DWR
CCTAG
Subgroup - Scenarios

May 12, 2012

Meeting Agenda

- Strengths/Weaknesses/Criteria summary Discussion
- Review CWP (WEAP) needs
- List which materials are available today
- Sacramento 30 Year Avg Data - Curtis
- Models
  - CAT for 4 DWR locations – Cayan/Schwarz
  - BDCP for 4 DWR locations – Schwarz
  - CVP IRP BDCP method – Jamie A.
- SFPUC Approach – Young/Schwarz
- DWR Feather River Basin Sensitivity Paper – Jamie A.
- Discussion of selection of scenarios for CWP
- Determine 5/11 full CCTAG presentation approach
- Another subgroup webinar later in May to meet CWP deadline?

DRAFT Strengths/Weaknesses and Criteria for Climate Model Scenarios – 5/2/12

	12 Cat Scenarios	5 BDCP Scenarios
Strengths	• Scenario selection based on GCMs using criteria developed by CAT • Thoroughly peer reviewed in published literature. • Used extensively in past statewide impact evaluations. • Preserves variability displayed in projections, doesn't rely on historical observations to incorporate inter-annual/inter-decadal variability. • Provides individual realizations of the future projection distribution.	• Captures wider range of possible climate from wet to dry and less warm and warm and central tendency • Includes 3 emissions scenarios • Includes information from all available projections • Provides a smaller set of scenarios to evaluate. • Multi-decadal variability bias and spatial inconsistencies of individual projections are buffered by aggregating several projections.
Weaknesses	• Bias toward drier side of projections • 30 year running averages appear to be flat for several of the scenarios. Is this reasonable? • Does not capture full range of uncertainty as described by the full CMIP3 archive of projections. • Has not been reevaluated since completion in 2008—new methods, research is available. • Does not provide a single central tendency or most likely outcome that can be used for detailed/project level decision making • Unsure if selection of models provides the appropriate sampling needed for given study.	• Does not capture extremes unless mapped to a historical pattern • Computationally complex—requires considerable resources and expertise to modify in any way. • Scenarios are currently only available at two time periods 2025, 2060 • Not thoroughly peer reviewed. • Collapses variability of multiple projections into ensemble average, potentially masking increases in future variability. • Difficult to maintain spatial continuity of the desired projection distribution realization that is run.

Technical Criteria for Selecting Climate Scenarios

- Capturing precipitation variability is important
- Pick the best of the CAT and BDCP scenarios
- Visually observe 30 year running average precipitation
- Want to capture extremes, including extended dry periods
- Matching historical record is not a predictor of confidence of future projections
- Mimic historical variation
- Select scenarios that can be used for multiple planning purposes

Task Statement

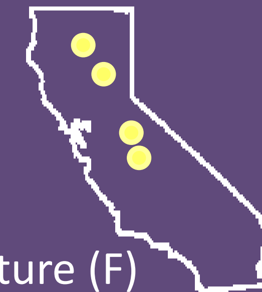
By May 2012, provide a high level assessment of the strengths and weaknesses of the 12 CAT climate scenarios and the 5 ensemble informed scenarios used by BDCP, and other existing and available projections or ensembles of projections for sampling the distribution of future climate projections.

By May 2012, provide recommendations for climate scenarios (selecting from existing and available projections or ensembles of projections) that are appropriate for representing a reasonable variation of future climate conditions for use in Update 2013 of the Water Plan.

Following the May 11 CCTAG full meeting, the subgroup could recommend a more detailed approach for assessment, selection, and technical approaches to future climate scenarios for water resources planning.

Climate Change Scenarios Subgroup
Available Data for Scenario Comparison

Data request: Temperature and precipitation data for all methods to facilitate comparison of the range of changes represented by each method



Comparison sites: (N to S) Red Bluff, Oroville, Millerton, Fresno
Metrics: total annual precipitation (inches), average annual temperature (F)

Data Available Now

12 CAT Scenarios

GCM output for 1950-2100
(12 time series)

5 BDCP scenarios

- 88 year historical time series 1915-2003 adjusted with average changes for
  - 2025 (5 time series)
  - 2060 (5 time series)

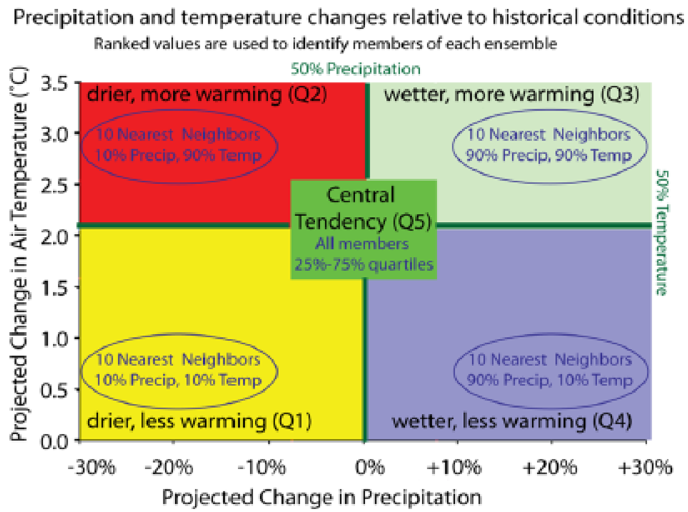
5 CVP IRP scenarios

Data Requested

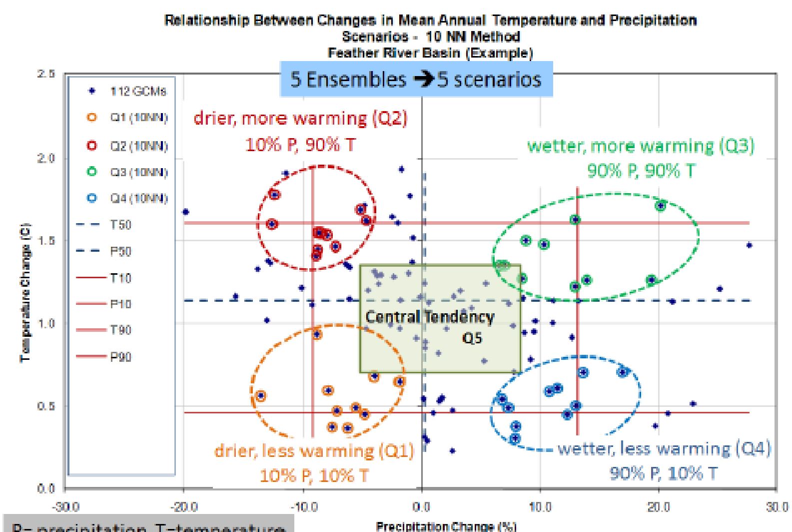
88 year historical time series 1915-2003 adjusted with climate change that evolves over time
(1915→2011…2003 →2099)
(5 time series)

BDCP Ensemble-Informed Climate Change Scenarios

Conceptual Mapping of 5 Scenarios:



Example of selection of ensemble members for 5 scenarios:



P= precipitation, T=temperature

Data and Approaches Presentations

30 year Sacramento Data - Curtis

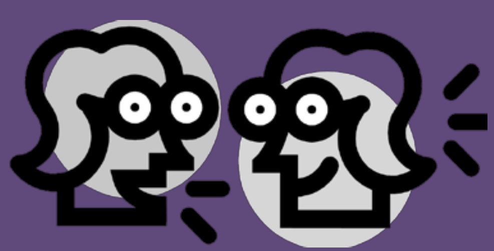
Models

- **CAT for 4 DWR locations – Cayan/Schwarz**
- **BDCP for 4 DWR locations – Schwarz**
- **CVP IRP BDCP method – Jamie A.**

SFPUC Approach – Schwarz/Young

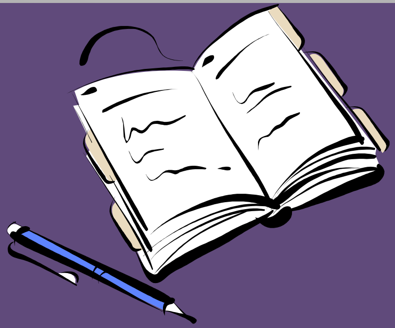
DWR Feather River Basin Sensitivity Paper – Jamie A.

Discussion



Climate Scenarios Subgroup

Set next Webinar date



THANK YOU!

CAT Scenarios

CAT Scenarios	Ref. year	Emissions Scenarios	Adjusted Climatology	Unadjusted Climatology
Parallel Climate Model; National Center for Atmospheric Research	2000	A2, B1	NO	YES
Geophysical Dynamics Laboratory model version 2.1; US Dept. of Commerce/National Oceanic and Atmospheric Administration (NOAA)/Geophysical Fluid Dynamics Laboratory (GFDL)	2006	A2, B1	NO	YES
Community Climate System Model; National Center for Atmospheric Research (NCAR)	2006	A2, B1	NO	YES
Max Planck Institute (MPI) for Meteorology, Germany	2006	A2, B1	NO	YES
Center for Climate System Research (University of Tokyo), National Institute for Environmental Studies, and Frontier Research Center for Global Change (JAMSTEC), Japan	2004	A2, B1	NO	YES
Meteo-France / Centre National de Recherches Meteorologiques (CNRM), France	2005	A2, B1	NO	YES

BCDP Scenarios

Bay Delta Conservation Plan Ensemble Scenarios

Q1- 10nn (drier, more warming)	2010	ensemble A2, B1, A1b	YES	YES
Q2-10nn (drier, less warming)	2010	ensemble A2, B1, A1b	YES	YES
Q3-10nn (wetter, more warming)	2010	ensemble A2, B1, A1b	YES	YES
Q4-10nn (wetter, less warming)	2010	ensemble A2, B1, A1b	YES	YES
Q5-25th-75th percentile ensemble (approx 25-38 members)	2010	ensemble A2, B1, A1b	YES	YES

Available Scenarios* that DWR has used in the Past

CAT Scenarios	Ref. year	Emissions Scenarios	Adjusted Climatology	Unadjusted Climatology
Parallel Climate Model; National Center for Atmospheric Research	2000	A2, B1	NO	YES
Geophysical Dynamics Laboratory model version 2.1; US Dept. of Commerce/National Oceanic and Atmospheric Administration (NOAA)/Geophysical Fluid Dynamics Laboratory (GFDL)	2006	A2, B1	NO	YES
Community Climate System Model; National Center for Atmospheric Research (NCAR)	2006	A2, B1	NO	YES
Max Planck Institute (MPI) for Meteorology, Germany	2006	A2, B1	NO	YES
Center for Climate System Research (University of Tokyo), National Institute for Environmental Studies, and Frontier Research Center for Global Change (JAMSTEC), Japan	2004	A2, B1	NO	YES
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Bay Delta Conservation Plan Ensemble Scenarios				
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Q2-10nn (drier, less warming)	2010	ensemble A2, B1, A1b	YES	YES
Q3-10nn (wetter, more warming)	2010	ensemble A2, B1, A1b	YES	YES
Q4-10nn (wetter, less warming)	2010	ensemble A2, B1, A1b	YES	YES
Q5-25th-75th percentile ensemble (approx 25-38 members)	2010	ensemble A2, B1, A1b	YES	YES

OCAP Scenarios				
Projection 1 (wetter, less warming)-MRI CGCM2.3.2a		A2 sim#5	No	Yes
Projection 2 (wetter, more warming)-NCAR CCSM3.0		A1b sim#3	No	Yes
Projection 3 (drier, less warming)-MRI CGCM2.3.2a		A2 sim#2	No	Yes
Projection 4 (drier, more warming)-UKMO HADCM3		A2 sim#1	No	Yes
TOTAL NUMBER OF AVAILABLE SCENARIOS			5	21

*Scenario in this context is defined as a simulation of future conditions based on a single GCM projection or the ensemble average of multiple GCM projections

10nn= ensemble based on 10 nearest neighbor method

OCAP Scenarios

OCAP Scenarios

Projection 1 (wetter, less warming)-MRI CGCM2.3.2a	A2 sim#5	No	Yes
Projection 2 (wetter, more warming)-NCAR CCSM3.0	A1b sim#3	No	Yes
Projection 3 (drier, less warming)-MRI CGCM2.3.2a	A2 sim#2	No	Yes
Projection 4 (drier, more warming)-UKMO HADCM3	A2 sim#1	No	Yes
TOTAL NUMBER OF AVAILABLE SCENARIOS		5	21

Summary of Uncertain Factors, Resource Management Strategies, Relationships, and Performance Metrics to Support Analysis for Water Plan Update 2013

Uncertain Factors (X)	Resource Management Strategies (L)
Population Urban and agricultural land footprint Climate conditions Costs of management options	Urban water use efficiency Agricultural water use efficiency Recycled municipal water Conjunctive management & groundwater storage Surface storage System reoperation Meet non-required instream flow objectives Groundwater overdraft recovery
Relationships or Systems Model (R)	Performance Metrics (M)
WEAP Central Valley Model UPlan SWAP Demographic analysis Cost and economic impact tools	Urban supply reliability Agricultural supply reliability Instream flow reliability Groundwater levels Unmet environmental objectives Delta exports (CVP + SWP) Cost of implementing management Economic impacts of shortages