Climate Change Characterization and Analysis
in California Water Resources Planning Studies

A survey of the approaches taken by the California Department of Water Resources and its partner agencies for analyzing the effects of climate change on proposed projects, existing projects, and general planning studies

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Study Description
Purpose and Need

The simulation of future climate and hydrology for the purpose of future planning is evolving rapidly. Following this evolution, DWR's planning studies have used an array of different approaches for considering climate change.

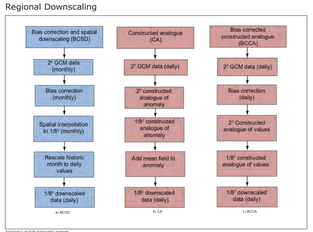
This report surveys and summarizes the climate change characterization approaches and methodologies that have been used in recent planning studies conducted by DWR and its partner agencies. It is the first comprehensive comparative look at different climate change characterization approaches, their strengths and weaknesses, and how they have been used in past studies.

This report is the first step toward identifying opportunities for developing common climate change analysis approaches for studies with similar purposes and assumptions. This work is envisioned to lay the groundwork for a future DWR study aimed at developing a standard framework and a consistent set of approaches to be used for characterizing and analyzing climate change in future DWR planning studies.

Characteristics
Reported

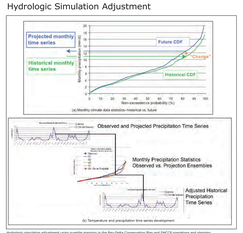
- Planning horizon
- Spatial coverage
- Climate analysis approach
- Number of projections
- Regional downscaling (see figure)
- Scenario Selection
- Climate variables adjusted
- Climate variable adjustment method
- Sea level rise projection
- Hydrologic model & hydrologic simulation adjustments (see figure)

Regional Downscaling



Screenshots of GCM downscaling methods
Maurer, E. P. 2009. Scenarios of Future Climate. Oregon Climate Change Research Institute (OCCRI) Workshop: Translating Global Models to Local Scale. Oct. 29-29.

Hydrologic Simulation Adjustment

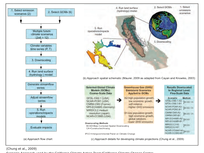


Hydrologic simulation adjustment using quantile mapping in the Bay Delta Conservation Plan and DWCCP operations and planning

Summary
of Climate Analysis Approaches

Scenario Analysis

A scenario analysis approach uses one or more simulations generated by Global Climate Models (GCM) to represent potential future conditions. In the scenario analysis approach, each of the simulations represents an equally likely potential future.



(a) Regional step-wise approach (Maurer, 2009 as adapted from Cayan and Knowles, 2005)

(b) Global step-wise approach (Maurer, 2009 as adapted from Cayan and Knowles, 2005)

(c) Regional step-wise approach (Maurer, 2009 as adapted from Cayan and Knowles, 2005)

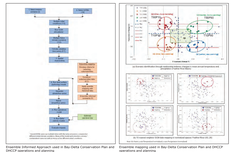
(Chung et al., 2009)
Scenario Approach used by the California Climate Action Team/California Climate Change Center
Chung, F., I. Anderson, S. Arora, M. Ejeta, J. Gault, T. Kadir, S. Kao, S. Olson, C. Quan, S. Reuter, M. Rivas, S. Samarasinha, J. Schwarz, J. Vasquez, and W. Yeung. 2009. Climate Change Characterization and Analysis in California Water Resources Planning Studies. Draft Report. Prepared by the California Department of Water Resources. 66 p. May.
www.water.ca.gov/climatechanging_future_climate_projections_to_support_water_resources_decision_making_in_california/docs/ongoingcca/DraftReportStudyAndNotes_Jun09_web.pdf

Relative Change Approaches

A relative change approach relies on impact assessment results from other studies that indicate the general direction and order of magnitude of the expected changes due to climate change. This information is then used to determine a defined quantity or percentage quantity to add or subtract from observed levels of a parameter of interest to estimate the potential change due to climate change. A relative change approach can be used to generate a factor of safety or perturbation factor that can be used to model more extreme events that could occur in the future. The modified parameter values can then be used in successive analyses to study impacts or design parameters.

Ensemble-Informed Approach

An ensemble-informed approach uses information from a large array of GCM generated future climate simulations. The simulations are aggregated using various statistical methods to develop a new ensemble-informed simulation. Sub-ensemble simulations may also be developed to highlight potential extreme conditions. For example, a sub-ensemble representing simulations that are hotter or wetter than the median results could be developed by aggregating those simulations that exhibit extreme hot or wet results. The ensemble-informed approach allows systems to be analyzed using any type of simulation e.g. median, hot, wet, hot and wet, etc).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