Variability of Droughts in Southern Africa

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Smart Water Management, Taiwan ICDF, October 2021

Introduction

- Drought - natural hazard that results from below-normal precipitation -beyond a given threshold over time - negatively affects ecosystems and society in several ways (Karavitis et al., 2011; Van Loon, 2015)

- Better understanding of inter annual drought occurrences - crucial for planning mitigation and adaptation measures for agricultural planning and water resources management

DROUGHT AND ARIDITY

Drought	Aridity	Water Scarcity:
Drought is a relative deficit in a given area compared to its average or usual water availability, either in the form of rainfall, river flow, surface/ ground water storages or due to combination of these for certain period of time. Thus drought is a temporary phenomenon.	Aridity refers to persistently short supply of water even in normal circumstances. It is a climatic attribute of the region. It applies to the persistently dry regions like arid areas & deserts, where, water is always in short supply. It is a permanent climatic feature of the region	The water scarcity refers to long-term unsustainable use of water resources, which water managers can influence. *Or in other words,* it is associated to over exploitation of water resources when demand for water is more than its availability. Thus water scarcity is a human induced phenomenon.

CASE STUDIES

Nationwide spatial and temporal variability of droughts in Eswatini: 1961-2018

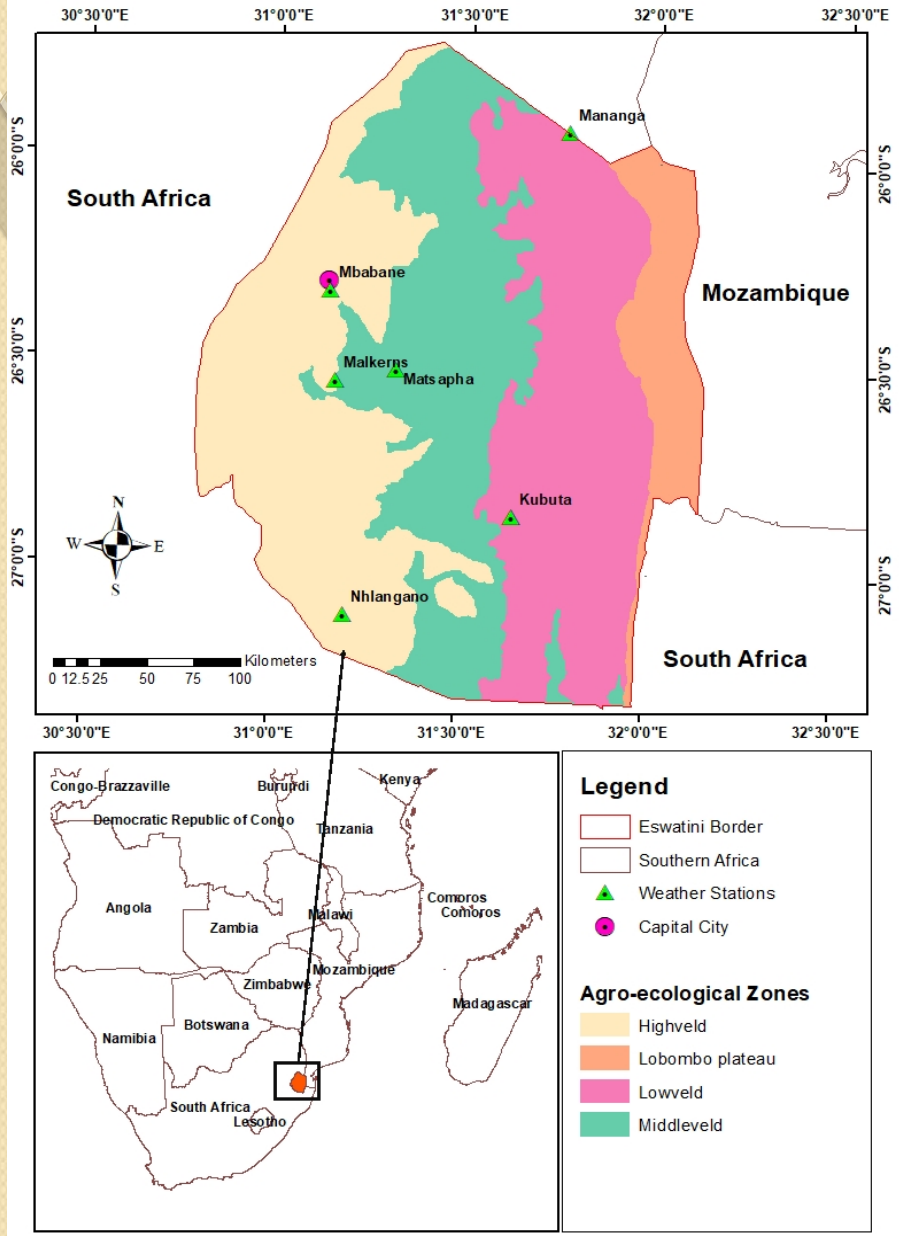
(Published in Heliyon Journal, 2021)

C.M. Tfwala, A. Mengistu, E. Seyama, M.S. Mosia, B. Mvubu, M. Mbingo, P. Dlamini

Objectives

- Were to determine:
  - i) the occurrence and severity of droughts
  - ii) the frequency of occurrence of droughts across the agro-ecological zones.

Meth. Cont….



- Two meteorological stations were selected from different agro-ecological zones
- Monthly rainfall data for these met. stations were sourced from the Department of Meteorology
- SPI, developed by Mckee et al. (1993) was used, long-term precipitation data is fitted to a probability distribution function to transform it into a normal distribution so that the mean SPI = 0.

SPI classes (Guttman, 1999)

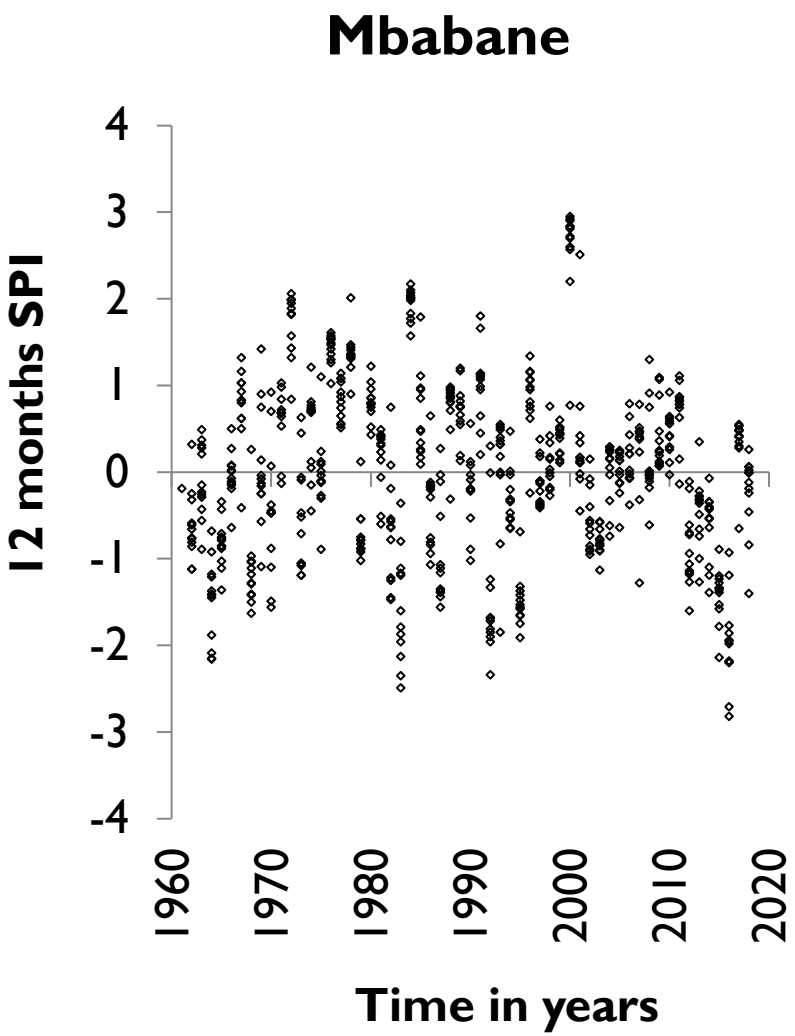
SPI value	Classification
2.0 +	Extremely wet
1.5 to < 2.0	Very wet
1.0 to < 1.5	Moderately wet
>-1.0 to < 1.0	Near normal
-1.0 to > -1.5	Moderately dry
-1.5 to > -2.0	Severely dry
-2.0 and less	Extremely dry

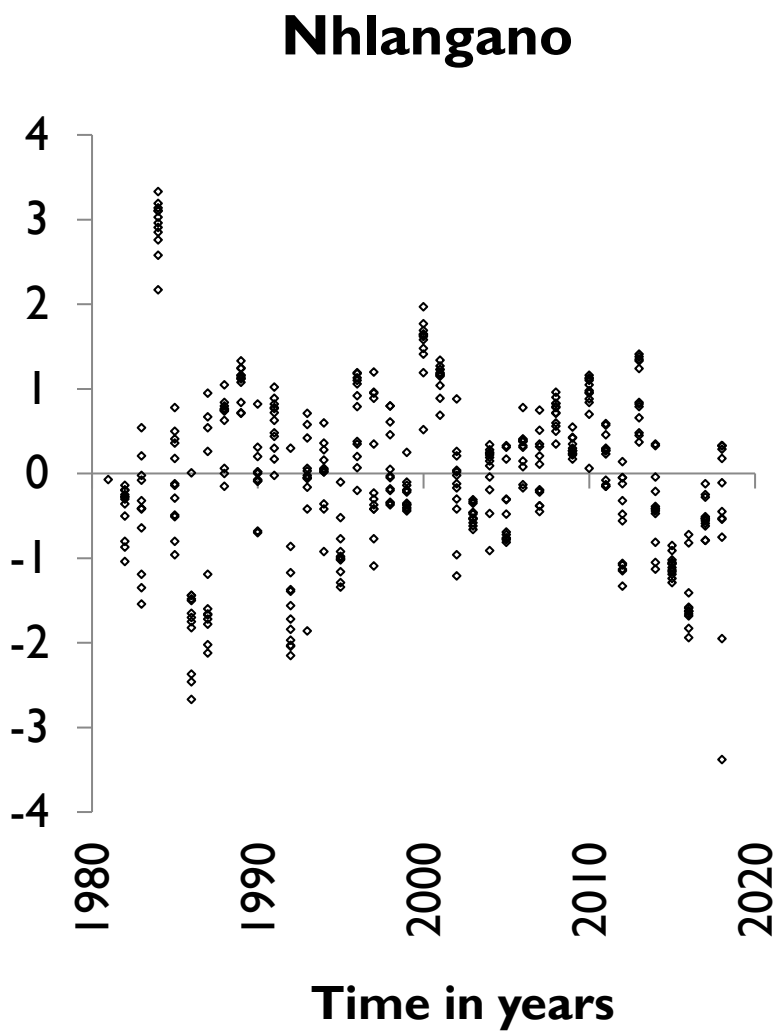
Metho. Cont.…

- A frequency analysis was carried out using Python (Version 3.6)

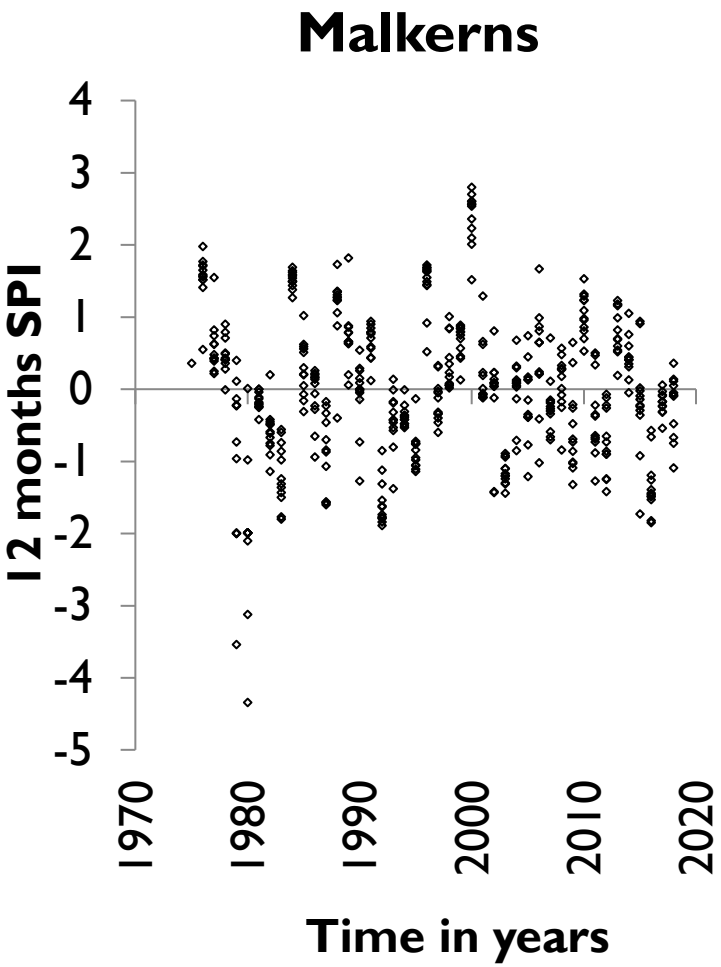
- To calculate re-occurrences of drought events of specific intensity over a period of time in years using SPI index values

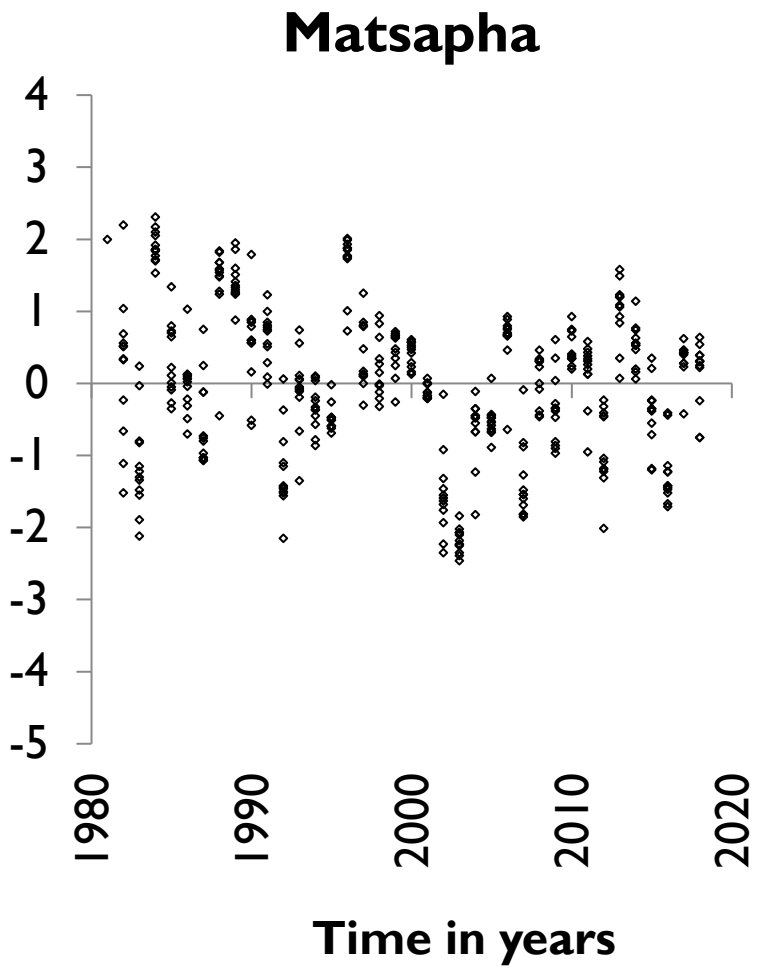
Results – SPI Highveld



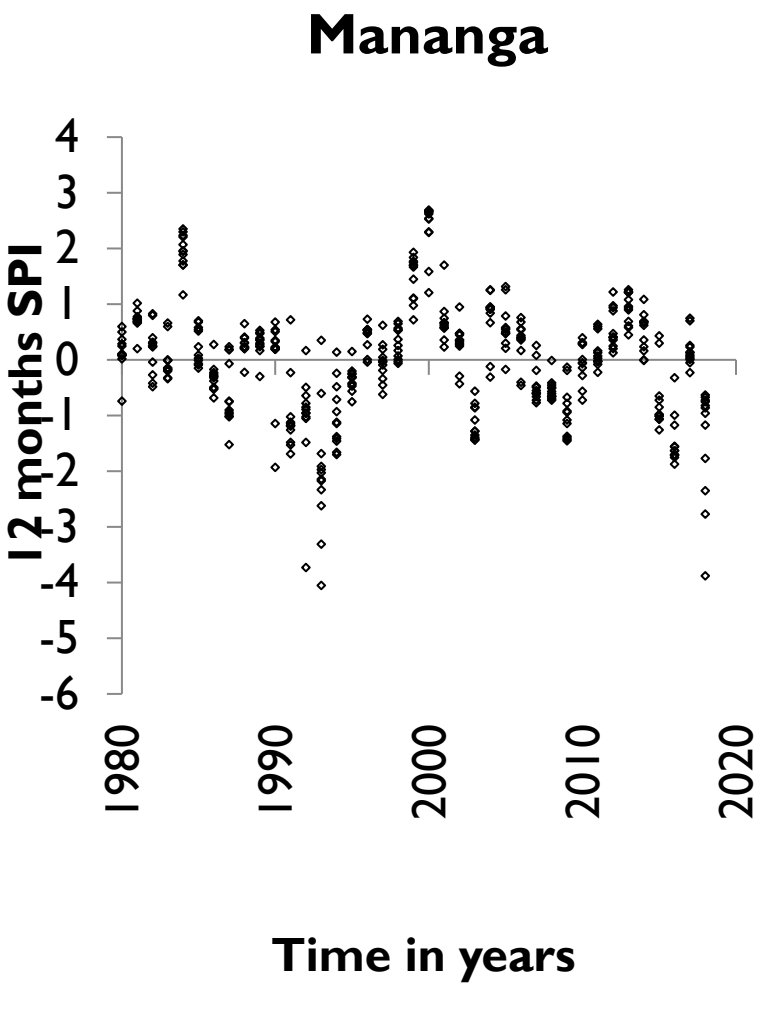


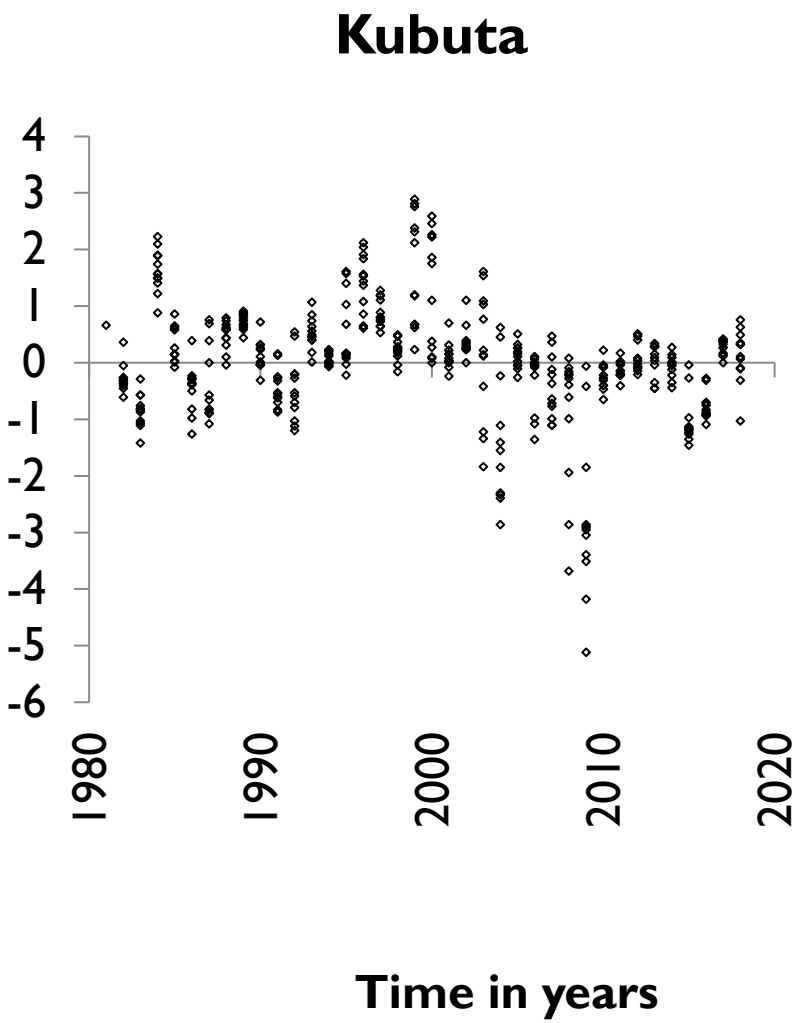
Results – SPI Middleveld



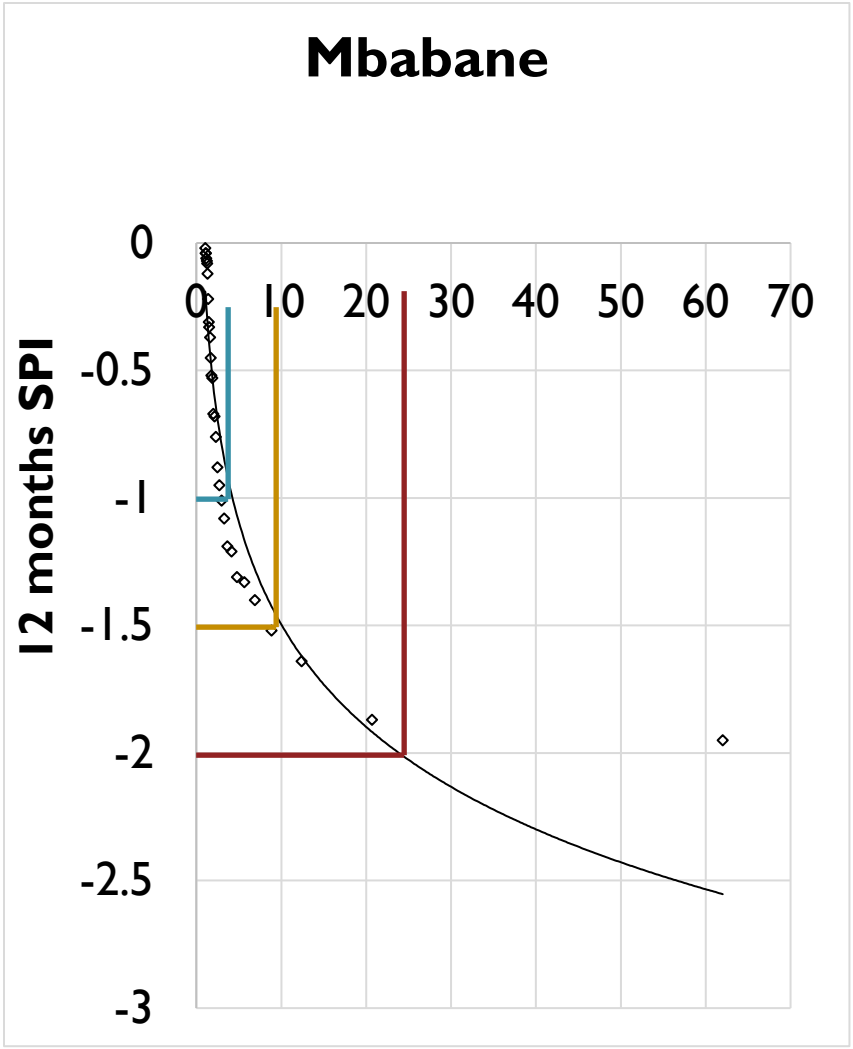


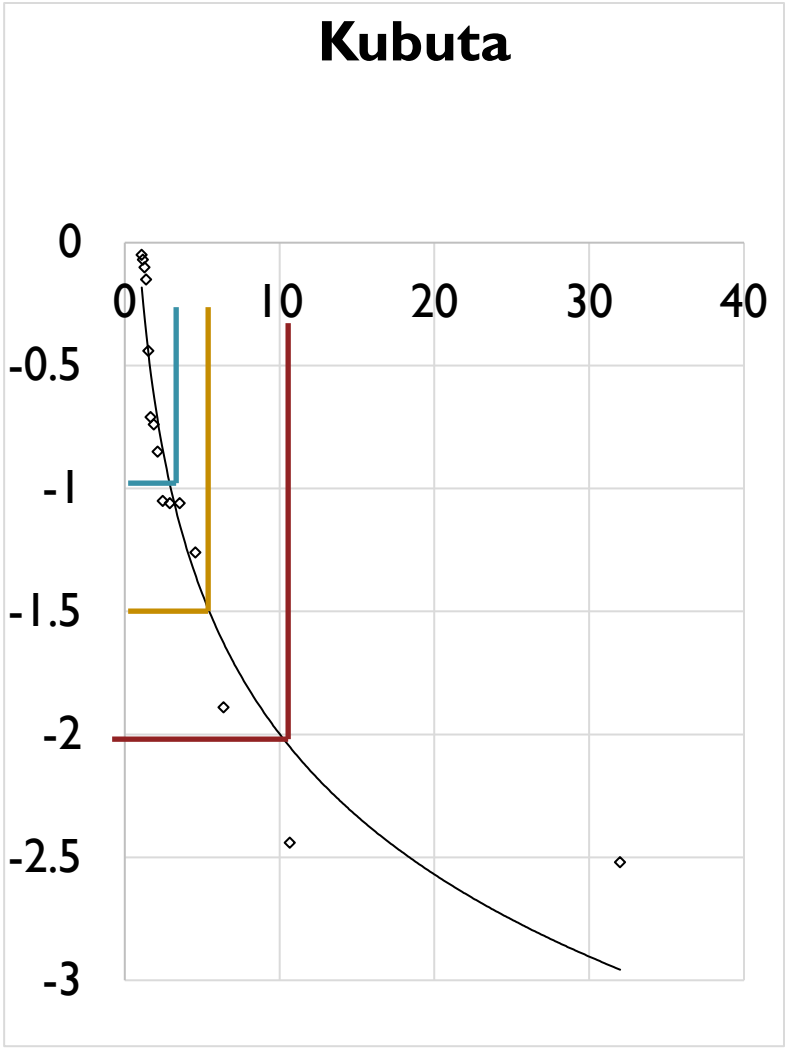
Results – SPI Lowveld





Results – Frequency of re-occurrence





Conclusions

- Droughts have increased in prevalence and severity post the year 2000, especially in the dry areas (Lowveld), where (70%) of the droughts occurred during this period.

- The frequency of droughts is higher in the dry areas of the country compared to the high rainfall areas. For instance extreme droughts are expected every 21 years (Highveld), 14 years (Middleveld) and 13 years (Lowveld).

Drought dynamics and Interannual Rainfall Variability on the Ghaap Plateau, South Africa, 1918-2014

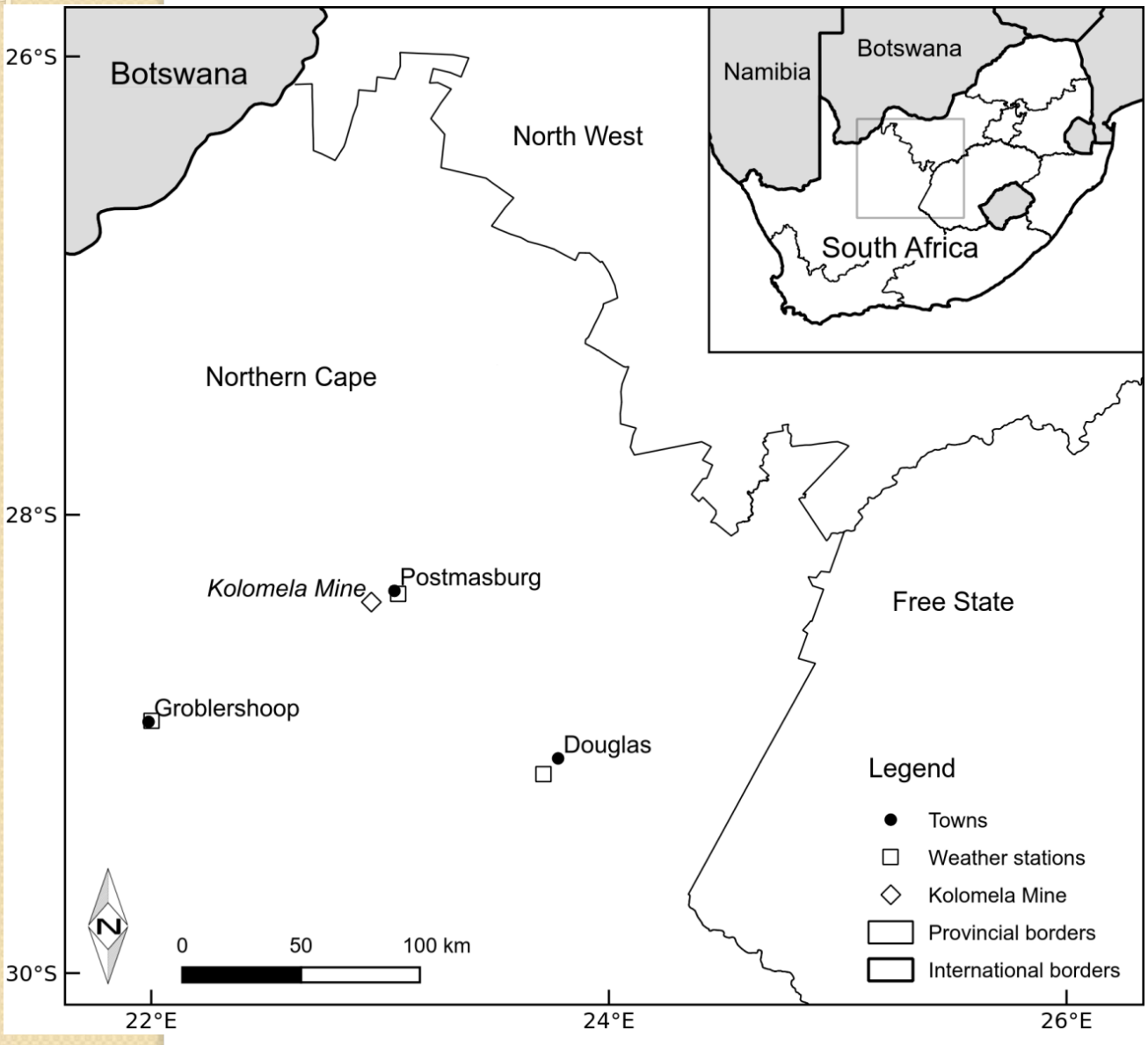
(Physics and Chemistry of the Earth, 2018)

C.M. Tfwala, L.D. van Rensburg, R. Schall and P. Dlamini

Objective

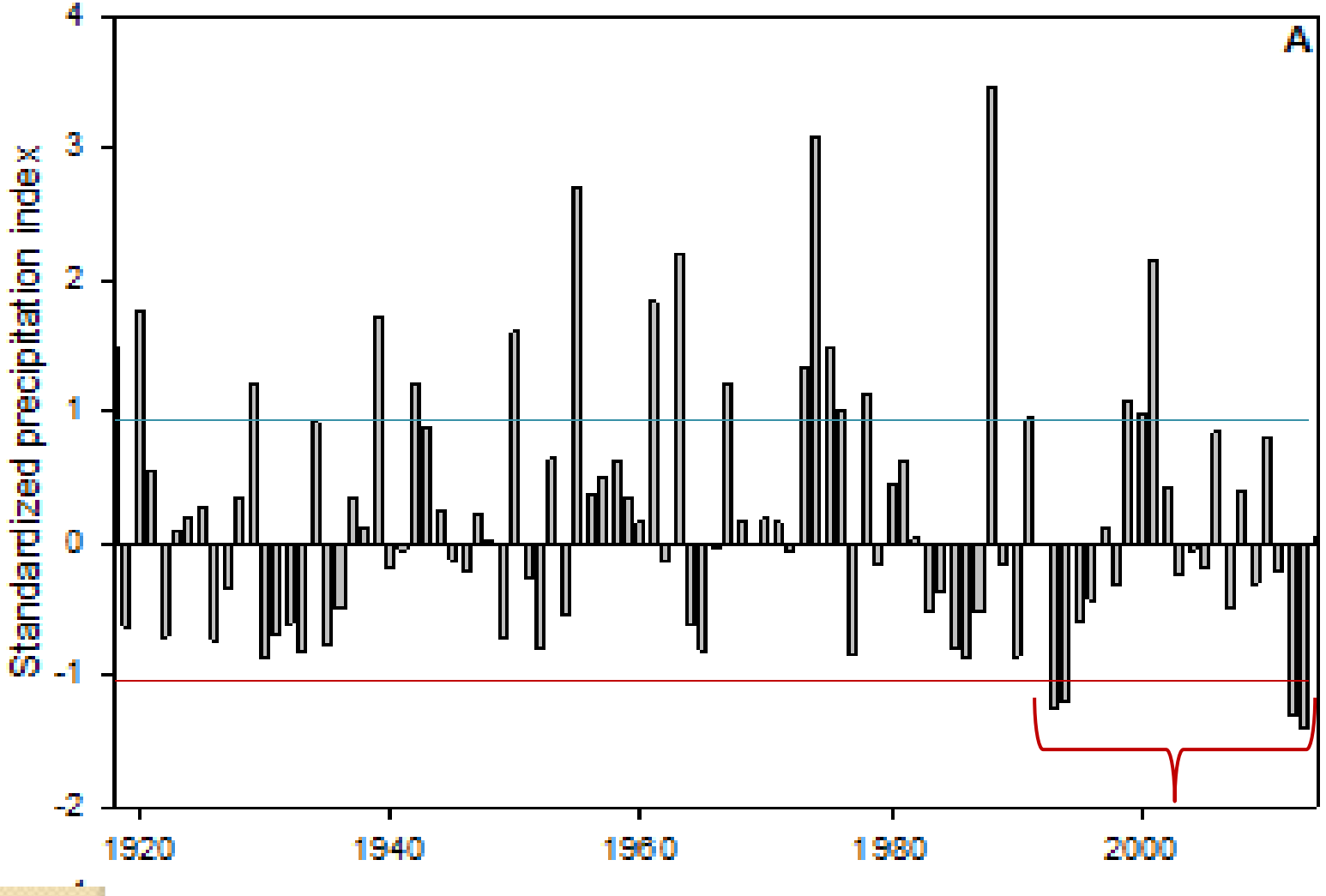
- The objective of this study was to determine the occurrence and severity of droughts in the Ghaap Plateau of South Africa

Methodology

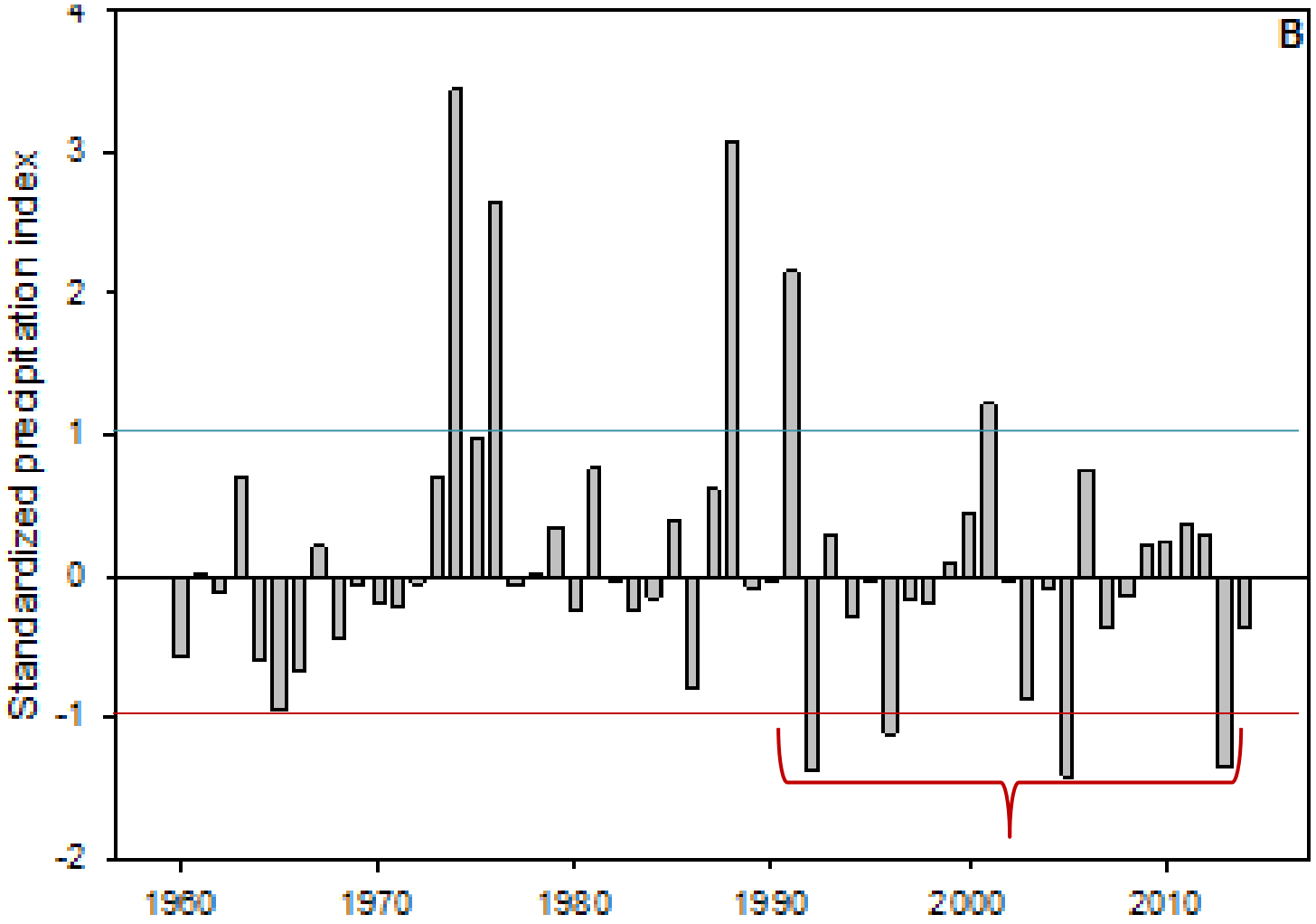


- 3 weather stations
- Representative of the plateau
- Central part of the Northern Cape Province
- **Occurrence & severity of droughts determined using the same SPI as in the 1st study**

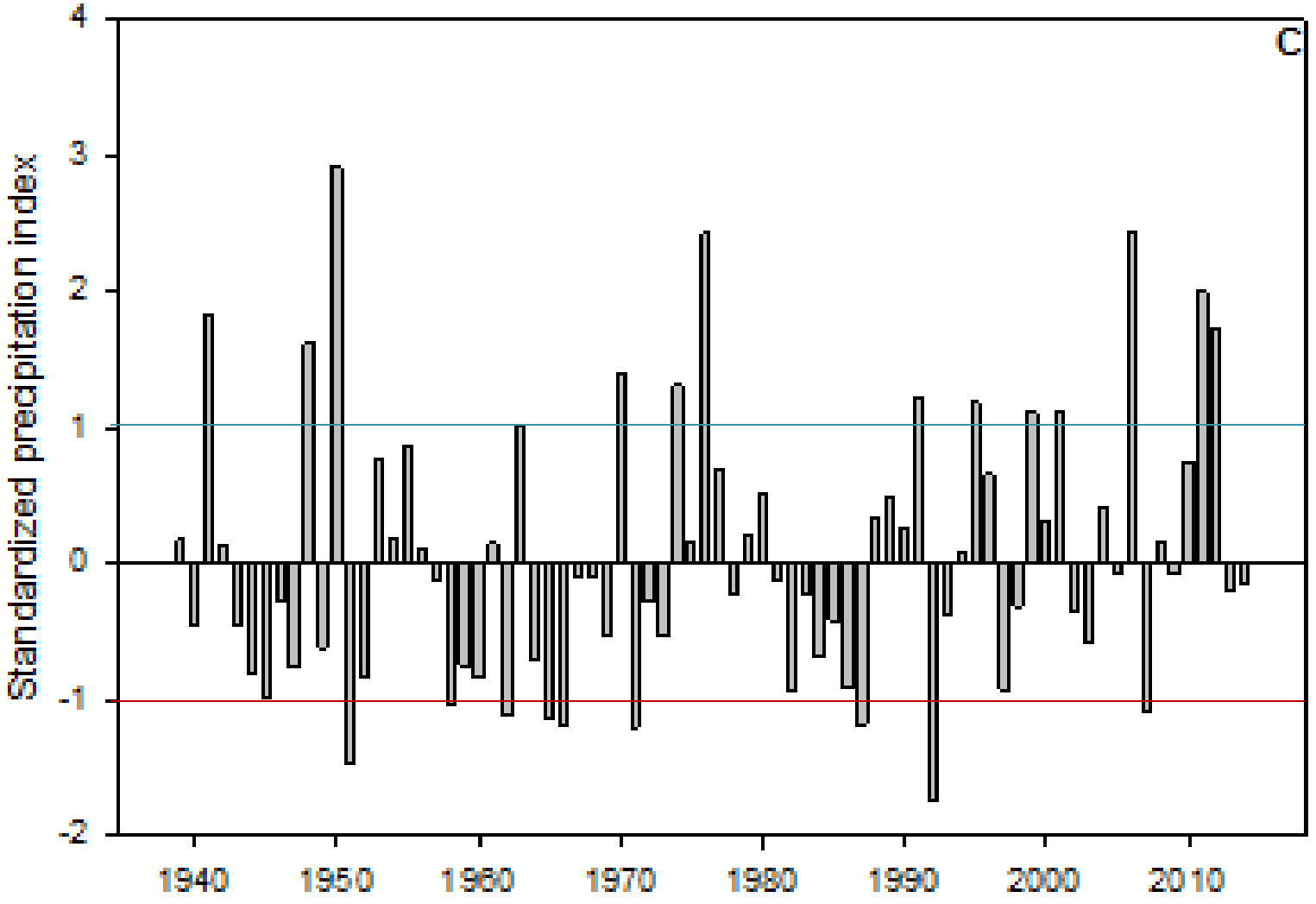
SPI - Postmasburg



SPI - Douglas


B
Standardized precipitation index
3
2
1
0
-1
-2
1960
1970
1980
1990
2000
2010

SPI - Groblershoop



Conclusion

- Droughts have become more prevalent in the plateau post 1990, and a majority of them are moderate

Overall Recommendations for Adaptation

- Storage reservoirs to store water during times of abundance (National Projects and Estate Plantations)
- Continuous improvement on the efficiency of irrigation to improve water productivity
- Intensify on the early warning systems based on weather forecasting
- Crop diversity with particular focus to drought tolerant crops especially for the smallholder farmers on rainfed agric.

THANK YOU

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