

# Old and New Hydrology--Implications

Presented to

Western States Water Council

Climate Change Adaptation Workshop

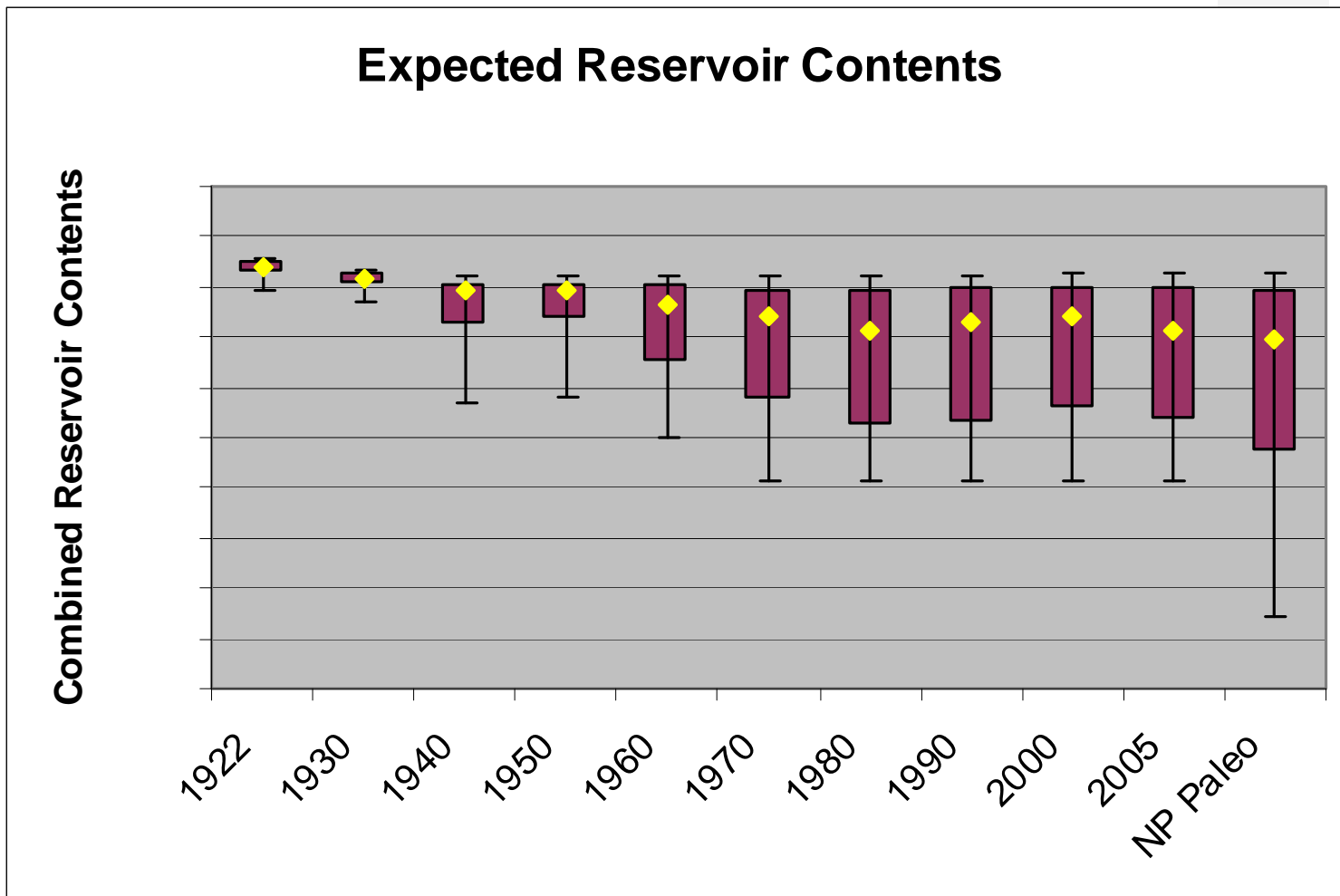
Irvine California September 23, 2008

## Twain's First Law

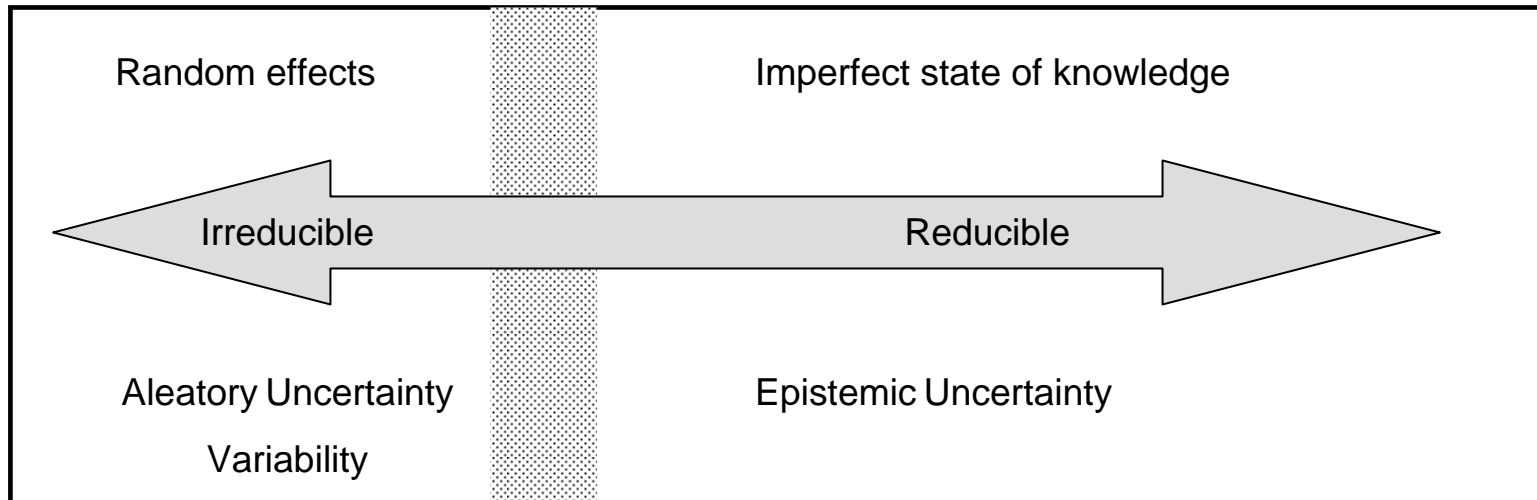
*It's not what you don't know that gets you in trouble.*

*It's what you know for sure that just ain't so.*

# How did our state of knowledge improve?

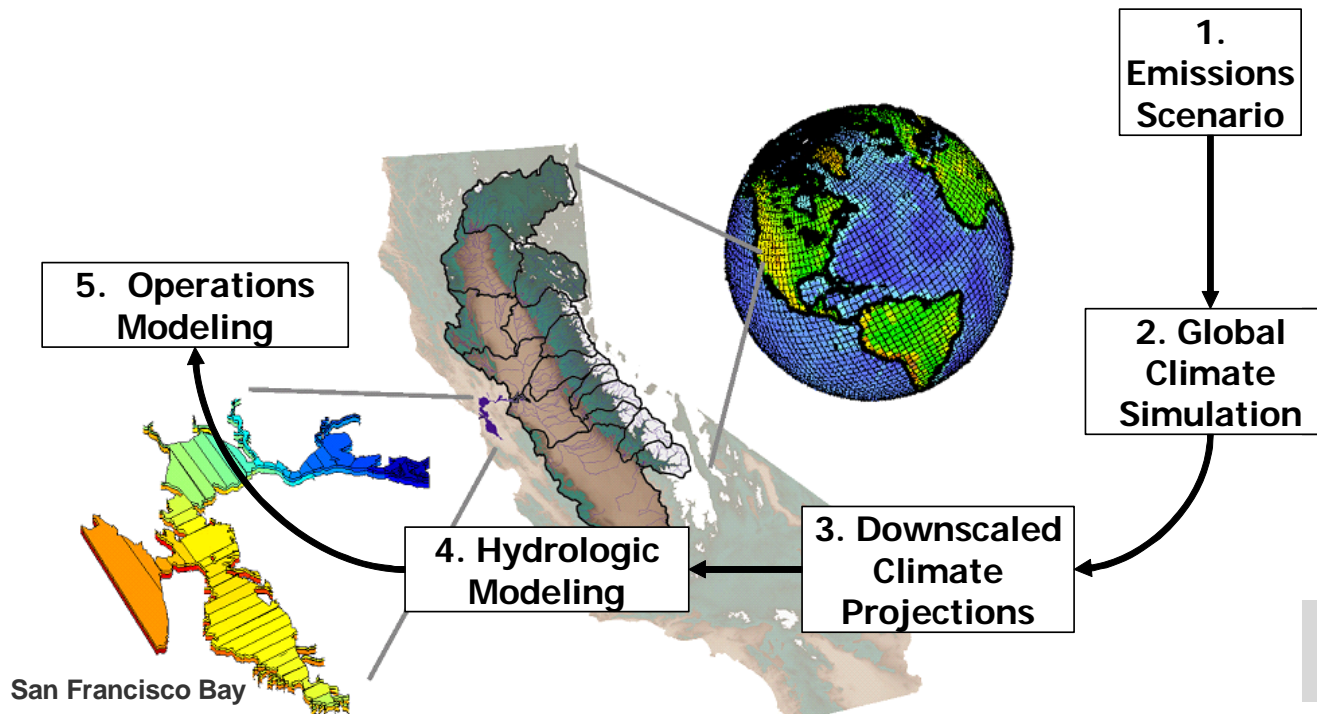


# Uncertainty and Variability

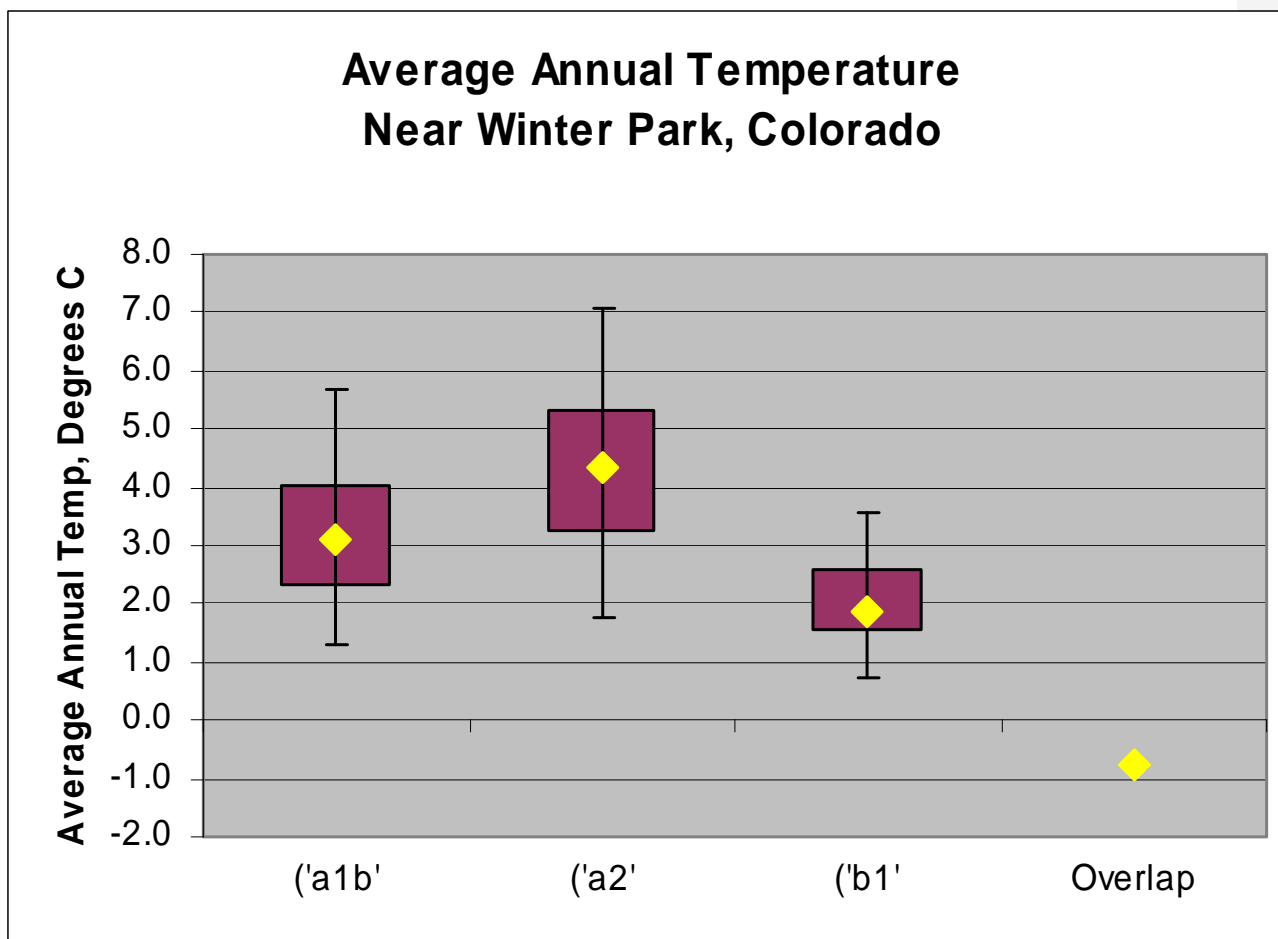


# Quantifying Future Hydrology

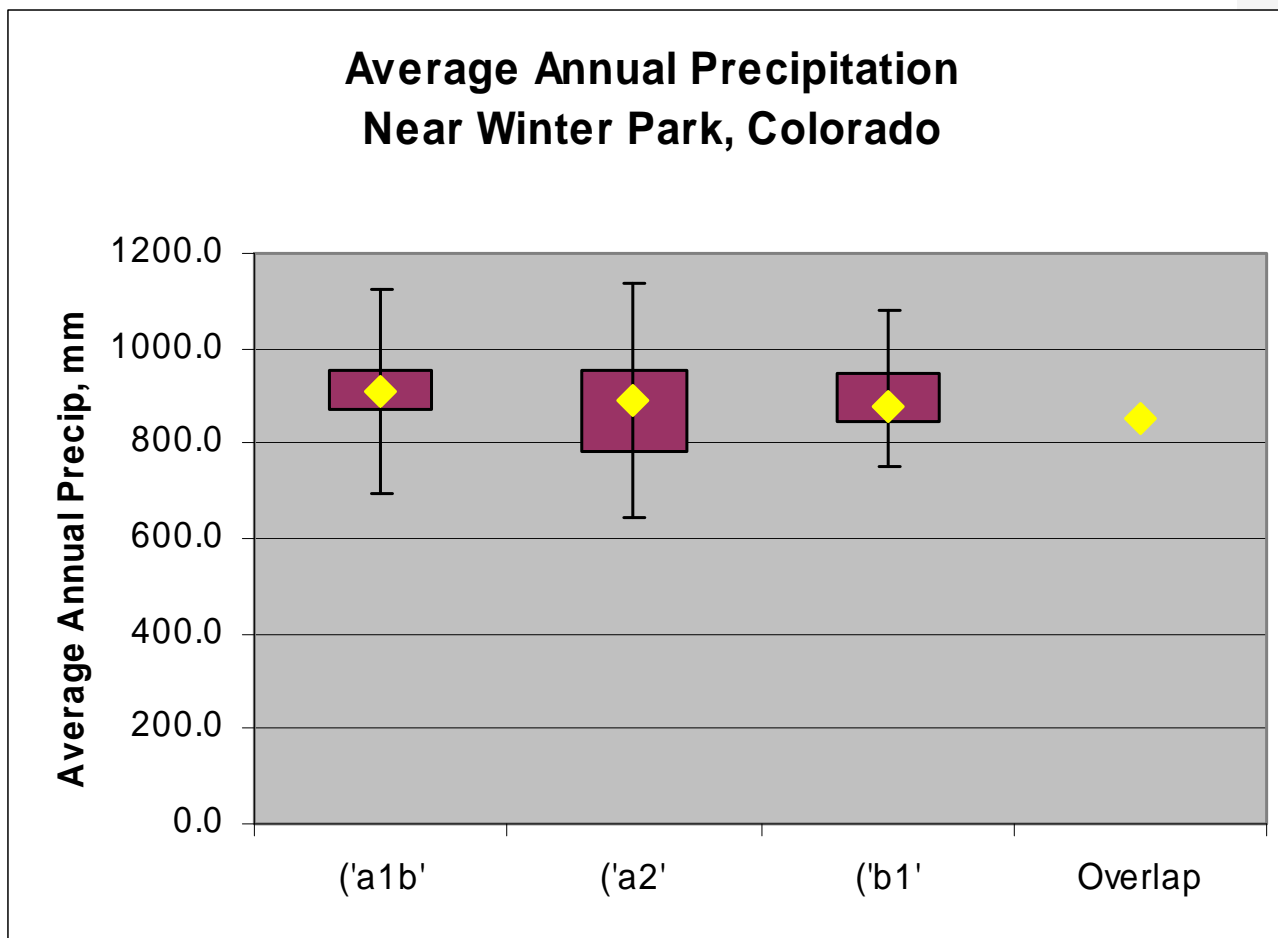
- We must rely on models to project future climate conditions.



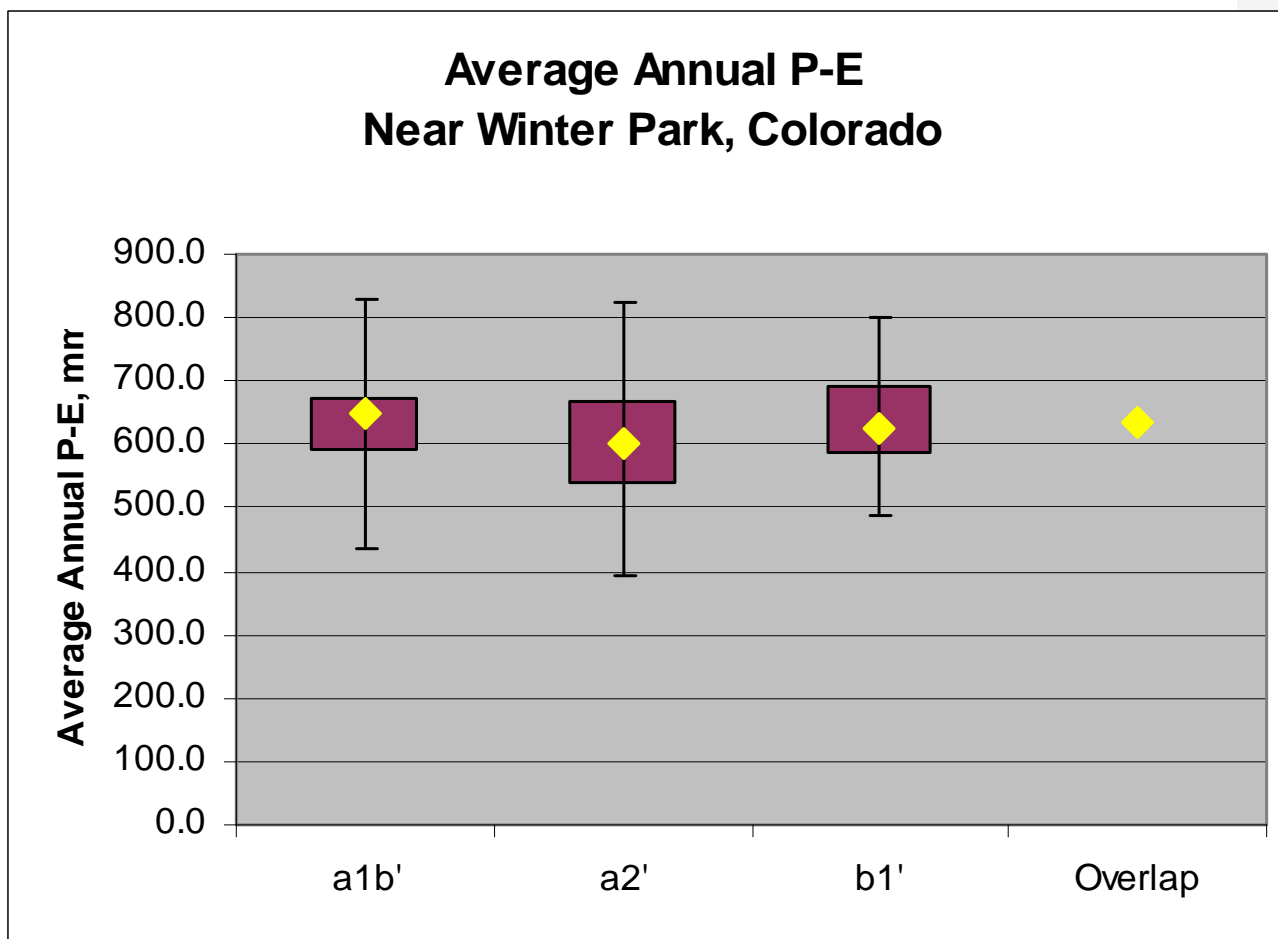
# Mean Temperature



# Mean Annual Precipitation

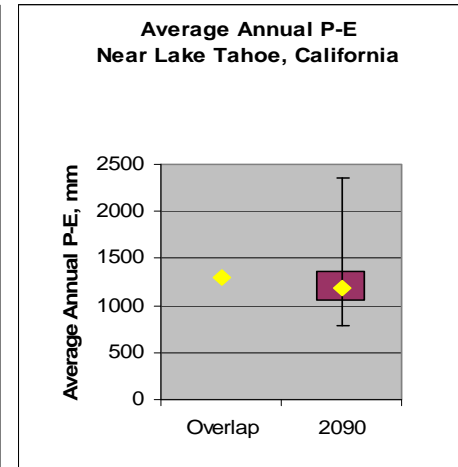
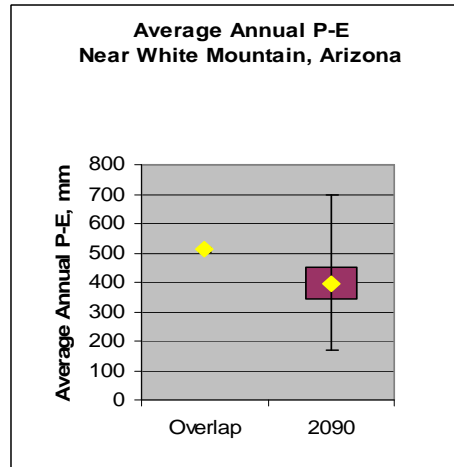
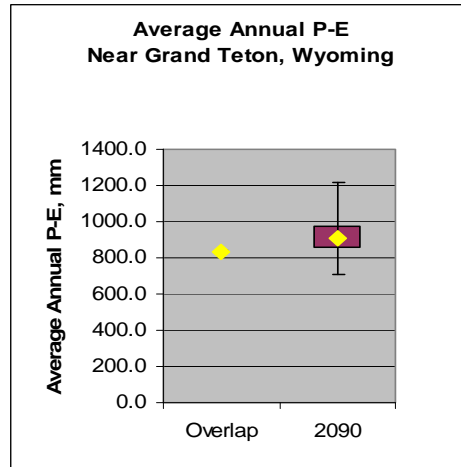
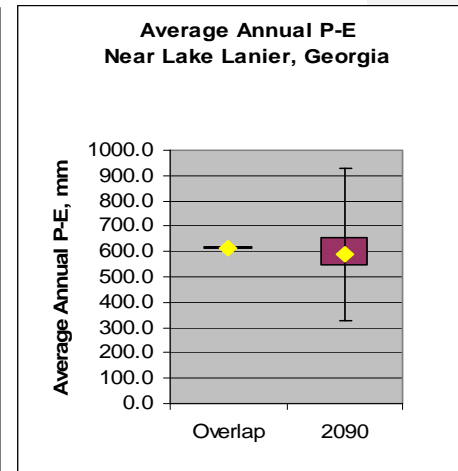
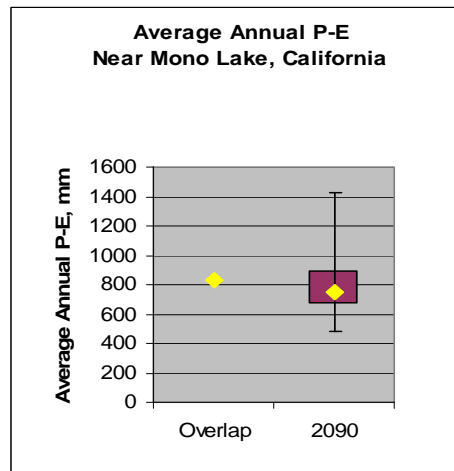
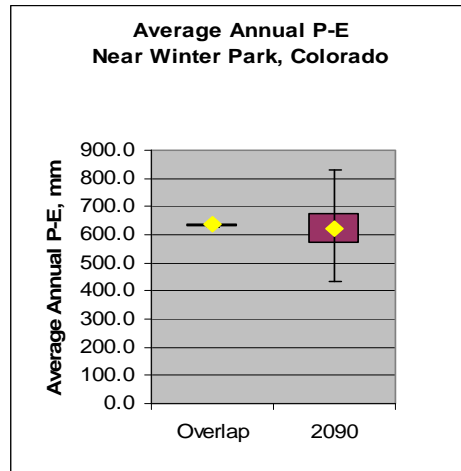


# Hydrologic Impact



# Model Estimates of Changes to Hydrologic Index

Thornwaithe



## The Challenge

- Science is showing us a future that ranges from dismal to business as usual (sort of) or beyond.
- Water resources decisions are often essentially permanent, with unlimited time frame
- There is a broad range of consequences, and no estimates of likelihood
- How can we prioritize responses and investments?

# Risk Assessment

- Conventional responses and simple answers are inadequate
- There is simply no alternative to adopting a risk assessment approach.
  - Risk assessment is necessary to prioritize the allocation of resources
  - Risk assessment requires estimates of both likelihood and consequence
  - Consequences are comparatively easy to estimate
  - Likelihoods are very poorly understood
  - *We can't fall back on frequency analysis*

## Advocates for Risk Assessment

- U.S. Congress: Public Law 110-114 (WRDA)
  - “Use of...best available ... principles and ... techniques...including *risk and uncertainty* analysis.”
- American Society of Civil Engineers
  - “Establish *quantifiable risk*...”
  - “Establish core risk assessment research programs...”
- Stephen Schneider and some other climate scientists
  - “It is simply very difficult for policy makers to have a ‘consequences alone’ definition of risk

## Apply “Hydro-Climate” Engineering

- Better science will help, but we can't wait
- Begin practicing the applied science of “hydro-climate” engineering
- Recognize that assessing likelihood will be central to this effort
  - Estimates of likelihood are necessarily subjective
  - There are no frequency data to work from
- Create standing risk assessor panels

# Risk Assessor Panels

- Risk Assessor Panels at three levels
  - National
  - State
  - Regional/Supply area
- Quantify “credibility” for emission scenarios and models at relevant locales and scales
  - Integrate science, data and judgment
  - State and local panels refer “upward”
  - Use their assessment of credibility of “higher” assessors as one piece of information in their own assessments
- Quantify likelihoods of consequences
  - Will allow prioritization of investments and responses

*Prediction is very difficult, particularly if it is about the future.*

Niels Bohr, as channeled by Yogi Berra.