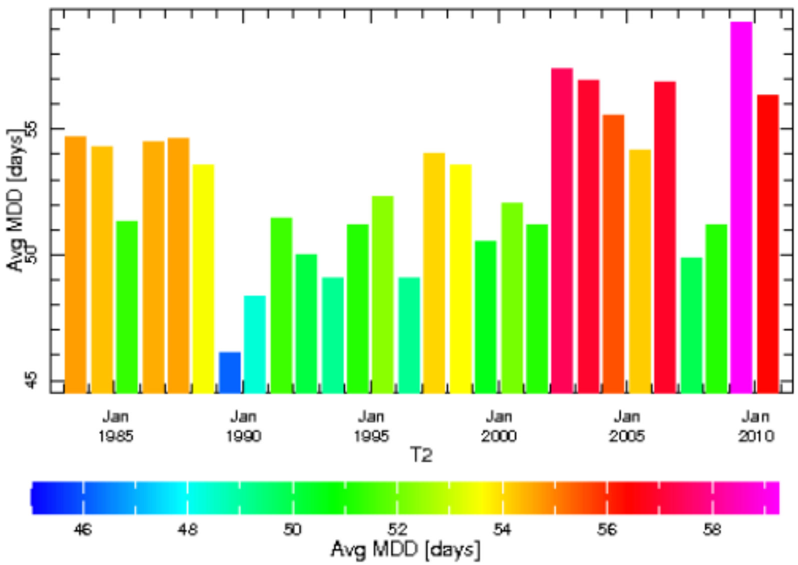
What is Now Feasible

Malaria Degree Days in ENACTS
(T_{mean} – 15.4)

Average Monthly MDD, Elevation > 1500m



Annual MDD, Elevation > 1500m



"Here's a list of 100,000 warehouses full of data. I'd like you to condense them down to one meaningful warehouse."

Example 2 -- An East African "Climate Paradox"

A Wetter East Africa Due to Climate Change?

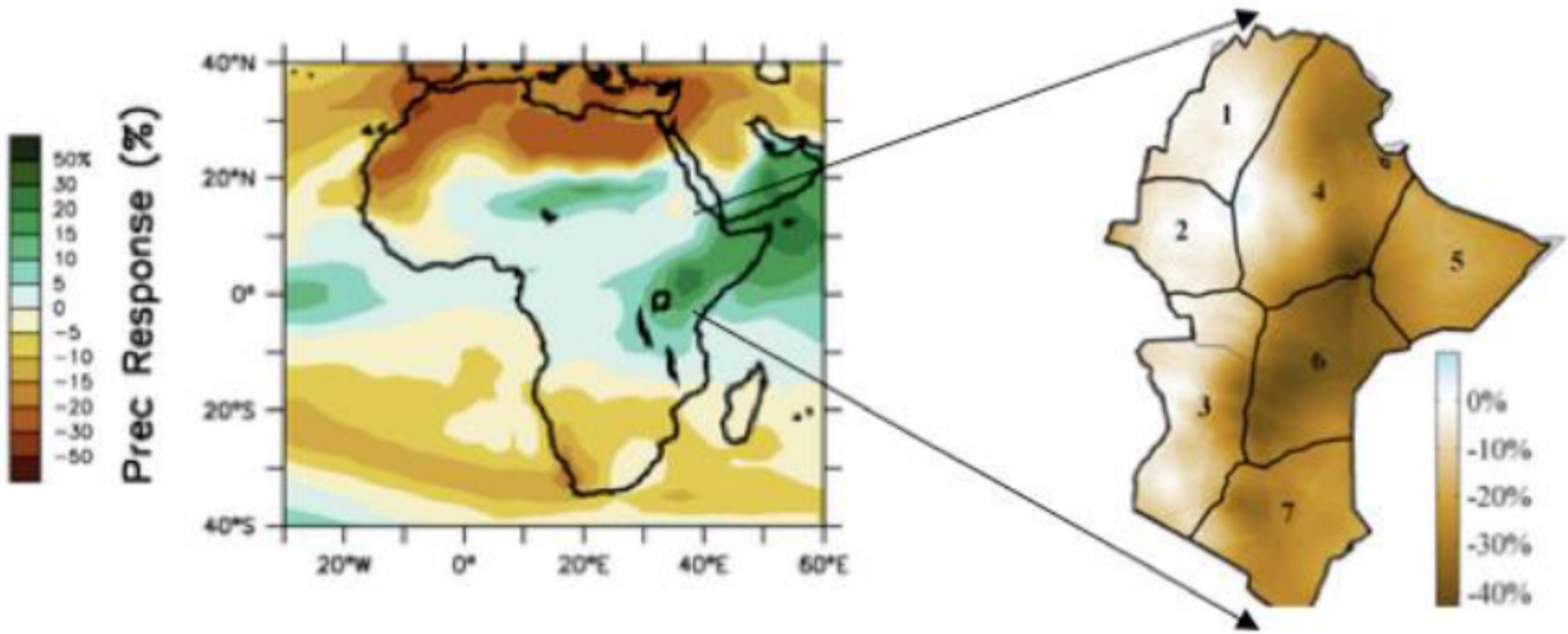
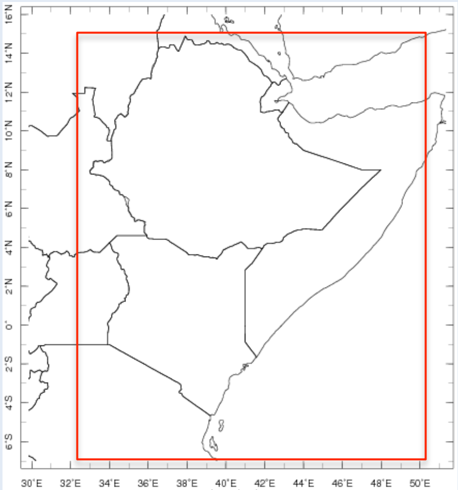
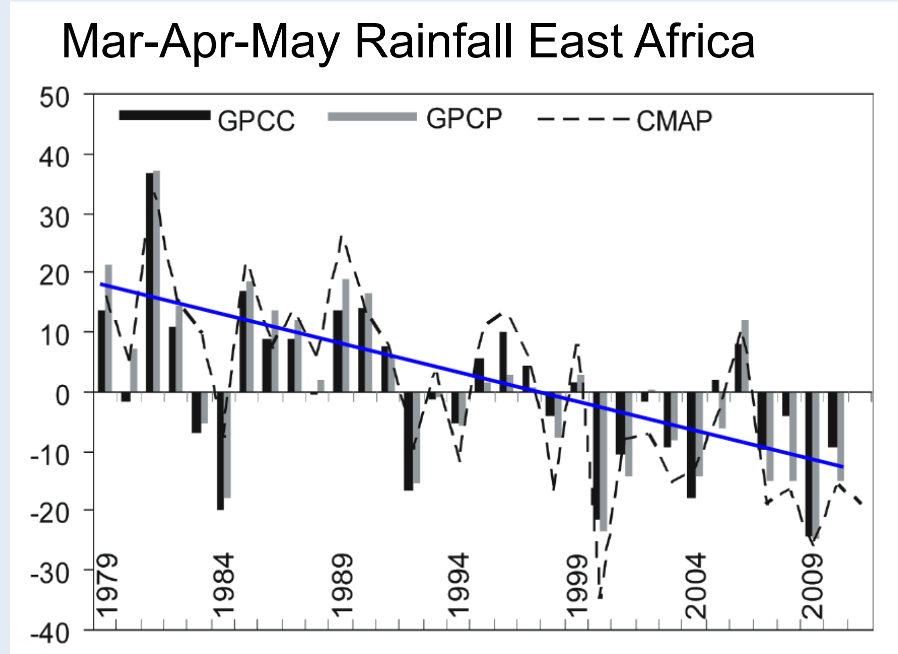
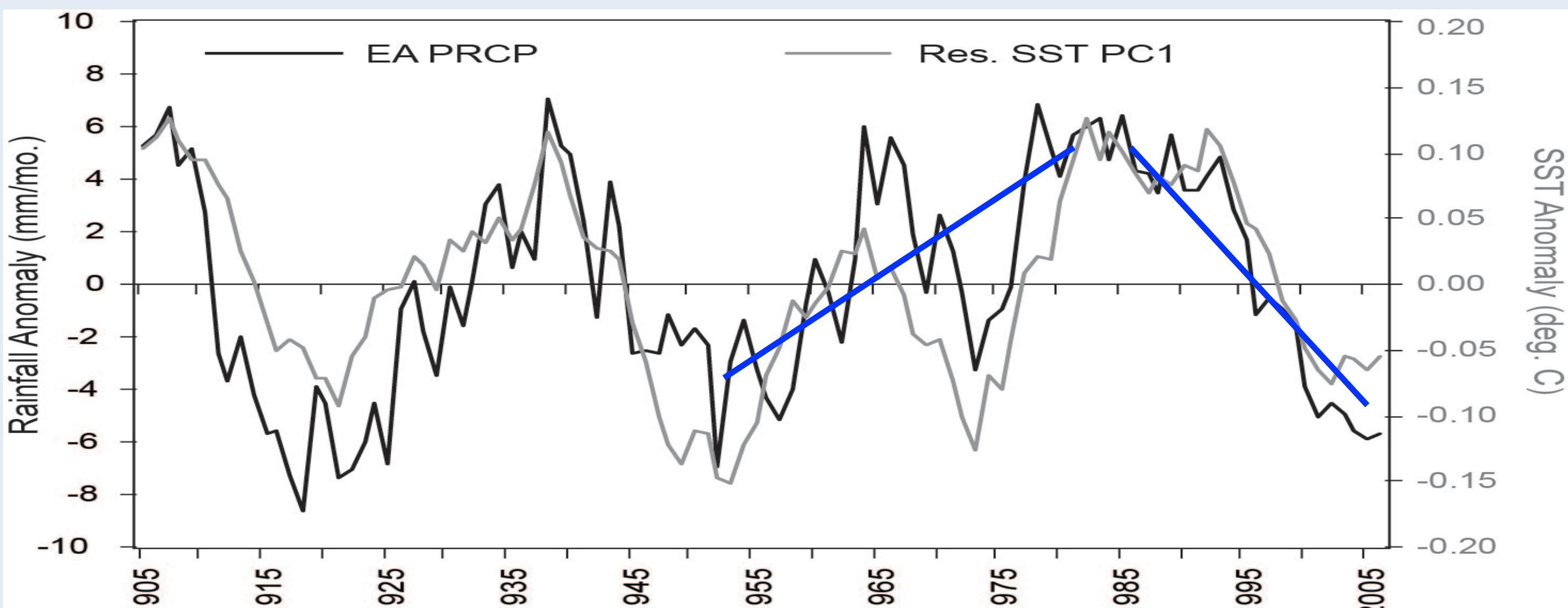


Figure 1. (Left) Projected change in annual precipitation 2080-2099 relative to the observed climate 1980-1999. From IPCC Fourth Assessment Report Working Group I Figure 11.2. (Right) Observed percent change in long rains precipitation (March to June) in the Greater Horn 1979-2009 relative to 1950-1979. From Williams and Funk (2011).

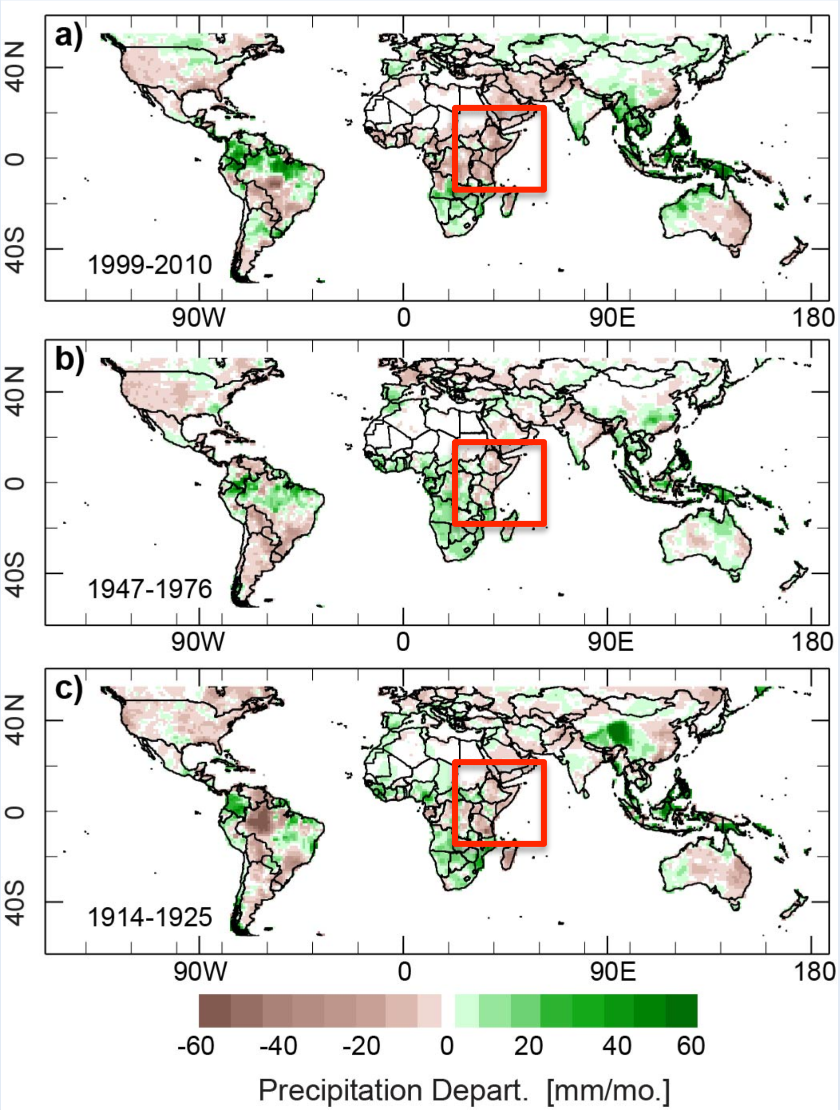
East African "Climate Paradox"

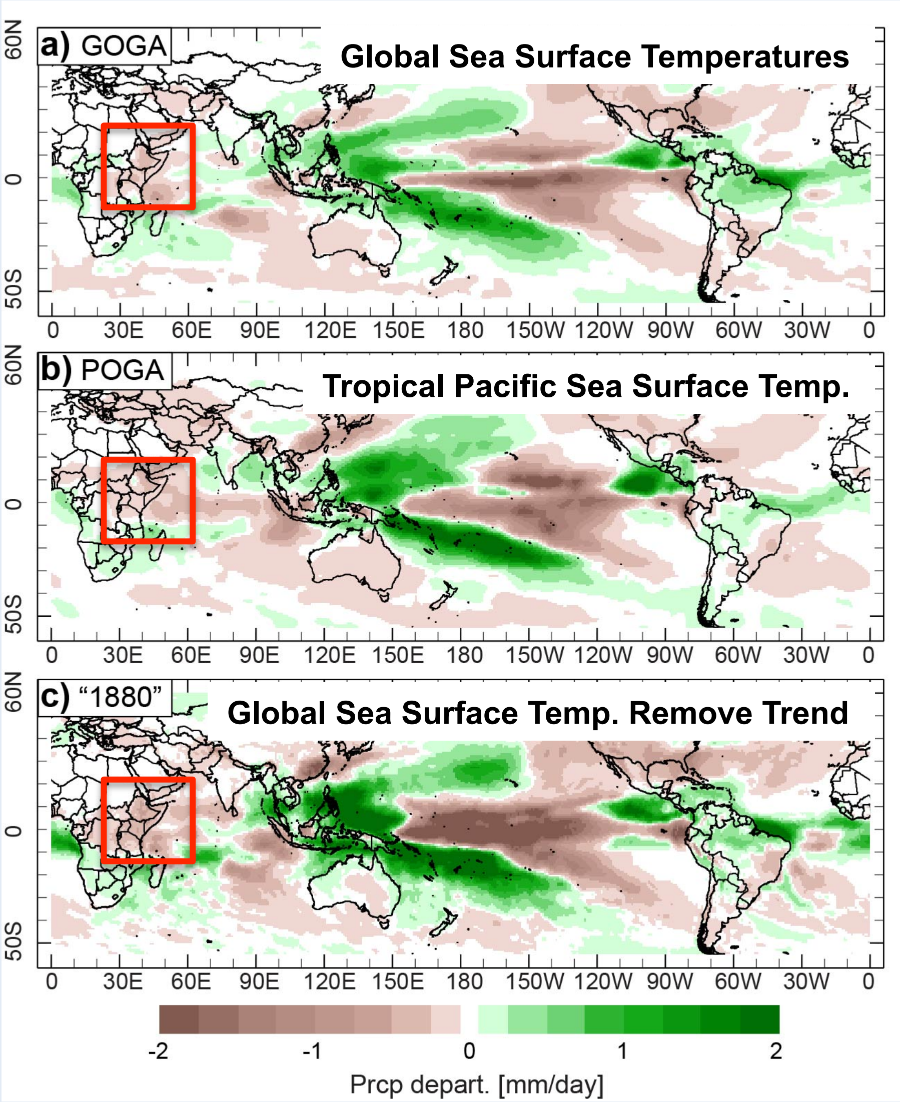






East African "Climate Paradox"





Lyon, 2014

Lyon and Vigaud, in press

Example 3: Data for Modeling…

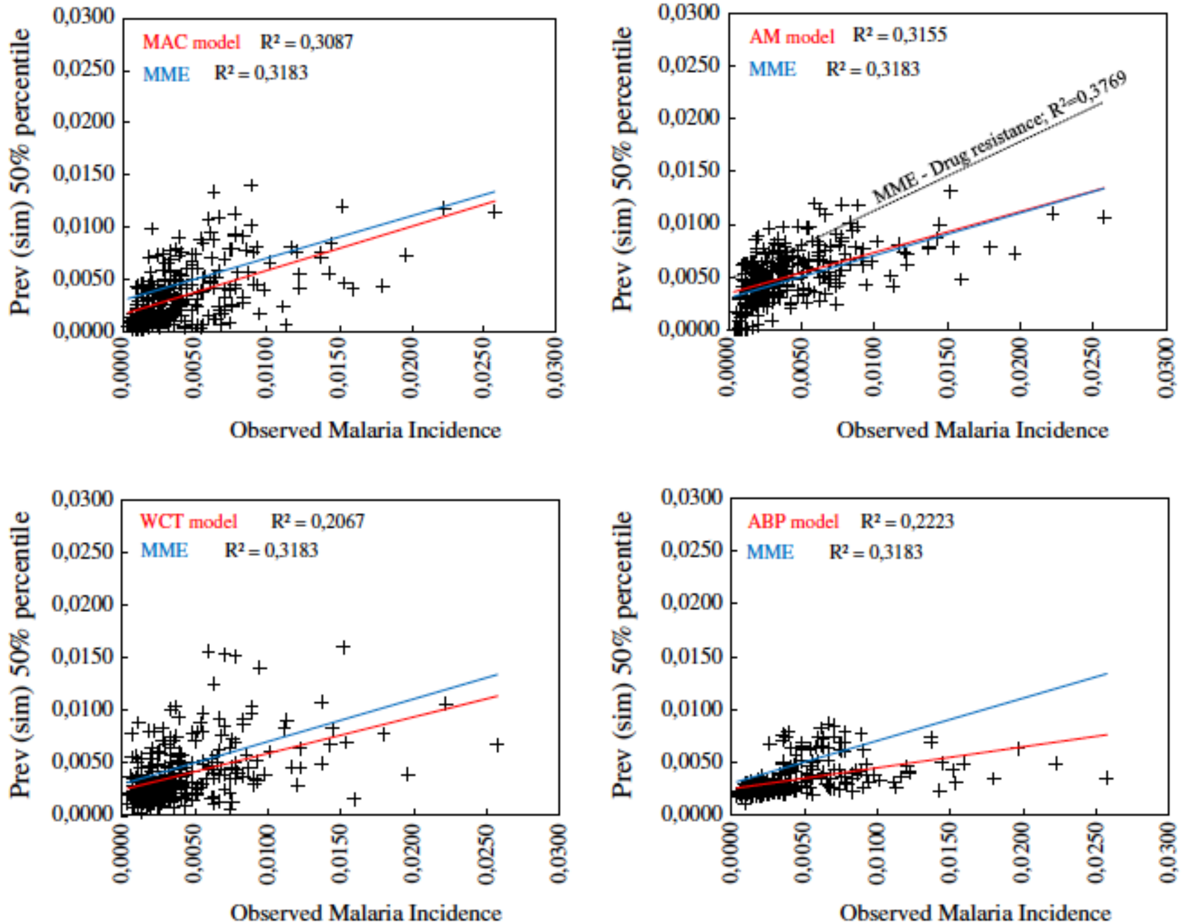
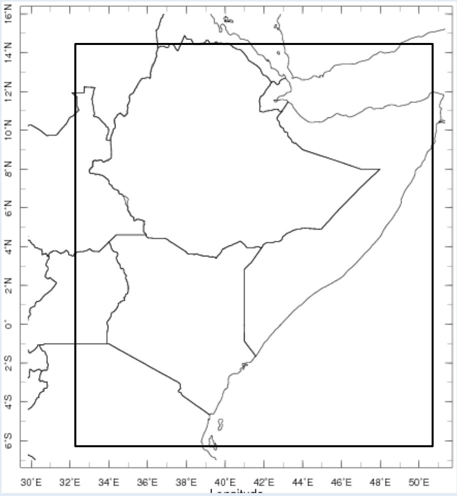
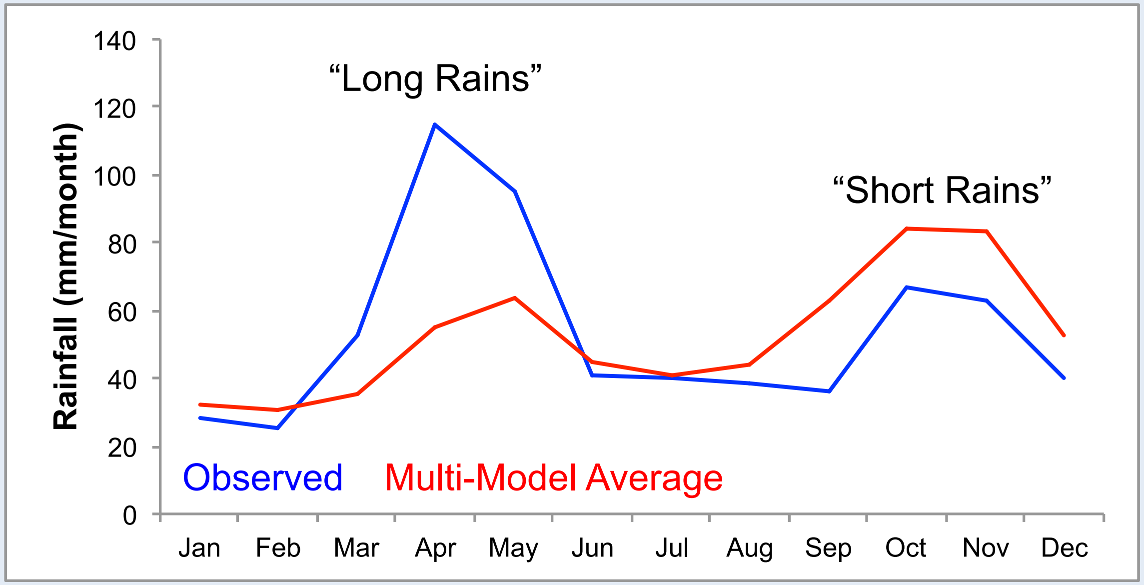


Figure 2 Malaria-model ensemble simulation outputs. Monthly *P. falciparum* malaria incidence observed in Kericho over the period spanning January, 1979 to October, 2004 (x-axes) *versus* the 50% percentile of the distributions of monthly *P. falciparum* malaria prevalence (y-axes) simulated by the MAC (upper left panel), AM (upper right), WCT (lower left), and ABP (lower right) models, for the actual climatic conditions, for the period spanning January, 1979 to December, 2009, and for 1-, 1-, 2-, and 0-month time lags, respectively. Red and blue solid lines represent the adjusted linear trends (see R^2-values on each panel) for each model and for the four-malaria-model ensemble (MME), respectively. Dashed black line in the upper-right panel depicts the adjusted linear trend for the MME when non-linear changes in the mean duration of host's infectivity to vectors are considered.

Ruiz et al., 2014

Example 3: … and Model Data





Many climate models struggle to capture average rainfall conditions in E. Africa

→ Are some models better suited to the question being addressed than others?

→ Be careful in blindly taking model data directly off the shelf…

→ There are other methods available to address uncertainty in future climate conditions, particularly in the next 10-30 years.

Conclusions

- **Know thy data: If it involves climate, involve a climate scientist**

  → An enormous amount of weather and climate data is available
  →This provides many new opportunities for research and "operations"
  → The challenge is selecting which data is most appropriate….

- **Need to match climate data to the specific question be addressed**

  → Spatial scale (local, regional, global)
  → Time scale ("weather", sub-seasonal, interannual, decadal, CC)

- **Current monitoring and prediction capabilities of global weather and climate are unprecedented. This includes an increasing amount of data available in near "real-time."**

  → Linking available weather and climate data to useable information in the health community (and other fields) is an unprecedented opportunity. Collaboration across disciplines is the necessary mechanism to overcome the attendant challenges.

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