

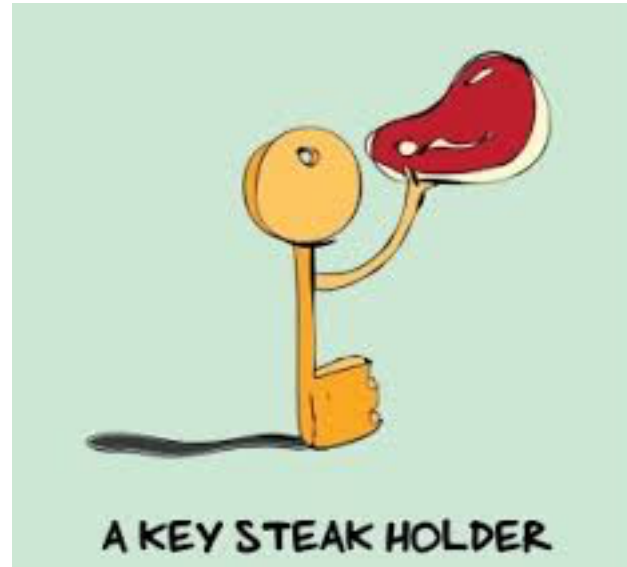
The IRI logo is a large, faint, light blue circular emblem on the left side of the slide. It features the letters 'IRI' in a serif font, centered within the circle. The circle has a subtle gradient and a slight shadow effect.

Do Climate Forecasts Really Matter in the User World

Lisa Goddard

International Research Institute
for Climate and Society
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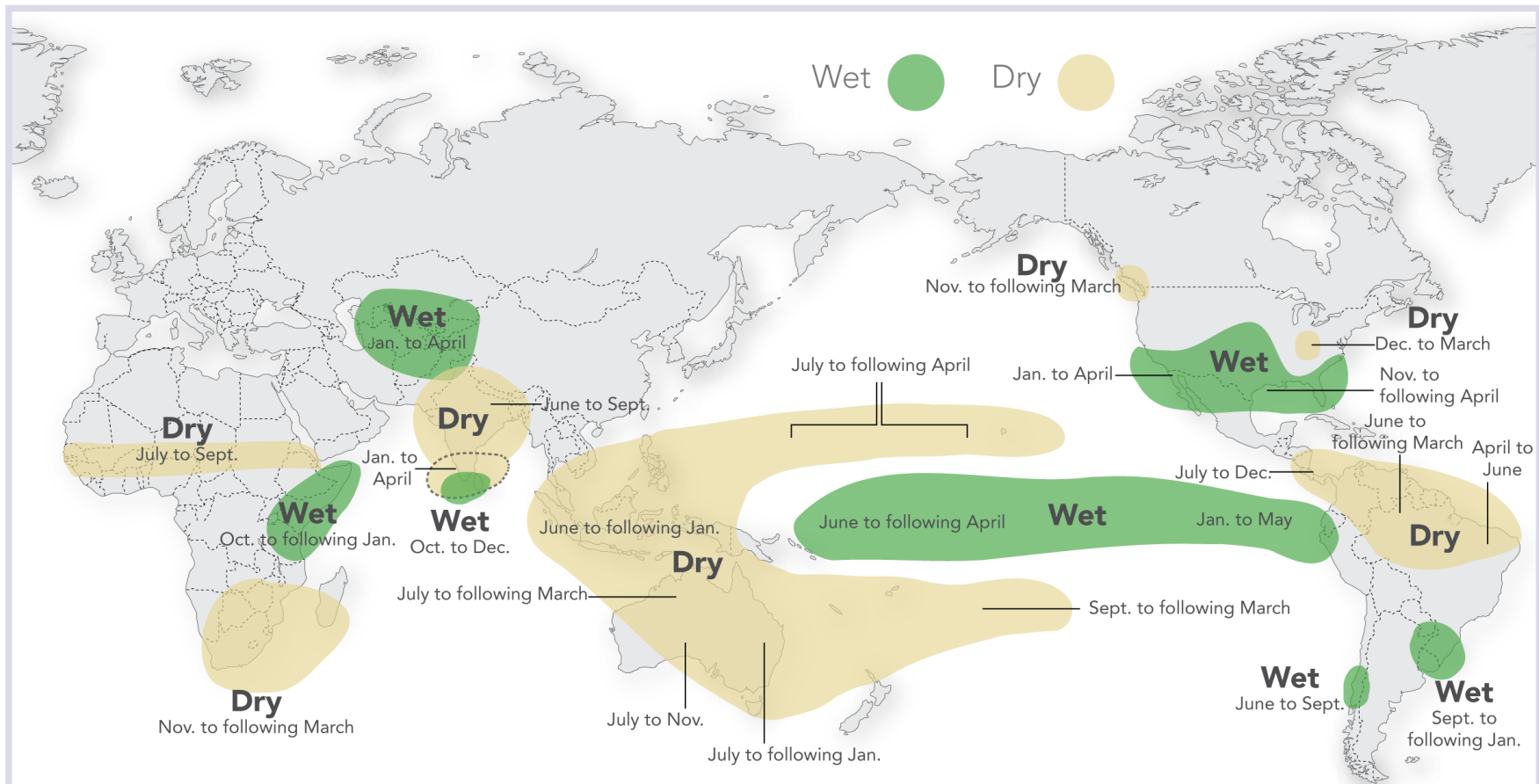
Not all steakholders are the same



“Expected” Climate Impacts During El Niño

El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



For more information on El Niño and La Niña, go to: <http://iri.columbia.edu/enso/>

Sources:

1. Ropelewski, C. F., and M. S. Halpert, 1987: Global and regional scale precipitation patterns associated with the El Niño Southern Oscillation. Mon. Wea. Rev., 115, 1606-1626;
2. Mason and Goddard, 2001. Probabilistic precipitation anomalies associated with ENSO. Bull. Am. Meteorol. Soc. 82, 619-638



f /climatesociety

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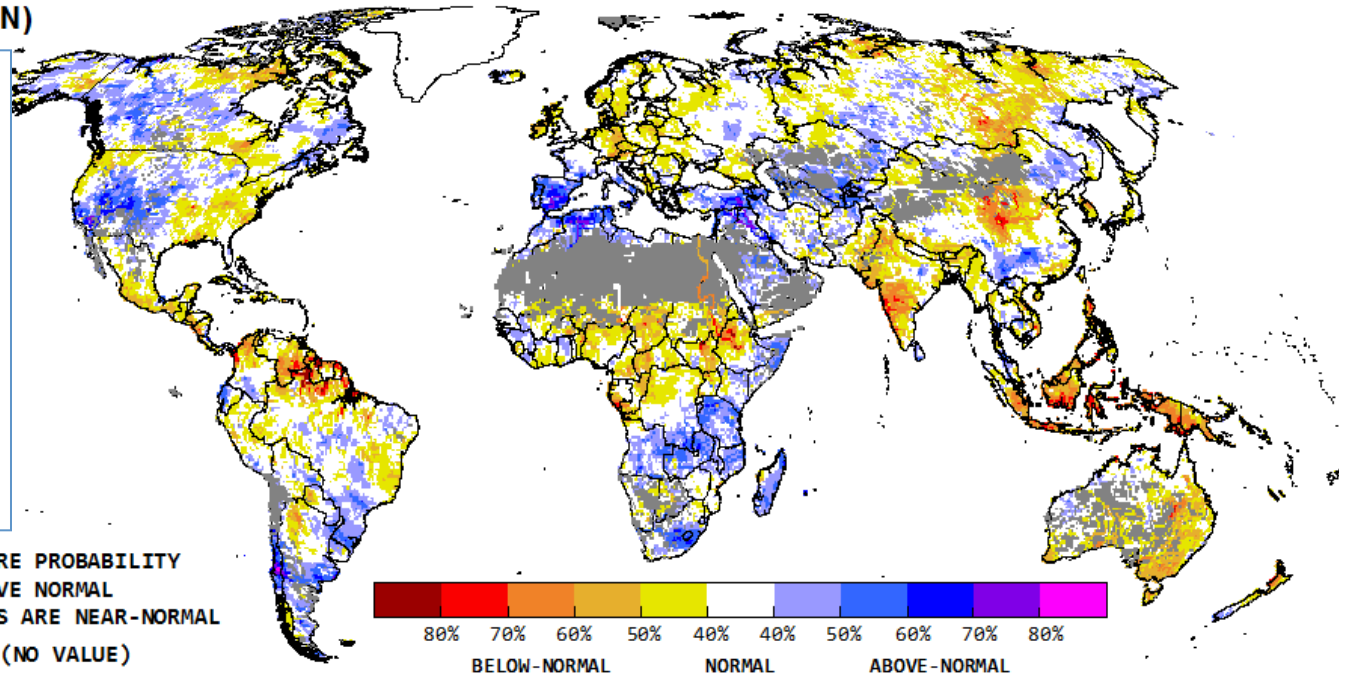
<http://iridl.ldeo.columbia.edu/maproom/IFRC/> → “Past Conditions”

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Expectations of flood risk during an El Niño event

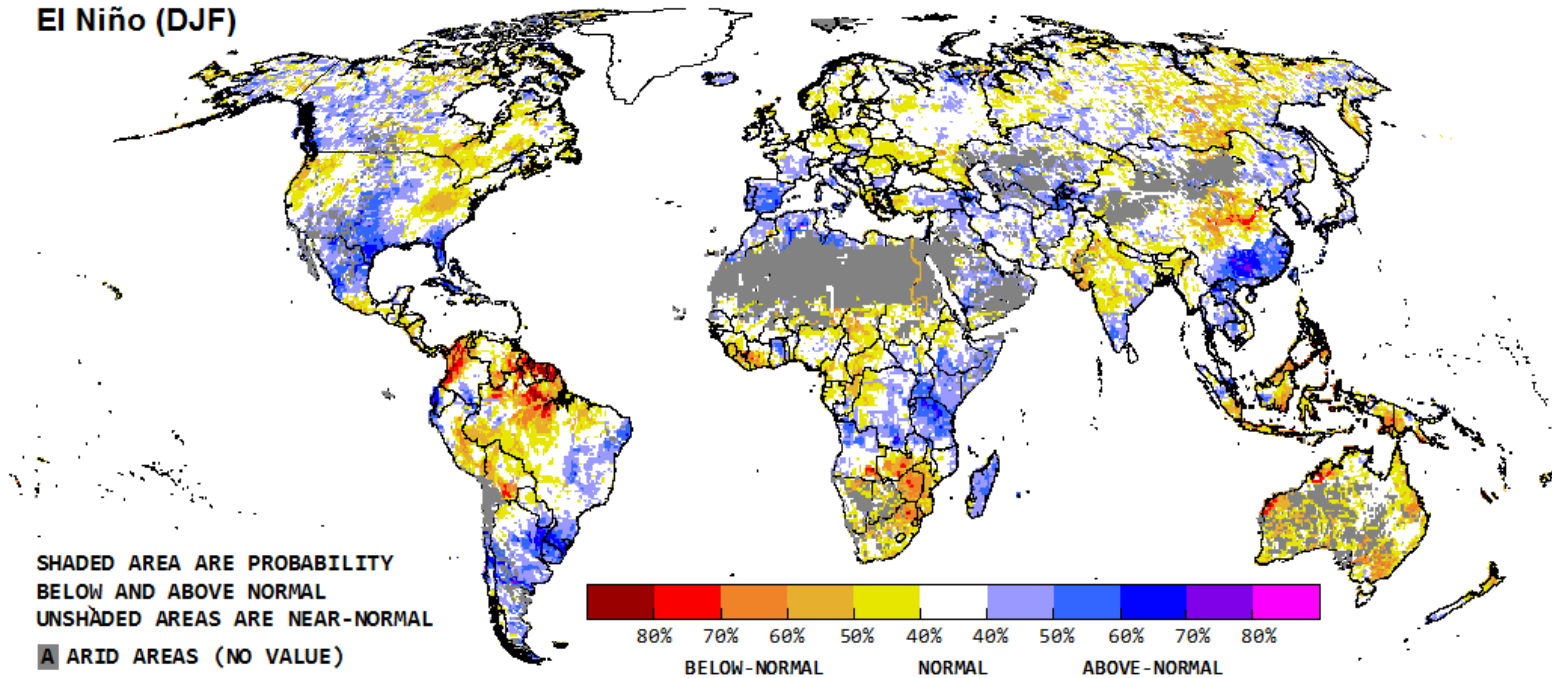
El Niño (SON)

SHADED AREA ARE PROBABILITY
BELOW AND ABOVE NORMAL
UNSHADED AREAS ARE NEAR-NORMAL
A ARID AREAS (NO VALUE)



El Niño (DJF)

SHADED AREA ARE PROBABILITY
BELOW AND ABOVE NORMAL
UNSHADED AREAS ARE NEAR-NORMAL
A ARID AREAS (NO VALUE)



FAO: Early Warning – Early Action

SOMALIA EXAMPLE: RESULTS

Situation Analysis



- El Niño 2015: Risk of floods affecting more than 90 000 people and 9100 ha of farmland along the Shebelle and Juba Rivers.

Example FAO Actions:

- strengthen riverbanks
- build flood barriers

Return on Investment

- Investment: 1.7m USD
- approx. 6.7m USD in maize production saved, 4 x the investment



Humanitarian Health Action

Humanitarian Health Action

Crises

Technical guidelines

Key policy documents

Donor centre

Global network

Global Health Cluster

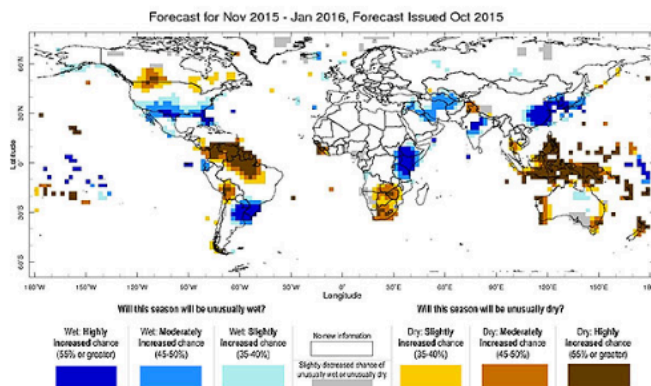
Health preparedness for El Niño event 2015 - 2016

Global Situation Assessment of El Niño-related Health Risks

WMO has confirmed reports that a mature and strong El Niño is present in the tropical Pacific Ocean. International climate models suggest that the 2015/2016 El Niño will strengthen further before the end of 2015 and become one of the strongest El Niño events in the past twenty years.

The El Niño phenomenon is a major concern to global public health as it has the potential to exacerbate health risks associated with extreme weather in different parts of the world. The last major event of similar magnitude in 1997-1998 resulted in significant health impacts across multiple WHO Regions [WHO Factsheet : El Niño Fact sheet on the El Niño Southern Oscillation (ENSO) and health UPDATE OF NO.192 (2000)], for example:

- in Eastern Africa, extensive flooding led to food insecurity associated with widespread economic losses in agriculture and livestock, as well significant destruction of health infrastructure throughout the region;
- in Djibouti, Kenya, Mozambique, Somalia, Uganda and the United Republic of Tanzania unusually high rainfall triggered major outbreaks of cholera in, as well as unexpectedly large outbreaks of Rift Valley Fever (RVF) in Kenya, Somalia and Tanzania, for example, in Garissa District, Kenya (population 231,022) alone, there were 170 deaths from haemorrhagic fever and an estimated 27,500 infections;
- in Latin America, Peru and central Ecuador experienced rainfall more than 10 times the usual levels, with consequential flooding and extensive landslides that resulted in widespread destruction of homes and infrastructure;
- the Pacific Island region was hit by a drought so severe that 50% of Fiji's population required government water delivery, and the sugarcane harvest was slashed by 50% with widespread economic impacts.



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pdf, 360kb

IGAD Climate Prediction and Applications Centre Monthly Bulletin, May 2015 October 2015

Estado actual de las condiciones del Océano Pacífico Y su posible evolución durante el año 2015-2016.

Rift Valley Fever factsheet

WHO pre-positions emergency supplies in Somalia in preparation for El Niño

World Health Organization Reports
<http://www.who.int/hac/crises/el-nino/en/>

EL NIÑO EFFECTS AND HEALTH CONSEQUENCES



What Ministries of Health and WHO are doing for country and regional preparedness for El Niño

WHO is acutely aware of the high risk conditions of 2015 and providing support to WHO Member States and partners to enhance preparedness measures for the current El Niño event. The health sector should prepare for the specific risks associated with the El Niño event. This event also provides the opportunity to reinforce all-hazards preparedness of communities and countries, and the readiness of WHO, the Global Health Cluster and other national, regional and global actors for health emergencies.

There are no answers, only choices.

Stanislaw Lem/Steven Soderbergh (Solaris)



EXAMPLES

Seasonal-to-Interannual:

1. [Red Cross](#): West Africa flood preparedness
2. [World Food Program](#): Food Security preparedness
3. [Jamaica Ag. Ministry](#): Drought monitoring & forecasts

Seasonal-to-Decadal:

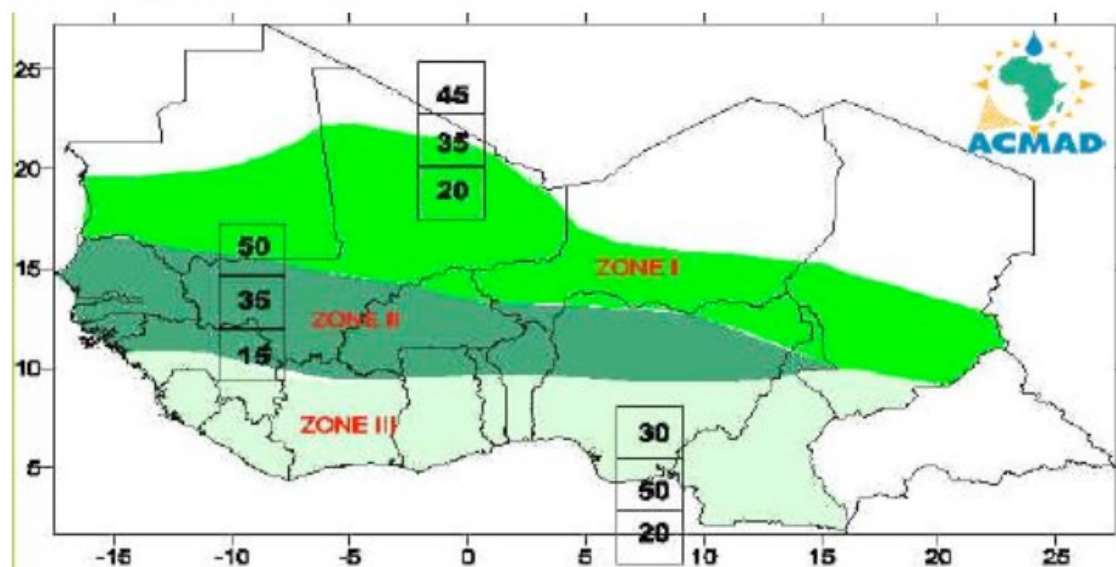
1. [President's Malaria Initiative](#): Program evaluation
2. [South Africa \(western Cape\) Water Mgmt](#): System resilience



International Federation
of Red Cross and Red Crescent Societies

West Africa preparedness appeal

Precipitation Forecasts
Jun-Aug 2008



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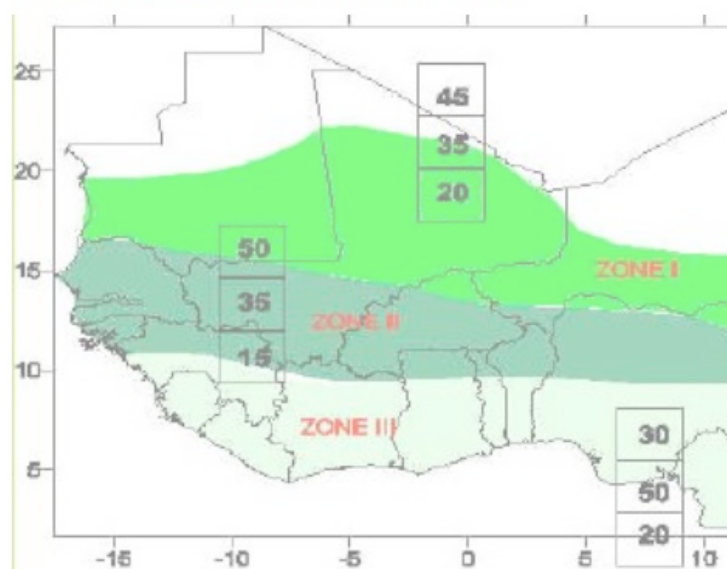
S-I

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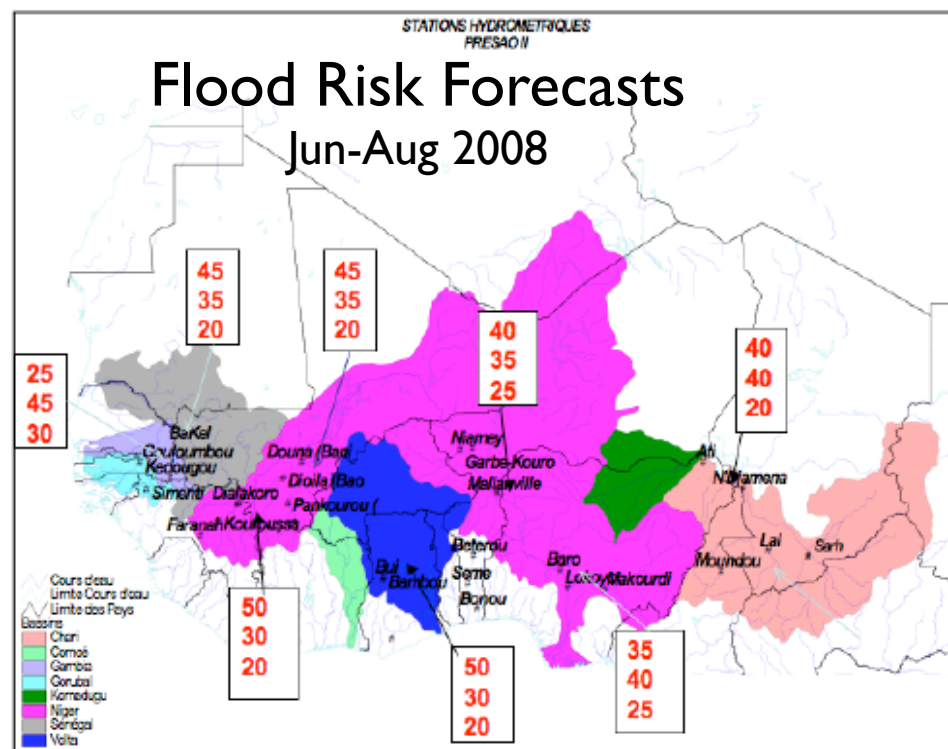


West Africa preparedness appeal

Precipitation Forecast
Jun-Aug 2008



Flood Risk Forecasts
Jun-Aug 2008



Emergency appeal



International Federation
of Red Cross and Red Crescent Societies

West and Central Africa: Flood preparedness

Emergency appeal n° MDR61003
11 July 2008

This preliminary Emergency Appeal seeks CHF 750,000 (USD 731,134 or EUR 462,475) in cash, kind, or services to support the National Societies of West and Central Africa to assist 47,500 beneficiaries.

CHF 483,047 has been allocated from the Federation's Disaster Relief Emergency Fund (DREF) to start the planned activities. Discussions are currently taking place to reallocate approximately CHF 550,000 remaining from the 2007 West Africa floods appeal to support this appeal. While these discussions are underway, partners are encouraged to provide timely support to this appeal.



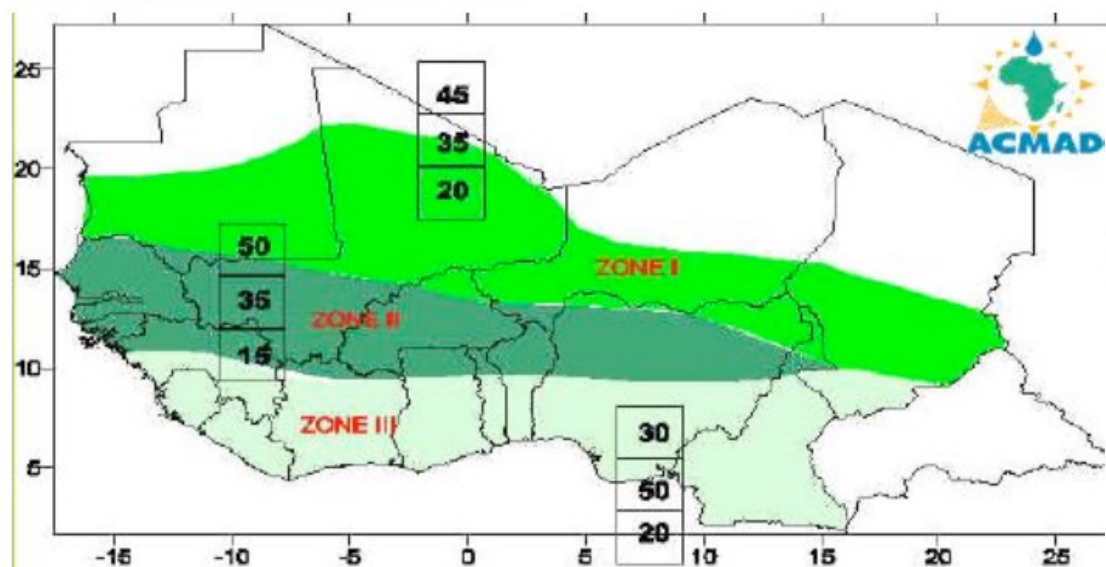
Red Cross Volunteer, Lomé, Togo, June, 2008



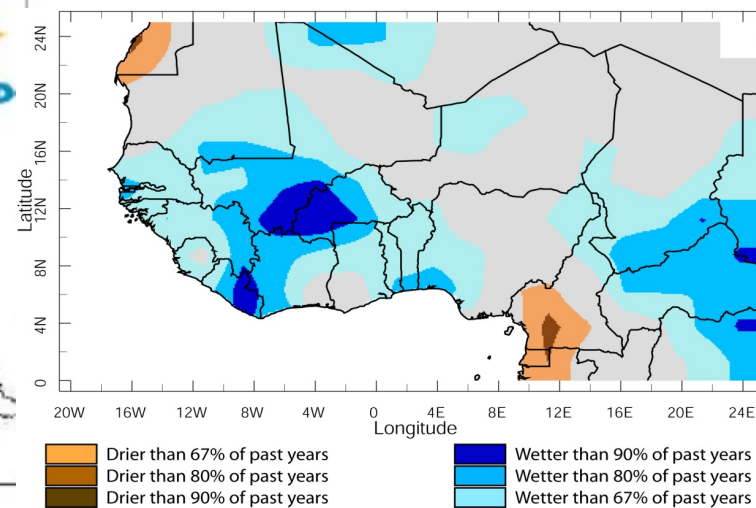
International Federation
of Red Cross and Red Crescent Societies

West Africa preparedness appeal

Precipitation Forecasts Jun-Aug 2008



Observed Rainfall



IRI

S-I

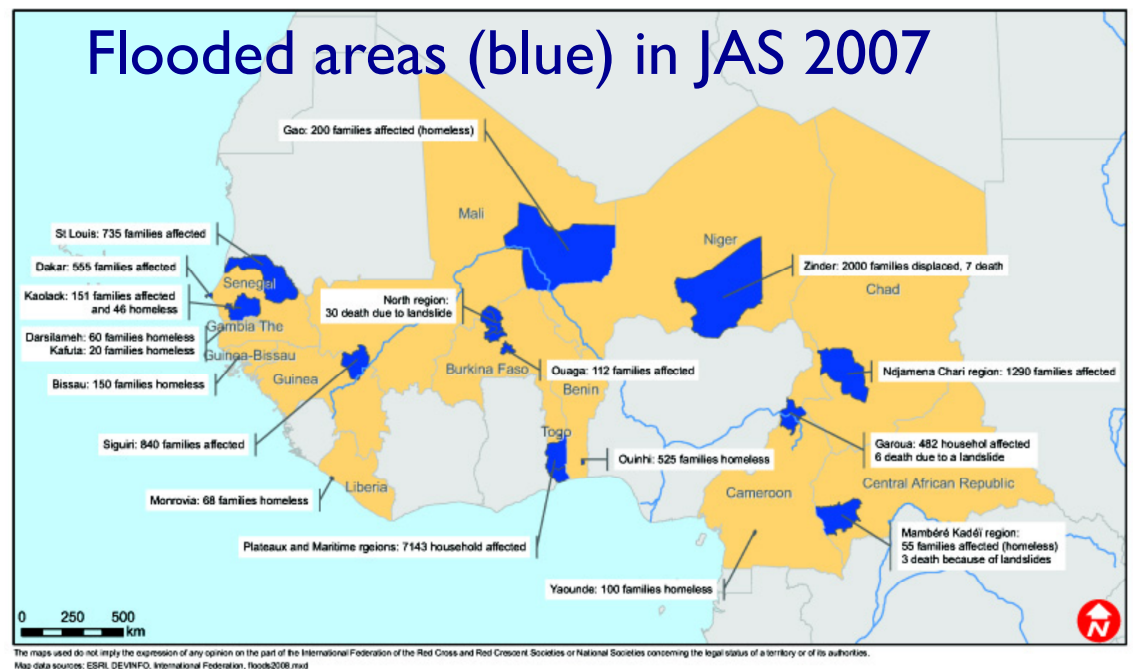
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Early Action works:

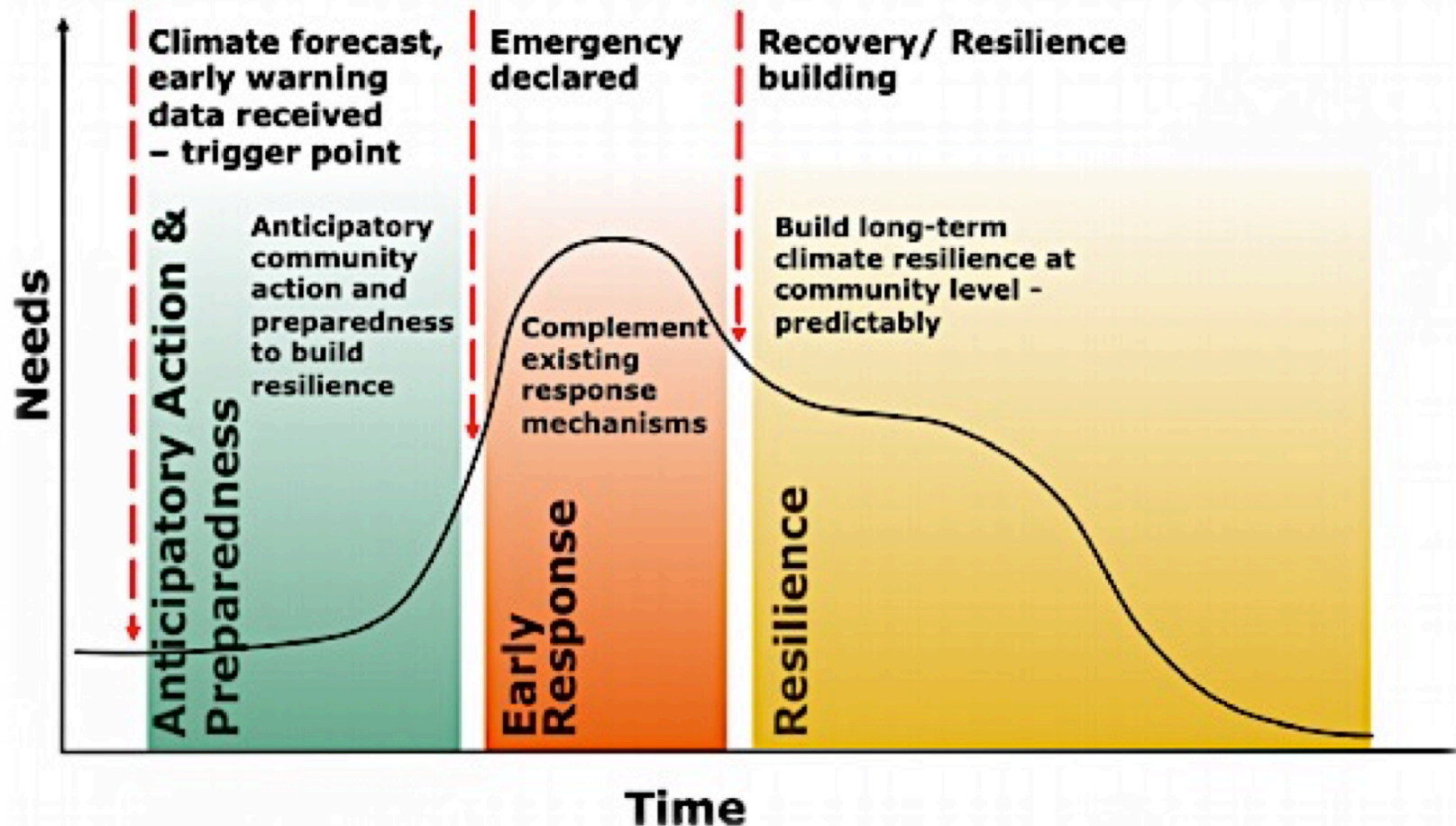
- Faster response: **1-2** days rather than 40 in 2007
- Fewer victims (**30** instead of hundreds)
- Lower cost per beneficiary (**30%**)

Example: Red Cross volunteers in Ghana saving lives by alerting Volta fishermen that the Bagre dam would be spilled.



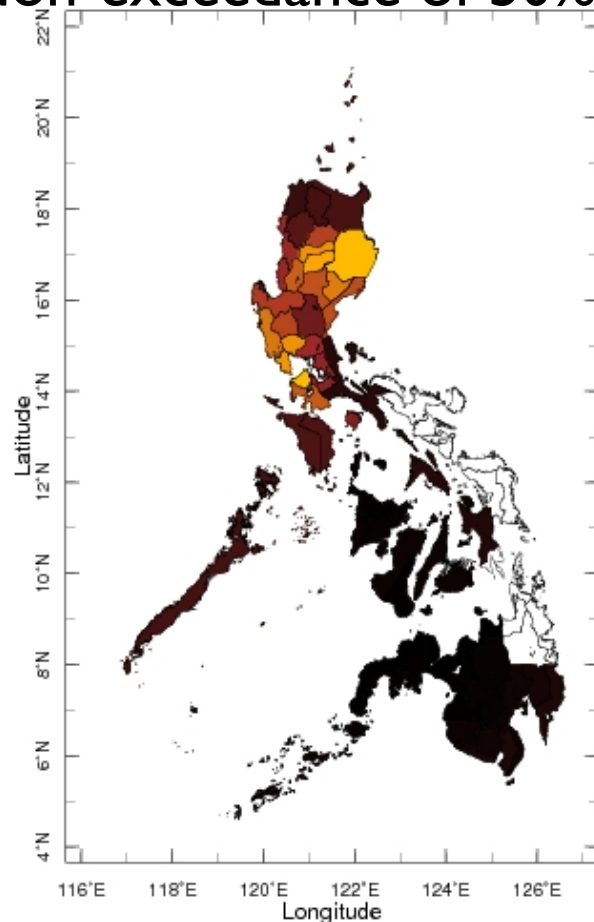
WFP's Food SECuRE

Pioneering Example of Forecast-based Financing



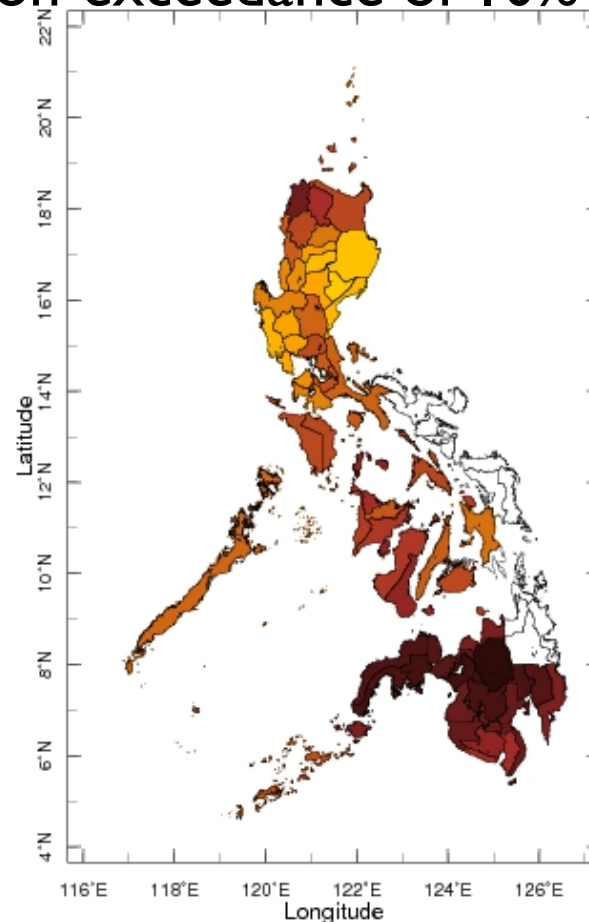
WFP's Food SECuRE – Drought Triggers

Non-exceedance of 50%-ile



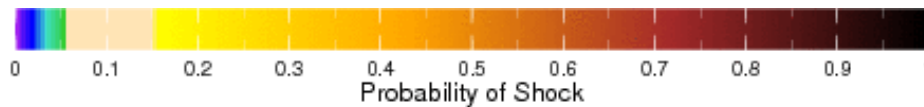
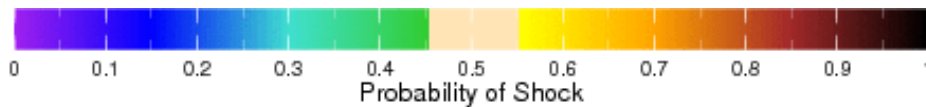
Jan-Apr 2016 Forecast issued September 2015

Non-exceedance of 10%-ile



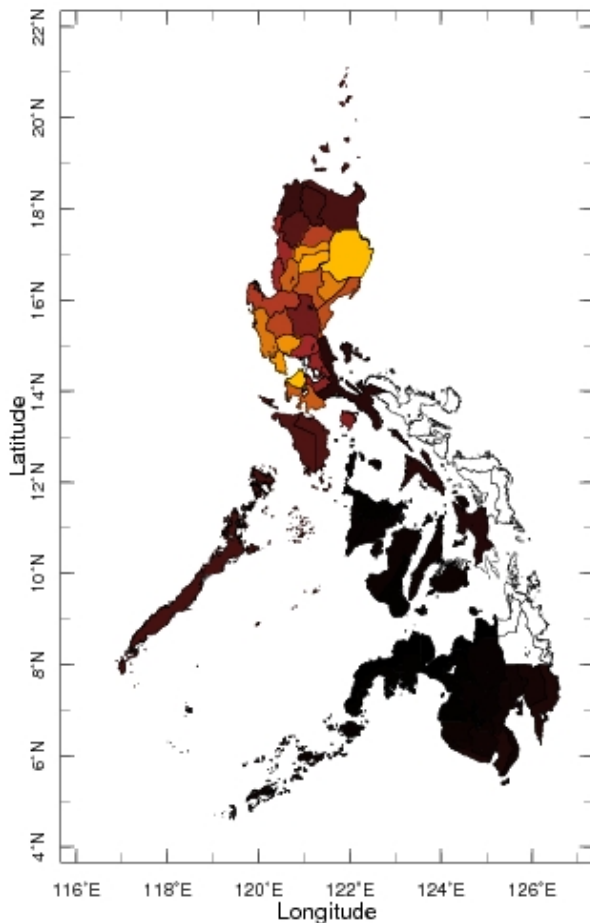
Jan-Apr 2016 Forecast issued September 2015

Made
Sept.
2015



WFP's Food SECuRE – Drought Triggers

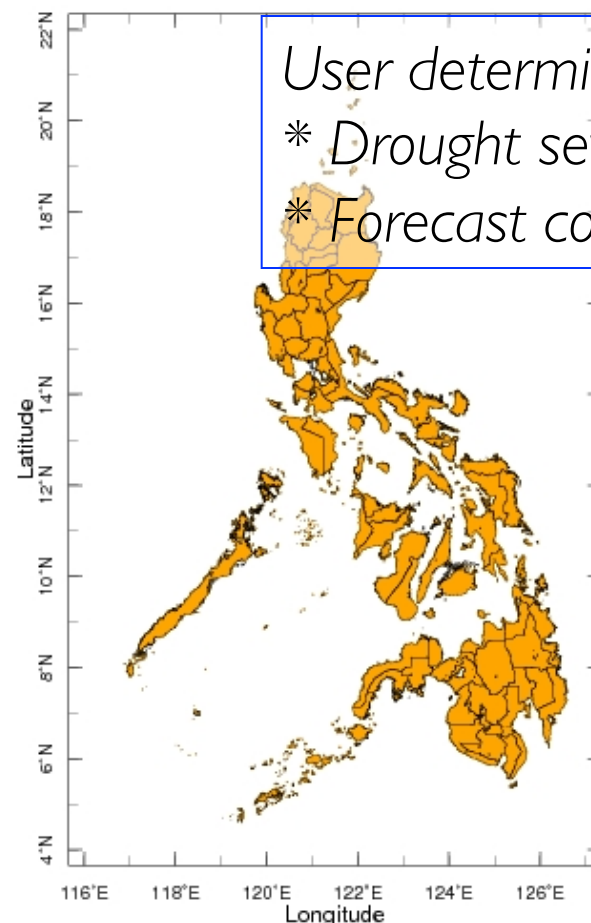
Non-exceedance of 50%-ile



Made
Sept.
2015

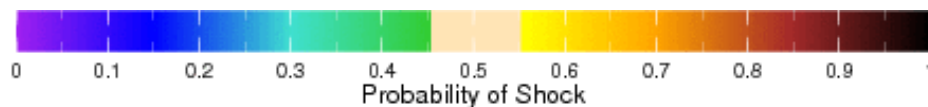


“ACTIVE TRIGGERS”



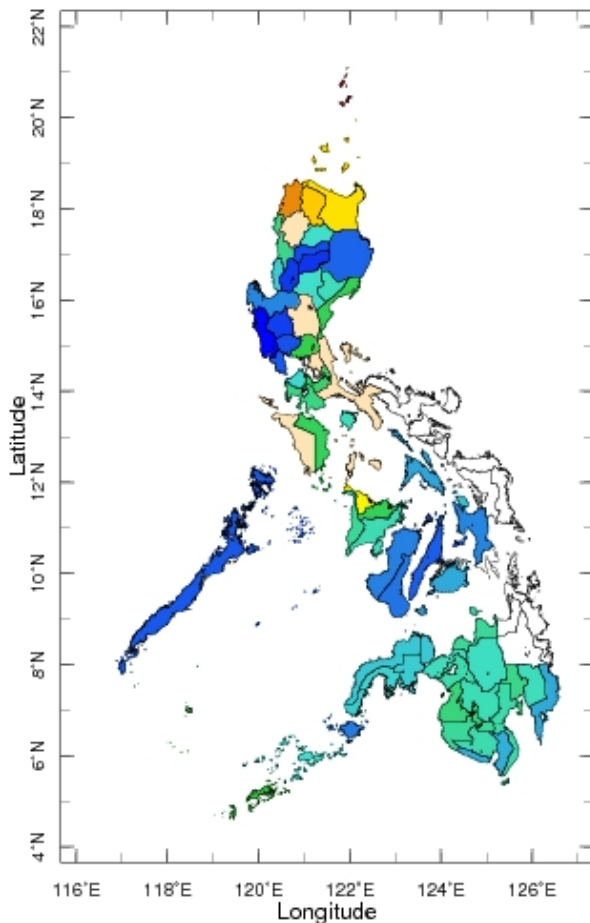
User determines:
* Drought severity
* Forecast confidence

Jan-Apr 2016 Forecast issued September 2015

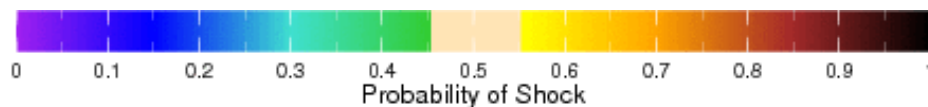


WFP's Food SECuRE – Drought Triggers

Non-exceedance of 50%-ile



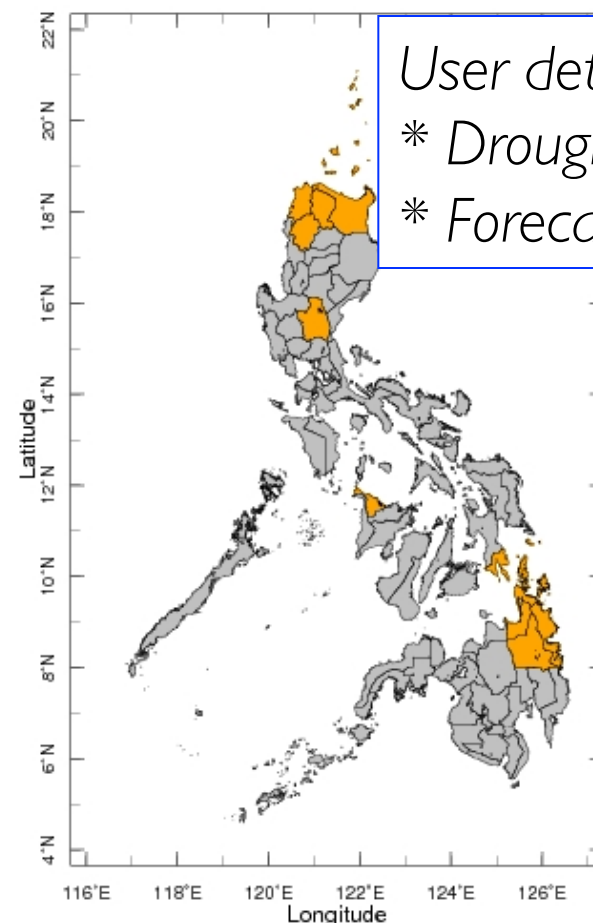
Jan-Apr 2017 Forecast issued September 2016



Made
Sept.
2016



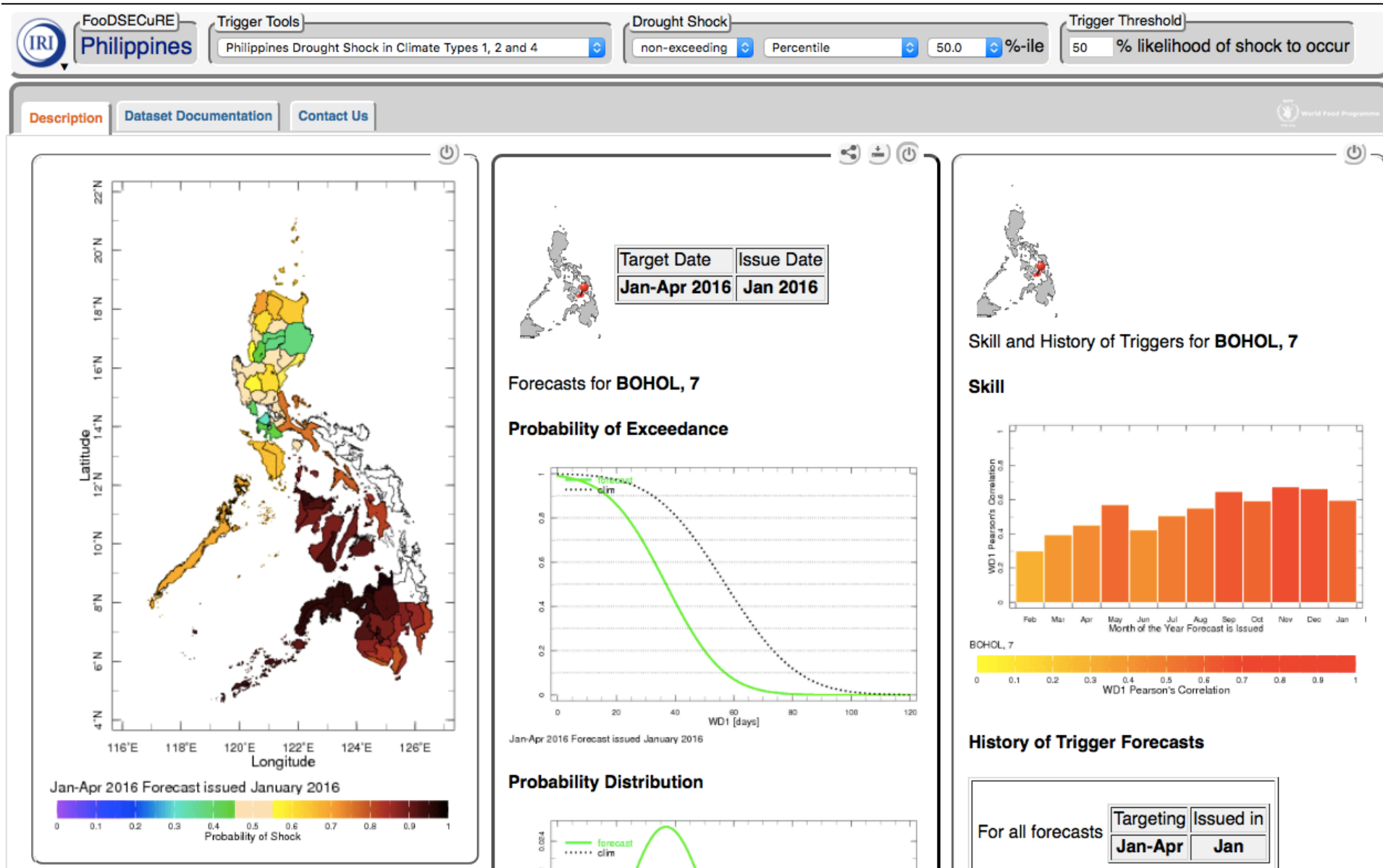
“ACTIVE TRIGGERS”



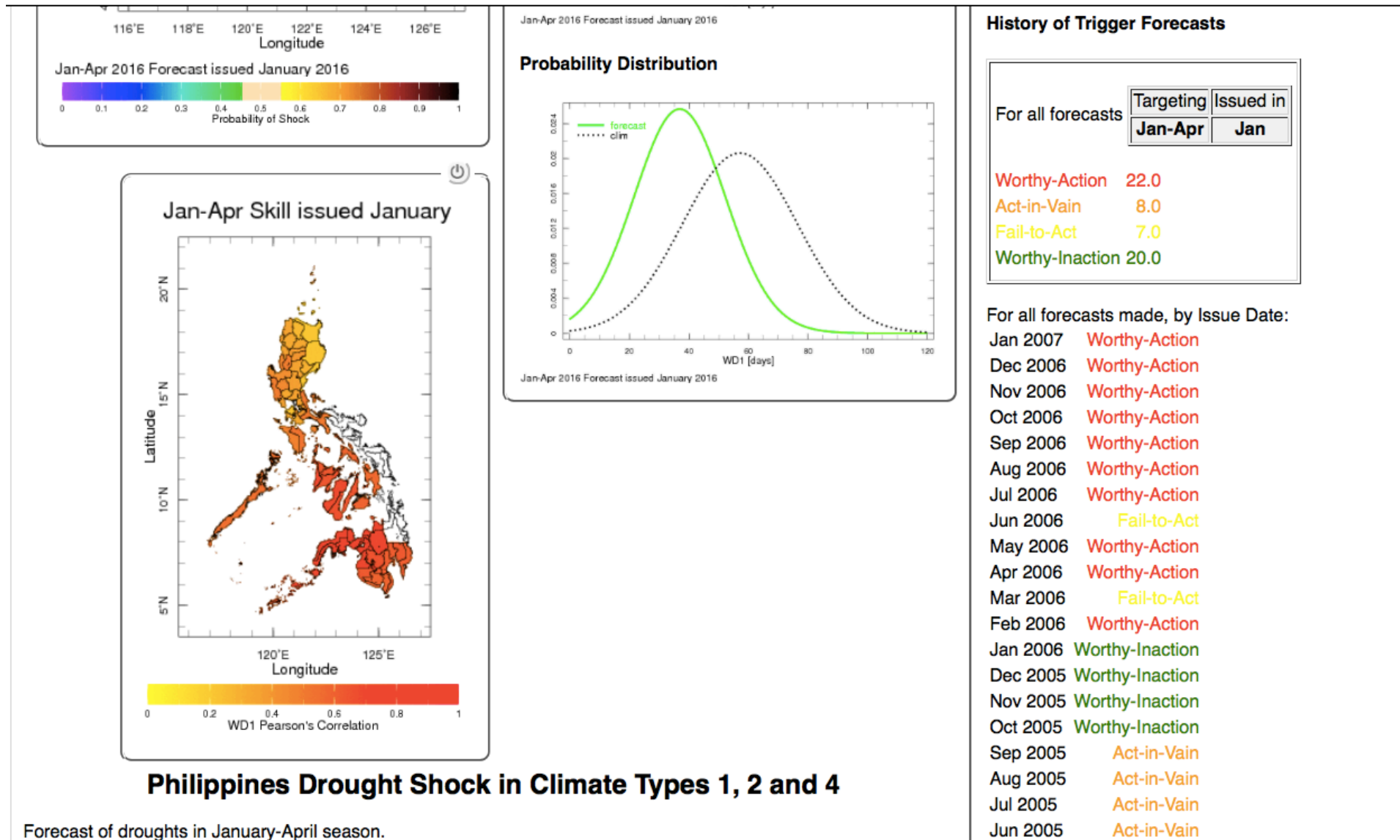
User determines:
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WFP's Food SECuRE – District Dashboard



WFP's Food SECuRE – District Dashboard

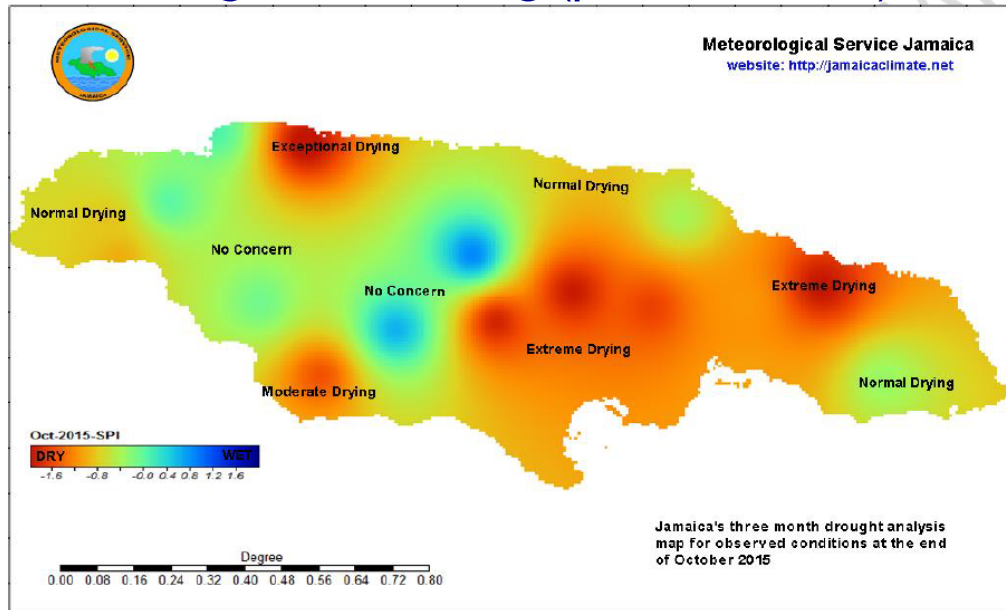


JAMAICA — Demand for drought information

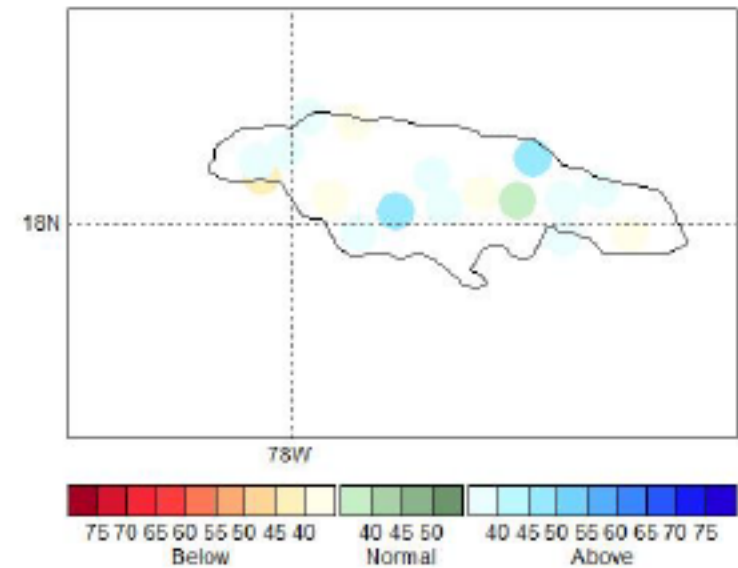
Drought Monitoring (past 3 months)



Rainfall Forecast (next 3 months)



Probabilistic forecasts



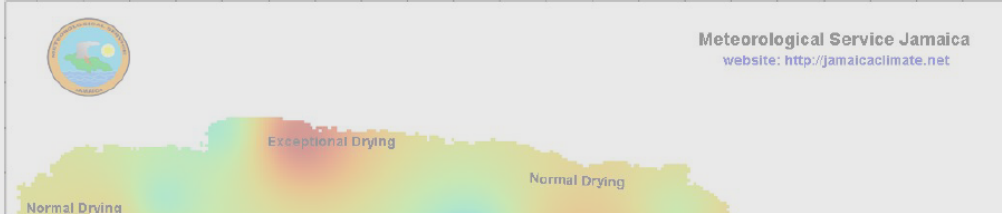
JAMAICA

Drought Monitoring (past 3 months)

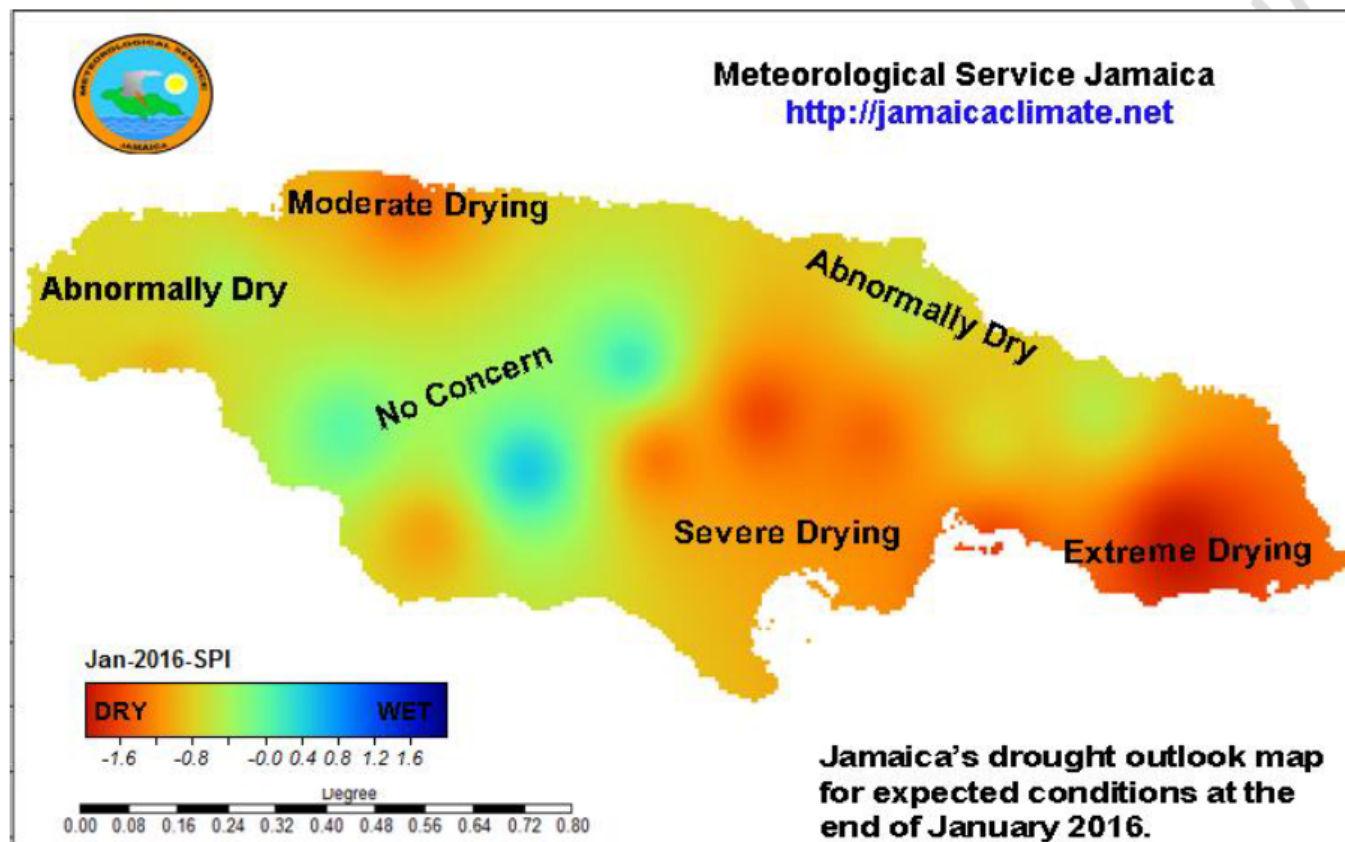


Rainfall Forecast (next 3 months)

Probabilistic forecasts

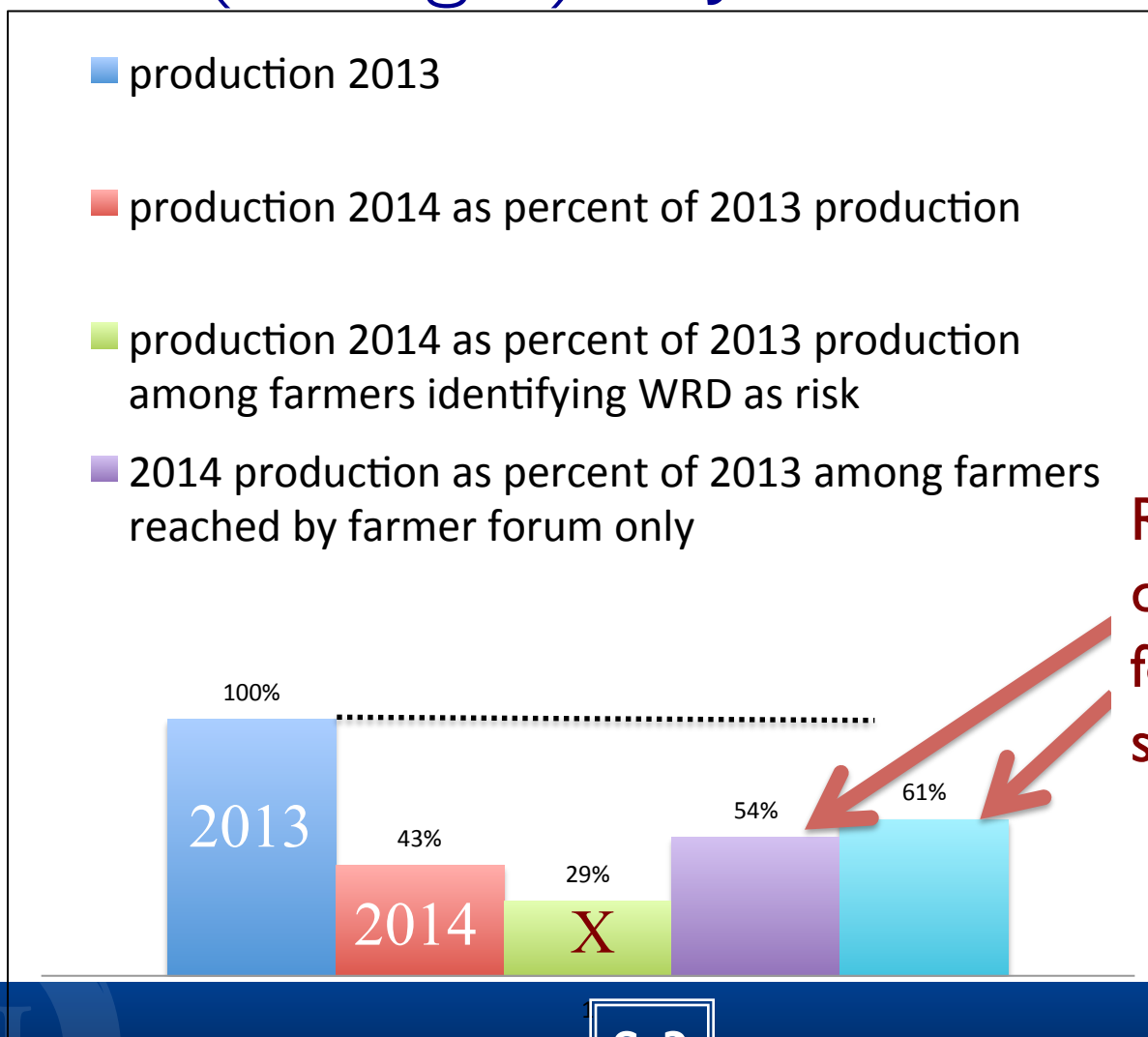


➔ 6-Month Drought Forecast



Jamaica's drought outlook map for expected conditions at the end of January 2016.

Ag. Production in 2013 (pre-drought) vs 2014 (drought) in Jamaica



**Reduced losses
due to
forecasts &
services**

(Rahman et al. 2016)

Seasonal-to-Decadal



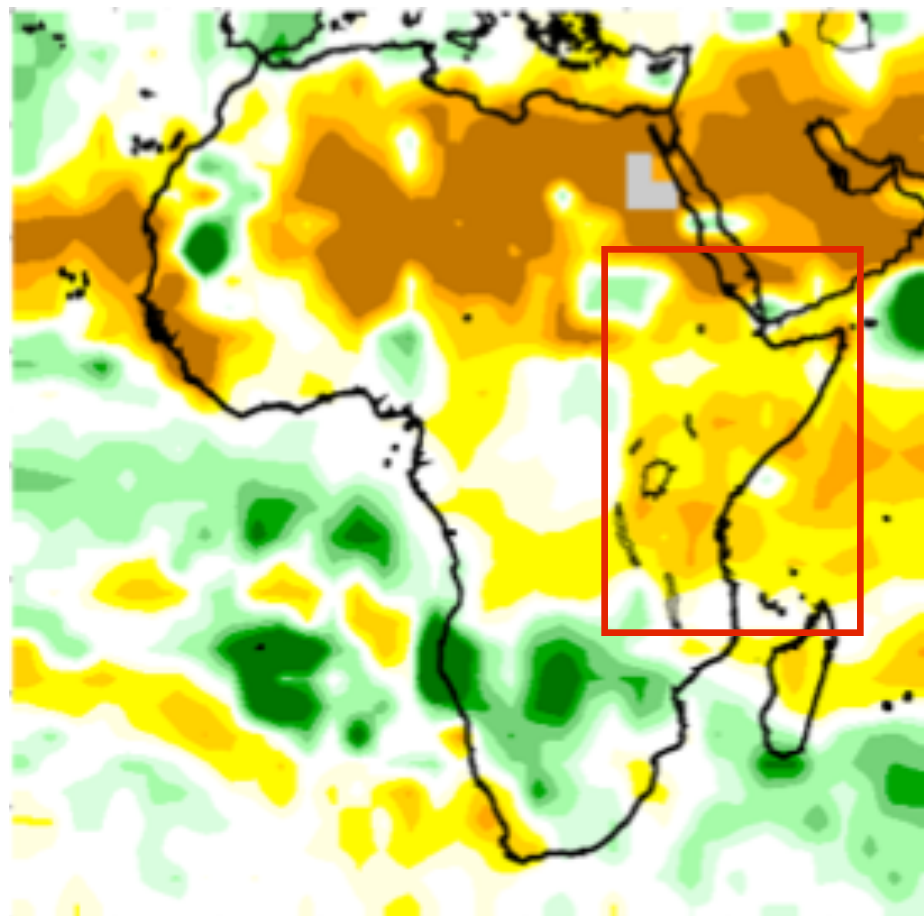
Evaluation of Malaria Interventions in East Africa



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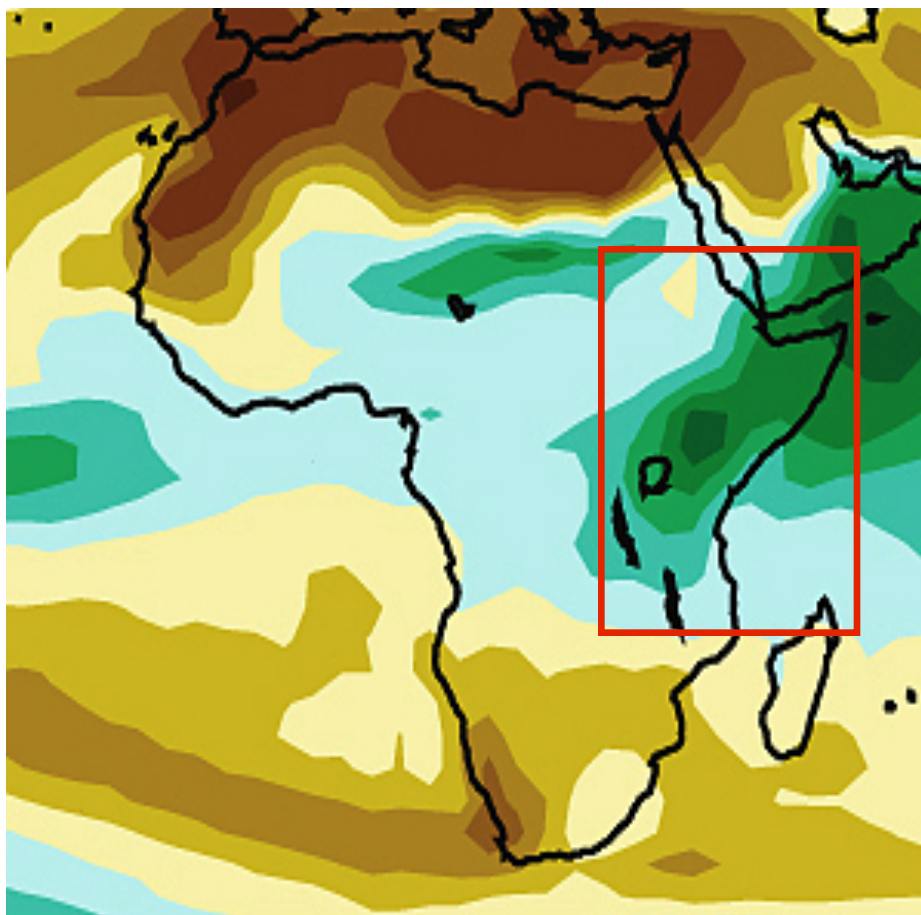
Evaluation of Malaria Interventions in East Africa

Observations
(last 15 years)

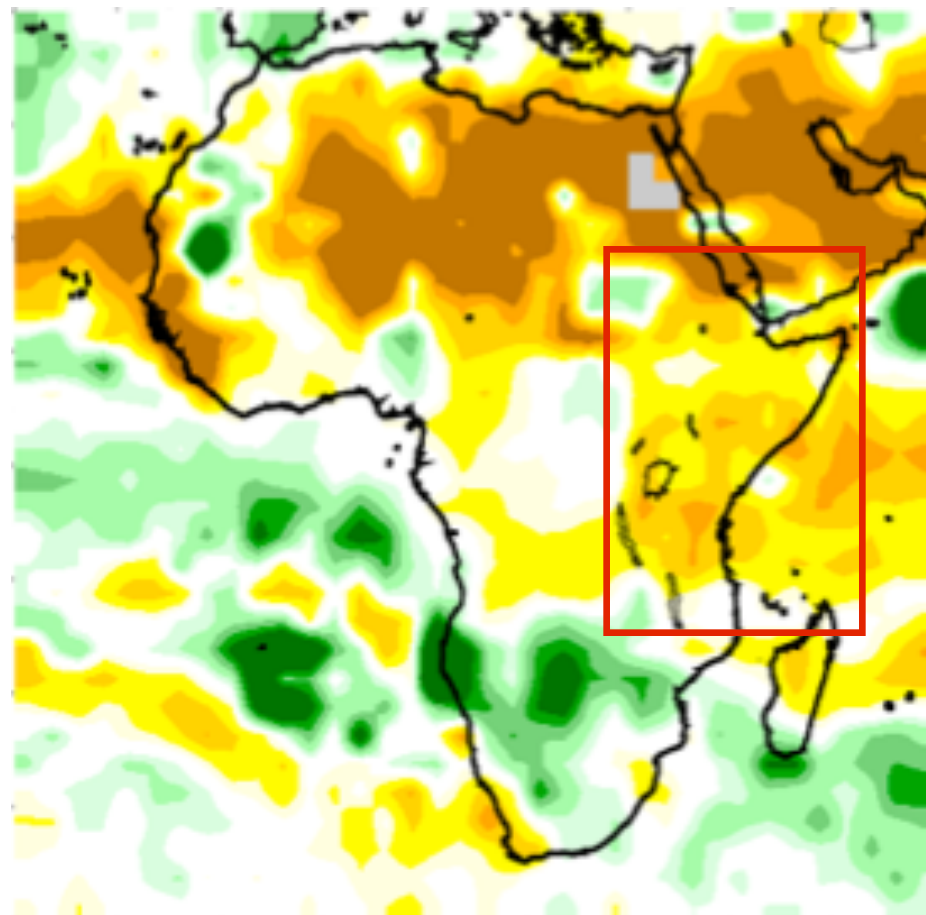


Evaluation of Malaria Interventions in East Africa

Climate Change Projections
(end of 21st century)



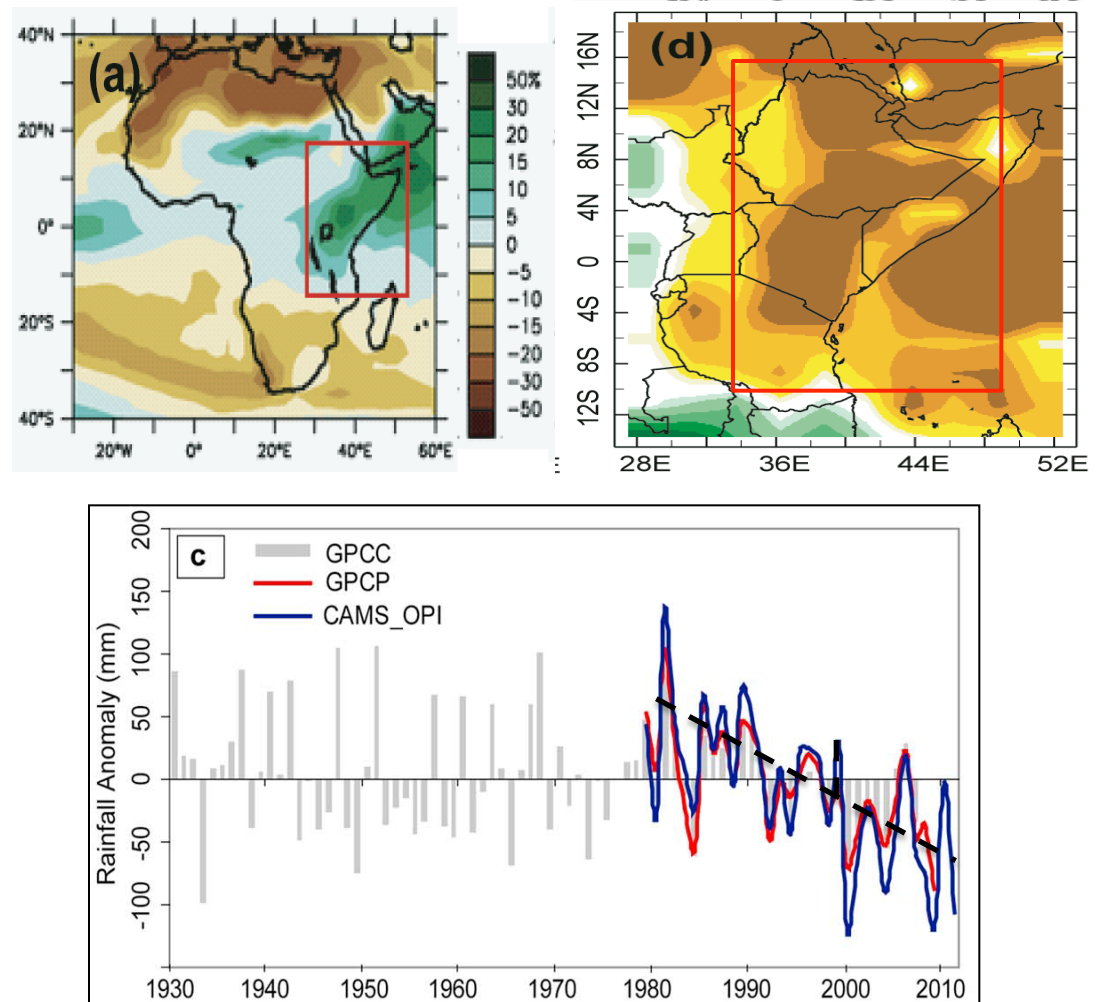
Observations
(last 15 years)



~~Evaluation of Malaria Interventions in East Africa~~

Increased Drought Frequency in East Africa

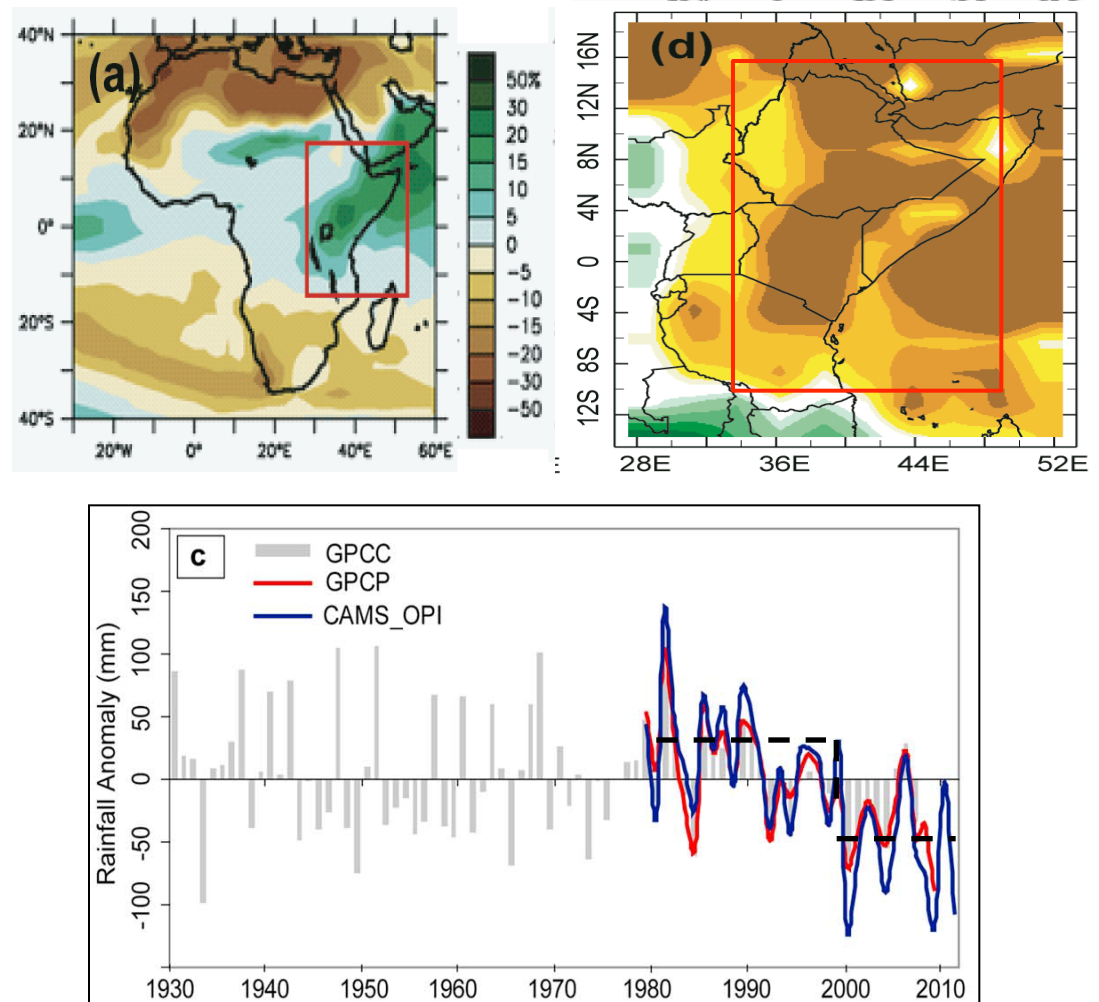
- Over the past ~15 years, drought has become much more frequent
- WHY?
- Is this climate change?



~~Evaluation of Malaria Interventions in East Africa~~

Increased Drought Frequency in East Africa

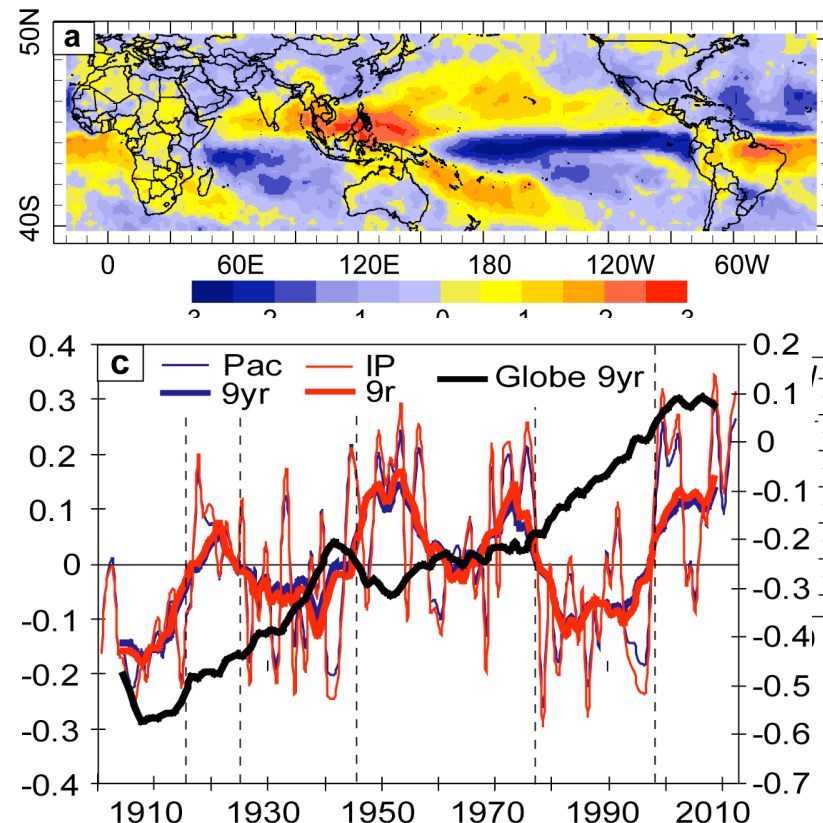
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~~Evaluation of Malaria Interventions in East Africa~~

Increased Drought Frequency in East Africa

- Increased frequency of drought in East Africa is **mainly the result of multi-decadal climate variability** in the Pacific
- The recent shift in East African rainfall is part of a **global climate shift that occurred in 1998-99**

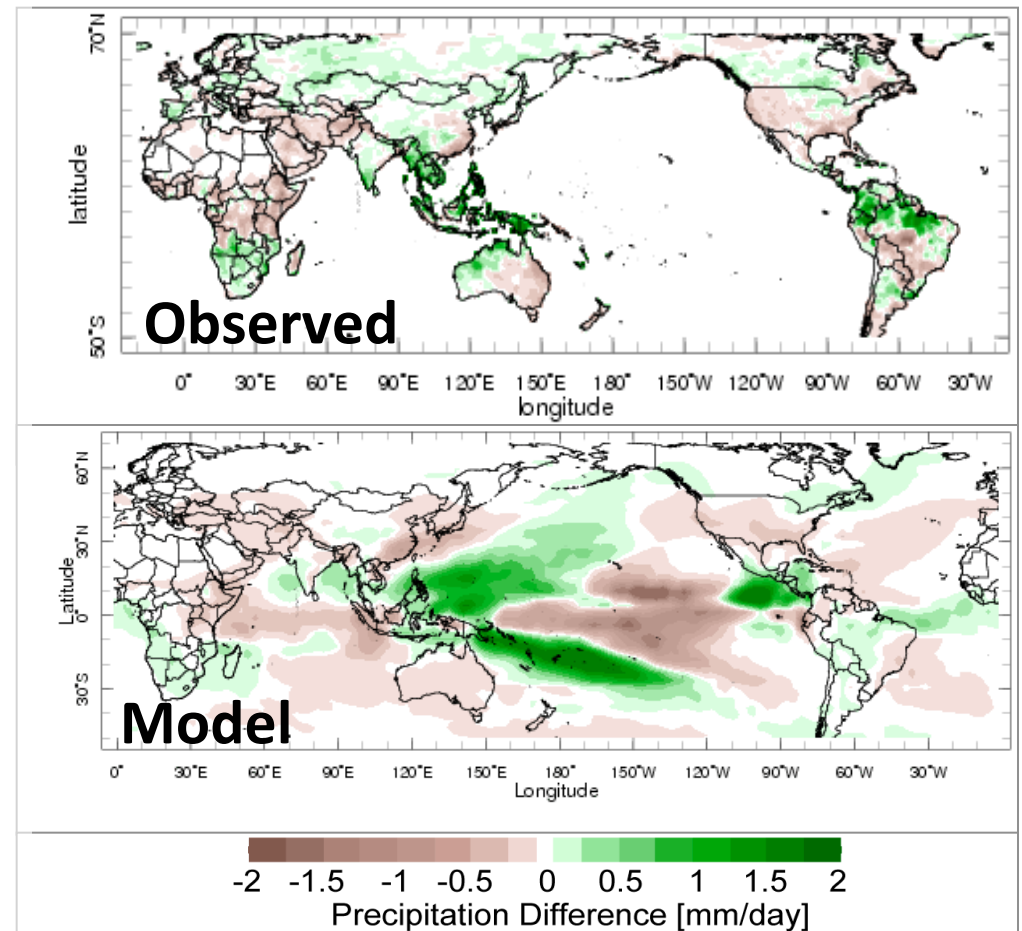


(Lyon et al. 2012, 2013, GRL, Clim. Dyn.)

~~Evaluation of Malaria Interventions in East Africa~~

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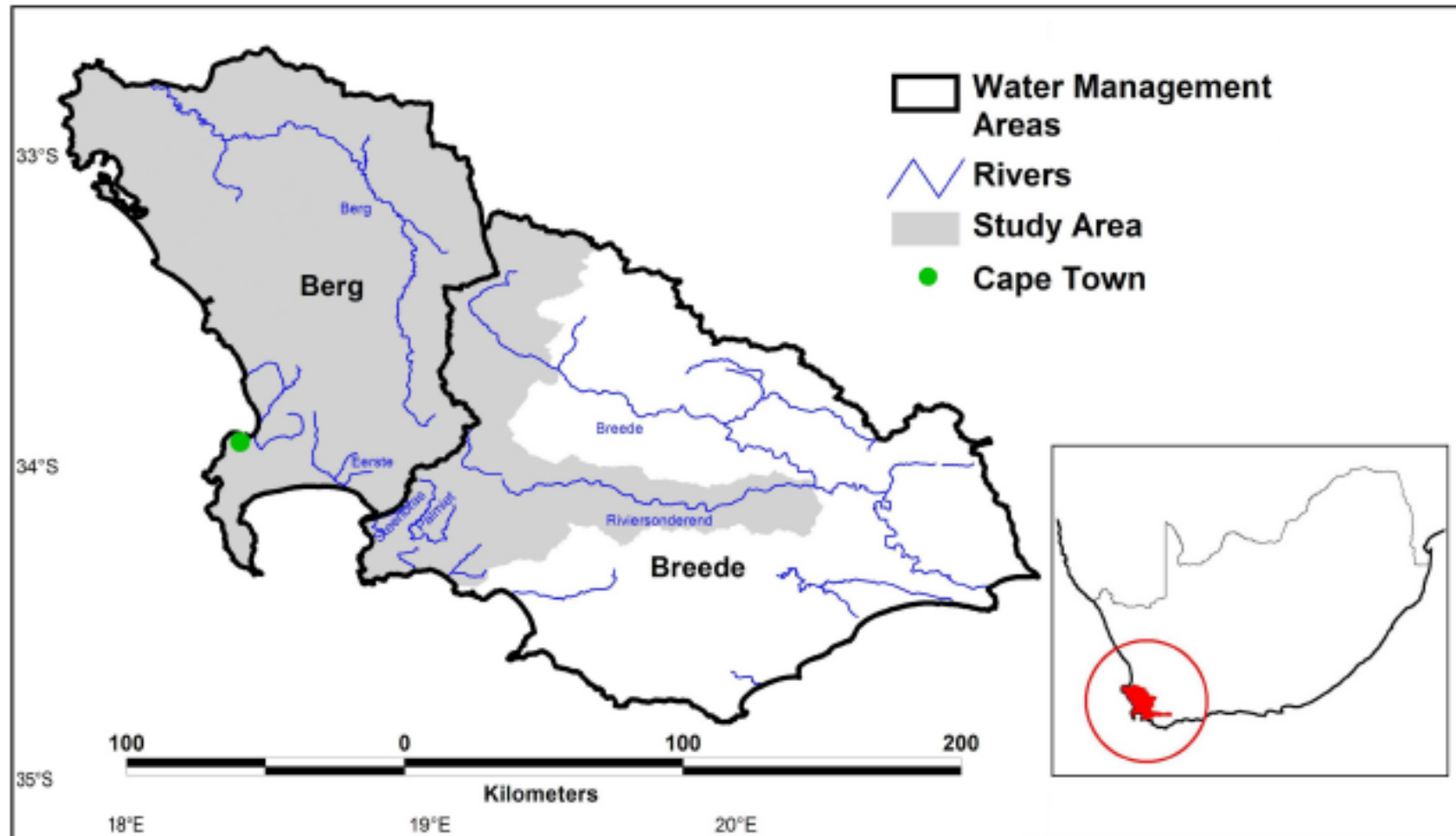


FUTURE AHEAD?

What information can be provided in places where there is no signal from decadal phenomena, or where the models have poor performance??

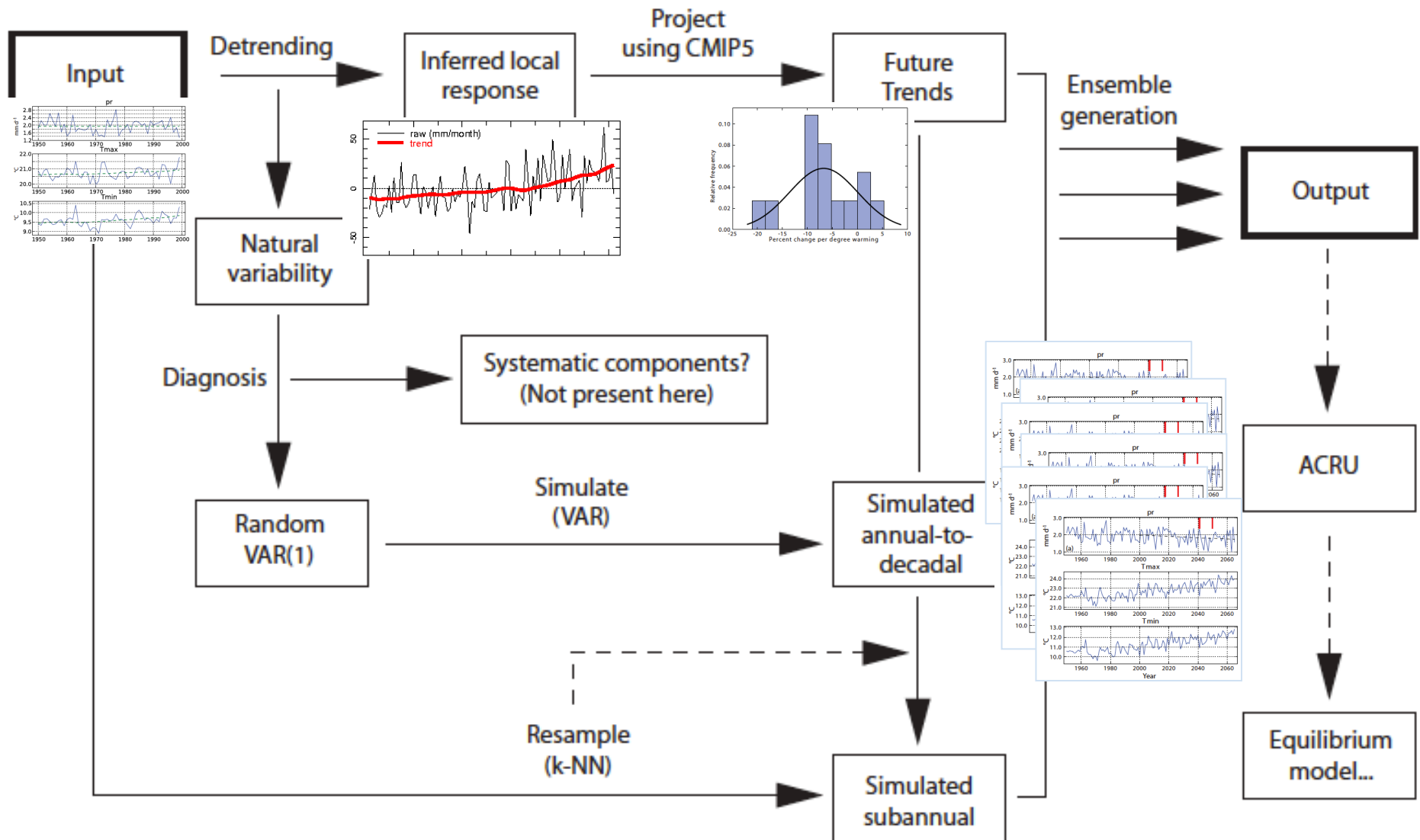
Resiliency of Water Resources and Mgmt

Berg and Breede Water Mgmt Areas



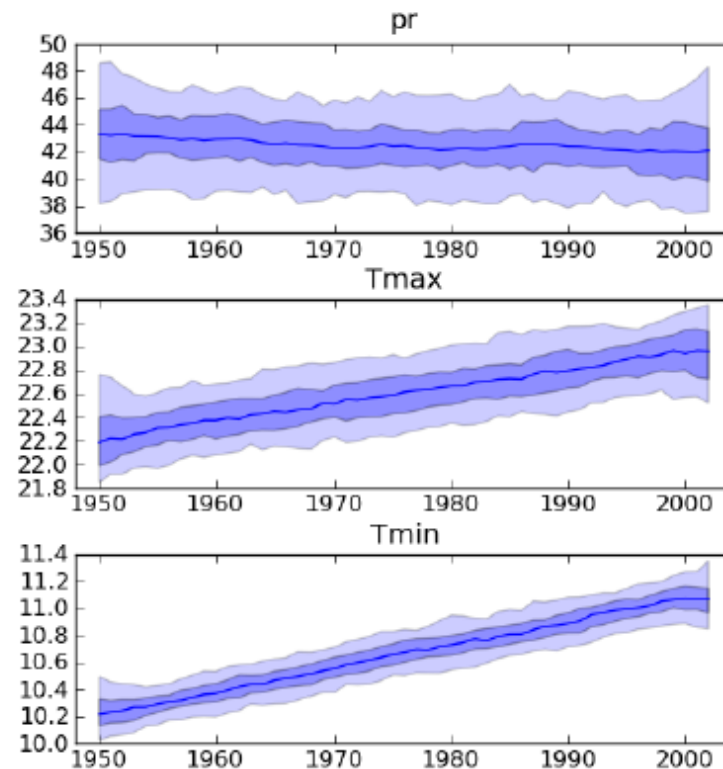
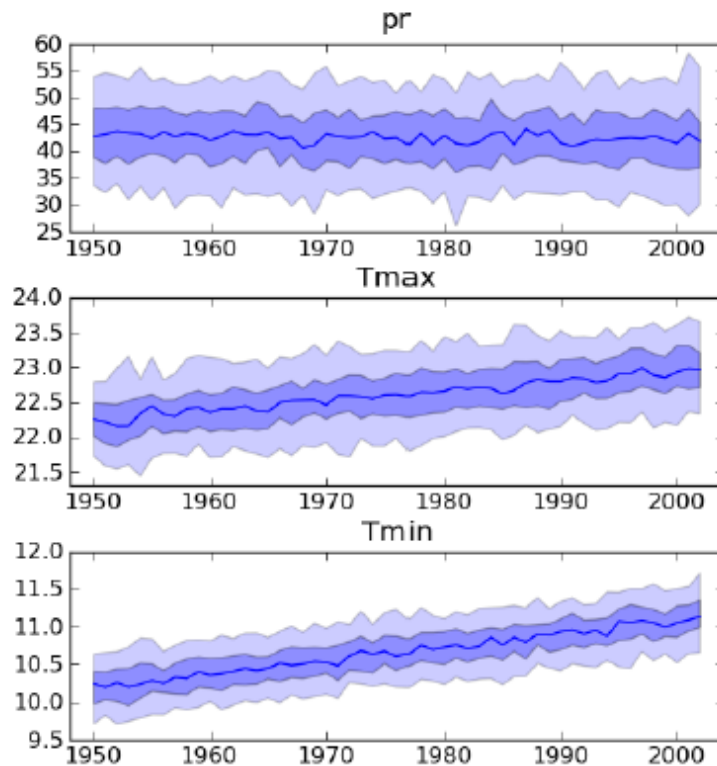
STOCHASTIC SIMULATIONS:

(Greene, et al. 2012)



STOCHASTIC SIMULATIONS:

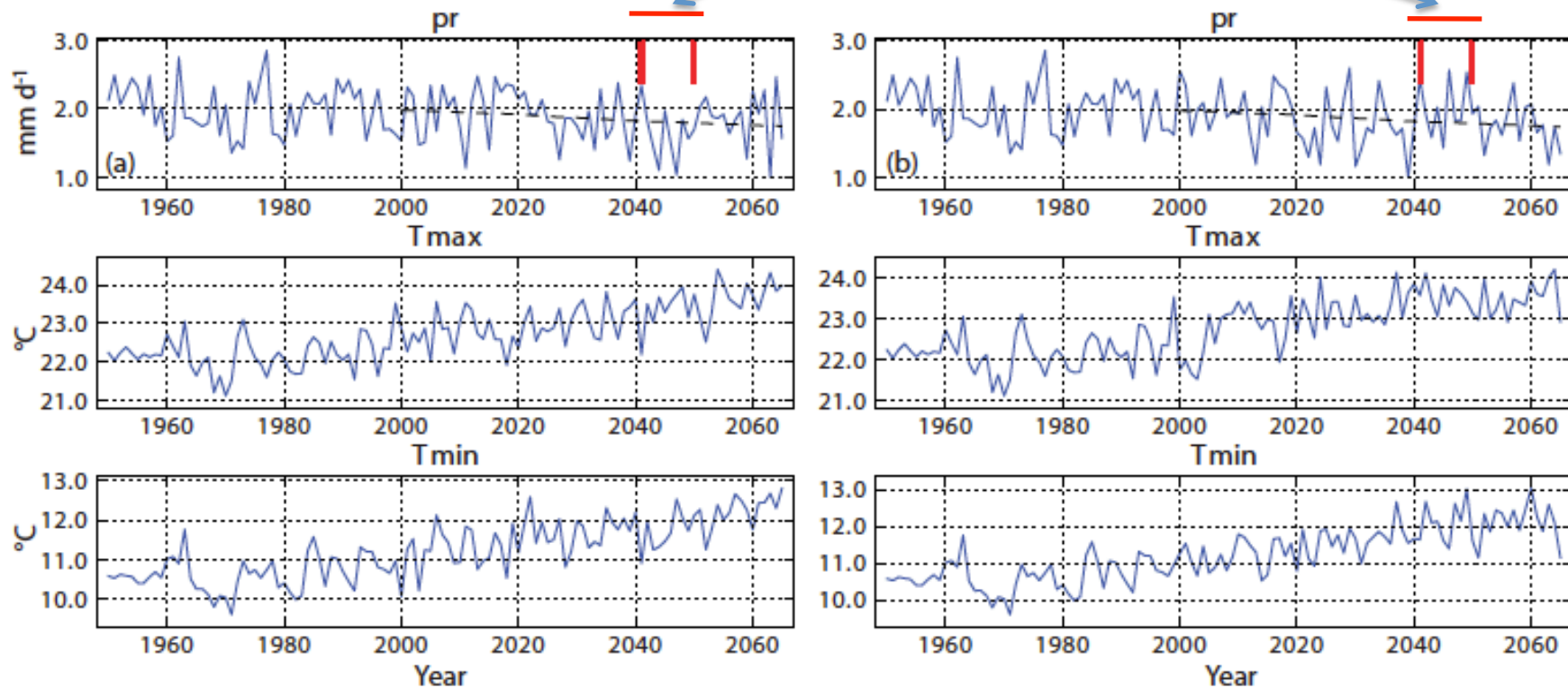
... the envelope please



- Left: Unsmoothed simulations
- IQR and 0.05-0.95 quantile shown, 100 simulations.
- Right: Similar, but for smoothed simulations (9-year unweighted running mean)

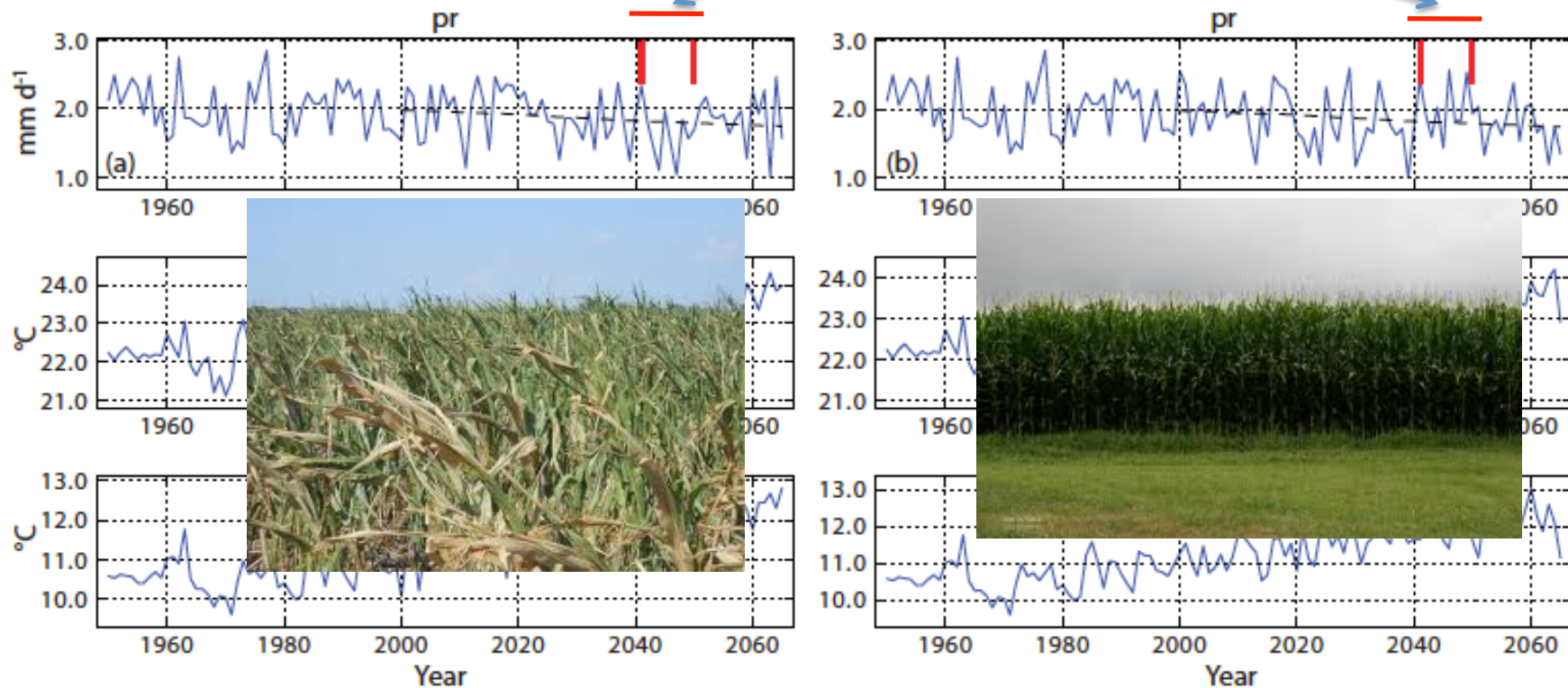
STOCHASTIC SIMULATIONS: 2 *Ensemble Members*

Decadal Variability



STOCHASTIC SIMULATIONS: 2 *Ensemble Members*

Decadal Variability



There are no answers, only choices.

Stanislaw Lem/Steven Soderbergh (Solaris)



Thank You



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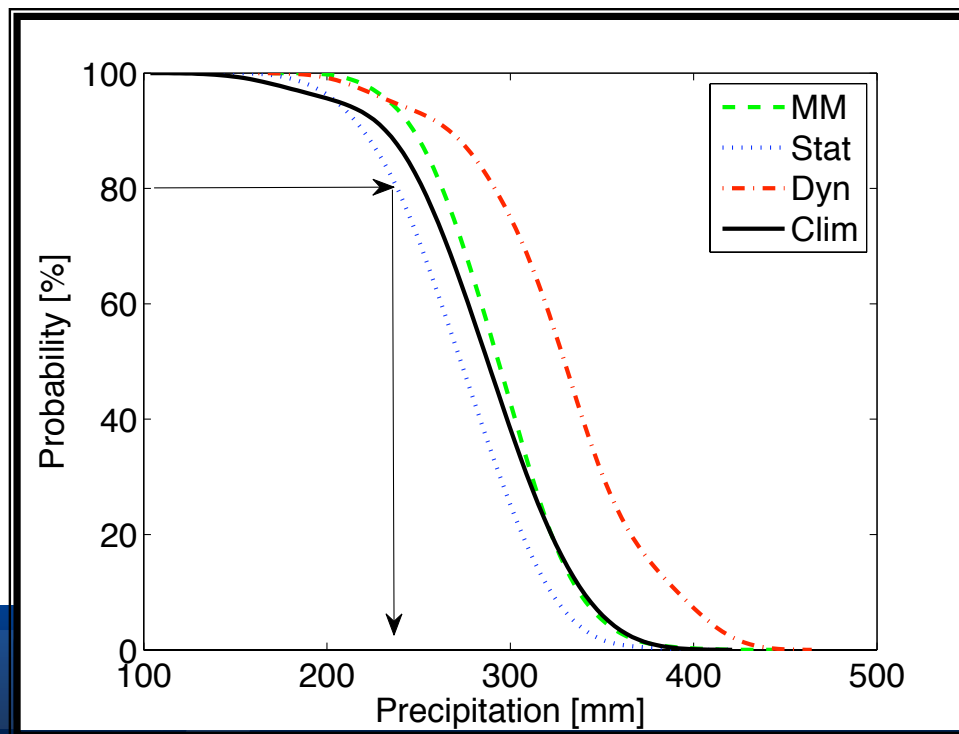
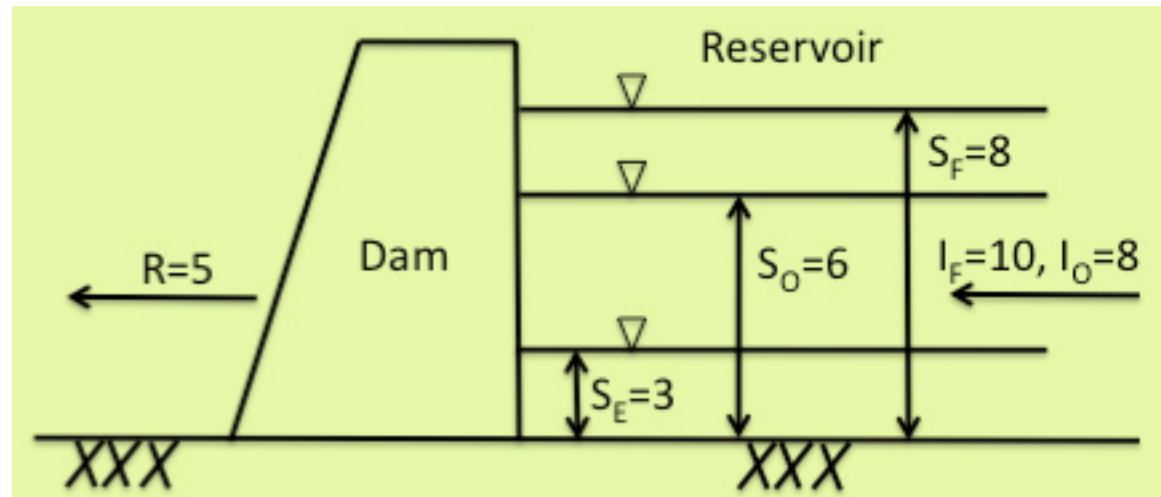
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Linked Model System (example: *Ethiopia*)

Monthly reservoir update
based on forecast and
observations



Select precipitation
exceedance probability,
apply to prediction
ensemble

(Block and Goddard, 2012, WRR)

Hydropower Benefits (example: Ethiopia)

Using probabilities of exceedance; threshold reliability = 200 GW hrs/mo

Forecast Technique	Mean Benefits [\$M/dec]	Mean Losses [\$M/dec (f)]	Dependability [%]	Superior Benefit Cases	
				Decadal [%]	Annual [%]
Perfect Forecast	3350	-	100%		
<i>prob = 80%</i>					
Statistical	2740	25 (10%)	100%	18	23
Dynamical	2610	100 (66%)	100%	0	15
Multi-model	2780	5 (2%)	100%	82	35
No Forecast	2610	-	>99%	0	27
<i>prob = 95%</i>					
Statistical	2500	35 (23%)	100%	8	20
Dynamical	2200	237 (100%)	100%	0	0
Multi-model	2550	48 (5%)	100%	88	44
No Forecast	2440	-	100%	4	36

For prob=50%: benefits and reliability drop



Hydropower Benefits (example: Ethiopia)

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