

## Assessment of Climate Variability and Trends in Water Availability in South America

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### INTRODUCTION & AIM

South America faces strong hydrological variability, with droughts and floods becoming increasingly severe due to climate change. Parametric indices such as SPI and SPEI do not always adequately capture these extremes, motivating the adoption of SNIPE (Standardized Non-parametric Indices of Precipitation and Evaporation) (Onyutha, 2021). This study aims to apply SNIPE to map and quantify spatial and temporal variations of drought and wetness at multiple scales in the region, as well as to analyze their associations with ocean–atmosphere variability modes.

### METHOD

Datasets include CRU TS (1960–2015), ERA5-Land (1981–2015), and CMIP6 covering 1960–2100, with future projections under SSP2-4.5 and SSP5-8.5. Monthly P–PET (CWA) were aggregated to 3, 6, and 12-month scales to compute the nonparametric SNIPE, which was finally correlated with major climate indices (ONI, TNA, TSA, AMO, TPI-IPO, PDO, SAM) to assess teleconnection influences.

### RESULTS & DISCUSSION

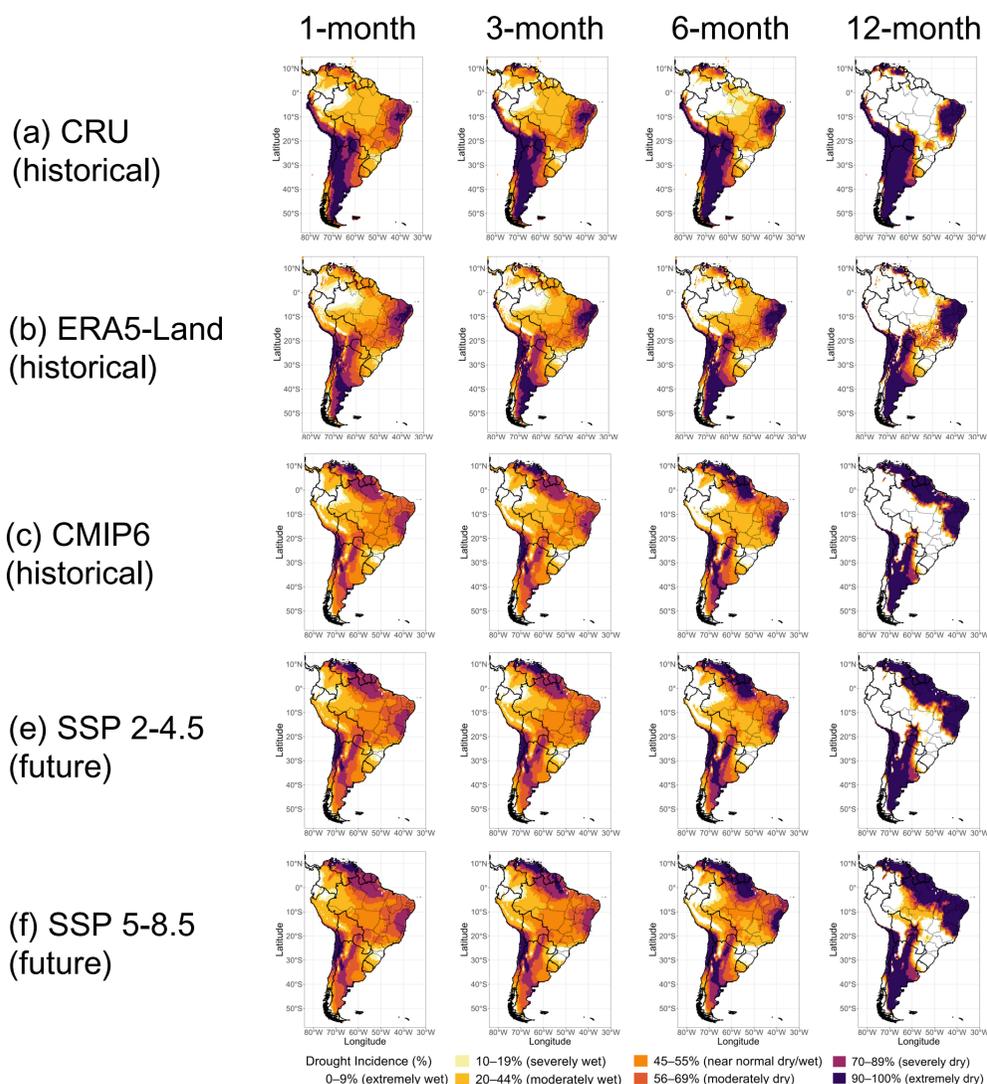


Figure 1: Drought incidence (percentage of months) for South America for a CWA (precipitation minus potential evapotranspiration) threshold of 1mm. Panels a and c refer to 1960–2014, panel b to 1981–2014, and panels e and f to 2015–2100.

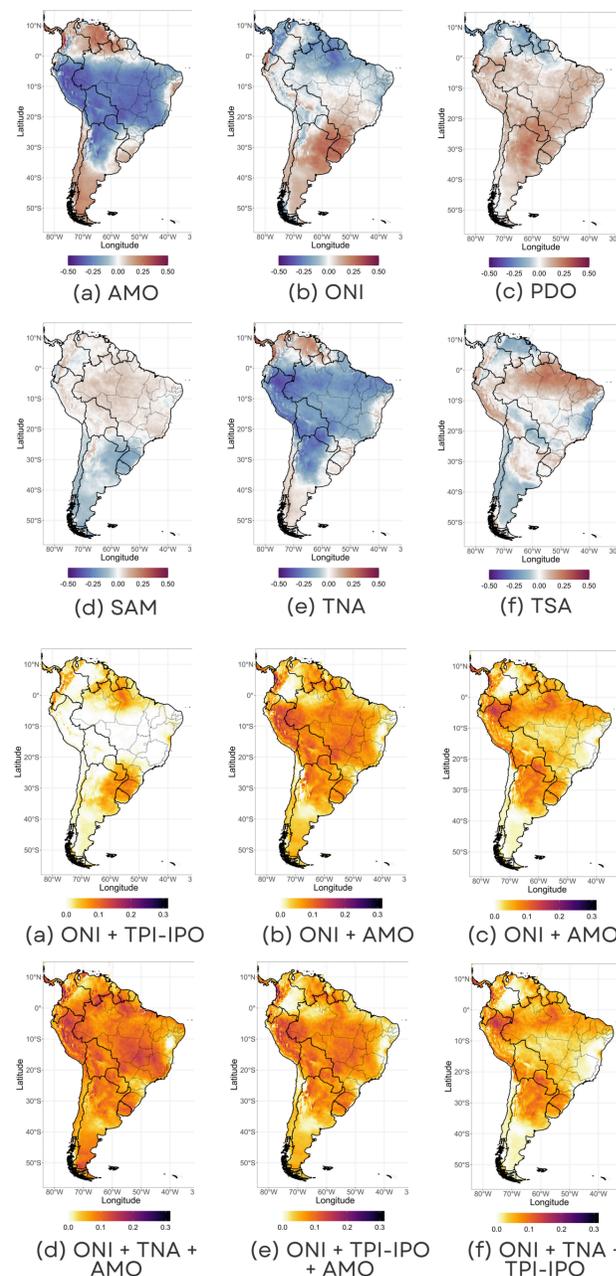


Figure 2: Correlation (Pearson) between atmospheric indexes and SNIPE (based on ERA5-Land) for the historical period (1981–2014) based on a 6-month smoothed monthly time series.

Figure 3: Multiple linear regression (coefficient of determination) between atmospheric indexes and SNIPE (based on ERA5-Land) for historical period (1981–2014) based on a 6-month smoothed monthly time series.

### CONCLUSION

Historical observations (CRU TS, ERA5) and CMIP6 models agree on drier conditions in Patagonia, the Atacama, the Central Andes, and Northeast Brazil, with wetter conditions in the Amazon and Southeast Brazil. Future projections (2015–2100) show expanding, intensifying drought—especially in transition zones like the Cerrado, Amazon margins, Chaco, and semi-arid Northeast—most pronounced under SSP5-8.5. Correlations between SNIPE and climate indices (TPI-IPO, ONI, TSA, etc.) highlight ocean–atmosphere influences on Southeastern South America’s hydrology, underscoring SNIPE’s value for enhancing forecasts and water management.

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