Meteorological Data and Climatology Lead Executive

Climatology and Remote Sensing Desk

Ten Daily Satellite Rainfall Estimation and Vegetation Coverage Bulletin

3rd Dekad of November 2024

Date: Dec 03, 2024

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As an entity responsible for monitoring local and country-wide climatic features and their day-to-day evolution, the National Meteorological Agency of Ethiopia strives hard to present useful information to different socio-economic activities. The production of satellite-based rainfall estimates and vegetation greenness bulletin is part of this effort.

The launch of meteorological satellites which happens as a result of technological advancement opens a new horizon in weather and climate monitoring. Unlike manned point observations, satellites collect data on clouds, vegetation, and other parameters from parts of the world that are not easily reachable or accessible. Satellite observation supplements ground manned observation and when it comes to vegetation cover, it is the only source of information.

The Ethiopian Meteorological Institute uses products from the TAMSATA group based in UK and Copernicus for producing dekadal rainfall estimates and vegetation greenness bulletins. We have a strong belief that various socio-economic activities related to planning disaster mitigation, water resources management, construction, environmental protection, transportation, recreation, tourism, and others will benefit most from the careful and continuous use of this bulletin. Meanwhile, your comments and constructive suggestions are highly appreciated to make the objectives of this bulletin a success.

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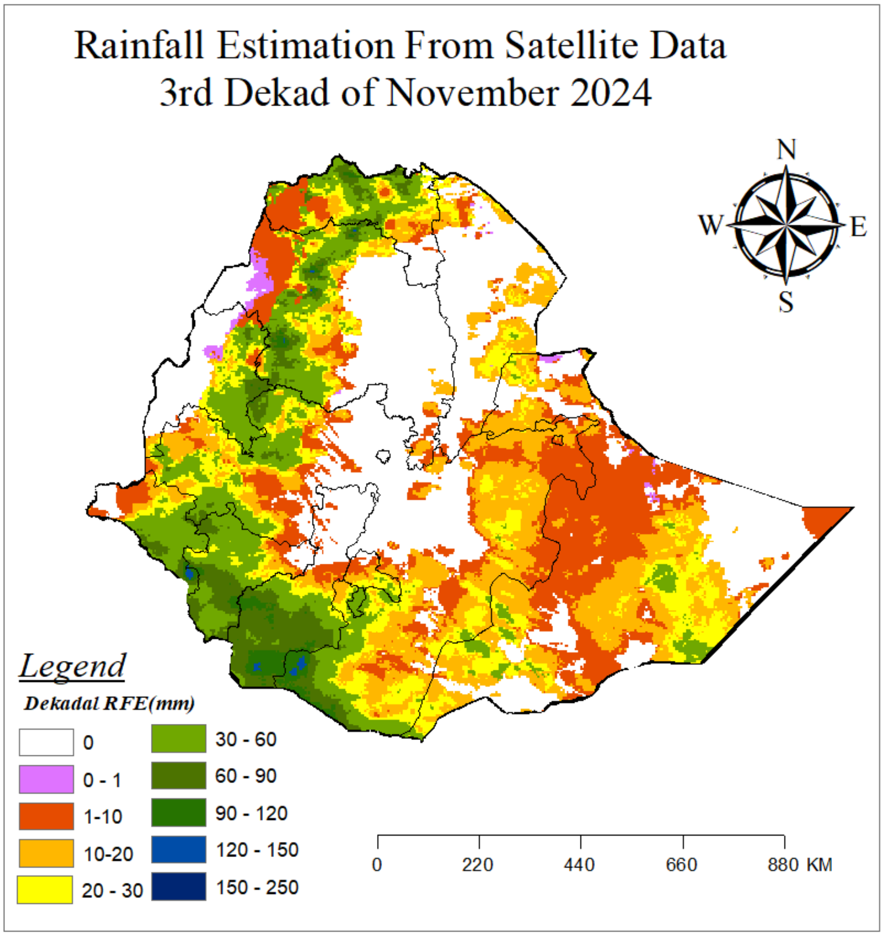
Introduction

Satellite remote sensing is a valuable tool for estimating vegetation distribution and productivity across large spatial scales. Among the various indices used, the Normalized Difference Vegetation Index (NDVI) is the most widely applied for assessing vegetation greenness and has been utilized in numerous studies (Brandt et al., 2015; Chen et al., 1998; Santos & Negri, 1997; Zhang et al., 2009). The spatial distribution of NDVI, and consequently of terrestrial vegetation, is largely influenced by climatic factors such as rainfall and temperature. A well-documented relationship between NDVI and rainfall exists across various spatial and temporal scales (Davenport et al., 1993; Grist et al., 1997; Nicholson et al., 1990; Potter & Brooks, 1999; Wang et al., 2001). While results vary, these studies consistently highlight rainfall as a key predictor of vegetation distribution, particularly in transitional zones where ecosystems shift from humid to arid or semi-arid conditions. This relationship is especially evident in regions like the Sahel of Africa, where rainfall patterns significantly impact vegetation cover (Zhao et al., 2015).

Rainfall is a critical resource for many socioeconomic activities, particularly in African countries that rely heavily on rain-fed agriculture. Over recent decades, these countries have experienced significant challenges due to rainfall variability and long-term changes in both the amount and distribution of rainfall. However, the network of rain gauges across Africa is sparse, unevenly distributed, and deteriorating, limiting the accuracy and reliability of ground-based rainfall measurements. To address this gap, satellite-based rainfall estimates are increasingly being used as a substitute for, or to supplement, gauge observations, providing broader spatial coverage and more consistent monitoring of rainfall patterns (Tufa Dinku et al.).

In this bulletin, satellite rainfall estimates and vegetation greenness for the 3rd Dekad of November 2024 were generated using TAMESAT and METOSAT vegetation products. During this period, moderate rainfall was observed in parts of the Bega rain-benefiting areas, particularly in the southern, southwestern, and southeastern regions, resulting in significant vegetation cover as indicated by the Normalized Difference Vegetation Index (NDVI). In contrast, central Ethiopia, along with parts of Amhara, Afar, and central Oromia, received minimal to no rainfall. These regions showed low vegetation cover, with some areas exhibiting bare or sparse vegetation.

Rainfall Estimation from Satellite Data

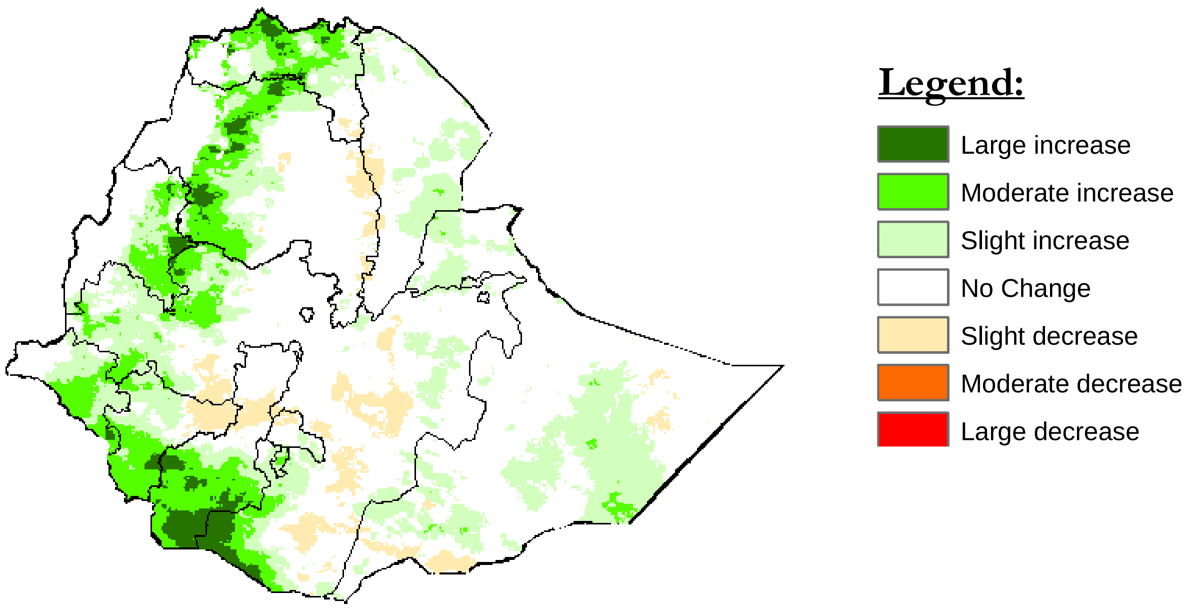


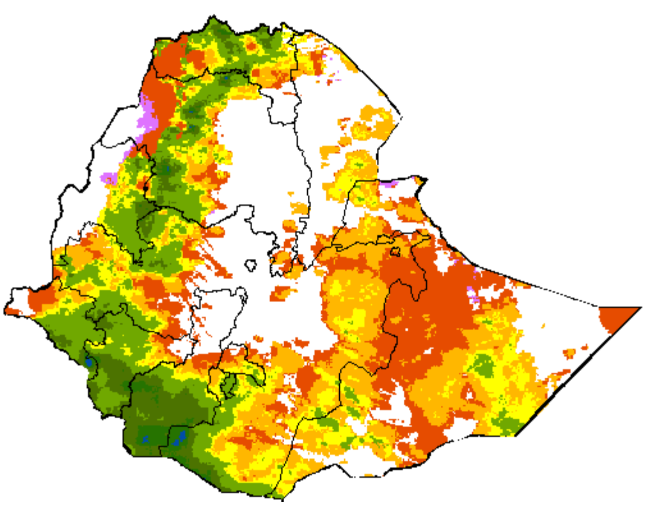
Rainfall distribution

The Bega season, which spans from October to January, marks the dry season for most of Ethiopia. However, by the third dekad of November, rainfall had begun in various parts of the country. Notably, regions such as Southwest Ethiopia, Southern Ethiopia, Benishangul Gumuz, Gambella, Tigray, and some localized areas of Oromia and Amhara received rainfall ranging from 10 to 90 mm. In contrast, minimal to no rainfall was recorded in other parts of the country, highlighting the spatial variability of precipitation during this period.

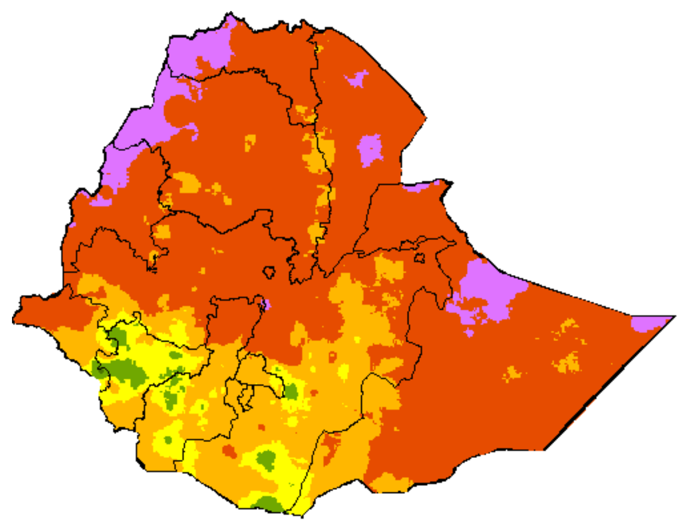
Comparison with climatological normal

During this dekad, a comparison between satellite rainfall estimates and the climatological average revealed a slight to large increase in rainfall across regions such as South West Ethiopia**,** South Ethiopia**,** Tigray**,** Benishangul Gumuz**,** Gambella**,** western and southern Oromia, and parts of the Amhara region. In contrast, a slight decrease in rainfall was observed in parts of Sidama**,** Central Ethiopia and central Oromia**.** No significant changes were recorded in the rest of the country.





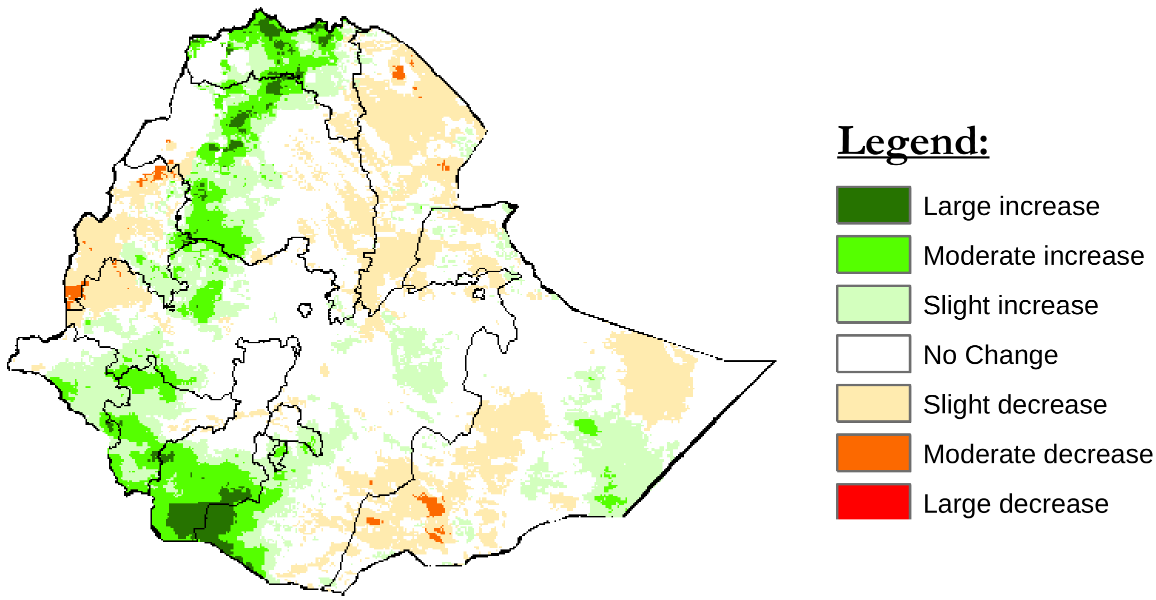
Current dekad



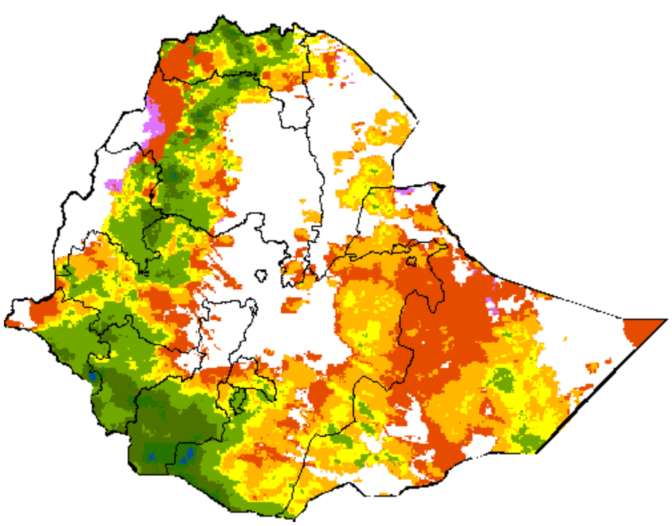
Climatological normal

Comparison with the previous Dekad

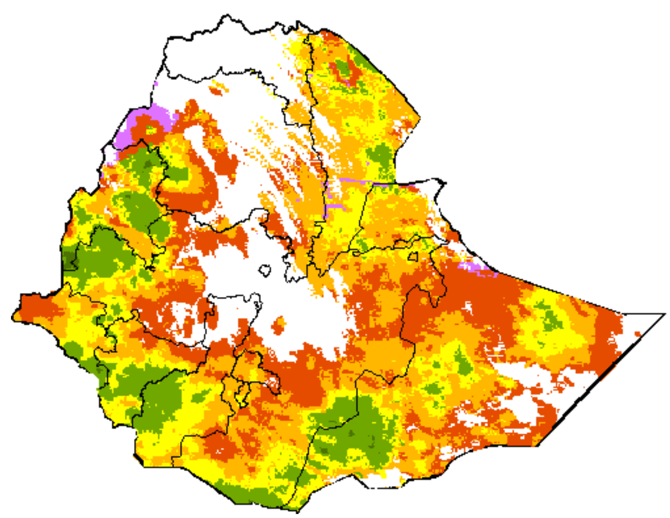
A comparison between the 2nd dekad of November 2024 and the 3rd dekad of November 2024 shows a slight to large increase in rainfall across South West Ethiopia, South Ethiopia, Tigray, Gambella, and parts of the Amhara and Oromia regions. Conversely, a slight to moderate decrease in rainfall was observed in Afar, Benishangul Gumuz, Somali, and some localized areas of Amhara and Oromia.



Difference of two Dekad



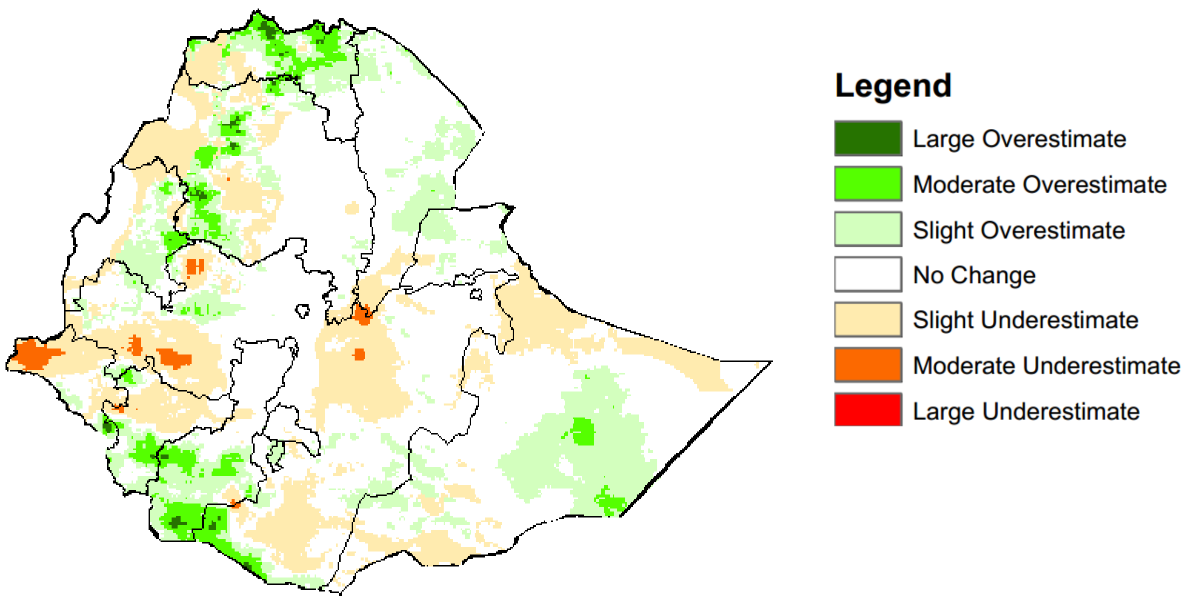
Current dekad

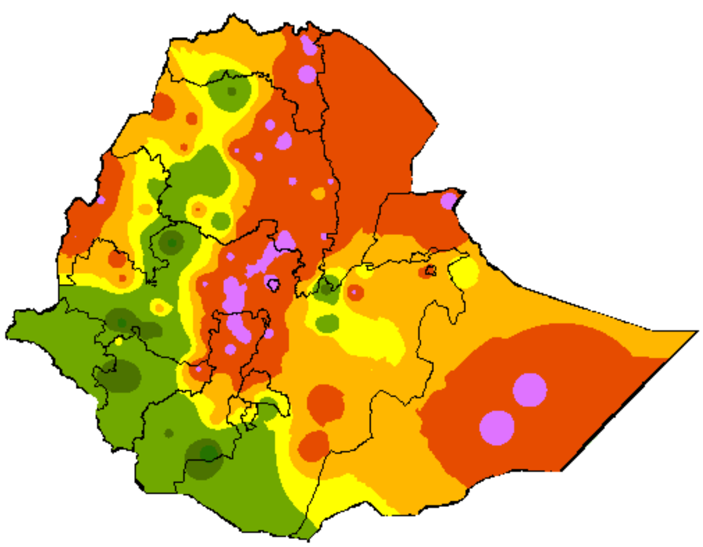


Previous dekad

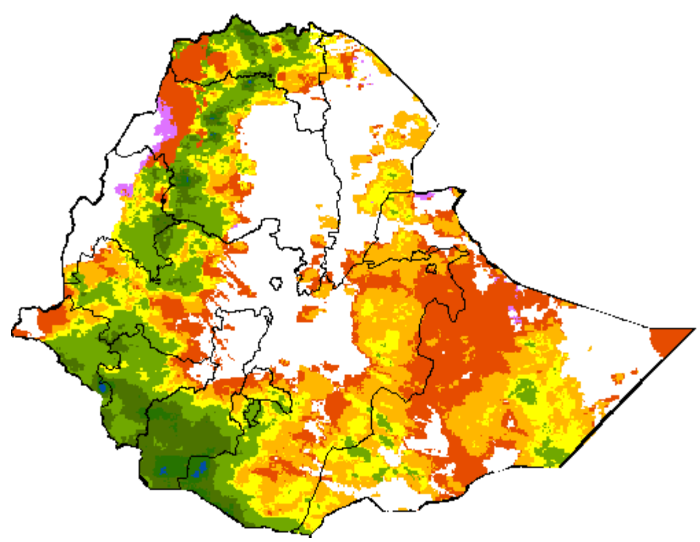
Comparison with the ground observation

The satellite rainfall estimation indicates a slight to large overestimation in South Ethiopia**,** South West Ethiopia**,** Tigray, and some localized areas of Amhara**,** Somali**,** and Oromia regions. In contrast, a slight to moderate underestimation was observed in Gambella**,** Oromia, and parts of South West Ethiopia and Amhara. For the rest of the country, there was no significant difference, as the satellite estimates closely matched the actual rainfall patterns.



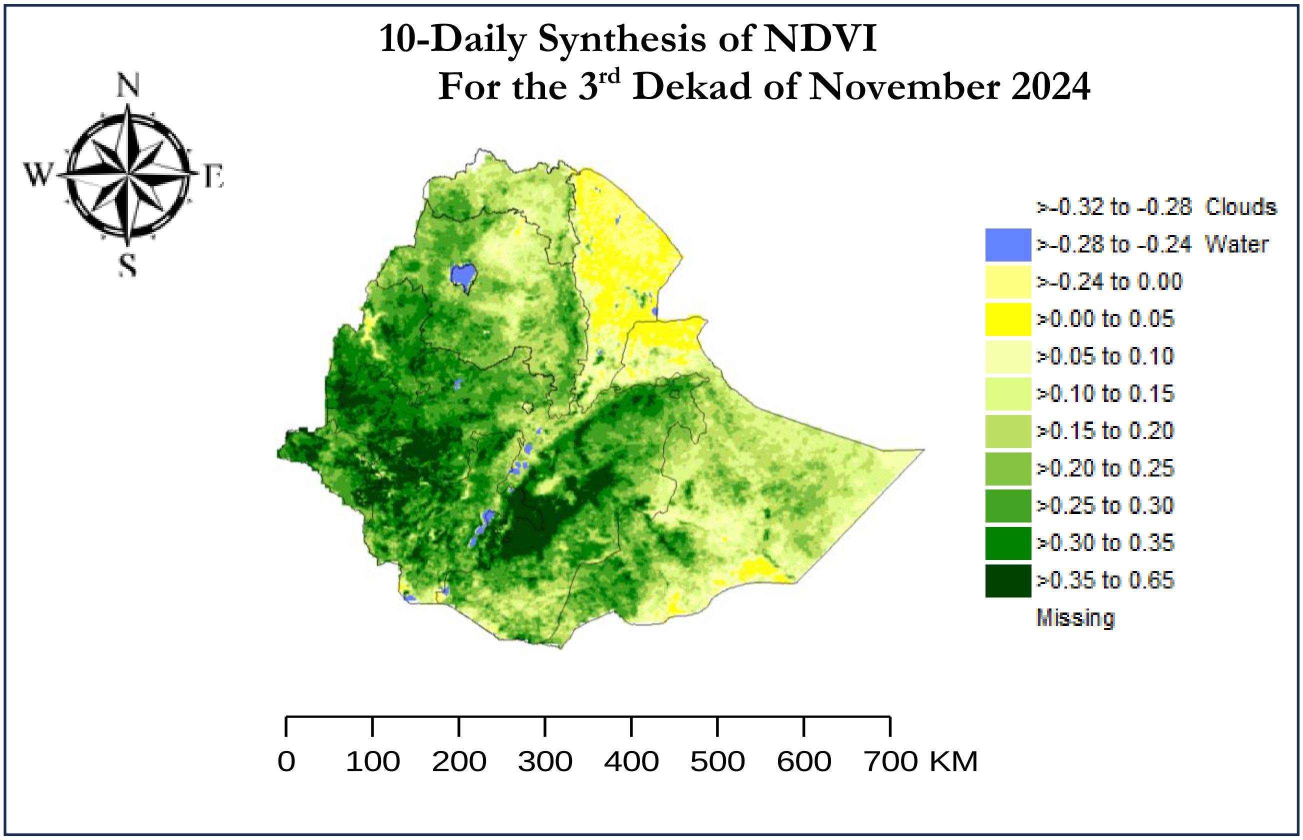


Ground Observation



Satellite rainfall estimation

10-Daily Synthesis of NDVI



Assessment of synthesis NDVI for the 3rd dekad of November 2024

The NDVI distribution for this dekad shows high greenness over most parts of the country. However, low NDVI values were observed in certain areas. Specifically, South West Ethiopia**,** South Ethiopia**,** Benishangul Gumuz**,** Sidama**,** Gambella**,** Central Ethiopia**,** Tigray**,** Amhara, and most parts of Oromia regions exhibit high to moderate greenness. In contrast, Afar and parts of the Somali region show low to bare greenness. (Refer to the actual figure above for detailed visualization.)

Comparison with the Climatological Normal

A comparison between the current dekad and the climatological normal shows a small to large increase in greenness in Dire Dawa, Tigray, Harari, Amhara, Benishangul Gumuz, Afar, Somali, South West Ethiopia, South Ethiopia, and Oromia regions. In contrast, a small to large decrease in greenness was observed in Somali, southern and western Oromia, and Sidama regions.