Disaster Early Warning and Response Activities at RCMRD

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About RCMRD:

- Established in 1975
- Intergovernmental Institution
- It is based in Nairobi-Kenya
- Currently, has 18 member States

Our Vision
To be a premier Centre of excellence in the provision of Geo-Information & Information Technology Applications in Africa & beyond

Our Mission
To provide quality Geo - Information & allied Information Communication Technology products & services in environmental & resource management for sustainable development in our Member countries & beyond
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
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
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
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

Identification of Hotspots Using EO and Climate outlook data
2011 Drought in the GHA

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 refugee centre in Dadaab is indicated.

The graph below shows the course of RE during the past 30 years 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 years.
Crop Monitoring and Yield forecast Systems

MARS Crop Growth Monitoring and Yield forecast Systems (CGMYS)

Remote sensing
- Pixels 0.3 - 5Km

METEO
- LEVEL 1
- Ground Stations + ECMWF 50/25/10km grids

CGMS
- LEVEL 2
- Grids 50/25Km

SOIL+LC
- LEVEL 0

STAT
- LEVEL 3

Administrative Units

Crop models

SOIL

LAND COVER

QUALITATIVE INFO / EWS
- Near real-time Crop monitoring

QUANTITATIVE INFO
- Yield forecast

2012
Crop Monitoring and Yield forecast Systems

Crop yield 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.

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

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

Model

2012 UR Forum Mapping Global Risk
Flood Early Warning and Forecasting

Precipitation

Flood Potential

Flood Event Mapping

High resolution Model

CREST Stream Model

2012 UR Forum Mapping Global Risk
Response for Flooding in Kenya

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
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 risen 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.
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 data especially in-situ data,
- Need for promoting further Research and Development in EWS.
- Need for awareness creation among decision makers.
- Need to begin focusing more on long-term EWS.