

RECLAMATION

Managing Water in the West

Case Study:

California CVP OCAP Biological Assessment (2008)

Levi Brekke, Reclamation Technical Service Center (Denver, CO)

Workshop On Advanced Climate Modeling And Decision-Making In Support Of Climate Services, hosted by the Aspen Global Change Institute
Aspen, CO, 21-24 September 2009



U.S. Department of the Interior
Bureau of Reclamation

Mission

*...manage, develop,
and protect water and
related resources in an
environmentally and
economically sound
manner in the interest
of the American public.*



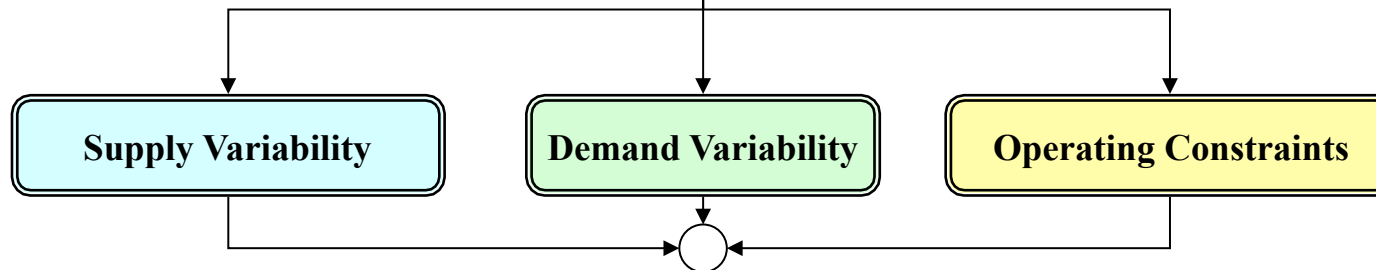
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Framework for relating Climate Information to Water Resources Planning (*traditional*)

I. Choose Climate Context

Instrumental Records:
observed weather (T and
P) and runoff (Q)

II. Relate to Planning Assumptions



III. Conduct Planning Evaluations

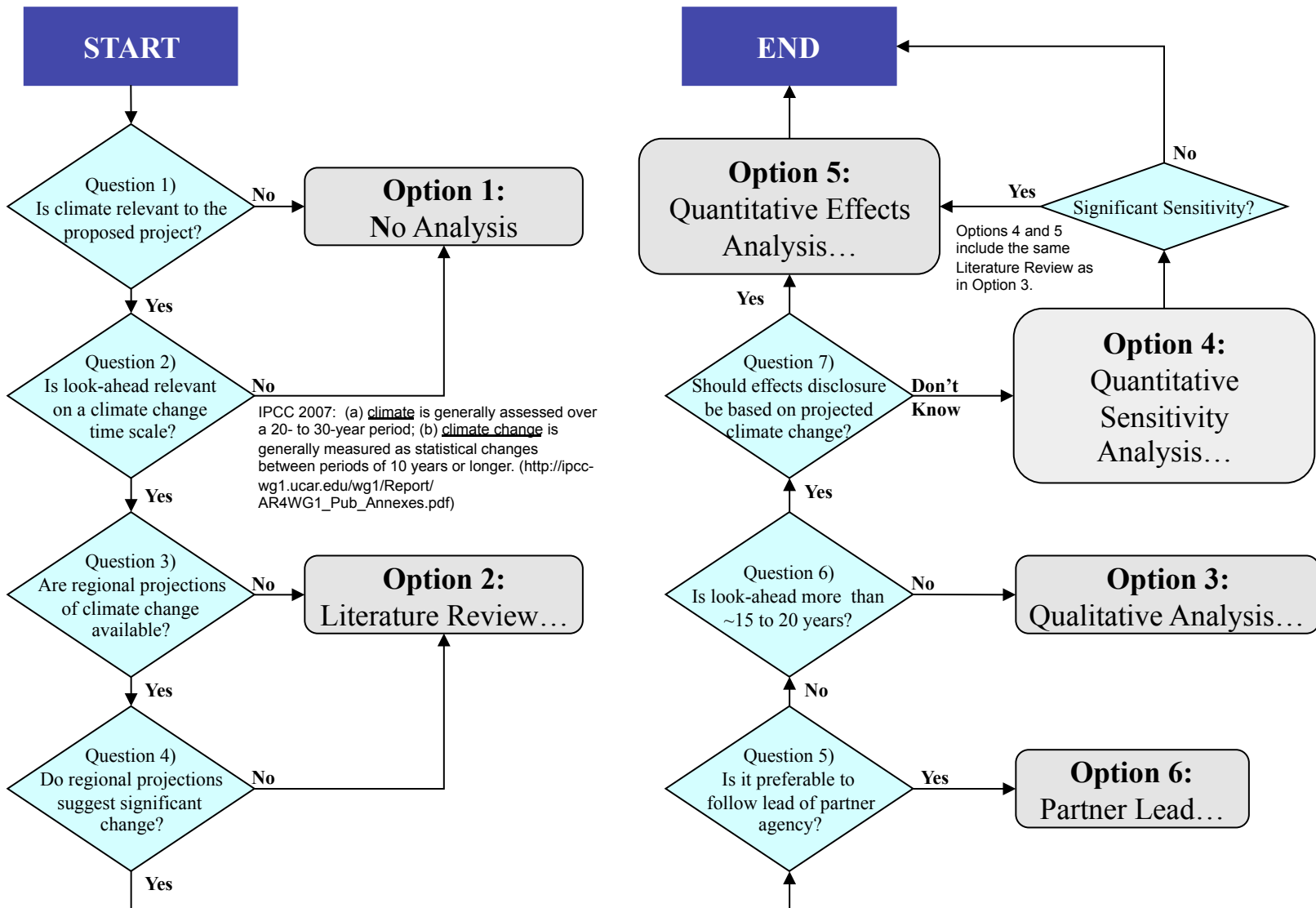
System Analysis, Evaluate Study Questions
(related to Resource Management Objectives)

Incorporating Projected Climate: Information Priorities

- Future precipitation and temperature data at basin-relevant resolution (downscaled)
 - *ideally* we'd also consider other vars. relevant to watershed ET (e.g., winds, radiation, humidity)
- Projection-rich dataset
 - CMIP3 dataset is large – we want our study to be representative
 - Support assessments of projection uncertainty
 - Support risk-based planning
- Support time flexible planning
 - future period of interest varies by planning questions
- Support consistent CC treatment, westwide

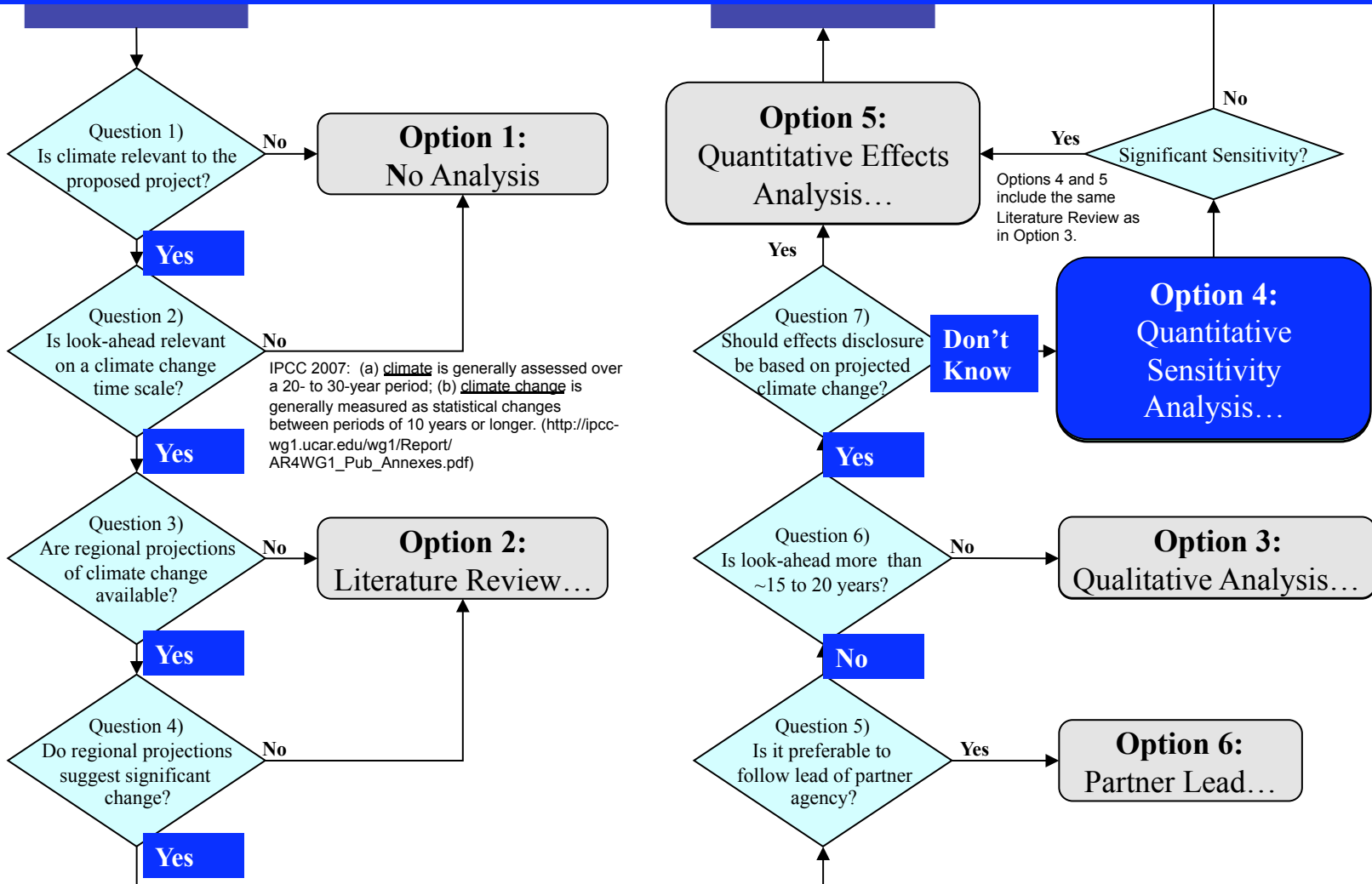
Introducing Projected Climate information:

Level of Analysis?



Case Study: ESA Consultation in CA's Central Valley, sensitivity to climate (CVP OCAP 2008)

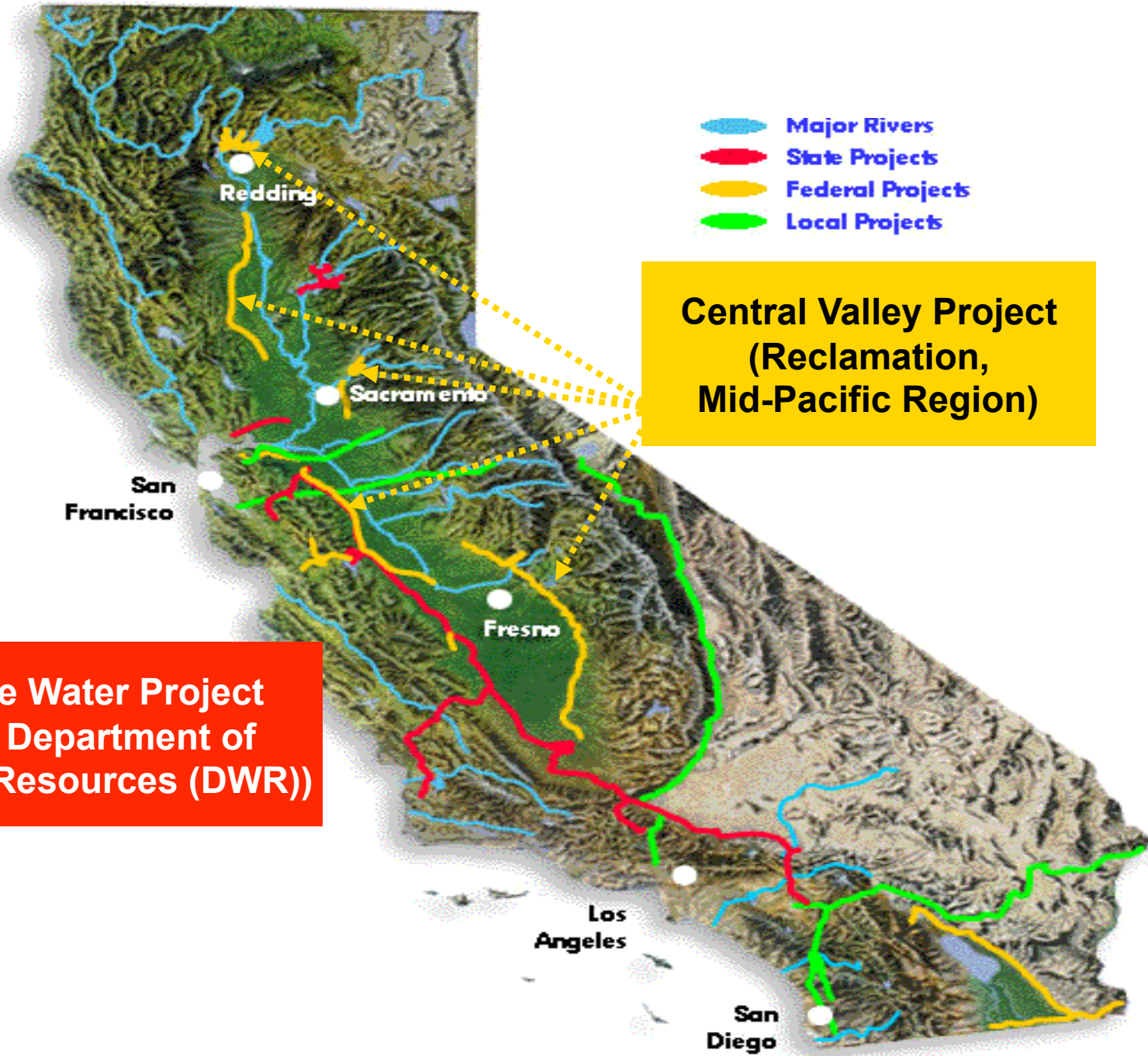
http://www.usbr.gov/mp/cvo/OCAP/sep08_docs/Appendix_R.pdf



CVP OCAP 2008: Background

- Multiple Listed/Threatened Species
 - Delta Smelt, several salmon fisheries
- Tasks
 - Water agencies produce Biological Assessment on effects of long-term operations (through 2030)
 - Water agencies consult with Fisheries agencies
 - Fisheries agencies produce Biological Opinions
- Key Issues
 - Geographically overlapping water systems
 - Upstream vs. downstream fisheries management
 - Climate Change

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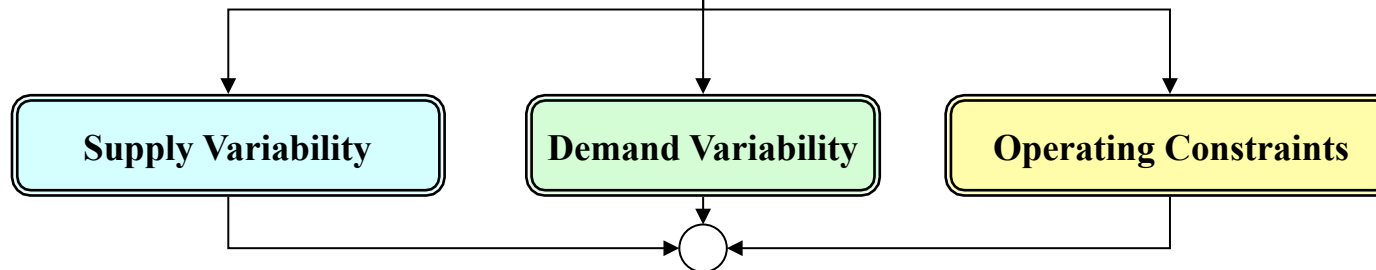


CVP OCAP 2008: Start with Traditional Framework...

I. Choose Climate Context

Instrumental Records:
observed weather (T and P)
and runoff (Q)

II. Relate to Planning Assumptions

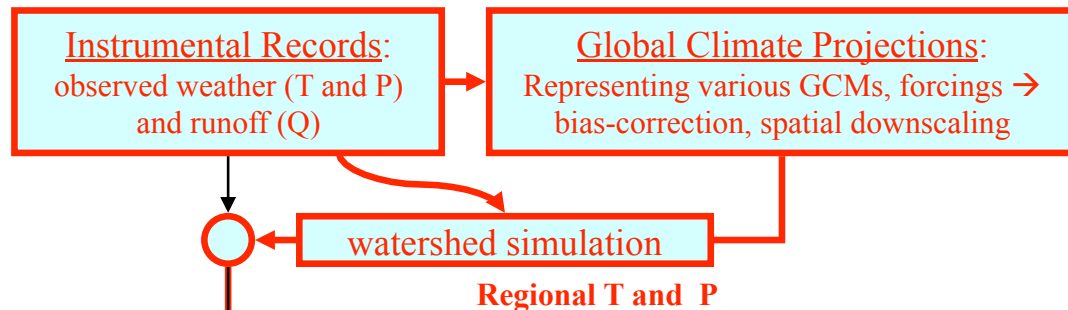


III. Conduct Planning Evaluations

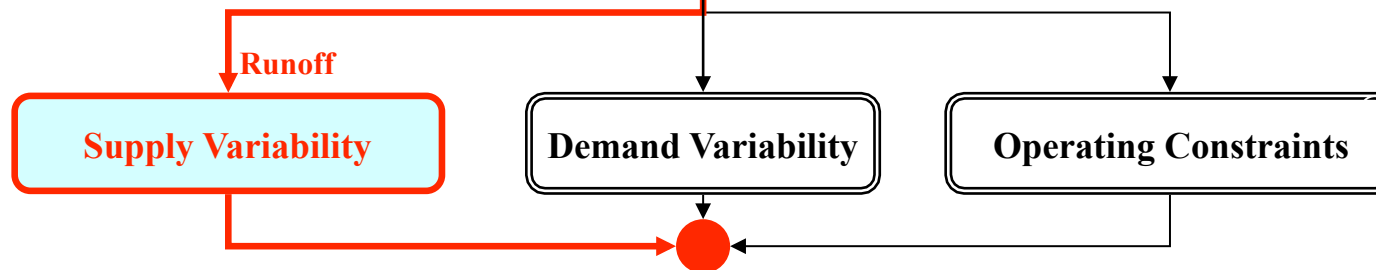
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CVP OCAP 2008: Add Regional Climate Projections

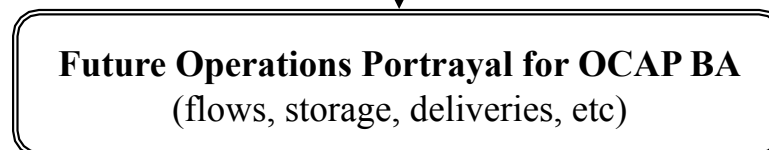
I. Choose Climate Context



II. Relate to Planning Assumptions

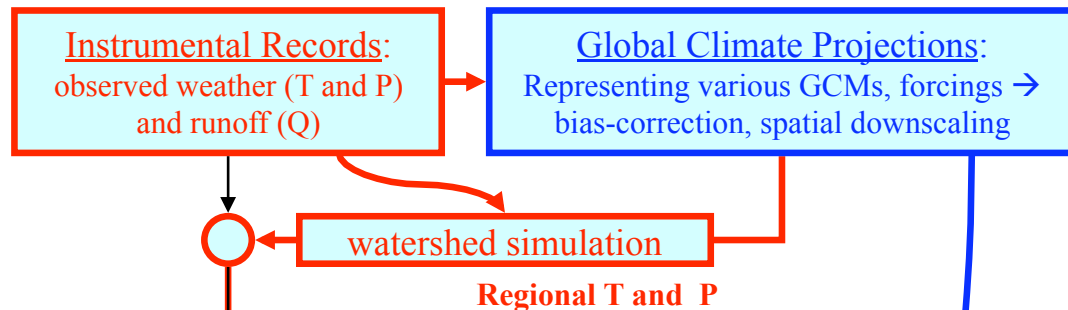


III. Conduct Planning Evaluations

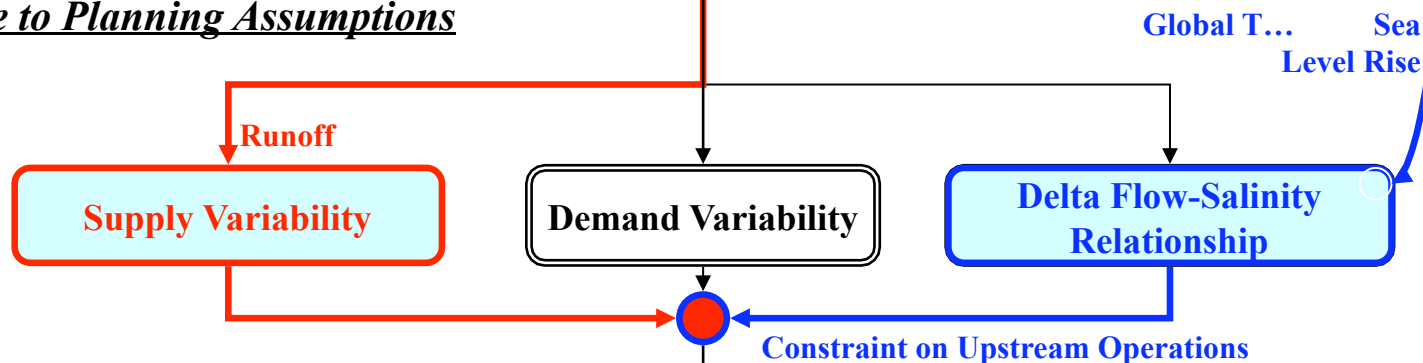


CVP OCAP 2008: Add Global Climate, Sea Level Projections

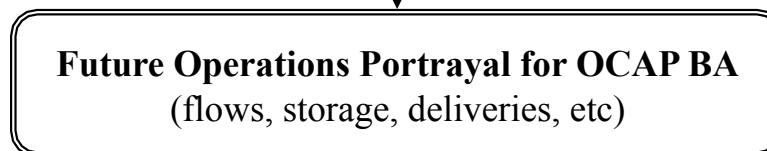
I. Choose Climate Context



II. Relate to Planning Assumptions

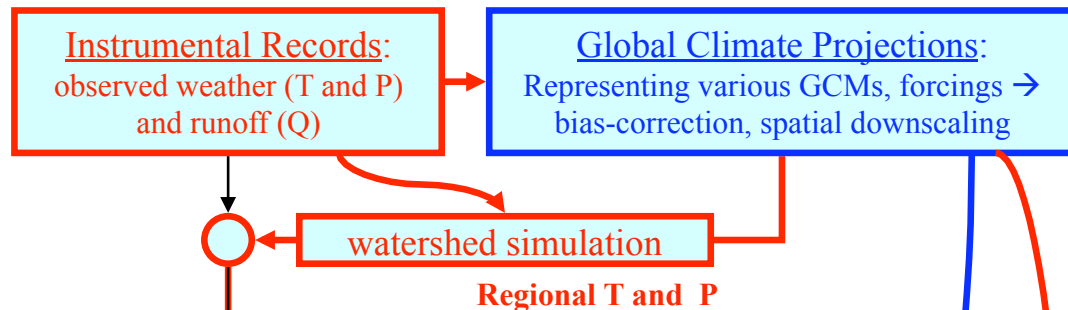


III. Conduct Planning Evaluations

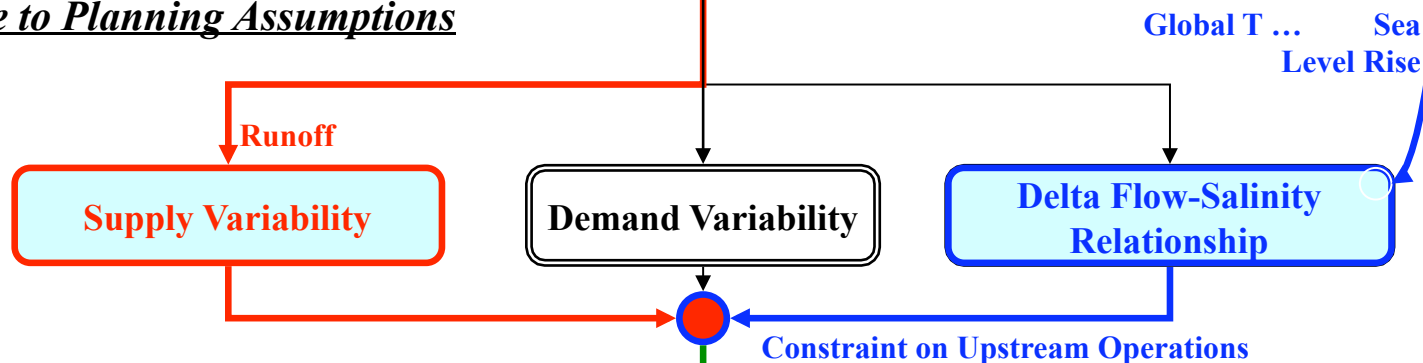


CVP OCAP 2008: Assess Operations, Water Temperatures

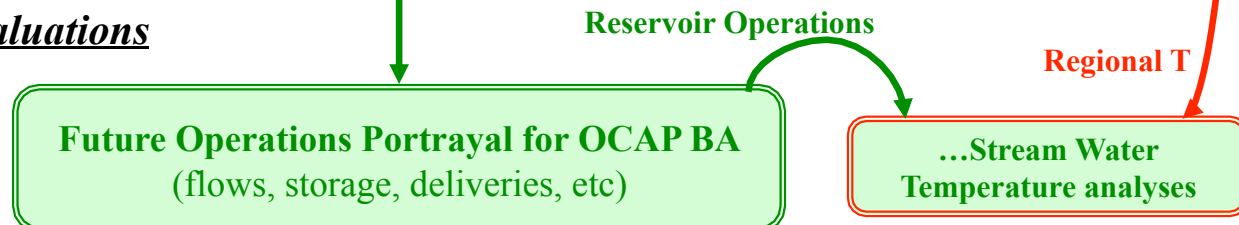
I. Choose Climate Context



II. Relate to Planning Assumptions



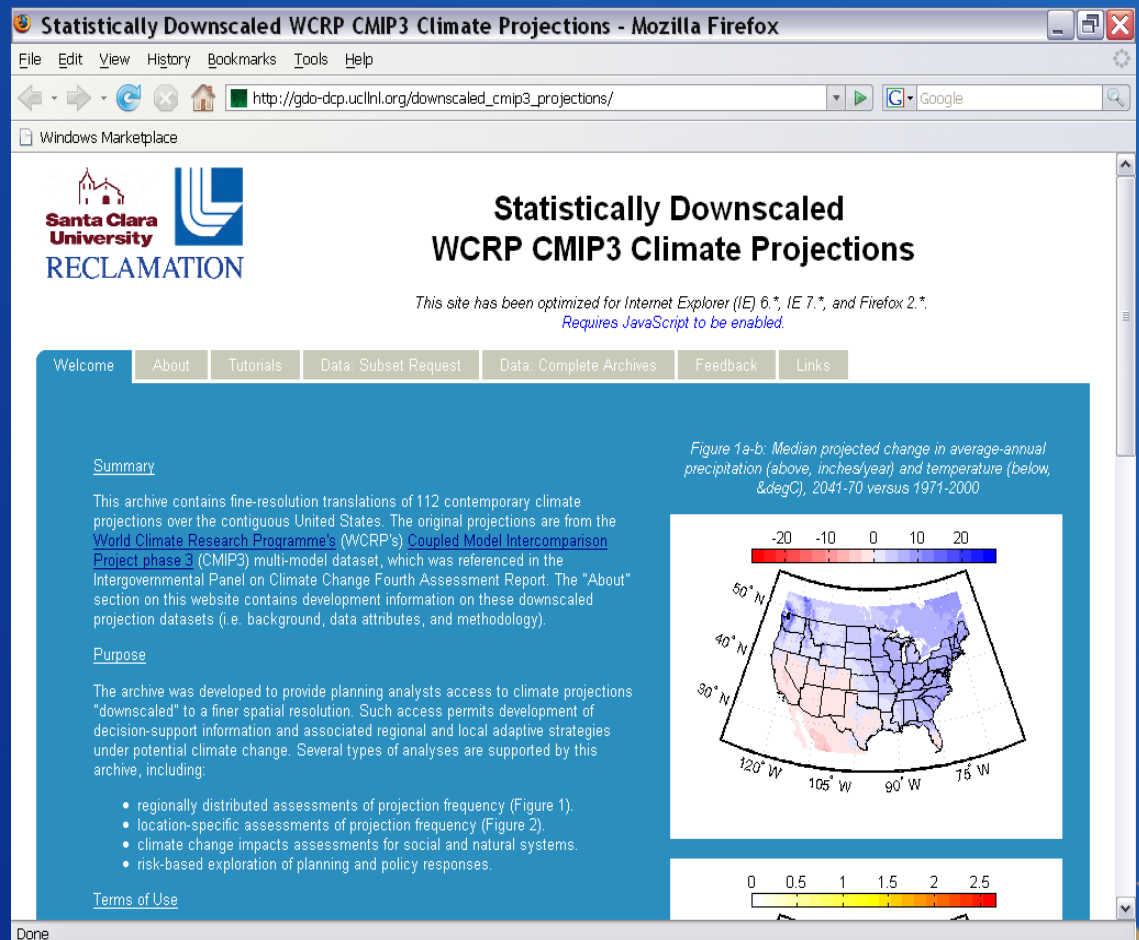
III. Conduct Planning Evaluations



CVP OCAP 2008: Data Source, Regional Climate Projections

http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/

- Developers
 - Santa Clara University
 - Reclamation
 - LLNL
- Funding
 - Reclamation, DOE NETL
- Contents
 - 112 projections, produced by 16 GCMs, 3 emissions paths, 1 or more “runs” per combo
 - Variables: T_{air} and P,
 - Spatial resolution & extent: $1/8^\circ$, contiguous U.S.
 - Time resolution & extent: monthly, 1950-2099



CVP OCAP 2008:

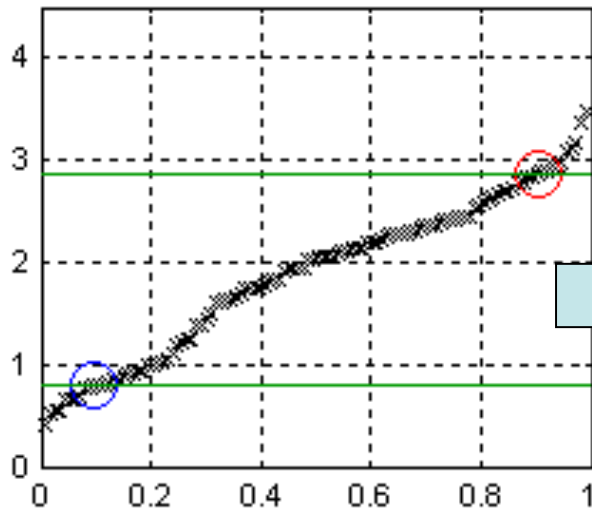
Selecting Regional Climate Projections

- Goal: Choose a small set of projections that represent the breadth of available information
- Question: Cull projections? no... (unclear basis)
- Selection Factors:
 1. *Climate periods* for assessing projected changes (future and historical)
 2. *Climate metric* simply for assessing spread of projected changes (guide projection selection)
 3. *Location* for assessing spread
 4. *Change range of interest* within the spread

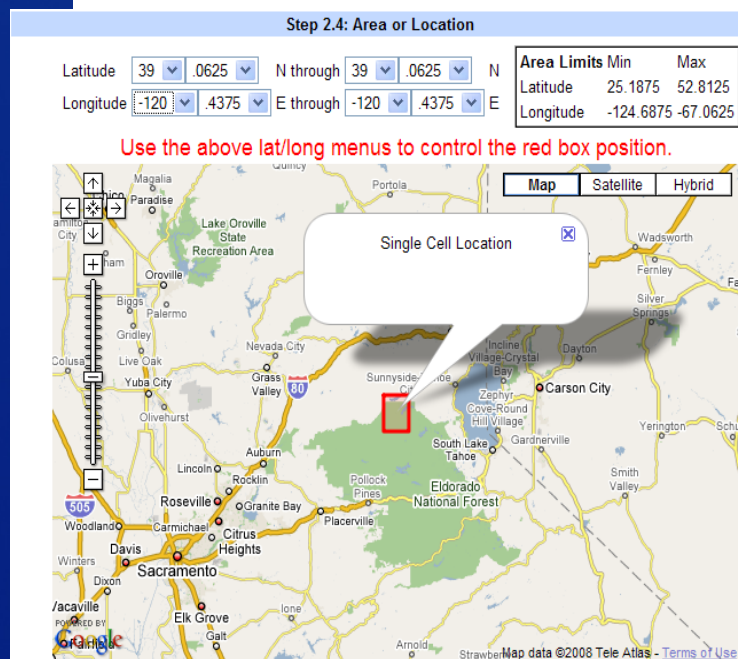
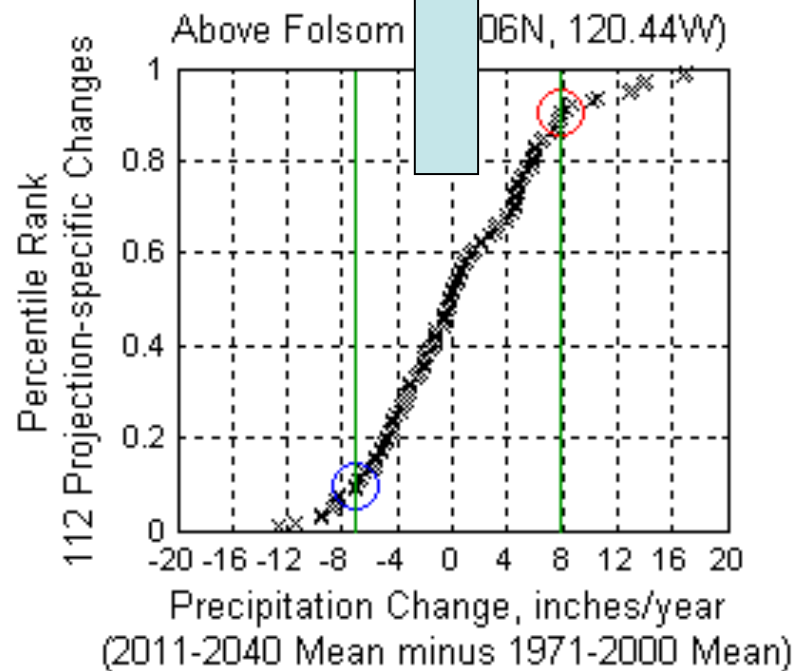
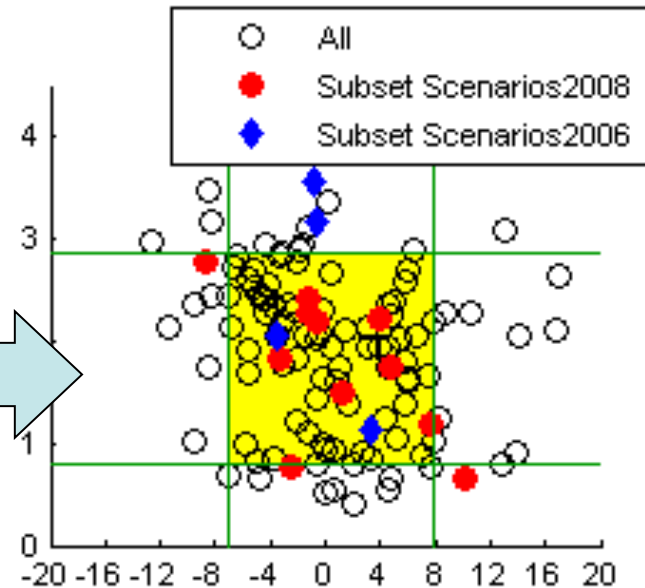
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Temperature Change, °F
(2011-2040 Mean minus 1971-2000 Mean)

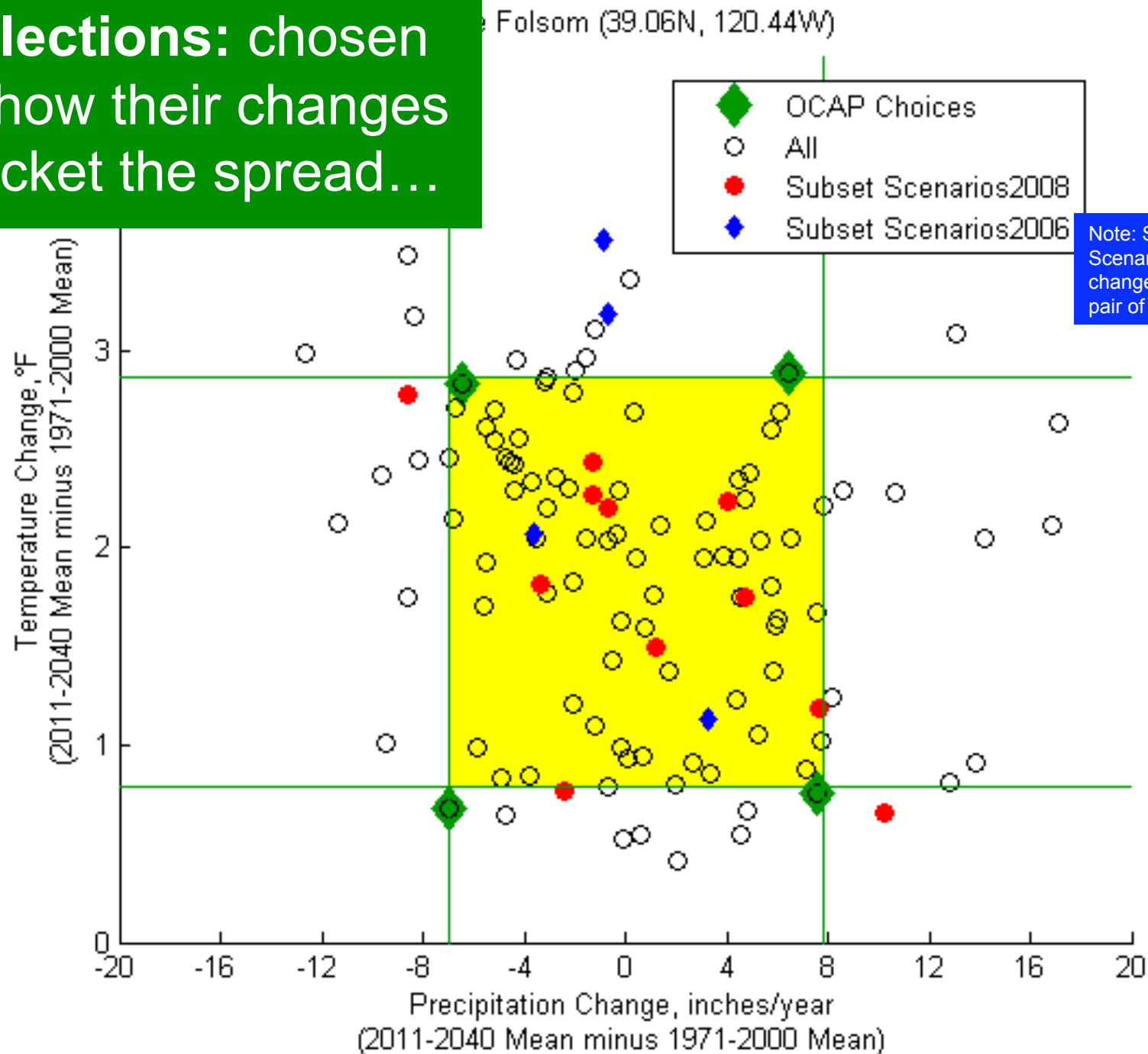
Above Folsom (39.06N, 120.44W)



Percentile Rank
112 Projection-specific Changes



**Selections: chosen
for how their changes
bracket the spread...**



CVP OCAP 2008, Unaddressed Issues

→ Research Needs

- Incorporating projected climate variability?
 - Droughts
 - Floods
- Water Demands?
- Watershed Vegetation, Ecosystems responses?
- Groundwater response?
- Socioeconomic response?
- Compounding uncertainties?
- ...

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Supply Variability: novel sequencing approach in CRB Study (2007), use of Paleo, Stochastics

I. Choose Climate Context

Paleoclimate Proxies:
reconstructed runoff (Q)

Instrumental Records:
observed weather (T and P)
and runoff (Q)

statistical modeling

Frequencies

Period-Statistics

II. Relate to Planning Assumptions

Supply Variability

Demand Variability

<http://www.usbr.gov/lc/region/programs/strategies.html>

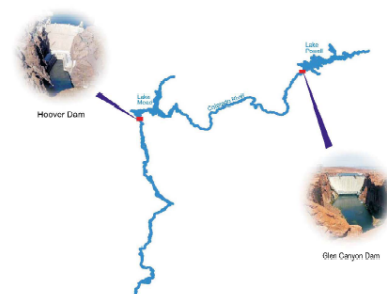
III. Conduct Planning Evaluations

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Final
Environmental Impact Statement



Colorado River Interim Guidelines for Lower Basin Shortages and
Coordinated Operations for Lake Powell and Lake Mead

Volume I

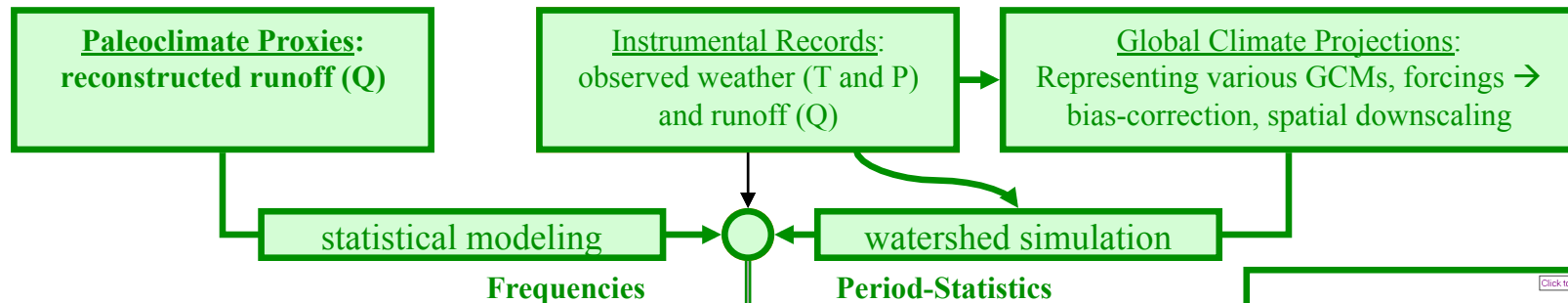
U.S. Department of the Interior
Bureau of Reclamation
Upper and Lower Colorado Regions

October 2007

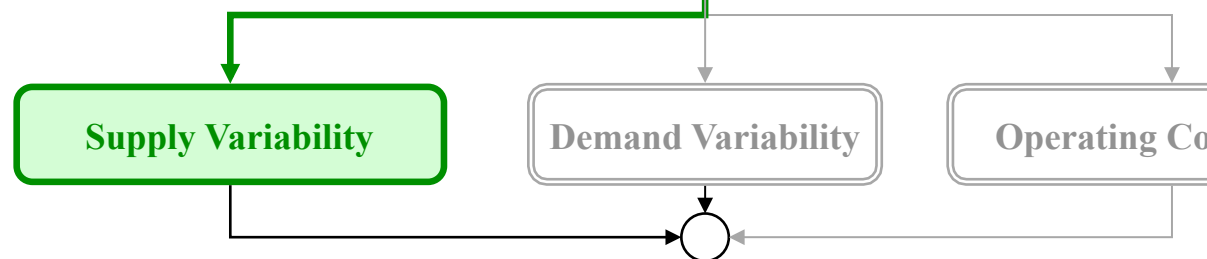


Supply Variability: extend 2007 approach? Blend paleo and projected climate? (Reclamation 2009)

I. Choose Climate Context



II. Relate to Planning Assumptions



III. Conduct Planning Evaluations

System Analysis, Evaluate Study C
(related to Resource Management Objectives)

RECLAMATION
Managing Water in the West

Long-Term Planning Hydrology
based on Various Blends of
Instrumental Records, Paleoclimate,
and Projected Climate Information



U.S. Department of the Interior
Bureau of Reclamation

July 2009

Info: Levi Brekke (lbrekke@usbr.gov),
Jim Prairie (jprairie@usbr.gov)

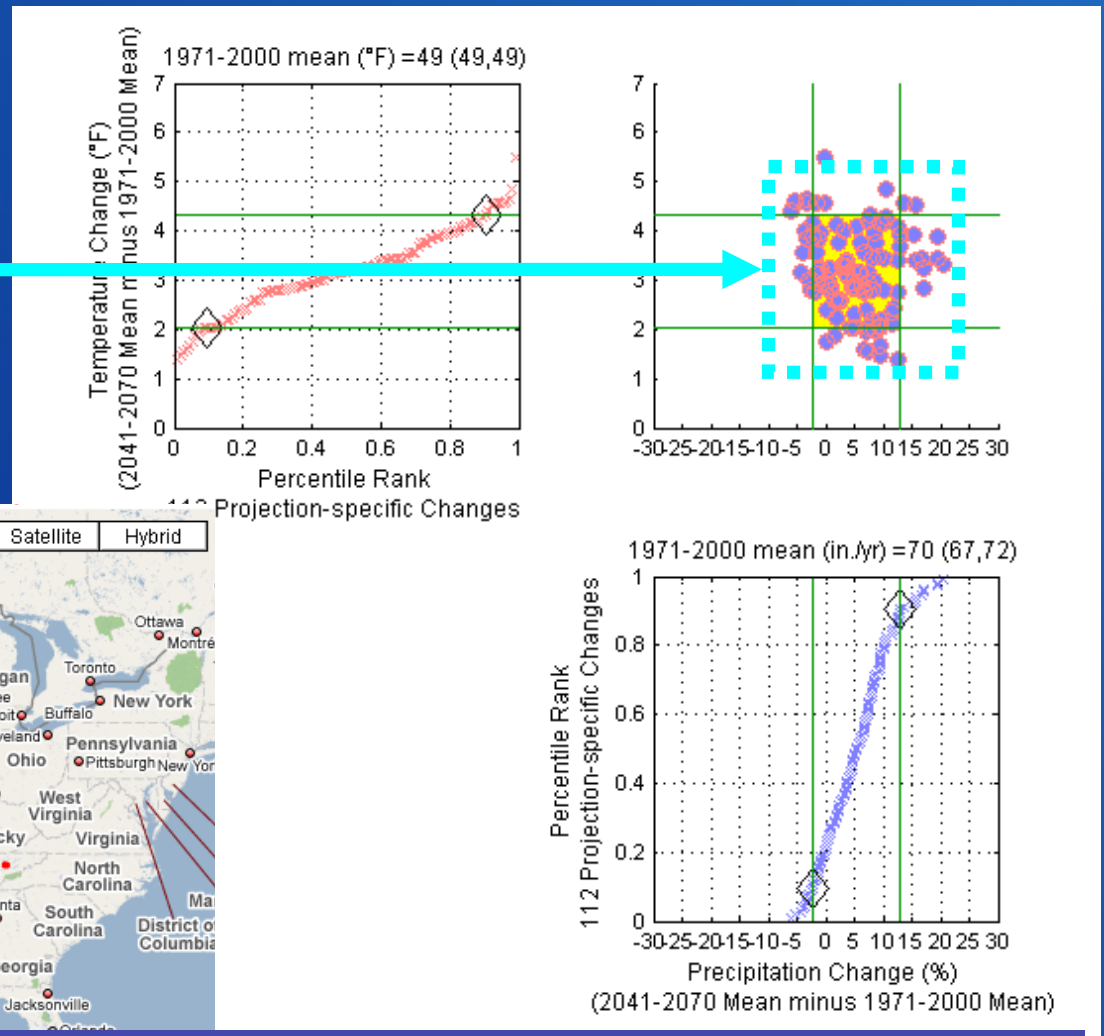
Final limitation emphasized here...

- Understanding on how to interpret time-developing aspects of climate projections for planning purposes.

“Delta” Application: (1) change in period mean T and P, (2) bracket spread, (3) relate to impacts

Question: Are these possibilities “*climate change only*” or “*blend of climate change and sampled multi-decadal variability*”?

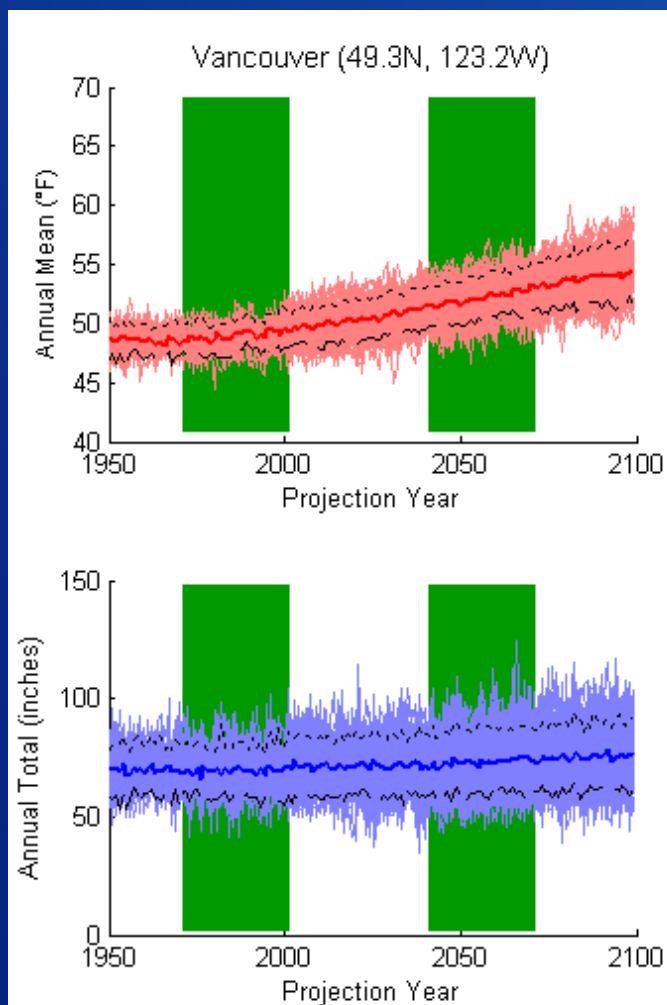
Vancouver



http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/

Transient Application vs. “Delta” Application: “Ensemble telling one stage-evolving story,” or “Ensemble of projection-specific stories”?

Transient Analysis



“Delta” Analysis

