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Analysis of Future Drought Risk in the State of New Jersey

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1. Introduction

Droughts are a climate related hazard that significantly impacts the environment and our society. Extensive studies have shown that climate change has as important influence on drought frequency and intensity, highlighting the need of adaptation and mitigation strategies. Global Circulation Models (GCMs) provide projections of climatic variables that allow the analysis of future droughts. However, the original resolution of these models is usually too coarse for regional analysis, highlighting the need of downscaling techniques (Araujo et. al., 2022).

This study is focused on the analysis of drought risk in the state of New Jersey and focuses on:

- Investigating changes in future drought severity for mid and end of century.
- Analyzing the projection of the spatial extent of droughts.

2. Study Area & Data



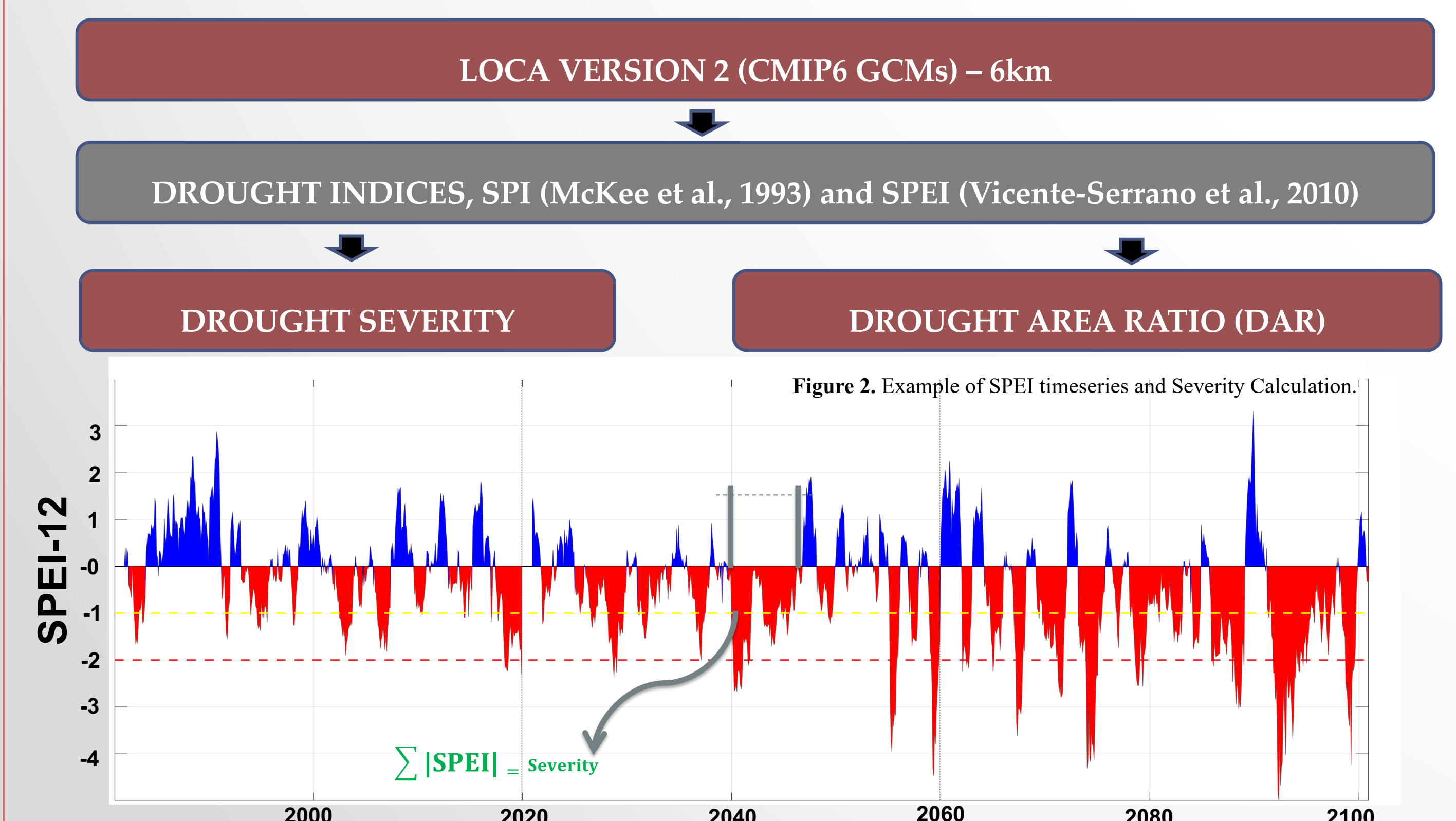
Figure 1. Study Area, the state of New Jersey, USA.

Climate data (Tmin, Tmax and Precip.) retrieved from LOCA version 2 dataset (Pierce et al., 2023, 2014).

Table 1. Original GCMs that were downscaled using the LOCA method

No.	Model	Institute
1	ACCESS-CM2	Commonwealth Scientific and Industrial Research Organization (CSIRO)
2	EC-EARTH3	EC-Earth Consortium
3	BCC-CSM2	Beijing Climate Center (BCC)
4	GFEL-ESM4	National Oceanic and Atmospheric Administration (NOAA)
5	INMCM-CM4-8	Institute for Numerical Mathematics (INM)
6	INMCM-CM5-0	Institute for Numerical Mathematics (INM)
7	MPI-ESM1-2-HR	Max-Planck-Institute (MPI)
8	ACCESS-ESM15	Commonwealth Scientific and Industrial Research Organization (CSIRO)
9	IPSL-CM6A-LR	Institut Pierre Simon Laplace
10	CanESM5	Canadian Centre for Climate Modelling and Analysis (CCCma)
11	MPI-ESM1-2-LR	Max-Planck-Institute (MPI)
12	FGOALS-g3	State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics (IAP)
13	MIROC6	Center for Climate System Research (CCSR), the University of Tokyo, the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and the National Institute for Environmental Studies (NIES)
14	NORES2-LM	NORCE Norwegian Research Centre
15	MRI-ESM2-0	Meteorological Research Institute (MRI)
16	NORES2-MM	NORCE Norwegian Research Centre

3. Methodology



4. Average Drought Severity

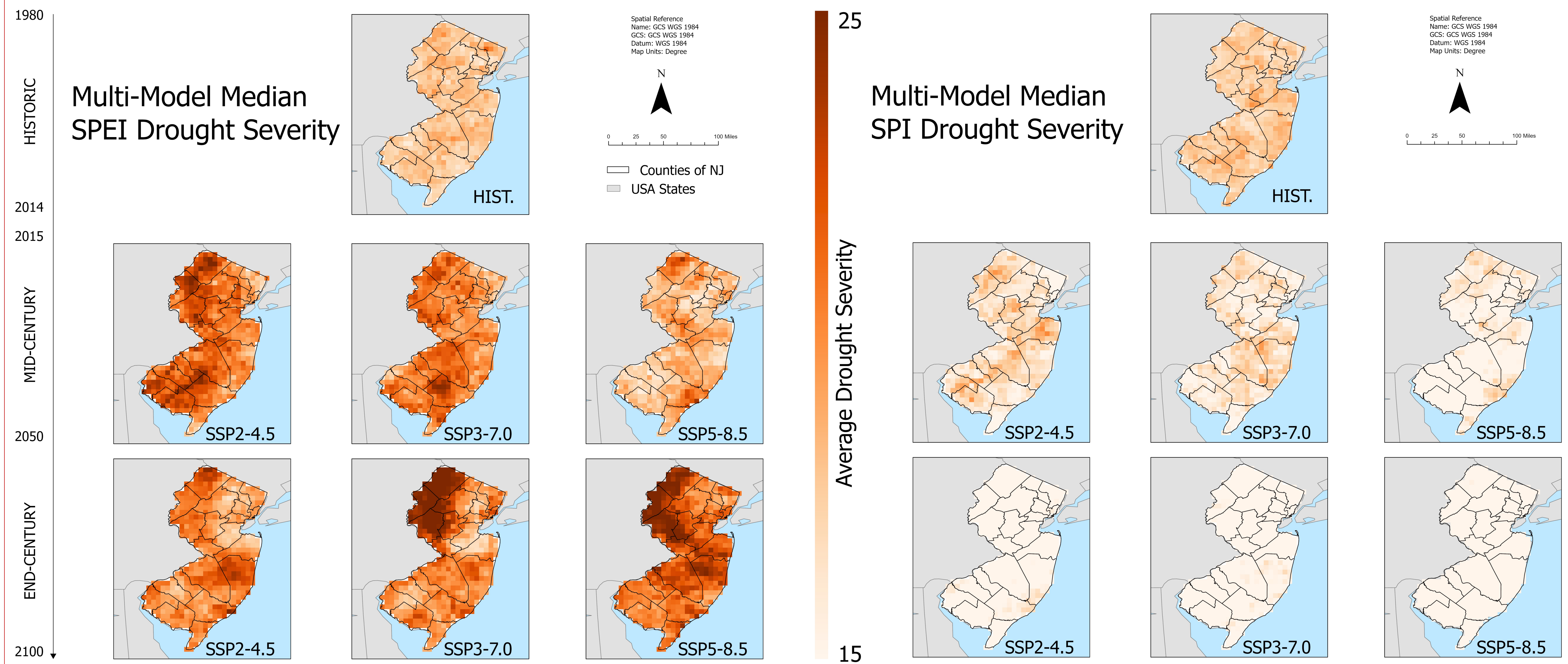


Figure 3. Multi-Model Median of the Average Drought Severity for three future projections (SSP2-4.5, SSP3-7.0 and SSP5-8.5) considering historic, mid-century and end-century periods.

5. Drought Area Ratio

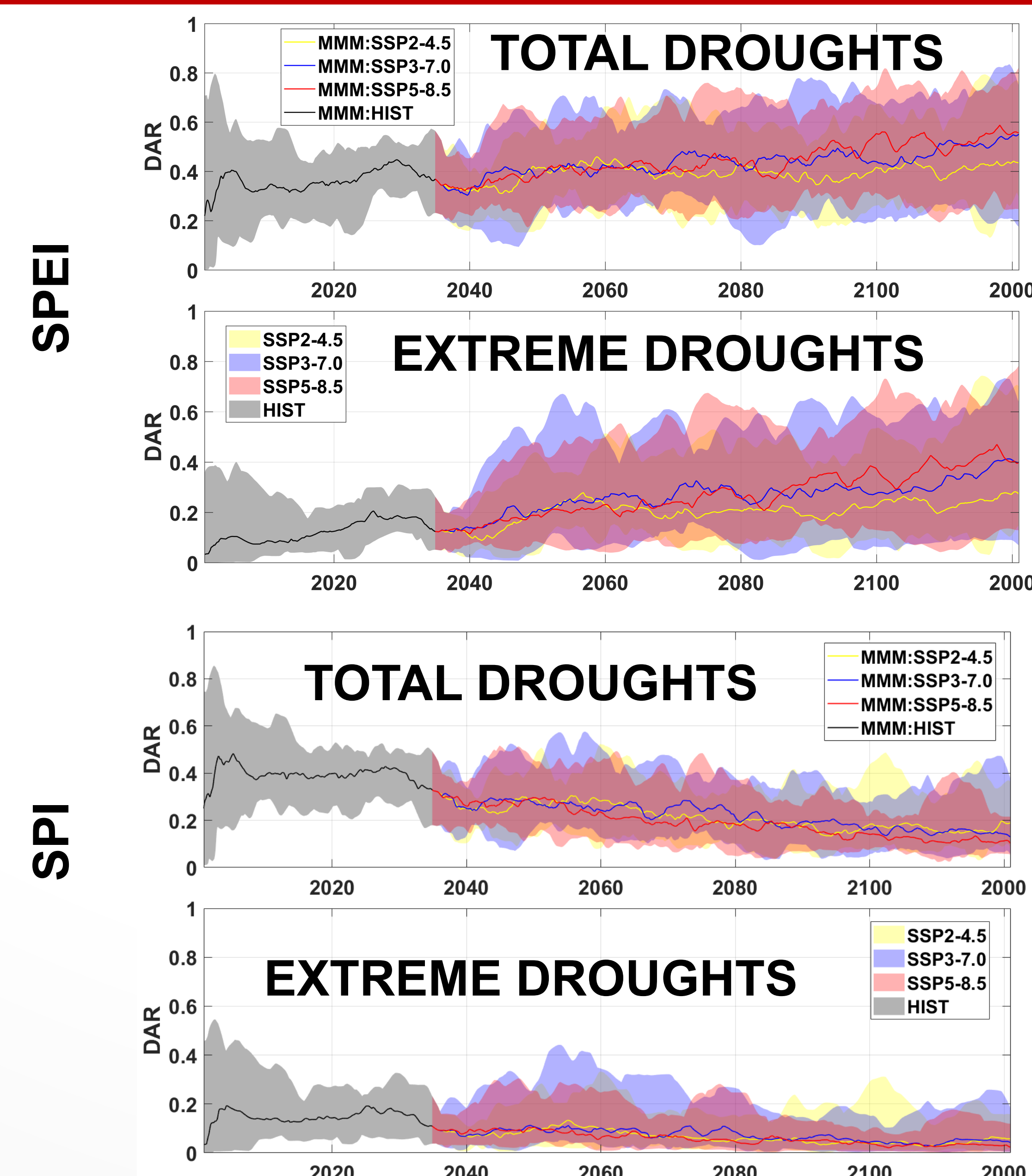


Figure 4. Decadal moving average of the Drought Area Ratio for the State of New Jersey. Upper panels are based on SPEI while bottom panels on SPI.

6. Summary

- We have developed a dataset on future projections of droughts based on 16 downscaled GCM from LOCA v2 dataset. Drought data are available at 6km/monthly for the entire state of New Jersey.
- Drought severity is increasing when considering SPEI while decreases considering SPI. This indicates that while no increase in precipitation deficits is detected, the atmosphere drying capacity, represented in the SPEI by the PET, is increasing, leading to increasing drought conditions in the future, especially in the northeast part of New Jersey.
- Drought spatial extent demonstrated to remain at historic levels considering total droughts for SPEI while decreasing for SPI. However, for the first index the area under extreme drought conditions (SPEI < -2) is projected to increase towards the end of the century.

7. Acknowledgments and References

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