Digital AgroClimate Advisory Platform-EDACaP

Managing Climate Risk to Enhance Adaptive Capacity of Farmers

Agroclimate prediction and advisory for Ethiopian agricultural extension

JEMAL SEID AHMED

Scuola Superiore Sant'Anna, Pisa, Italy

Ethiopian Institute of Agricultural Research

KINDIE TESFAYE

International Maize and Wheat Improvement Center

TEFERI DEMISSIE

CGIAR Research Program on Climate Change, Agriculture and Food Security

LULSEGED TAMENE

International Center for Tropical Agriculture

TEMESGEN GEBREMARIAM

Nanjing University of Information Science and Technology

DAWIT SOLOMON

CGIAR Research Program on Climate Change, Agriculture and Food Security

SEASONAL FORECAST FOR JUNE-SEPTEMBER 2020

Updated 28 May 2020

Summary of Outlook

To date, the performance of Belg rainfall has been mixed with favorable conditions in the southern and eastern half of Ethiopia's Southern Nations, Nationalities and Peoples Region (SNNPR), and adjoining western areas of Oromia. However, in eastern and southern Tigray, eastern Amhara, and northern Afar, seasonal rainfall has been erratic, delayed in onset, and slightly below average. As a result, Belg planting was delayed in these areas, and in some cases, farmers were deterred from planting despite heavy April rainfall. However, the favorable Gu/Genna rains (March to May) have supported relatively favorable production prospects for pastoral and agropastoral communities of Somali and southern Oromia.

In the second week of June 2020, heavy to moderate rainfall will be expected over Ethiopia's western and southwestern parts.

Compared to 1981-2010 averages, earlier than normal onset of the rainy season is likely across Ethiopia, including the Belg growing areas. Longer than average consecutive dry days also expected in pocket areas of northeastern Tigray, eastern Amhara, eastern and southern parts of Oromia.

This qualitative outlook is assessed for Ethiopia at the country level. For specific updates on the national scale, the relevant National Meteorological Agency (NMA) should be consulted.

A total rainfall of about 60-80 mm, which is slightly wetter than average, is expected over much of the SNNPR. Central, eastern and western Oromia, and some parts of western Amhara, will also continue to receive about 60 mm rainfall in the next ten days. However, rainfall over much of western Oromia, western Amhara, Benishangul Gumuz, and Gambela is expected to be below the normal average. Much of Amhara, Tigray, Afar, and the south and southeastern parts of the country will remain relatively dry. The two-week rainfall forecast shows that rain-bearing systems expect to expand over most of western Amhara and Tigray regions. As a result, above-normal rainfall will likely happen over western Tigray.

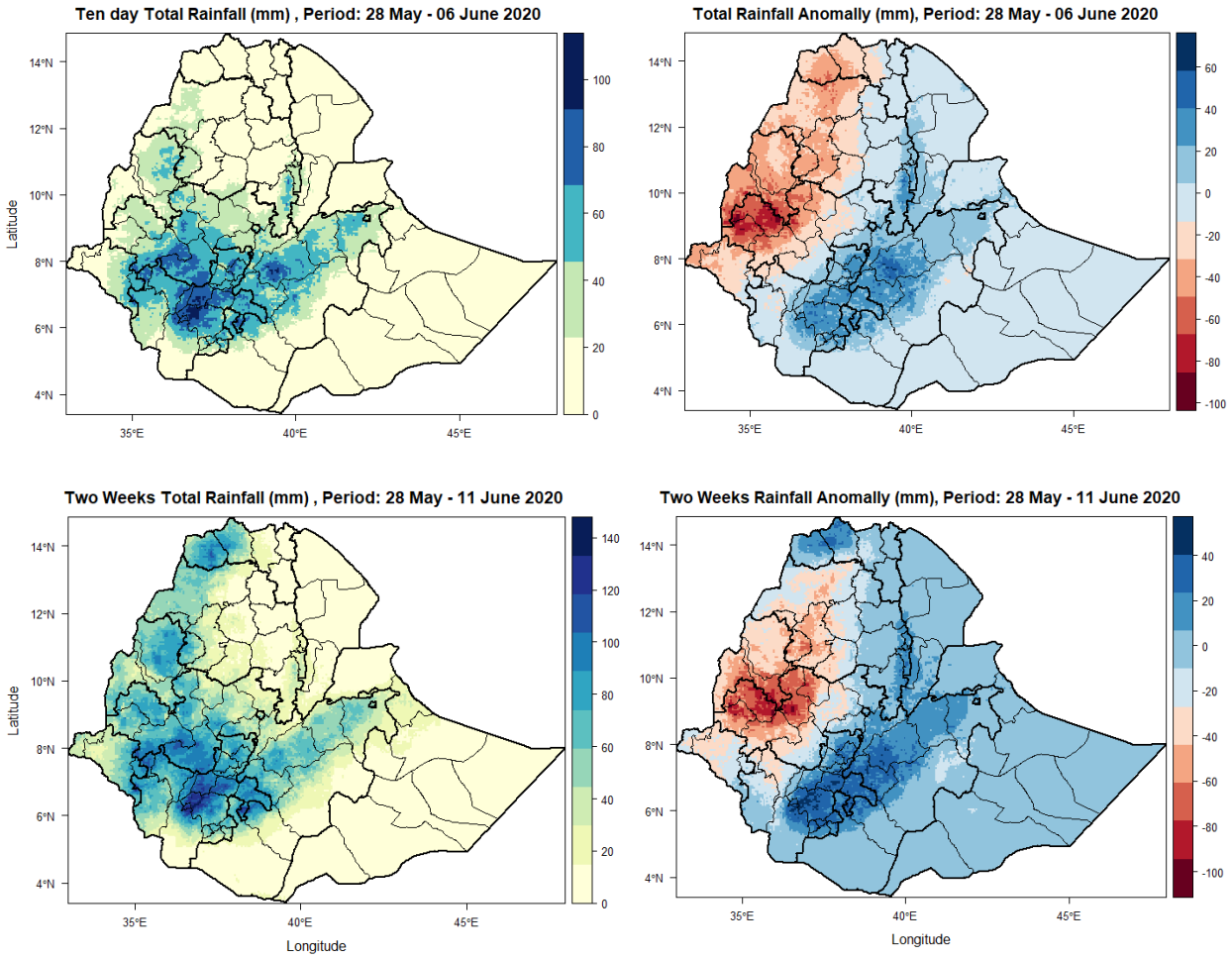
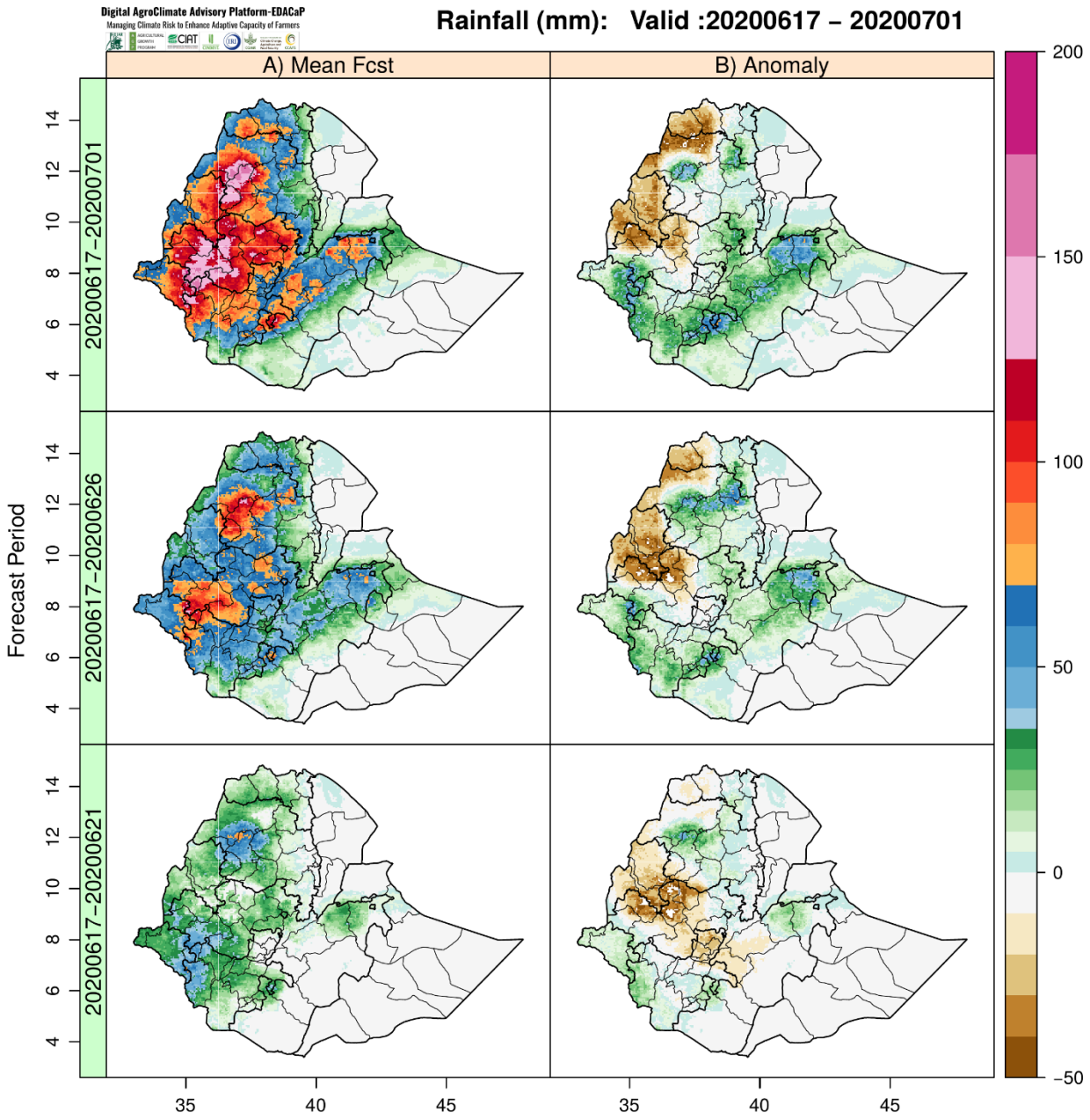


Figure 1. Ten daily rainfall forecast (Upper Panel), Weekly rainfall forecast (lower panel)

Ethio AgroClimate Outlook



Seasonal Rainfall Prediction (June-Sept 2020)

The seasonal climate forecast of Kiremt Season (June-September) shows that probabilities of above-normal rainfall dominated most parts of the country. Those areas are Central Oromia (north and east Shewa), East Oromia (west Hararghe, Arsi and Bale highlands), and the adjoining areas of SNNPR (Sidama, Wolayita, Silte zone, Gamo Gofa) as well as over the Belg growing areas of northeastern Amhara and southern Tigray. Whereas, much of the country's Kiremt rainfall receiving areas, central and western Amhara, Gambela, Benishangul, western Oromia, and significant portions of SNNPR and Tigray regions are likely to have rainfall tending to the normal-to-above-normal rainfall in the coming Kiremt rainy season. However, some areas in east and west Welega, as well as east and west Gojam, are likely to have below-average rainfall. On the other hand, heavy rainfall is likely over some regions in Bale and eastern Shewa.

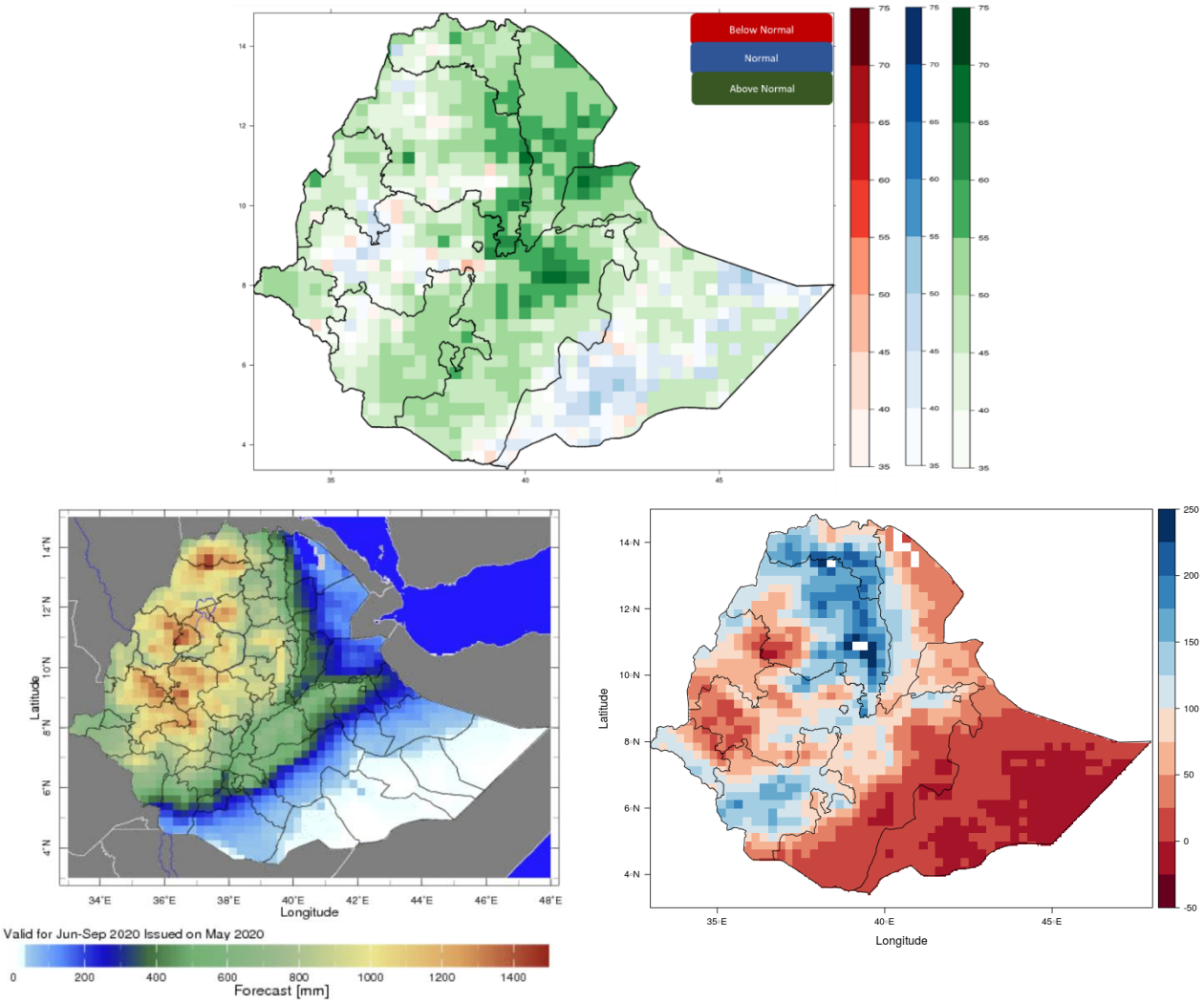


Figure 2. Kiremt 2020 seasonal rainfall prediction based on eight GCM models updated on May 17, probabilistic forecast (upper), deterministic forecast (lower left), anomaly (lower right)

Seasonal Temperature forecast (June-Sept 2020)

The seasonal temperature outlook for Kiremt 2020 shows that the maximum, minimum, and average temperatures are expected to decrease over the southern part of SNNPR. A slight decrease in maximum, minimum, and average temperature is also anticipated over east and west Hararghe and Bale's highlands. Warmer than normal temperatures are likely over much of the country's northern, central, western and southeastern parts.

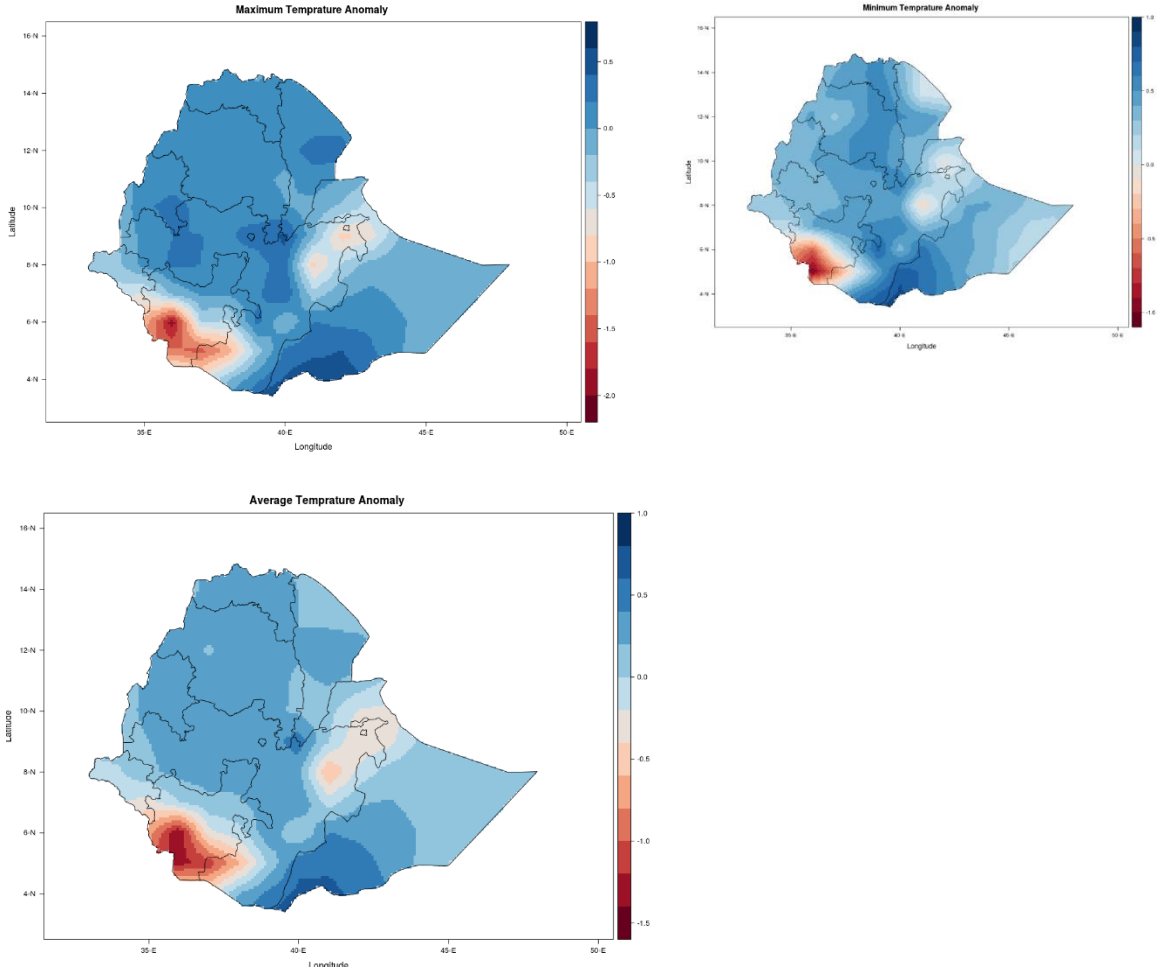
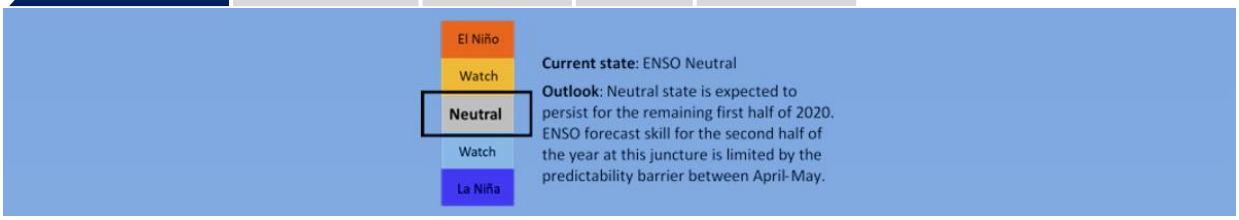


Figure 3. Kiremt 2020 seasonal temperature forecast anomalies



The El Niño Southern Oscillation (ENSO) monitoring system remains in the "Neutral" state. The sea-surface temperatures (SSTs) over the Nino3.4 region are in a neutral ENSO phase. Atmospheric indicators (e.g., cloudiness and trade wind anomalies) and sub-surface heat distribution over the tropical Pacific are consistent with a neutral state as well. The Nino3.4 index was 0.15°C for February 2020 and 0.27°C for the December 2019-February 2020 three-month average. There is a ~65% chance of ENSO-neutral during the Northern Hemisphere's summer 2020, with chances decreasing through the autumn (45-50%).

The neutral state is expected to persist for the remaining first half of 2020.

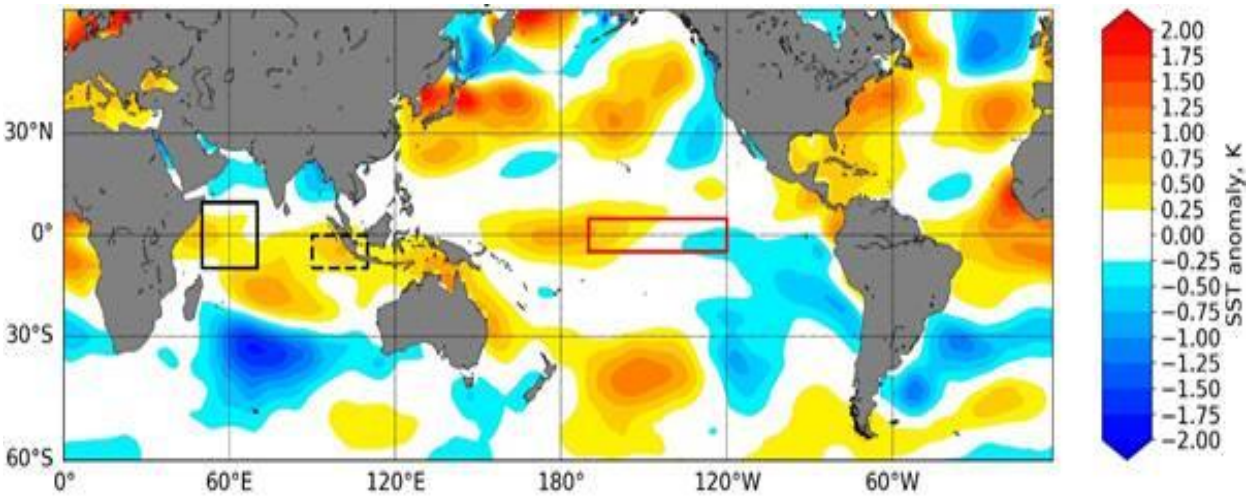
FURTHER INFORMATION ON ENSO

ENSO conditions are monitored by analyzing Pacific sea surface temperatures (SSTs), low level winds, cloudiness (using outgoing longwave radiation), and sub-surface temperatures. Special attention is given to SSTs, as they are key indicators used to monitor ENSO. Here, three different datasets are used, including HadISST, ERSSTv5, and COBE datasets. Globally, SSTs have gradually warmed over the last century under the influence of climate change, the SST values over the Nino3.4 will increasingly be magnifies with time and hence appear warmer than they should be. Therefore, this background trend is removed from the SST datasets (Turkington, Timbal & Rahmat 2018), before calculating SST anomalies using the climatology period 1976-2014. So far, there has been no noticeable background trend in the low-level winds or cloudiness.

El Niño (La Niña) conditions are associated with warmer (colder) SSTs in the central and eastern Pacific. The threshold for an El Niño (La Niña) in the Nino3.4 region is above 0.65°C (below -0.65°C). El Niño (La Niña) conditions also correspond to an increase (decrease) in cloudiness around or to the east of the international dateline (180°), with a decrease (increase) in cloudiness in the west, repectivelly. There is also a decrease (increase) in the trade winds in the eastern Pacific and sub-surface temperatures in the eastern Pacific should also be warmer (colder) than average, to sustain the El Niño (La Niña) conditions, respectively.

For ENSO outlooks, information from the World Meteorological Organization (WMO) and Climate Prediction Center (CPC)-USA, Bureau of Meteorology (BoM)-Australia, and International Research Institute for Climate and Society (IRI) which consolidates model outputs from other centers around the world were assessed. Each center uses different criteria, including different SST thresholds. Therefore, variations between centers on the current ENSO state should be expected, especially when conditions are borderline.

The SSTs over the central and eastern tropical Pacific remained within neutral thresholds in May 2020 (Figure 4). Across the Indian Ocean, the SSTs were warmer than average; however, the Indian Ocean Dipole (the difference between the western and eastern anomalies) is overall neutral. The tropical Pacific and Indian Ocean are expected to remain in a neutral state for the first half of 2020.



*Fi*gure 4. Detrended SST anomalies for May 2020 with respect to 1976-2014 climatology using ERSST v5 data. Red shades show regions of relative warming, while blue shades show regions of relative cooling. The tropical Pacific Ocean Nino3.4 Region is outlined in red. The Indian Ocean Dipole index is the difference between average SST anomalies over the western Indian Ocean (solid black box) and eastern Indian Ocean (black dotted box).

Looking at the Nino3.4 index over the past three years (Figure 5), the 1-month Nino3.4 value peaked in November 2018 after having crossed the El Niño threshold (0.65°C) for only two months (October and November 2018). Subsequently, the Nino3.4 value fluctuated around the threshold until April 2019, when it weakened and has since remained within neutral values. For El Niño conditions to be present, 1 month of warm SST anomalies (observed or forecast) should persist for at least four months above the threshold, with at least one of the months observed along supporting atmospheric observations.

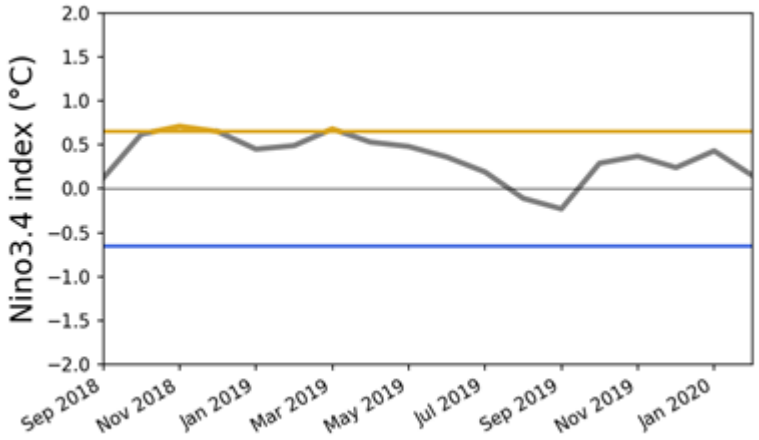


Figure 5. The Nino3.4 index using the 1-month SST anomalies. Warm anomalies (≥ +0.65; brown) correspond to El Niño conditions while cold anomalies (≤ -0.65; blue) correspond to La Niña conditions; otherwise neutral (> -0.65 and < +0.65; grey).

Model outlooks from the European Centre for Medium-Range Weather Forecasts (ECMWF) (Figure 6) indicate Nino3.4 SST to be within a spread of possible outcomes ranging from moderate-El Niño to strong-La Niña up to August 2020. However, the values are expected to remain neutral based on most ensemble forecast members that fall within neutral thresholds.

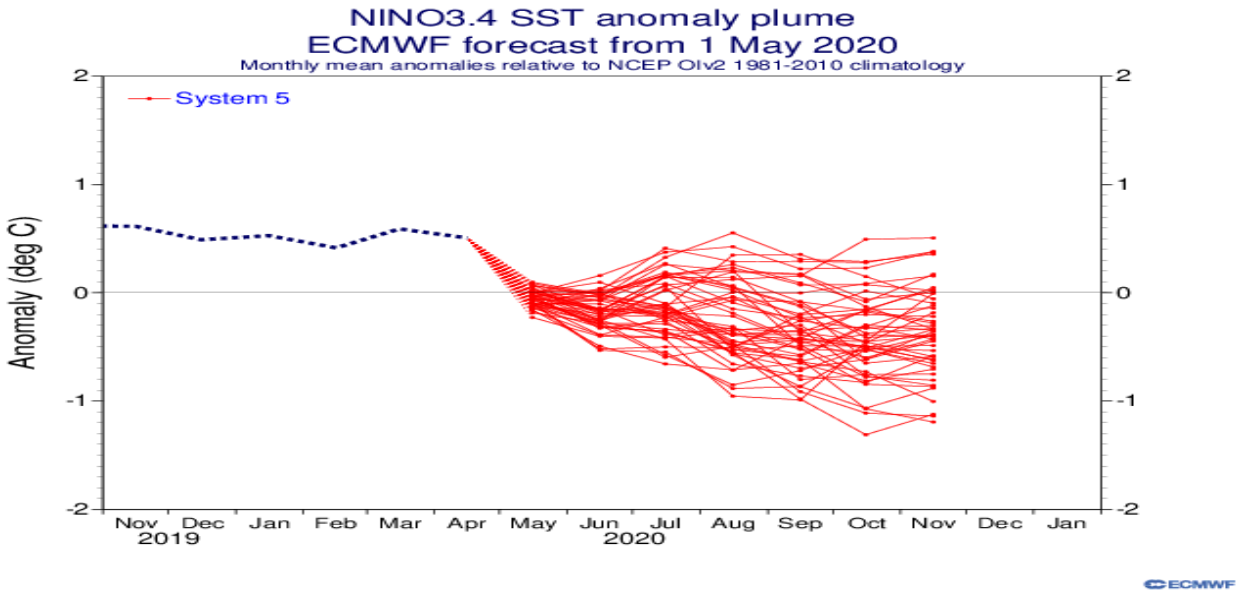


Figure 6. Forecasts of Nino3.4 index's strength until August 2020 from various seasonal prediction models of international climate centers (Image credit: ECMWF Copernicus C3S)

Historical ENSO Variability

To classify historical El Niño event, the 3-month average Nino3.4 value must be above 0.65°C for five or more consecutive months. For La Niña events, the threshold is -0.65°C. Otherwise, it is considered neutral. ENSO events with a peak value above 1.5°C (El Niño) or below -1.5°C (La Niña) are considered strong.

Otherwise, the events are considered weak to moderate in strength. The following (Figure 7) shows the development of the Nino3.4 index in 2015-18 compared to other El Niño/La Niña events.

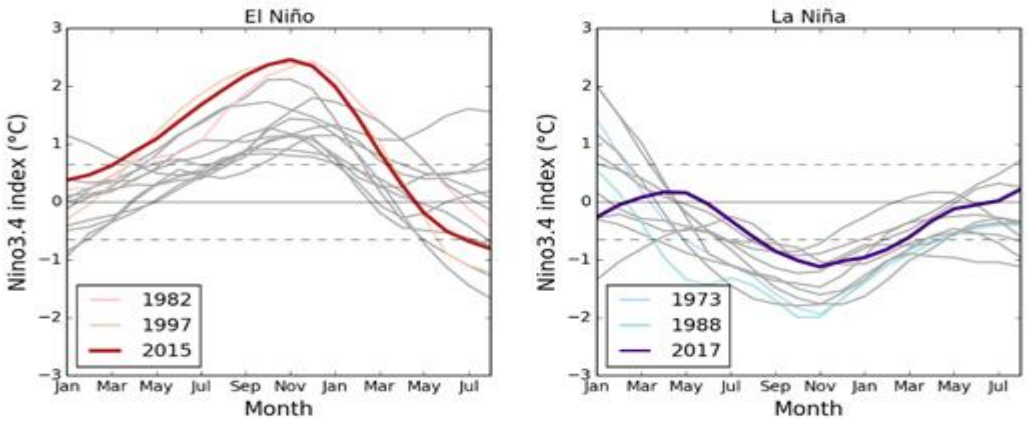


Figure 7. Three-month Nino3.4 index development and retreat of different El Niño (left)/La Niña (right) events since the 1960s. The most recent El Niño and La Niña events are in red and purple, respectively.

Agricultural Risks Prediction

2020 Onset and Cessation for 'Meher' growing areas

The onset of the 'Meher' growing season based on the consensus seasonal rainfall outlook starts in mid-to-late-May over most of the 'Meher' growing areas of Ethiopia. The growing season is likely to start 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 'Meher' growing season is likely over most parts of Ethiopia.

The cessation of the growing season ranges 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 may continue until the end of October.

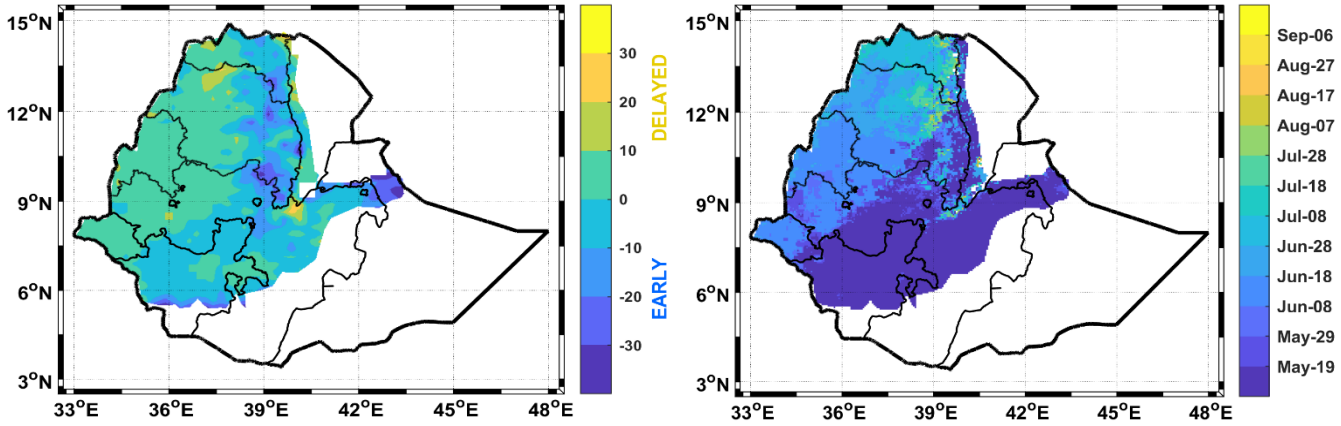


Figure 8. Kiremt 2020 Onset forecast, Anomaly (left) and Mean Seasonal onset (right)

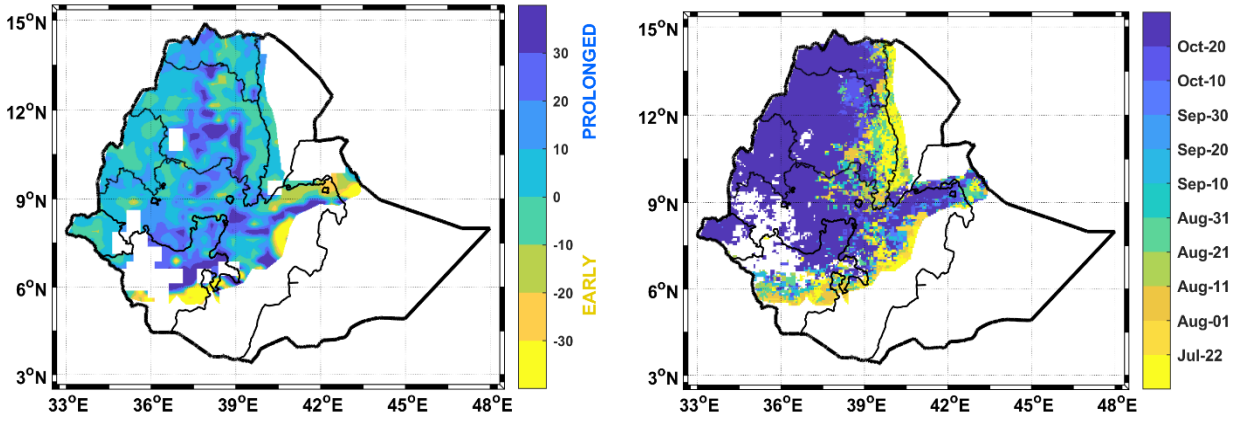


Figure 9. Kiremt 2020 Onset forecast, Anomaly (left) and Mean Seasonal Cessation (right)

Early cessation is probable over some parts of southeastern Amhara, southwestern SNNPR, and pockets of Oromia.

2020 Dry Spell Frequency for the 'Meher' Growing Season

Dry spells of seven consecutive days are likely to be more frequent in most parts of SNNPR, southeastern Oromia, eastern Amhara, eastern Tigray, and 'Meher' growing Afar and Somali areas. The frequency of dry spells of 15-days is minimal throughout the 'Meher' growing areas except for some areas in the eastern parts of Tigray and Oromia and the southeast part of SNNPR.

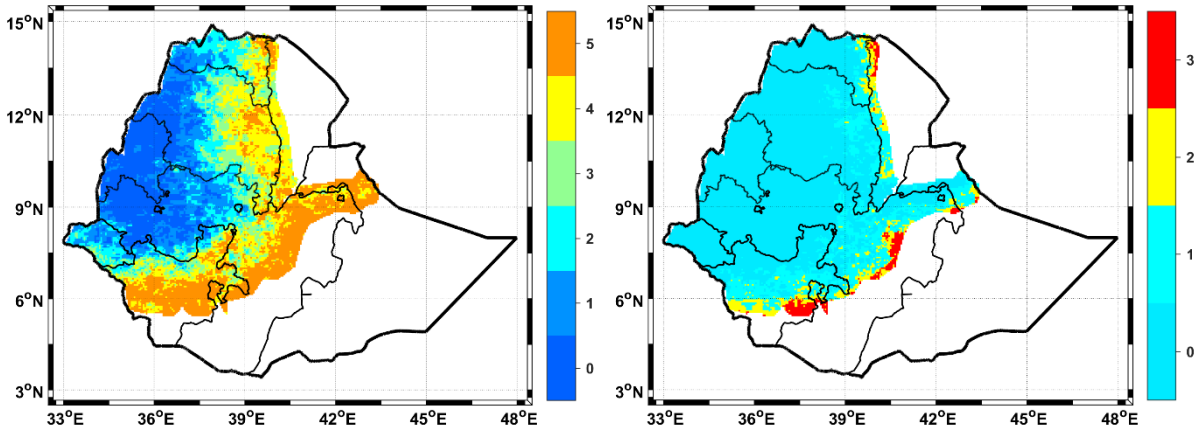


Figure 10. Frequency of dry spell: seven consecutive days (left), 15 consecutive days (right)

Agricultural Advisory

Farmers are advised to take note of the following actions in the coming season:

- Complete land preparation for the 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 start.
- 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 also within the expected range, so that farmers need to follow recommended varieties and crop management practices
- 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 even be favorable as it reduces excess water and runoff conditions.
- 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.

COVID-19 Ethiopia Cases and Climate Associations

Recently published papers have suggested that, as happens with the diffusion of other viruses, air temperature and humidity could alter the spread of COVID-19. Papers in the discussion also suggest that air pollution, particularly fine particulate matter, could affect morbidity and mortality due to COVID-19 and might also play a role in spreading the SARS-CoV-2 virus. In this section we try to allows the user to explore some of these claims by plotting the average air temperature and humidity of the most recent months, alongside current air pollution levels from the Addis Air Service and the mortality data obtained from Johns Hopkins University.

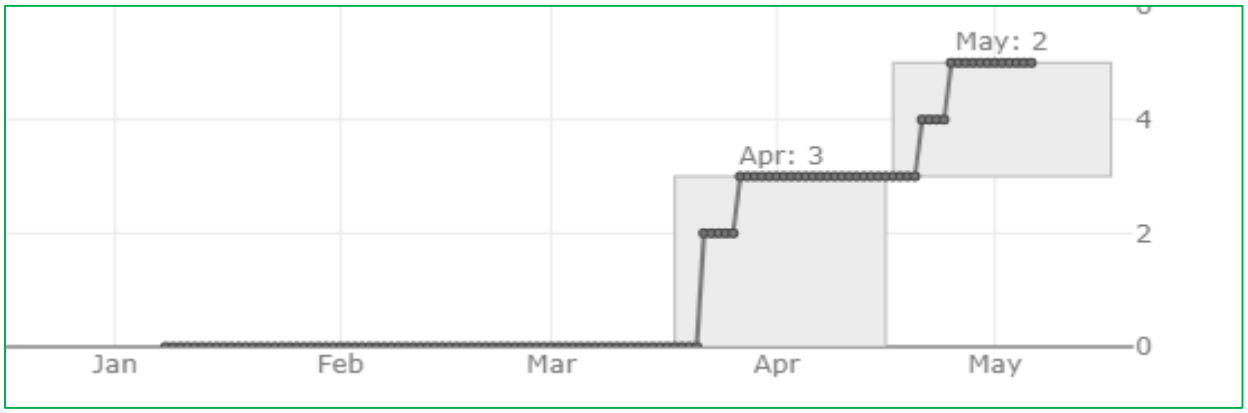


Figure 11 .The cumulative number of deaths in Ethiopia. Data is from the Johns Hopkins University Center for Systems Science and Engineering

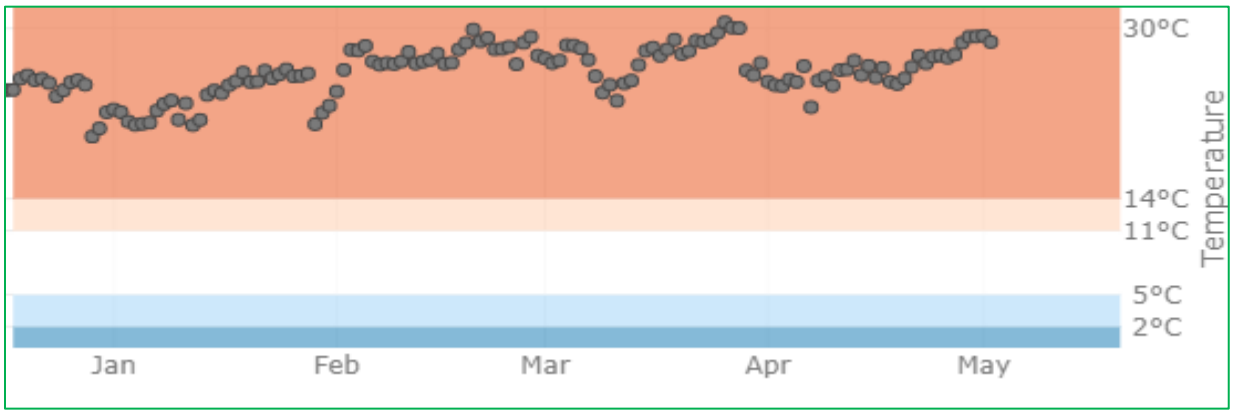


Figure 12. Daily average of the air temperature near the surface at the center of the circle, not representative of the whole country (Source: ECMWF Copernicus C3S).

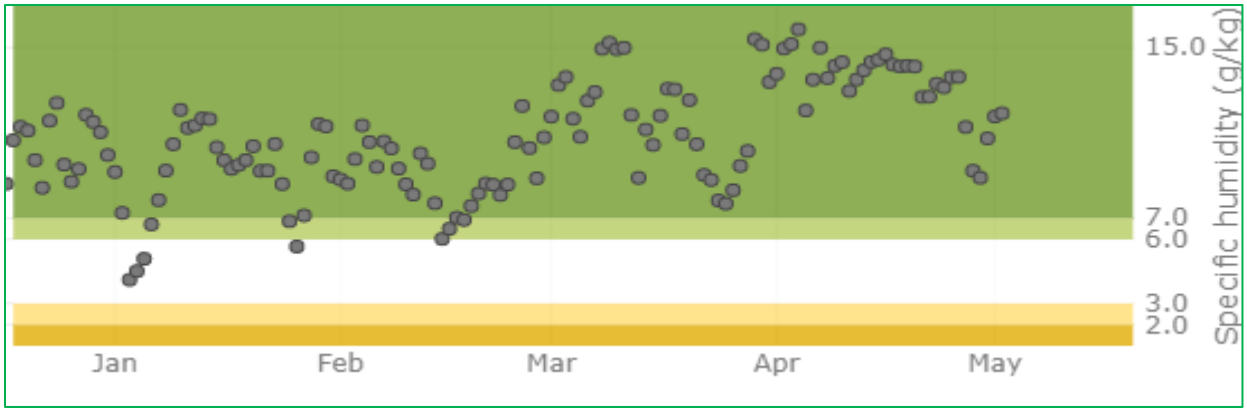


Figure 13. Daily average of the specific humidity at mean sea level at the center of the circle, not representative of the whole country (Source: ECMWF Copernicus C3S).

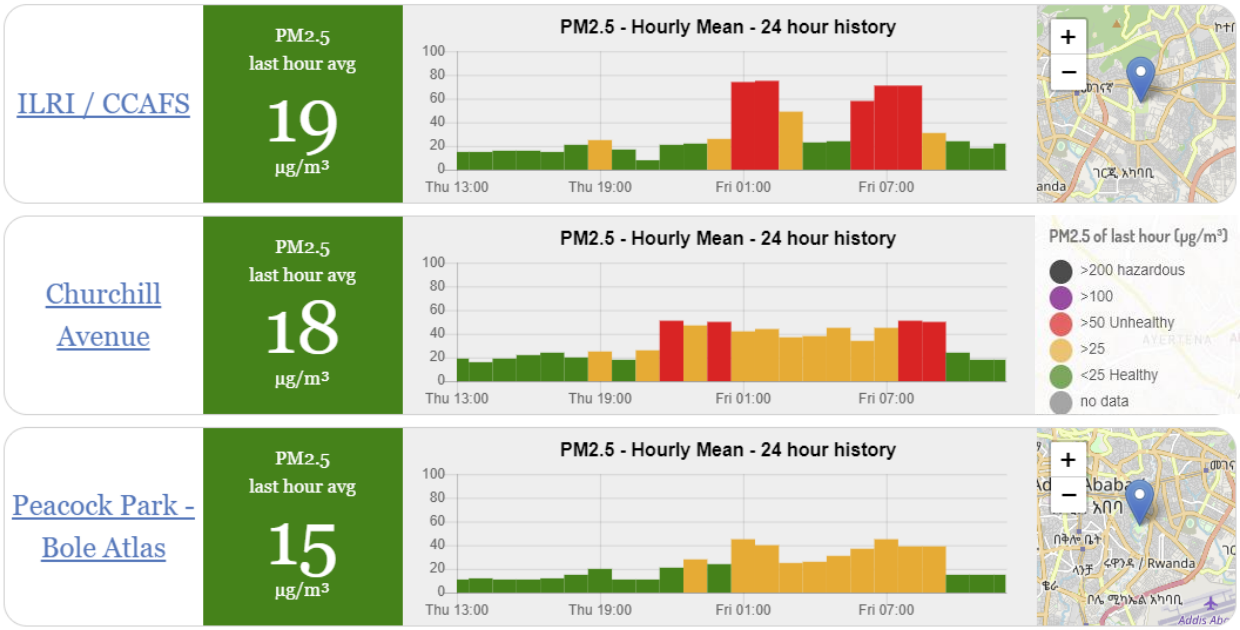


Figure 14. Real-time Addis Ababa air quality data (PM2.5). Image credit: Addis Air sensor network through citizen science: https://airquality.addisabeba.info/