Info Note

Climate Services amid the Covid-19 Pandemic

Seasonal and sub-seasonal climate advisory and communication to agricultural stakeholders in Ethiopia

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Key messages

- Communicating seasonal and sub-seasonal climate forecasts and agro-advisories is of critical importance to smallholders and other value chain actors in developing regions.
- Consistent use of live radio shows proved an effective means of reaching millions of smallholder farmers, other value chain actors and policy makers with seasonal and intra-seasonal climate advisories during the Covid-19 pandemic.
- As a safe and effective last-mile connectivity, Radio has a huge potential to strengthen Ethiopia's agricultural extension system if it is used effectively.
- Production and delivery of relevant climate agro-advisories require effective collaborations of professionals and institutions.

This brief summarizes a work that has been conducted in 2020 to provide seasonal and intra-seasonal climate forecasts and advisories to smallholder farmers amid the Covid-19 pandemic in Ethiopia. The work involved (i) preparation of seasonal outlook for the main rainy season, (ii) translation of the forecasts into advisories, and (iii) communication of advisories to smallholders to serve for tactical decision making. Similar steps were followed to generate 10 to 15 days forecasts and advisories and communicating them to smallholders together with COVID-19 status updates and awareness messages.

The Critical Importance of Climate Services

Climate change and seasonal and sub-seasonal climate variability pose serious challenges to smallholder farmers who produce more than 90% of the agricultural output under rainfed farming systems in Ethiopia (Tesfaye et al., 2015). Extreme events, such as droughts and floods, that have triggered humanitarian crises also erode farmers' capacity to recover long after the crisis is over by depleting their productive assets and human capital. By creating a disincentive for farmers to adopt more profitable practices and for value chain actors to engage small-scale farmers, the uncertainty associated with climate variability keeps many smallholders under subsistence production systems and in the vicious circle of poverty (Shiferaw et al., 2014).

Climate information and related agronomic advisory services have a significant importance to manage production risks induced from climate and weather events (Balehegn et al., 2019). But provision of reliable and timely information in many developing countries including Ethiopia is limited and most farmers rely on traditional weather forecasting knowledge for strategic and tactical farm management operations (David et al., 2017).

While Ethiopia's public agricultural extension system is regarded as the strongest in sub-Saharan Africa, it is not yet adequately equipped to tailor technology packages to the country's highly heterogeneous climate or to help farmers deal with year-to-year variability. Therefore, there is a need to support the national system by synthesizing climate forecasts, generating agro-advisories, and communicating them to smallholders, decision makers and other actors in the agricultural value chains.

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

In 2020, the Climate and Geospatial Research Directorate of the Ethiopian Institute of Agricultural Research (EIAR), the International Maize and Wheat Improvement Center (CIMMYT), ICRISAT and the East African Regional Office of the CGIAR program on Climate Change, Agriculture and Food Security (CCAFS) collaborated and implemented a climate service program that aimed at enhancing smallholder farmers' adaptation to seasonal and intra-seasonal climate variability risks by providing advanced weather and climate information coupled with agro-advisory services. The piloting was conducted from May to October 2020 during the main rainy season.

Generation of Seasonal Climate Forecasts

S2S (sub-seasonal to seasonal) Forecast Approach

In our innovative Digital AgroClimate Advisory platform (Seid et al., 2019), a seamless forecasting system was tested for a span of time ranges from 1 week to 6 months for rainfall and temperature forecasts over sites using multimodal ensemble bias corrected global datasets (GFS, ECMWF S2S and NMME). The aim was to improve location specific S2S forecast skill and to integrate medium-range forecasts with seasonal prediction to enhance agricultural yield prediction and minimize climate risk from seasonal to sub-seasonal timescale.

First, the daily air temperature and precipitation time series recorded between January 1, 1980, and December 31, 2010, from sites and different climatic zones were modeled and hindcasted. For each ten-day hindcast, we used the linear correction and seasonal correction methods using sinusoidal time function for temperature (mean, max, min and wind speed, and dew point), and quantile for rainfall over Ethiopia.

Secondly, for seasonal and sub-seasonal forecasts, we used Canonical Correlation Analysis (CCA), implemented via the Climate Predictability Tool (CPT), by adopting the IRI NextGen system (Simon J., 2020). This method provided a state-of-the-art approach to produce seasonal forecasts. These predictions included critical variables like accumulated rainfall, frequency of rainy days, and minimum, maximum, and mean temperature. Rather than focusing on probabilities of above normal, normal, and below-normal categories of total rainfall or mean temperature, NextGen also provides probabilities of exceeding thresholds of interest in the decision-making process (Muñoz et al., 2019). This enabled us to forecast with the same system both mean and extreme values. Indeed, NextGen is a general, flexible approach that helps produce probabilistic forecasts not only of the total amount of rainfall expected during the next season or next few weeks, but also rainfall characteristics, like how precipitation will be distributed: frequency of rainy/dry days, onset, cessation, and duration of the rainy season. The system can also provide other variables of interest if quality data is available, and the variables exhibit enough predictability. Finally, the climate forecasts were prescribed to the crop simulation models, and their utilities were evaluated for crop yield forecasting and agricultural decision support (Seid et al., 2020).

Results

Seasonal Rainfall Prediction

The seasonal climate forecast of the Kiremt Season (June-September) featured above-normal rainfall probabilities. Most parts of the country, including Central Oromia (north and east Shewa), East Oromia (west Hararghe, Arsi and Bale highlands), and the adjoining areas of Southern Nations, Nationalities and Peoples Region (SNNPR) such as Wolayita, Silte zone, Gamo Gofa, Sidama Region, and the northeastern Amhara and southern Tigray regions were expected to have normal rainfall. Most of the country's Kiremt rainfall receiving areas, central and western Amhara, Gambelia, Benishangul Gumuz, western Oromia, and large portions of SNNPR and Tigray regions were expected to have rainfall in the normal-to-above-normal range during the June-September Kiremt season. However, some areas in east and west Wolega, as well as east and west Gojam, could have below-average rainfall. Heavy rainfall was likely over some regions in Bale and eastern Shewa (Fig.1).

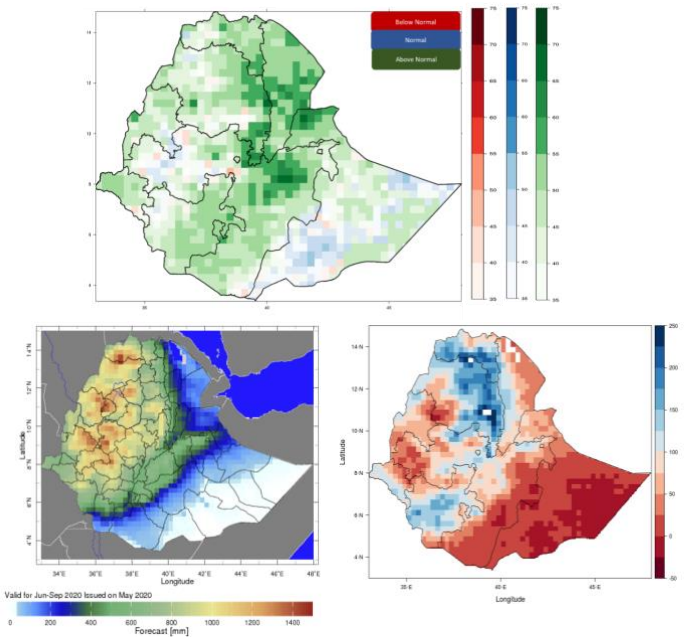

Figure 1. 2020 *Kiremt* seasonal rainfall prediction based on Eight GCM models updated on May 17, probabilistic forecast (upper), deterministic forecast (lower left), anomaly (lower right).

Seasonal Temperature Prediction

The seasonal temperature outlook for Kiremt 2020 showed that the maximum, minimum, and average temperatures could decrease over the southern part of SNNPR. A slight decrease in maximum, minimum, and average temperature were also anticipated over east and west Hararghe and Bale's highlands. Warmer than normal temperatures were forested over much of the country's northern, central, western, and southeastern parts (Fig. 2).

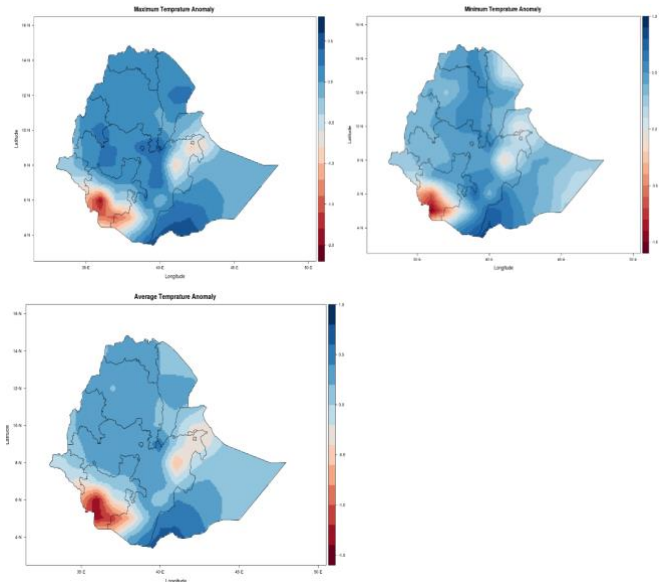

Figure 2. Kiremt 2020 Seasonal Temperature forecast anomalies.

Seasonal Agricultural Risk Prediction

The onset of the 'Meher' growing season based on the consensus seasonal rainfall outlook started in mid-to-late-May over most of the *Meher* growing areas of Ethiopia. The growing season likely to started in early-to-mid-June over the eastern half of Amhara, the northeastern tip of Oromia, and eastern and northeastern Tigray. In general, early and on time onset of the *Kiremt* growing season were forecasted over most parts of Ethiopia (Fig. 3).

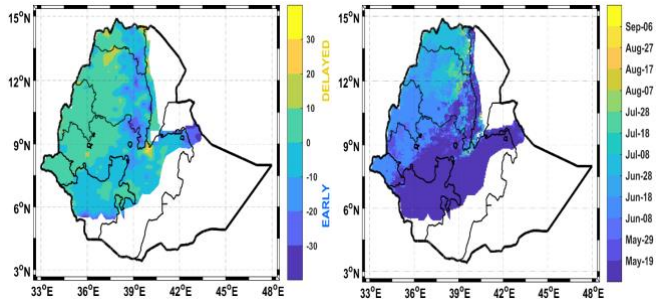

Figure 3. 2020 *Kiremt season* rainfall onset forecast anomaly (left) and mean seasonal onset dates (right).

The cessation of the growing season was forecasted to be between early- and mid-September over eastern Tigray, eastern Amhara, the southern part of SNNPR, and Somalia. In the western part of the country, the growing season could continue until the end of October (Fig. 4).

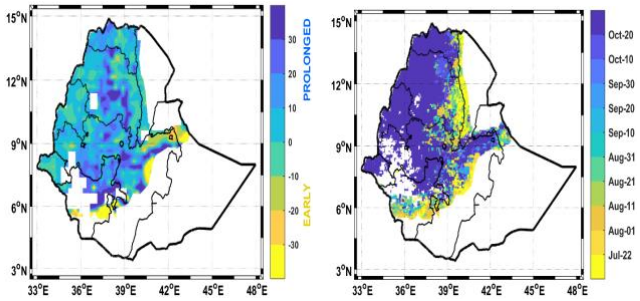

Figure 4. 2020 *Kiremt* season rainfall cessation forecast anomaly (left) and mean seasonal cessation dates (right).

Translation of Seasonal Forecasts to Agricultural Advisories

The seasonal forecasts presented above, and other detailed information generated by the forecast but not included in this report were translated to advisories by a group of experts who have a deep understanding of agro-climate, agronomy, and crop protection. The advisories generated and communicated to decision makers at different levels were the following:

- Farmers need to complete land preparation for the Kiremt season main planting season as soon as possible.
- The chance of long-dry spells is minimal across the country, and therefore farmers need to plant as soon as the rains starts.
- Except for some pockets, most areas will receive normal or above-normal rainfall. Hence, farmers are recommended to grow high-yielding varieties that can produce more under favorable rainfall conditions.
- The end of the season is within the expected range, so that farmers need to follow recommended varieties and crop management practices available in the national extension packages.
- Farmers in the northwestern part of the country where below-normal rainfall is projected should not be worried about the rainfall conditions as the areas normally have high rainfall conditions. The lower rainfall conditions may be even favorable as it reduces water logging and runoff

conditions in those areas while increasing the level of radiation received.

- Farmers need to be encouraged to follow the short-term advisories that will be given during the growing season.
- In order to exploit the favorable projected seasonal conditions, concerned offices, input suppliers, and dealers need to make sure that agricultural inputs such as seed and fertilizers reach the farmers as early as possible.

Generation of Sub-Seasonal Climate Forecasts

Like the seasonal one, sub-seasonal forecasts were made, and advisories were generated. The sub-seasonal forecasts were generated for a time scale of agricultural importance (10 to 30 days) depending on the need. An example of forecasts over a month or shorter time scales are presented below.

For example, a forecast for the month of June showed a total rainfall of about 60-80 mm, which was slightly wetter than average, over much of the SNNPR. The 10-day forecast showed that central, eastern, and western Oromia, and some parts of western Amhara, would continue receiving about 60 mm rainfall over the following ten days (Fig. 5). However, rainfall over much of western Oromia, western Amhara, Benishangul Gumuz, and Gambela was forecasted to be below the normal average. Much of Amhara, Tigray, Afar, and the south and southeastern parts of the country would remain relatively dry (Fig. 5).

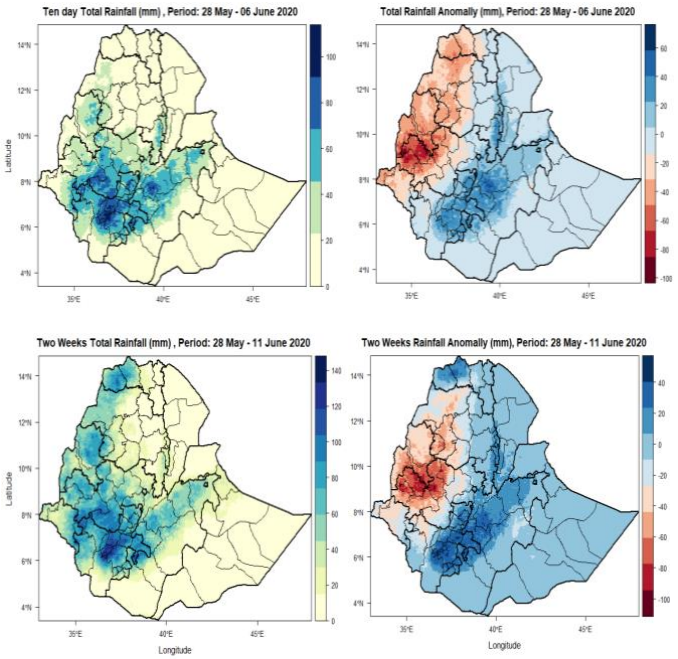

Figure 5. 2020 *Kiremt* season ten daily (upper panel), and weekly (lower panel) rainfall forecast for Ethiopia.

The two-week rainfall forecast showed that rain-bearing systems were expected to expand over most of Western Amhara and Tigray regions. As a result, above-normal rainfall would likely occur over western Tigray.

Similar forecasts were made for every month and shorter time scales until the end of September.

Communication of Climate Advisories to a Wider Audience

Individual, group and mass-media approaches have been used concurrently for agricultural extension services. The continuing increase in the number of farming families has led to a growing emphasis on approaches that reach more people at a time. Accordingly, the use of radio as a means to reach millions at a given time with different languages has attracted renewed interest. This is especially the case in 2020 due to the global COVID-19 pandemic which restricted travels, meetings, trainings, and physical meeting of development agents (DAs) to deliver extension and the in agro-climate advisories to support farm decisions.

In areas where climate variability is a major challenge for agricultural production, provision of agro-climate advisory can be considered as one of the critical inputs of production. Customized climate advisories assist smallholder farmers to manage climate risks through informed decisions such as identifying optimum planting time/sowing windows, planting density at the start of the rainy season, and managing fertilizer applications. Moreover, agro-advisories can also benefit farmers' decisions and practices on soil water, weed, disease and pest management throughout the growing season. Climate agro-advisory can also inform value chain actor decisions on demand for agricultural inputs, when and where inputs are required, etc. Climate agro-advisories are also required by policy makers for planning, early warning and estimating the level of expected production levels.

In Ethiopia, the penetration of web-based dissemination of agro-climate information and other agricultural updates is only taking off. Radio transmission covers over almost 100 percent of the country and approximately half of households own a radio (personal discussion with FANA BC Expert). This makes radio one of the most cost-effective channels for conveying climate agro-advisories to a wider audience.

Because of the COVID-19 pandemic and the benefits of using radio in communicating climate agro-advisories to not only to smallholders but also to other actors of the value chain (whose decisions affect farmers in one way or another, a radio program was started in collaboration with FANA Broadcasting Corporate (https://www.fanabc.com/) to disseminate agro-climate information and other

relevant agricultural information (e.g., Covid-19 updates and precautions) to smallholders, policy makers and the wider public during the 2020 Kiremt season. The FANA FM Radio service is a publicly funded media with eleven substations in different parts of the country using several local languages. The main goal of FANA radio broadcast is to inform and educate its audiences by focusing mainly on issues that matter most to the public. Based on its social journalism approach, the media gives emphasis to agriculture, health, livelihoods, education, and youth, among others. The FANA FM Radio service reaches up to 15 million people at a given time within Ethiopia.

As a main implementation strategy, a tested approach was devised by EIAR – defined as a "planned, radio-based activity conducted over a specific period of time", in which a broad population of farmers are encouraged to make seasonal and sub-seasonal agricultural decisions based on the best available climate forecast and advisory. The communication of climate agro-advisory and other relevant agricultural information including Covid-19 update and advices were provided throughout the season on regular intervals but also depending on forecast conditions. The contents provided during the radio-programs included the following:

- **General overview of crops status**: general information on the seasonal climate and weather performance throughout the growing period, and crop and other environmental conditions.
- **Agro-climate advisories:** general weather/climate conditions and their implications for crop growth, disease, and pest incidences (insect, diseases and weeds, range conditions, and crop and natural resource management needs). These advisories were developed and provided by a group of experts from EIAR, National Meteorology Agency (NMA), Ministry of Agriculture (MoA), CIMMYT, and CCAFS.
- **Short-term, Woreda-specific agro-climate forecasts**: specific information on weather conditions experienced in the district, main crop growing seasons, characteristic features of weather during the crop growing season, climatic risks, farming situations and farm specific advisories. It also includes information on expected crop management practices and effects of extreme weather.
- **COVID-19 update and precautions:** include information on the status of Covid-19 spread in the country, its impacts on health, the agriculture sector, markets, and the precautions that farmers need to make (physical distancing, hand washing and use of locally available face masks).

Broadcasting Format

A LIVE SHOW radio program (broadcasted from 11:30 AM to 01:30 PM once every month on Sunday morning) was used as a major communication channel from June to October 2020. The live show included interactive communication sessions with farmers, agriculture, and agro-meteorology professionals. In addition, this program created an opportunity for national policy makers to update the public on issues related to agricultural activities, including government efforts on importing agricultural inputs, pest and disease outbreaks, and other timely information. Accordingly, we participated with department and unit heads at the Ministry of Agriculture (e.g., agricultural input and logistic director, agricultural extension director, crop development director) in updating the status of inputs supply and delivery, area of land covered by different crops, current activity of extension workers, plans and challenges, etc. In addition to the monthly program, a 10-minutes, bi-weekly radio program was used to give updates and alerts on climate extremes, disease and pest outbreaks and other urgent messages including Covid-19 updates.

Figure 6. Experts at the FNA BC live radio broadcast studio.

Experts Participated in the Lives Broadcast

As mentioned above, this extra-ordinary program during the active Covid-19 pandemic was made possible because of the participation of professionals from different institutions. The experts participated were drawn from national institutions (NMA, EIAR, MoA) and international institutions (CIMMYT, CCAFS-EA, FAO). The diversity of the team appeared in the live shows helped to contextualize the information delivered to diverse audience of the Radio including using the local knowledge of smallholders, which helped to make the advisory relevant and location specific.

Records of the live shows broadcasted from June to October are available at the FANA BC website (https://www.fanabc.com/የፖለቲካና-ወቅታዊ-ጉዳዮች) on the radio program known as *Mogach*.

Conclusions and policy implications

The Covid-19 pandemic has challenged the conventional ways we do things. With respect to agriculture, the pandemic has limited the provision of information and guidance of farmers through the current extension system. However, farmers continued their agricultural activities, and they need climate information, extension advisories and alerts on disease and pest outbreaks and climate extremes to help them make appropriate decisions at every level of the production system.

Under such conditions, the traditional radio media came to the rescue to reach to millions of farmers and decision makers along the agriculture value chain. In this study, it was possible to (i) generate spatially explicit seasonal to sub-seasonal climate forecast including extreme events, (ii) translating forecasts to advisories, and (iii) communicating the advisories to smallholders, decision makers and value chain actors during the Covid-19 pandemic to provide relevant and timely agro-climate advisories using the most accessible broadcasting means. The effort helped not only to deliver agro-advisories to a wider audience (est. 13-15 million) but also enabled to bring in updates from relevant directorates and units of the Ministry of Agriculture to provide plans, updates, and advice to the farmers. The situation created synergetic interactions among different professionals and institutions to server the agricultural community in general, and smallholders in particular.

Although the impact of this work is yet to be evaluated, the effort demonstrated the value of traditional media (Radio) to bring together different actors in the agriculture sector to provide timely and relevant information to smallholders and value chain actors in a consistent and cheaper manner over an extended period of a rainy season. Policy makers need to think of using Radio as one of the avenues to reach to smallholders and guide them to make relevant decisions in areas like Ethiopia where the penetration of internet and the literacy level of farmers is still very low.

Further reading

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This series of briefs summarizes findings of a project entitled "Capacitating African Stakeholders with Climate Advisories and Insurance Development?"" undertaken by researchers from CIMMYT, ICRISAT, EIAR, CCAFS-EA. This brief focuses on delivery of climate information and agro-advisories to smallholders and decision makers in Ethiopia.

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) brings together some of the world's best researchers in agricultural science, development research, climate science and Earth system science, to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. Visit us online at **https://ccafs.cgiar.org**.

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