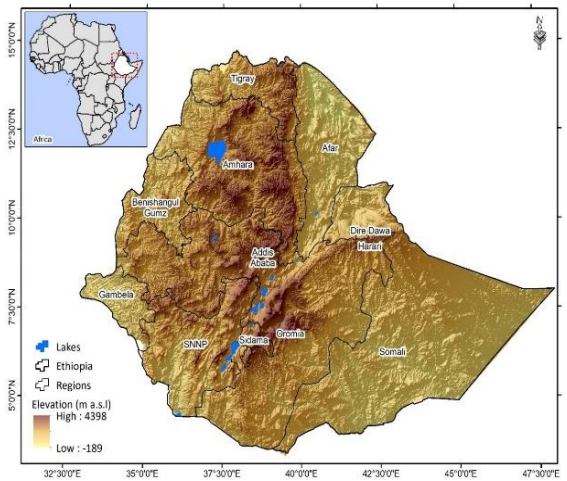
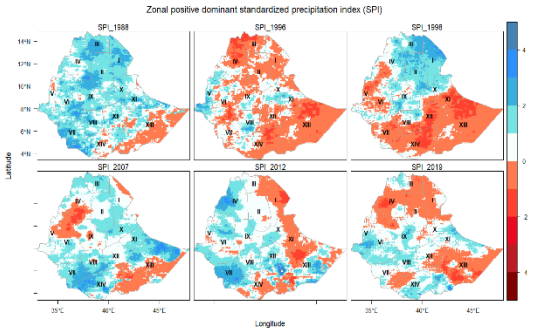
SPATIOTEMPORAL CLIMATE VARIABILITY AND METEOROLOGICAL DROUGHT CHARACTERIZATION IN ETHIOPIA

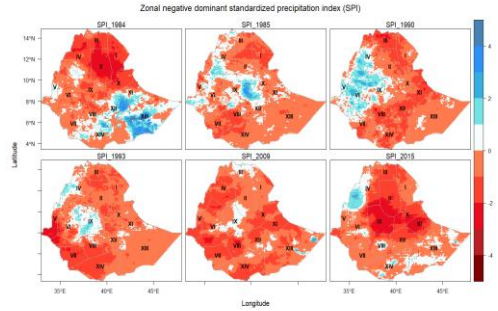
Introduction

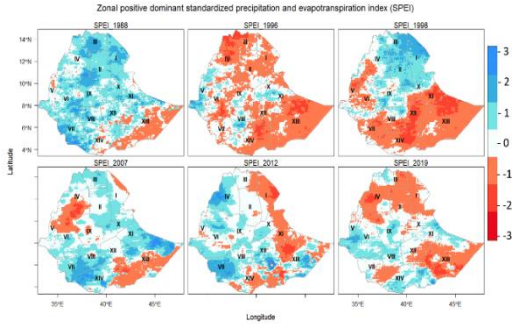
Drought is one of the most recurrent natural disaster in Ethiopia (Negash et al., 2020; Kourouma et al., 2021; Eze et al., 2022). Over the past 57 years, 30 historical drought events hit the country, 13 of which were severe and known to have covered the entire nation (McCann 1995; Gebrehiwot et al. 2011).

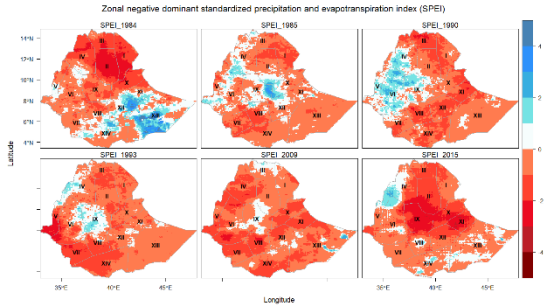
Understanding the spatiotemporal climate variability and meteorological drought characterization over Ethiopia is of socio-economic importance, given its impacts on the agricultural sector and the most vulnerable communities that rely on rain-fed farming for subsistence.











Materials and methods

- The study combined 16 Ethiopians' weather stations climatic data and the CHIRPS data generated from 100 randoms stations based on the topography, the climate and seasonal synoptic systems classification to analyze drought patterns and severity in Ethiopian's 14 homogenous rainfall zones.
- PCA used to reduce the number of variables and extract 3 large rainfall regimes over Ethiopia (Northeastern, Southern, and Western regions),
- Cluster analysis was used to classify 0the rainfall regime into 14 clusters.
- The SPI and SPEI were computed using time-series meteorological data from 1983 to 2020 to depict the spatial extent of drought characteristics and patterns at 4- and 12-month timescales.

Results

The analysis of the zonal positive dominance of an SPI shows moderate to extreme drought events occurring in the southern parts of the country in 1988. Moderate to extreme drought events were observed across the country in 1996. In the year 1998, only the northeastern and a large portion of the northern part were exempted and wet.

The study observed that during the study period, drought events vary spatially and temporally.

The years 1984/85, 1997/98, and 2015/16 witnessed the most impactful and countrywide drought episodes. The magnitude of droughts deep to extremes of ' 2.90 for both SPEI 4 and SPEI-12 timescale in the area.

Conclusion and recommendations

The drought magnitude portends the likelihood of inescapable food insecurity and the need for preparedness in adapting to these situations as they will be more frequent in the face of climate change.

The study, draw the attention of policymakers with local-scale planning to be focused on the Northwestern, Northeastern and Southeastern parts of Ethiopia.

Government interventions and preparedness for drought should focus more on effective strategies to cope with drought through developing more resilient ecosystems, adaptation strategies like water harvesting, irrigation systems and a geographical shift of the agricultural system.

The rainfall deficit according to the geographical location should be a good guide for future interventions. Areas with a rainfall deficit between 8% and 16% should be prioritized, given their vulnerability to drought conditions. This study provides foundational information for future studies on drought assessments for the development of early warning systems, drought preparedness, contingency planning, and climate change adaptation.

References

1, Korecha D, Barnston A. 2007. Predictability of June-September rainfall in Ethiopia. Monthly Weather Rev. 135(2):628–650.

2, Korecha D, Sorteberg A. 2013. Construction of homogeneous rainfall regimes for Ethiopia. Int J Climatol. 49:7681–7697.

3, Kourouma JM, et al. 2021. Assessing the Spatio-temporal variability of NDVI and VCI as índices of crops productivity in Ethiopia: a remote sensing approach. Geo Nat Hazards Risk. 12(1):2880–2903.