Application of Climate information in the management of water resources

Christopher Oludhe (Ph.D)
Department of Meteorology
University of Nairobi
And
IGAD Climate Prediction and Applications Centre (ICPAC)

Workshop on Multi-Country Support Programme to Strengthen Climate information systems in Africa

Background

• **Extreme climate events** are very common within the IGAD sub-region and whenever they occur, they are associated with loss of life and property, destruction of infrastructure resulting in large losses to the economy and sometimes retarding national economic growth backwards by several years.

• **Climate monitoring, prediction and timely early warning** of such extreme climate events is one of the best strategies for mitigating the negative impacts resulting from these events.

• **Climate information** can also be used to improve crucial decisions required in all the components of an integrated disaster management namely early warning, prevention, mitigation, preparedness, relief and rescue, rehabilitation and reconstruction.
Climate Hazards

El Niño
- Tropical cyclones
- Storm surges
- Ice Storms
- Dust storms
- Hail & Lightning
- Flash floods
- Tornadoes
- Mud & landslides
- Avalanches

La Niña
- Hot & cold spells
- Droughts
- River basin flooding
- Heavy precipitations (rain or snow)
- Storm (winds)
- Wildland fires & haze

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Climate Impacts
**Water as a Resource**

- Water as a resource plays a major role in **driving the economy of a country** and is practically used in all sectors and more so for domestic consumption in urban and rural areas, industries, energy generation, agriculture, livestock, fisheries among others.

- **Rainfall** is a **major input into the hydrological cycle**, hence surface water resources are greatly influenced by climatic factors.

- **Climate variability** and change strongly affects the spatial and temporal distribution of the water Resources

- **Too much** or **too little** water is a major concern to water managers and there is need to manage this resource for sustainable development of a country.

- **Freshwater availability** and **access** is a priority in many countries in Africa including the IGAD sub-region.
Global Water Resources

- **97% Oceans Water**
- **3% Fresh Water**
  - **79% Ice caps & Glaciers**
  - **20% Ground Water**
- **1% Accessible Surface Fresh Water** (high spatial variability)
- **52% Lakes**
- **38% Soil Moisture**
- **8% Atmospheric Water vapour**
- **1.4% Water Within Living Organisms**
- **0.6% Rivers**

- **Total Fresh Water** = 35 000 000 Km³
- **Total Water Flowing in the Rivers** = 21 200 Km³
The main factors contributing to water stress are population growth, irrigation, and livestock watering, droughts and deforestation, poor land management, and pollution from human activities and industry.
Climate information needs in the Water Sector

• Efficient management of water resources.
• Reservoir (Dam) planning and operations
• Hydropower generation
• Development of appropriate water harvesting techniques
• Development of flood early warning systems
• Flood Hazard (risk) mapping and management
• Water conservation, regulation and allocation
• Ensuring water security for various socio economic activities
Role of ICPAC in the GHA

• The IGAD Climate Prediction and Applications Centre (ICPAC), formerly known as the Drought Monitoring Centre, Nairobi (DMCN), is a specialized regional centre of the Inter-Governmental Authority on Development (IGAD) charged with the responsibility of climate monitoring, prediction, early warning and applications for the reduction of climate related risks including those associated with climate variability and change.

• ICPAC serves 11 member countries within the GHA which include Kenya, Uganda, Tanzania, Rwanda, Burundi, Somalia, Ethiopia, South Sudan, Sudan, Eritrea and Djibouti.
Operational Activities

- Development and archiving of regional and national quality controlled climate databanks
- Data processing including development of basic climatological statistics
- Timely acquisition of near real-time climate and remotely sensed data
- Monitoring space-time evolutions of weather and climate extremes over the region
- Generation of climate prediction and early warning products
- Timely dissemination of early warning products
- Climate change monitoring, detection and attribution including climate change modeling.
- Delineation of risk zones of the extreme climate related events
- Downscaling of global climate forecasts to regional and national levels
- Conduct capacity building activities in the generation and application of regional tailored climate products relevant to user needs
- Organization of Climate Outlook Forums (COFs) for the GHA countries
- Enhancement of interactions with users through users workshops and pilot application projects
- Enhanced networking with the NMHSs, regional and international centers for data and information exchange
- Promoting technical capacity building at NMHS level (e.g. acquisition of hardware, software, etc.), as required for implementation of climate services.
Climate Monitoring Indicators at ICPAC

The frequently used indicators for monitoring, analyzing and predicting extreme climate events at ICPAC include:

• Sea Surface Temperatures (SSTs)
• El-Niño Southern Oscillation (ENSO) Indices
• Indian Ocean Dipole (IOD)
• Tropical Cyclones (TC)
• Inter-Tropical Convergence Zone (ITCZ)
• Surface and Upper Air winds,
• Air Temperature
• Humidity among others
Niño Areas

Nino 3.4 Index

Nino-3.4 Index from DJF 1981 - FMA 2011 (3 month running mean)
GLOBAL OCEAN SST INDEX PATTERNS
FOR A MATURE PHASE OF EL-NINO
GLOBAL SST INDEX PATTERNS FOR A MATURE PHASE OF LA-NINA
Indian Ocean Dipole (IOD)
IOD AND EL NINO LINKAGES

El Nino triggers Indian Ocean dipole

The Walker circulation weakens and shifts to the east, delivering its moist warm air and rain to the central Pacific. The Walker circulation's western cell then delivers sinking dry air to northern Australia.

El Nino's western cell strengthens the flow of easterly winds across the Indian Ocean, triggering the cooling of the east Indian Ocean and warming the west.

Indian Ocean Dipole
El Nino
Warm ocean
Cool ocean
Example of a Statistical Climate Prediction

Voi, An ASAL area, SE Lowlands– Near normal tending to depressed rainfall expected.
Regional Climate Outlook Forums (RCOFs)

- RCOFs provide platforms for Climate experts and climate information users to:
  - Discuss current climate status
  - Exchange views on scientific developments in climate prediction
  - Develop consensus-based regional climate outlooks that can feed into national climate outlooks produced by NMHSs
  - Engage in user-provider dialogue

- An important aspect of RCOFs is the facility to bring together experts in various fields, operational climate providers and end users of forecasts in an environment that encourages interaction and learning.
Regional Climate Outlook Forums Worldwide
A SECTION OF GHACOF35 PARTICIPANTS - (August 2013, Eldoret, Kenya)
Examples of ICPAC Tailored Products, Partnership and Community Service Projects
Masinga Dam Tailored Forecasts during the 1999/2000 La-Nina Drought

KenGen
KRC’s Strategic Partnership in Climate Information (Forecast/Prediction)

- ICPAC – Seasonal predictions and early warnings
- KMD – 4 day, weekly, bi-weekly, monthly forecasts.
- Indigenous Knowledge and partnership with community

MOU between KRCS and ICPAC
Example of Turning El Nino into an Opportunity

- Kenya Red Cross used the downscaled COF 2009 SOND Forecasts (El-nino Year) to distribute seeds worth Ksh. 30 Million (US$ 350,000) in a drought prone Ukambani area and reaped a bumper harvest estimated at a Ksh. 2.5 billion (US$ 30M).
Situation in Turkana one Year before Red Cross moved in

Drought
Greenhouses and Water harvesting changing lives in Turkana
Areas to watch for possible changes in food security outcomes
Health Outlook: SOND-2013

Disease outlook

Zone I & V:
- No variation in expected incidences of malaria
- No significant changes in other water and climate related diseases
- However, diseases related specifically to water deficiency e.g. trachoma, diarrhea scabies may occur where it is endemic

Zone II:
- No significant change expected in malaria transmission
- No variation expected in other climate induced disease
- Due to likelihood of water scarcity in arid and semi-arid areas in the zone – there are chances of increased diarrheal diseases including cholera, trachoma, scabies etc

(Zone III):
- General increased risk of Malaria in the zone and likelihood of epidemics in prone fringe and highland areas
- Due to likelihood of localized flooding and destruction of sanitation utilities – there are chances of increased diarrheal diseases including cholera, dysentry

(Zone IV):
- Likelihood of increased malaria cases but no epidemics is expected
- Likelihood of VHF(dengue), filariasis may occur
The Server is used to simultaneously and rapidly broadcast information through an SMS to selected registered users. It will be customized to allow receiving feedback from the users.
ICPAC’s Regional Climate Outlook Forum

NHMS National Forecast

NHMS Downscaling of National Forecast

Local Forecasts Based on Indigenous/Traditional Knowledge

Consensus Meeting between NHMS Scientists and the Local Forecasters to Produce a Merged Local Forecast

Meeting with District Government Line Ministry Officers, Community Leaders, Local Seed Company Representatives and others to Develop Relevant Sectoral Advisories with Respect to the Merged Forecast

COMMUNITY
FARMERS MAKE INFORMED DECISIONS ABOUT THE TECHNOLOGIES TO EMPLOY
CONCLUSIONS

• Weather/Climate monitoring and prediction is one of the best strategies for mitigating the negative impacts of weather/climate related disasters.

• ICPAC plays an important role in providing the IGAD subregion with weather and climate advisories and more importantly, timely early warnings on extreme climate events.

• The use of these predictions products can help countries put measures in place to mitigate against some of the adverse impacts of extreme climate events.
THANK YOU