

How forecasts can trigger humanitarian action

Andrew Kruczkiewicz

2016 HEPEX Workshop

Quebec City

8 June, 2016

International Research Institute
for Climate and Society

EARTH INSTITUTE | COLUMBIA UNIVERSITY

RED CROSS/RED CRESCENT

CLIMATE CENTRE



International Federation
of Red Cross and Red Crescent Societies

The Netherlands **Red Cross**

Part 1: What comes first?





Games for a new climate: Namibia. Villagers in Katima Mulilo, on the Zambezi River, play Ready! The region has suffered severe annual floods in recent years. (Photo: Colleen Mackinn/Parsons the New School)



Researchers/
MET



Climate

Climate Forecast

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

Region

Ethiopia

Spatially Average Over:

Season: Tercile: ENSO State:

[Description](#) [Dataset Documentation](#) [Instructions](#) [Contact Us](#)

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

This map shows the historical probability (given in percentile) of seasonal average monthly rainfall falling within the upper (wet), middle (normal), or bottom (dry) one-third ("tercile") of the 1983-2014 historical distribution in the country given the state of ENSO (El Niño, Neutral, La Niña) during *that same season*.

Here, the ENSO state for each season is defined according to the Oceanic Niño Index (ONI). It is using Sea Surface Temperature (SST) anomalies, based on 1981-2010 normal, in the geographical box (170°W, 5°S, 120°W, 5°N). A season is considered El Niño (La Niña) if it is part of at least 5 consecutive overlapping 3-month long seasons where the ONI is above 0.45°C (below -0.45°C). Use the controls on the page to select the season, temperature tercile category of interest, and ENSO state.

Clicking on the map will then display, for the selected point, yearly seasonal rainfall averages time series. The color of the bars depict what ENSO phase it was that year, and the horizontal lines show the historical terciles limits. This allows to quickly picture what years fell into what ENSO Phase and into what Rainfall Tercile category.



Researchers to (with) MET



Maproom Climate

Climate Forecast

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

Region: Ethiopia

Spatially Average Over: gridpoint

Season: Nov-Jan

Tercile: Dry

ENSO State: La Niña

Description Dataset Documentation Instructions Contact Us

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

IRI Multi-Model Probability Forecast for Precipitation for October-November-December 2015, Issued September 2015

This map shows the probability of monthly averages (in a season) rainfall tercile conditioned on ENSO. The forecast is for October-November-December 2015, issued in September 2015. The map shows the probability of monthly averages (in a season) rainfall tercile conditioned on ENSO. The forecast is for October-November-December 2015, issued in September 2015.

Here, the Niño index is based on 5°N. A consecutive 0.45°C (temperature) increase in the Niño index is a strong indicator of a La Niña event.

Clicking on a region on the map will allow you to view the probability of monthly averages (in a season) rainfall tercile conditioned on ENSO for that region.

Key


- Percentage likelihood of:
 - Above-normal Precipitation
 - Near-normal Precipitation
 - Below-normal Precipitation
- White regions over land have climatological probabilities
- D Dry Season Masking

Probability (%) of Most Likely Category

Below-Normal	Normal	Above-Normal
40	40	40
45	45	45
50	50	50
60	60	60
70	70	70



Researchers
to (with) MET



**JAMBUURI YA MUUNGANO WA TANZANIA
WAZARA YA LUENZI, UCHUKUZI NA HAVANILIANO
MAJALAKA YA HALLI YA HIRWA TANZANIA**

Simu: 255 22 2460733/2460706
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Barua pepe: met@met.go.tz
Tovuti: www.met.go.tz


Chapishaji la bahari la asili:
Kundi No: TMA-1622 06 Juni, 2016

Taarifa kwa Umma: Urepeji mkali wa mawimbi makubwa vintarajwa katika mwanoo wa shamba wa Pwani.

Faraghi No.	201606-03
Mwaka wa Katiwa	06 Juni 2016
Mwaka wa Katiwa	06 Juni 2016
Tarehe	07 Juni, 2016
Tarehe	09 Juni, 2016
Siku ya Katiwa	Urepeji mkali unatoitaki kati ya kuu 60 kwa saa na mawimbi makubwa yanayotaki mika 2.0.
Kiwango cha uhakika	Wakati (70%)
Mwanoo wa Katiwa	Uvumbuzi wa mlima ya Tanga, Pwani, Lindi, Mwanoo, Uru wa vikoko vya mlima ya Uru ya Uru na Pwani.
Mawimbi	Mawimbi wa urepeji wa Katiwa unatoitaki kuwa na nguzunguzi mkubwa wa hewa katika Pwani ya Afrika Mashariki.
Ingali	Wakati wa bahari na wakati wa mwanoo wa kikuu wakati wa bahari na wakati wa kikuu.
Mawimbi ya Halli ya Hirwa	Mawimbi ya Halli ya Hirwa unatoitaki kuhusishwa katika Halli ya Hirwa ambapo Halli unatoitaki.
Mawimbi ya Halli ya Hirwa	Mawimbi ya Halli ya Hirwa unatoitaki kuhusishwa katika Halli ya Hirwa ambapo Halli unatoitaki.

Inshikwa na Mawimbi ya Halli ya Hirwa Tanzania.

Regional
Gov't/Red Cross




Tuesday 7th Jun 2016		Min 22°C Max 32°C
Wednesday 8th Jun 2016		Min 22°C Max 29°C
Thursday 9th Jun 2016		Min 21°C Max 30°C
Friday 10th Jun 2016		Min 19°C Max 32°C
Saturday 11th Jun 2016		Min 21°C Max 30°C

Climate | Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO | Region: Ethiopia

Spatially Average Over: gridpoint | Season: Nov-Jan | Tercile: Dry | ENSO State: La Niña

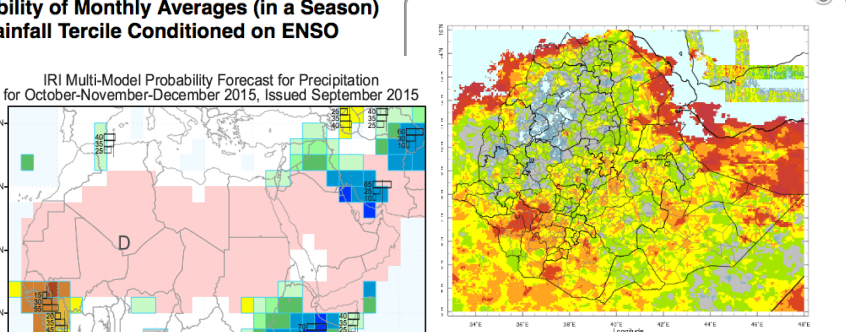
Description | Dataset Documentation | Instructions | Contact Us

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

This map shows the IRI Multi-Model Probability Forecast for Precipitation for October-November-December 2015, issued September 2015.

Here, the Niño index is based on 5°N. A consecutive 0.45°C (temperature) increase in the equatorial Pacific has led to a decrease in rainfall over the region.

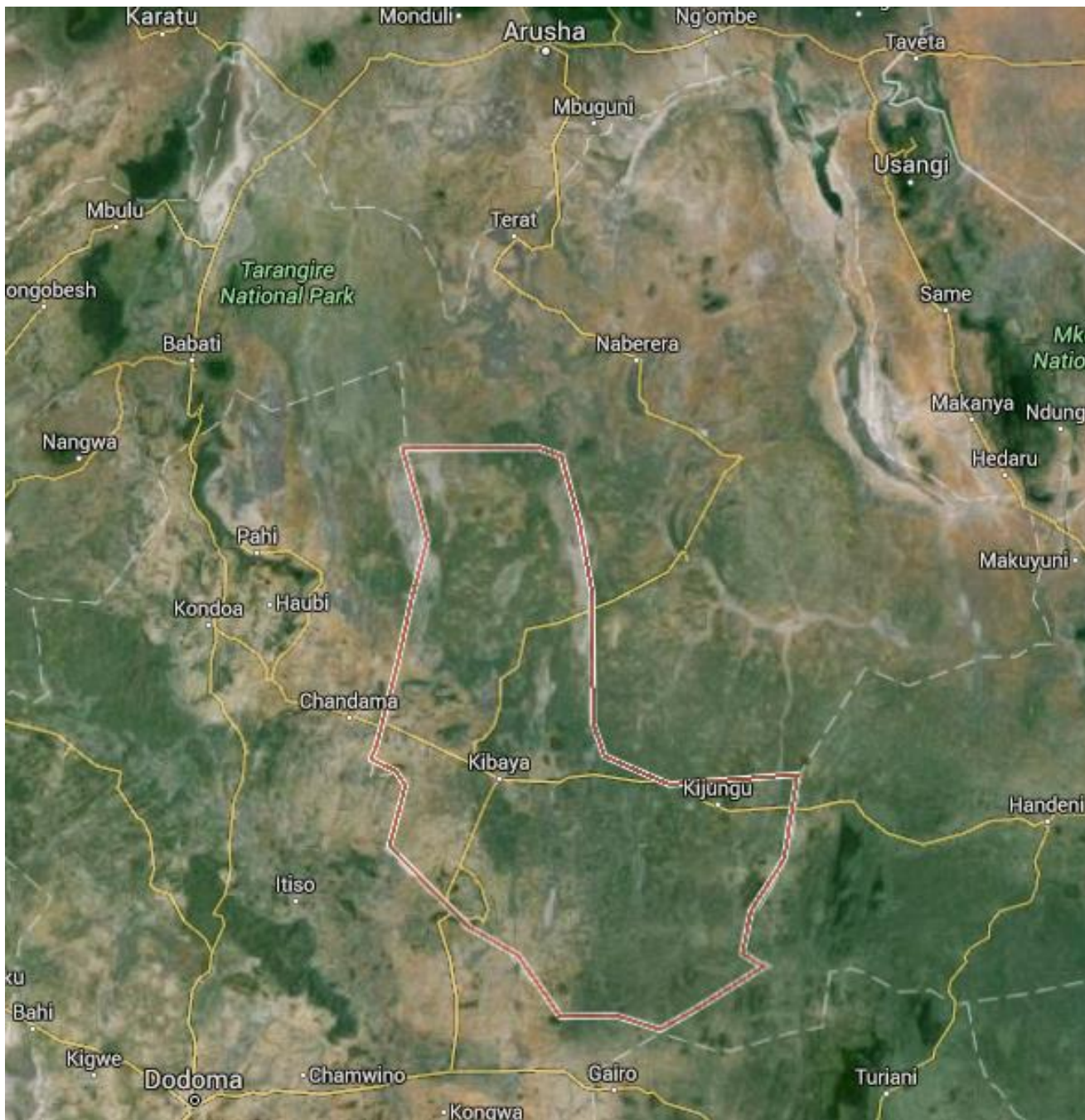
Clicking on the map will allow you to view the rainfall data for that location.



Key: The likelihood of normal precipitation is indicated by the color scale. Probabilities over land have been smoothed to avoid local probabilities.

Probability (%) of Most Likely Category

Below-Normal	Normal	Above-Normal
45 50 60 70	40	40 45 50 60 70





**JAMHURI YA MUUNGANO WA TANZANIA
WAZARA YA KUENZELI KIBUKUZI NA HAWANI LINDO
MAMLAKA YA BALE YA BEWA TANZANIA**

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Chapishaji kadhaa kadhaa:
Kumb. No. TMA-1822 06 Juni, 2016

Taarifa kwa Umama: Ujuzi mkali wa mawimbi makubwa vitarajiwa katika mwenzi wa shamba wa Pwani.

Faiziye No.	201606-03
Milaka wa Kaulimbi	06 Juni Saa 10:00 Alaiti
Milaka za Faiziye	Tahadhari
Kaulimbi	07 Juni, 2016
Tarjuma	09 Juni, 2016
Waziye ya Kaulimbi	09 Juni, 2016
Kaulimbi zilizotajwa	Ujuzi mkali unawidhi kaulimbi za kwanza kwa sasa na mawimbi makubwa yanayotajwa mika 2.0.
Kaulimbi zilizotajwa	Wakati (7:00)
Mawimbi yanayotajwa	Uwimbi wa mlima ya Tanga, Pwani, Lindo, Mwanzi, Uru wa ukweli pamoja na enzi ya Unga na Pwani.
Makubwa wa upaji wa Kaulimbi	Makubwa wa upaji wa Kaulimbi unawidhi kuwa nguzunguzo makubwa wa kwanza katika Pwani ya Afrika Mashariki.
Mawimbi	Wakati wa kuhari na Wikati wa mwanzi njwani wamuhaririwa kaulimbi tahadhari na hatua dhidi.
Mawimbi ya Ziada	Mawimbi ya Hali ya Hewa inawidhi kuhariri hali kati na hatua amara kati idha idha idha.

Inawidhiwa na
Mamlaka ya Hali ya Hewa Tanzania.

Researchers to (with) MET

Regional Gov't/Red Cross



Maproom Climate

Climate Forecast

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

Region: Ethiopia

Spatially Average Over: gridpoint

Season: Nov-Jan

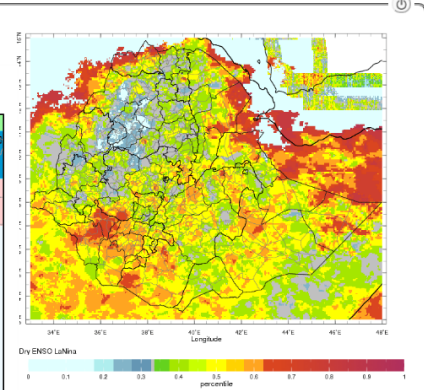
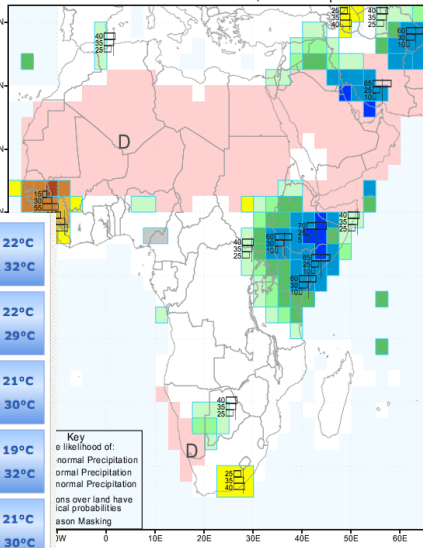
Tercile: Dry

ENSO State: La Niña

Description Dataset Documentation Instructions Contact Us

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

This map shows the IRI Multi-Model Probability Forecast for Precipitation for October-November-December 2015, issued September 2015. Here, the Niño index is based on 5°N. A consecutive 0.45°C (temp) increase in the Niño index is the same as a 0.45°C (temp) increase in the Niño index.



Tuesday 7th Jun 2016	☁️	Min 22°C Max 32°C
Wednesday 8th Jun 2016	☀️	Min 22°C Max 29°C
Thursday 9th Jun 2016	☀️	Min 21°C Max 30°C
Friday 10th Jun 2016	☀️	Min 19°C Max 32°C
Saturday 11th Jun 2016	☀️	Min 21°C Max 30°C



Local Gov't





**JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA UENZI, UCHUKUZI NA HAVANLIANO
MAMLAKA YA HAI YA HWA TANZANIA**

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Tovuti: www.met.go.tz

Chapishaji kutishaji mabali:
Kush. No. TMA-1822 06 Juni, 2016

S.L.P. 3006
DAR ES SALAAM

Taarifa kwa Umama: Upepo mkali wa mawimbi makubwa vintarajwa katika mwanoo wa shamba wa Pwani.

Faiziye No.	201606-03
Milaka wa Kaulimbi	06 Juni Saa 10:00 Alasani
Maa ya Afrika Mashariki	Tahadhari
Chungu la Faiziye	Kaulimbi
Tarehe	07 Juni, 2016
Mwaka	09 Juni, 2016
Tarehe	09 Juni, 2016
Ma ya Kauli	Upepo mkali unatakiwa kuu ya kati 40 kwa saa na mawimbi makubwa yanayotakiwa mita 2.0.
Kiwango cha shahika	Wakati (70%)
Mwanoo yanayomruvika	Uwanoo wa mlima ya Tanga, Pwani, Lindi, Mwanoo, Uru wa ukamba pamoja na eneo ya Unga na Pwani.
Makubwa wa upopo wa Kauli unatakiwa ku upopo wa nguzunguzo mkubwa wa kawa katika Pwani ya Afrika Mashariki.	
Mawimbi:	Wanawimbi wa bahari wa Wakati wa mwanoo njwa wamuhimbiwa kuchukua tahadhari na hatia mkali.
Mawimbi ya Ziada	Mawimbi ya Hali ya Hwa inamuhimbiwa kuhimbiwa hali hii na hatia amara hii itakayafika.
Inshikwa na	Mwanibwa ya Hali ya Hwa Tanzania.



Researchers to (with) MET

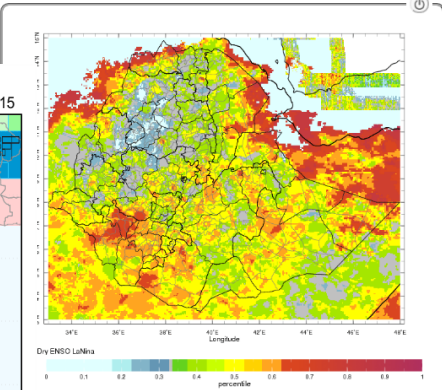
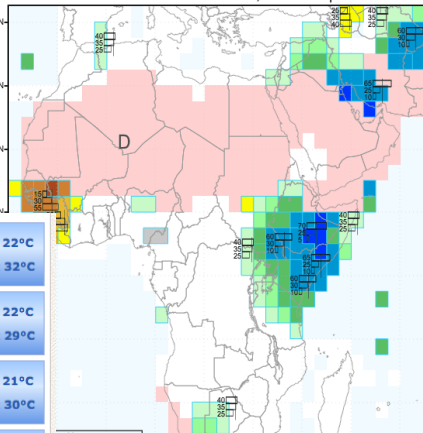
Regional Gov't/Red Cross

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Thursday 9th Jun 2016		Min 21°C Max 30°C
Friday 10th Jun 2016		Min 19°C Max 32°C
Saturday 11th Jun 2016		Min 21°C Max 30°C

Maproom Climate
 Spatially Average Over: gridpoint
 Season: Nov-Jan
 Tercile: Dry
 ENSO State: La Niña
 Region: Ethiopia

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

IRI Multi-Model Probability Forecast for Precipitation for October-November-December 2015, Issued September 2015



This map shows the probability of monthly averages (in a season) rainfall tercile conditioned on ENSO. Here, the Niño index is based on 5°N. A consecutive 0.45°C (temperature) increase in the Niño index is associated with a 0.45°C (temperature) increase in the Niño index.

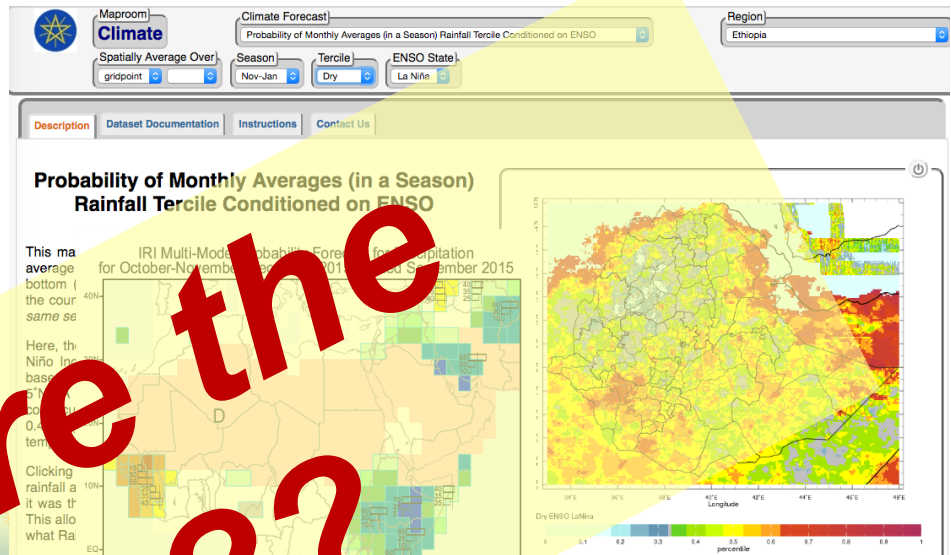
Local Gov't



Community Action



Researchers
to (with) MET



Regional
Gov't/Red Cross

Who are the users??

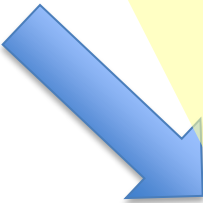
Taariikh: 09 Jun 2016
Umoogaya taariikhda: 09 Jun 2016
Kumb. No.: TMA/1822

Taariikh iyo Umoogaya: Ujoojo makiil oo maawinbi makubwa siinatarajawa katiba mamee ya shanda wa Pasaal.

Faarjiid. No.	201606-03
Miladka wa Farjiidka	09 Jun 2016 10:00 Alaxari
Shaxda iyo Farjiidka	Tahaabur
Kaawaha	07 Jun 2016
Tarjaha	09 Jun 2016



Local Gov't



Community
Action



Part 1: What comes first?





**JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA KUENZELI CHUKUZI NA HAWANIANO
MAMBAKA YA HAI YA HIRWA TANZANIA**

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FAX: 255 22 2460715/2460700
Email: info@met.go.tz
Website: www.met.go.tz

Chapishaji katibziti mabiki:
Kush. No. TMA-1822 06 Juni, 2016

Taarifa kwa Umma: Upepo mkali na mawimbi makubwa vitarajiwa katika mwanja ya shamba wa Pwani.

Faiziye No.	201606-01
Milaka wa Kaulimbi	06 Juni Saa 10:00 Alaiati
Milaka ya Mshauri	Tahadhari
Kaulimbi	07 Juni, 2016
Tarbuhi	09 Juni, 2016
Mwaka	09 Juni, 2016
Waka	09 Juni, 2016
Waka	09 Juni, 2016
Waka	09 Juni, 2016



Researchers to (with) MET

Regional Gov't/Red Cross

Local Gov't/Red Cross



Community Action

Maproom | Climate | Climate Forecast | Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO | Region | Ethiopia

Spatially Average Over | Season | Tercile | ENSO State

gridpoint | Nov-Jan | Dry | La Niña

Description | Dataset Documentation | Instructions | Contact Us

Probability of Monthly Averages (in a Season) Rainfall Tercile Conditioned on ENSO

This map shows the IRI Multi-Model Probability Forecast for Precipitation for October-November-December 2015, issued September 2015. The map displays the probability of monthly averages (in a season) rainfall tercile conditioned on ENSO. The color scale ranges from 0% (blue) to 100% (red). The map shows a high probability of above-normal rainfall (red and orange) over the central and eastern parts of Ethiopia, and a low probability (blue and green) over the western and southern parts.

Here, the probability of above-normal rainfall (red and orange) is high, indicating a high probability of above-normal rainfall (red and orange) over the central and eastern parts of Ethiopia, and a low probability (blue and green) over the western and southern parts.

Clicking rainfall a it was th this allo what Ra

Tuesday 7th Jun 2016		Min 22°C Max 32°C
Wednesday 8th Jun 2016		Min 22°C Max 29°C
Thursday		Min 21°C





Κέντρο Υγείας
Επικοινωνία
Τηλέφωνο
Επείγουσα
Επείγουσα

Κέντρο Υγείας
Επικοινωνία
Τηλέφωνο
Επείγουσα
Επείγουσα

Επικοινωνία
Τηλέφωνο
Επείγουσα
Επείγουσα



- Action
 - Length of time to prepare
 - How to execute the action
 - Reality in the community
 - Local culture








Small notice or document posted on the wall.

KIMA Map Room

The climate and health response is a collection of maps and other figures that monitor climate and health conditions at present and in the recent past. The maps and figures can be manipulated and are linked to the original data. Even if you are currently interested in data about your location, there is a good chance to see which regions are particularly suited for monitoring climate conditions.

Climate

Historical, current and forecast climate conditions across the country.



Climate and Health

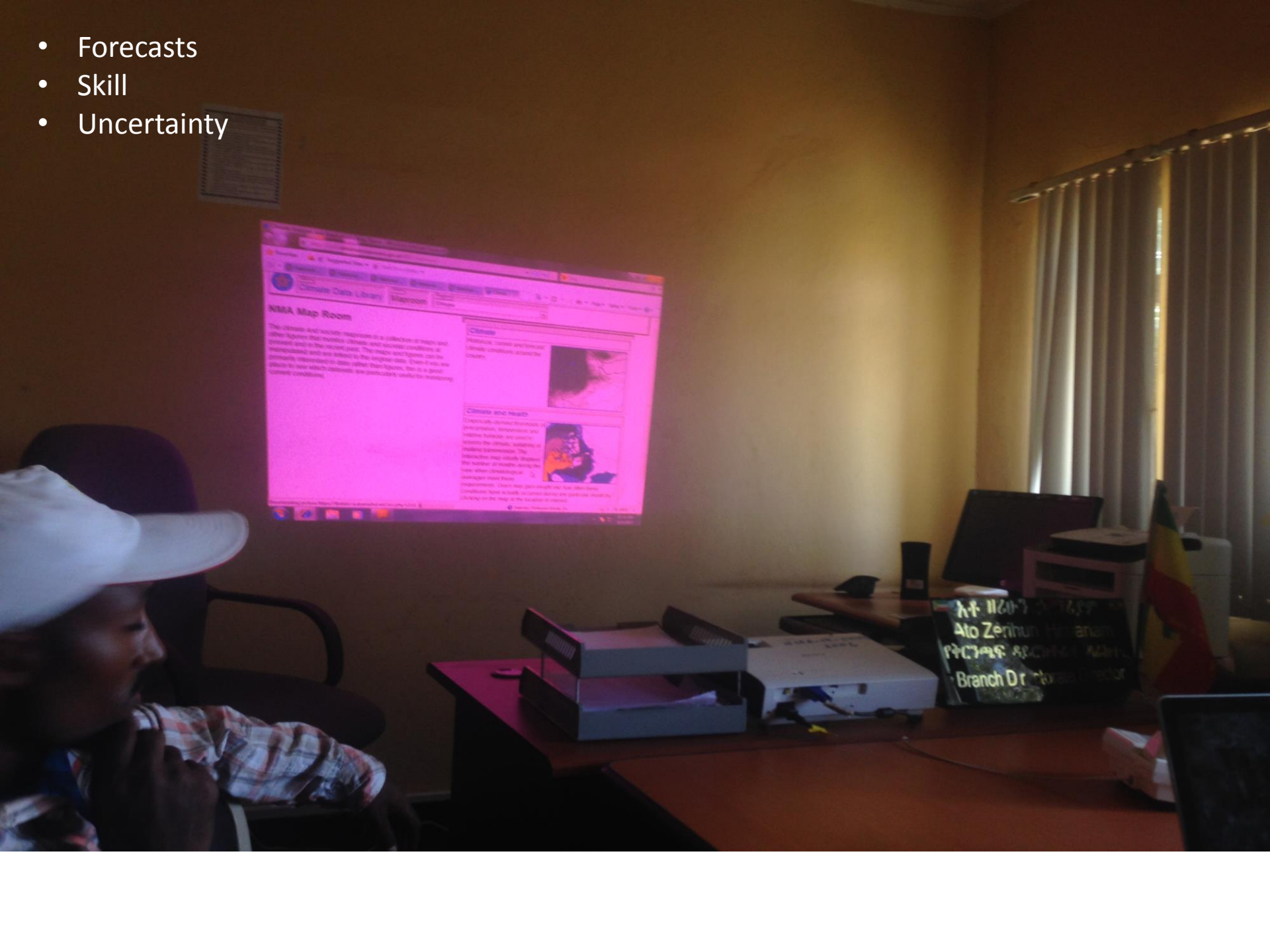
A map of Ethiopia showing the distribution of climate and health conditions. The map is interactive and can be used to explore the climate and health conditions in different regions. The interactive map shows the number of people living in each region and the number of people living in each region who are affected by climate change. The map also shows the number of people living in each region who are affected by climate change.



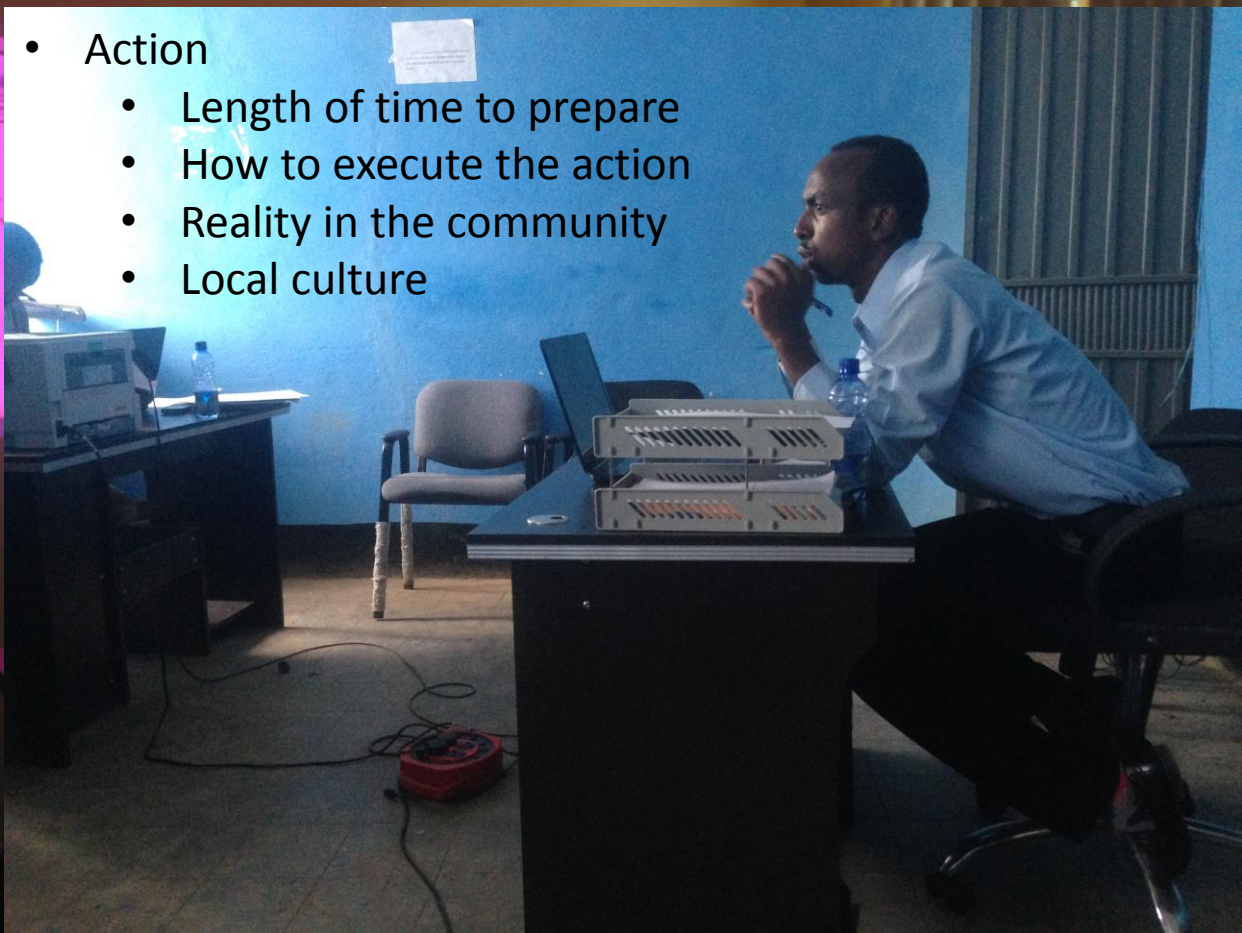
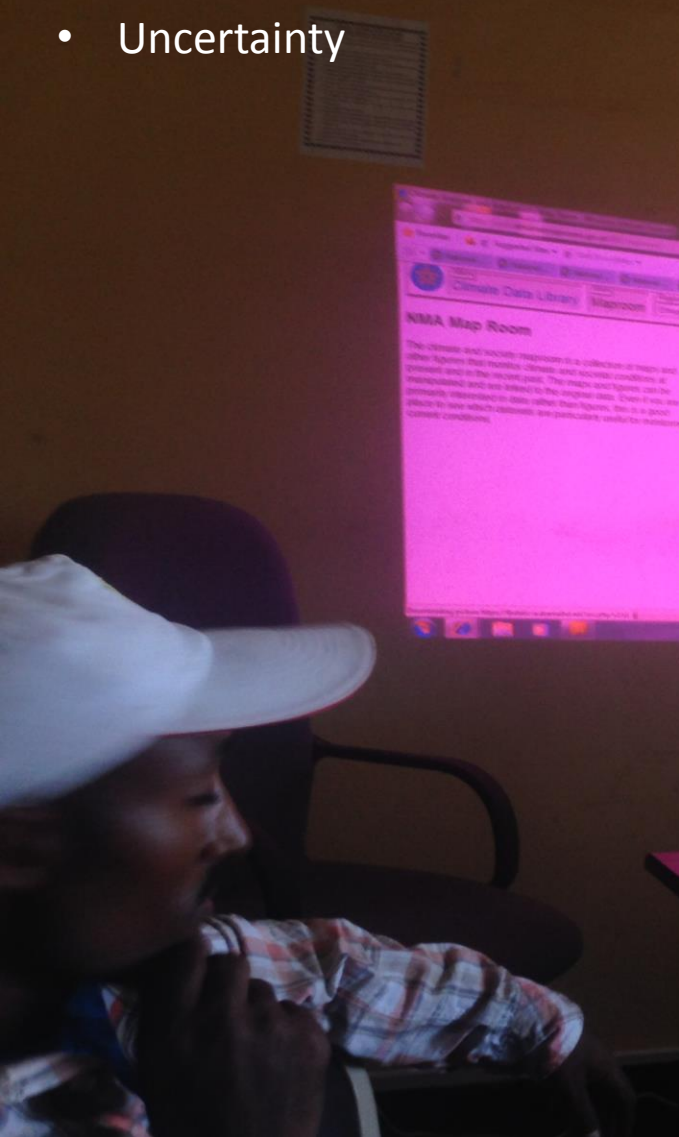
አቶ ዘርዘር ገብረመስቀል
Ato Zerihun Gebremeskel
የፖለቲካ ምክርቤት ማኅበር
Branch Director



- Forecasts
- Skill
- Uncertainty

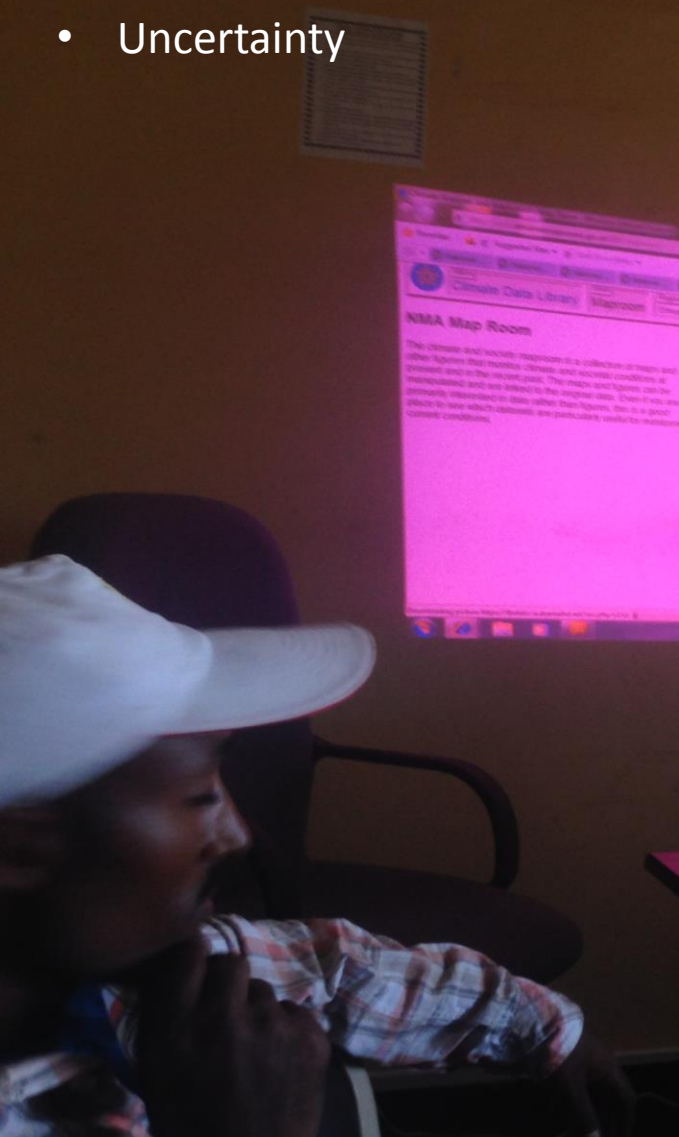


- Forecasts
- Skill
- Uncertainty



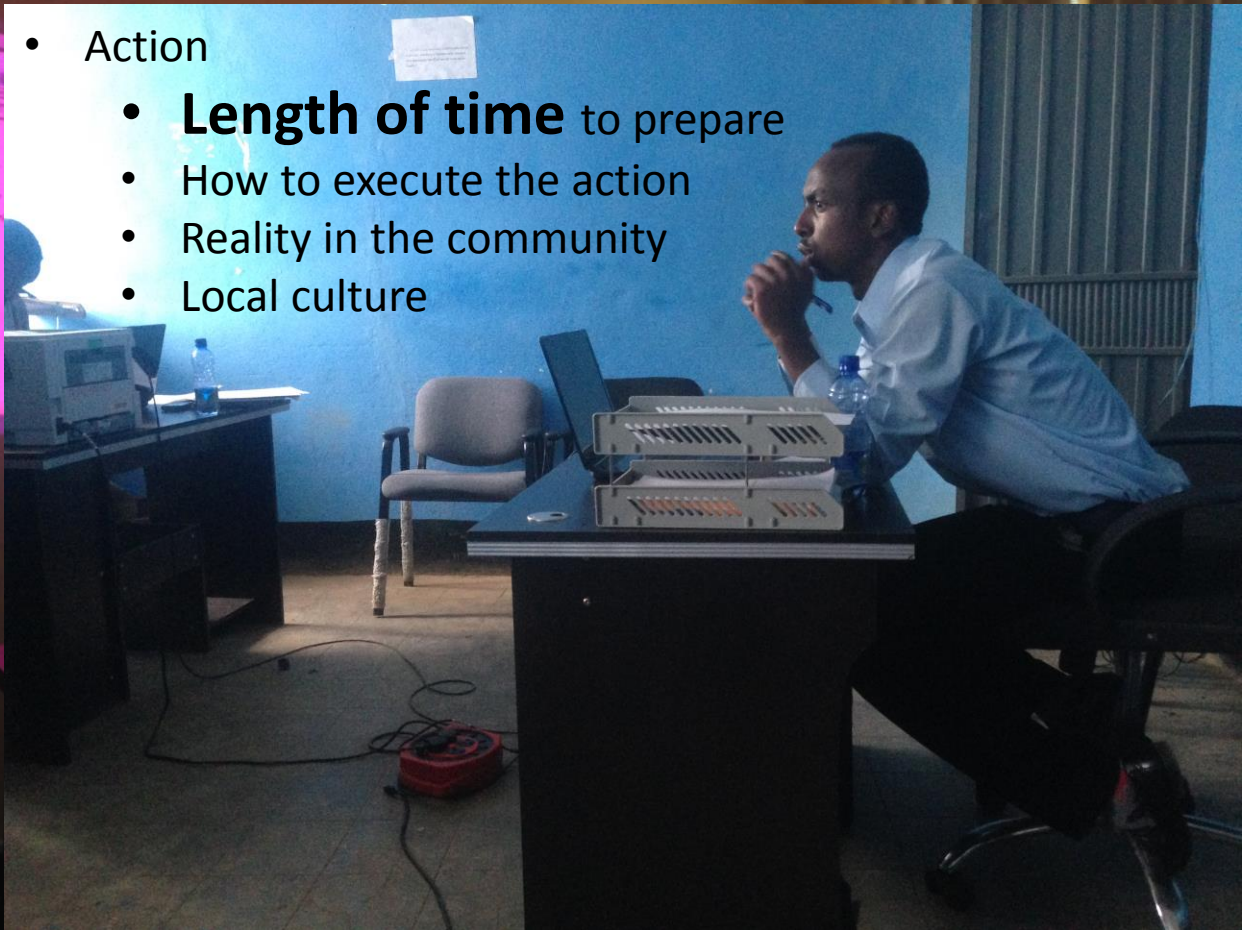
- Action
 - Length of time to prepare
 - How to execute the action
 - Reality in the community
 - Local culture

- Forecasts
- Skill
- Uncertainty



- Action

- **Length of time** to prepare
- How to execute the action
- Reality in the community
- Local culture





Warning for strong winds and large waves/Tahadhari ya Jun 06

upepo mkali na mawimbi makubwa 07-09/06/2016.

From: [tma cfo](#)

To: [cmsangi@yahoo.com](#) [Ewald bonifasi](#) [fanosbert@yahoo.com](#)

[godfridaclement@yahoo.com](#) [kazimilistephen@yahoo.com](#)

[konyonanai@pmo.go.tz](#) [turuka@yahoo.com](#) [carockilembe@yahoo.com](#)

[agnes.kijazi](#) [massytambwe@gmail.com](#) [ndungu karemeri](#)

[DMintern Africa](#) [Renus Mkaruka](#) [Andrew Kruczkiewicz](#)

[Geofrey M...](#) [Joseph Kimaryo , Director Disaster Management](#)

[kibari2006@yahoo.com](#) [Vivaonva Snoo](#) [Jule Arrighi](#)

[arrighi@climatecentre.org](#) [joycekagaruki@yahoo.com](#)

[WARNING 06-06-2016.pdf \(113.8 KB\)](#) [Preview](#) | [Download](#) | [Briefcase](#) | [Remove](#)

[TAHADHARI 06-06-2016.pdf \(105.5 KB\)](#) [Preview](#) | [Download](#) | [Briefcase](#) | [Remove](#)

[Download all attachments](#)

[Remove all attachments](#)

Please receive the warning information on strong winds and large waves along the entire coast from 07-09/06/2016.

Tafadhali pokea taarifa ya tahadhari ya upepo mkali na mawimbi makubwa katika ukanda wote wa pwani kuanzia tarehe 07-09/06/2016.

Thank you/Ahsante

Public Weather Services Department/Kitengo cha Huduma za Hali ya Hewa kwa Umma,
Central Forecast Office/Ofisi Kuu ya Utabiri,
Tanzania Meteorological Agency/Mamlaka ya hali ya Hewa Tanzania.

JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA UJENZI, UCHUKUZI NA MAWASILIANO
MAMLAKA YA HALI YA HEWA TANZANIA

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Tovuti: www.meteo.go.tz



S.L.P. 3056
DAR ES SALAAM

Unapojibu tafadhali nakili:
Kumb. Na.: TMA/1622

06 Juni, 2016

Taarifa kwa Umma: Upepo mkali na mawimbi makubwa vinatarajiwa katika maeneo ya ukanda wa Pwani.

<i>Taarifa Na.</i>	201606-01
<i>Muda wa Kutolewa</i> <i>Saa za Afrika Mashariki</i>	06 Juni Saa 10:00 Alasiri
<i>Daraja la Taarifa:</i>	Tahadhari
<i>Kuanzia:</i> <i>Tarehe</i>	07 Juni, 2016
<i>Mpaka:</i> <i>Tarehe</i>	09 Juni, 2016
<i>Aina ya Tukio</i> <i>Linalotarajiwa</i>	Upepo mkali unaozidi kasi ya km 40 kwa saa na mawimbi makubwa yanayozidi mita 2.0.
<i>Kiwango cha uhakika:</i>	Wastani (70%)
<i>Maeneo yanayotarajiwa kuathirika</i>	Mwambao wa mikoa ya Tanga, Pwani, Lindi, Mtwara, Dar es salaam pamoja na visiwa vya Unguja na Pemba.
<i>Maelezo:</i>	Msukumo wa upepo wa Kusi unaotokana na uwepo wa mgandamizo mkubwa wa hewa katika Pwani ya Afrika Mashariki.
<i>Angalizo:</i>	Watumiaji wa bahari na Wakazi wa maeneo tajwa wanashauriwa kuchukua tahadhari na hatua stahiki.
<i>Maelezo ya Ziada</i>	Mamlaka ya Hali ya Hewa inaendelea kufuatilia hali hii na itatoa mrejeo kila itakapobidi.

Imetolewa na
Mamlaka ya Hali ya Hewa Tanzania.

Part 2: Forecast Based Financing

Actions: Who/When/Where?

Funding

Acting in vain



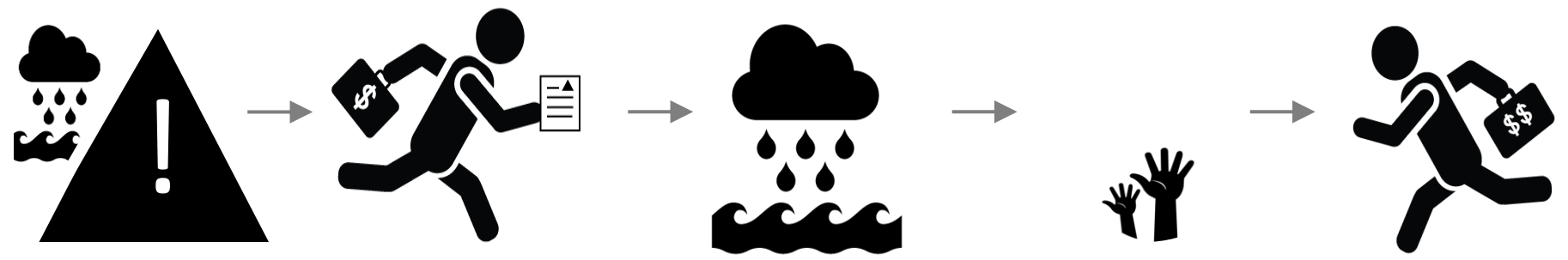
The Usual Surprise



The Usual Surprise



The Proposed Innovation



No early action



Response



Suffering

Forecast-based Financing for Preparedness Actions



Preparedness



Response



Act in Vain + Set-Up



Suffering

VS

Thresholds, Funding and Action

No early action



Response



Suffering

Forecast-based Financing for Preparedness Actions



Preparedness



Response



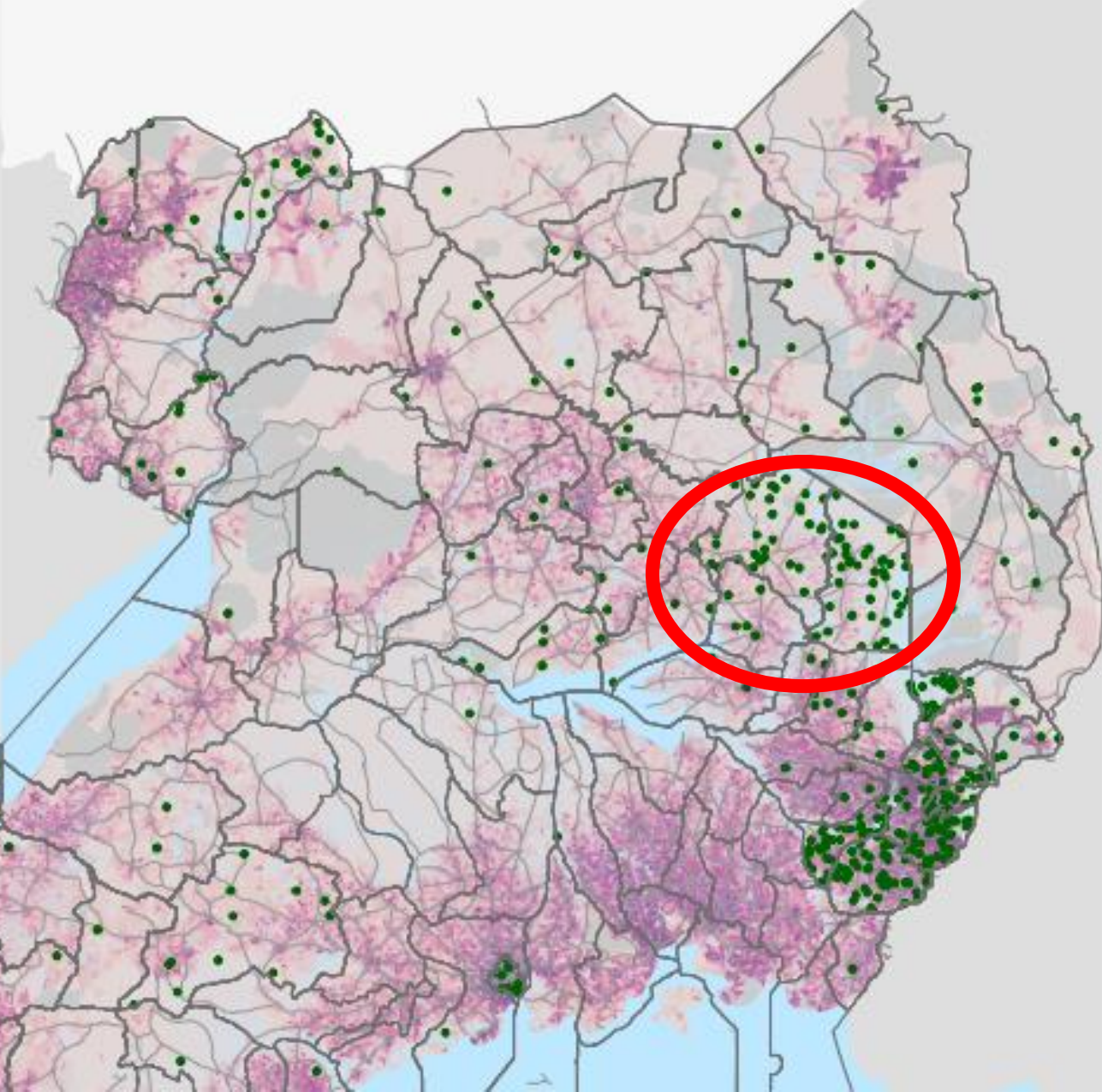
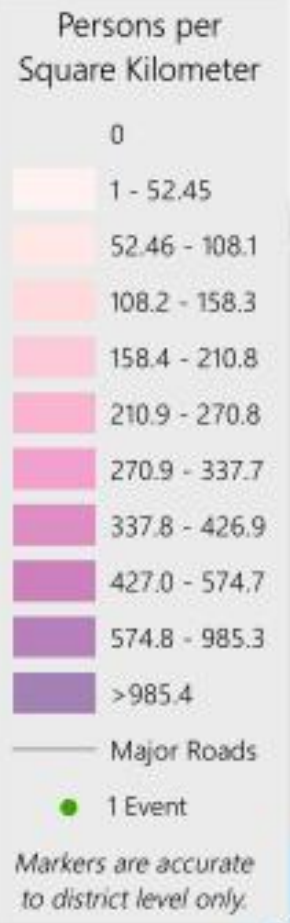
Act in Vain +
Set-Up



Suffering

VS

UGANDA MAJOR ROADS, POPULATION, AND FLOOD EVENTS (2002 - 2012)



Risk Knowledge: What is a disaster?



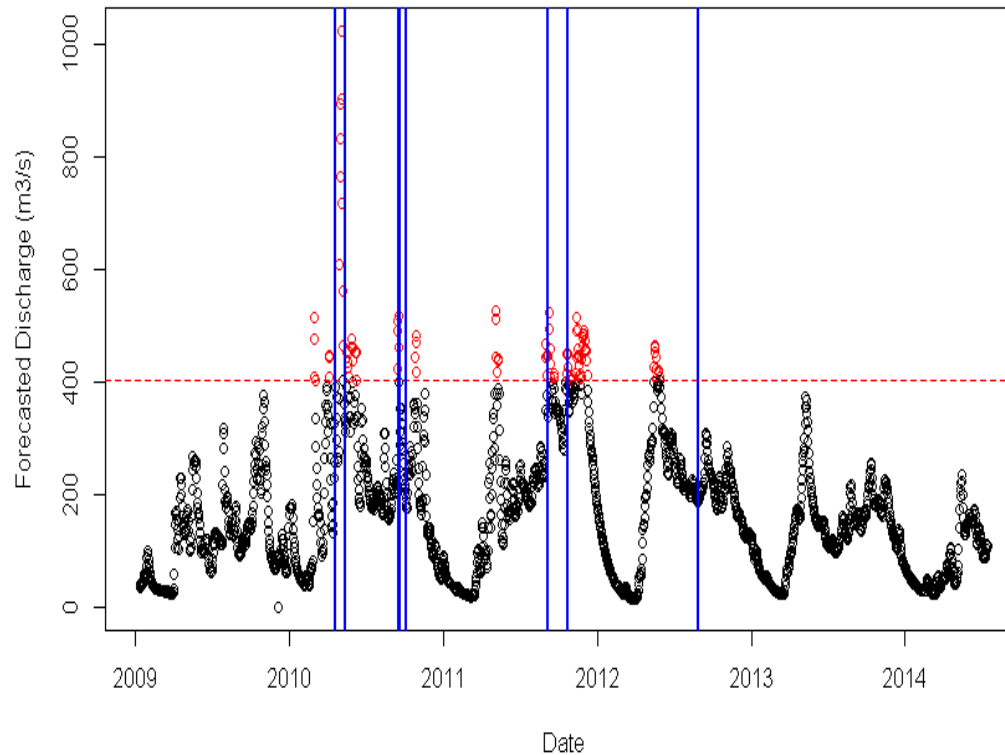
Risk Knowledge: What is a disaster?



Risk Knowledge: What is a disaster?

GLOFAS

Magoro



95th Percentile of historical daily discharge

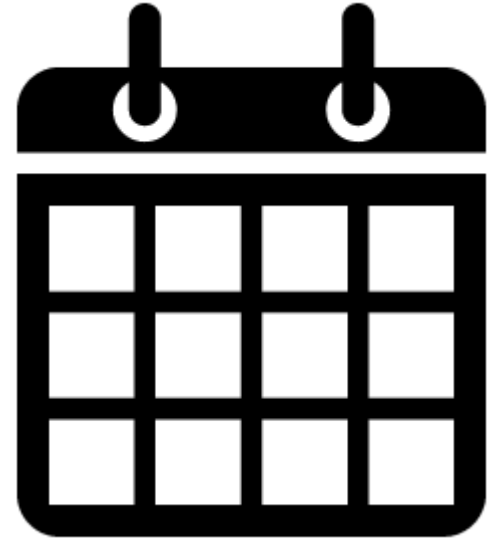
Action Option: Preposition Stocks



Action Option: Preposition Stocks

Step 1: Acquire and stock Non food Items (NFI)

- NFI kits (large)
- NFI kits (small)
- Mosquito nets
- Gum boots
- Rain suits
- Hygiene booklets
- Water purification tablets



Warning Response: Other actions to take?

Action	Time required to complete the action (lead time)
Water storage and purification: distribute jerry cans, soap, and a 30-day supply of chlorine tablets to vulnerable households	4 days
Water drainage and water source rehabilitation: clear drainage, rehabilitate broken boreholes	4 days
Food Storage: Move vulnerable items into storage facilities on high ground	7 days

Action Option: Strengthening houses



How long will it take to strengthen Houses?



3 Months

Hygiene Kits



Warning Response: Act in vain?



Warning Response: Act in vain?



50%

Possible Outcomes

	Does the extreme event materialize?	
	DISASTER	NO DISASTER
ACTION	“Worthy Action” <i>Faster response post-flood, reduced disease burden</i>	“Act in Vain” <i>Extra transport costs, reputational costs, perception</i>
INACTION	“Fail to Act” <i>Disaster</i>	“Worthy Inaction” <i>Regular day</i>

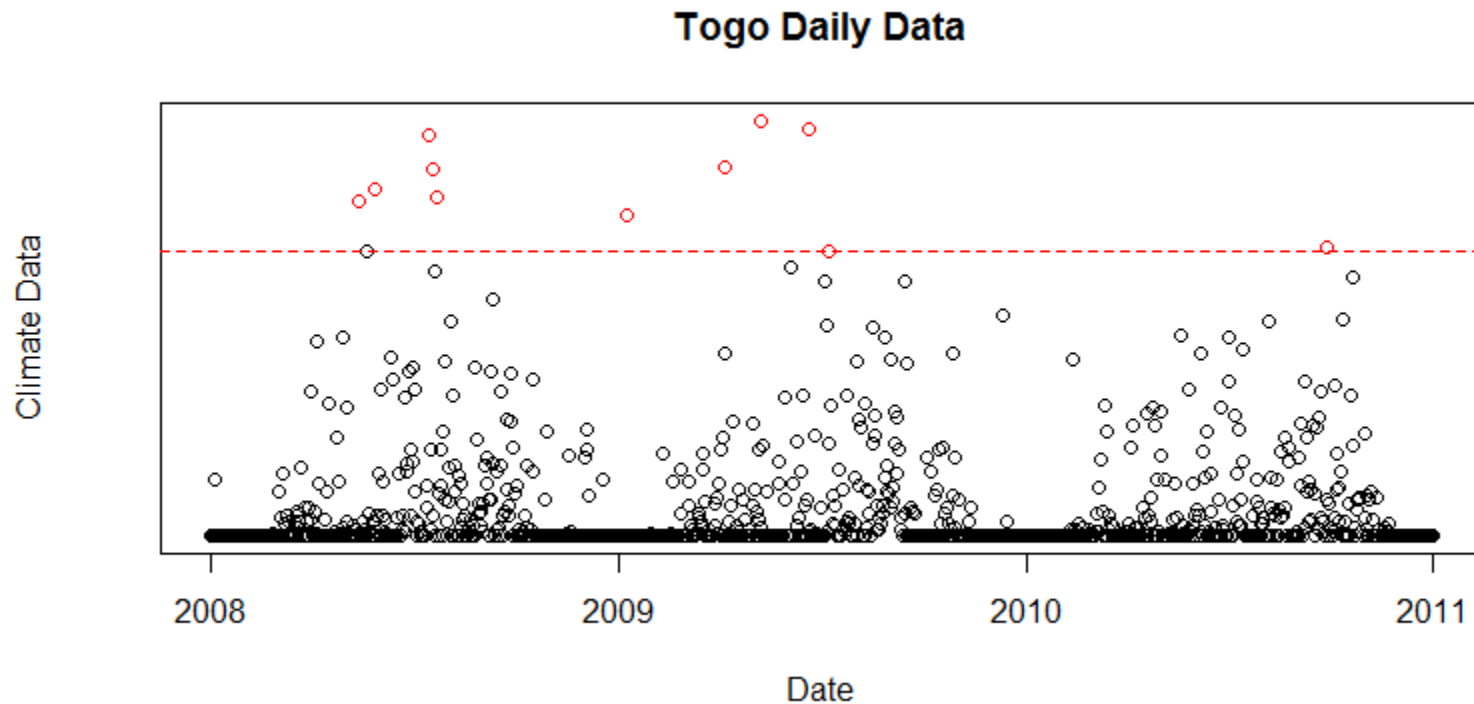
Part 3: Challenges

- Thresholds. When to act in the area of interest? Seasonality? Nodes of variability? Trend?
- Developing SOPs (Standard Operating Procedures). Reaching consensus.
- Inciting action at the community level.
- Perfect forecast = perfect action?

<https://vimeo.com/152150976>

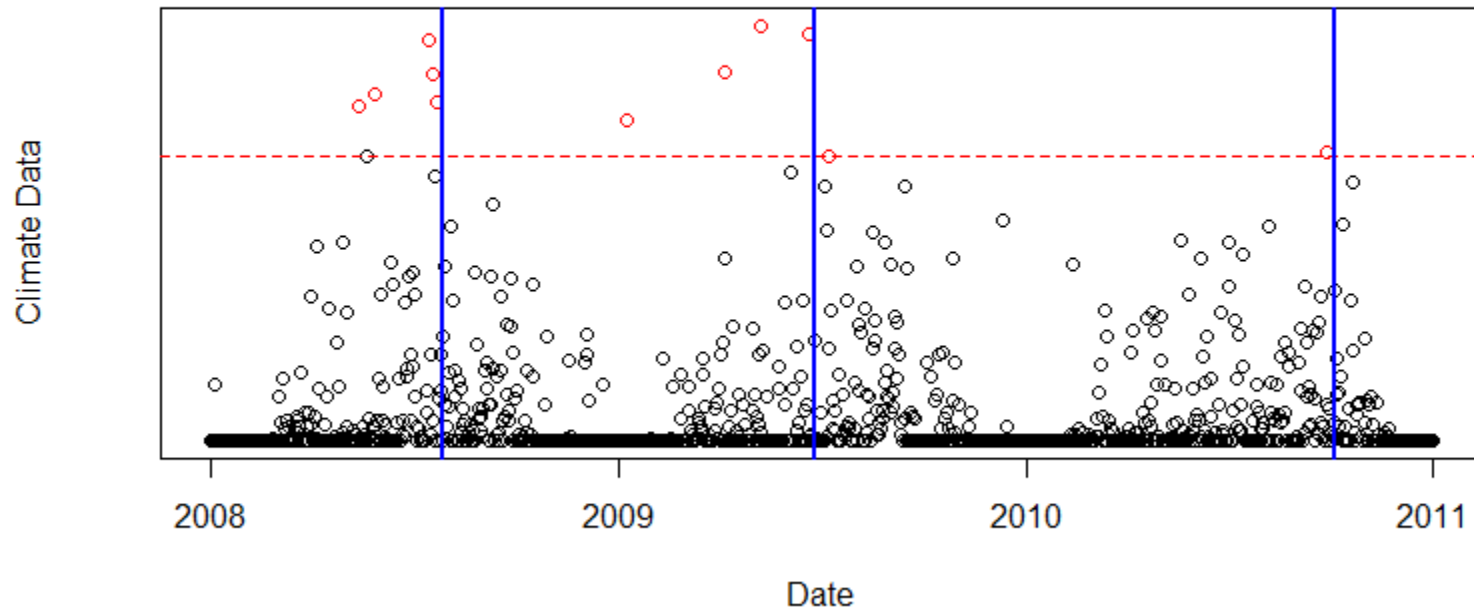
Challenges

Act if forecast \geq *threshold 1*



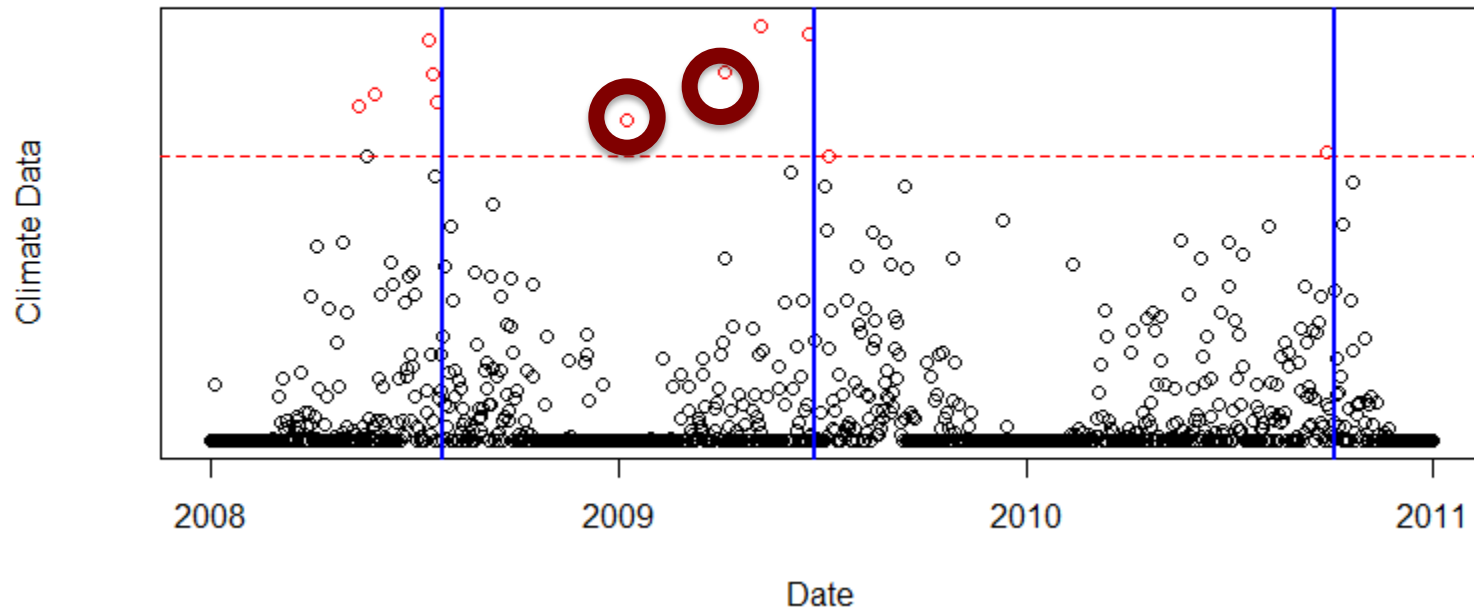
Floods!

Togo Daily Data

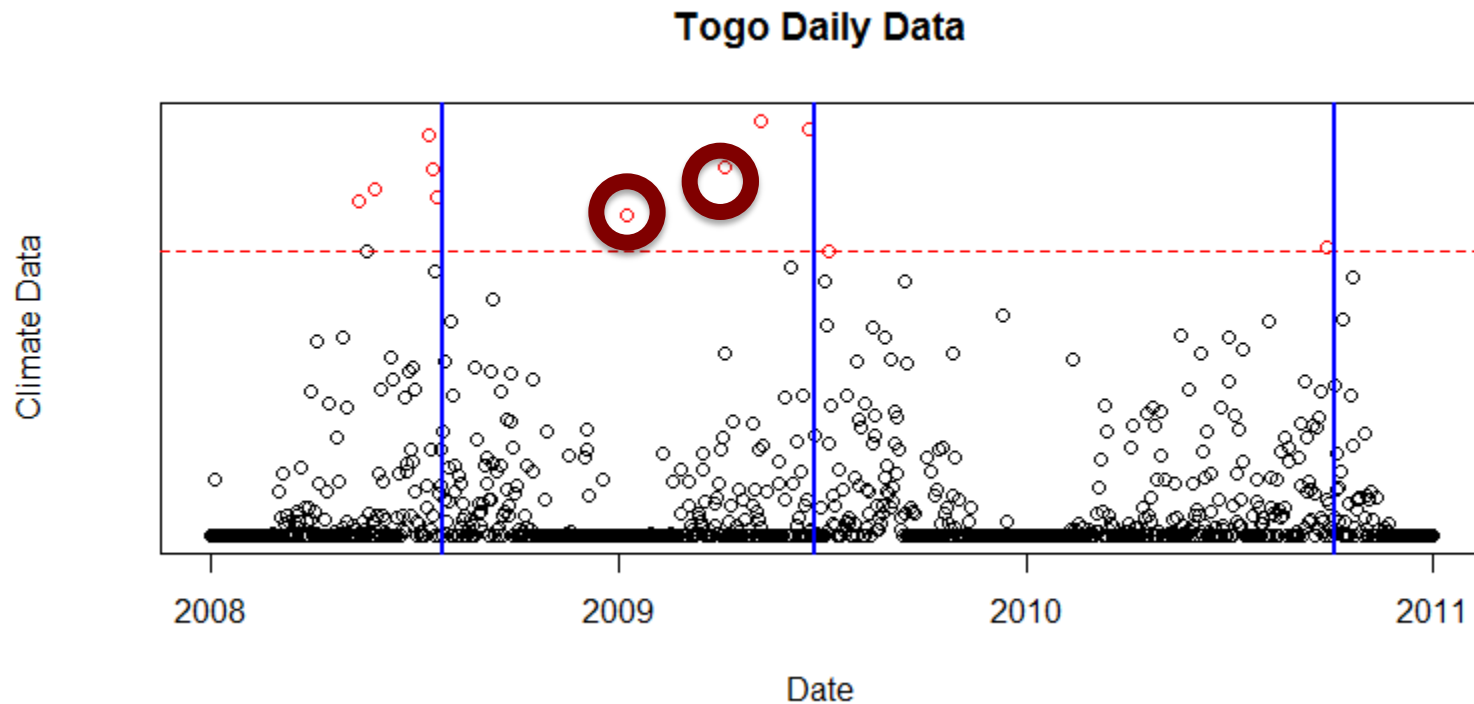


Floods!

Togo Daily Data

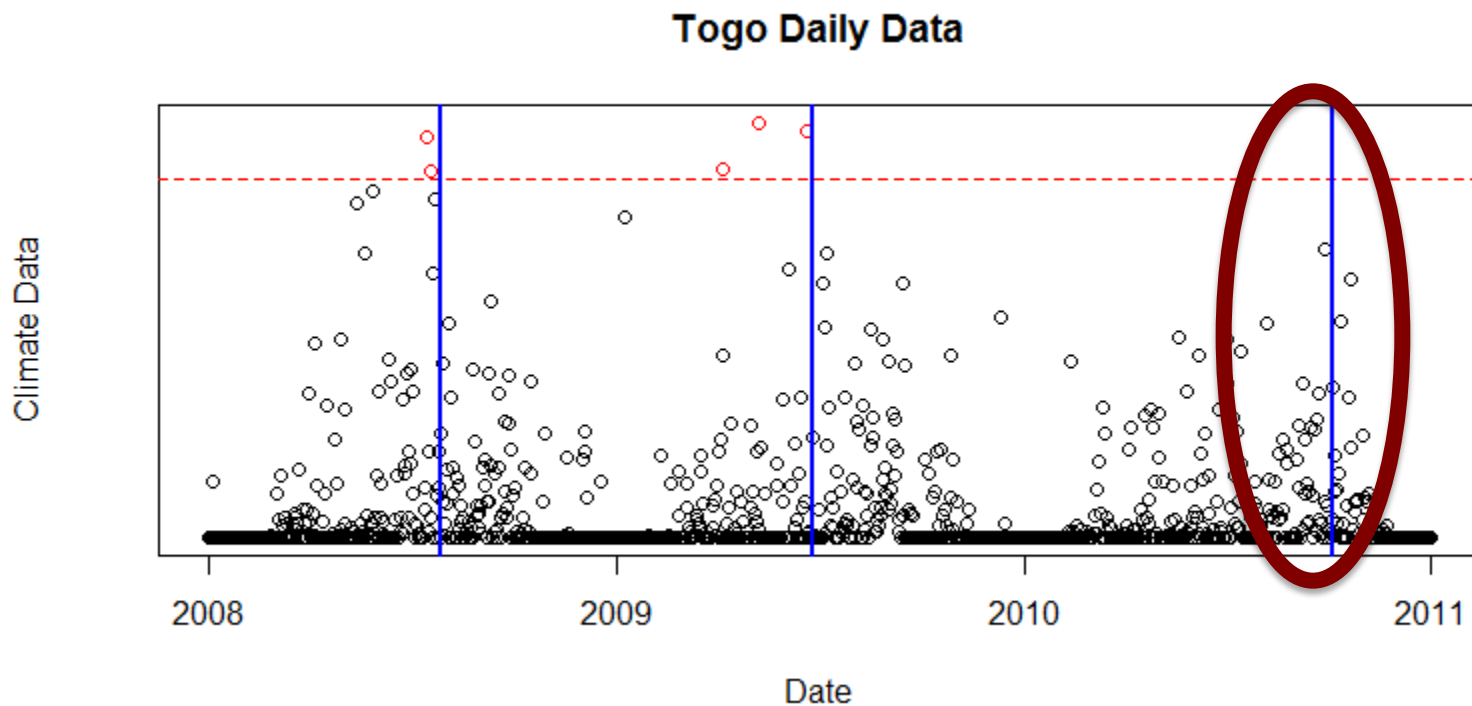


Floods!



2 False Alarms in 1 year!

Alternative *threshold 2*



Missed 1!

<https://vimeo.com/152150976>

RED CROSS/RED CRESCENT

CLIMATE CENTRE



International Federation of Red Cross and Red Crescent Societies

The Netherlands **Red Cross**



African Union
a United and Strong Africa



ISDR

International Strategy for Disaster Reduction
Africa

THE **ROCKEFELLER**
FOUNDATION



IFAD

unicef



WORLD
RESOURCES
INSTITUTE



Oxfam
America



A
Aalto University



CSAG



OPDS
Organismo Provincial
para el Desarrollo Sostenible

Stanford
University



HARVARD
HUMANITARIAN
INITIATIVE

UNFCCC



American
Red Cross



Climate & Development
Knowledge Network



THANK YOU!!!