

Climate Change and California



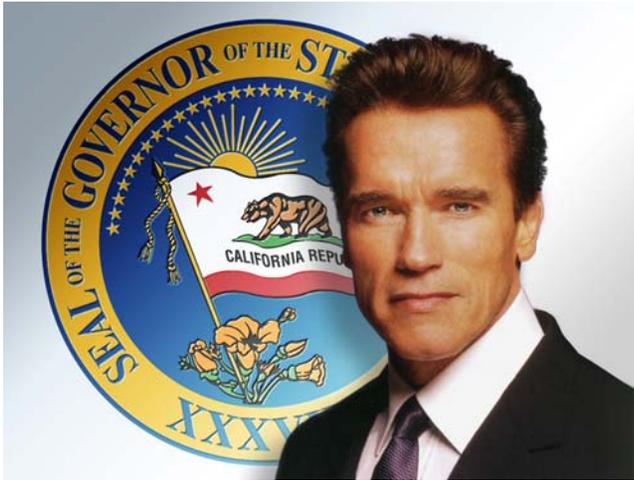
Michael Anderson
November 18, 2005



Let's start with a
message from the
boss...



Governor Arnold Schwarzenegger on Global Warming:



“I say the debate is over. We know the science. We see the threat. And we know the time for action is now.”

United Nations World Environment Day Conference, June 1, 2005, San Francisco



EXECUTIVE ORDER S-3-05

June 1, 2005

- **Recognizes global climate change and its impacts on California.**
- **Establishes aggressive greenhouse gas emission reduction targets for the State.**
- **Requires biennial assessments of climate change impacts and the development of impact mitigation/adaptation plans.**
- **Requires the formation of an interagency team to implement the Governor's Order.**



The Climate Action Team

- CA Department of Water Resources
- California Energy Commission
- Cal EPA
- Reclamation
- USGS
- University of California Davis
- University of California Berkeley
- Santa Clara University
- Scripps Institute of Oceanography
- Lawrence Berkeley Lab
- Lawrence Livermore Lab



DWR Climate Change Work Team



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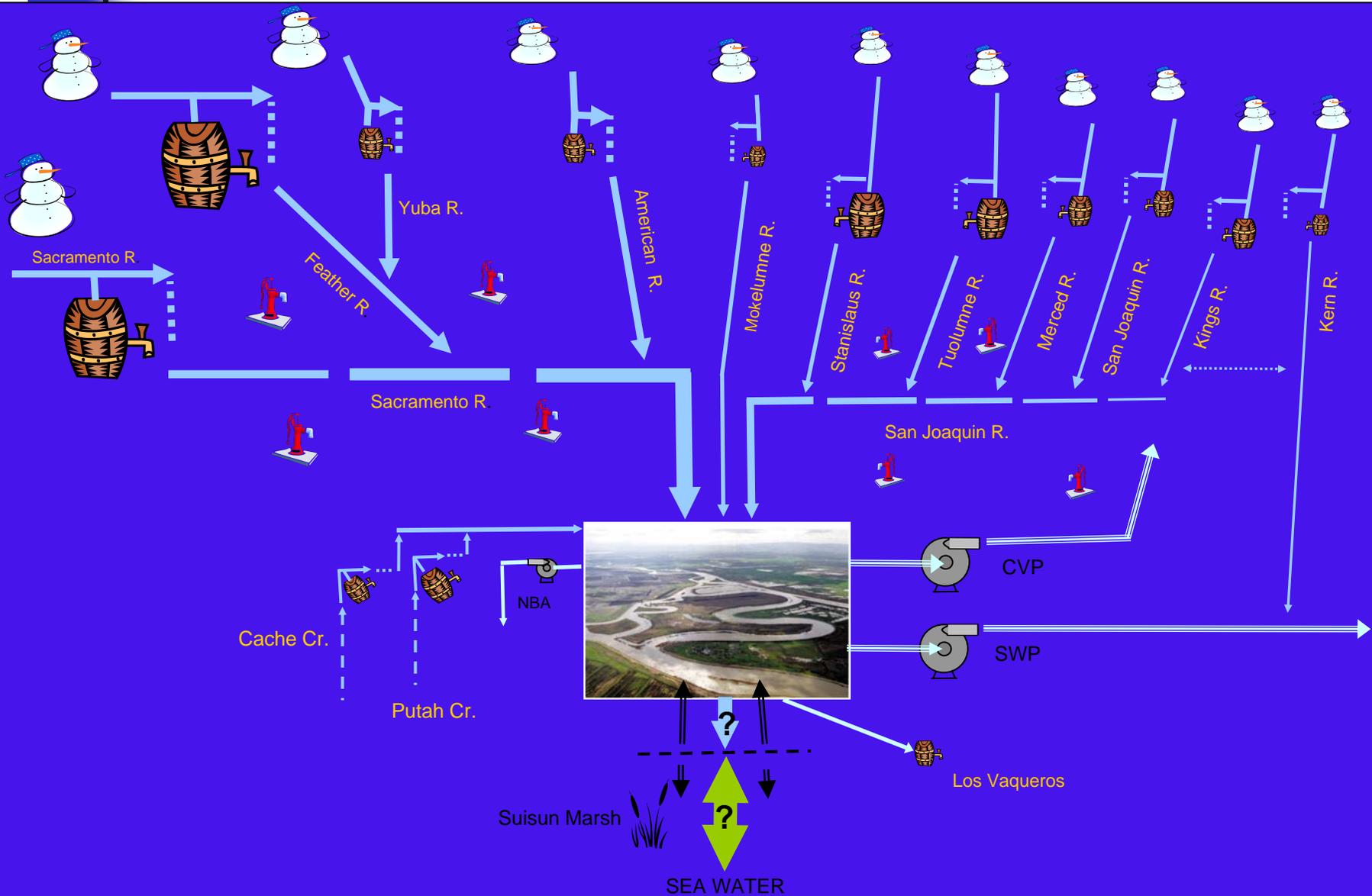


DWR Climate Change Report ~Jan06

- Potential Impacts of Climate Change
- Impacts on SWP and CVP
- Impacts on Delta Water Quality
- Implications for Flood Management
- Implications for Water Supply Forecasting
- Impacts on Evapotranspiration
- Future Directions



The System





Expected Changes with Global Warming

- Less precipitation falling as snow
- Earlier snowmelt
- Changes in water demand
- Increased evaporation losses
- Changes to watershed vegetation and runoff
- Increased water temperature

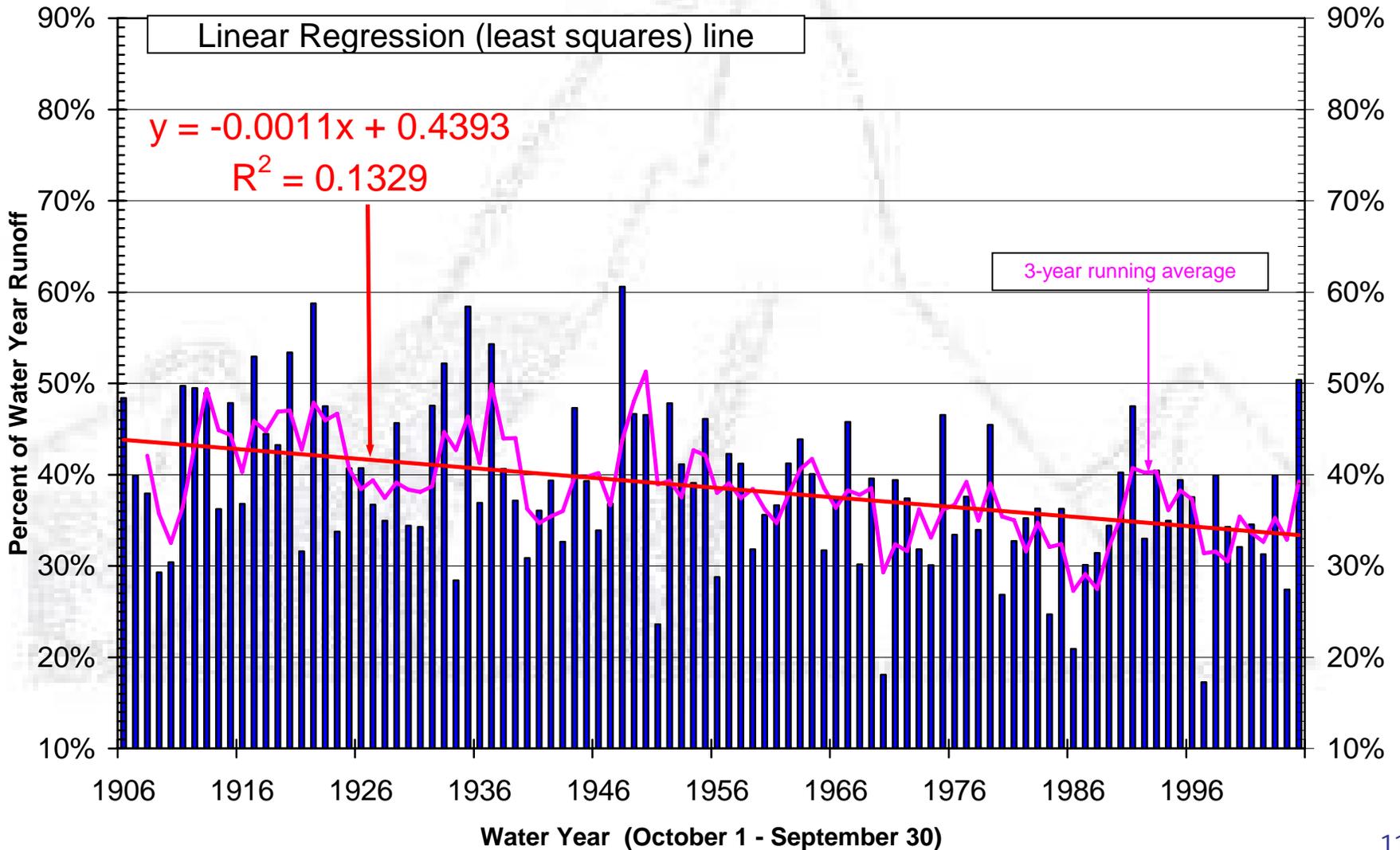


Why?



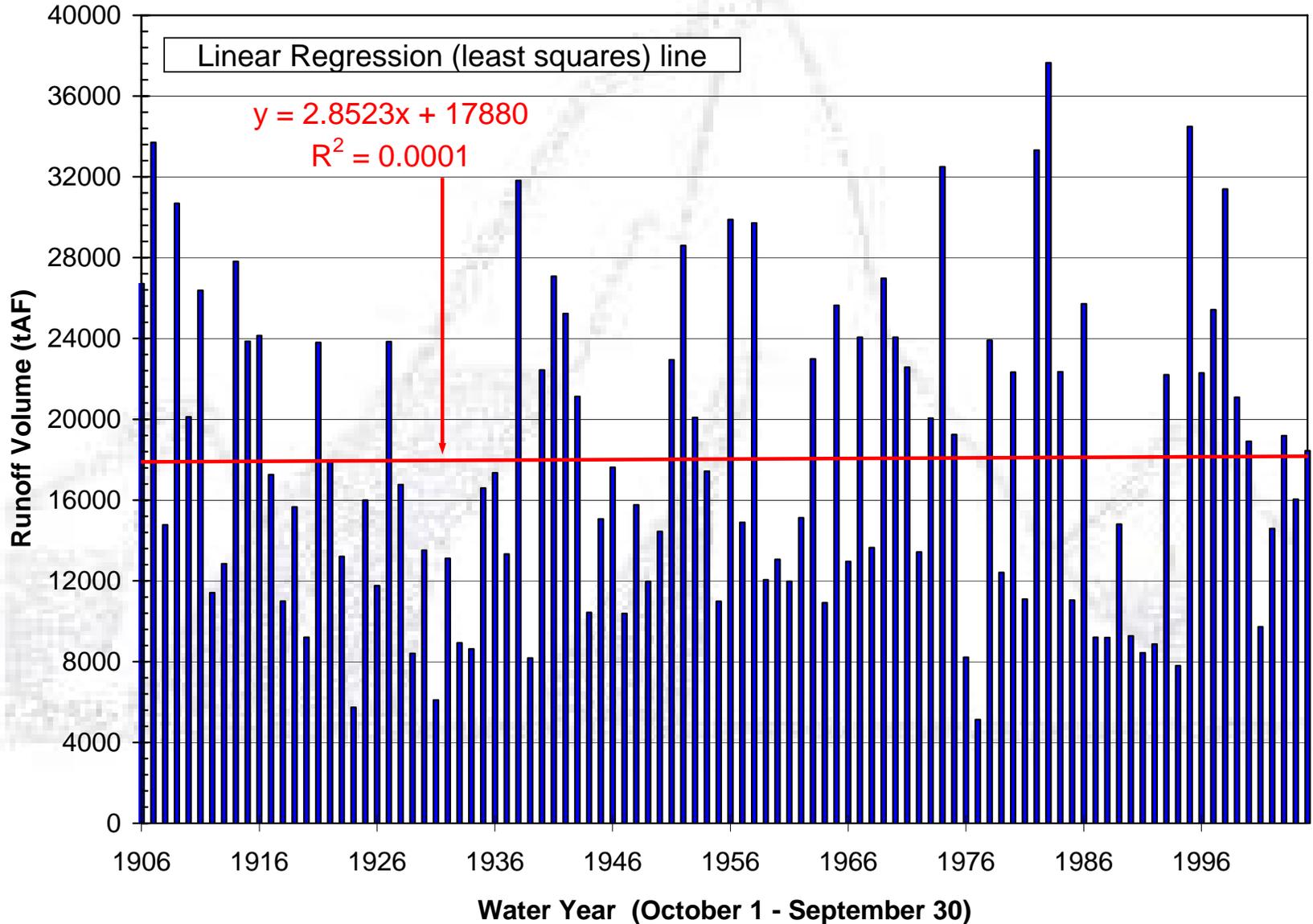
Historical Evidence...

Sacramento River System Runoff April - July Runoff in percent of Water Year Runoff





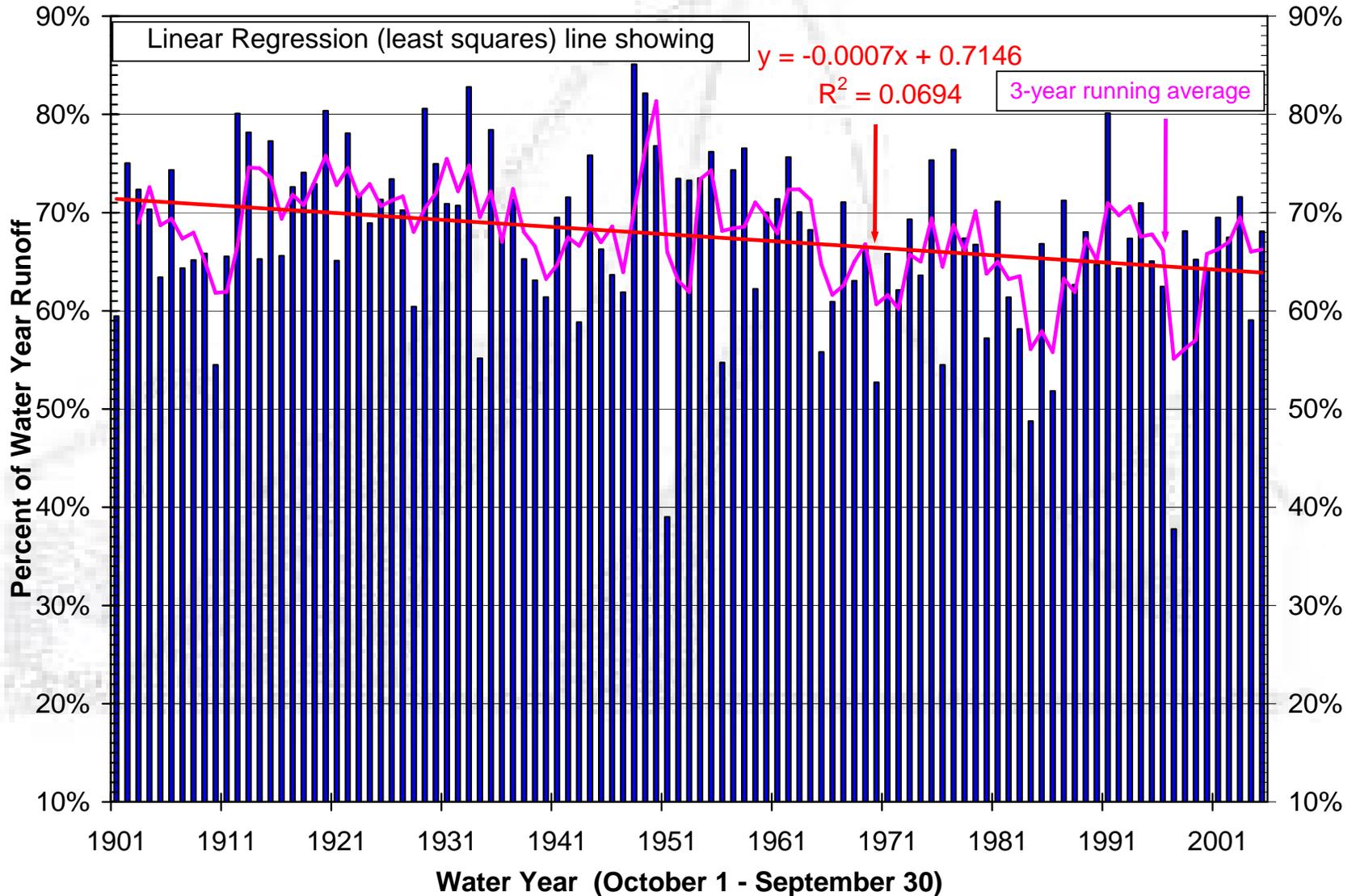
Sacramento River Runoff Water Year Runoff Volume





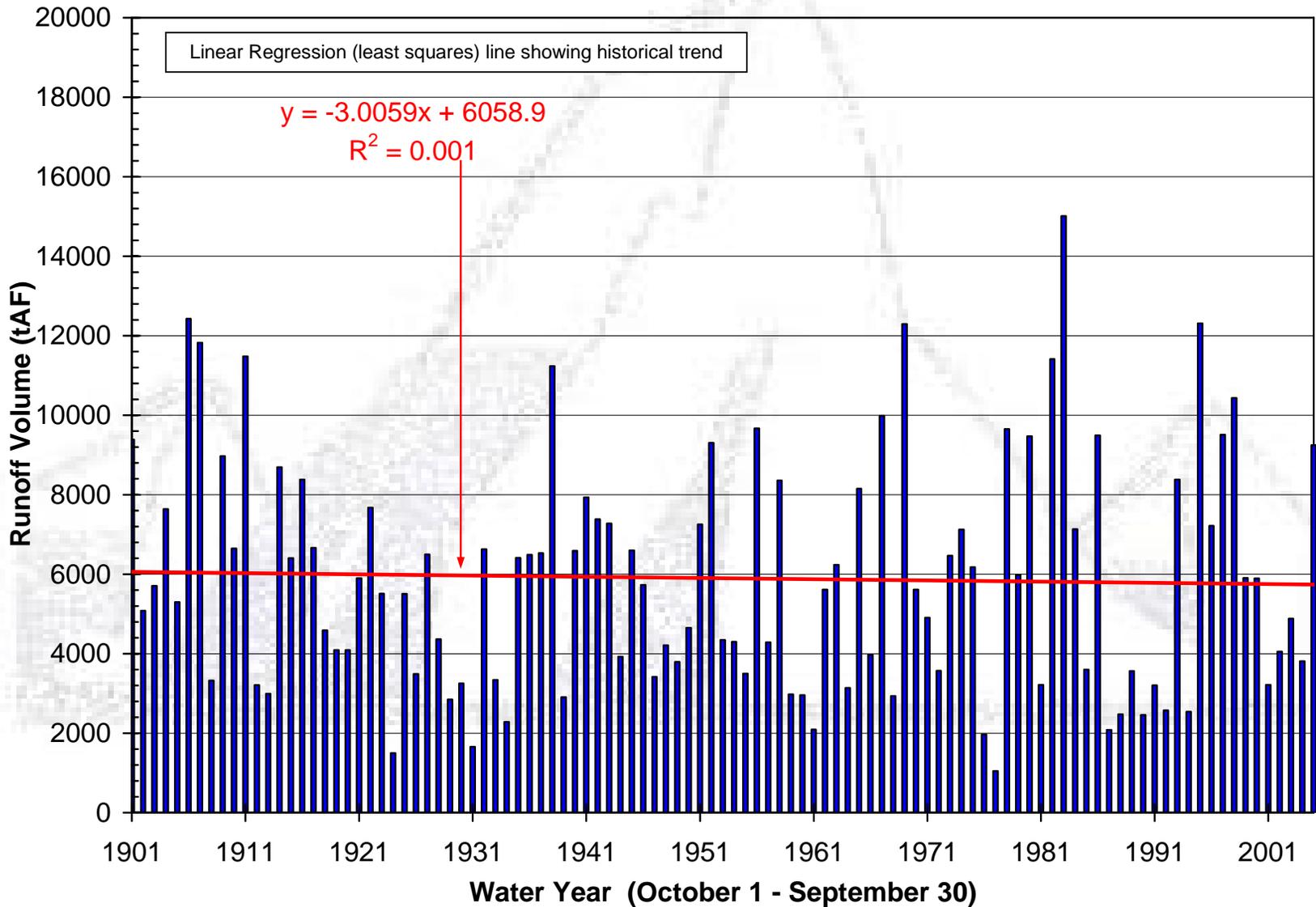
More Evidence

San Joaquin River System Runoff April - July Runoff in percent of Water Year Runoff





San Joaquin River Index Water Year Runoff Volume



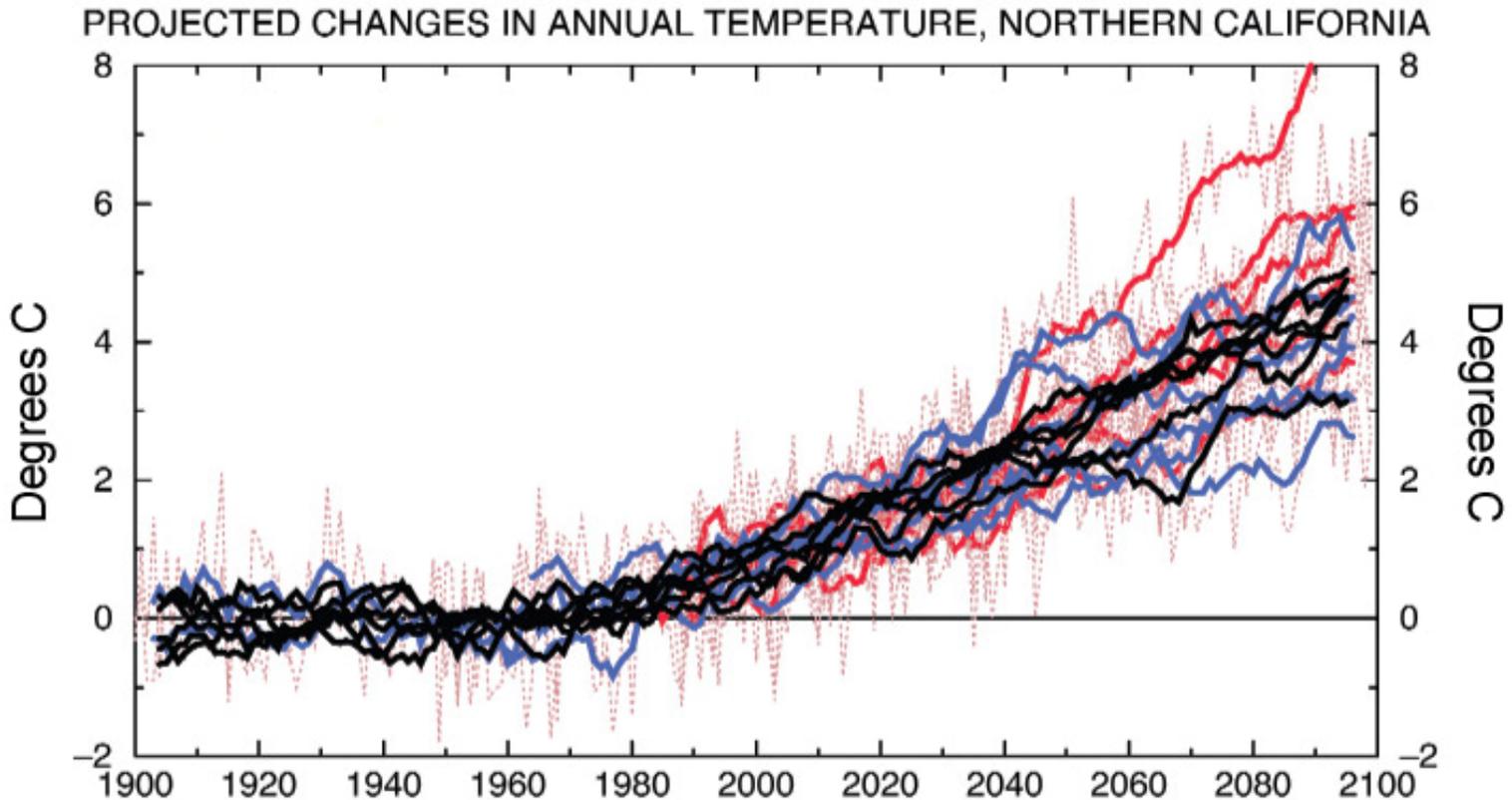


What about the future?





Climate Change Data

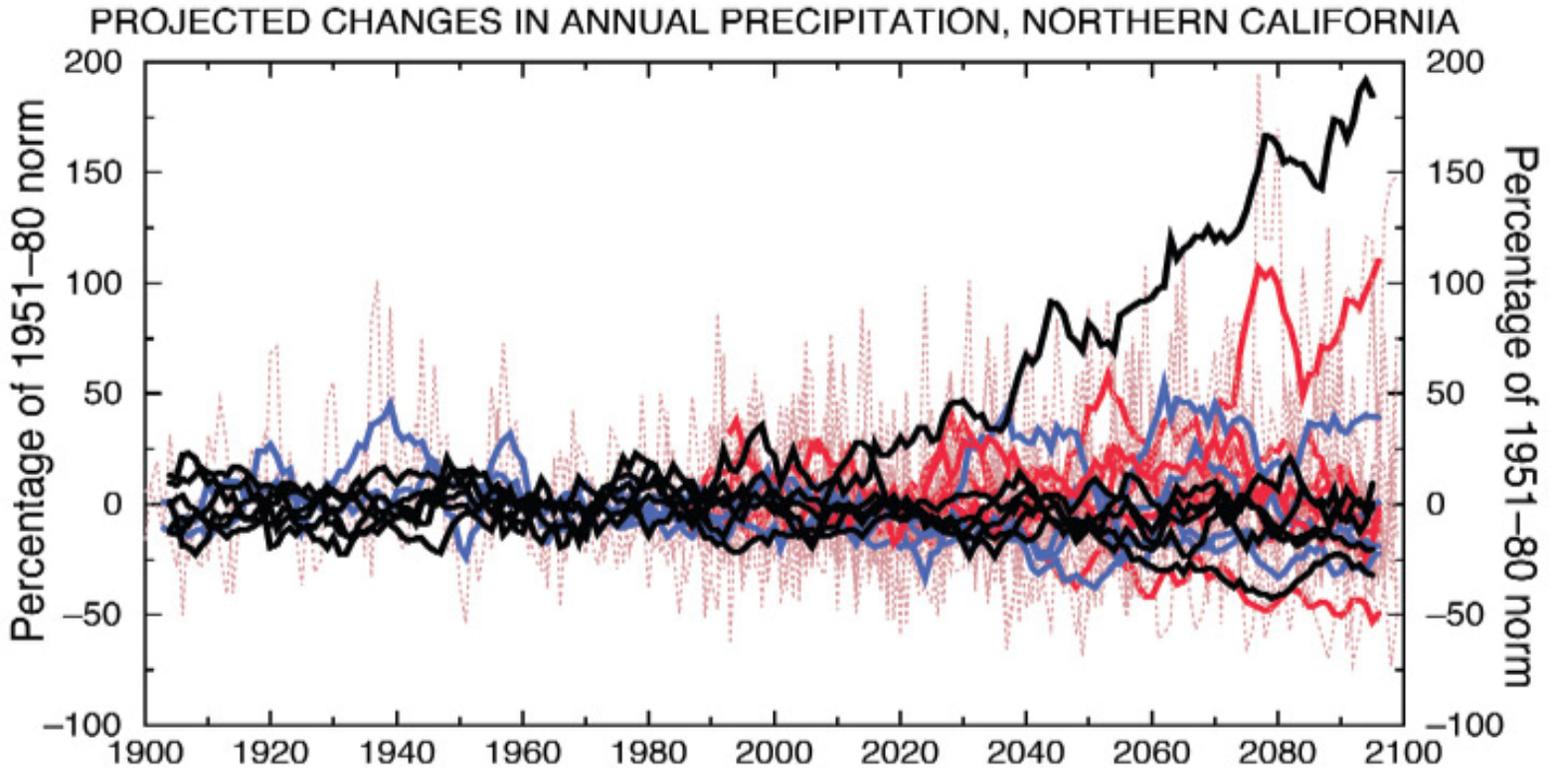


Some Uncertainty

From Dettinger, 2005



Climate Change Data



Lots of Uncertainty !

From Dettinger, 2005



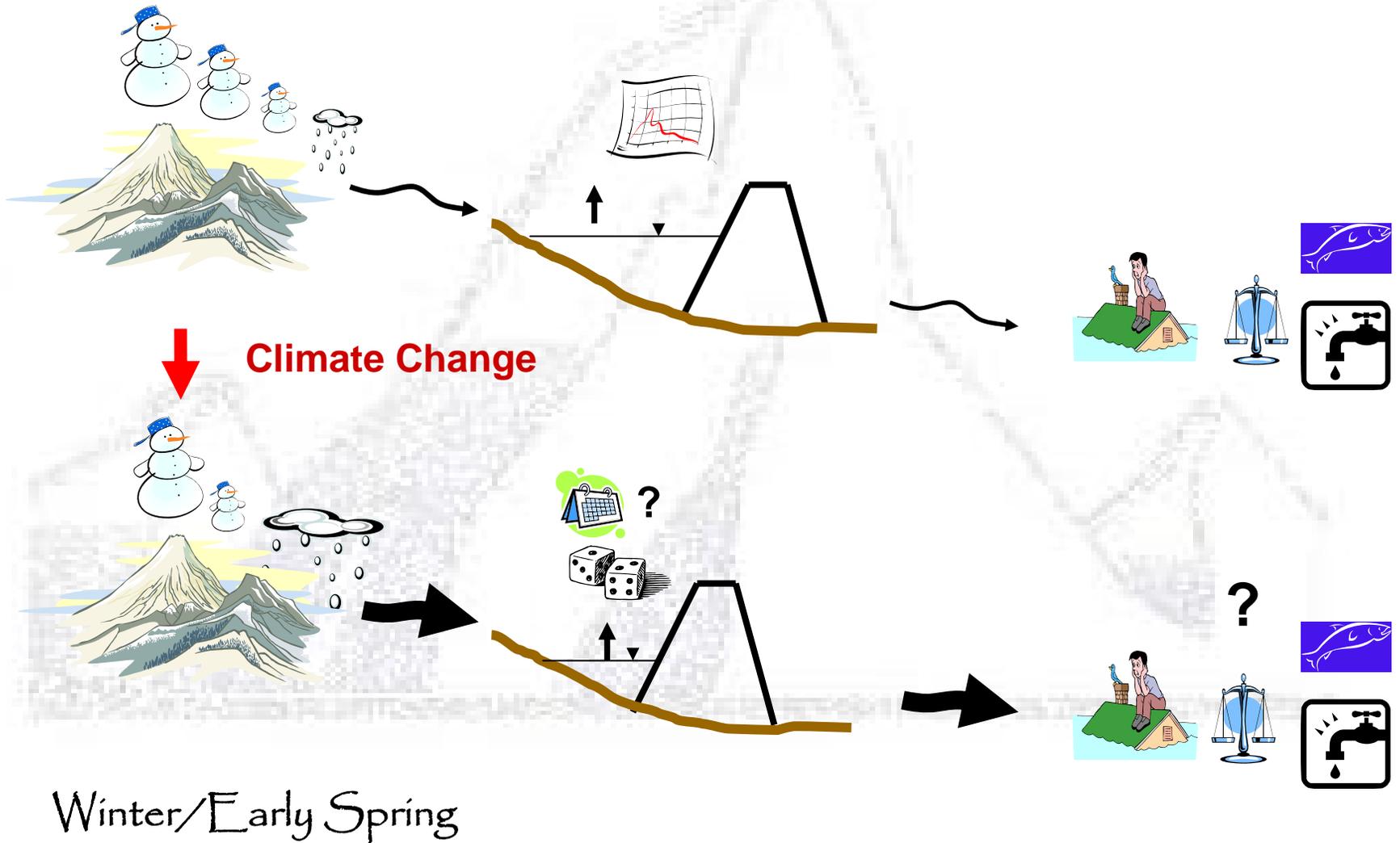
Let's Compare



- **13.5 MAF** ~ Approx. total reservoir capacity for the Sacramento Valley (excluding west-side reservoirs south of Cottonwood Creek).
- **11 MAF** ~ Approx. total reservoir capacity for the San Joaquin Valley
- **14 MAF** ~ Average annual total snow pack for the Central Valley
- A 3 degree Celsius rise in temperatures over the next century (a "moderate" projection) is expected to increase the snow elevation about 1,500 feet. This could result in a loss of water storage in the Sierra snow pack on the order of: ~ **4 to 5 MAF** — ouch!

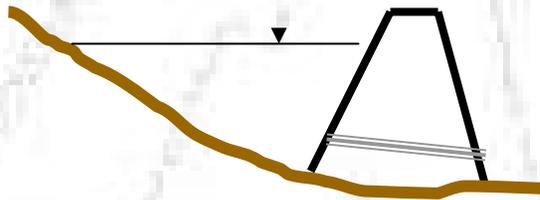


Operational Challenges - Reservoirs

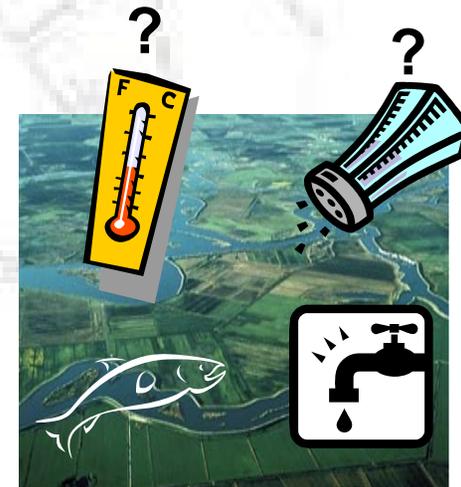
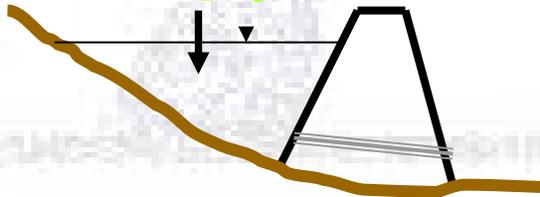




Operational Challenges - Reservoirs



Climate Change



Late Spring/Summer



What to do?

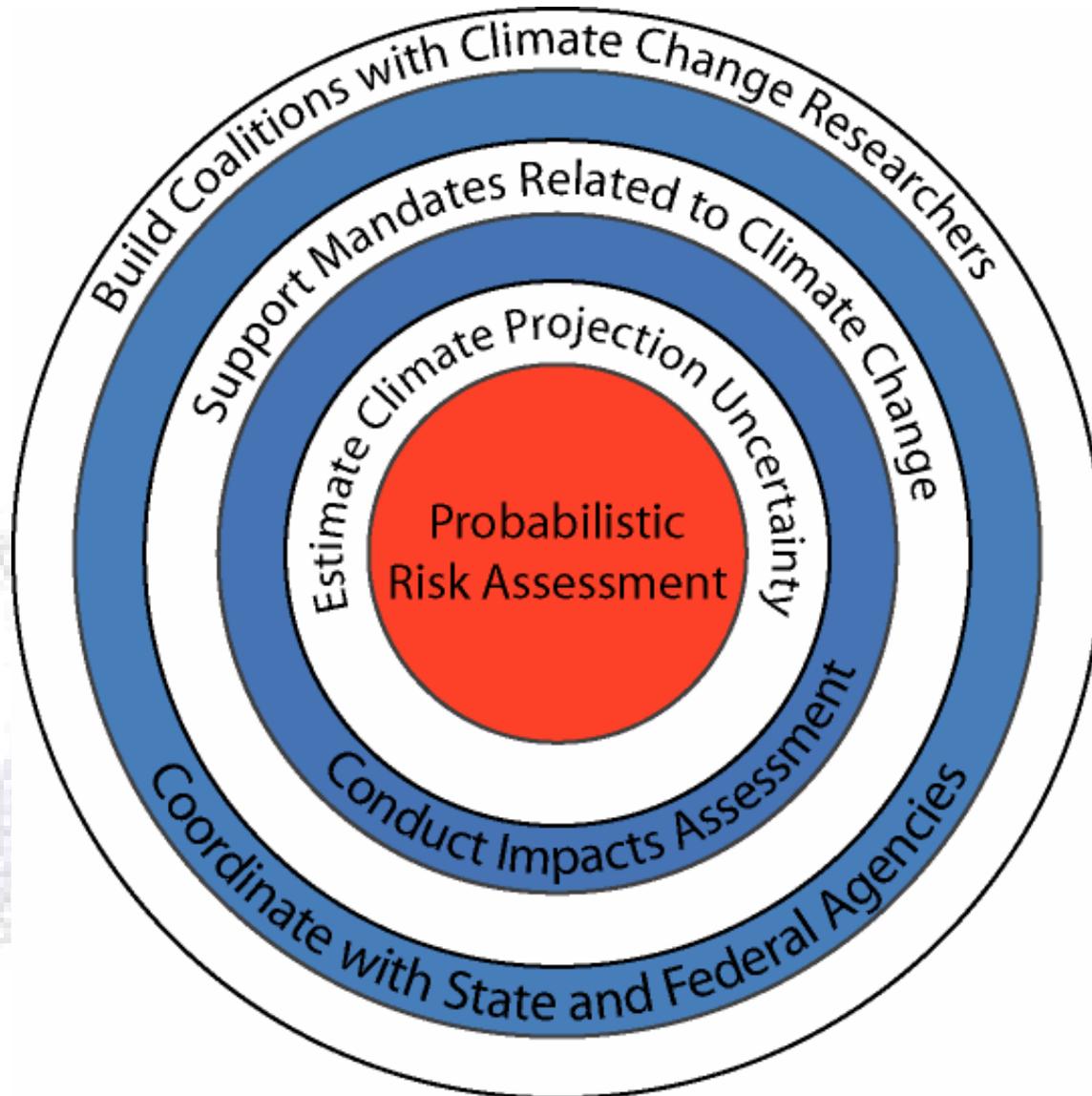


A laundry list of possible actions

- Increased monitoring of climatologic and water resource conditions
- Re-regulation of surface reservoirs
- Increased water use efficiency
- Construction of additional on-stream and/or off-stream reservoirs
- Increased groundwater recharge/conjunctive management
- Increased water banking and transfers
- Construction and operation of new/alternate water conveyance facilities
- Delta levee augmentation/rehabilitation
- Delta/Suisun Marsh modification
- Crop shifts/fallowing
- Water right revisions--amount/timing/location of diversions (SWRCB)
- Increased enforcement actions against illegal diversions (SWRCB)
- Nutrient control and other measures to protect water quality
- Installation of additional cold-water release facilities from reservoirs
- Shoreline engineering to protect coastal resources, including coastal aquifers
- Implement changes in aquatic habitat restoration efforts
- Observe and react
- Pawn all this off on our kids!



DWR Climate Action Team Work Plan Summary



www.climatechange.ca.gov

Questions?

