Space-based Technologies for Disaster Management - "Risk Assessment in the Context of Global Climate Change”

Disaster Early Warning and Response Activities at RCMRD

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Regional Centre for Mapping of Resources for Development
Nairobi-Kenya

United Nations International Conference 7th – 9th November 2012
Beijing, China

1. RCMRD and its member States

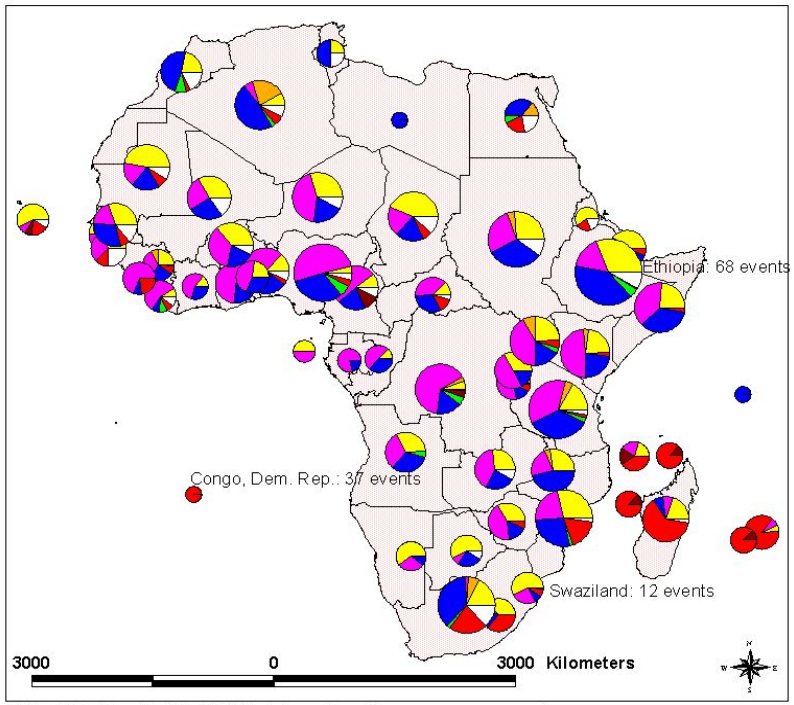
About RCMRD:

- Established in 1975 by ECA
- Intergovernmental Institution
- It is based in Nairobi-Kenya
- Currently, has 19 member States

2. RCMRD Main Activities

- Training: Geoinformation and IT applications,
- Project Services: at Local, Regional and Continental levels
- Advisory Services: mainly to member States
- Research and Development: both applied and fundamental researches
- Spatial Data: acquisition, archiving and dissemination
- ➢ Early warning and forecast: Disaster early warning (flood, famine, epidemic diseases, etc.)
- Engineering Services: Maintenance, repair and calibration of survey and mapping equipments

3. Major Disasters in the Region



Current Situation, (Ref. GARNET-E, 2012)

1. **Droughts**
2. **Flooding**
3. Landslides
4. Fire
5. Volcanic Hazards
6. Epidemic Diseases
7. Land Degradation
8. Tsunami

- **95%** of hazards are caused by droughts and flooding.
- **70%** of loss of life and **75%** of economic loss is by both

4. Disaster Early Warning At RCMRD

Early Warning Defined As:

- The provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response *(ISDR, 2006)*

- EW integrates four key elements, namely; risk knowledge, monitoring and prediction, information dissemination, and response

- Failure of any of these elements usually collapses the entire system

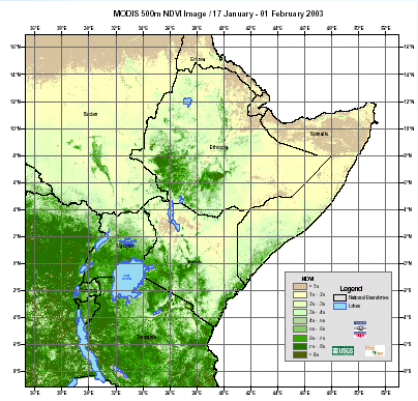
Disaster Early Warning At RCMRD…

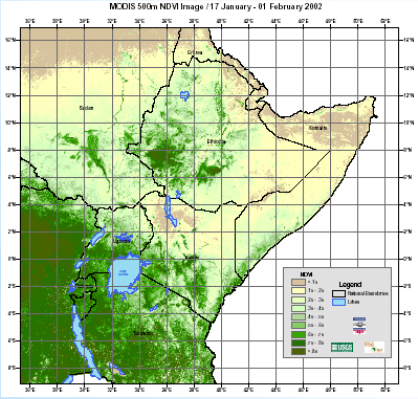
A. Drought:

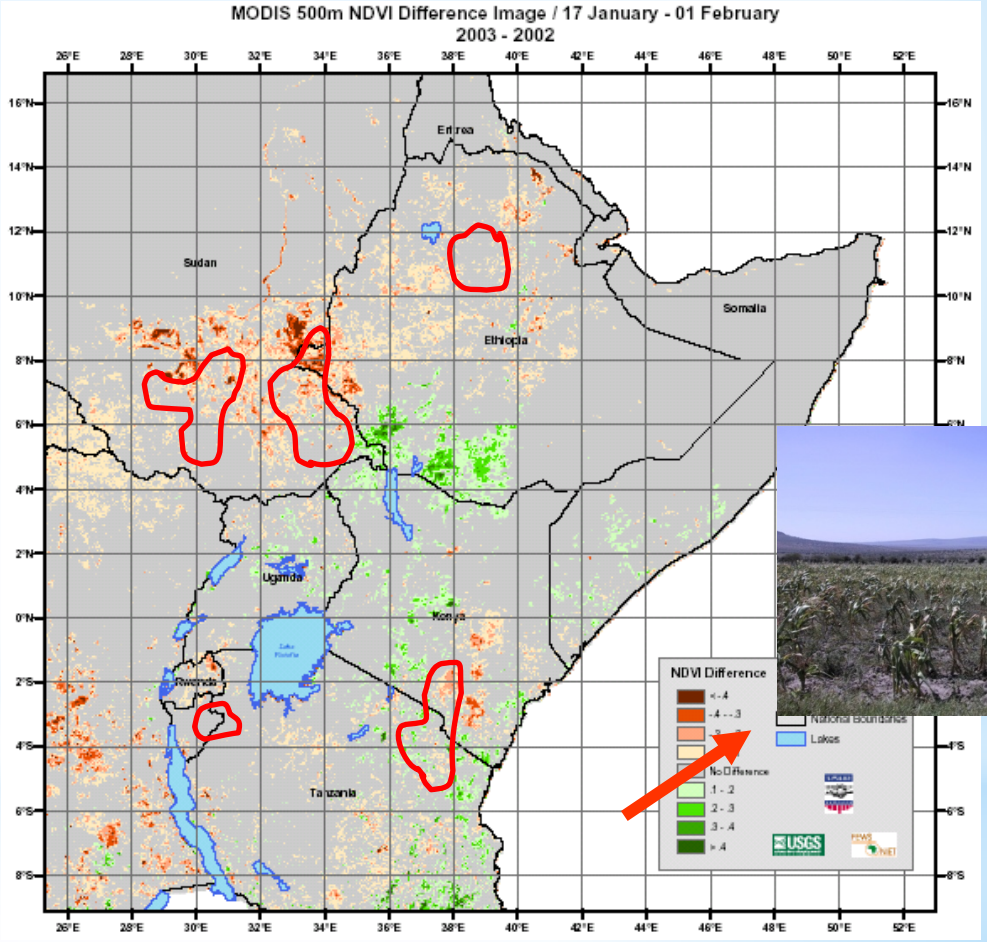
- Using the existing technologies and skills, it is possible to predict drought with lead time from weeks to seasons that may last up to four months.
- The key variables that need to be indicated in the prediction of drought are:
  - The timing (when),
  - The geographical area (where) and
  - Intensity and duration of the drought
- The indicators to be monitored are:
  - Precipitation,
  - Groundwater and reservoir levels and
  - Soil moisture.

Drought Early Warning using NDVI…

Identification of Hotspots Using EO and Climate outlook data



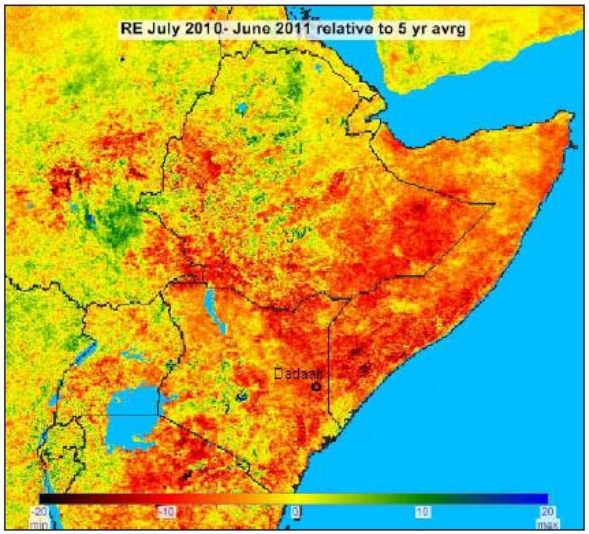




Drought Early Warning using NDVI…

2011 Drought
in the GHA

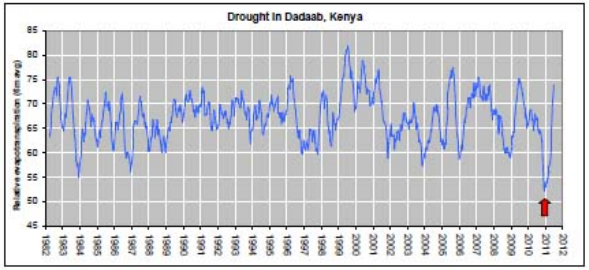
Drought in the Horn of Africa



Map shows the Meteosat derived relative evapotranspiration (RE) during a 12 month period from July 2010 to June 2011 relative to the 5 yr average. RE is a measure of water availability and plant productivity. Red colors indicate lower than average productivity due to drought. The location of the UN fugitive centre in Dadaab is indicated.

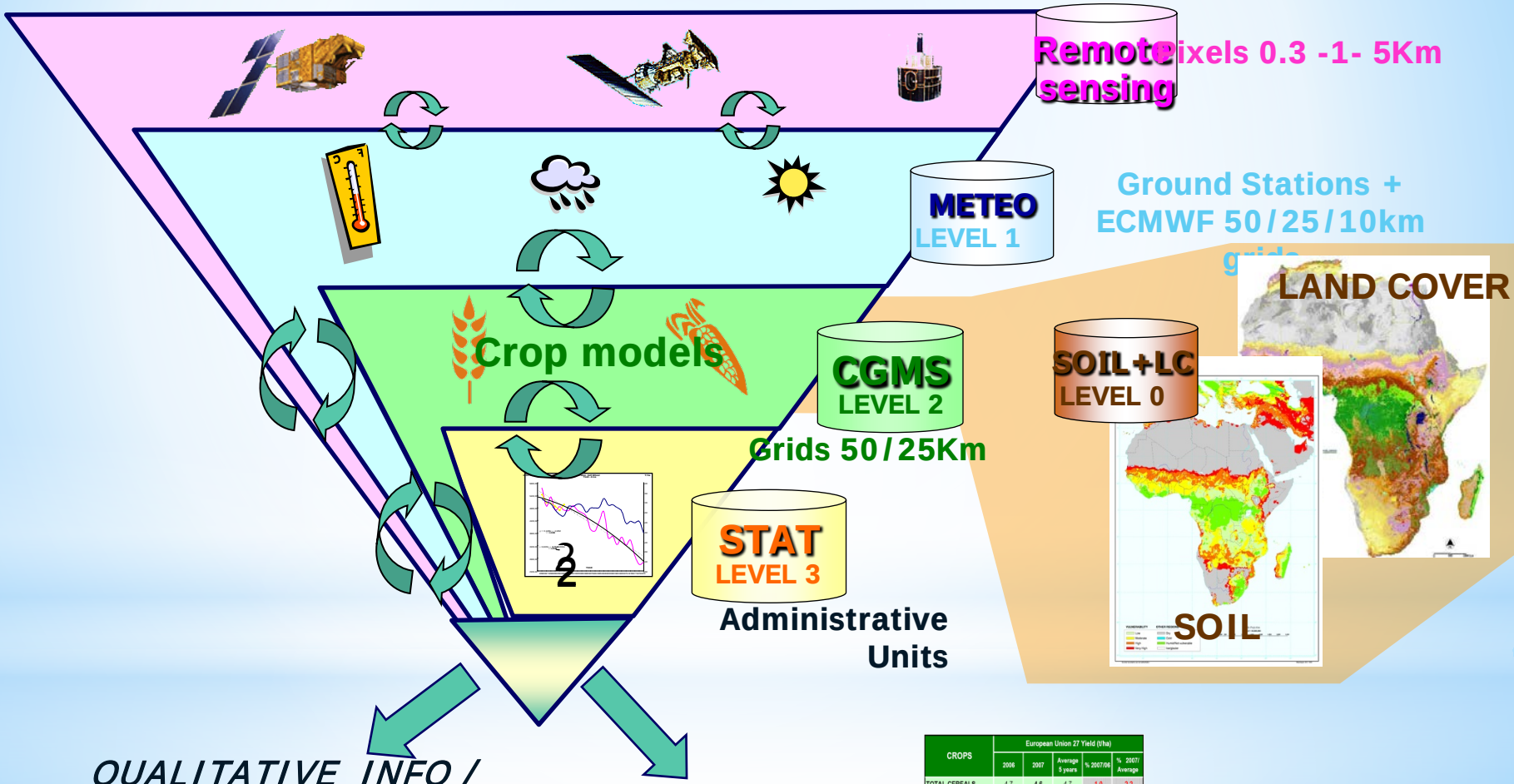
The graph below shows the course of RE during the past 29 year in an area of 30*30 km around Dadaab. The second half of 2010 and first half of 2011 are the driest period during the past 30 year.

EARS Earth Environment Monitoring BV, Delft, the Netherlands, 20 July 2011



Crop Monitoring and Yield forecast Systems

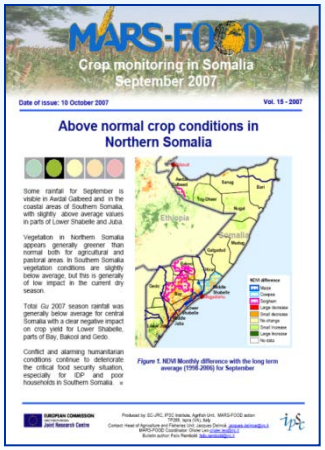
MARS Crop Growth Monitoring and Yield forecast Systems (CGMYS)

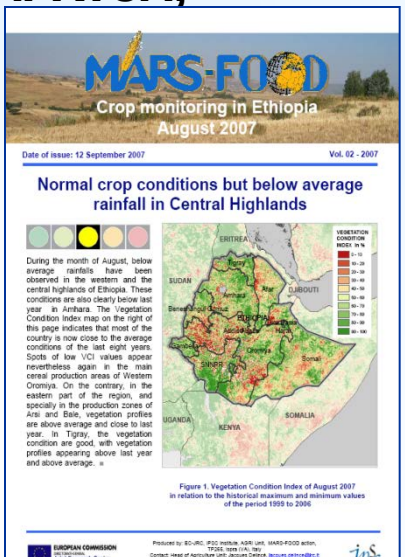


CROPS	European Union 27 Yield (t/ha)				
	2006	2007	Average 5 years	% 2007/06	% 2007/ Average
TOTAL CEREALS	4.7	4.6	4.7	-1.0	-2.2
Soft wheat	5.4	5.4	5.4	-0.3	-1.6
Durum wheat	3.0	2.9	2.7	-2.5	+9.2
[illegible]	5.1	5.1	5.1	-0.2	+0.2
Total barley	4.1	4.3	4.2	+4.6	+2.6
Grain maize	6.5	5.9	6.5	-9.1	-8.0
Other cereals (1)	2.9	2.9	3.2	+1.0	-7.2
Rape seed	3.0	2.9	3.0	-4.3	-5.1
Sunflower	1.7	1.5	1.6	-13.1	-8.3
Potato	25.3	27.3	26.6	+7.8	+2.7
Sugar beet	58.5	60.3	57.8	+3.1	+4.3

Crop Monitoring and Yield forecast Systems

Crop yeild forecast in the Horn of AFRICA, application of EO





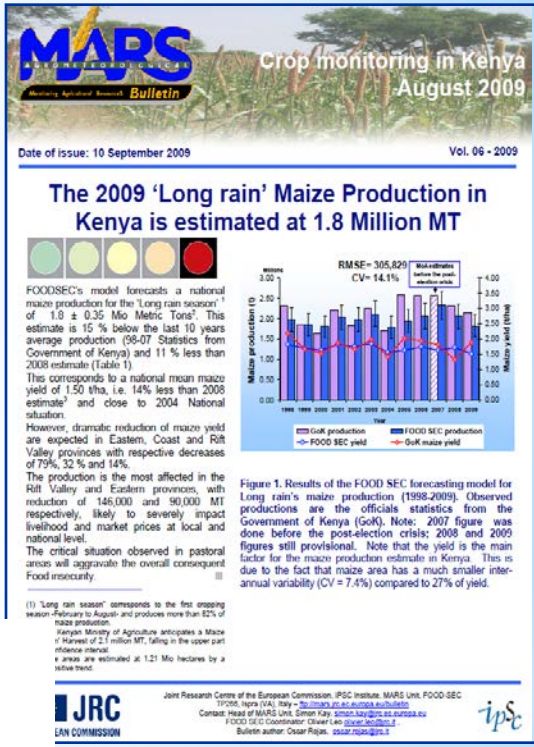


Table 1. Estimation of the National maize production during the "Long rain" crop season 2009 and comparison with the FOOD SEC 2008 estimates.

Province	Estimated yield 2009	Wf*	Estimated maize area 2009	Maize production 09 MT	Maize production 08 MT	Variation % (2009 vs 2008)	Absolute difference MT
Central	1.60	0.07	84,890	136,129	134,312	1	1,817
Coast	0.71	0.04	48,508	34,348	49,975	-31	-15,627
Eastern	0.11	0.18	218,287	24,072	114,365	-79	-90,293
Nyanza	1.61	0.13	157,652	254,402	252,361	1	2,041
Rift Valley	1.80	0.43	521,465	939,715	1,085,765	-13	-146,050
Western	2.39	0.15	181,906	435,431	418,706	4	16,725
National	**1.50**		**1,212,708**	**1,824,097**	**2,335,886**	**-22**	**-511,789**

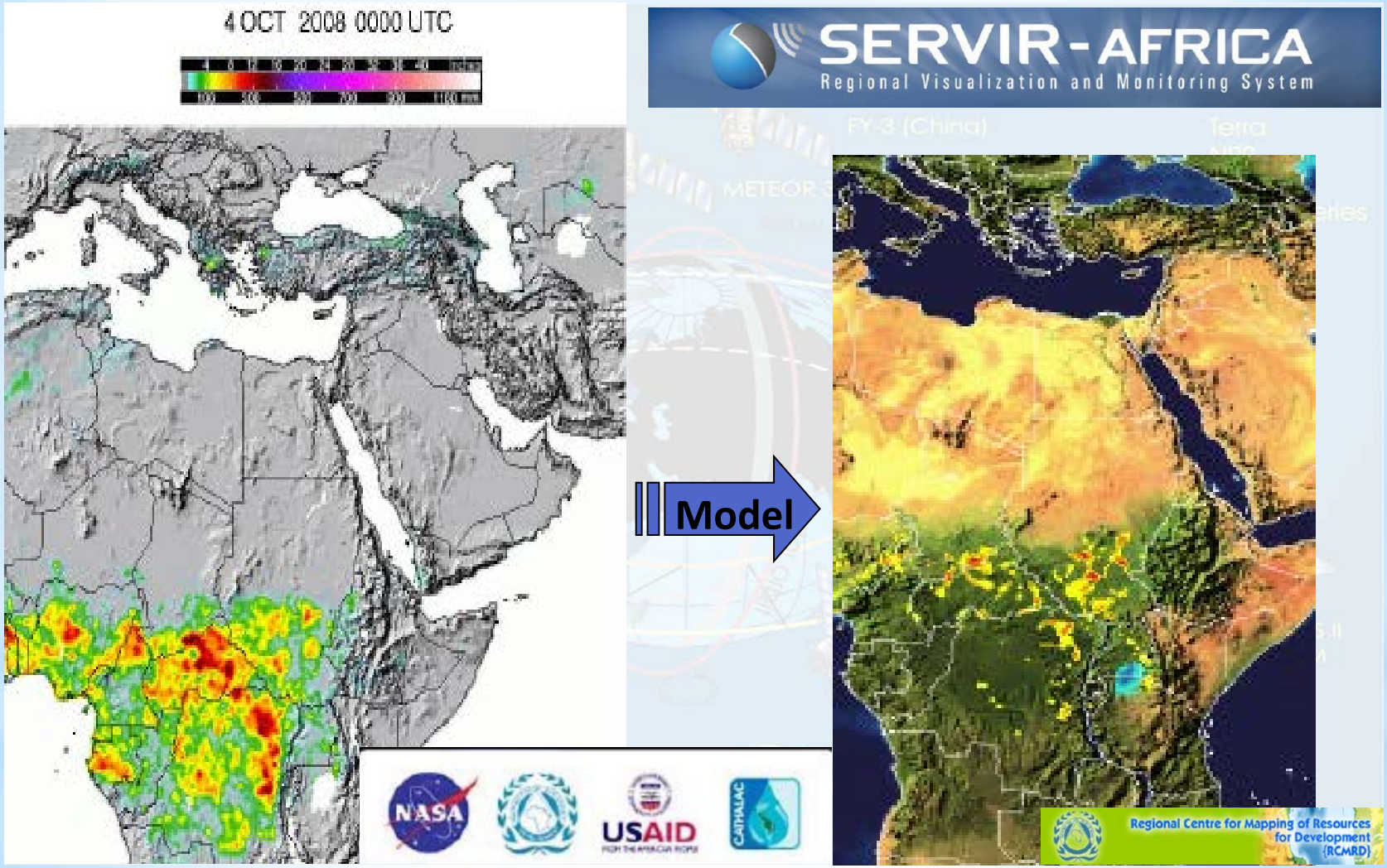
Statistical models combining best predictors from EO (NDVI, LAI, DMP) or Agromet model and trend.

B. Flooding:

- Flooding is the second major disaster in the region.
- The predictability lead time of flooding varies from minutes (flash floods) to weeks (stream floods)
- The key variables that need to be indicated in the prediction of flooding are:
  - The timing (when),
  - The geographical area (where) and
  - Water level, and velocity.
- The indicators that are monitored for flood prediction are:
  - Precipitation,
  - Soil moisture,
  - River gauge level

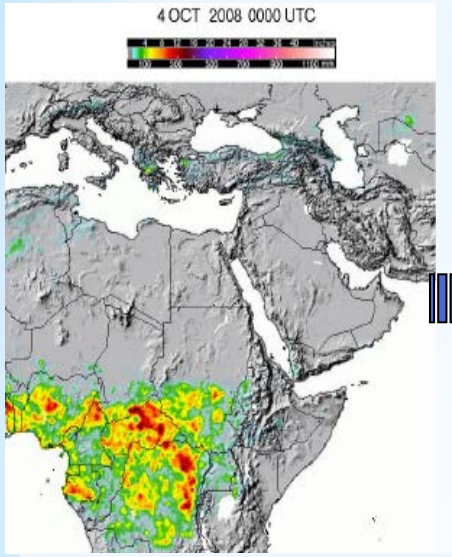
All of these indicators are monitored both from satellite and ground observations.

Flood Early Warning and Forecasting



Flood Early Warning and Forecasting

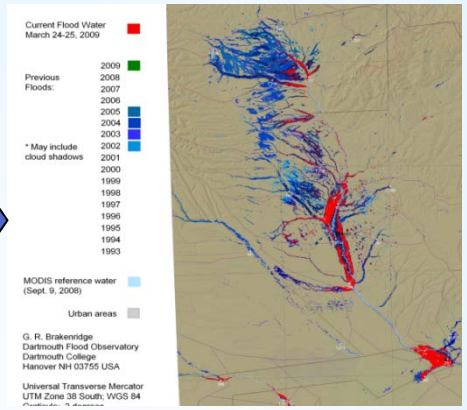
Precipitation



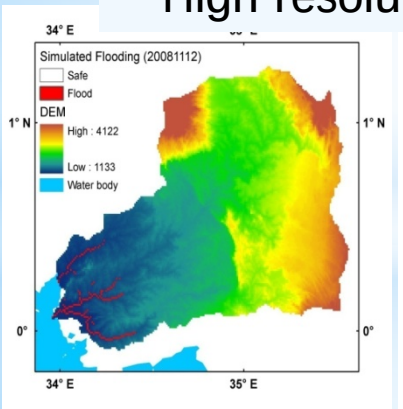
Model

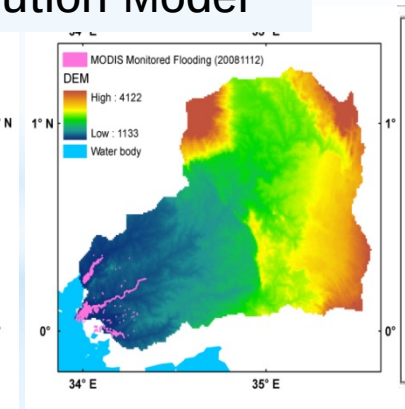
Flood Potential

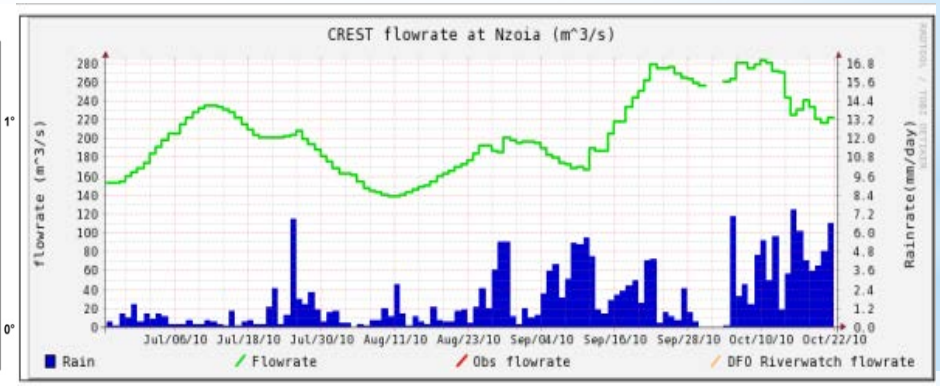
Flood Event Mapping



High resolution Model

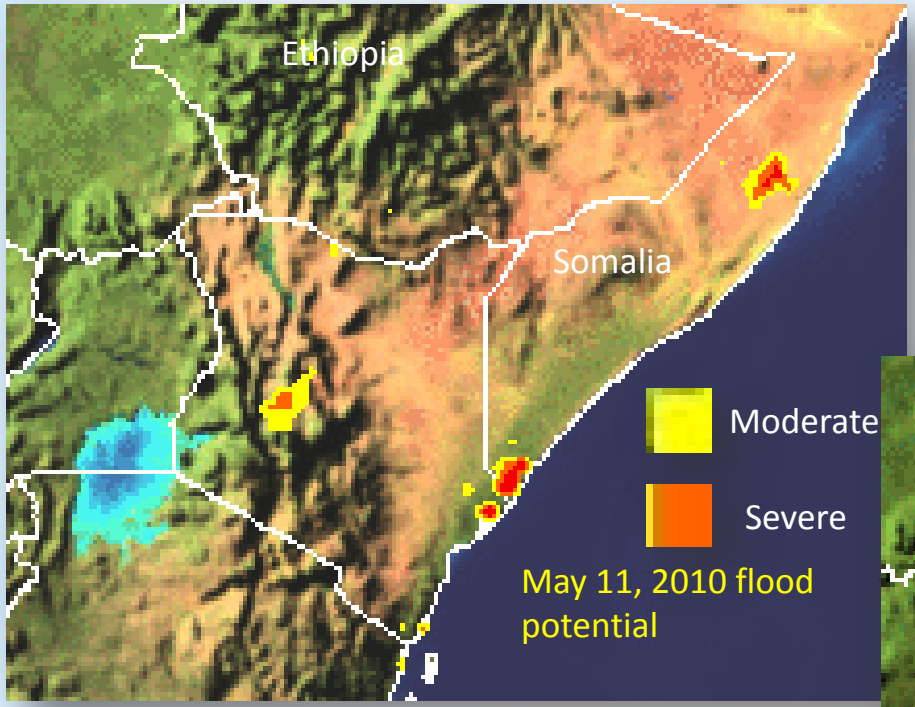


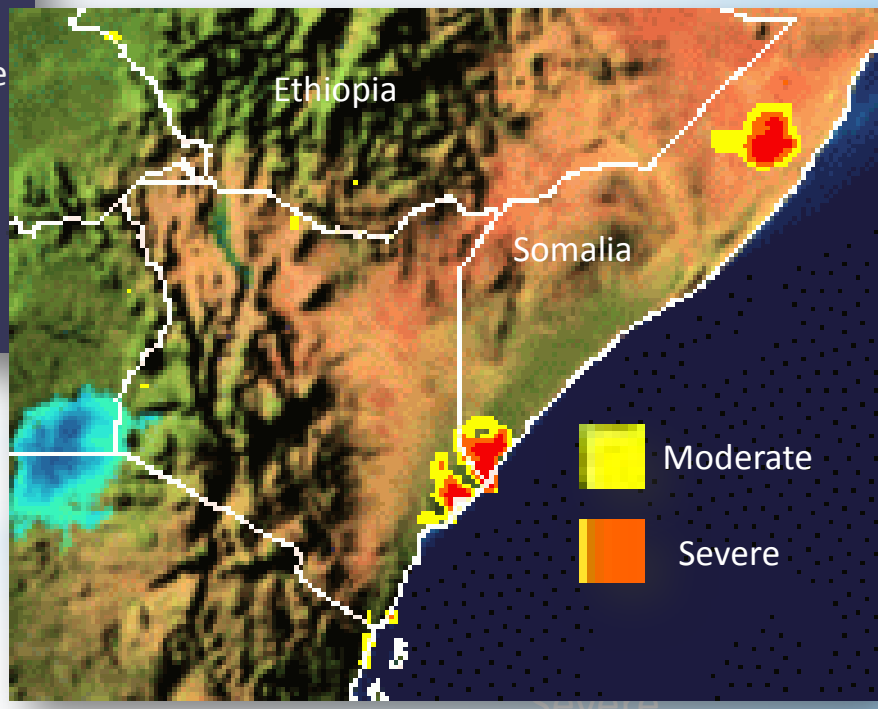




CREST Stream Model

Flood Early Warning and Forecasting , Kenya

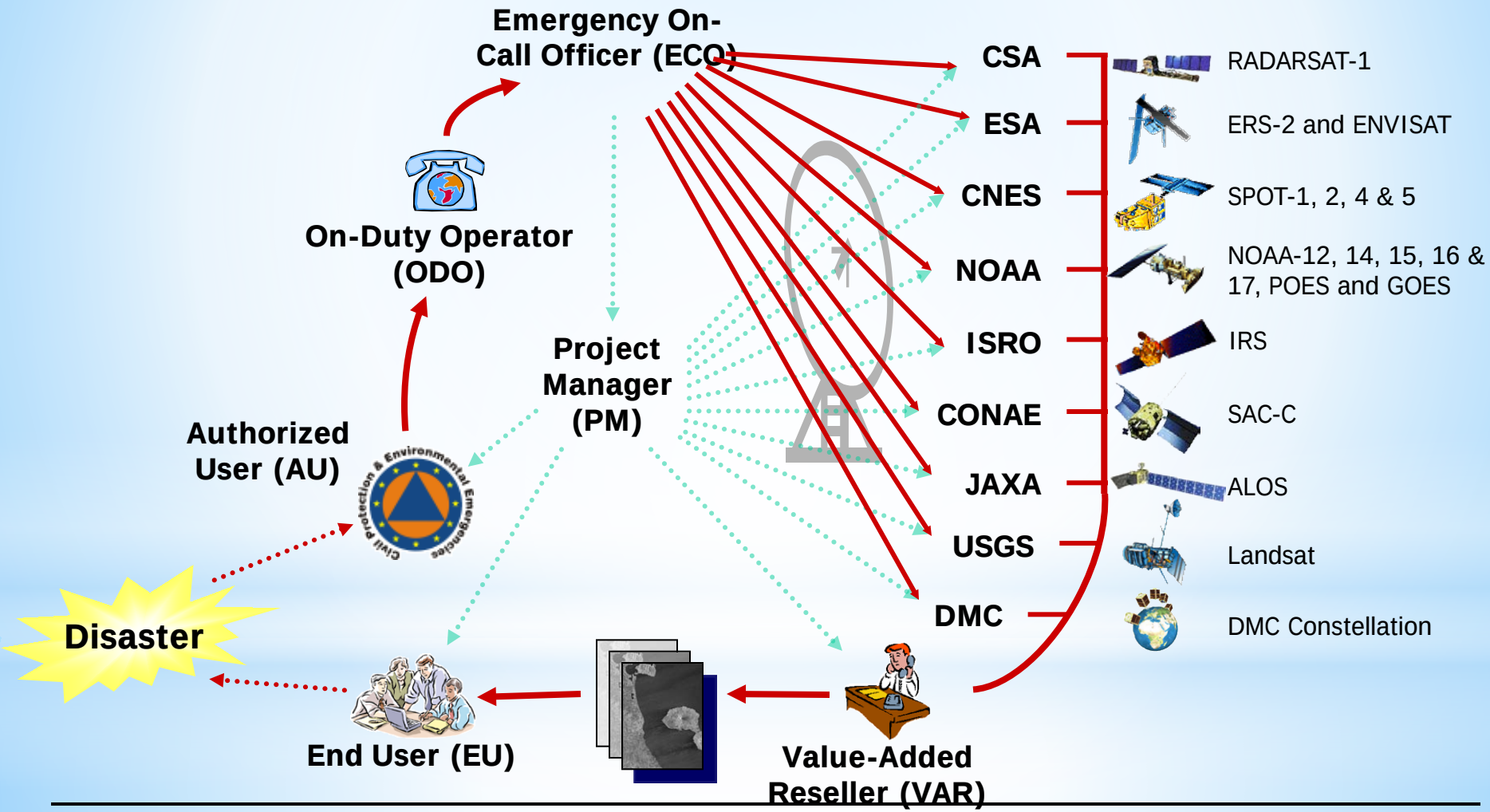




Flood Early Warning and Forecasting

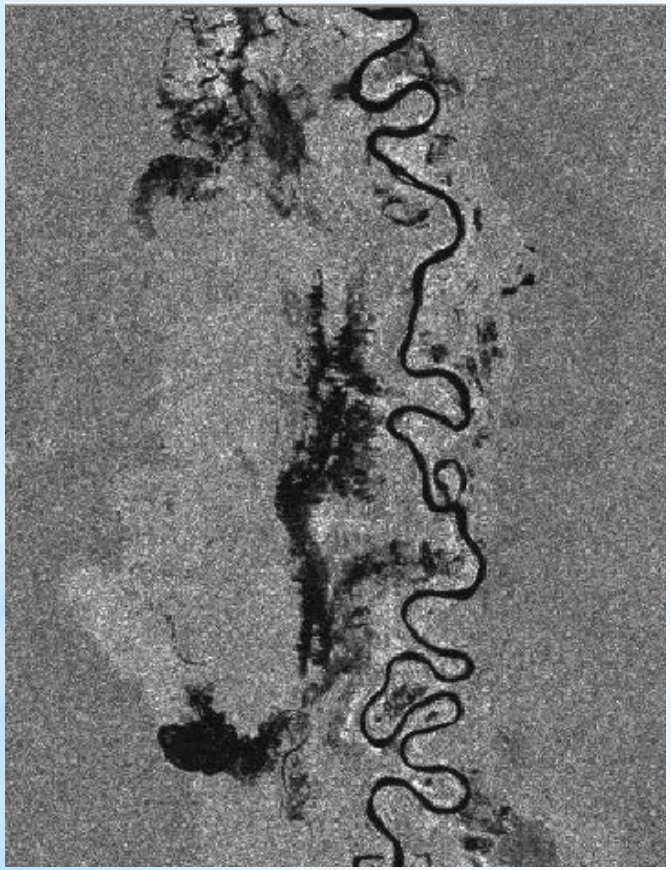
COUNTRY	WATER LEVEL & Latitude/Longitude		NEARBY LOCATION
Kenya	**142mm**	-2.13 40.88	~ 16.76km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**159mm**	-1.63 40.88	~ 72.17km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**172mm**	-1.38 41.38	~ 116.62km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**193mm**	-1.88 40.88	~ 44.28km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**204mm**	-1.38 41.63	~ 133.21km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**221mm**	-1.88 41.13	~ 55.00km from **LAMU/MANDA ISLAND** -2.27 40.83
Kenya	**256mm**	-1.63 41.63	~ 113.70km from **LAMU/MANDA ISLAND** -2.27 40.83

Response through International Disaster Charter

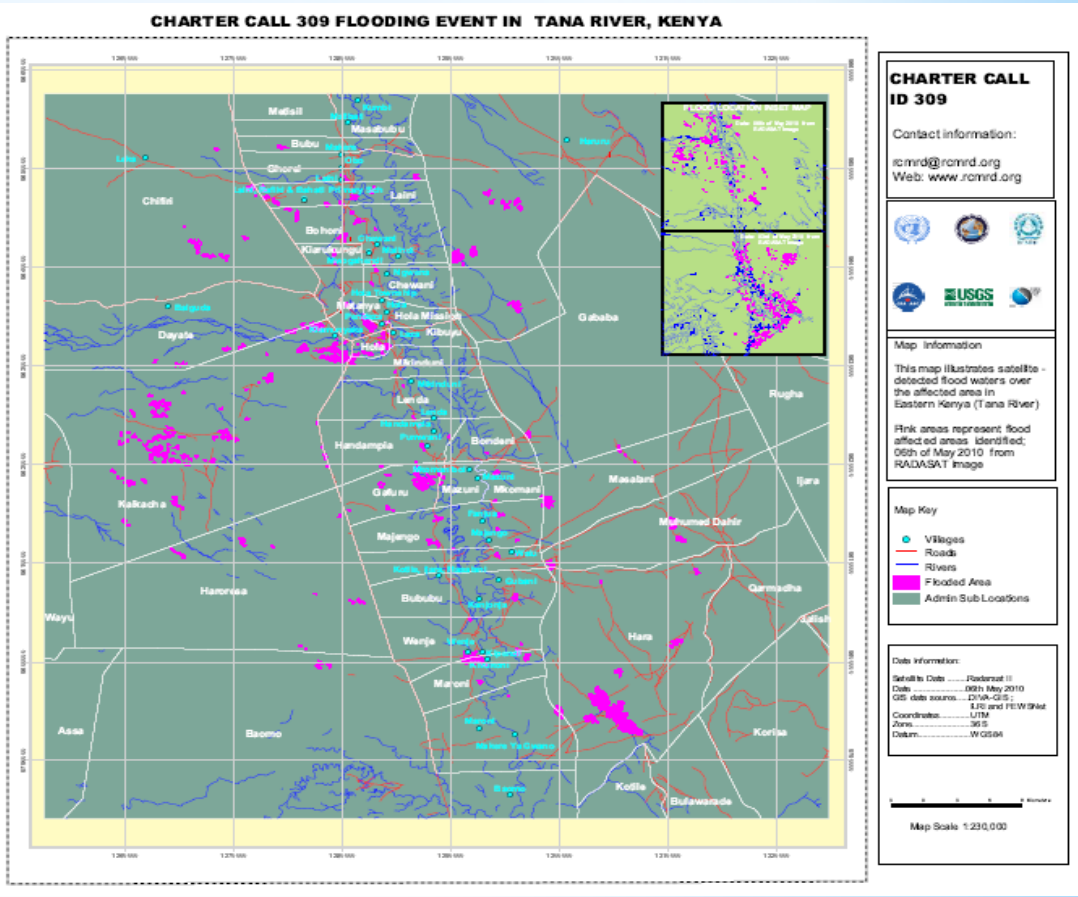


Response for Flooding in Kenya in June 2010

Charter Activation 309, RADARSAT Image



Flood Disaster Rapid Map



Response for Landslide Disaster in Uganda

C. Landslides/ Mud flow/ Rock fall

- **Stereoscopic EO data provides DEM and Land Cover Information which are required for landslide vulnerability assessment and monitoring.**

- **Several historical landslide scars were mapped from Landsat Images in Kenya and Ethiopia**

Examples: Western Kenya, Ethiopia, Malawi

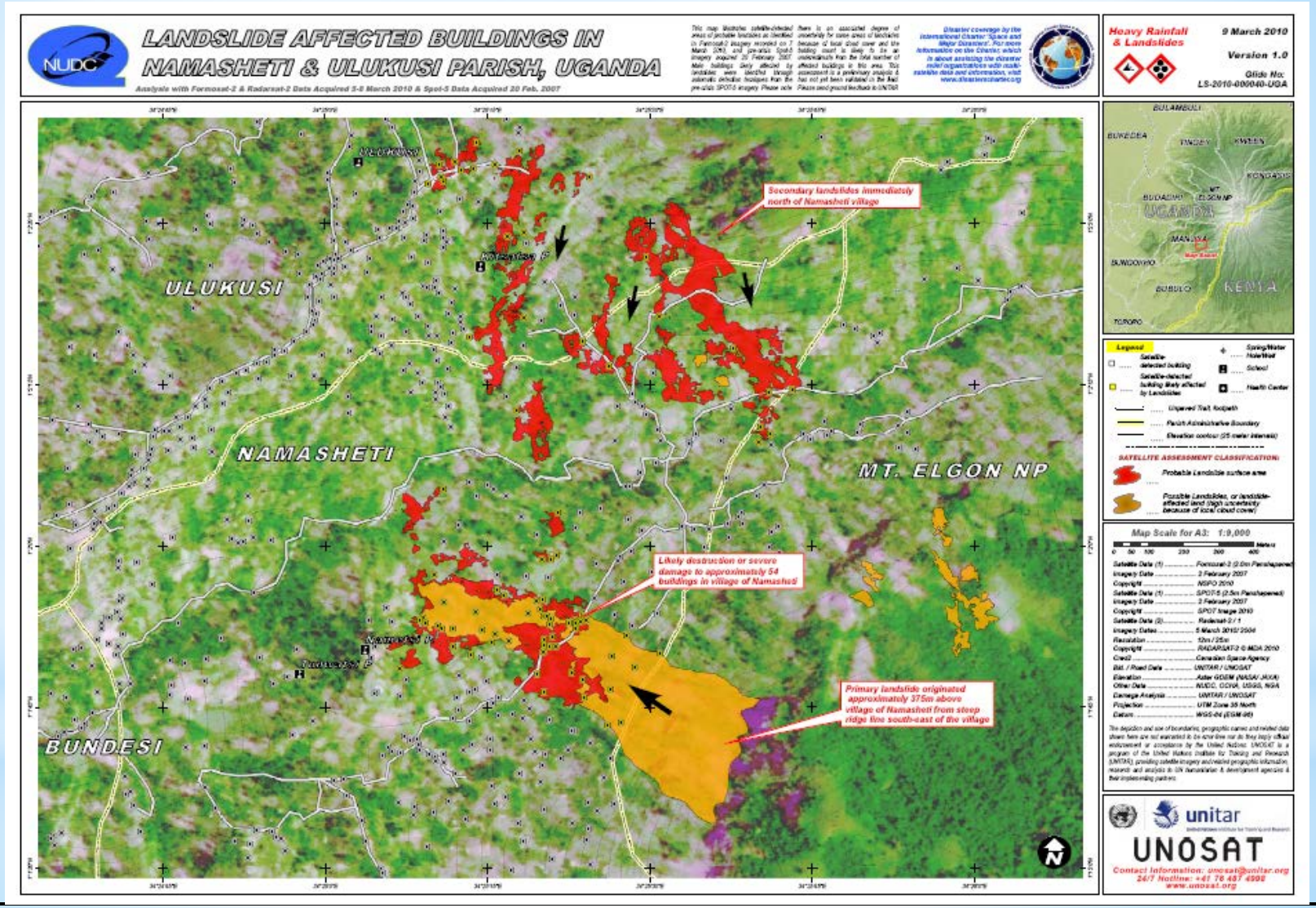
Response: Landslide

On March 2, 2010 a massive landslide occurred in Eastern Uganda's Bududa District. A trading centre in a village was flattened, leaving shops and houses buried under the mud. By morning March 3 2010 the official death toll had raised to 85 people but more than 350 were still unaccounted for.

The Advanced Land Imager (ALI) on NASA's Earth Observing-1 (EO-1) satellite captured this natural-color image on March 11, 2010. Gravity constantly tugs downward on a slope, but only when gravity's force exceeds the strength of the rocks, soils, and sediments composing the slope does land begin to slide down hill. Landslides often occur in conjunction with other events, and rainfall in the Bududa region likely initiated this slide

For more information, visit www.servir.net

Response: Landslide



Challenges in Disaster EW for the Region

- Most of the EWS in the GHA (and Africa in general) are project based – thus have a limited lifespan,
- Inadequate / inaccurate in-situ data, lack of standardized baseline data,
- There is Need for promoting Research on development of EWS and disaster rapid mapping,
- Need for awareness creation among decision makers on the importance and use of geospatial mapping for disaster risk assessment.
- Focus more on long-term EWS (Preparedness rather than costly response)

The DRM program at RCMRD

- Four confirmed years of initialization (2012-2014)
- Established in light of all phases of disaster management

Initial focus on:

•Preparedness and early warning – Development of tools and applications and leveraging on existing ones

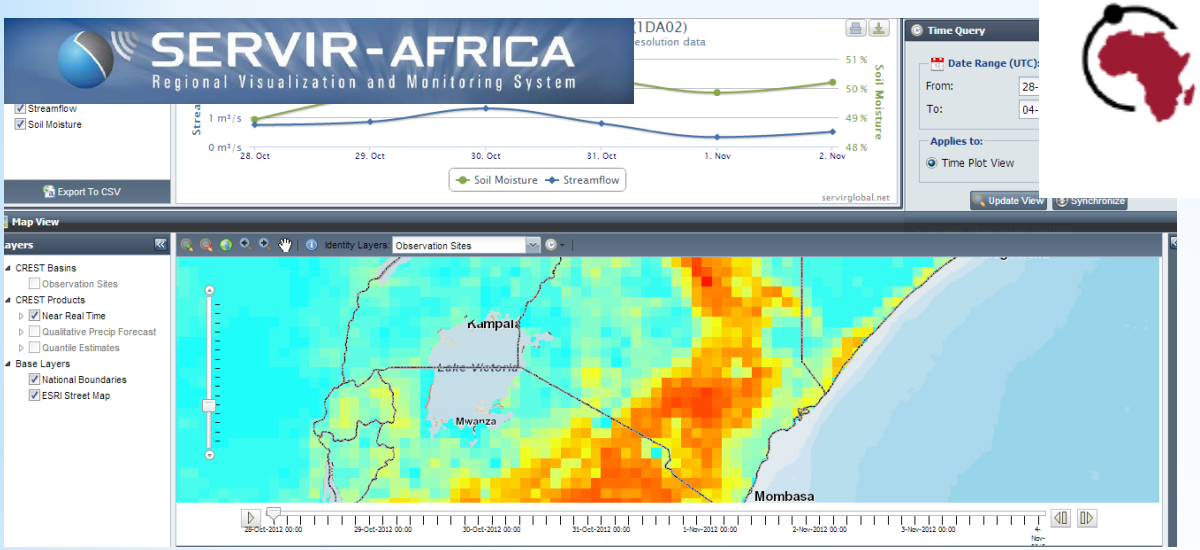
•Risk assessment – Hazard, vulnerability and risk mapping

•Response – Rapid mapping, EO based damage and loss assessments

•Mitigation – Capacity building (Institutional and individual levels)

Building on past and current disaster related activities/projects

SERVIR CREST Flood warning and mapping tools



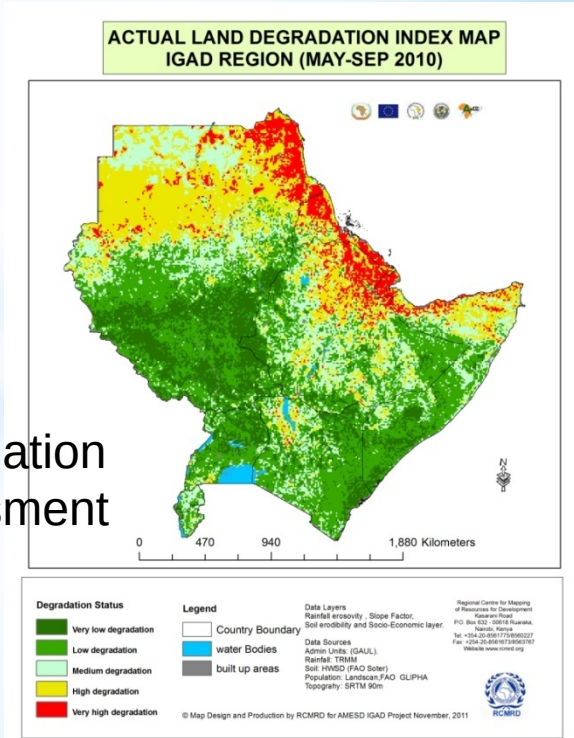
garnet-e
GMES FOR AFRICA - REGIONAL NETWORK FOR INFORMATION EXCHANGE AND TRAINING IN EMERGENCIES

- Rapid mapping
- Charter activation

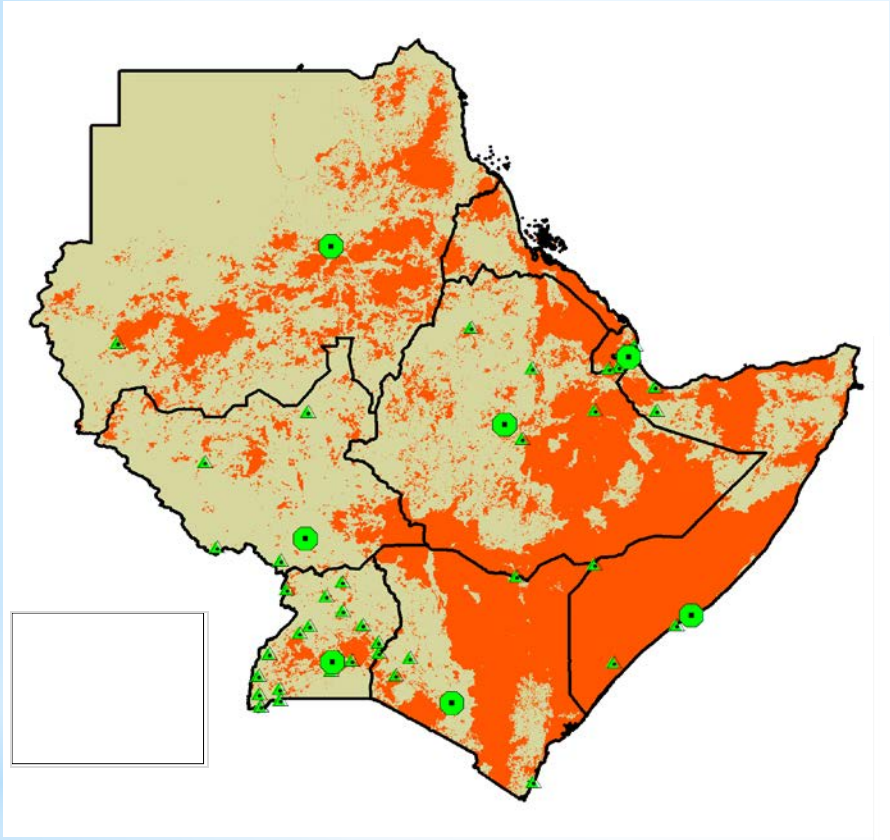
GMFS
Global Monitoring for Food Security

- Drought early warning
- Crop monitoring

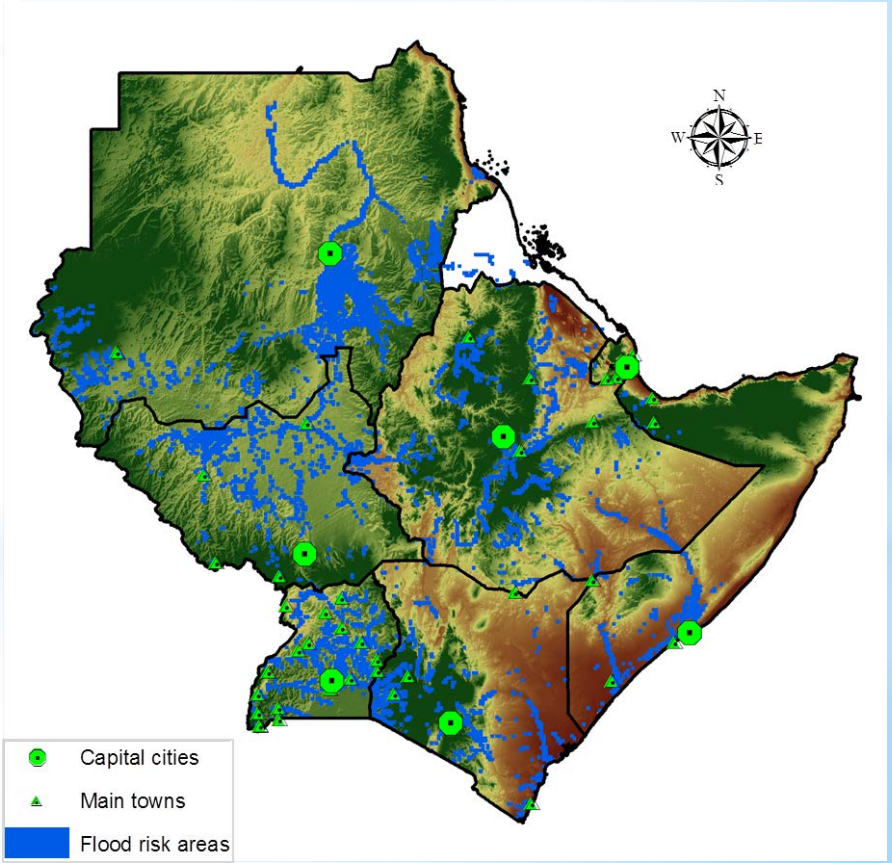
Land degradation assessment



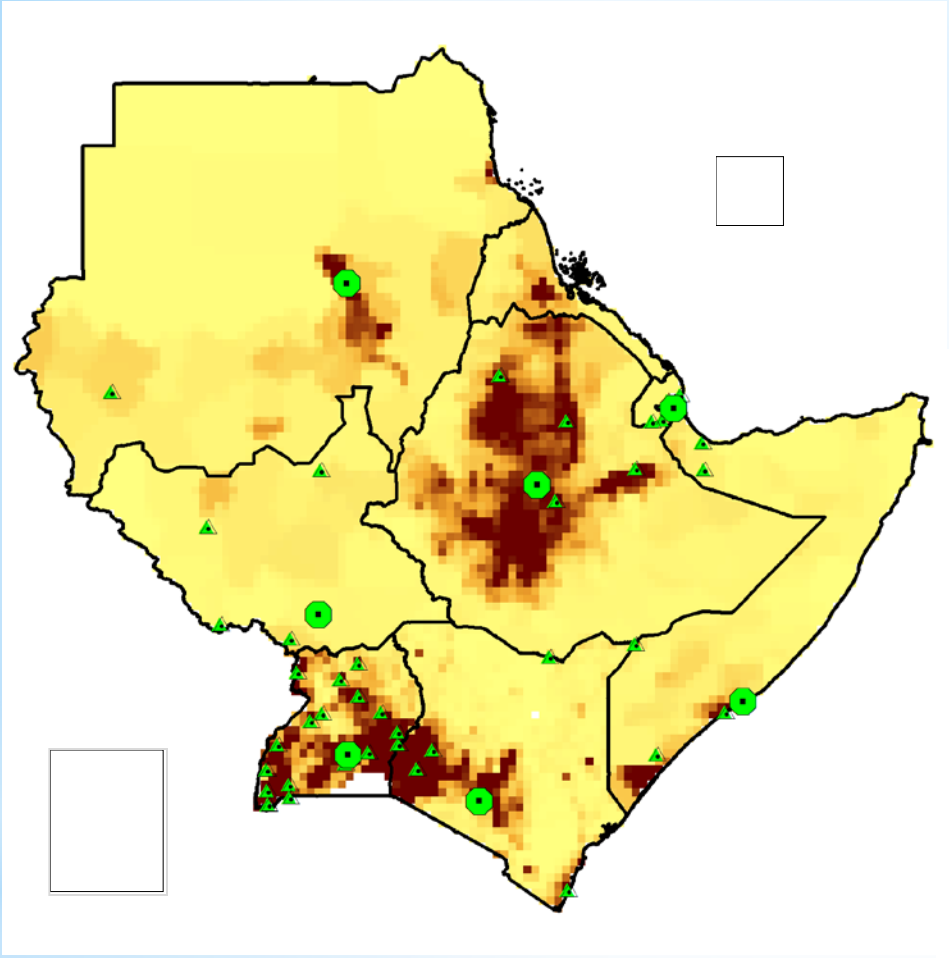
IGAD region Hazard mapping



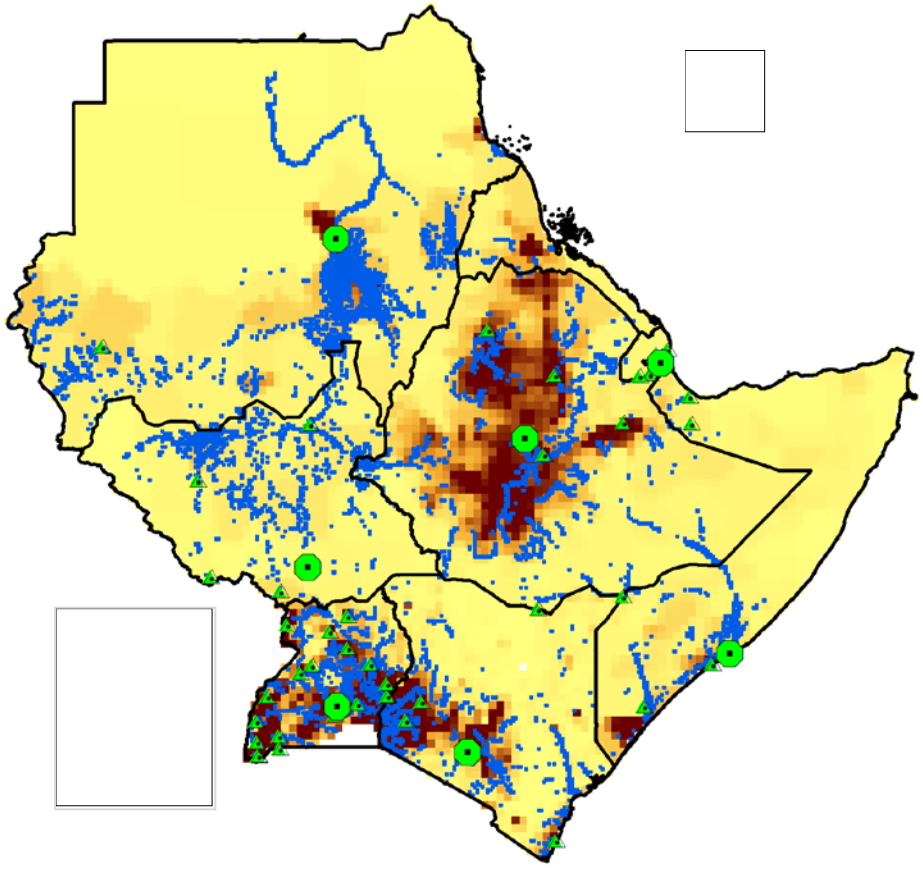
Who's the 'elephant' in the room?



Where are the people living?



What's the level of exposure, who's vulnerable?

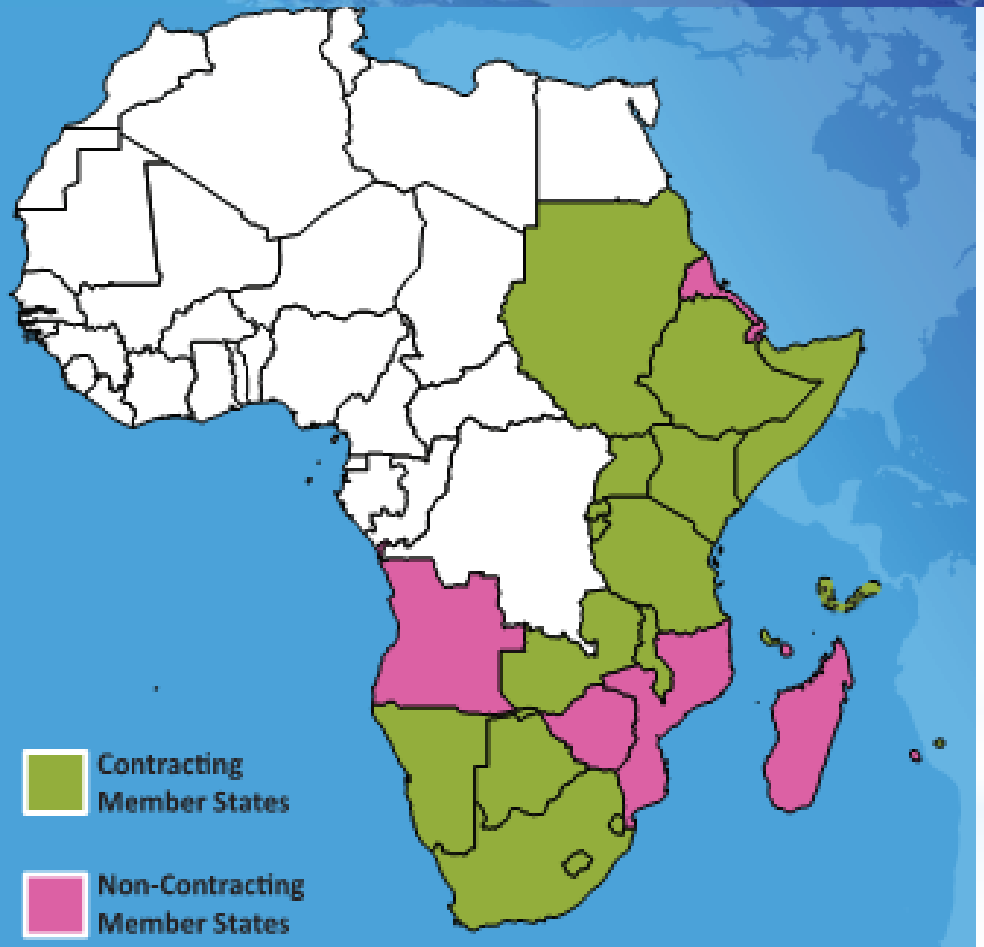


What is the risk?

Our disasters want to party all the time!

REGIONAL CENTRE FOR MAPPING OF RESORCES FOR DEVELOPMENT

RCMRD



Thank You,

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