



Progress on Incorporating Climate Change into Management of California's Water Resources

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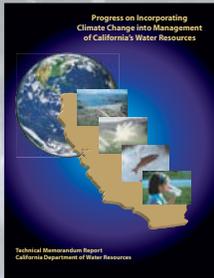
Motivation

- Gov. Arnold Schwarzenegger issued Executive Order S-3-05 on June 1, 2005
- Establishes green house gas emission reduction targets
- Requires reports every two years on climate change impacts to five areas, including water resources
- Formed Climate Action Team to oversee reports
- <http://climatechange.ca.gov>



DWR Climate Change Report

- Prepared by DWR-Reclamation Climate Change Work Team
- Technical chapters were peer reviewed
- <http://baydeltaoffice.water.ca.gov/climatechange.cfm>



- CH1 Introduction
- CH2 Background
- CH3 DWR Studies
- CH4 State Water Project and Central Valley Project
- CH5 Delta Impacts
- CH6 Flood Management
- CH7 Evapotranspiration
- CH8 Future Directions

Climate Change Scenarios

- 4 scenarios were selected by the Climate Action Team
- 2 models x 2 green house gas emissions scenarios
- All scenarios show warming
- No consistent trend in precipitation change

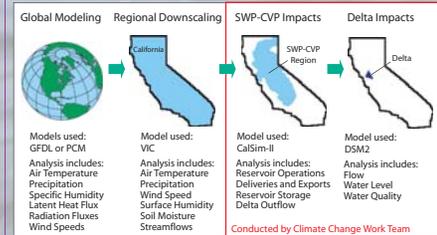
Air Temperature and Precipitation Changes for 4 Climate Change Scenarios

Scenario/Model	A2	B1
GFDL		
PCM		

Acknowledgements

Contributors to this report include the following DWR staff: Michael Anderson, Dan Easton, Michael Floyd, Roy Peterson, Joel Dudas, Messele Ejeta, Jim Goodridge, Brian Helland, Arthur Hinojosa, John King, Bunleoung Lek, Aaron Miller, Stephen Nemeth, Al Olson, Morteza Orangi, Michael Perrone, Tawny Pranger, David Rizzardo, Maurice Roos, David Todd, Matt Winston, Hongbing Yin
 Additional contributors: U.S. Bureau of Reclamation: Levi Brekke and Russell Yaworsky; University of CA, Davis: Richard Snyder; California Energy Commission: Guido Franco Lawrence Berkeley Nat'l Laboratory: Norman Miller; Santa Clara University: Ed Maurer
 Background photo by Jim Wilde

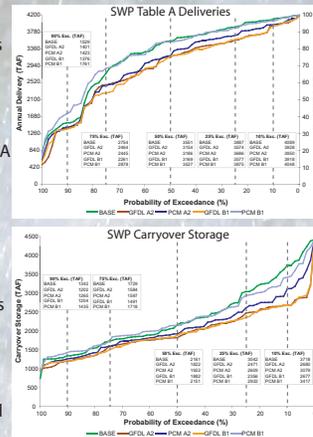
Preliminary Impacts Assessment Methodology



- Use existing models
- 2050 runoff projections
- 2020 land use estimates
- Modify historical inflows to reservoirs to reflect climate change
- Use current operating rules
- No operations changes for sea level rise
- All results are preliminary

State Water Project and Central Valley Project Impacts

- Current operating rules lead to shortages in CVP North-of-Delta reservoirs during droughts; operations changes may be necessary
- Changes in SWP Table A deliveries ranged from +1% for the wet scenario to -10% for the drier scenarios
- Increased winter runoff & lower Table A allocations lead to higher Article 21 deliveries for the 3 drier scenarios; for the wet scenario higher Table A allocations resulted in slightly lower Article 21 deliveries
- Changes in CVP South-of-Delta deliveries ranged from +2.5% for the wet scenario to -10% for the drier ones
- For both SWP and CVP, carryover storage was reduced for the drier scenarios & increased for the wet one
- Changes in stream temperature and power generation were also examined
- Sea level rise was not considered



Sacramento-San Joaquin Delta Impacts

- Base case and four climate change scenarios
 - at present sea level
 - for a one-foot sea level rise (SLR)
- Water quality standard compliance at municipal and industrial intakes
 - 100% compliance at SWP and CVP for all scenarios
 - Operations changes maintain compliance for present sea level scenarios
 - SLR with no changes to operations ⇒ ~8% increase in violations at Rock Slough

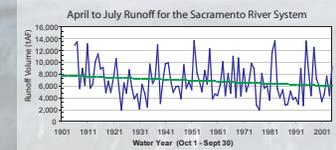
Compliance with 250 mg/l Standard at Old River at Rock Slough

Scenario	BASE	1ft SLR	GFDL A2	PCM A2	GFDL B1	PCM B1
Present sea level	97.2%	-	98.0%	98.0%	98.2%	97.4%
1-ft sea level rise	97.2%	89.9%	89.6%	90.3%	90.1%	90.9%

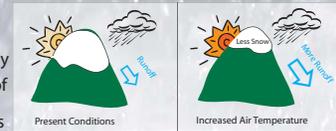
- Chloride mass loadings at municipal and industrial intakes
 - Decreased for climate change at present sea level scenarios due to lower exports
 - Increased for 1-ft sea level rise scenarios due to increased salt intrusion
- Future work will look at operations changes to reduce effects of sea level rise

Flood Management Impacts

- Field data for California indicate
 - Increasing air temperatures
 - Increasing precipitation in North decreasing precipitation in South
 - Interannual variability in precipitation is increasing
 - More runoff in winter (Oct-Mar) Less runoff in spring/summer (Apr-Jul)
 - Flood peaks increasing in mean and variance

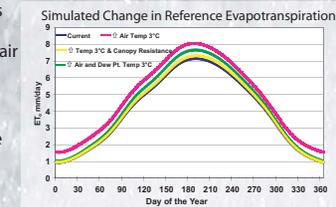


- Future climate change
 - Projections are for long-term averages
 - Actual weather events may vary greatly
 - Changes in variability and frequency of extreme events are important and are not well represented in climate models



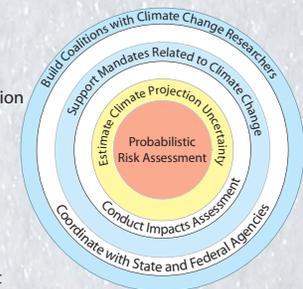
Evapotranspiration Impacts

- Evapotranspiration (ET) has 2 processes
 - Evaporation from soil, water & plants
 - Transpiration of water from plants to air
- Climate change could affect both processes
- 3°C increase in air temp increases reference ET by 3%-6% which is a large volume of water over the entire state
- Higher water demands due to climate change could be offset by improved water use efficiency
- SIMETAW model could be used to study ET changes due to climate change



Future Directions

- Provide information that is useful to water resources managers
- Interact with climate change researchers
- Regularly update climate change information
- Develop needed tools and methods e.g. a way to represent sea level rise in operations studies
- Develop representation of climate change effects on consumptive use of water due to changes in crop evapotranspiration
- Study more climate change scenarios
- Extend impacts analysis to risk assessment by associating likelihoods with each scenario



Climate Change Work Team Goals

Additional Information

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- <http://baydeltaoffice.water.ca.gov/climatechange.cfm>