Managing Hydrological Drought Risk under Climate Change

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WATER RESEARCH COMMISSION

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Introduction

- **South Africa is a water-stressed country**
  - Climate (semi arid to arid)
  - Low annual rainfall but high evaporation
  - Continuous investment on large-scale water infrastructure (e.g., dams, canals and reservoirs)

- **The water stress may aggravate in the future**
  - Population growth is likely to increase the water demand in the next few years
  - Climate change is likely to reduce rainfall and enhance evaporation, thereby reducing water availability
  - These may overstretch the infrastructure or render them useless.
  - Hence, there is a need to move beyond infrastructure development solutions and toward research-driven environmental solutions

Quantifying the Impacts of Climate Change on Droughts (SPI vs SPEI)

Standardized Precipitation Index (SPI; McKee et al. 1993**)**

- WMO approved index
- Can identify any type of drought depending on the timescale: (1-month SPI, 3-month SPI, etc.)
- Based on precipitation (only)

Standardized Precipitation Evapotranspiration Index (SPEI; Vicente-Serrano et al. 2010**)**

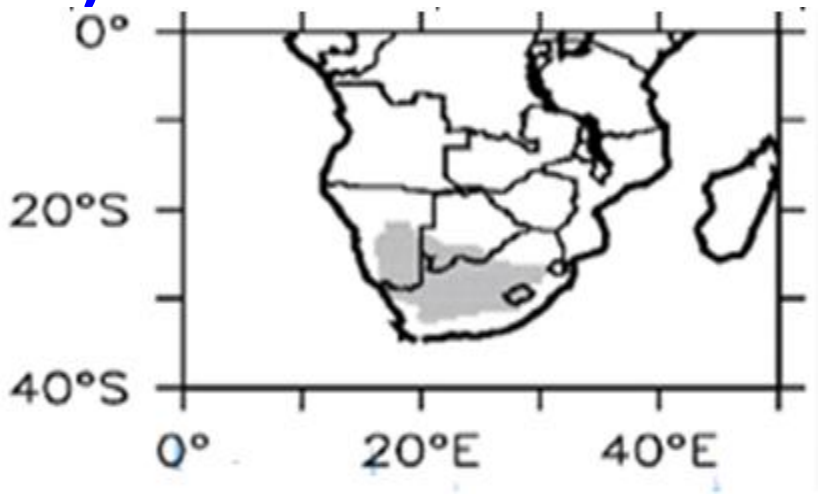
- Extension of the SPI
- Based on Climate Water Balance (CWB) instead of precipitation
- CWB = PRE-PET

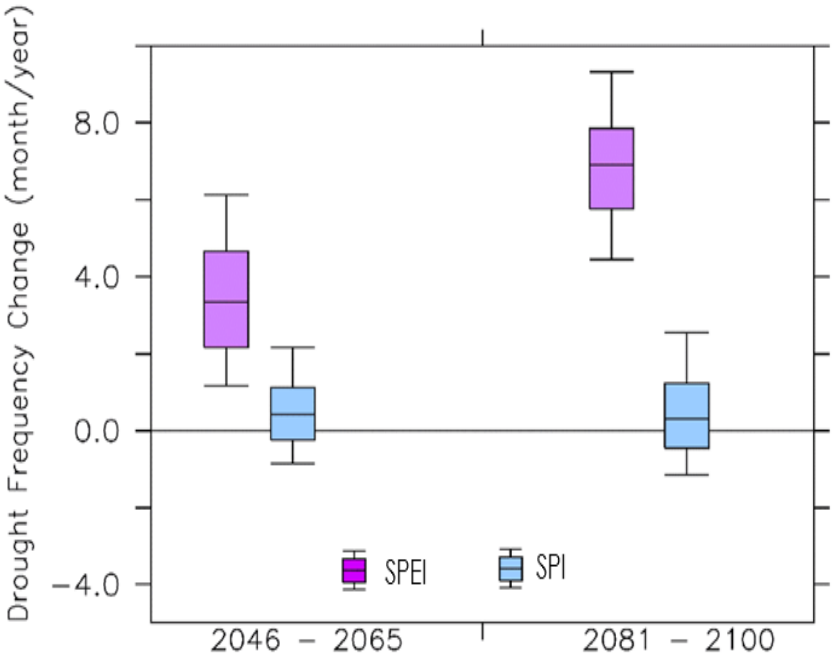
  where:

  PRE = Precipitation

  PET = Potential Evapotranspiration

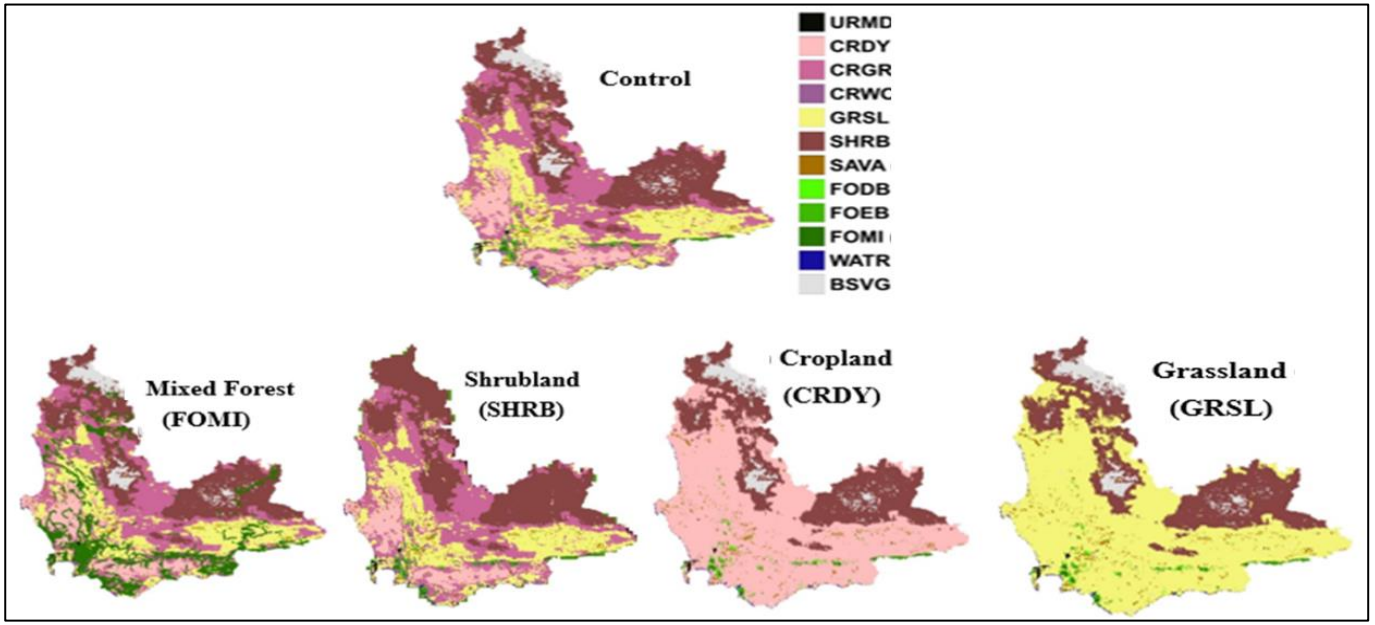
12-month SPEI and SPI

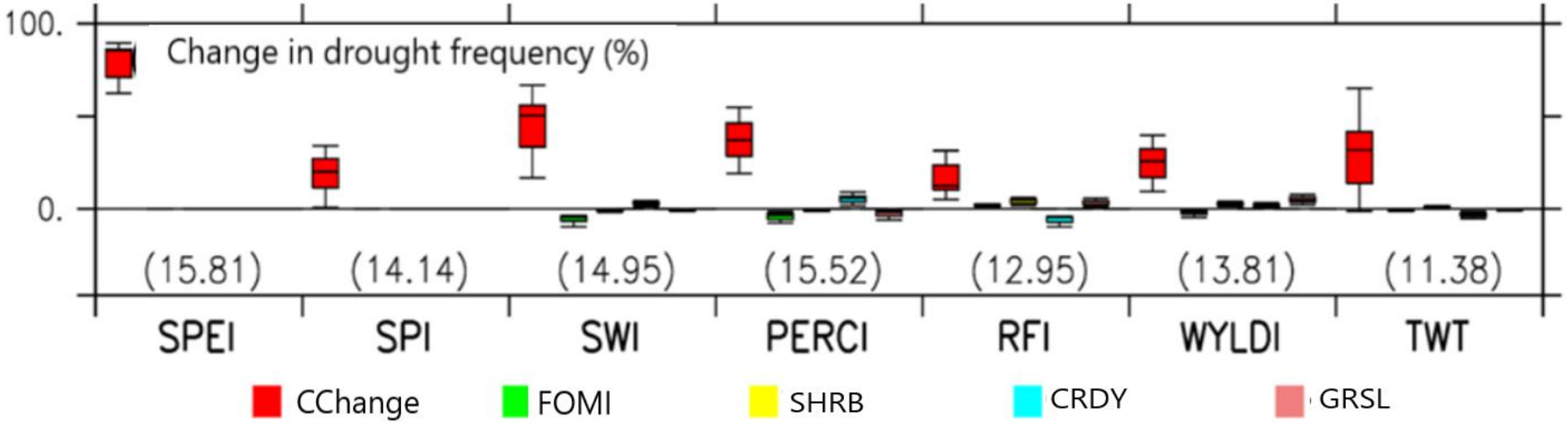




Abiodun et al. (2018)

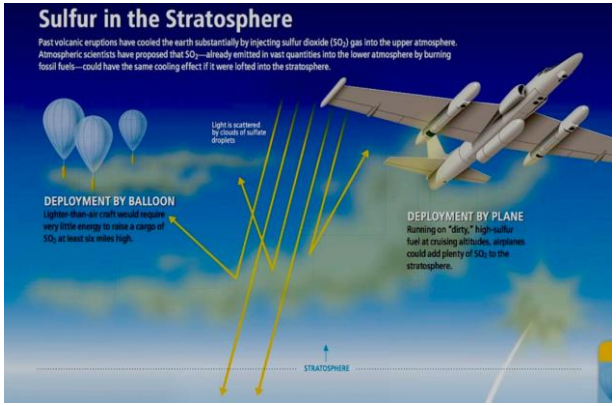
Using Landcover Changes to Mitigate the Impacts of Climate Change on Droughts

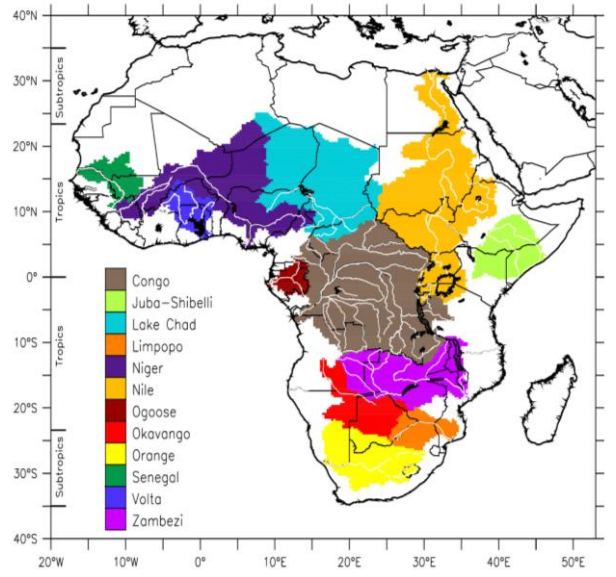


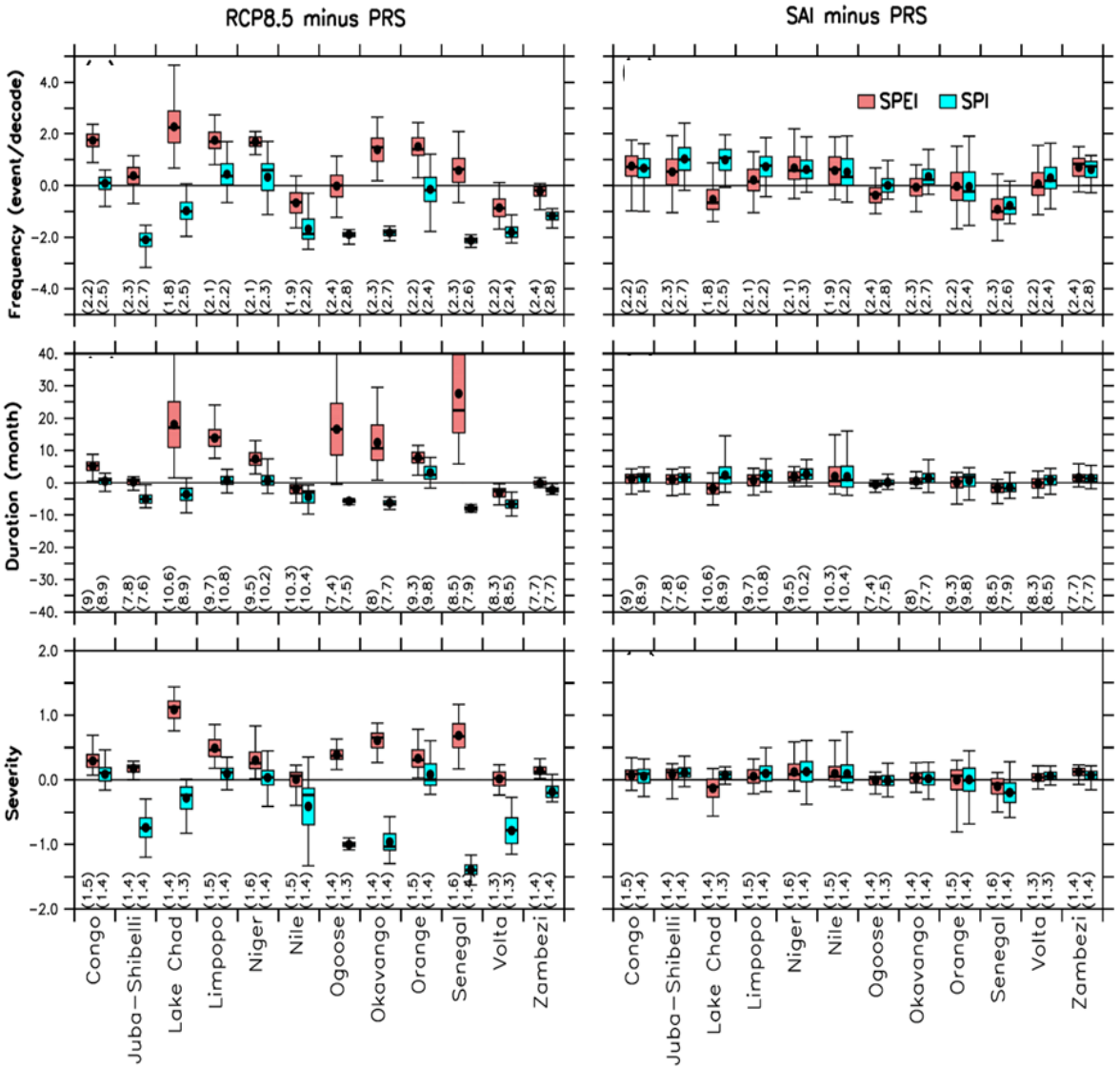


Naik and Abiodun et al. (2022)

Using Stratospheric Aerosol Injection (SAI) to Mitigate the Impacts of Climate on Droughts

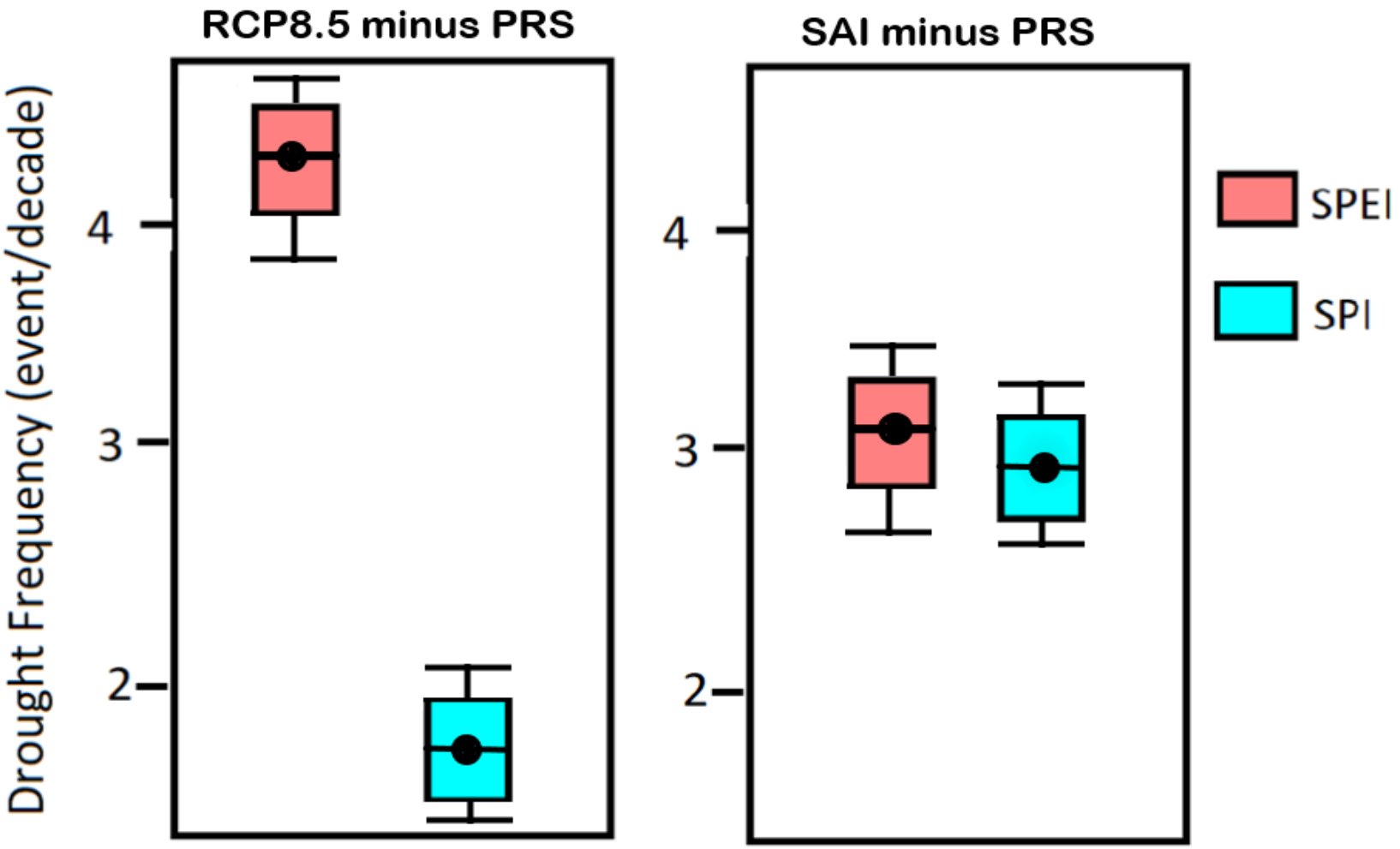






Abiodun et al. (2021)

Implication for drought risk management over the basins in the future



Abiodun et al. (2021)

Conclusion

- SPI future projection may underestimate the severity of climate change impacts on hydrological droughts.
- Land cover could alter the impacts of climate change on hydrological drought, but the magnitude of the alteration is small compared to the climate change impacts.
- Stratospheric aerosol injection could result in more predictable drought risk, but it could also result higher and unmanageable drought risk.
- Hence, reduction in greenhouse gas emission is still the safest way to avoid more drought risk in Africa.

Thank you!!!

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