Applications (example studies informed by CMIP3)

Period-Change Analysis: Climate Change → Hydrology and Yield Response

Reclamation 2010:
- Goal: Evaluate yield under different future climates.
- Approach: Start with BCSD climate projections and derive climate change scenarios using three methods. Develop initial inputs under each set of scenarios for driving reservoir yield analysis.
- Credit: U.S. Army Corps of Engineers.

Reclamation 2011b:
- Goal: Consistently evaluate hydrology and water supply impacts under projected climate conditions for western U.S. over basins.
- Approach: Start with BCSD climate projections and apply USG hydrology models provided by University of Washington (Reclamation 2011a) to translate BCSD climate projections into hydrologic projections (Reclamation 2011b). Use results to support ABCEWS reporting (Reclamation 2011b). Make results publicly available to support planning, research, and educational activities (see Content).
- Credit: U.S. Geological Survey (Mike Dettinger) for guidance on constructed analogs application in the development of daily downscaled climate projections. We would also like to thank staff at Lawrence Livermore National Laboratory, Livermore, CA.

Reclamation 2012a,b:
- Goal: Characterize current and future water supply and demand conditions in the Colorado River Basin resources, considering multiple climate change scenarios.
- Approach: Use hydrologic projections from Reclamation (2012b) in poly-climate context for characterizing future water supplies (i.e., considering palaeoclimate, instrumental records, and projected climate information: Reclamation 2012a). Carry information forward, translating hydrologic projections and climate change scenarios into operations projections and assessment of system reliability (Reclamation 2012b).
- Credit: Use results to support ABCEWS reporting (Reclamation 2012b).

http://www.usbr.gov/crwr/program/brandy.html

About the Archive
- Website: http://gdo-dcp.ucllnl.org/downscaled_cmip5_projections/
- Purpose: Provide public access to large collection of contemporary downscaled climate and hydrology projections, support planning, research and education activities.

Collaborators:
- Lawrence Livermore National Laboratory
- U.S. Army Corps of Engineers
- Climate Central
- Climate Analytics Group
- U.S. Geological Survey
- Climate Change Scenarios Network (CCSN)
- National Center for Atmospheric Research
- NCAR
- National Marine Fisheries Service
- U.S. Forest Service
- Climate Analytics Group
- U.S. Department of the Interior

Content (New!)

Summary:
- Two statistical downscaling techniques – monthly bias-correction and spatial disaggregation (BCSD) and daily bias-correction and statistical downscaling (BCSDD) – have been applied to a large ensemble of two climate projections released through the World Climate Research Programme (WCRP) Coupled Model Intercomparison Project phase 5 (CMIP5). The downscaled projections are developed over the contiguous U.S. and represent the latest content addition to the “Bias-Corrected and Downscaled WCRP CMIP5 Climate and Hydrology Projections” web archive, available at http://gdo-dcp.ucar.edu/downscaled_cmip5_projections/.
- A subset of the BCSD climate projections have been translated into hydrologic projections over the contiguous U.S.
- Archive efforts stem from recognition that water managers need to assess what future climate change could mean for the management of their systems, and to assess when vulnerabilities and impacts would appear to cross thresholds triggering need for adaptive intervention.
- In order to assess such needs, managers must be able to quickly and easily access global climate projections information that has been bias-corrected to account for systematic climate model errors and downscaled to reflect local controls on climate.
- This effort builds on collaborative climate projections downscaling and hydrologic modeling activities that have been ongoing since 2007. In 2010, BCSD archives have been made publically available at the archive below. To-date, more than 11,000 data requests have been served through this website in association with planning, research and education activities.

How do precipitation changes from CMIP5 compare to those from CMIP3?

Analysis:
- (1) Use monthly BCSD climate sources (CMIP5 and CMIP3) and compute the precipitation difference for each projection and grid cell.
- (2) Pool changes by model and over the entire domain to produce the change in (1).
- (3) Pool model-specific change patterns and compute the ensemble-model (EMM) precipitation change (i.e., model-specific change patterns in CMIP5 and from CMIP3 model-specific patterns in CMIP3).
- (4) Map the ensemble-model median change by climate (precipitous) zones and source (first and second columns). Map differences by source (third column).

Impressions:
- At the large scale, CMIP3 and CMIP5 median changes are similar.
- At the local scale, significant differences are evident (e.g., by late 21st century CMIP5 projections are in some cases 10% less than CMIP3, and reach over 25% higher in the Southwest).
- At the local scale, there is significant inter-model differences, but generally less than 0.5 °C.

REFERENCES


U.S. Geological Survey (Mike Dettinger) for guidance on constructed analogs application in the development of daily downscaled climate projections. We would also like to thank staff at Lawrence Livermore National Laboratory, Livermore, CA.

How do temperature changes from CMIP5 compare to those from CMIP3?

Analysis:
- See above.

Impressions:
- At the large scale, CMIP5 and CMIP3 model changes are similar.
- At the local scale, there are minor differences, but generally less than 0.5 °C.

Impressions:
- The next level of inquiry is to understand why this is the case. Two potential factors are that CMIP5 projections are developed using a different collection of models; representing recent climate science as opposed to the partial collection of new climate forcing scenarios (Representative Concentration Pathways). Accounting for the differences between CMIP5 and CMIP3, whereas these two factors remain a matter of research.

Summary:
- These results show that the CMIP5 and CMIP3 models are consistent in how they express generally similar changes over large areas, but sometimes significantly different changes for more local regions.

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How do temperature changes from CMIP5 and CMIP3 compare to those from previous studies?

Analysis:
- (1) Use monthly BCSD climate sources (CMIP5 and CMIP3) and compute the temperature difference for each projection and grid cell.
- (2) Pool changes by model and over the entire domain to produce the change in (1).
- (3) Pool model-specific change patterns and compute the ensemble-model (EMM) temperature change (i.e., model-specific change patterns in CMIP5 and from CMIP3 model-specific patterns in CMIP3).
- (4) Map the ensemble-model median change by climate (precipitous) zones and source (first and second columns). Map differences by source (third column).

Impressions:
- At the large scale, CMIP3 median changes are similar.
- At the local scale, there are minor differences, but generally less than 0.5 °C.

Impressions:
- These results show that the CMIP5 and CMIP3 median changes are similar.
- These results show that the CMIP5 and CMIP3 median changes are similar.