

Downscaled Climate and Hydrology Projections Website

New daily climate and Western United States hydrology projections are now available

Bottom Line

Downscaled climate and hydrology projections help users answer local questions about daily climate, streamflow, and water resources. Researchers and planners can use these projections to evaluate potential future climate and hydrology, assess societal impacts, and explore adaptation options.

Better, Faster, Cheaper

Via the website, Reclamation makes downscaled climate and hydrology projections available to scientists and engineers quickly and easily. Using this web service reduces assessment costs and supports risk-based climate adaptation planning.

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Collaborators

Reclamation

- Technical Service Center
- WaterSMART Basin Studies Program

Climate Analytics Group
Climate Central
LLNL–Green Data Oasis
Santa Clara University
Scripps Institution of Oceanography
U.S. Army Corps of Engineers
U.S. Geological Survey

Problem

Global climate models (GCM) are used to simulate future climate responses to scenario increases in atmospheric greenhouse gases. While GCMs simulate a variety of climate responses, including changes in surface temperature and precipitation, they are spatially coarse and not adequate for evaluating local climate impacts.

Users need to quickly and easily access GCM output translated to locally relevant resolution (i.e., “downscaled”). They also need this output to be finely resolved in time so that they may address monthly to daily climate questions (e.g., precipitation amounts, reoccurrence of wet and dry weather patterns, daily temperature range). Users also need:

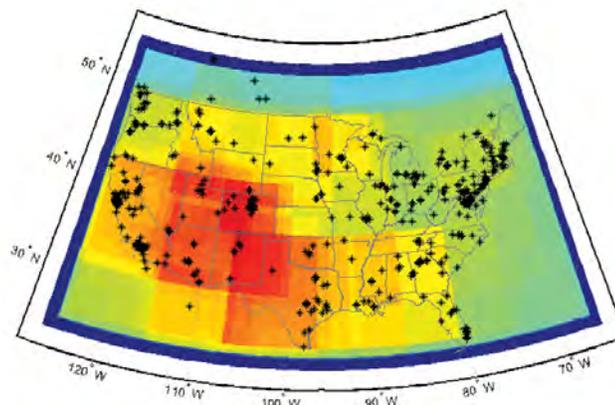
1. A way to correct for the GCM’s bias towards erroneously simulate climate as too warm or cool and/or too wet or dry; and
2. Understanding what these climate projections mean for local hydrology (e.g., streamflow, snowpack, water supplies).

Initial Solution

In 2007, Reclamation collaborated with Santa Clara University and Lawrence Livermore National Laboratory (LLNL) to apply a proven technique called “Bias Correction Spatial Disaggregation” (BCSD) to 112 contemporary global climate projections made available through the World Climate Research Program Couple Model Intercomparison Project, Phase 3 (WCRP CMIP3). These projections represent 16 GCMs simulating climate responses to 3 greenhouse gas scenarios from multiple initial climate system conditions.

The effort produced 112 monthly temperature and precipitation projections over the continental United States (U.S.) at 1/8 degree (12 kilometers) spatial resolution for a 1950 through 2099 climate period. These projections were the first information resources on the website.

Following its launch, the website served information requests for a variety of educational, research, and planning efforts.



Website supports customized user requests from across the U.S.—Since 2007, the archive has served more than 1,400 users submitting greater than 21,000 data requests. Map shows the spatial distribution of data requests (color shading) and unique user locations (asterisks). In total, the archive has served 55 terabytes of data from full-file FTP and customized subset web services.

New Needs, New Solutions

Daily Climate Projections and Western United States Hydrologic Projections

In 2011, the archive received two significant information additions:

1. Responding to users suggestions to include additional information on projected daily temperature range (important for ecological studies) and potential changes in daily precipitation conditions (important for flood hydrology studies). The collaboration expanded in 2010 to leverage a technique developed at Scripps Institution of Oceanography, U.S. Geological Survey, and Santa Clara University, "Bias Correction Constructed Analogs" (BCCA), which operates on daily GCM output. It was applied to 53 of the 112 BCSD projections during 3 sub-periods: 1961 - 2000, 2046 - 2065, and 2081 - 2100.
2. To consistently support assessment of climate change impacts on hydrology for all of Reclamation's water systems, Reclamation (Science and Technology Program, WaterSMART Basin Studies Program, and the Technical Service Center) collaborated with the University of Washington's Climate Impacts Group (CIG) and the National Oceanic and Atmospheric Administration's National Weather Service Colorado Basin River Forecast Center to generate hydrologic projections over the Western U.S., corresponding to the monthly BCSD climate projections contained at this website.

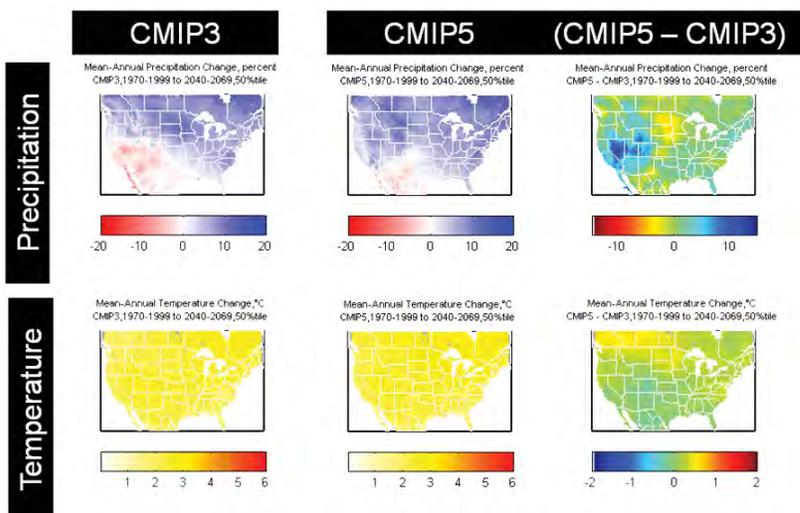
A New Generation of Global and Downscaled Climate Projections (CMIP5)

The WCRP develops global climate projections through its CMIP roughly every 5 to 7 years. Results from CMIP3 were released in 2007 and later used in Reclamation research and assessments including the 2011 SECURE Water Act Report and WaterSMART Basin Studies completed in the Colorado, Yakima, and St. Mary River-Milk River Basins. Results from the WCRP CMIP5 efforts were released during 2012 and represent more comprehensive global climate models, updated greenhouse gas emissions scenarios and a broader set of experiments to address a wider variety of climate science questions.

Reclamation and its collaborators recognized user interests to quickly be able to access and evaluate this new information, responding by applying BCSD and BCCA to a large collection of daily and monthly CMIP5 projections of precipitation, average temperature, and daily temperature ranges. These data were issued in May 2013.

Future Plans

In 2014, archive collaborators plan to develop and issue hydrologic projections for the contiguous U.S. associated with BCSD CMIP5.



BCSD CMIP5 and CMIP3 are broadly similar, but with some significant regional differences.

“Reclamation and its partners are taking leading roles to develop an understanding on how this new information complements previous climate projections made available through CMIP3, and on how CMIP5 projections should be considered in water planning and management.”

Michael L. Connor
Commissioner, Reclamation

More Information

Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections available at:

http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/

CMIP3:

http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php

CMIP5:

<http://cmip-pcmdi.llnl.gov/cmip5/>

Downscaled Climate Projections:

http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/#About

Western U.S. BCSD CMIP3 Hydrology Projections:

www.usbr.gov/WaterSMART/docs/west-wide-climate-risk-assessments.pdf