

South Central Climate Projections Evaluation Project (C-PrEP)

Abstract

Global climate models (GCMs) are numerically complex, computationally intensive, physics-based research tools used to simulate our planet's inter-connected climate system. In addition to improving the scientific understanding of how the large-scale climate system works, GCM simulations of past and future climate conditions can be useful in applied research contexts. When seeking to apply information from global-scale climate projections to address local- and regional-scale climate questions, GCM-generated datasets often undergo statistical post-processing generally known as statistical downscaling (hereafter, SD). There are many different SD techniques, with all using information from observations to address GCM biases and to provide information at finer spatial scales than that of a GCM, thereby yielding data products often considered more suitable for use in climate impacts-related applications.

This collection of statistically downscaled future climate projections includes 81 sets of SD-processed projections of daily high temperature, daily low temperature, and daily total precipitation across the south-central United States. The 81 sets can be viewed as a 3x3x3x3 matrix, created based on a combination of three GCMs from the CMIP5 archive (CCSM4, MIROC5, and MPI-ESM-LR), each of which simulated 21st century climate responses for three different future atmospheric composition scenarios (known as representative concentration pathways or RCPs 2.6, 4.5, and 8.5). Three different SD techniques were employed, and each used three gridded observation-based data products to train (i.e. calibrate) the SD methods. The three downscaling techniques include a delta method (DeltaSD), an equidistant quantile mapping method (EDQM), and a piecewise asynchronous regression method (PARM). The observational data products used for training were Daymet v. 2.1, Livneh v. 1.2, and PRISM AN81d v. D1. The resulting SD-processed projections are on a 10 km by 10 km grid covering the south-central United States (all of AR, KS, LA, NM, OK, TX, and portions of CO and MO). Both historical baseline files (1981-2005) and future projections (2006-2099) are provided, as appropriate.

Though not exhaustive, these downscaled climate projections for the south central US region represent a range of potential future climate

trajectories that can serve as a component of climate impacts research studies. That 81 sets of future projections, and not just one, are provided is indicative that some uncertainties exist regarding the trajectory of the 21st century climate change, though all show notable warming. Uncertainties in how human activity may change future atmospheric composition are represented by the different RCP scenarios. Differences in how sensitive the surface climate of this region will be to atmospheric composition changes are sampled by the use of different GCMs. Similarly, because each SD method has different performance characteristics and observational products differ, the use of different SD techniques and training data set combinations acknowledges that SD methodological choices influence the value-added statistically refined climate projection data products. Applied researchers may explore aspects of their applications' sensitivities to some climate projection uncertainties by sampling from these 81 sets of SD data products. However, this collection should not be considered comprehensive in spanning the entire scope of SD processed climate projections for the south central US region. These climate projection data products are provided as is without any warranty and no agreement to support subsequent projects based on this dataset, beyond providing the data to public domain through the USGS GeoData Portal.

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