Comparing the 2015/2016 drought with historic droughts in Southern Africa – A case of the Incomati River Basin

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BACKGROUND

- The impacts of drought has shown notable effects on the society, environment and economy of many countries (Van Loon, 2015) particularly in Africa where more than 60% of the population depends on rainfed agriculture.
- Future climate projections for Southern Africa indicate more frequent and intense droughts with less rainfall and increased temperatures (Dai, 2013).
- The Incomati basin is regarded as an over utilized basin and is currently under water stress, making the situation worse during drought events.

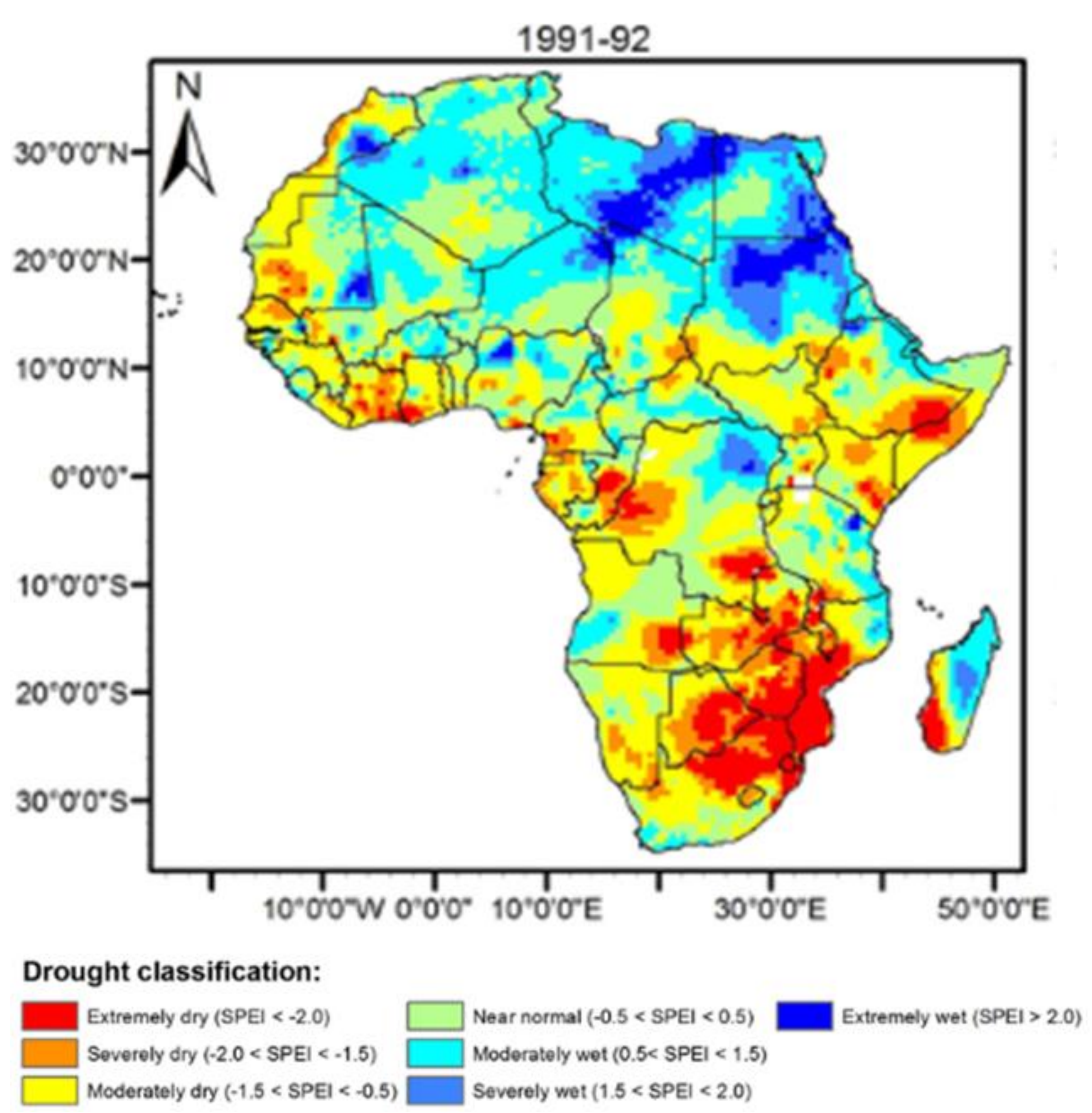

Figure 1: Geospatial coverage of the extreme drought event if 1991/1992 (source: Masih et al., 2014)

OBJECTIVES

- To determine the severity and intensity of the 2015/2016 drought event.
- To compare the 2015/2016 drought with other severe droughts after the 1980s

METHODS

- To characterise drought, precipitation and runoff anomaly analysis, Standardized Precipitation Index (SPI) and Standardized Runoff Index (SRI) drought indicators were computed.
- The reservoir storage levels and inflows records of Maguga and Driekoppies dams were examined for the available period of April 2002 to March 2017.
- The precipitation anomaly and SPI analyses were computed using data from two meteorological stations, Witklip and Mhlume station for the period 1970-2017 and 1969-2017, respectively.
- The river flow (runoff) anomaly and SRI analyses were computed using data from Hooggenoeg and Boschrand gauging stations, for the period 1910-2017 and 1930-2017, respectively.
- SPI program was used to compute SPI and SRI

RESULTS

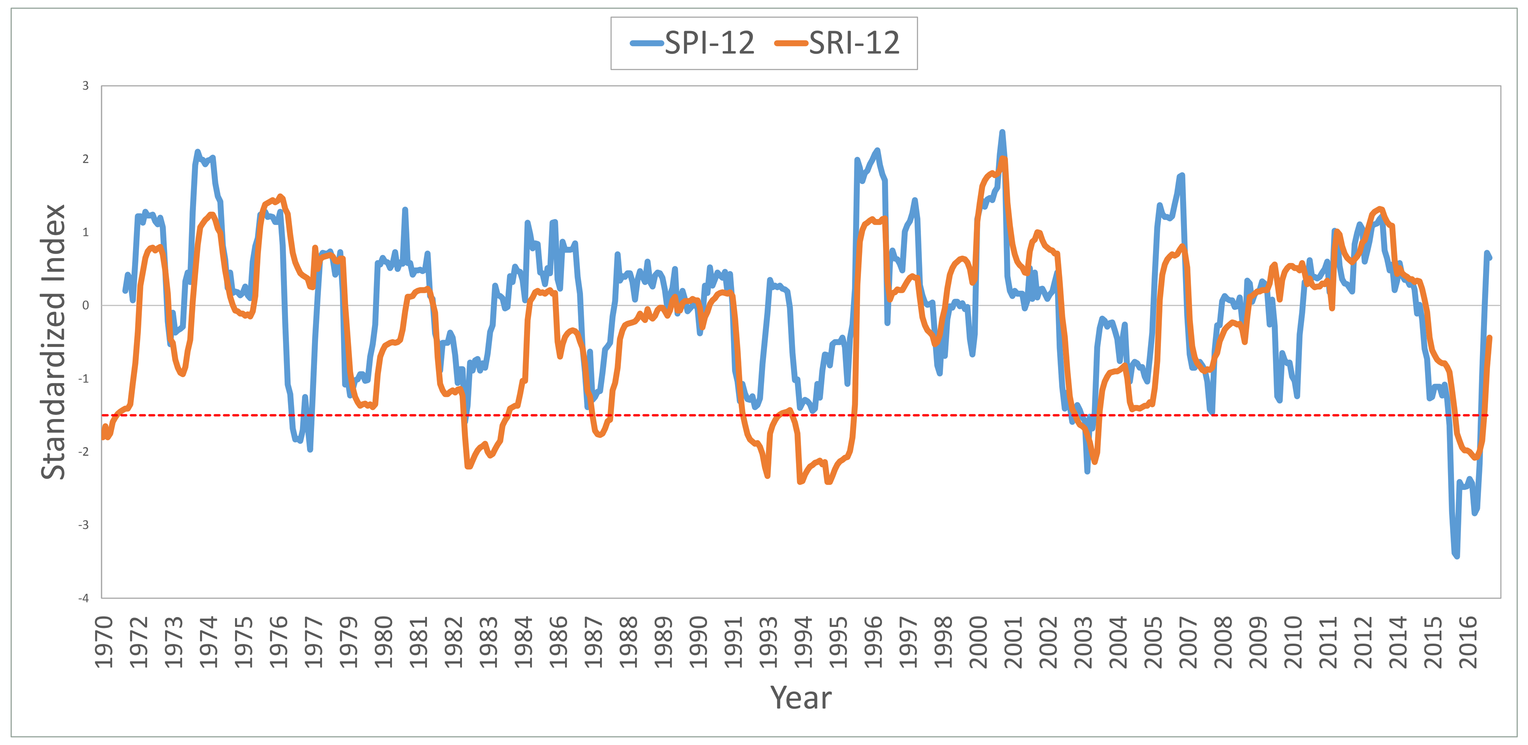

Figure 2: Historical time series of SPI-12 and SRI-12 for two stations in the Incomati Basin

- The meteorological drought indicator (SPI) represent the occurrence of dry and wet years in phase with the hydrological drought indicator (SRI) even though the fluctuation of the SRI seems to be slightly lower than the SPI in both catchments.
- This is probably due to that the streamflow has a higher persistence than precipitation
- The 12-month SPI and SRI of Witklip station and Boschrand station indicate a very similar pattern as expected from the high correlation between the annual precipitation in Witklip and runoff in Boschrand (r=0.68).

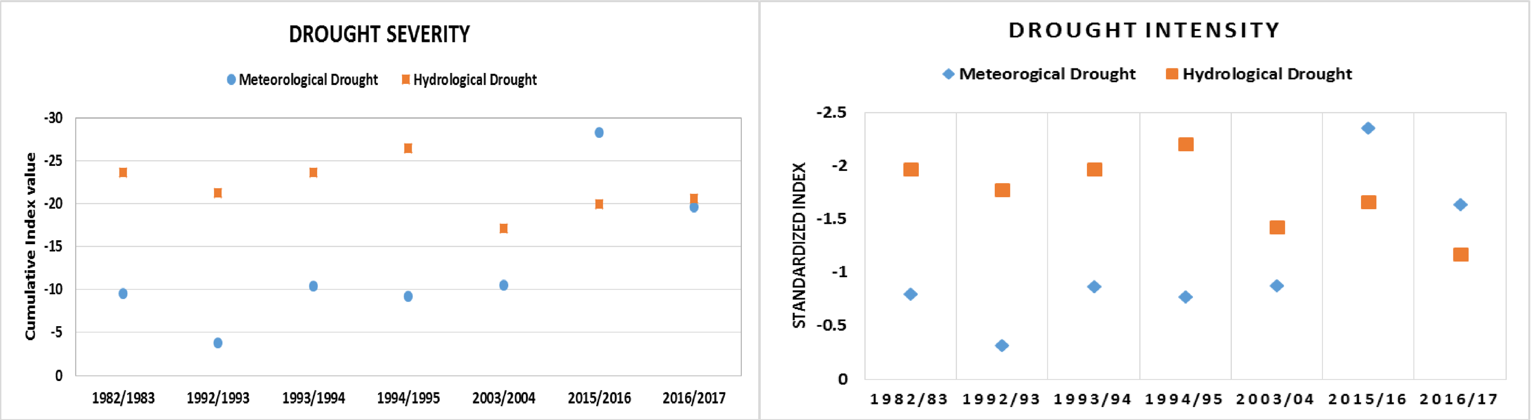

Figure 3: Comparison of the severity and Intensity of the meteorological and hydrological drought

- Extreme meteorological drought in 2015/2016, more severe and intense compared to other severe droughts recorded after the 1980s
- Less severe and intense hydrological drought

Dam levels declined:

- Maguga – 17 %
- Driekoppies – 24 %

Responses to the drought:

- Water rationing
- Water resources monitoring
- Awareness campaigns
- Exploring alternative water sources
- Change of irrigation scheduling

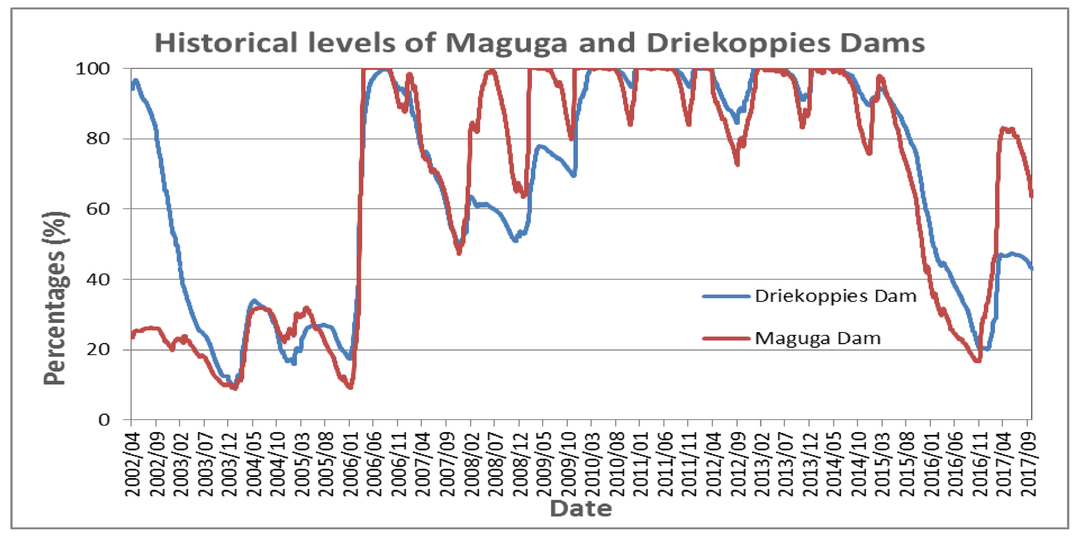

Figure 4: Historical dam levels of Maguga and Driekoppies dams in the Komati catchment

DISCUSSION

Challenges and lessons learnt in the2015/16 event:

- Increase of illegal water abstraction
- Transboundary flow to Mozambique not met
- Improve communication or translation of weather forecasts information to users
- Develop drought management plans

Figure 5: Maguga dam during the 2015/2016 drought event

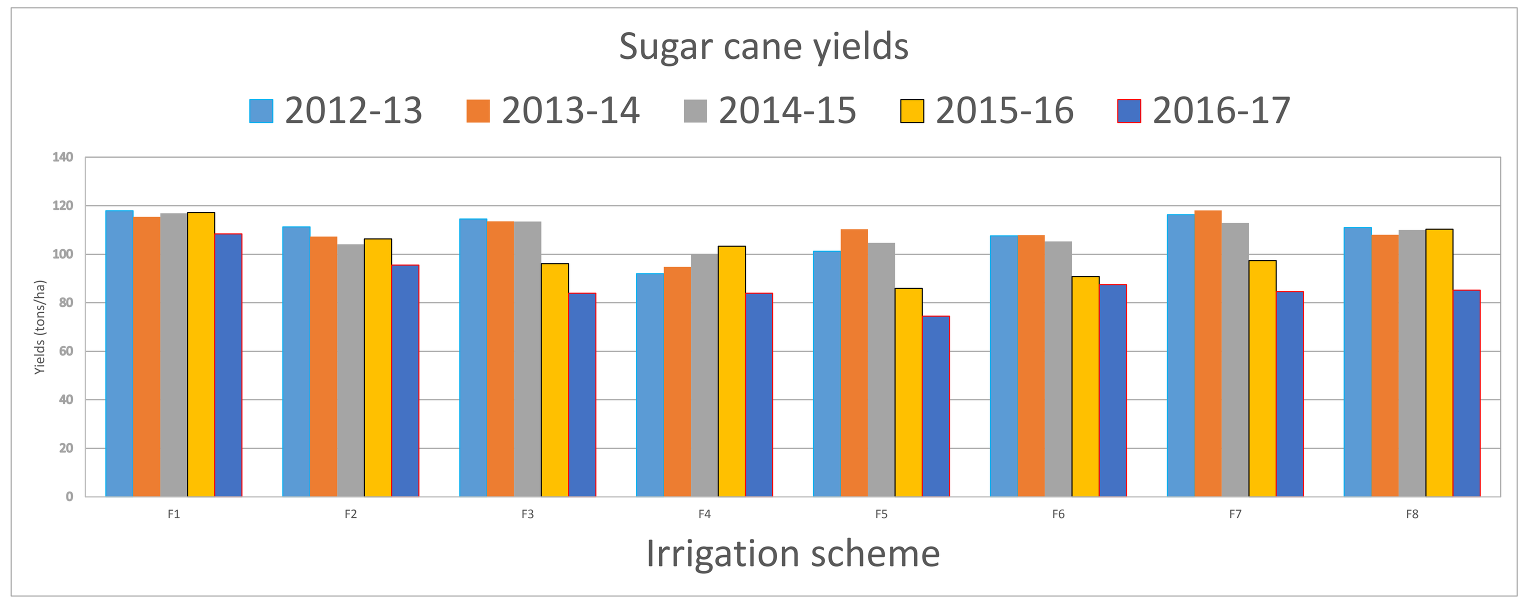

Figure 6: Sugar cane yields recorded in the last 5 years for selected irrigation schemes in the Komati catchment

- The main impact faced by the farmers was the reduction of the crop yields.
- Even though the sugar cane yields were not affected much on 2015/2016, they were significantly reduced in the 2016/17 water year by 20 – 30 %.

CONCLUSIONS

- The study concludes that the 2015/2016 had an extreme meteorological and hydrological drought with severity ranging from -22 to -28 and intensity ranging from -1.8 to -2.4 compared to the other severe droughts of 1982/1983, 1992/1995 and 2003/2004.
- The 2015/2016 drought resulted in total failure in rainfed crop production and about 20-30 % yield reduction for irrigated sugar cane in the Komati catchment.

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