

DROUGHTS IN SOUTHERN MINAS GERAIS, SOUTHEASTERN BRAZIL: UNDERSTANDING THE LAST 100 YEARS

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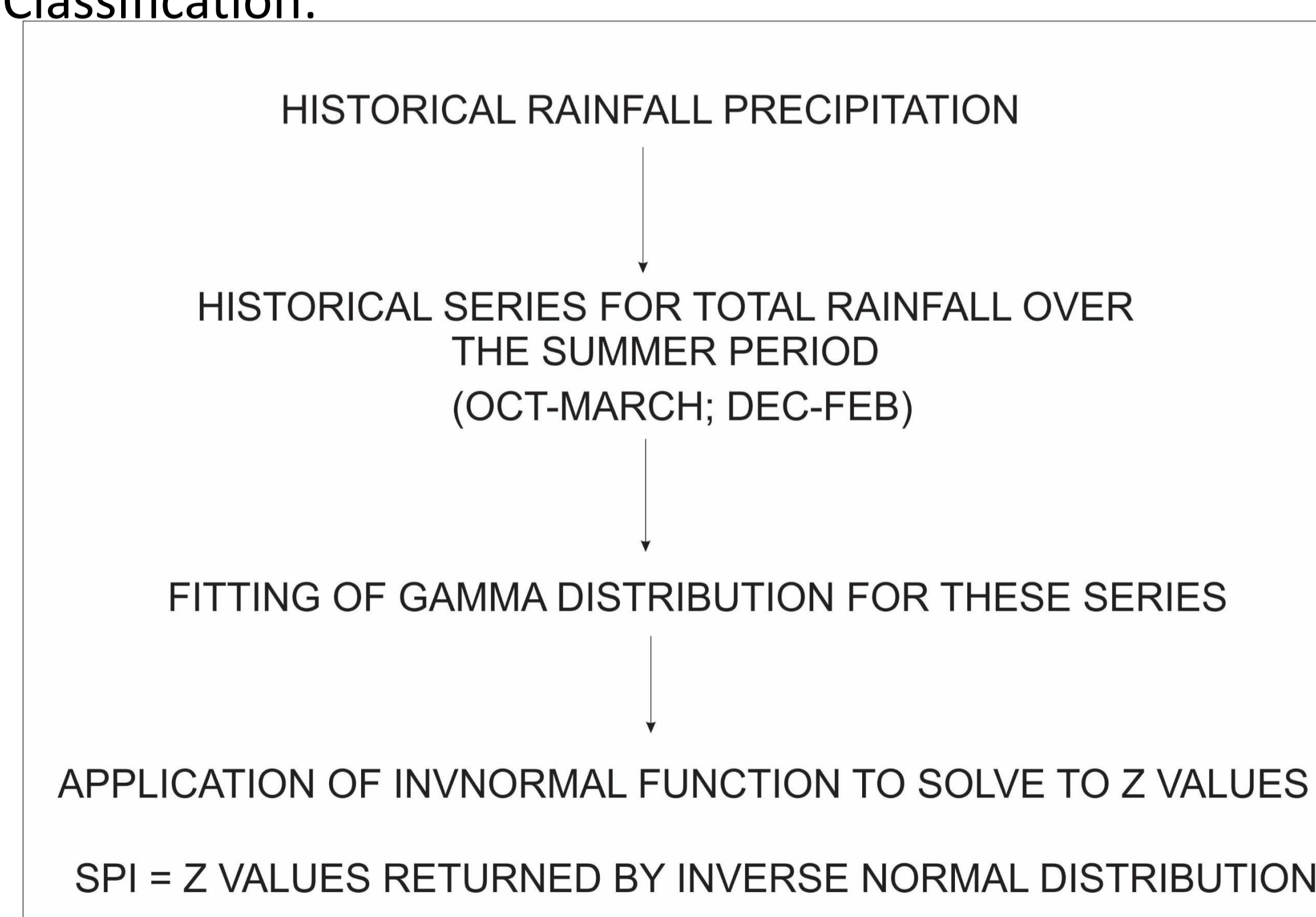
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INTRODUCTION

The hydrological years of 2013-2014 and 2014-2015 in southeastern Brazil had people, governments, and scientists concerned due to a much lower than expected amount of rainfall. Drought affected eastern South America with catastrophic effects on the economy, and the water availability for human consumption, agriculture, and electric energy production (more than 70% of Brazilian energy comes from hydropower plants, and most of them are in operation in southern Minas Gerais State). In a recent study, Coelho et al. (2015)* studied eastern São Paulo State, where they characterized 2014-2015 as the driest year ever recorded. However, these authors addressed in the study only taking into account the records only from 1961 to 2010, which are not long enough to make a significant conclusion. Thus, we aimed to answer: are these droughts normal? What is the expected frequency of them? Were the 2013-2014 and 2014-2015 hydrological years really the worst droughts recorded?

MATERIAL AND METHODS

- We used the historical series which observed rainfall for the last 101 years in Lavras county, Southern Minas Gerais, which accounted for the total rain over the summer period (6 month – October to March; and 4 months: December to March), which accounts for over 80% of the total rainfall to analyze for SPI Classification:



SPI PROCEDURE (NOAA)

- SPI CLASSIFICATION:** < - 2: Exceptionally Severe Droughts; -2 to -1.6: Severe Droughts; -1.60 to -1.3: Very Dry; -1.30 to -0.80: Moderately dry; -0.80 to -0.51: Abnormal dry

* Coelho, C.A.S., D.H.F. Cardoso, and M.A.F. Firpo. 2015. Precipitation diagnostics of an exceptionally dry event in São Paulo, Brazil. Theor. Appl. Climatol. DOI 10.1007/s00704-015-1540-9.

RESULTS

Figure 1 shows the temporal distribution of SPI-6M and SPI-4M throughout the last 101 years for the studied rain-gauge station. The 5-year moving averages for both SPI series are also presented. Drought periods were common, since we observed 20 and 22 years, respectively, with SPI-6M and SPI-4M characterized as “moderately dry” or “very dry”. However, “exceptionally dry” years were very rare, and were observed only 2 times for SPI-6M and just once for SPI-4M. For SPI-6M, this anomaly was detected for the hydrological years of 1949-1950 and 2013-2014. Regarding the 1950’s decade, it should be highlighted that there were a number of consecutive years with negative SPIs (lesser than -1) detected, and the moving averages demonstrated that this decade was one of the driest ever recorded.

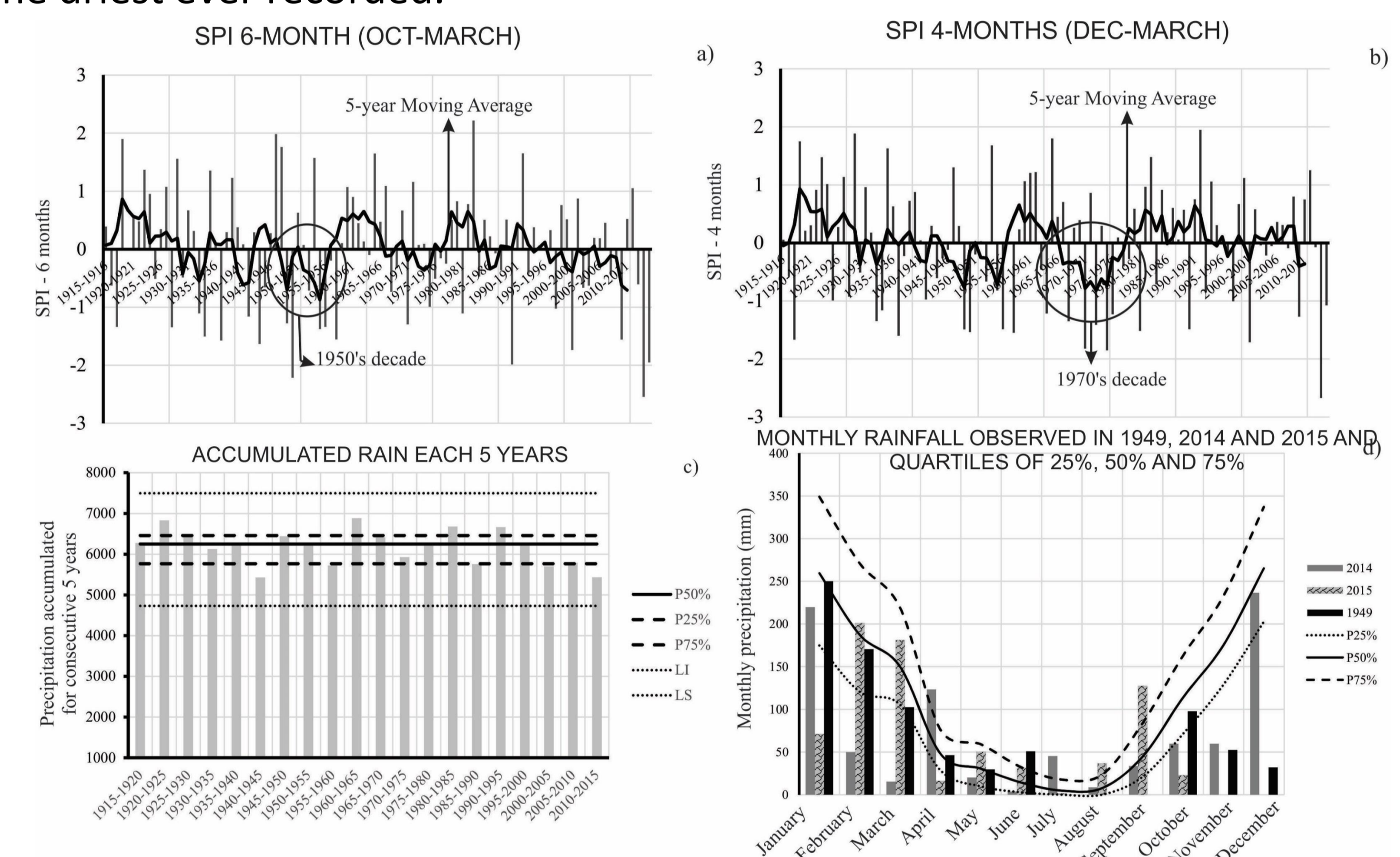


Figure 1. Precipitation records from Lavras, Minas Gerais State, Brazil: (a) SPI-6M, (b) SPI-4M, (c) Five hydrological years precipitation accumulation, and (d) Monthly precipitation behavior and monthly precipitation for 1949, 2014 and 2015.

CONCLUSIONS

- Acute reduction (lesser than the $P_{25\%}$ quartile) of monthly rainfall was observed in 1949, 2014 and 2015;
- For the hydrological years of 1949-1950 and 2013-2014 SPI 6-month values were -2.3 and -2.6 which means the driest years observed in the region;
- Drought's occurrence is common in southern Minas Gerais State, and, by extent, in much of southeastern Brazil. The hydrological period between 2010 and 2015 has been the most severe in the last 101 years; however, the 1950's decade was another historical drought episode and seemingly, there may be a 50-60 years periodicity.
- For curiosity: 2015-2016 year SPI 6-month was -0.28 (a normal year);