



Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections

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Downscaled CMIP5 climate and hydrology projections' documentation and release notes available [here](#).

Summary

This archive contains fine spatial resolution translations of climate projections over the contiguous United States (U.S.) developed using three downscaling techniques (monthly BCSD Figure 1, daily BCCA Figure 2, and daily LOCA Figure 3), CMIP3 hydrologic projections over the western U.S., and CMIP5 hydrology projections over the contiguous U.S. corresponding to monthly BCSD climate projections.

Archive content is based on global climate projections from the [World Climate Research Programme's](#) (WCRP's) [Coupled Model Intercomparison Project phase 3 \(CMIP3\)](#) multi-model dataset referenced in the Intergovernmental Panel on Climate Change Fourth Assessment Report, and the phase 5 ([CMIP5](#)) multi-model dataset that is informing the IPCC Fifth Assessment.

For information about downscaled climate and hydrology projections development, please see the [About](#) page.

Purpose

The archive is meant to provide access to climate and hydrologic projections at spatial and temporal scales relevant to some of the watershed and basin-scale decisions facing water and natural resource managers and planners dealing with climate change. Such access permits several types of analyses, including:

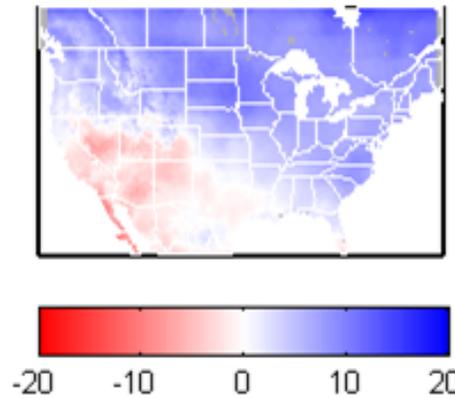
Figure 1. Central Tendency Changes in Mean-Annual Precipitation over the contiguous U.S. from 1970-1999 to 2040-2069 for BCSD3, BCSD5, and Difference.

- assessment of potential climate change impacts on natural and social systems (e.g., watershed hydrology, ecosystems, water and energy demands).
- assessment of local to regional climate projection uncertainty.
- risk-based exploration of planning and policy responses framed by potential climate changes exemplified by these projections.

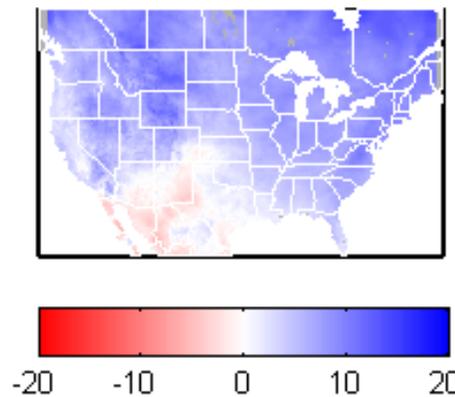
Archive History

- November 2007: Archive launched, initially serving 112 projections of monthly BCSD CMIP3 temperature and precipitation projections over the contiguous U.S. for the period 1950-2099.
- December 2010: Archive expanded to include (1) gridded meteorological observations that guided BCSD CMIP3 application and (2) the intermediate datasets developed during BCSD application, namely the 2-degree "regrid" global climate projections (i.e. over spatially interpolated global climate model results from native model resolution to a common 2-degree grid over the contiguous U.S.) and 2-degree bias-corrected versions of the regrid projections.
- August 2011: Archive expanded to include (1) 53 projections of daily BCCA CMIP3 projections of minimum temperature, maximum temperature and precipitation for three periods (1961-2000, 2046-2065, 2081-2100), with results being of potential interest to ecological studies requiring information on projected diurnal temperature range and/or flood-related studies requiring information about projected daily precipitation patterns; and, (2) 112 projections of monthly and daily hydrologic projections in the western U.S. associated with the monthly BCSD CMIP3 projections.
- May 2013: Archive expanded to include (1) 234 projections of monthly BCSD CMIP5 projections of precipitation and monthly means of daily-average, daily maximum and daily minimum temperature; and, (2) 134 projections of daily BCCA CMIP5 projections of precipitation and daily maximum and daily minimum temperature, all covering the period 1950-2099.

Mean-Annual Precipitation Change, percent
CMIP3,1970-1999 to 2040-2069,50%tile



Mean-Annual Precipitation Change, percent
CMIP5,1970-1999 to 2040-2069,50%tile



Mean-Annual Precipitation Change, percent
CMIP5 - CMIP3,1970-1999 to 2040-2069,50%tile

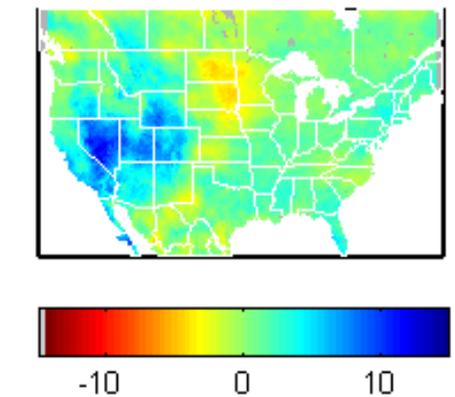


Figure 2. BCCA CMIP3 Daily Climate Analysis example - Calendar-day, ensemble-mean change in 20-year diurnal temperature range for three percentiles of diurnal range: 10th, 50th and 90th for the period pairs shown.

- July 2014: Archive expanded to include 97 projections of monthly and daily hydrologic projections over the contiguous U.S. associated with monthly BCSD CMIP5 projections.
- September 2016: Archive expanded to include 64 projections of daily LOCA CMIP5 projections over the contiguous U.S. of precipitation and daily maximum and daily minimum temperature, all covering the period 1950-2099.

Through August 2016, this web-site has served projections to roughly 2760 users, collectively issued through approximately 40600 requests. Geographically, the requests have covered the contiguous U.S. and parts of southern Canada and northern Mexico.

Current archive content development activities are focused on developing hydrologic projections corresponding to LOCA CMIP5 for the contiguous U.S. as well as Canadian portions of the Columbia River and Missouri River Basins.

Terms of Use

These projections are being distributed to interested users for consideration in research and planning applications. Such applications may include any project carried out by an individual or organized by a university, a scientific institute, public agency, or private sector entity for research or planning purposes. Any decision to use these projections is at the interested user's discretion and subject to the Disclaimer provided below.

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These projections are being made available to provide immediate access for the convenience of interested persons. They are being made available by Archive Collaborators (i.e. [Bureau of Reclamation](#), [Climate Analytics Group](#), [Climate Central](#), [Lawrence Livermore National Laboratory](#), [Santa Clara University](#), [Scripps Institution of Oceanography](#), [U.S. Army Corps of Engineers](#), [U.S. Geological Survey](#), [National Center for Atmospheric Research](#), and [Cooperative Institute for Research in Environmental Sciences](#). Archive Collaborators believe the information to be correct representations of potential high-resolution climate/hydrologic variations and changes subject to the limitations of

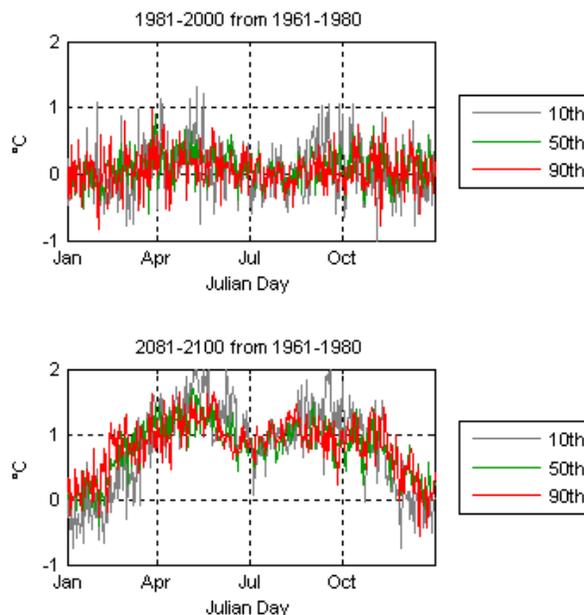
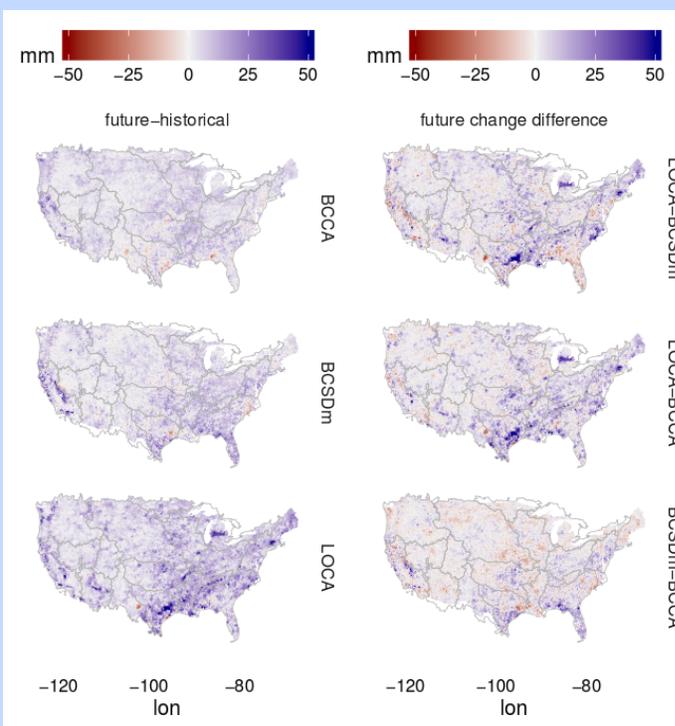


Figure 3. Comparison of the ensemble median of max daily precipitation for three daily downscaling methods. Shown is the difference (first column) between the historical period (1970-1999) and the future period (2040-2069) for each method: BCCA (top), BCSDm (middle) and LOCA (bottom). The second column shows differences between future changes of each method, each row represents differences between pairs of methods: LOCA-BCSDm (top), LOCA-BCCA (middle) and BCSDm-BCCA (bottom).



the CMIP3 and CMIP5 global climate simulations, and the downscaling methods and their limitations, as described elsewhere in this web site. However, human and mechanical errors remain possibilities. Therefore, Archive Collaborators do not guarantee the accuracy, completeness, timeliness, or correct sequencing of the information. Also, neither Archive Collaborators, nor any of the sources of the information shall be responsible for any errors or omissions, or for the use or results obtained from the use of this information.

Acknowledgements and Citation of these Projections

Whenever you publish research based on projections from this archive, please include two acknowledgements:

1. First, acknowledge the superceding effort.
 - a. For CMIP3, the following is language suggested by the CMIP3 archive hosts at PCMDI: "*We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset. Support of this dataset is provided by the Office of Science, U.S. Department of Energy.*" PCMDI also requests that in first making reference to the projections from this archive, please first reference the CMIP3 dataset by including the phrase "*the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project phase 3 (CMIP3) multi-model dataset*". Subsequent references within the same publication might refer to the CMIP3 data with terms such as "*CMIP3 data*", "*the CMIP3 multi-model dataset*", "*the CMIP3 archive*", or the "*CMIP3 dataset*".
 - b. For CMIP5, , the model output should be referred to as "the CMIP5 multi-model ensemble [archive/output/results/of simulations/dataset/ ...]". In publications, you should include a table (referred to below as Table XX)

listing the models and institutions that provided model output used in your study. In this table and as appropriate in figure legends, you should use the CMIP5 “official” model names found in "[CMIP5 Modeling Groups and their Terms if Use](#)" (pdf document, also in [Word doc](#) format). In addition, an acknowledgment similar to the following should be included in your publication:

“We acknowledge the World Climate Research Programme's Working Group on Coupled Modelling, which is responsible for CMIP, and we thank the climate modeling groups (listed in Table XX of this paper) for producing and making available their model output. For CMIP the U.S. Department of Energy's Program for Climate Model Diagnosis and Intercomparison provides coordinating support and led development of software infrastructure in partnership with the Global Organization for Earth System Science Portals.”

where, “Table XX” in your paper should list the models and modeling groups that provided the data you used. In addition it may be appropriate to cite one or more of the CMIP5 experiment design articles listed on the [CMIP5 reference page](#).

2. Second, generally acknowledge this archive as "Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections" archive at https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/. To reference specific information in the archive, you may also use the following references:

- a. (for original reference to this website)
Maurer, E. P., L. Brekke, T. Pruitt, and P. B. Duffy (2007), 'Fine-resolution climate projections

enhance regional climate change impact studies', *Eos Trans. AGU*, 88(47), 504.

- b. (for reference to all BCSD and BCCA downscaled content, including CMIP3 and CMIP5), you can reference the [technical memorandum](#) using the following citation: Reclamation, 2013. 'Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections: Release of Downscaled CMIP5 Climate Projections, Comparison with preceding Information, and Summary of User Needs', prepared by the U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center, Denver, Colorado. 47pp.
- c. (for BCSD CMIP3 hydrologic projections) Reclamation, 2011. 'West-Wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections', Technical Memorandum No. 86-68210-2011-01, prepared by the U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center, Denver, Colorado. 138pp.
- d. (for BCSD CMIP5 hydrologic projections) you can reference the [technical memorandum](#) using the following citation: Reclamation, 2014. 'Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections: Release of Hydrology Projections, Comparison with preceding Information, and Summary of User Needs', prepared by the U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center, Denver, Colorado. 110 pp.
- e. (for LOCA CMIP5 projections) you can reference: Pierce, D. W., D. R. Cayan, and B. L. Thrasher, Statistical Downscaling Using Localized Constructed Analogs (LOCA), *Journal of Hydrometeorology*, 15(6), 2558-2585, 2014.; and Pierce, D. W., D. R. Cayan, E. P. Maurer, J. T. Abatzoglou, and K. C. Hegewisch, 2015: Improved bias correction techniques for hydrological

simulations of climate change. J.
Hydrometeorology, v. 16, p. 2421-
2442. DOI:
<http://dx.doi.org/10.1175/JHM-D-14-0236.1>.

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