Workshop Report: Training and Discussions on Seasonal Rainfall Forecasts for March-May 2018 in Rwanda and September-December 2017 Verification

February 2018

Asher Siebert
Alison Rose

Training and discussions on seasonal rainfall forecasts for March-May 2018 in Rwanda and September-December 2017 verification

Kigali, Rwanda, February 2018

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

Asher Siebert
Alison Rose

Correct citation:

Siebert, A. and Rose, A. 2018. Workshop Report: Training and Discussions on Seasonal Rainfall Forecasts for March-May 2018 in Rwanda and September - December 2017 Verification. CCAFS Workshop Report. Wageningen, Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

CCAFS Workshop Reports aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

Published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD).

Contact:
CCAFS Program Management Unit – Wagenigen University & Research, Lumen Building, Droevendaalsesteeg 3a, 6708 PB Wageningen, the Netherlands. Email: ccafs@cgiar.org

Contact:

Abstract

This report describes training activities in Kigali, Rwanda, February 2018, led by Dr. Asher Siebert from the International Research Institute for Climate and Society (IRI). The training visit was part of the Rwanda Climate Services for Agriculture project, a four-year initiative (2016-2019) funded by the U.S. Agency for International Development (USAID) that seeks to transform Rwanda's rural farming communities and national economy through climate services and improved climate risk management. The main objective of the training visit was to collaborate on seasonal rainfall forecasts for MAM 2018 in Rwanda and SOND 2017 verification.

Keywords

Climate information services; Rwanda; Seasonal climate forecast; Maproom

About the authors

Asher Siebert is a Post-Doctoral Research Scientist at the International Research Institute for Climate and Society (IRI), Columbia University, New York, USA. Contact: asiebert@iri.columbia.edu.

Alison Rose is the Science Officer for Flagship 4: Climate Services and Safety Nets of CCAFS and is based at IRI at Columbia University. Contact: arose@iri.columbia.edu.

Acknowledgements

This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit https://ccafs.cgiar.org/donors.

We gratefully acknowledge institutional and technical support provided by the CGIAR International Center for Tropical Agriculture (CIAT) and the International Research Institute for Climate and Society (IRI). This report is an output of the Rwanda Climate Services for Agriculture Project, and was made possible through support provided by the U.S. Agency for International Development (USAID) Rwanda Mission. The opinions expressed herein are those of the authors, and do not necessarily reflect the view of the USAID and other donors.

Contents

Introduction 8

Training 8

Forecast Details and Dissemination 9

Conclusion and Recommendations 13

Appendix 1: Daily Programme 14

Appendix 2: Participant List 15

Acronyms

CCAFS	Research Program on Climate Change, Agriculture and Food Security
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
CIAT	International Center for Tropical Agriculture
CPT	Climate Predictability Tool
ENACTS	Enhancing National Climate Services Initiative
ENSO	El Niño Southern Oscillation
GCM	General Circulation Model
GEOCOF	Geospatial Climate Outlook Forecasting Tool
GHACOF	Greater Horn of Africa Climate Outlook Forum
ICPAC	IGAD Climate Prediction and Applications Center
IRI	International Research Institute for Climate and Society
MAM	March, April, May
SOND	September, October, November, December
SST	Sea Surface Temperature s
USAID	US Agency for International Development
WRF	Weather and Research Forecasting Model

Introduction

This report describes training activities in Kigali, Rwanda in February 2018 led by Asher Siebert from the International Research Institute for Climate and Society (IRI). The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), in collaboration with IRI, held trainings for the Rwanda Meteorology Agency (Meteo Rwanda). The training visit was part of the Rwanda Climate Services for Agriculture project, a four-year initiative (2016-2019) funded by the U.S. Agency for International Development (USAID) that seeks to transform Rwanda's rural farming communities and national economy through climate services and improved climate risk management.

Training

The purpose of the visit was to contribute to the forecast for MAM 2018 season with forecasts for seasonal total rainfall, rainy day frequency and onset date and share some insights on forecast verification methods for SOND 2017 forecast.

Prior to coming to Rwanda, Dr. Siebert had participated in the GHACOF 48 in Mombasa, Kenya. At a side meeting, he made a presentation on the technical side of the ICPAC Agriculture and Food Security Maprooms. At Meteo Rwanda, Dr. Siebert delivered his presentations from the GHACOF and gave a presentation that he had given at the American Meteorological Society conference in January on the climatology and SOND 2017 forecast.

Dr. Siebert also discussed and provided training on several other topics. This included the station and gridbox based approaches to forecast verification and covered probabilistic forecast verification methods in CPT.

Mr. Steven Higiro from Meteo Rwanda gave his forecast presentation from the GHACOF. This forecasting approach used multiple platforms: CPT as a tool, multiple GCM outputs, GEOCOF and the WRF regional model. Further discussions focused on a consensus forecast for Rwanda for subsequent dissemination.

Forecast Details and Dissemination

In the week prior to the training (February 5-9), Mr. Higiro spent time in Kenya working with regional partners at ICPAC during the pre-COF. In the pre-COF process, scientists at ICPAC guide national meteorological service representatives of each country to create forecasts using CPT with multiple GCM outputs, GEOCOF and the WRF model. These multiple factors are brought together and evaluated by ICPAC scientists in order to produce the seasonal consensus forecast for the region; the individual national representatives use their own analysis to produce a consensus forecast for each nation. While this multiple-tool approach may have some advantage in exploring many approaches to forecasting, the output of the different tools can often be contradictory (with one tool suggesting above average rainfall while another suggests below average rainfall for the same geographic region and season). Additionally, because of the short time involved in producing these multiple forecasts, there is not always adequate time to evaluate the hindcasts and gain a clear picture of the skill of each method. As a consequence, there may be an impulse to "average" the output of the different tools in order to arrive at a "reasonable" consensus. But this approach may, at times, omit important skill evaluation, which might rule some platforms out of consideration altogether while simultaneously emphasizing the value of other platform outputs.

Using this pre-COF process, Mr. Higiro produced a forecast map for Rwanda that anticipated near normal to above normal conditions in the northern and northeastern region of Rwanda, with near normal conditions for much of the rest of the country (except perhaps the southwest corner). This was largely consistent with the official GHACOF statement. See Figures 1 and 2 below. Mr. Higiro also produced forecasts for the rainy-day frequency and onset date using this multi-factoral pre-COF process.

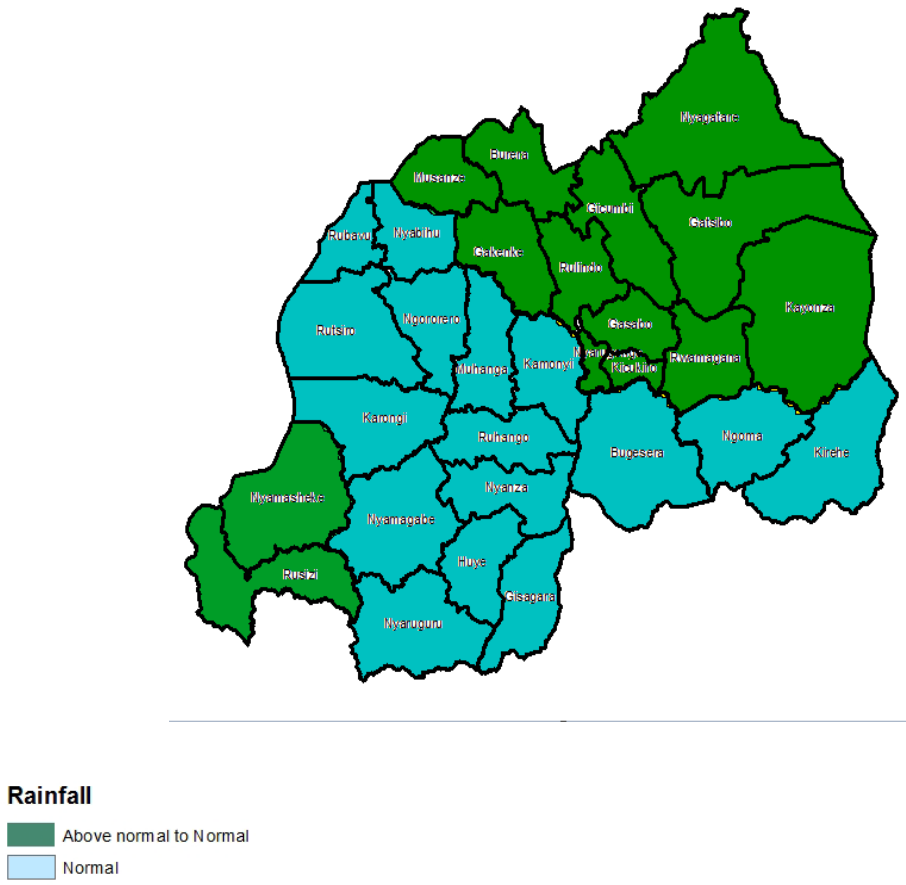

Figure 1: Forecast outlook for Rwanda MAM 2018 total rainfall from Mr. Higiro's presentation (*note that the final version of this graphic that was used for dissemination is slightly different)

Dr. Siebert was not involved with the pre-COF process. Prior to and during his trip to East Africa, he completed several different predictor-predictand analyses exclusively using CPT and high resolution observational data as the predictand (using both ENACTS and CHIRPS). The forecast he found to have the highest empirical skill leaned more towards drier conditions than the GHACOF consensus forecast or Mr. Higiro's forecast. He also made a forecast for rainy day frequency (which also leaned towards fewer than normal rainy days). He shared his forecast parameters with the trainees, so they could reproduce the same output through their own CPT analysis. The summary graphic for this forecast is shown in Figure 3.

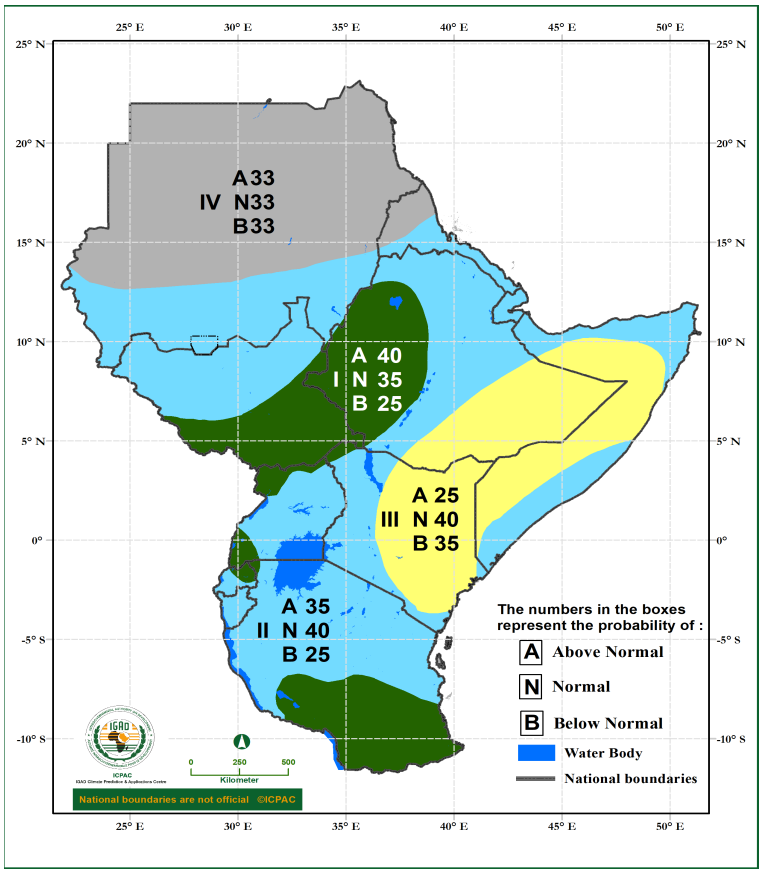

Figure 2: Forecast outlook for GHA MAM 2018 total rainfall from ICPAC

Both anecdotally and empirically, the SOND 2017 season was observed to be above average rainfall and above average rainy day frequency in most parts of Rwanda. The forecasts made by Dr. Siebert were evidently fairly close to being correct with relatively small errors (not more than 15% average error across 13 stations for the SOND 2017 season). Furthermore, anecdotally, rainfall in January and early February continued to be above average, in spite of weak La Niña and weakly negative Indian Ocean Dipole conditions. This is somewhat unusual because, in most years, January and February are somewhat drier than SOND and, in many cases, La Niña conditions and negative Indian Ocean Dipole conditions are associated with below normal rains in much of tropical East Africa. The IRI seasonal forecast, as of early February 2018, anticipated a gradual transition over the coming 3-6 months back from the weak La Niña conditions towards more ENSO neutral or even El Niño conditions. In light of these environmental and observational factors, the GHACOF consensus statement and the

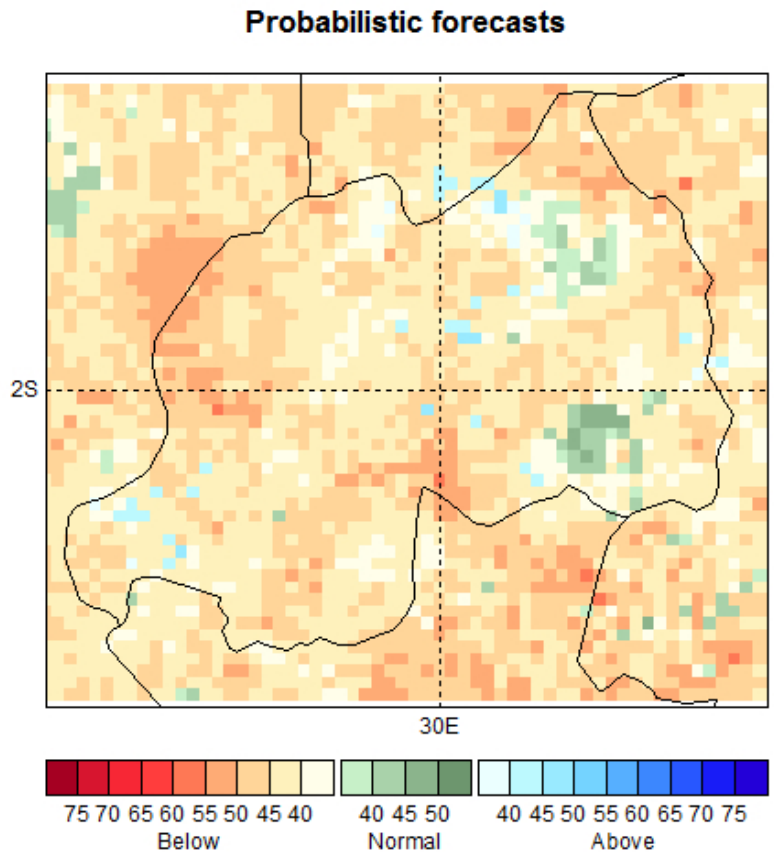

Figure 3: Forecast outlook for Rwanda MAM 2018 total rainfall using CPT analysis of January tropical Indian Ocean SSTs and ENACTS rainfall.

output of Mr. Higiro, Dr. Siebert worked primarily with Mr. Higiro and Mr. Anthony Twahirwa to hone Mr. Higiro's forecast in subtle ways to prepare it for dissemination (rather than advocating his own drier forecast). This was a judgment call both based on time considerations and on scientific confidence (while the goodness indices and historical performance of his forecast seemed robust, the drier forecast for MAM 2018 seemed to be at odds with environmental conditions at the time).

On February 17, there was a smaller working session consisting of Mr. Higiro, Mr. Twahirwa, Dr. Siebert and Director General of Meteo Rwanda, Mr. John Semafara. During this session, the process of extracting site-specific probability distributions for individual locations within the country was illustrated and the director general seemed particularly engaged in learning about this feature of CPT and making sure that Meteo-Rwanda staff take advantage of that capacity in the future.

Conclusion and Recommendations

Several key conclusions have emerged regarding the next phase of the project related to capacity building, skill assessment of forecasting platforms, and data access and usage.

1. Capacity Building: Building the capacity within Meteo Rwanda to make high quality objective seasonal forecasts was articulated as a key goal for the next phase of the project. This approach to seasonal forecasting should be based on the best sources of predictability for each season. Furthermore, this forecasting approach must produce statistically downscaled user-oriented information that can be made accessible through maprooms. Another objective of the next phase of the project is to enable Meteo Rwanda staff to upload the output of these forecasts into Maproom format independently of IRI. Objective skill assessment must also be feasible for future forecasts. All of these objectives can be facilitated by the use of CPT.

2. Skill Assessment: Skill assessment of the forecasts in operation and retrospective forecast validation/hindcast validation were also articulated as goals for the next phase of the project. There is a need to evaluate the skill of the different platforms used in the pre-COF process objectively and compare those approaches with a more careful analysis of CPT based forecasts of regional observed datasets (such as SST and ENACTS). Earlier training at Meteo Rwanda done by Dr. Siebert (in September 2017) illustrated how to use many features of CPT, including, the evaluation of the skill of a CPT forecast. This training also instructed Meteo Rwanda staff on how to extract daily-derived variables from the IRI data library and from the Meteo Rwanda data portal.

3. Data Access and Use: Another immediate issue for Meteo Rwanda seemed to be that not all forecasting officers had reliable access to the ENACTS data or had been using the ENACTS data in their forecast analysis. At this point in the project, the value of the ENACTS data has been demonstrated and all Meteo Rwanda staff who have a responsibility pertaining to seasonal forecasting should access these data and factor them into their seasonal forecasting efforts for all related forecast variables. While other data sets can be used in conjunction with ENACTS for exploration and comparison, ENACTS data uses considerably Meteo Rwanda station data than any global product, and should thus be mainstreamed into Meteo Rwanda's operational forecasts.

Appendix 1: Daily Programme

February 14: Presentation from the GHACOF with Meteo Rwanda staff.

February 15: Presentation from the American Meteorological Society conference in January on the climatology and SOND 2017 forecast. Discussions on station and gridbox based approaches to forecast verification.

February 16: Discussions on forecast files and specifications and probabilistic forecast verification methods in CPT. Presentation by Mr. Steven Higiro from the GHACOF.

February 17: Working session with Meteo Rwanda on target villages for the PICSA process

Appendix 2: Participant List

Name	Institutional Affiliation	Gender
Ms. Peace Bamurange	Rwanda Meteorology Agency, Rwanda	Female
Mr. Joseph Hazabintwari	Rwanda Meteorology Agency, Rwanda	Male
Mr. Steven Higiro	Rwanda Meteorology Agency, Rwanda	Male
Mr. Vedaste Iyakaremye	Rwanda Meteorology Agency, Rwanda	Male
Mr. Jonah Kazora	Rwanda Meteorology Agency, Rwanda	Male
Mr. Felix Mucyo	Rwanda Meteorology Agency, Rwanda	Male
Mr. Godfrey Musafiri	Rwanda Meteorology Agency, Rwanda	Male
Ms. Annonciata Muteteri	Rwanda Meteorology Agency, Rwanda	Female
Mr. Felix Ndabarase	Rwanda Meteorology Agency, Rwanda	Male
Mr. Mishak Ndikuyo	Rwanda Meteorology Agency, Rwanda	Male
Ms. Esperance Nyiranteziryavo	Rwanda Meteorology Agency, Rwanda	Female
Mr. Emmanuel Rukundo	Rwanda Meteorology Agency, Rwanda	Male
Ms. Joyce Rusaro	Rwanda Meteorology Agency, Rwanda	Female
Mr. Joseph N. Sebiza	Rwanda Meteorology Agency, Rwanda	Male
Mr. Serge Senyana	Rwanda Meteorology Agency, Rwanda	Male
Mr. Amos Uwezeye	Rwanda Meteorology Agency, Rwanda	Male
Mr. Anthony Twahirwa	Rwanda Meteorology Agency, Rwanda	Male
DG Mr. John N. Semafara	Rwanda Meteorology Agency, Rwanda	Male
Dr. Asher Siebert	IRI, USA	Male