RCOF Review 2017

Greater Horn of Africa Climate Outlook Forum (GHACOF)

Status Report (Survey)

Specific Climate features of the Greater Horn of Africa (GHA) region

The northern/southern sectors of GHA receive rainfall during the respective hemispheric summer months, namely June–September/December–February. The equatorial areas of the GHA have two main rainfall seasons centered on March-May and October-December months. Parts of the equatorial sector receive rainfall all year round, especially those near large moisture sources. Among the ocean-atmosphere phenomenon that cause greatest disruption of the normal climatic conditions round the globe is the El Niño-Southern Oscillation (ENSO).. The other major system is the Indian Ocean Dipole (IOD). These systems and other regional climate forcings induce significant anomalies in the characteristics of the regional monsoonal wind circulation that are the major sources moisture.

Typical impacts of ENSO over the Greater Horn of Africa

Warm episodes (El Niño events) are often, but not always, associated with suppressed (below normal) rainfall over most parts of the northern sector of the GHA region during the peak rainfall season of July to September. On the other hand, cold events (La Niña) tend to enhance (above normal) rainfall amounts over most parts of the northern sector during the same period.

Over the equatorial sector, enhanced rainfall is common over most areas during October to December at the onset year for El Niño events. The enhanced rainfall during October to December tends to extend into the following year, creating slightly wetter conditions in the usually dry months of January and February. On the other hand, rainfall tends to be suppressed during the June to September period in the western parts of the sector.

During a cold event (La Niña), the rainfall tends to be suppressed over most parts of the equatorial sector during March to May and October to December, but enhanced in the western areas during June to September.Below/above average rainfall amounts are often observed over most parts of the southern sector of the GHA during OND season for the warm/cool ENSO events.

It should, however, be noted that not all El Niño or La Niña events produce the same impacts in the GHA. In addition, the overall influence on the rainfall patterns is dictated by a number of other factors such as the time of onset, month of peak intensity, seasonal persistence and withdrawal phases as well as strength of the event and the characteristics of the surrounding oceans. These oceans are the moisture sources for rainfall generation.

Indian Ocean Dipole (IOD) is one of the key regional systems over Indian Ocean that has significant impacts on climate variability over GHA. The IOD is a coupled ocean-atmosphere phenomenon in the equatorial Indian Ocean that affects the climate over the regions near the Indian Ocean basin, including the GHA (Saji *et al*., 1999). A positive IOD period is characterized by cooler than normal Sea Surface Temperatures (SSTs) in the tropical eastern Indian Ocean and warmer than normal SSTs in the tropical western Indian Ocean. Owiti *et al*. (2008) observed that ENSO linkages seemed to be stronger when a strong positive IOD coincided with El Niño event. In general, above/below normal rainfall conditions spread over the region during the positive/negative IOD events.

The key climate sensitive socio-economic sectors in GHA include Agriculture/Food Security, Livestock, Water resources, Disaster Risk Management, Health and Energy among many others.

Rain fed agriculture is highly vulnerable to extreme weather and climate events such as floods and droughts. The direct and indirect adverse impacts of climate variability therefore significantly affect the welfare of the communities and tend to escalate poverty in the GHA region due to famine and food insecurity. Factoring climate outlooks (early warning for early action) into agricultural practices would help to determine the optimal time for cropping practices that can maximize productivity through the reduction of post harvest losses, and the utilization of crop suitable for the expected seasonal rainfall. Climate-related losses in yield and livestock productivity can thus be reduced or fully avoided.

Water availability from rivers, lakes, underground aquifers and roof catchments are directly and indirectly linked to rainfall amounts. Many parts of the GHA have replenishable freshwater resources below 1000 m^3 per capita per year, a threshold commonly accepted as a benchmark for freshwater scarcity. The demand for available freshwater resources, however, increases year by year due to the fast population growth. Climate factors, especially rainfall and evaporation have significant impacts on quantity and quality of water resources, and the design and development of the water storage and flood control systems in the region.

Climate variability accounts for the majority of the disasters related to natural hazards in the GHA. These climate related disasters are often associated with far reaching socio-economic impacts. For example, the impacts of a single disaster that can reverse the economic development pattern by several decades can be seen in the 1997/98 El Niño related floods and the 1999/2000 La Niña related drought in the region. Many human and animal lives were lost; millions of people displaced; many roads, railway lines and other infrastructure destroyed; and losses worth millions of dollars reported. No sustainable development can be achieved in the region without reducing climate related risks and vulnerability.

Most diseases in the region such as malaria, cholera and Rift valley fever are due to climate variability and change. Too much or too little rainfall results in water related diseases in the GHA region.

Energy is the driving force for economic growth in any society and the GHA region is endowed with abundant renewable energy resources such as solar, wind, hydroelectricity and non-renewable energy resources such as petroleum. Much of the energy for industrial and urban areas in the GHA is derived mainly from hydropower. This power resource is currently the most established in the region and accounts for over 50% of the total electricity supply. The resource is, however, highly sensitive to climate variability such as droughts and floods. Droughts are known to be accompanied with low water levels in the major dams while floods bring a lot of silt into the dams and can sometimes lead to destruction of dams , damage to the turbines and increase in overhead operation cost.

The GHACOF background

Since 1996 an innovative process known as the regional climate outlook forum (RCOF) has been running in many parts of the world aimed at providing consensus seasonal climate guidance to reduce climate-related risks in support of sustainable development efforts of the specific regions. RCOFs were initiated by the WMO Climate Information and Prediction Services (CLIPS) project in collaboration with National Meteorological and Hydrological Services (NMHSs), regional institutions and other international organizations. The first meeting was held in 1996 in Victoria Falls, Zimbabwe. RCOFs gained momentum as a regional response to the major 1997–1998 El Niño event, with the first Southern Africa Climate Outlook forum in September 1997. In February1998 the first Greater Horn of Africa Climate Outlook Forum (GHACOF1) was organized for the March to May (MAM) 1998 rainfall season by the Drought Monitoring Centre (DMC), now called IGAD Climate Prediction and Applications Centre (ICPAC). Since then the GHACOF process has been sustained in the region, and is currently organized by ICPAC on rotational basis within the participating Member Countries three times annually for the main rainfall seasons of March to May (MAM), June to September (JJAS) and October to December (OND). The most recent GHACOF 46 was held in May 2017 in Khartoum, Sudan. GHACOF covers eastern African countries namely Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda.

The participating ICPAC member institutions include the following National Meteorological and Hydrological Services (NMHSs); Institut Géographique du Burundi, Agence National de la Météorologie de Djibouti, Eritrea Meteorological Service, National Meteorological Services Agency of Ethiopia, Kenya Meteorological Department, Rwanda Meteorological Agency, Somalia Meteorological Services, South Sudan Meteorological Services, Sudan Meteorological Authority, Tanzania Meteorological Agency, Uganda National Meteorological Authority; and cooperating international partner organizations such as World Meteorological Organisation (WMO), United Nations Development Programme (UNDP), World Bank, African Development Bank (AfDB), United States Agency for International Development (USAID),WMO Global Producing Centers (GPCs), United Nations International Strategy for Disaster Reduction (UNISDR),Met Office of the United Kingdom, International Research Institute for Climate and Society (IRI), National Centers for Environmental Prediction (NCEP), and Famine Early Warning Systems Network (FEWS-NET) among others.

The main objectives of GHACOF are to (a) develop consensus regional climate outlook for the coming rainfall season; (b) formulate mitigation strategies to the implications of consensus regional climate outlook on the key socio-economic sectors in the GHA region; (c) provide a regional interaction platform for decision makers, climate scientists, research scientists as well as users of climate information; and (d) review lessons/experiences from the use of the products provided in the previous regional climate outlook forum and also to assess the performance of the previous consensus regional climate outlook.

The GHACOF process

The main focus of the GHACOF is to deliver consensus-based and user-relevant climate outlook products through regional cooperation and partnership.

The typical GHACOF process coordinated by ICPAC usually includes the following components:

- Pre-COF capacity building training workshop (Figure 1) to improve skills of national and regional climate scientists in climate modeling and prediction using both dynamical and statistical downscaling;
- Meeting to generate the consensus regional climate outlook (see Figure 2 below), usually in probabilistic nature formed by merging inputs from the WMO Global Producing Centres, regional inputs and national climate outlooks using expert interpratation;
- A forum where the consensus regional climate outlook is presented to the users who translate the forecast into sectoral impacts and develop mitigation strategies for their respective sectors;
- User interface sessions involving face to face engagement of providers and multi-sectoral users;
- Dissemination and press release of the RCOF outcome through a statement
- National dissemination forums in which the consensus regional climate outlook is downscaled to national and subnational levels and disseminated to the national and sub-national users.

GHACOF Forecast updates

Forecast updates are generated and disseminated on 10-day, monthly, and three-month rolling seasonal timescales. General Circulation/Climate Model (GCM) outputs from seven global centers are reprocessed for the GHA region and bias-corrected and regression-based ensemble probabilistic and deterministic forecasts of precipitation and temperature are routinely prepared and disseminated every month with lead times of up to 2 months on monthly and three-month rolling seasonal basis. These products are further strengthened with statistically downscaled monthly and seasonal individual GCM and SST based forecasts using CPT and GeoCOF. In addition, six-hourly Climate Forecast System Version 2 (CFSv2) GCM outputs are used for initial and boundary conditions for dynamical downscaling of forecasts using the Weather Research and Forecasting version 3.8 (WRFv3.8) regional climate model. Downscaled deterministic forecasts are issued with up to 2-months lead time for regionally important parameters including precipitation, maximum and minimum temperatures, and wind. In addition, user oriented and agriculture focused forecasts of onset, cessation, dry and wet-spells, and length of growing season and their anomalies relative to 20-year average obtained from WRF-ERA INTERIM driven hindcast are also produced for major GHA seasons. If there is unique climate event, a Climate Watch is usually issued by ICPAC and posted on the web site and further disseminated to stakeholders through e-mail mailing list.

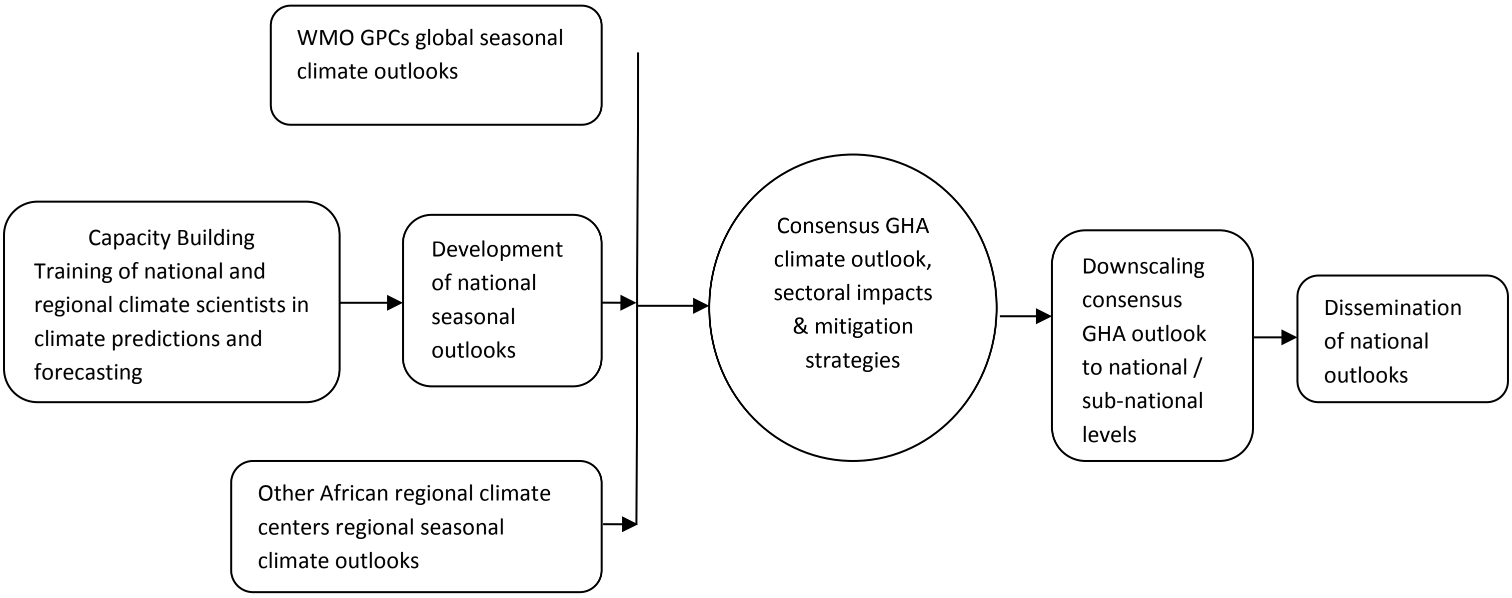

Figure 1: GHACOF process

The consensus regional rainfall outlook for June to September 2017 season for various zones within the GHA region is given in Figure 2a and consensus regional temperature outlook in Figure 2b below.

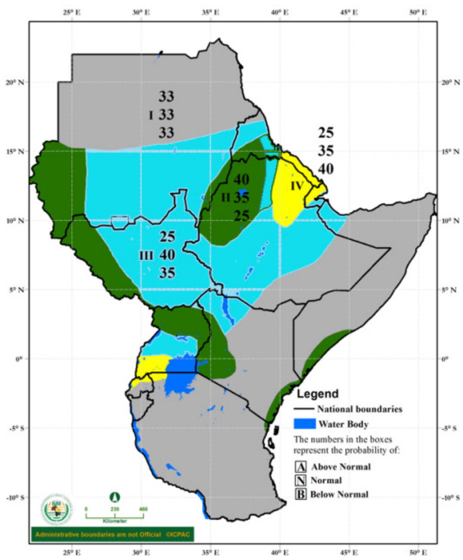

Figure 2a: Sample Greater Horn of Africa Consensus Rainfall Outlook for June to September 2017

Zones I: Usually dry during June to September
Zones II: Increased likelihood of above normal rainfall
Zones III: Increased likelihood for near normal rainfall
Zones IV: Increased likelihood of below normal rainfall

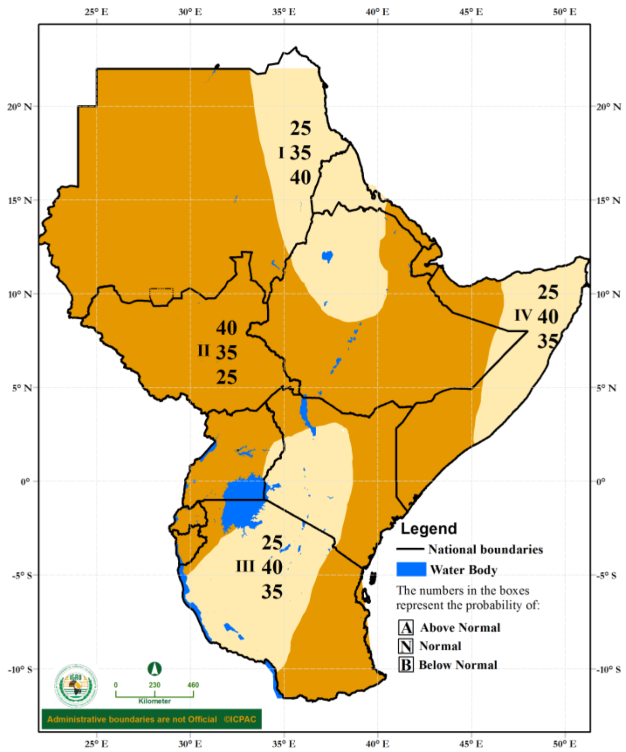

Figure 2b: Sample GHA Consensus Mean Temperature Outlook for June to September 2017

Zone I: Increased likelihood of below normal mean temperatures
Zone II: Increased likelihood of above normal mean temperatures
Zone III: Increased likelihood of near normal mean temperatures
Zone IV: Increased likelihood of near normal mean temperatures

Evaluation of the past GHACOF consensus climate outlooks

The skills of all GCM deterministic forecasts are diagnosed and results posted on the IGAD RCC web page. The state of the climate is also diagnosed every month and season. All GHACOF consensus climate outlooks are verified against observations using hit rate as well as Heidke Hit Skill Score and results provided during GHACOFs and regularly posted on the IGAD RCC web page. Table 1 for instance shows summary verification of the past 45 GHACOFs.

Table 1: Summary of GHACOFs Verification Skills

RCOF	HIT RATE	HEIDKE HIT SKILL SCORE
GHACOF 1	71	42
GHACOF 2	65	29
GHACOF 3	67	35
GHACOF 4	72	44
GHACOF 5	65	30
GHACOF 6	56	13
GHACOF 7	85	70
GHACOF 8	70	40
GHACOF 9	68	36
GHACOF 10	71	42
GHACOF 11	71	41

GHACOF 12	70	40
GHACOF 13	77	54
GHACOF 14	74	47
GHACOF 15	73	45
GHACOF 16	56	11
GHACOF 17	71	42
GHACOF 18	58	16
GHACOF 19	79	59
GHACOF 20	83	66
GHACOF 21	76	52
GHACOF 22	72	43
GHACOF 23	63	26
GHACOF 24	73	46
GHACOF 25	72	44
GHACOF 26	75	50
GHACOF 27	73	46
GHACOF 28	71	42
GHACOF 29	71	42
GHACOF 30	57	14
GHACOF 31	69	38
GHACOF 32	67	33
GHACOF 33	73	46
GHACOF 34	63	26
GHACOF 35	76	53
GHACOF 36	66	32
GHACOF 37	74	48
GHACOF 38	73	46
GHACOF 39	84	68
GHACOF 40	78	56
GHACOF 41	75	49
GHACOF 42	77	54
GHACOF 43	71	42
GHACOF 44	70	40
GHACOF 45	70	39

Capacity needs

The Pre-GHACOF training does not include routine capacity development sessions in sub-season to season and climate change projections. A major gap that should be filled is lack of balanced interdisciplinary training in how the climate functions, how it will evolve over the next few decades, and how the reliability of that information may be assessed and results applied to build resilience to climate change. Therefore, there is urgency to train a new generation of professionals who understand how actionable climate science information may be derived and applied to empower stakeholders in making optimal risk management decisions.

Presently, GHACOF's products focus on rainfall and mean temperature. There is need for ICPAC to co-design and co-produce tailored products with key sectors such as agriculture, water sector, DRM, Health and energy in alignment with the Global Framework for Climate Services (GFCSs).

ICPAC needs to develop capacity of Regional Climate Centre (RCC) users in the access and use of the World Climate Research Programme's (WCRP) Coupled Model Inter-comparison Project (CMIP) climate model simulations; perform downscaling of climate change scenarios; provide information for the development of climate change adaptation strategies. Other relevant information for RCC users may include changes in onset, intensity and cessation of rainy seasons, and other drivers such as tropical cyclone frequency and intensity which affect dry and wet spells within a season.

User involvement

The GHACOF programme is organized in format that include parallel sessions that focus to meet the user needs. The main GHACOF users include NMHSs, various socio-economic sectors such as Agriculture and Food Security, Water Resources, Energy, Disaster Risk Management and Health as well as Food Security and Nutrition Working Group (FSNWG), regional and international humanitarian agencies, Governmental and Non-Governmental organizations.

The forum is a co-production platform, involving sector experts and climate scientists processing and delivering climate information for strategic decisions and management of climate sensitive socio-economic activities during the forecast period across the whole region. The GHACOF is also used as a mechanism to collect user feedback by forming country or sector working groups to discuss and present lessons learned in the use of previous GHACOF consensus climate outlook and circulating questionnaires during the forum. The feedback so far has been on the need to provide rainfall amounts, intra-seasonal characteristics such as dry spells, onset and cessation of season. ICPAC has piloted co-production with some key users and started to provide tailored climate services but there is a need for further improvement and expansion to include more sectors. During GHACOF Forum,.

Strength, Weakness, Opportunity and Threat analysis

Strength Weakness Opportunity and Threat (SWOT) analysis is a useful technique for understanding organization's strengths and weaknesses, and for identifying both the Opportunities and the Threats to the organization. The GHACOF strength is linking climate prediction science to the users as it has become the main regional mechanism for bringing together researchers, climate scientists, forecasters and users for dialogue and to formulate climate guidance and sector implications. GHACOFs have enhanced the capacity of NMHSs in data processing, diagnosis, and seasonal climate prediction, development of empirical/statistical prediction models and downscaling of global circulation model products. In addition, promotion of application of climate information and prediction by various end users has been enhanced. GHACOFs have also enhanced the collaboration between partners at national, regional and international levels. GHACOFs have demonstrated that optimum use of climate information and products can contribute enormously to resilience building for sustainable development in the region.

The weakness of GHACOF is the subjective development of consensus climate outlook and lack of socio-economic data sets and baselines for deriving and formulating objective sector mitigation strategies.

Opportunities that GHACOF provide include improved technical capacity of NMHSs to provide value-added climate services and a regular interaction and dialogue between producers and the users of climate information constituting user interface within the GFCS. This forms the basis for the generation of quality and user-driven products. Other RCOFs around the world also provide this kind of user-provider interface platform in line with the GFCS Pillars.

The other challenges facing the GHACOF include downscaling and improvement of prediction and early warning products, technical capacity both hardware and human resources, integration of community / local indigenous knowledge, effective awareness and communication systems, multi-sectoral / stakeholders involvement, need for strong national COFs modeled like the RCOF system involving all national sectors and players. These stakeholders can assure community level availability of downscaled RCOF products and information.

Sustainability of GHACOF

ICPAC as the WMO designated Regional Climate Centre for eastern Africa has been and will continue to lead and coordinate the organization of GHACOFs in collaboration with NMHSs and development partners of the region. It is the responsibility of ICPAC to incorporate user feedback in the subsequent forums. ICPAC would continue to mobilize resources required in the organization of the GHACOFs. However, there is need for key users to start sourcing for their own funding to attend GHACOFs while ICPAC takes care of convening the forum and meeting the cost of the meeting room. Currently, GHACOFs are mainly organized with resources from various projects at ICPAC.

Way forward

- Online platform where NMHSs could share and discuss their downscaled forecast, followed with video conference to update consensus regional climate outlook need to be in place. Users will also access products through on-line maprooms and geo-portal. ICPAC will be part and parcel of the National COFs.
- ICPAC could devise innovative methods of tracking the benefits of its climate services to local level users e.g farmers and water resources managers amongst others, which could be useful in demonstration of the value of climate information and to catalyze further uptake in more public and private socio-economic sectors
- Introduction of one day high level forum after every GHACOF dedicated to policy makers to communicate brief outcome of GHACOF for policy adoption
- Co-design and co-produce tailored climate services with users and innovate to enable ICPAC to add value to sector applications.
- ICPAC needs to implement an objective method for developing consensus regional climate outlook.
- There are plans to expand GHACOF products to include monitoring information for the recent and current seasons, sub-seasonal information including onset and cessation, rainfall distribution, climate advisories, impact-based outlooks as well as climate change information for adaptation.

References

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