Interactive Web Applications for Projecting Climate and Drought Metrics into the 21st Century

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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 of these desired metrics to support scenario-based assessments

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

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

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:
- Observations (1979-2020): gridMET (gridded, 4 km resolution) from 20 global climate models for 2 emission scenarios (RCP 4.5 and 8.5)

R-Shiny Apps Developed

- Drought Indices: Projecting drought indices under different climate scenarios
  - Evaporative Demand Drought Index (EDDI)
  - Standardized Precipitation and Evapotranspiration Index (SPEI)
  - 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

R-Shiny Apps

- Daily PET is not available from MACAv2-METDATA
- No future projections for PET extremes was developed because of unavailability of daily PET data
- Future Projections (1951-2099): MACAv2-METDATA

Future Improvements

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

References


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Website: https://nccasc.colorado.edu/climate-science-support-platform.cssp