

## 1) Introduction

Drought is commonly defined as a deficiency of precipitation from expected climatological mean that extends over a season or longer period of time (Palmer 1965). Drought is one of the major weather related disasters and recent events over East Africa have demonstrated the continuing exposure to this natural hazard. The impact of drought depends on the severity, duration and spatial extent of the rainfall deficit. The aim of this work is to quantifies the severity, duration and the spatial extent of drought over this region.

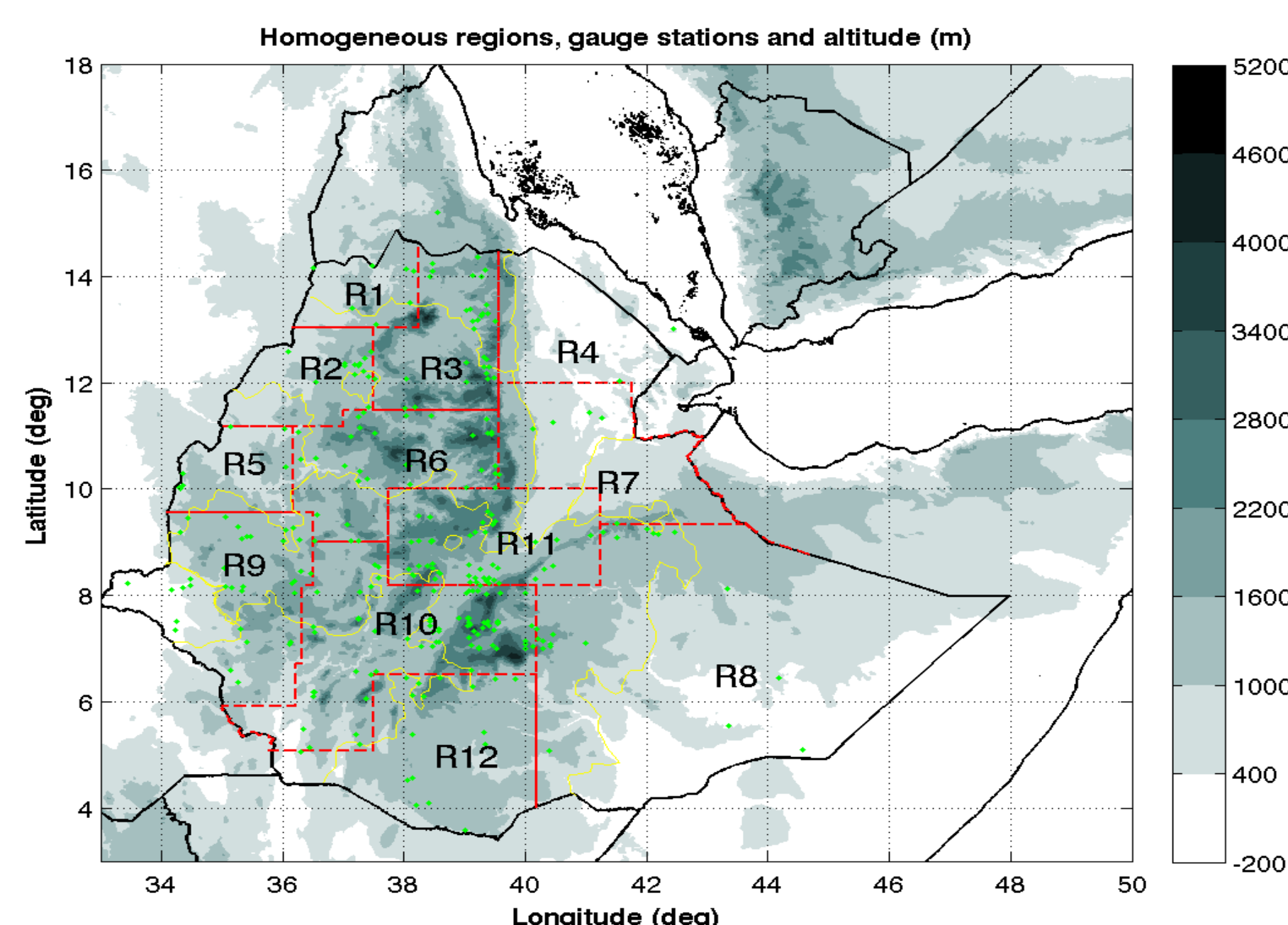


Figure 1. Homogenous regions (from Zeleke et al , 2012 Submitted ).

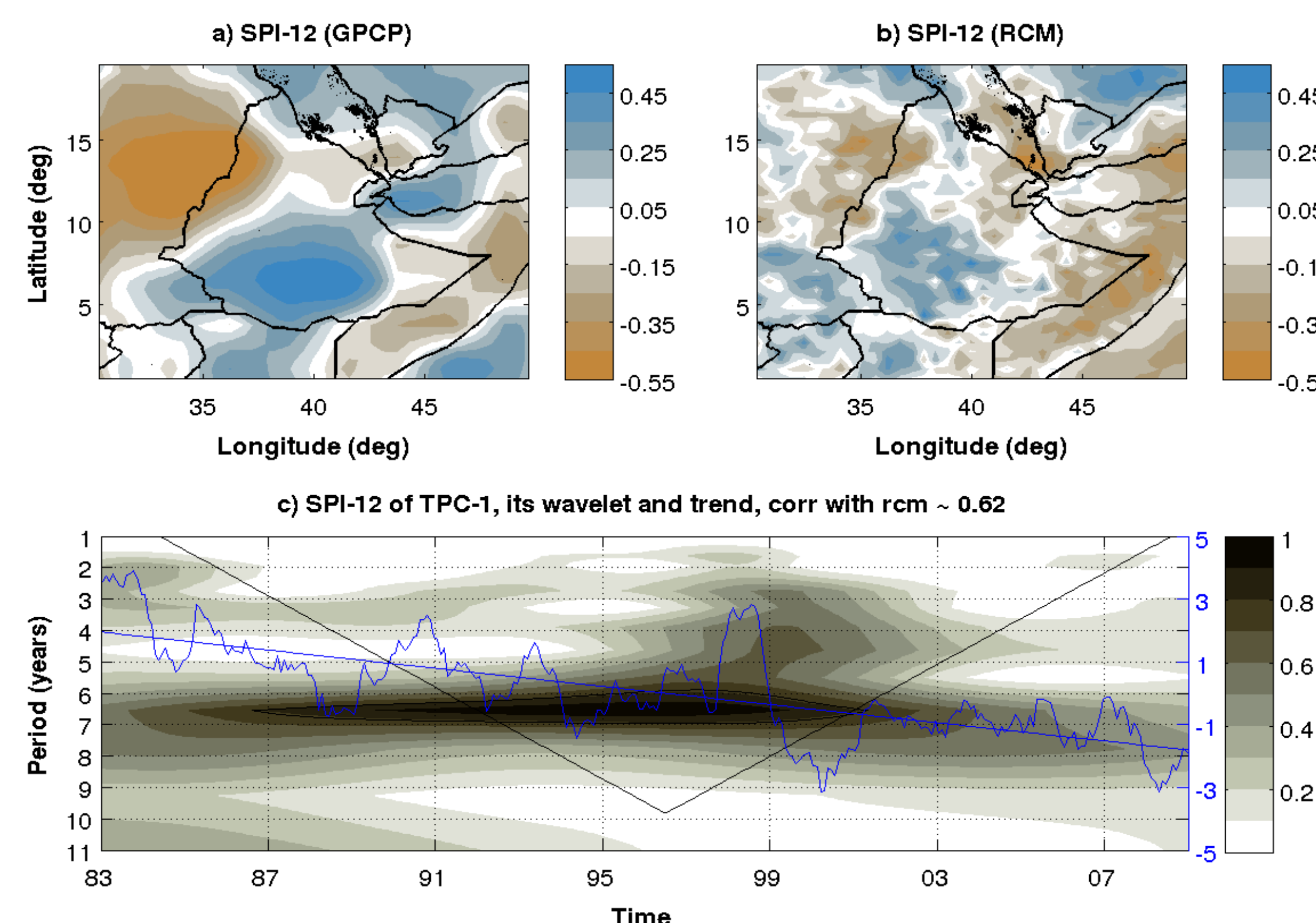


Figure 2 TEOF of SPI -12, corresponding time series (TPC, TPC wavelet and its trend for both)

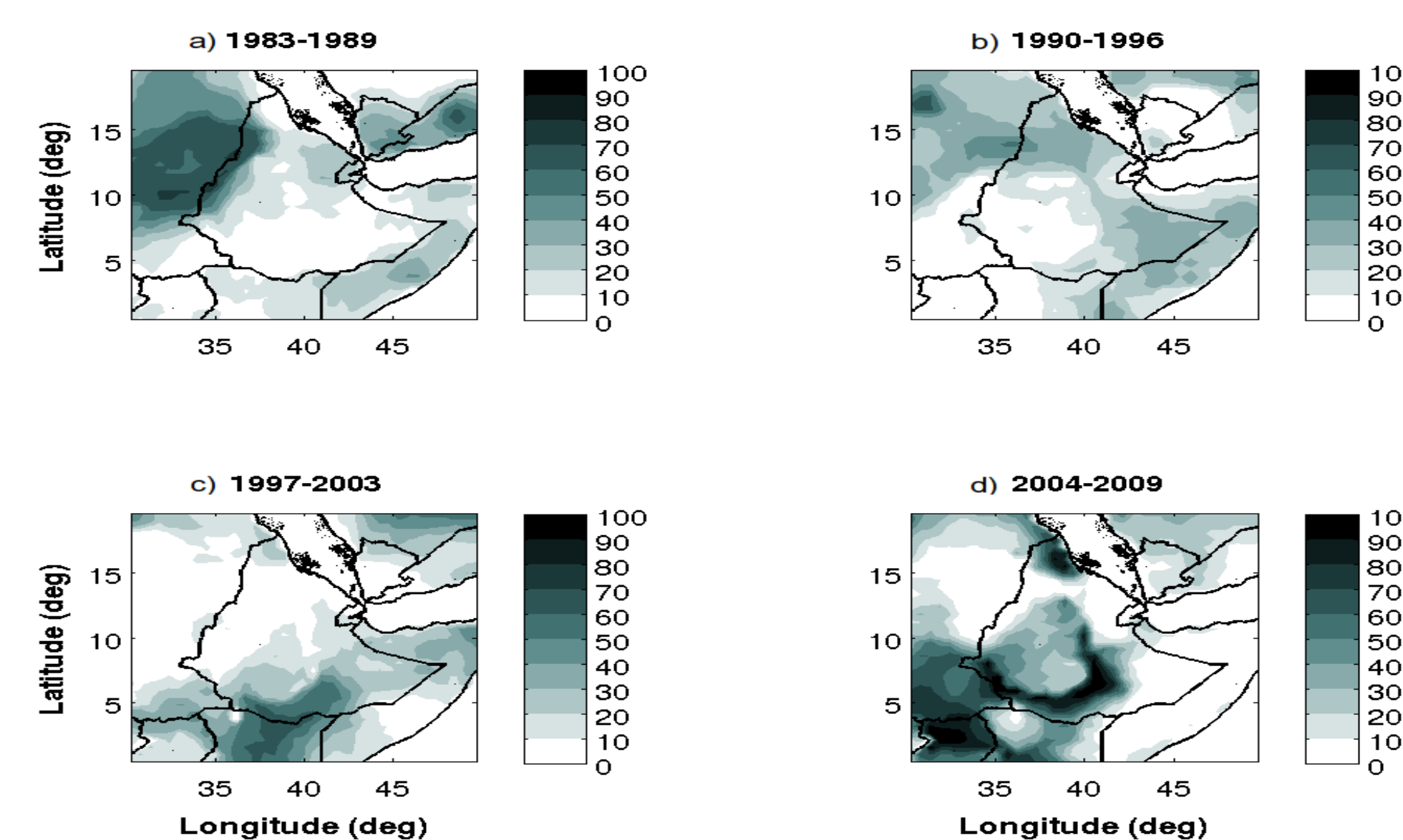


Figure 3. Number extreme and sever drought occurrence percentile per sub period

genous rainfall zones in southern and northern regions are analyzed and the pattern of drought frequency obtained by counting the number of sever drought occurrences over the last four equal heptads during the last 28 years (Figure 3). To investigate if this increase in the drought frequency and intensity could be linked to global phenomena correlation has been done between the TPC-SPI and global SST. Figure 4 indicates that the equatorial Atlantic and ENSO events are strongly correlated to the drought over the southern Ethiopia. Further analysis of the time series of eastern pacific (Figure 5) SST with dominant TPC-SPI and with vertical profile zonal wind were used to analyze WTC. Figure 5 shows their common high power and relative phase in time-frequency space, which is ~2 and ~4-6 years band and coherent in the period from 1997-2001.

Similar results are found using palmer drought severity index (PDSI)

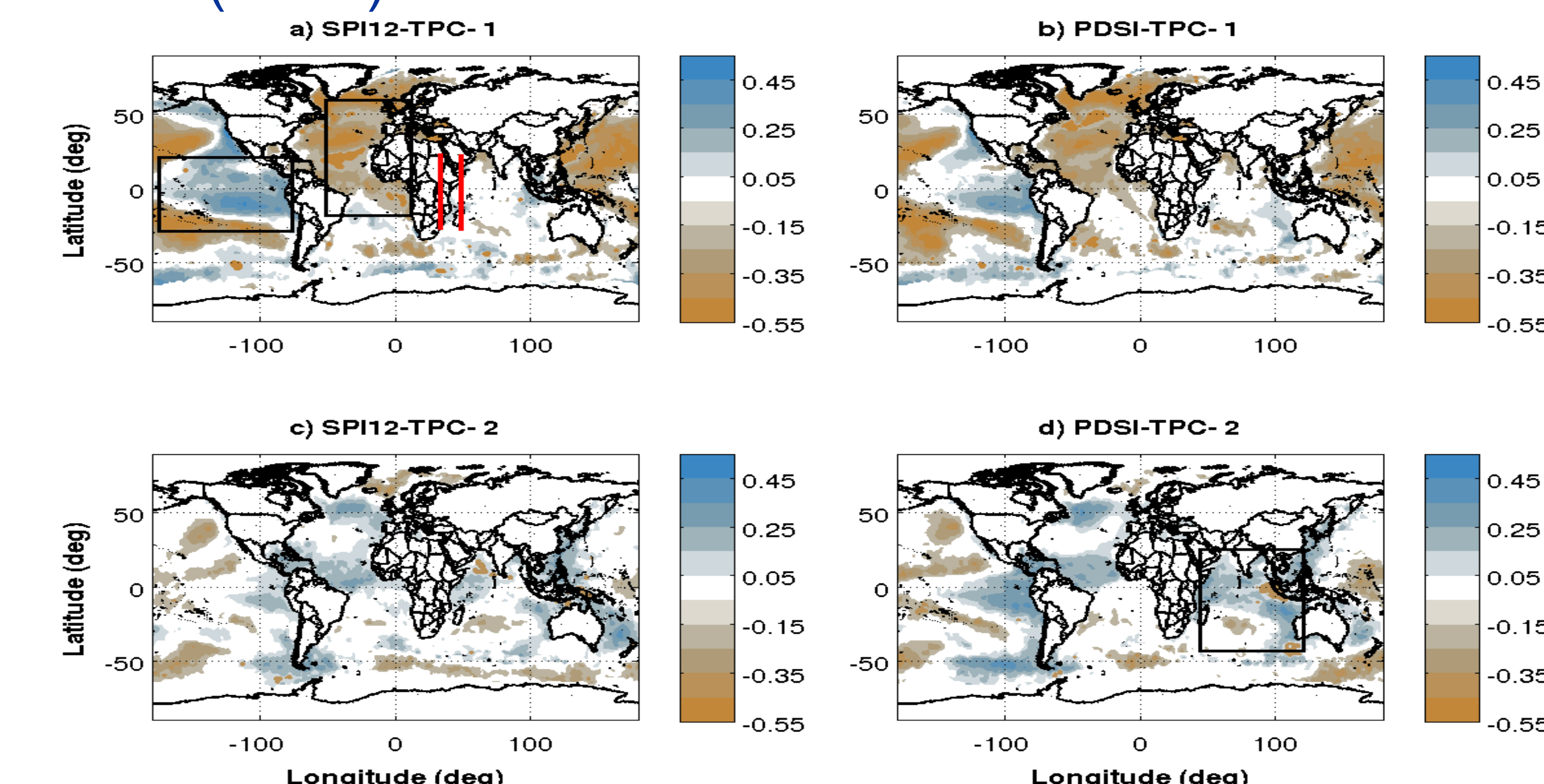


Figure 4. SST correlation with TPC of SPI-12, only significant above 95% are displayed

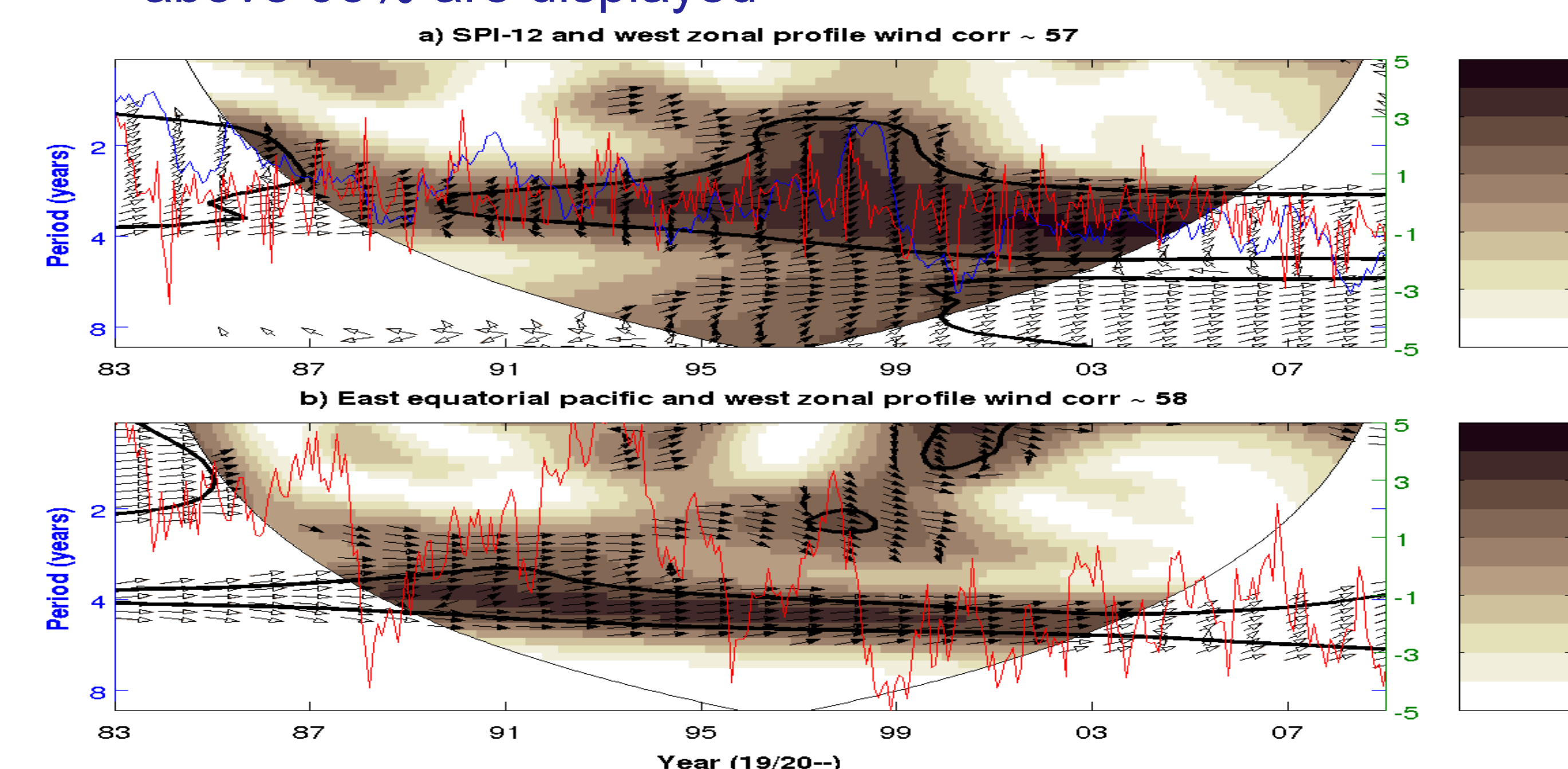


Figure 5. Wavelet coherence between TPC-SPI with the east equatorial pacific SST

## 4) Conclusion

During the recent decade, there has been an increase in frequency and intensity of drought over the southern regions of Ethiopia. This drought can be due to both local and remote forcing. ENSO and Equatorial Atlantic SST anomalies seems to be the candidates for the remote forcing. Future work will examine the local forcing eg Land use change and explore further mechanism for these remote forcing.

## Acknowledgments

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## References

- Palmer, W. C., 1965. Meteorological Drought. Research Paper No. 45, U.S. Department of Commerce Weather Bureau, Washington, D C
- Zeleke T, Giorgi F, Mengistu G and Diro GT, 2012 Spatial and Temporal variability of summer rainfall over Ethiopia from observations and a regional climate model experiment: Theoretical and Applied Climatology , DOI s00704-012-0700-4

## 2) Data, Model and Methodology

GPCP and simulated RegCM4 rainfall are used to calculate standardized precipitation index (SPI). Trend empirical orthogonal function (TEOF), is employed to extract the dominant trend and its spatial pattern in the raw SPI data. Wavelet, and regression methods are then applied to the 1<sup>st</sup> trend principal component (TPC) to analyze the periodicity and its trend. Extreme drought percentile per sub period is also used to consolidate the wavelet analysis. In addition to TPC, homogenous regions (Figure 1) time series are used to see the characteristics of drought. Correlation and wavelet coherence (WTC) methods are also applied to see the possible linkage of TPC-SPI and SST.

## 3) Results and Discussion

Figure 2 shows the dominant pattern of TEOF, its time component and the wavelet analysis of TPC. The dominant trend pattern exhibits significant dry trend over southern regions whereas for the northern regions wet trend is not statistical significant. Similar results obtained when raw SPI time series of homo-