Regional Climate Services for Agriculture Project Presentation, and Demonstration and Discussion of Agricultural Maprooms

Launch Events at 44th Greater Horn of Africa Climate Outlook Forum

Workshop Report

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS);

IGAD Climate Prediction and Applications Centre (ICPAC);

International Research Institute for Climate and Society (IRI).

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Abstract

A joint collaborative initiative between ICPAC, CCAFS and IRI was launched publically through a series of presentations and side sessions at the 44th Greater Horn of Africa Climate Outlook Forum (GHACOF44) in Kampala, Uganda, on 30 August 2016. This initiative is part of the Climate Services for Africa Project, a three-year project funded by the United States Agency for International Development (USAID). The project is being implemented at ICPAC and is intended to roll out climate services in support of Agriculture and Food Security to ICPAC member states (all IGAD and EAC countries) with technical support from CCAFS and IRI. The overall goal of this initiative is to strengthen the capacity of ICPAC and that of ICPAC member countries to develop effective climate products and services for agriculture and food security, for the benefit of smallholder farmers.

Keywords

East Africa; Greater Horn of Africa; Regional climate outlook forum; ENACTS; seasonal climate information; capacity building

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Acronyms

CCAFS	CGIAR research program on Climate Change, Agriculture and Food Security
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
ENACTS	Enhancing National Climate Services
GHA	Greater Horn of Africa region
GHACOF44	The Forty Fourth Greater Horn of Africa Climate Outlook Forum
ICPAC	IGAD Climate Prediction and Applications Centre
IGAD	Inter-Governmental Authority on Development
IRI	International Research Institute for Climate and Society
LGP	Length of Growing Period
NMHS	National Meteorological and Hydrological Services
PICSA	Participatory Integrated Climate Services for Agriculture
PR	Permanent Representative (to World Meteorological Organization)
SPI	Standardized Precipitation Index
WRSI	Water Requirement Satisfaction Index

Introduction

The potential benefits of climate information services to the region's agriculture and food security sector are not fully realized due in part to gaps between available information and the needs of agriculture and food security decision-makers, including farmers. ICPAC, CCAFS and the IRI are collaborating to strengthen the provision of climate information for agriculture and food security, in a manner that benefits smallholder farmers. The intended outcomes of this effort include:

- Strengthened provision of the technical support that ICPAC provides to national hydro-meteorological services of member countries;
- Increased usefulness of regional climate information and the GHACOF process for the agriculture and food security sectors; and
- Enhanced awareness and capacity of national and regional agriculture and food security stakeholders to use and communicate an expanded suite of climate information products, and enhanced input into their design.

This initiative was launched publically through a presentation and side sessions at GHACOF44, Kampala, Uganda, 30 August 2016. The work will be completed as a part of the *Climate Services for Africa Project*, a three-year project funded by the United States Agency for International Development (USAID).

Introductory Presentation to GHACOF44 Plenary

Jasper Batureine Mwesigwa (ICPAC) introduced the project in the main program of GHACOF44. He presented a brief overview of the collaborative initiative within the main program of GHACOF44. Along with discussing the project's goals and outcomes, this session highlighted planned new products that inform agricultural and food security decision making as well as proposed data source, type, and quality.

He noted that climate information is one of the fundamental inputs to agricultural planning and decision-making process. The potential benefits of climate information are not fully

realized in the GHA region due to widespread gaps between the available information and the needs of agriculture users. Tools and methods are available that could greatly close this gap and increase the usefulness of climate information. Advanced gridded datasets frommerging satellite and station data (e.g., CHIRPS, Funk et al., 2015), and ENACTS data sets developed by several African NMHSs provide an avenue for providing locally relevant information that is complete in space and time. Many products that would meet known needs of the agriculture and food security sector could be derived from daily gridded data. Statistical downscaling tools, such as the Climate Predictability Tool (CPT), provide a pathway for developing seasonal forecasts of some derived variables, on a high-resolution grid, in a range of probabilistic formats. The IRI's Data Library tools can be customised to provide a platform for producing and disseminating a range of useful derived data and graphical climate information products through online "Maprooms."

The overall goal of this initiative is to strengthen the capacity of ICPAC, and that of ICPAC member countries, to develop effective climate information products and services for agriculture and food security, for the benefit of smallholder farmers. Specific objectives are to:

- Develop a regional set of gridded historical and seasonal forecast climate information products tailored to the needs of the agriculture and food security sector;
- Develop and share tutorials and other manuals on communication and use of new agro-climatic and related food security products available in the online Maprooms;
- Raise awareness and build capacity of participating member countries to produce high-resolution online Maproom products;
- At the end of the project, assess how this initiative has contributed to the capacity of member countries to produce, communicate and use new high-resolution climate information products; and
- Develop a strategy to further develop and integrate useful new products and processes for developing climate services for agriculture into ICPAC's operational services and technical support for NMHS of member countries.

The proposed newMaproom products include: number of rain days; frequency and characteristics of dry and wet spells; rain-fed cropping season onset and cessation dates and length; peak of the growing season; SPI and percentile of precipitation; and WRSI and related

seasonal water balance variables. Table 1 shows the status of each. These products are being developed with the CHIRPS global data set (daily, 0.05 degree resolution) accessed through the IRI Data Library, which will later be replaced by an ICPAC version of CHIRPS incorporating regional station data.

Table 1. The status of ICPAC agriculture and food security Maproom products.

Maproom product	Status		
	Operational	Prototype	Under development
Data library and Maproom software at ICPAC (www.icac.net)	■		
Historical rainfall total, number of rainy days, number of wet/dry spells	■		
Historical rain-fed growing season onset (user-defined)		■	
Downscaled seasonal forecasts of rainfall total, onset, cessation, LGP, number and length of wet/dry spells			■
Rain-fed growing season cessation, LGP, SPI, Percentile of precipitation			■
Customization of a water balance tool for GHA			■

The new products target NMHSs, agricultural practitioners (farmers, pastoralists, agro-pastoralists), the agricultural extension community, early warning institutions, the humanitarian community, policy decision-makers, development partners and the agrometeorology research community. The presentation included a summary of how the new products can be used within an early warning system to trigger action.

During the discussion and questions session immediately after this presentation, a participant noted that this project presents good opportunities for improvement of Agro-Climate service delivery both at ICPAC and within the member countries; and that it addresses most of the issues raised during the previous GHACOFs. He went on to inquire about project funding: he wondered whether participating NMHSs would receive part of the project funds since they were mentioned as partners. He was informed by the presenter that the budget that was available for this work was so little to be distributed to each of ICPAC's member NMHS; the funders therefore agreed with ICPAC to have the latter manage the available funds while supporting capacity building at member states level.

Demonstration and Discussion on Agriculture Maprooms

During the afternoon session, the project team introduced and demonstrated the new Maprooms that are being developed under the project, including an operational Daily Precipitation Analysis Maproom, and a preliminary prototype of a Growing Season Analysis Maproom that currently provides analysis of rain-fed growing season onset dates. The rationale for the new and planned Maproom products, and the expected timetable for rolling them out were discussed. Part of the session was reserved for discussion and feedback from stakeholders, as a first step towards incorporating the feedback of end-users throughout the process of tool development. Below is a summary of the afternoon session presentations.

Rationale for the Proposed Maproom Products and Formats

The presentation, by James Hansen (IRI, CCAFS Flagship 2 Leader), started by making the case that there is currently a widespread gap between known climate information needs of farmers and other agricultural decision-makers, and the information that is routinely available in Eastern Africa. The most widely reported gap is in information that is relevant at the local scale at which most agricultural decisions are made. Other recognized needs include: (a) forecast information about agriculturally relevant growing season characteristics (e.g., timing and duration of the growing season, risk of damaging dry spells and other extremes, soil water balance), (b) transparent information about historic variability and seasonal forecast accuracy in probabilistic terms, and (c) consistent formats and spatial scales of forecast and historic information. The sparse observing network through the region has been a constraint to meeting these needs away from locations with long-term station records. With the development of methods to reconstruct historic records on a high-resolution grid, by merging station observations with satellite and reanalysis data, data scarcity no longer needs to be a constraint to providing locally relevant climate information for agriculture at scale.

Hansen reviewed the expanded suite of historic climate variables under development at ICPAC. Planned Maprooms will show spatial distributions of means, standard deviation and probability of exceeding user-specified thresholds. By selecting individual pixels or administrative polygons, users will be able to access seasonality time series, and probability-of-exceedance graphs of any of these variables for their location of interest.

Through an overview of PICSA, Hansen discussed how the graphic products from these Maprooms could benefit farmers. PICSA is a structured participatory approach, developed by University of Reading in partnership with CCAFS, for working with farming communities to understand and incorporate climate information into their farm and livelihood planning. The approach has been piloted successfully in Rwanda, Tanzania, Malawi, Senegal, Ghana, Mali and Zimbabwe; and has reached a stage where it can be mainstreamed, through staff training, into the operations of agricultural extension and other intermediary organizations. PICSA makes extensive use of the types of graphs that are under development in the agriculture Maprooms, to help farmers understand the variability and trends of their local climate, and assess risks of not meeting the climate requirements of their farming practices and promising options.

Plans include developing seasonal forecast information, downscaled to the same grid used for the historical products. Any of the historic seasonal variables discussed earlier, that show significant prediction skill, is a candidate seasonal forecast product. The planned Agriculture and Food Security Seasonal Forecast Maprooms will introduce a probability-of-exceedance format, in addition to terciles, and package the forecast with the historic observations and hindcasts that are used to downscale the forecasts. Hansen gave several reasons for making forecasts available in probability-of-exceedance format. First, it matches local historic climate variability, and hence the information that decision-makers would use in the absence of the forecast. Second, it preserves the full distribution information, allowing a user to know the probability associated with any threshold (e.g., minimum season length for given variety). Third, it conveys forecast skill in a clear, transparent manner. Fourth, although interpreting probabilistic information is challenging regardless of the format, experience suggests that well-developed participatory methods for relating probability-of-exceedance to farmers' experience with historic variability enable them to use the information and avoid some the confusion that often arises with tercile probability shifts. Hansen summarized a participatory process developed by the IRI, and piloted successfully in Kenya, Senegal and Tanzania, for training farmers to understand and use seasonal forecasts in probability-of-exceedance format. The PICSA process is being adapted and extended to incorporate this process, for use in Rwanda.

Demonstration of new and prototype agriculture

Jasper Mwesigwa, an Agrometeorologist at ICPAC, led the presentation and demonstration. The purpose of the demonstration was to help participants understand what is planned, and seek their feedback. The sequence of the demonstration, and screen shots for each step, are detailed in Appendix 3. Jasper demonstrated the process of accessing Maprooms from the ICPAC website opening page, and gave an overview of the current operational products. The demonstration then focused on a Growing Season Analysis prototype Maproom that currently only supports analysis of rain-fed growing season onset. Because of the change of seasonality with latitude, the prototype divides the IGAD region into three sectors: northern, equatorial and southern. Onset date is defined as the first time within the normal range of onset dates, that rainfall in a 3-day (default) period exceeds 20 mm (default), without being followed by a dry spell of 7 (default) or more days during the subsequent 21 (default) days. This is based on a widely used criterion, but the Maproom interface allows users to adjust all of the threshold quantities and durations. Further work is planned on the analysis of onset and cessation dates.

The demonstration concluded with the Daily Climate Analysis Maproom. This Maproom is operational at ICPAC. For any user-selected period (season and subset of years), the Maproom provides analysis of total rainfall, number of rain days, mean rainfall intensity (on rainy days), and frequency of dry and wet spells beyond user-selected threshold lengths. For any of these quantities, users can view maps of the spatial distribution of mean, standard deviation or probability of exceeding user-selected thresholds. Selecting a grid cell, or administrative polygon (district/county, province/state) provides location-specific time series graphs of the selected quantity. The Maproom menu gives users control of the spatial domain and resolution, period within the year, set of years to include in the analysis, variable, statistic to map, rain/dry day threshold rain amount, and threshold wet/dry spell duration.

Discussion

During the discussion session, a participant mentioned that some NMHSs are already producing similar products (such as onset and cessation dates). In addition, the IRI data library has also been installed in their websites with support from IRI. He questioned if there would be duplication. A response from ICPAC was that the new daily Maproom products (including onsets and LGP) are based on a global product (CHIRPS), while the NMHSs that are implementing ENACTS have higher quality datasets, since they incorporate many more

station observations than are available regionally at ICPAC. Besides, so far only Rwanda has daily Maproom.

Another participant inquired whether data in the form of maps could be downloaded and used in other relevant analyses. The presenters demonstrated the various formats (e.g. GeoTiff, PDF, GIF, JPG, etc.) into which daily Maproom products can currently be downloaded.

Another user from South Sudan inquired whether the daily Maproom could be used to demonstrate the 1998 drought in South Sudan. The answer was "yes," since the daily analysis Maproom is able to provide a number of user-defined products such as total cumulative seasonal rainfall, number of wet/dry days, rainfall intensity, number of dry/wet spells, etc. These products can be compared with long-term average seasonal characteristics to enable users be able to tell whether there was a drought in a given past year.

Working Dinner Session

A working dinner provided an opportunity for in-depth discussion and feedback on agriculture Maproom products and project plans. The set of invited participants (Appendix 2) represented NMHS and agriculture sector agencies from each IGAD country; and project collaborators from ICPAC, IRI, CCAFS and CARE.

Session introduction

In his introductory comments, Guleid Artan (ICPAC Director) stressed the close collaboration of ICPAC, IRI and CCAFS to improve the usefulness of seasonal forecasting and climate information services for the agricultural sector in the GHA region.

James Hansen (IRI) asked who had attended the CCAFS side event earlier in the day, and if the vision of CCAFS and products were in-line with the PRs visions; also asked about the relevance of the CCAFS tools that had been created. He summarized the objectives of the project as: (a) extending the usefulness of climate information produced by ICPAC for regional agricultural and food security stakeholders, and (b) building capacity at ICPAC so ICPAC can enable capacity building with national meteorological services of member states.

Tufa Dinku (IRI) added that ICPAC should: (a) build the capacity of the national met services; (b) build internal capacity and act as the regional centre of excellence for climate

science and services; (c) provide climate information of regional interest and at regional levels; and (d) lead efforts in sustaining regional climate services building on the ENACTS initiative.

Discussion

Tufa started the discussion by asking participations to consider two questions: “Are the proposed products really new?” and “Are the products useful?”

Helen (Tanzania) raised the issue of duplication between regional and national Maprooms, and asked why not develop a hub that links all member countries to ICPAC. Tufa (IRI) replied that national products incorporate observations from national stations, resulting in better quality than the regional products that will be developed by ICPAC based on the CHIRPS global product. Since only Rwanda and Madagascar have daily merged data so far, ICPAC can lead the effort to help other countries develop products and Maprooms adapted to their needs. Peter (Kenya)argued that national capacity for these products and services should be built first, before moving to regional level. Guleid (ICPAC)commented that ICPAC will never take the place of the national met due to lack of money and data. Peter (Kenya) noted that the national met services have far more stations and better daily gridded data than ICPAC. Zachary (ICPAC) commented, and Guleid confirmed, that it is the job of ICPAC to give regional forecasts, but NHMS should provide downscaled forecasts to users.

Tufa then addressed the issue of regional and national data sets being housed within ICPACMaprooms causing confusion. He proposed a solution: that the ICPAC Maproom link and rout users to national Maprooms, in those cases where NMHS have implemented them. Ahmed (Sudan) suggested that there should be a step-wise verification process for the creation of products at the national level (e.g. climatology, dekadal, daily data, onset of season, etc.). Tufa agreed and suggested that ICPAC should lead this. A participant from Ethiopia added that it is important to buildthe capacity of ICPAC, while at the same time strengthening national capacity, with the continued help of the IRI.

A participant from Sudan raised the issue of user capacity. Jamesexplained that part of the Africa Climate Services project is focused on building the capacity of agricultural extension to use the new information products, but that additional investments are needed at the national

level for those who work with farmers. Tufa noted that the third pillar of ENACTS is improving user capacity.

Participants from Djibouti and Somalia asked how NMHS capacity could be improved in member states that are less developed. Guleid cited ICPAC's role in making stations operational in Djibouti; but emphasized that it was a small and limited project. He asked member countries to reach out to ICPAC, and suggested that the DL and Maprooms could help build capacity at a national level. He admitted that he initially did not know what the Data Library and Maprooms were until he visited the IRI in Nov 2015 for the El Nino conference, and suggested that the potential of the Maprooms is limited only by the imagination of NHMS.

When asked what are the main take-away points for the CCAFS project with ICPAC, James responded that the project aims primarily to build capacity within the agriculture sector – yet this can only happen if it helps reduce the gap between the information that agriculture needs, and the information that regional and national climate institutions provide. He explained that the funding from USAID cannot be used at the country level, but the products and capacity that are developed at the regional level (through ICPAC) could hopefully attract investment in climate services at the national level. Tufa seconded these key messages and mentioned that CCAFS projects could be very effective, leveraging small amounts of funding to produce large outputs and achieve large impact.

Helen (Tanzania) proposed that NMHS could help build the capacity of other NMHS in the region. Tufa responded that ICPAC has advantages for helping individual countries, but needs to first build its own technical capacity in order to do this effectively. He mentioned that an ENACTS meeting in November will provide opportunities to share best practices, challenges and opportunities.

Additional discussion highlighted several advantages of nation Maprooms relative to regional Maprooms, technical progress on platforms for real-time monitoring and feedback on Maproom performance and use, and the need for good online tutorials for agricultural Maprooms.

Conclusions

An ambitious collaborative effort between ICPAC, CCAFS and IRI, funded by USAID, is working to reduce the gap between available climate information, and the needs of the agriculture and food security sector, in eastern Africa. The intended outcomes of this initiative, publicly launched at GHACOF44, are (a) strengthened provision of the technical support that ICPAC provides to member country NMHS, (b) increased usefulness of regional climate information and the GHACOF process for the agriculture and food security sectors, and ultimately (c) enhanced use of climate-related information for agriculture and food security management in member countries.

The launch-related events at GHACOF44 showcased plans and progress so far in developing more useful suites of information products tailored to the needs of agriculture and food security decision-makers. Online Maprooms already provide flexible analysis of the variability in space and time of several quantities that are of interest to the agriculture sector: wet day frequency, rainfall intensity, risk of dry and wet spells beyond user-selected threshold durations. A prototype Maproom extends the analysis to the onset of the rain-fed growing season. Presentations outlined plans to further expand the suite of derived historical information products and analyses; and to develop downscaled, gridded, fully probabilistic seasonal forecasts for this expanded suite of variables tailored to the needs of the agriculture and food security sectors. Discussion and feedback endorsed the value of the suite of products that are planned.

A dinner session initiated discussion with NMHS and representatives of the agriculture sectors of all IGAD countries about how ICPAC could best support its member countries to strengthen their national climate services. The ideas, concerns and recommendations that came out of the discussion provided valuable feedback for ICPAC staff and collaborators. Frequent dialogue and close coordination with member states throughout the project will ensure that the effort is as useful as possible at both the regional and national level.

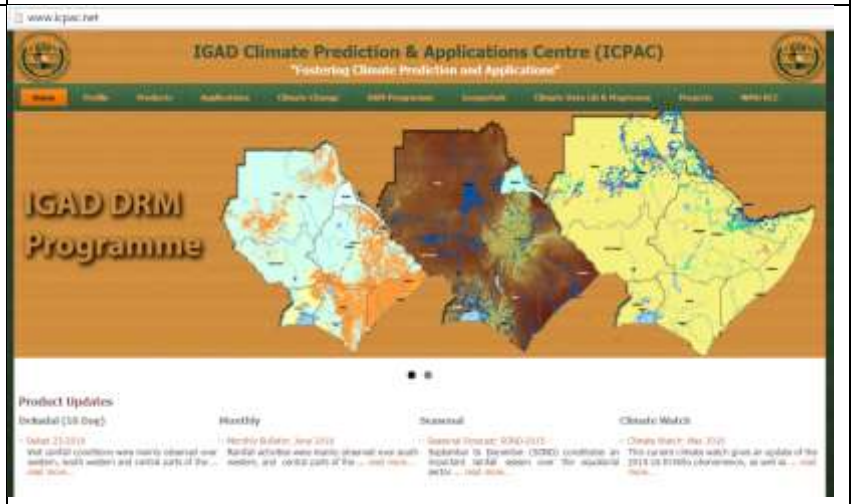
Appendix 1. Program of Launch Activities

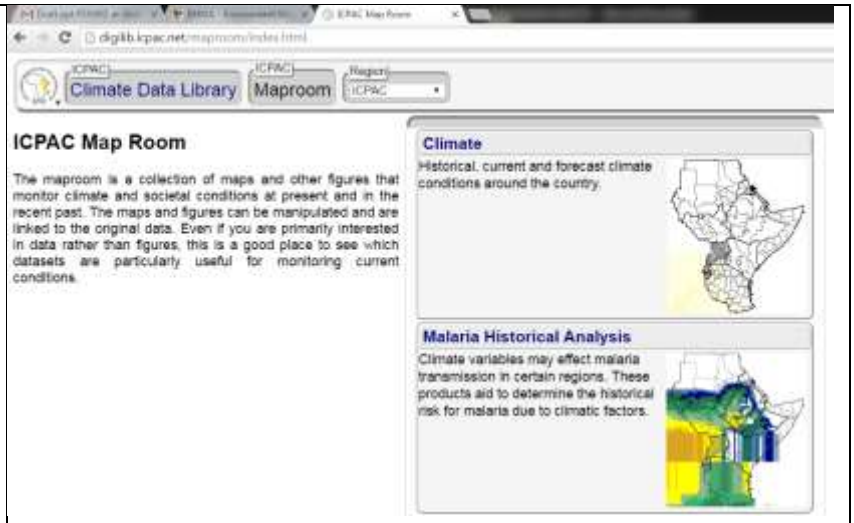
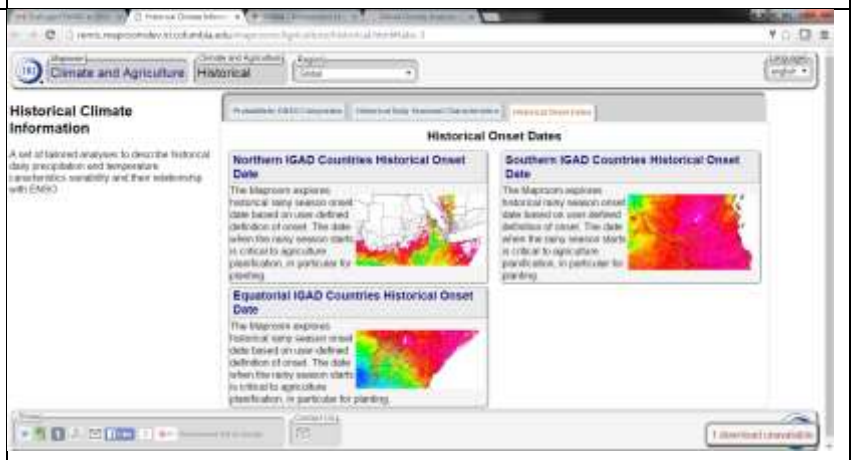
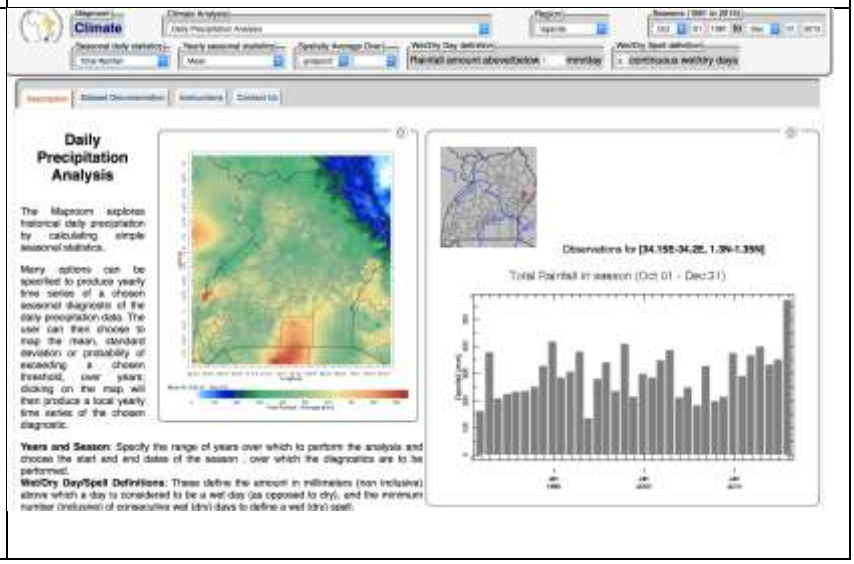
Time	Activity
GHACOF44Plenary	
12:40 – 13:00	Introductory presentation of ICPAC/CCAFS/IRI *Climate Services for Agriculture* Project
Side Session	
16:00 – 16:15	Demonstration and discussion of new and prototype Maprooms
16:15 – 16:30	Rationale for the proposed Maproom products and formats
16:30 – 16:50	Discussions and stakeholder feedback
16:50 – 17:00	Identification and registration of product evaluators
Dinner Session	
19:30 – 21:30	Dinner session – by invitation, Marina Restaurant

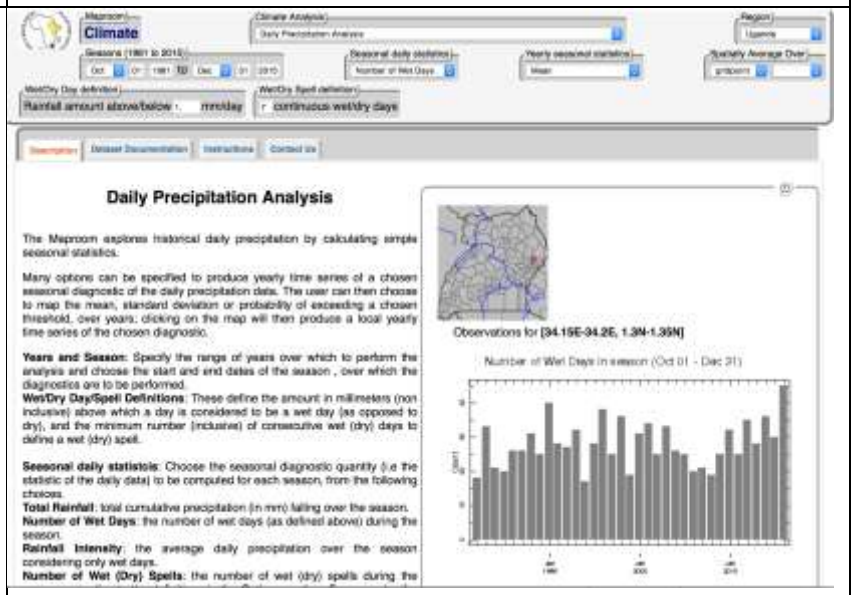
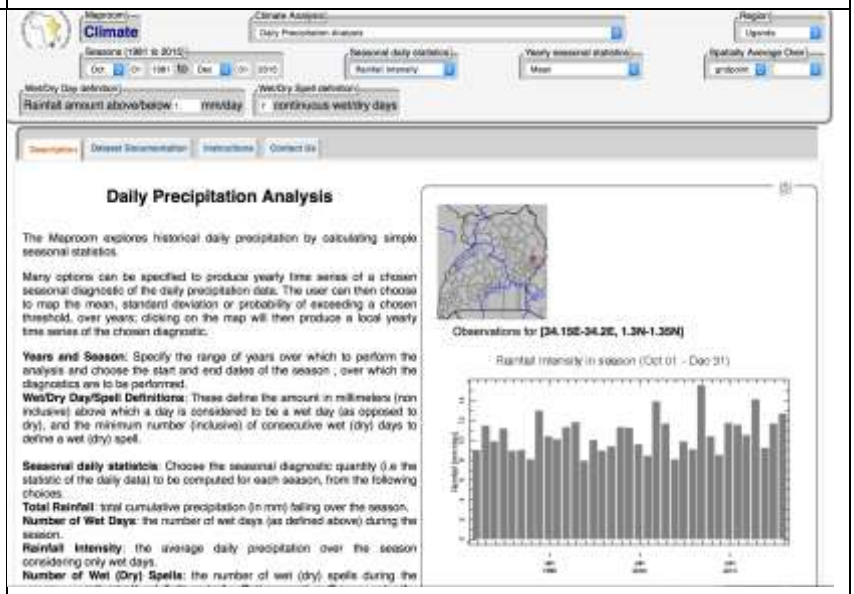
Appendix 2. Working Dinner Session Participants

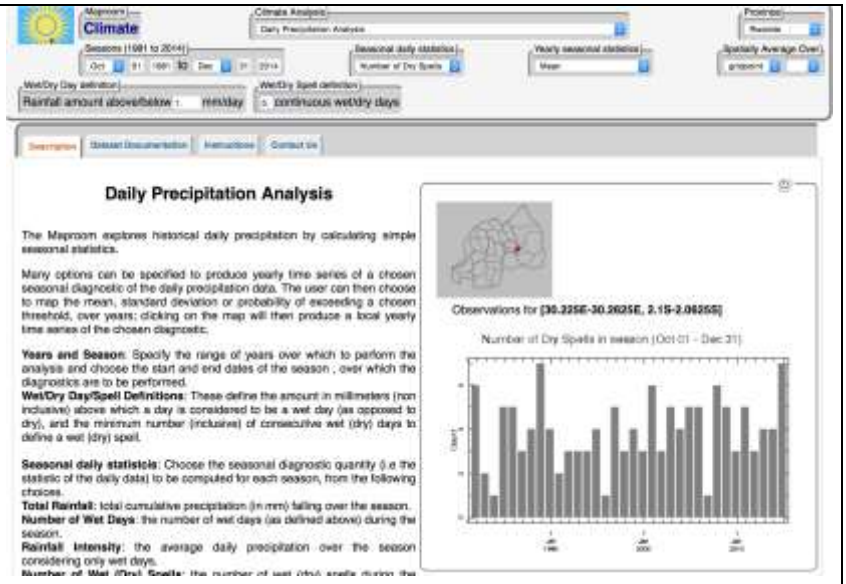
Category	Country/ Organisation	Name	Specialty	Gender
Agriculture &Agromet experts	Sudan	Ms. Hanan Yousif Mohamed Ahmed	Livestock Expert	F
	Ethiopia	Dr. Alemayehu	Livestock Expert	M
	Ethiopia	Mr. Dhaba Tilahun	Agrometeorologist	M
	Djibouti	Dr. Allaleh Wafi	Livestock Expert	M
	Somalia	Mr. Abdullahi Hassan Hussein	Agrometeorologist	M
	South Sudan	Mr. Justin Taban Aggrey	Agrometeorologist	M
	Uganda UNMA	Mr. Ojara Moses	Agrometeorologist	M
	Kenya	Mr. Edward Amoni	Agrometeorologist	M
	Tanzania	Ms. Halima Kwikenga	Food Security Expert	F
	Burundi	Ms Claudette Nkurunziza	Crop Scientist	F
PRs	Sudan	Dr. Ahmed Mohamed Abdelkarim	PR	M
	Ethiopia	Mr. Feten Teshome	PR	M
	Somalia	Mr. Abdulkadir Moallim Abdi Gure	Representing the PR	M
	South Sudan	Mr. Mojok Modo	PR	M
	Uganda	Mr. Deus Bamanya	Dep. PR UNMA	M
	Uganda	Mr. Robert Rutaagi	Board CM, UNMA	M
	Kenya	Mr. Peter Ambenje	Representing the PR	M
	Tanzania	Ms Helen Msemo	Representing the PR	F
	Rwanda	Mr. Mathew Mbati	Representing the PR	M
	Burundi	Mr. Aloysius Rurantije	PR	M
Partner organisa-tions	CARE	Ms Maureen Ambani	Climate Comm Advisor	F
	CARE	Ms Fiona Percy	Regional Coordinator	F
	CARE	Ms Jemimah Maina	Climate Comm Intern	F
	ICPALD	Ms Caroline Kirungu	Agroclimatologist	F
	IRI	Ms Aisha Owusu	Climate Researcher	F
	IRI	Dr Tufa Dinku	Research Scientist	M
	IRI	Dr Asher Siobert	Post Doc Scientist	M
	IRI	Ms Elisabeth Gawthorp	Comm Coordinator	F
	IRI/CCAFS	Dr. James Hansen	CCAFS Flagship Leader	M
ICPAC		Dr. Artan Guleid	Director	M
		Dr. Zewdu Segele	Climate Modeller	M
		Mr. Oliver Kipkogei	Downscaling Assistant	M
		Mr. Zachary Atheru	PM, Data & Diagnostics	M
		Dr. Philip Omondi	Climate Modeler	M
		Mr. Jasper Mwesigwa	Agrometerologist	M
		Mr. Keflemariam Sebhatu	PM, DRM Program	M
		Mr. Paul Ombai	Accountant	M

Appendix 3: Overview of Daily Climate Analysis, and prototype Growing Season Analysis Maprooms

Instructions	Display
To navigate to the daily precipitation analysis Maproom, click the data library and Maproom page on ICPAC website	
Then click on ICPAC Map Room	

Click on Climate	
The current prototype Growing SeasonAnalysis Maproom divides GHA into three distinctive regions(i.e. the northern sector, equatorial sector, and southern sector. The three sectors are divided by the 5 degrees latitude north and south of the equator.	
Navigate through the various fields on the interphase	
Select a season of interest (by selecting dates), select the required daily analysis (e.g. total rainfall, number of wet/dry days, rainfall intensity, number of dry/wet spells), select yearly seasonal statistics (e.g. mean, standard deviation, probability of exceedance), decide on the location or gridof interest, and then set the thresholds for wet/dry day and	

/or wet/dry spells.	
In the displayed map, now click on the grid of interest and change the seasonal daily statistic	
Continue changing the seasonal daily statistic and other variables	

You may change the country and select a new grid of interest	
On each display, you may navigate through various panes such as Description, Dataset Documentation, Instructions, Contacts, etc.	
You can also navigate through climate analysis, climate monitoring and climate forecasts.	Once an image is displayed, you can save it in various formats including GeoTif, JPG, PDF, etc. The displayed product can also be shared “on the fly”.