State of Climate in Ethiopia 2021

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Report

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Accelerating Impacts of CGIAR Climate Research for Africa

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Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)

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Titles in this series aim to disseminate interim climate change, agriculture, and food security research and practices and stimulate feedback from the scientific community.

About AICCRA
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About the authors

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Background

Ethiopia is located within 3.30°N–15°N and 33°E–48°E, in the Horn of Africa (Fig. 1). It covers an area of about 1.14 million square kilometers (944,000 square miles), with a total population of more than 85 million (MoFA,2013). The country's topography comprises high and rugged plateaus and the peripheral lowlands. From a topographic viewpoint, the country confines the Great African Rift Valley that bisects Ethiopia into the eastern and western escarpments. It gradually slopes up from the lowland edges of Rift Valley to the eastern and western escarpments into the southern, central, western and northern mountains.

Major parts of the country are made up of a wide plateau and mountains of various heights (Fig. 1). Elevations in the country range from 160 meters below sea level (northern exit of the Rift Valley) to over 4600 meters above sea level (of northern mountainous regions). The highest mountains are concentrated on the northern and southern plateaus of the country (MoWR,2013). The climatic condition of the country results in high rainfall during the rainy season, which in turn causes perennial and seasonal rivers and stream flows. However, as rainfall is seasonal, the volume of discharges of rivers, both local and transboundary, is subject to seasonal variations (MoWR,2013).

These complex topographical features coupled with large-scale forcing factors, including the Inter-Tropical Convergence Zone (ITCZ), El-Nino Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) and East African Monsoon are largely responsible for stronger spatial and temporal variability of climate patterns in the region.

The seasonal rainfall progression is mostly influenced by the north/southward migration of the Inter-Tropical Convergence Zone (ITCZ). Most parts of the country receive substantial rainfall amounts between June and September. Indeed, some parts of central, northeast and eastern Ethiopia receive relatively less rainfall between March to May. For Ethiopia's southern and southeastern regions, March-May and October-December are the major and small rainy seasons, respectively.

This report briefly describes the climate status in 2021 across the country, focusing on the observed rainfall, temperature, climate extremes and the associated socio-economic impacts. Both rainfall and temperature analysis for 2021 is based on 1981 -2010 baseline climatology.

Objective

The main objective of this activity is to analyze meteorological data on rainfall and temperature and develop a scientific report on the state of the climate in 2021 over Ethiopia (Figure 1).

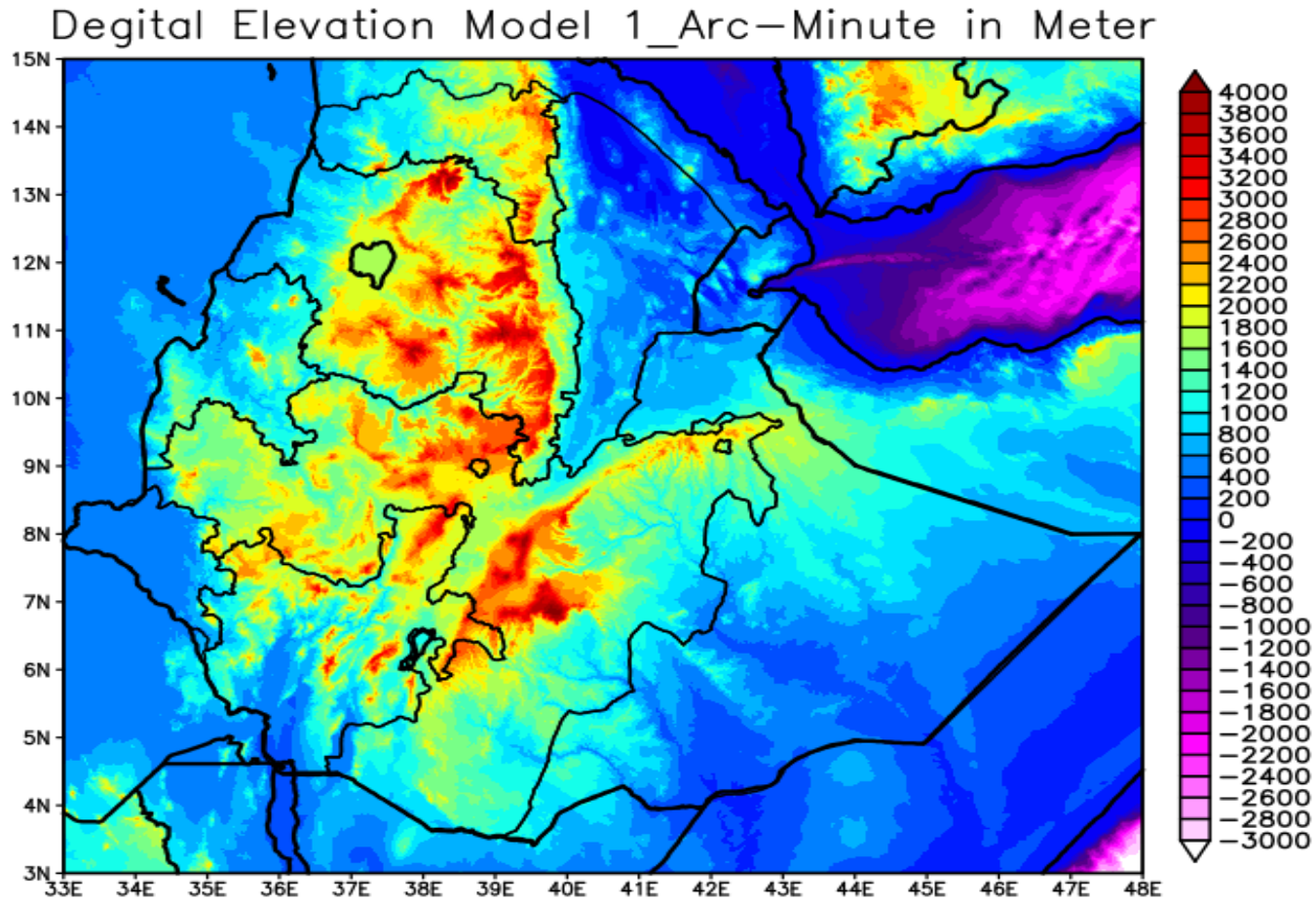

Figure 1. meteorological data across Ethiopia

Results of the State of the Climate in Ethiopia

Maximum Temperature Profile

Data from in-situ observation indicates that the Annual Maximum Temperature range from 19 to 26^{0}C was observed in the country's Northeastern, Central and southeastern highlands. While the rest of the country recorded from 27 to 36^{0}C, data from in-situ observation indicates that northwestern, northeastern, central and southern parts of the country experienced above-normal maximum temperatures ranging from 0.4 to about 3.5^{0}C. Pocket parts of the country, including most areas in Benishangule Gumuz, central and southern highlands, recorded below normal maximum temperature during 2021, ranging from -3-5 to about -1.5^{0}C below the long-term average. These observations

indicate non-uniform temperature dynamics in the region during 2020 that may be attributed to complex and diverse topographical features, Figure (2 a, b).

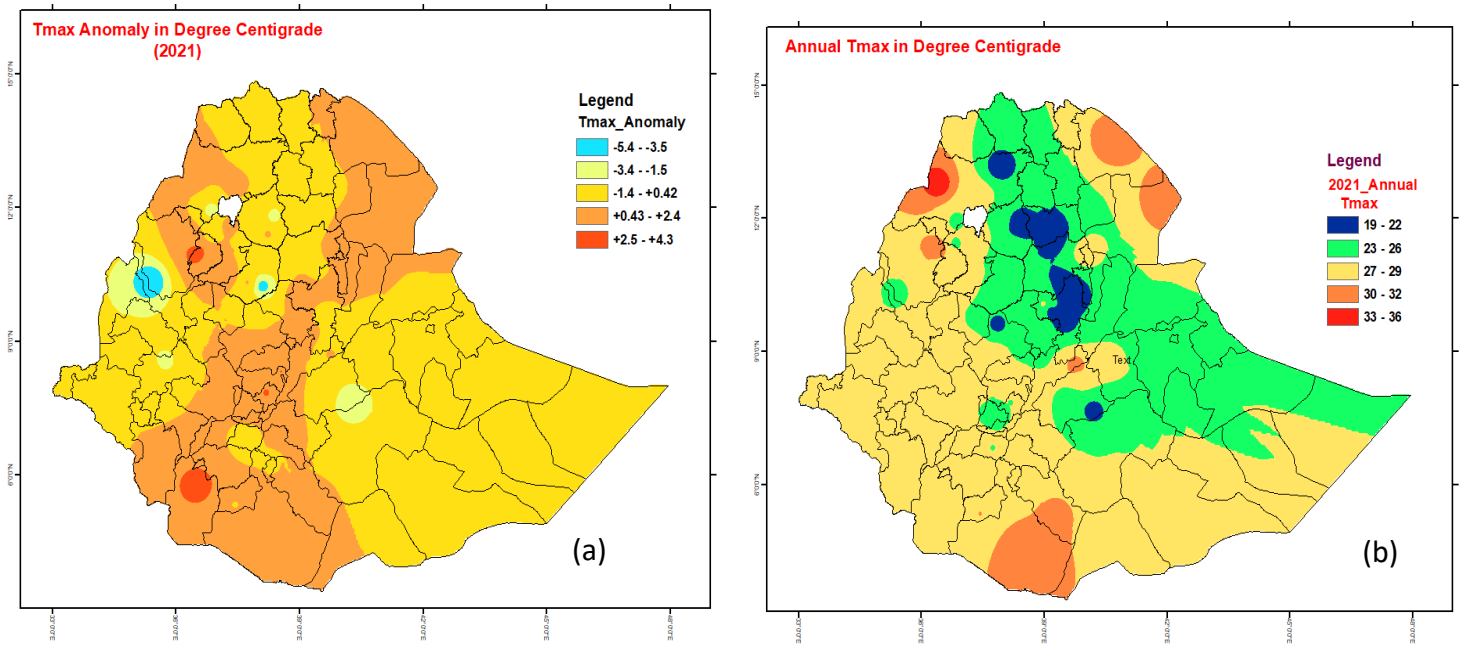

Figure 2.Annual surface air temperature (℃) (a) Annual temperature anomaly and (b) Annual maximum Temperature, 2021

Minimum Temperature Profile

2021 Observed Annual Minimum Temperature indicates that Northeastern Highlands, Central and southern highland parts recorded temperatures ranging from 4.8 to about 11^0C. At the same time, most parts of the country experienced annual minimum temperatures ranging from 12 to 19^0C.

Pocket parts of the country, including most areas in Benishangule Gumuz, Northeastern highlands, and central and southern highlands, recorded below-normal minimum temperature during 2021, ranging from -4-5 to about -1.30C below the long-term average. The recorded data indicates that most parts of the country experienced above-normal minimum temperatures ranging from 0.36 to about 3.50C. Analysis from in-situ data shows anomalously warmer temperatures for most of the country, being more pronounced in southern parts of Ethiopia (Figure 3 a, b).

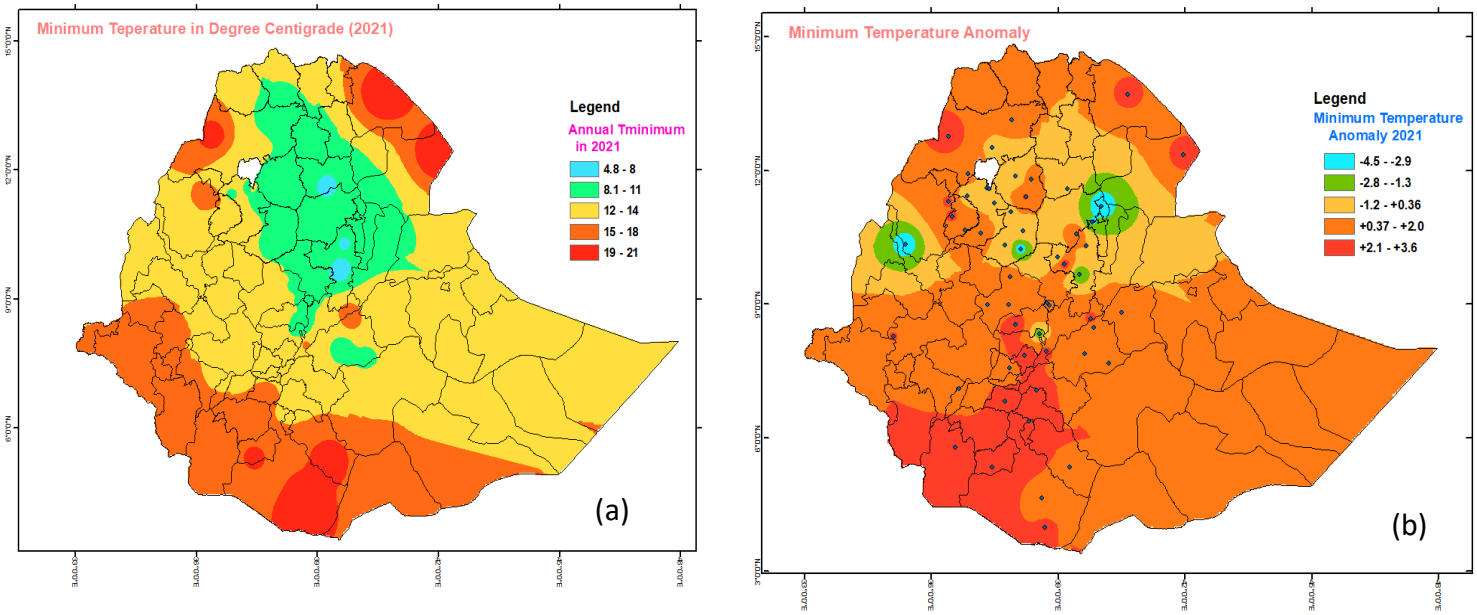

Figure 3: Annual surface air temperature in (℃) (a)Minimum air temperature and (b) Minimum air temperature anomaly, 2021

Temporal Maximum and Minimum Temperature Anomaly

From the observed maximum temperature anomaly, most stations have a positive anomaly with an increased trend. Most of the recorded stations Experienced above-normal maximum temperatures throughout 2021, ranging from -4.1 at Wombera, below the long-term average, to 4.2^{0}C at Chagni, above the long-term average. On aggregate mean annual temperature time series exhibit a warming trend as depicted in Figure 4a.

Data from in-situ observation indicates minimum temperature anomaly. Most recorded stations experienced above-normal minimum temperatures throughout 2021, ranging from -4.5 at Bati, below the long-term average to 3.60C at Metema, above the long-term average. Most of the stations have a positive anomaly with an increasing trend. On aggregate mean annual temperature time series exhibit a warming trend as depicted in Figure 4b.

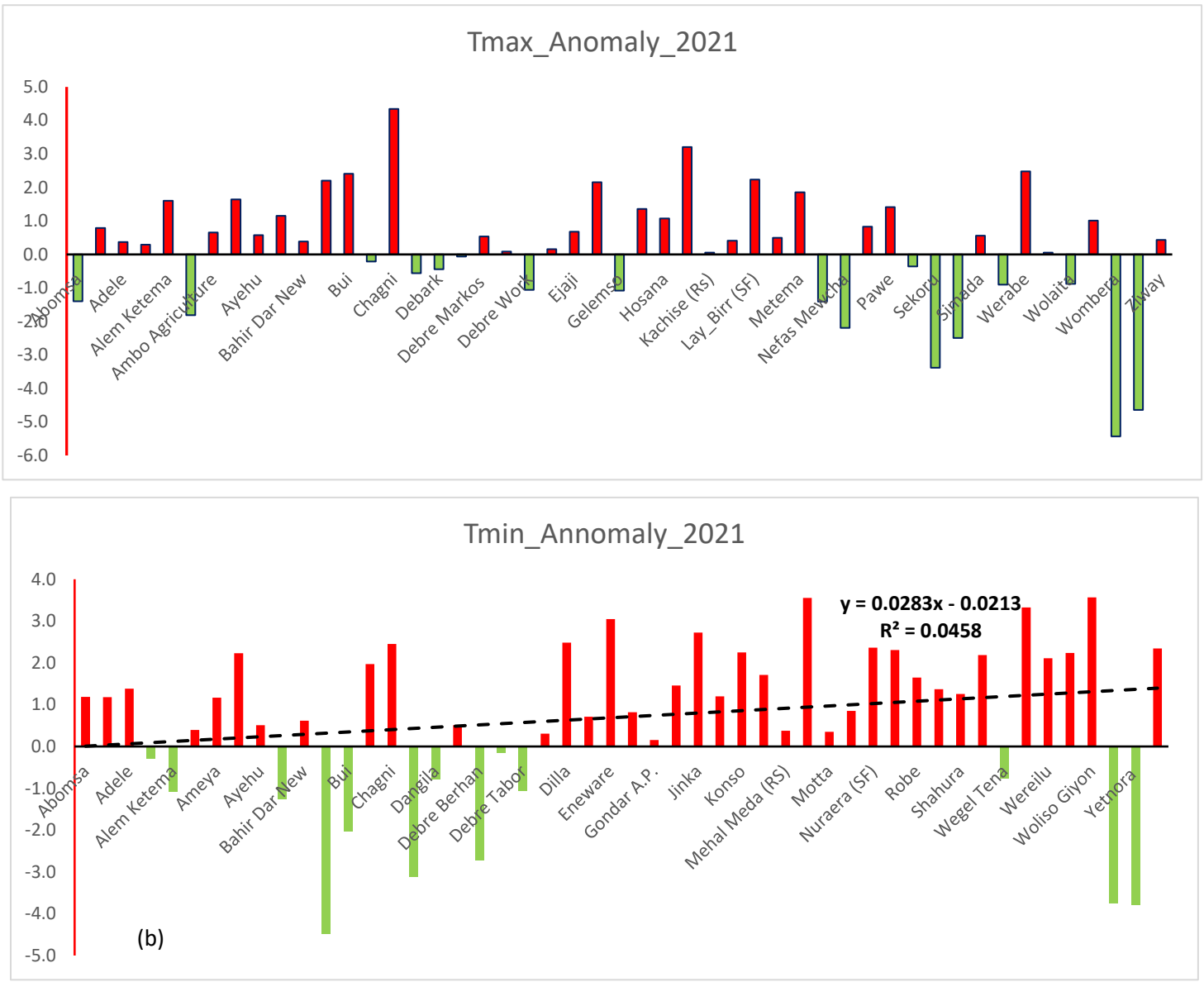

Figure 4. Time series of annual surface air temperature standardized anomaly. a) Maximum Temperature and b) Minimum Temperature

Rainfall Pattern

In 2021, annual total rainfall distribution kiremt benefits areas ranging from 1500 to 2100 mm. The Northeastern, northern Somali, central and SNNPR regions recorded from 700 to 1400mm of rainfall during the year. Areas like southern Oromia, southern Somali and eastern Afar region recorded rainfall from 400 to 700mm. Data from in-situ observation indicates annual rainfall anomaly in most parts of the country has a negative anomaly compared to the long-term mean. The country's northwest, west and southeastern parts experienced above-normal rainfall throughout 2021, ranging from +830 to +280 above the long-term average and below the long-term average ranging from -180 to -430mm below the long-term average across the region (Figure 5 a,b).

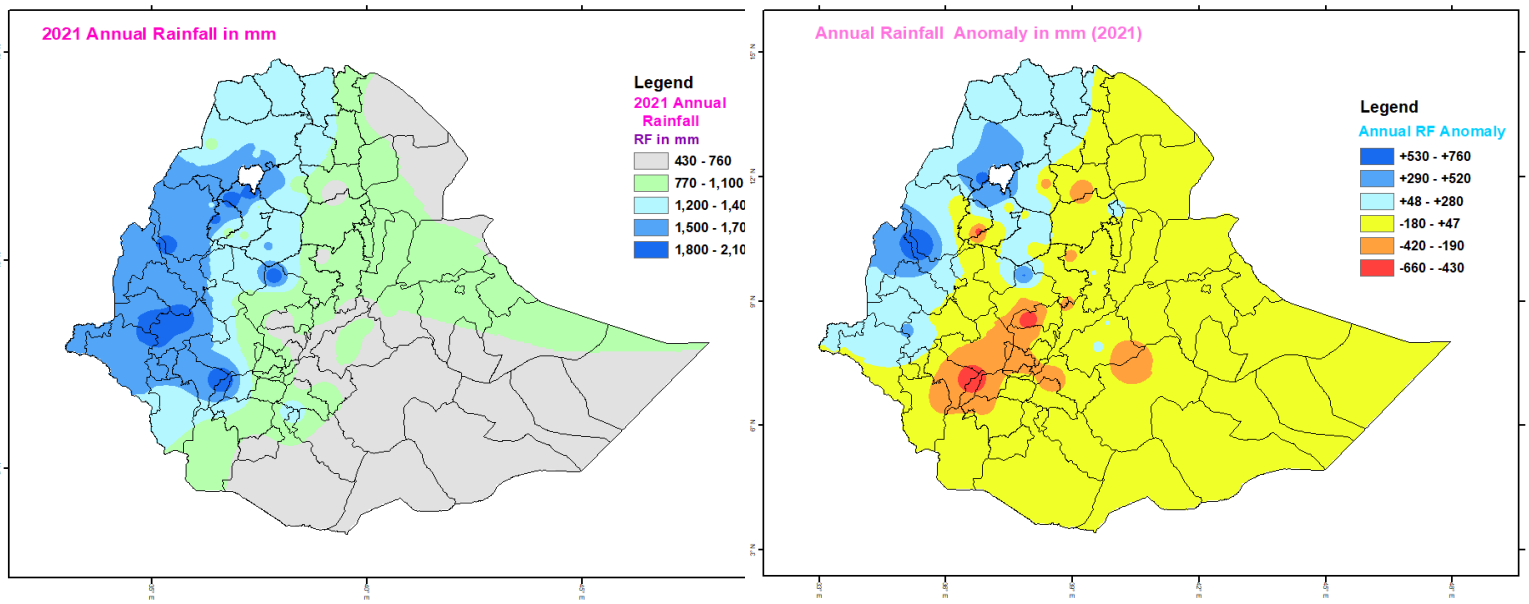

Figure 5a) Annual rainfall anomalies in 2021 and (b) Annual rainfall anomaly.

Extreme climatic events and related impacts

Incidences of extreme weather events, including heavy precipitation exceeding 50 mm in twenty-four hours and flooding, were observed in many parts of the region and caused devasting socio-economic impacts.

About AICCRA

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture.

It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank.

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