

Motivation

- ❖ Biologists and climate adaptation practitioners desire downscaled projections for various relevant climate and drought metrics. Many of these datasets (e.g., future projections of different drought indices) are not available and therefore need to be derived.
- ❖ Based on the input we have received from our partners at the North Central Climate Adaptation Science Center (NC CASC) – US Fish & Wildlife Service, National Park Service, US Geological Survey and others – we have been developing various R-Shiny Apps for users to visualize and access projections data (as timeseries) for many these desired metrics to support scenario-based assessments

Data

Climate: Daily precipitation, minimum and maximum temperature, minimum and maximum relative humidity, vapor pressure deficit and potential evapotranspiration* from the following sources

- ❖ Observations (1979-2020): gridMET (gridded, 4 km resolution)
- ❖ Future Projections (1951-2099): MACAv2-METDATA (gridded, 4 km resolution) from 20 global climate models for 2 emission scenarios (RCP 4.5 and 8.5)

Grasslands Productivity: Aboveground Net Primary Productivity (ANPP) which is the total aboveground biomass production during the growing season between 1982-2019

*Daily PET is not available from MACAv2-METDATA

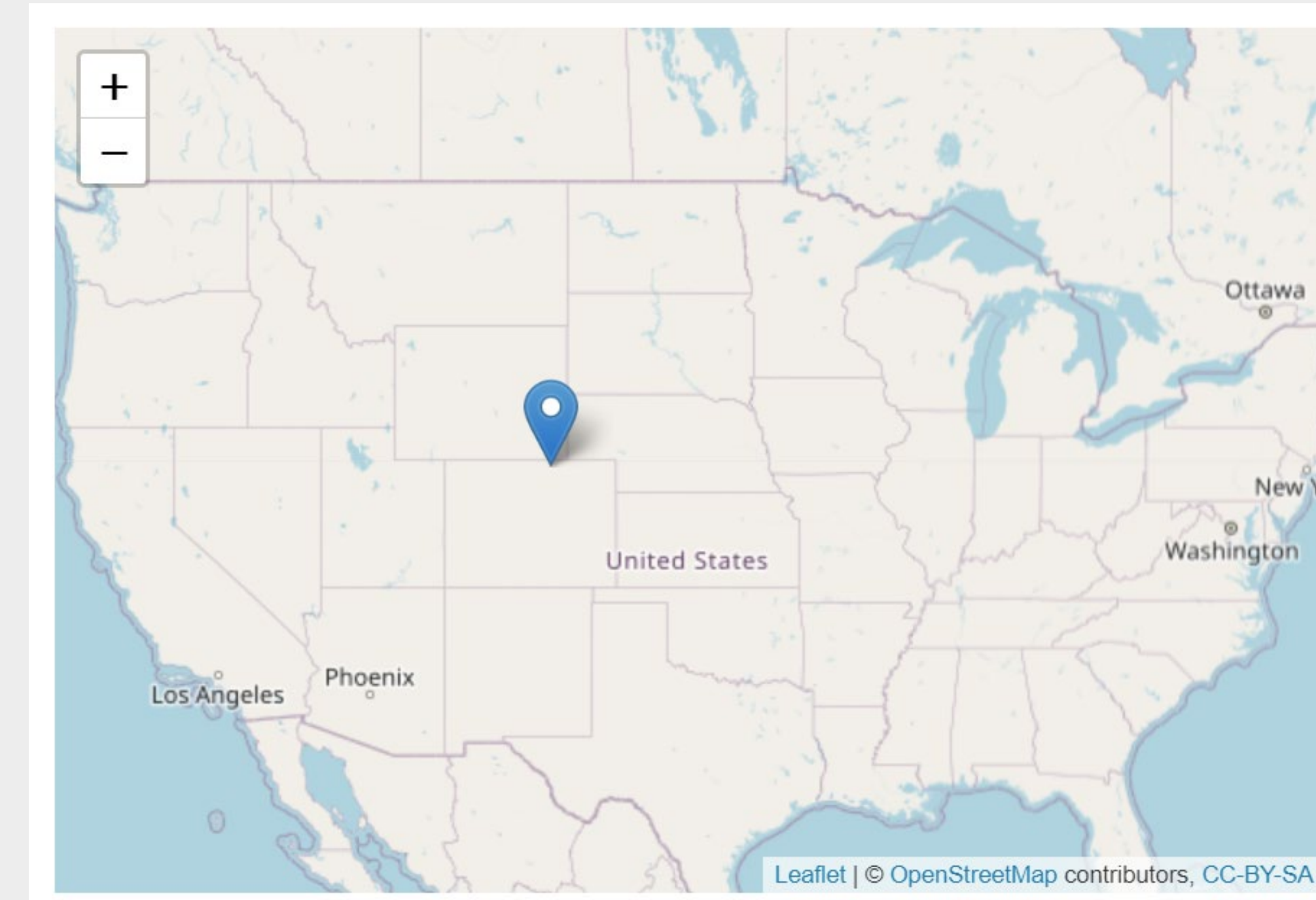
R-Shiny Apps Developed

- ❖ **Drought Indices:** *Projecting drought indices under different climate scenarios*
 - [Evaporative Demand Drought Index \(EDDI\)](#)
 - [Standardized Precipitation and Evapotranspiration Index \(SPEI\)](#)
 - [Standardized Precipitation Index \(SPI\)](#)
 - [Forest Drought Stress Index \(FDSI\)](#)
- ❖ **Extremes in Evaporative Demand:** *Assessing extremes at different timescales*
 - [Vapor Pressure Deficit](#)
 - [Potential Evapotranspiration*](#)
- ❖ **Snowfall and Rainfall:** *Partitioning total precipitation in snowfall and rainfall*
- ❖ **Grasslands Productivity (for US Great Plains Only):** *Projecting grasslands productivity under different climate scenarios*

* No future projections for PET extremes was developed because of unavailability of daily PET data

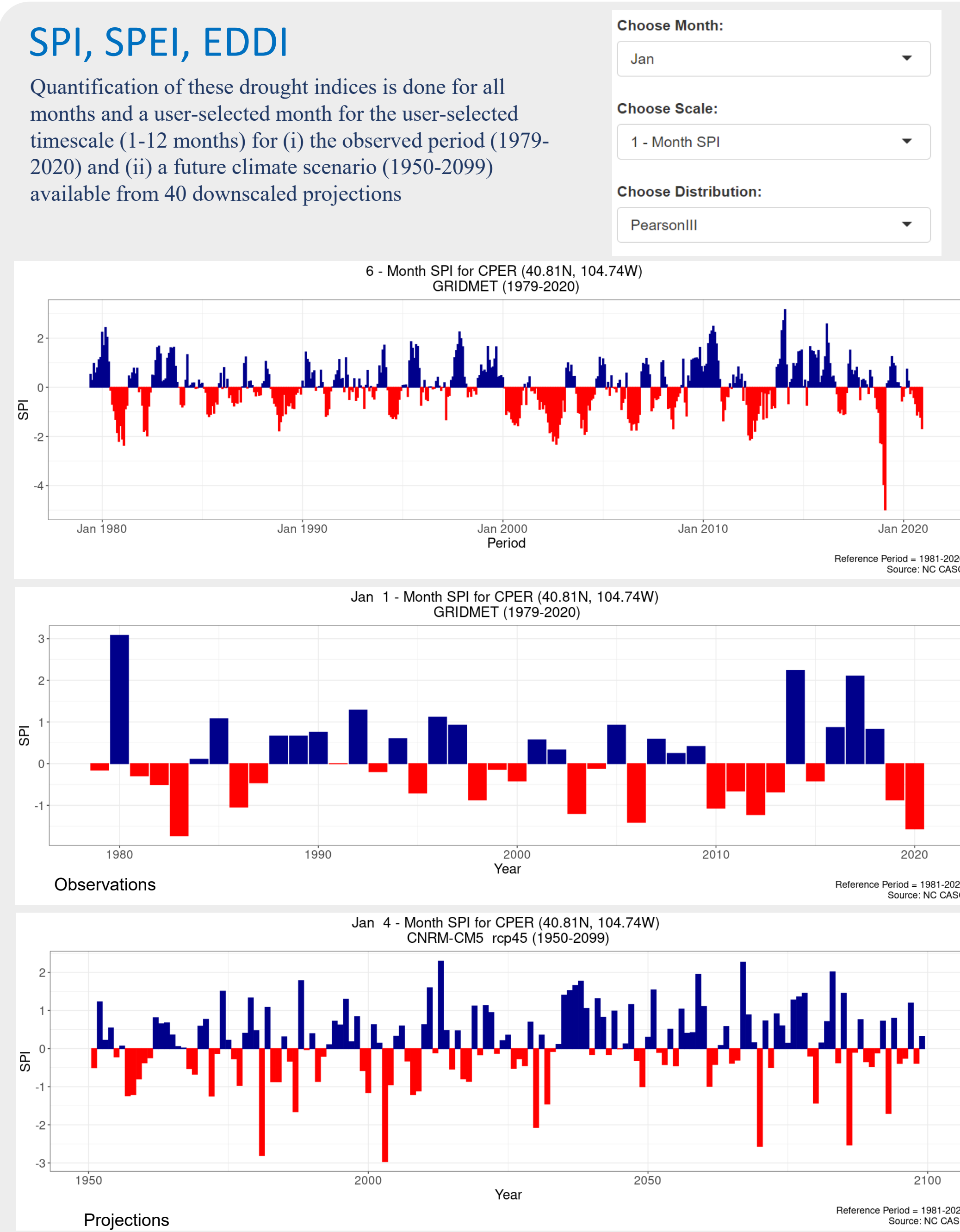
Output generated by the Apps

- ❖ Visualize and download time-series data associated with observations and future projections for any point location within the Contiguous United States (CONUS) except for the Grasslands app which is designed only for the Great Plains region
- ❖ Applications allow for working with different timescales and seasonality
- ❖ User can select across 20 GCMs and 2 RCPs – a total of 40 different climate scenarios



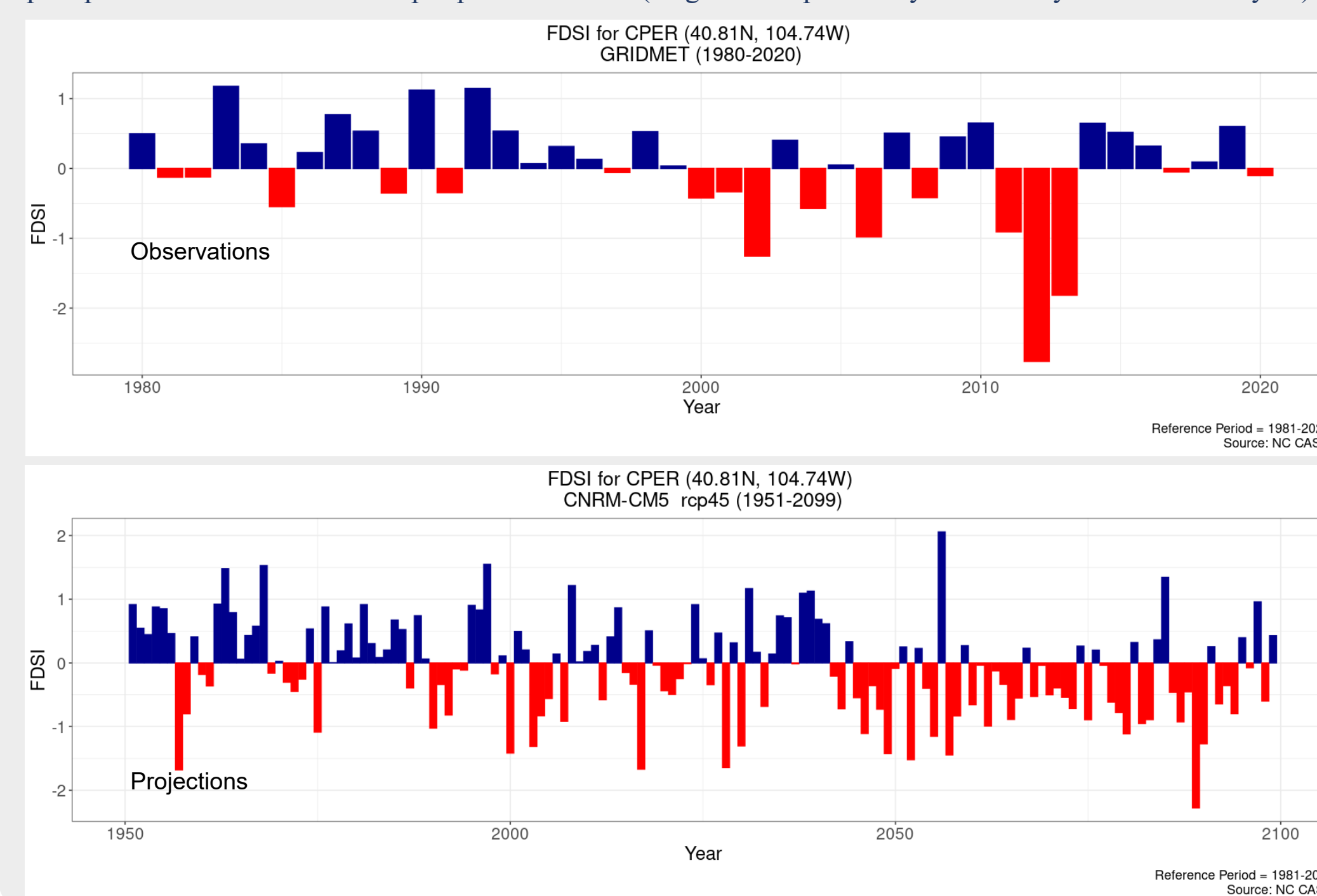
SPI, SPEI, EDDI

Quantification of these drought indices is done for all months and a user-selected month for the user-selected timescale (1-12 months) for (i) the observed period (1979-2020) and (ii) a future climate scenario (1950-2099) available from 40 downscaled projections

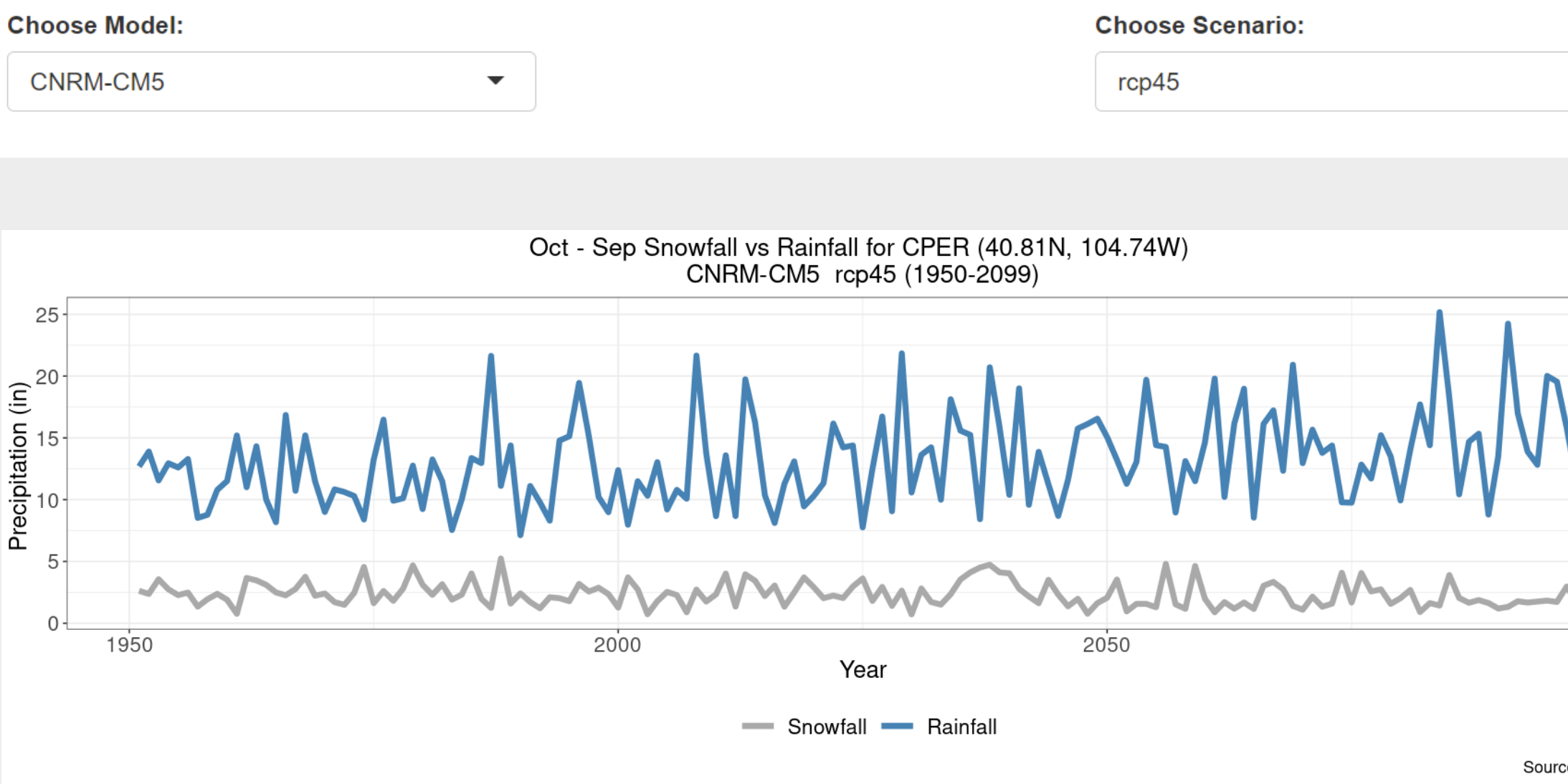
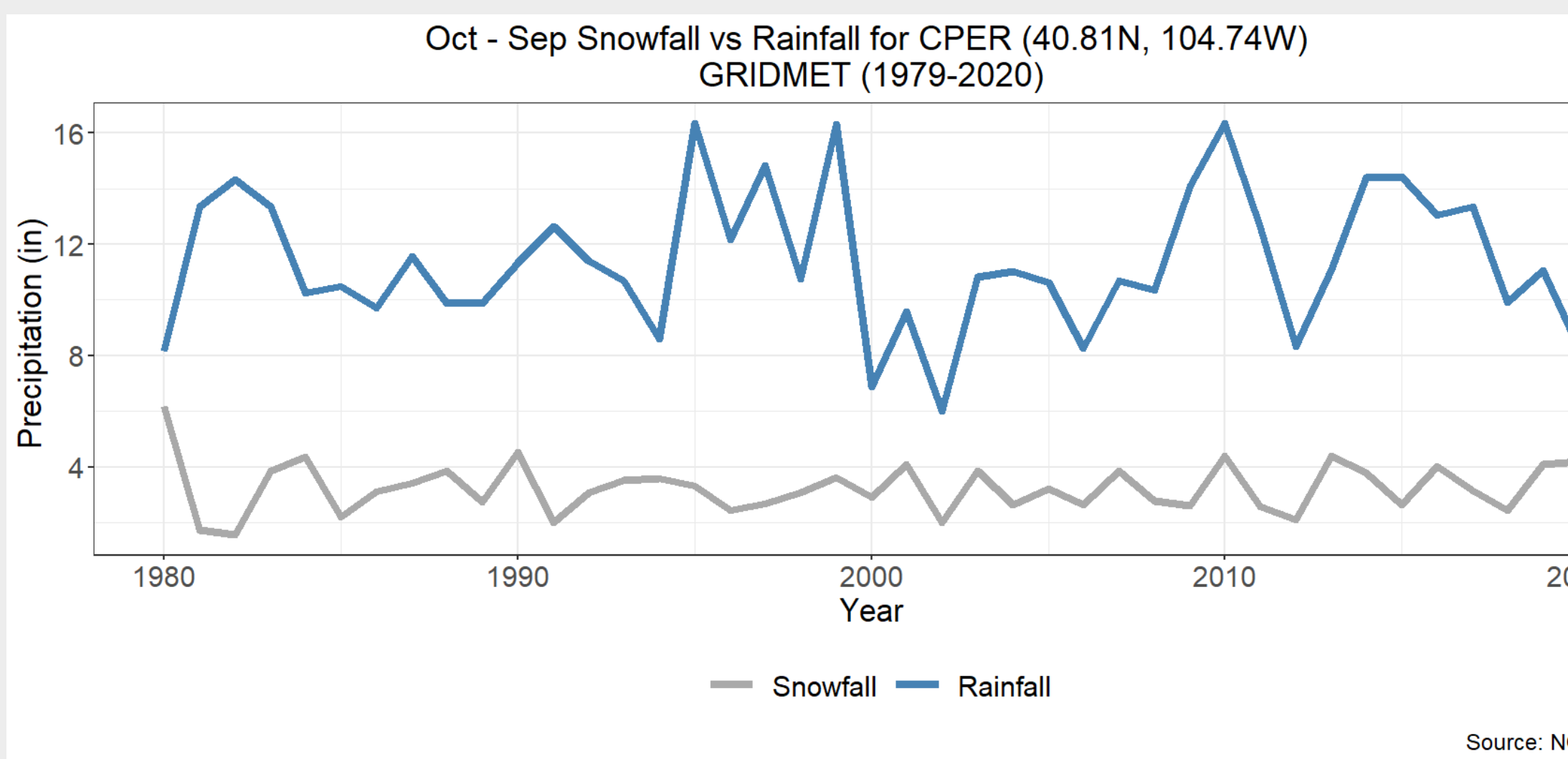
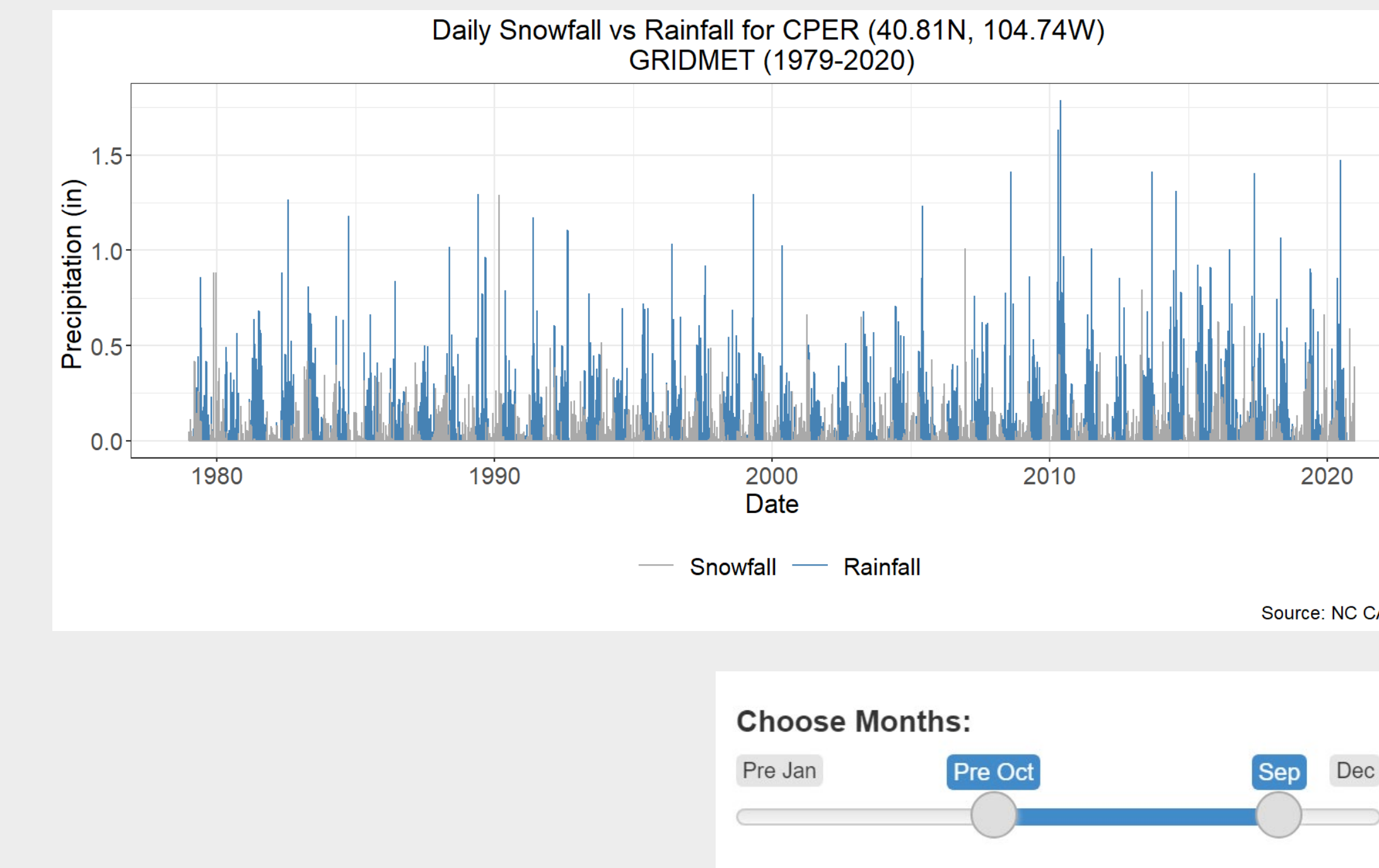


FDSI

FDSI measures drought stress across the water year by integrating anomalies in cold season (Nov - Mar) precipitation and warm season vapor pressure deficit (Aug - Oct of previous year and May - Jul of current year)



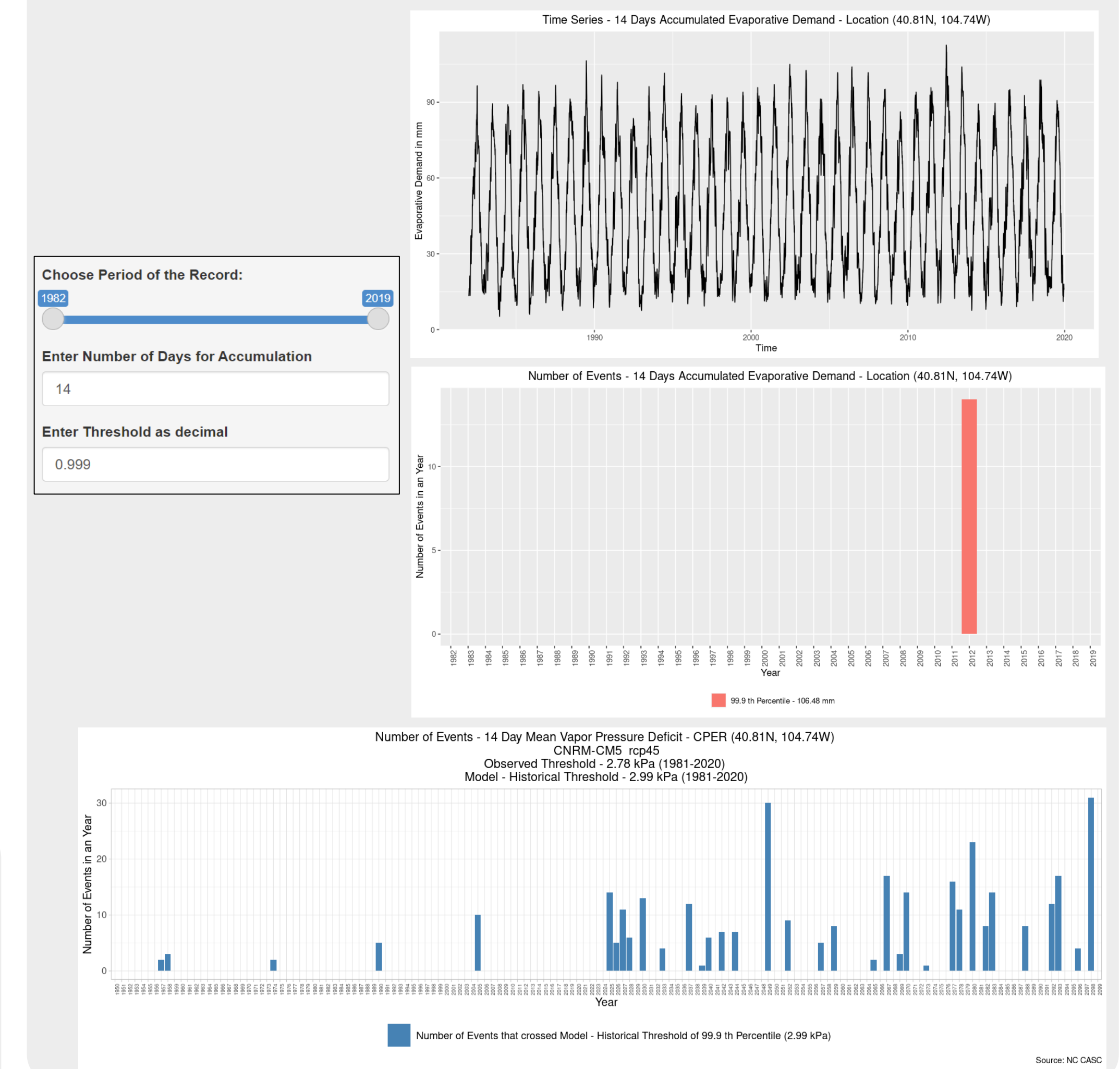
Snowfall and Rainfall



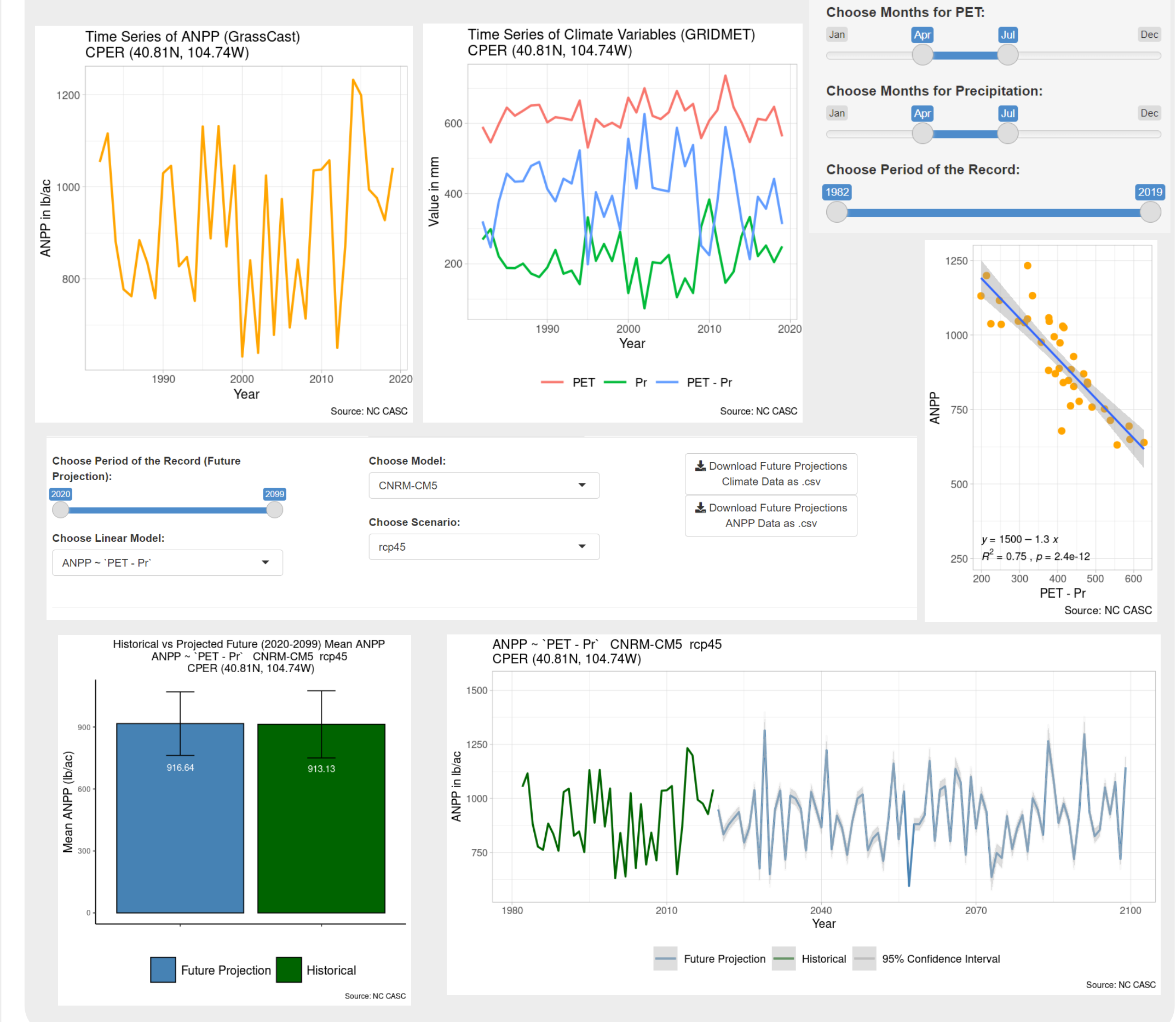
Future Improvements

- ❑ Improve location selection with interactive map
- ❑ Reduce the response time for generating data and plots

Extremes in Evaporative Demand



Grass Productivity and Climate



References

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Website: <https://nccase.colorado.edu/climate-science-support-platform-essp>