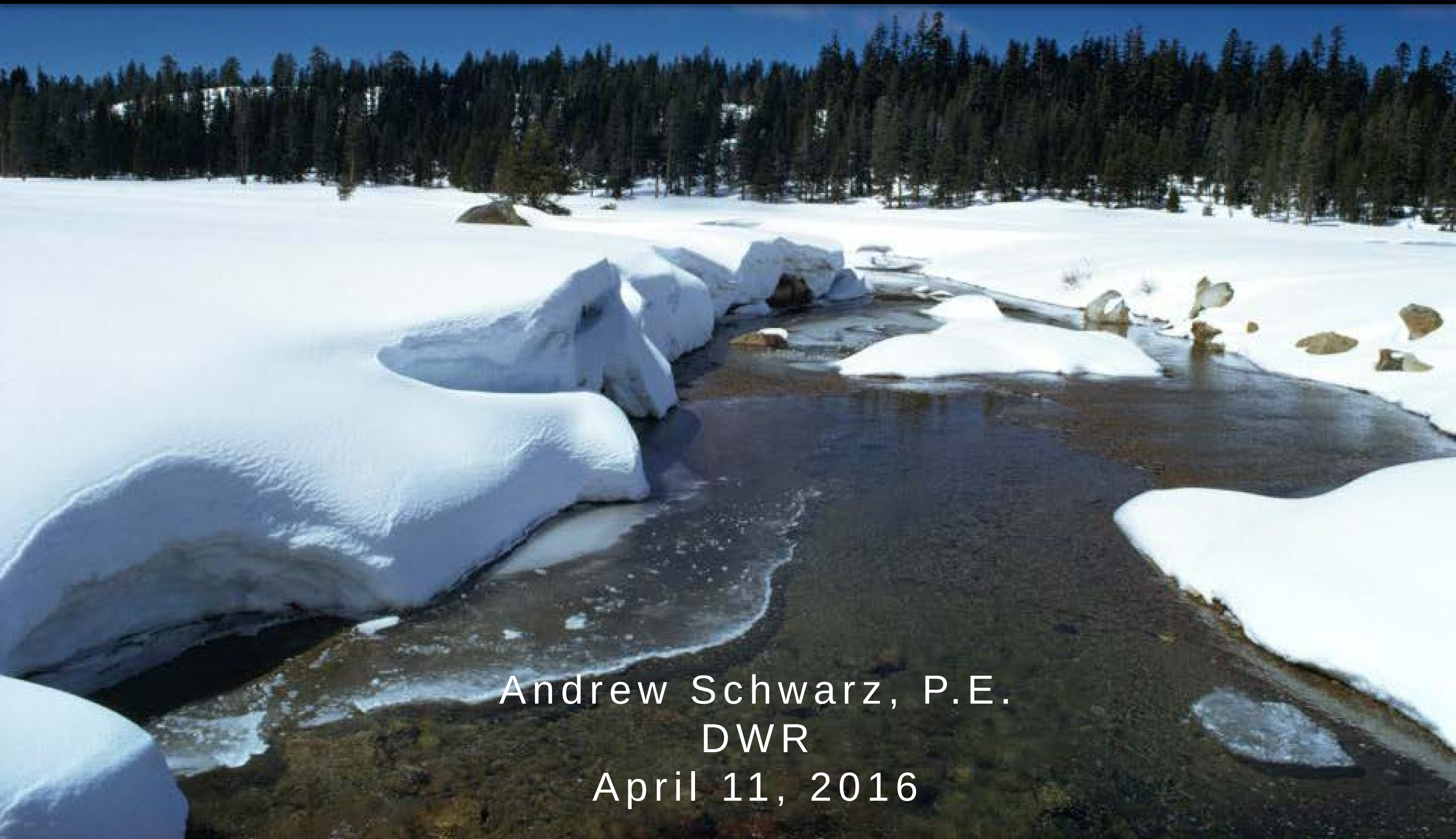
Decision Scaling with CalLite to Identify Climate Change Vulnerabilities to the State Water Project



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DWR Climate Change Vulnerability Assessment

Collaborative project between DWR-Climate Change Program and University of Massachusetts-Amherst Hydrosystems Research Group.

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We Want to Explore 2 Types of Vulnerability Simultaneously

1. Short-term climate conditions (Droughts)

2. Change in long-term precipitation and long-term temperature

And we wanted to use historical information without being tied to the historical wet/dry sequence of years

Why CalLite:

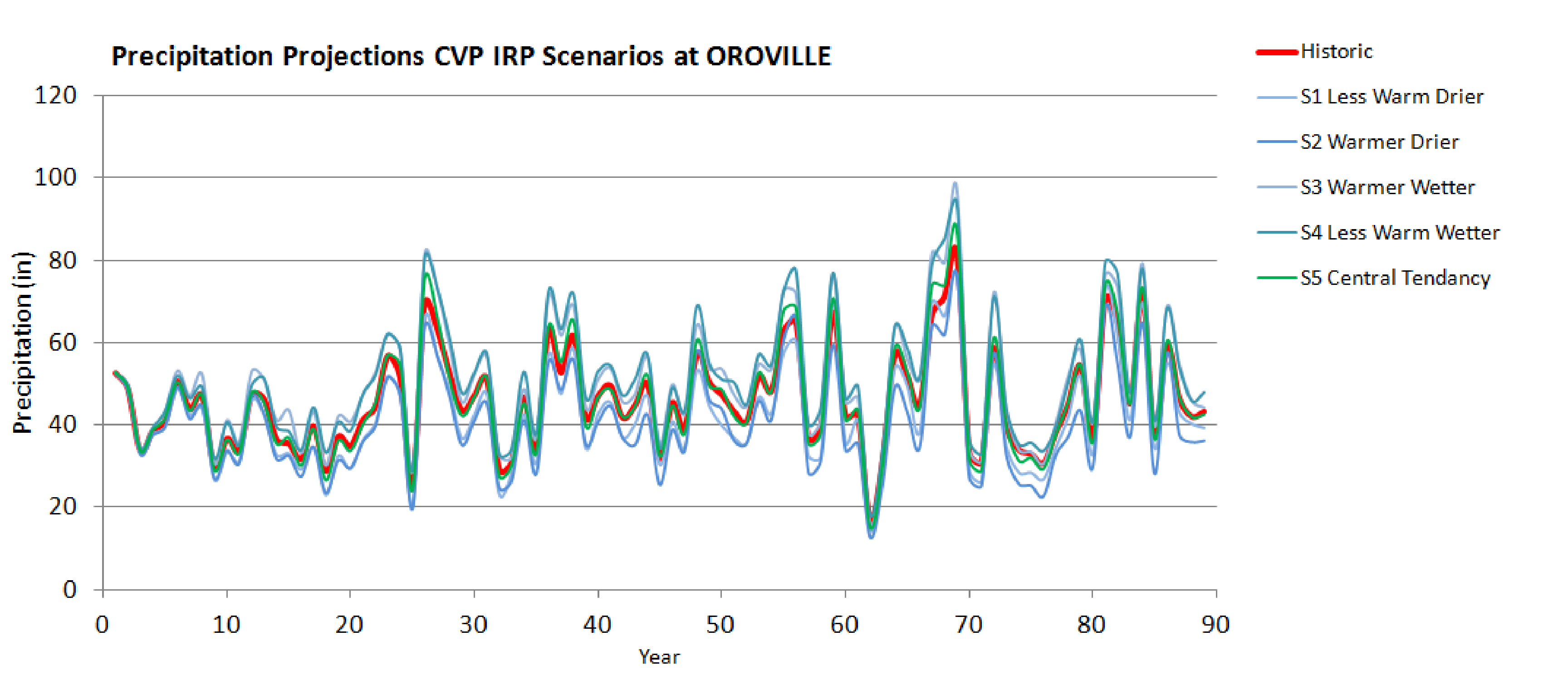
- Take advantage of CalLite's ability to rapidly simulate Central Valley water supply conditions to explore vulnerability to Climate Change.

- Ability to run the model in situ on multiple computers

Past Climate Change Investigations

always following the historical sequence of wet and dry years

Incrementally warming and wetting/drying the historical sequence



Goal: We want to assess the risk that climate change poses to our systems.

And we don't want to miss any risks.

Given the large degree of uncertainty about future climate,

our premise is that it is best to identify vulnerabilities first,

and then make judgments about whether vulnerabilities are likely or not.

Our Concern: GCM projections are used to sample uncertainty of future climate,

but their sampling is computationally expensive, inefficient and biased.

We’re concerned that real vulnerabilities will be missed.

Our Approach: Design a vulnerability approach that is not dependent on or biased by

ex ante scenarios,

a proiri probabilities,

or particular GCM projections.

Our Approach: Design the analysis to systematically explore changes in

mean conditions and variability

(and be able to tell the difference).

Our Approach: Design the analysis to scale to the most credible signals that can be derived from GCM projections,

Changes in mean Precip and Temperature

Coarse spatial scales

Challenge #1: want to design a "stress test" that varies climate in physically plausible ways to reveal vulnerabilities.

Maintain everything that we don't want varied (e.g., spatial correlation, temporal statistics),

but allow us to vary everything we want to (mean climate, temporal statistics, etc.) in a controlled fashion.

Challenge #2: Design the stress test such that we can make inferences about the revealed vulnerabilities:

- At spatial and temporal scales that can be linked to available information, including projections
- As function of physical mechanisms that are credibly represented in climate model simulations (or that can be investigated)

Projection driven vs Decision Scaling

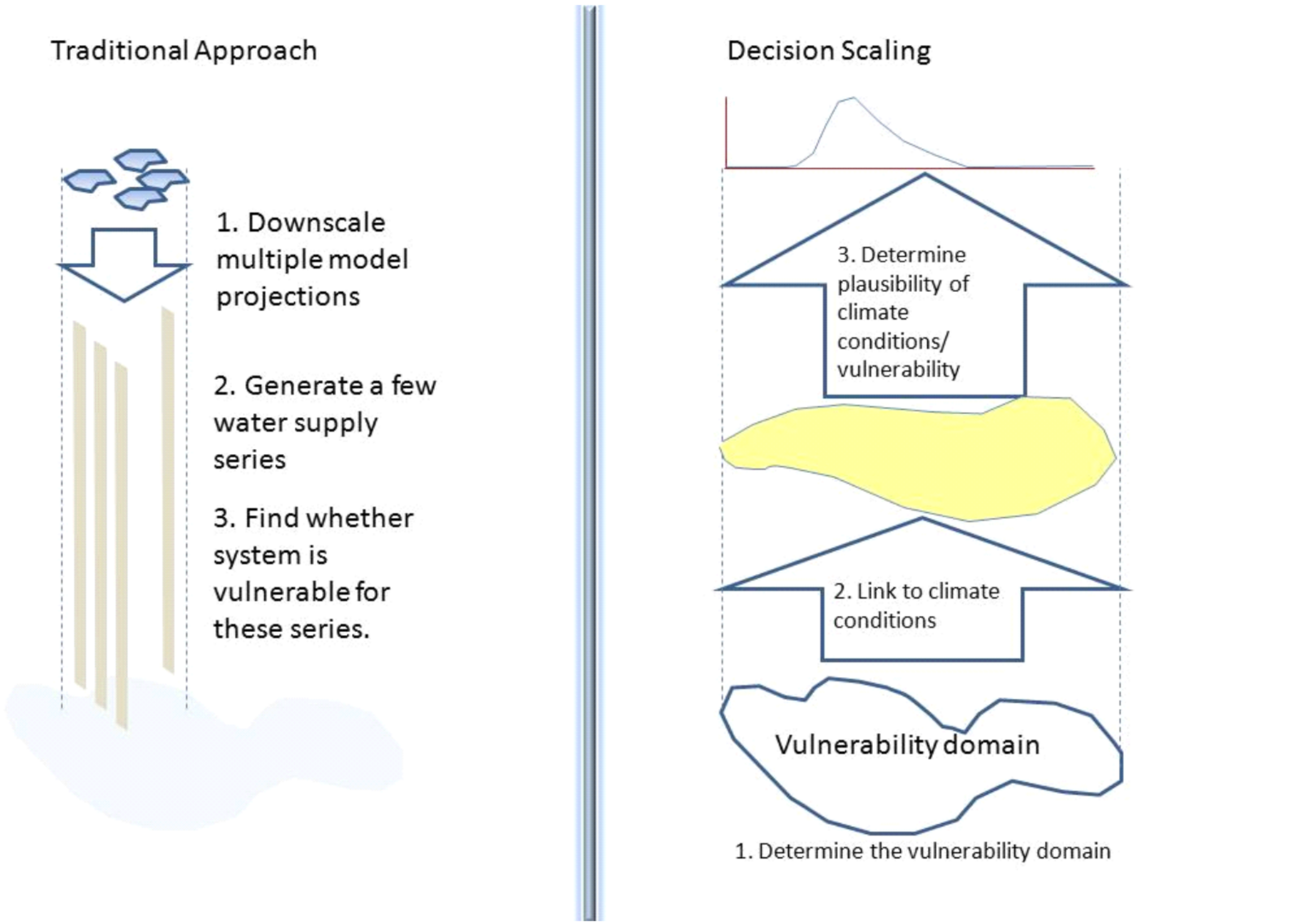


Figure 1 Steps in decision scaling vs. traditional approach

Brown et al., 2011 *JAWRA*

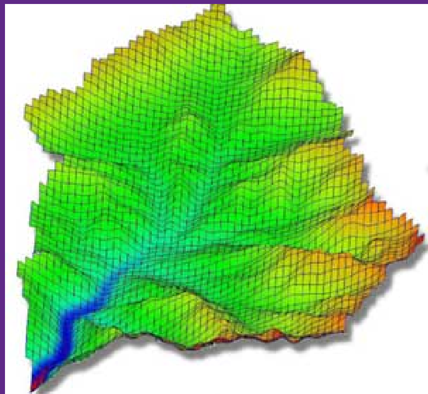
Exploration of A Wide Range of Future Climate Conditions

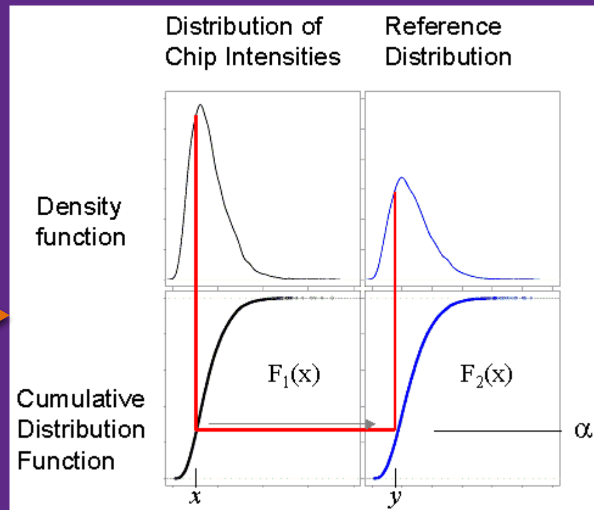
- Understand system vulnerabilities before deciding on specific GCM projections
- Sample across a wider range of interannual variability than just he historical sequence
- Characterize the likelihood of bad/unacceptable outcomes and strategies that are most effective for avoiding those outcomes

Exploration of Longer More Severe Droughts

- What is the likelihood/probability of various severities and durations of droughts
- How does the system respond to these droughts
- What adaptation strategies would be most effective for avoiding unacceptable conditions

Driving CalLite with New Hydrologies





New CalLite Input File

I5	I6	I7
567.2	879.4	45.7
345.8	987.6	678..4
….	…..	…..

Historical Input File

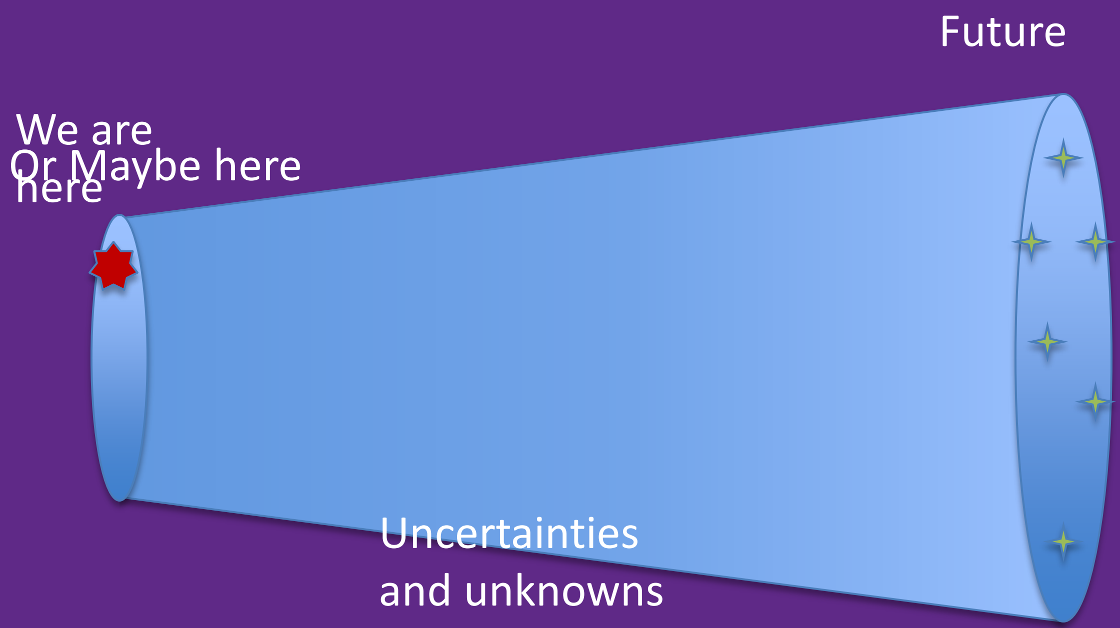
1.256
2.569
3.455
………

Water Year Type Monthly Averages

W1 2.345
W2 56.78
W3 96.33
……

Cone of Uncertainty

Cone of Uncertainty



Decision Scaling allows us to explore alternative existing conditions

- Simulation of a wide range of conditions

- We can use any climate data available to generate a complete set of consistent inputs to CalLite
- We are currently evaluating a suite of 13 unique climatological sequences
  - 1 historical sequence
  - 12 stochastic sequences spanning the distribution of minimum 5-year average precip.

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Simulation of a Wide Range of Climate Conditions

- Each sequence is run with every combination of temperature and precipitation change (63 combinations)

		% Δ Precipitation							
Degree C ΔTemperature		-30	-20	-10	0	10	20	30	40
	0								
	+0.5								
	+1.0								
	+1.5								
	+2.0								
	+2.5								
	+3.0								
	+3.5								
	+4.0								

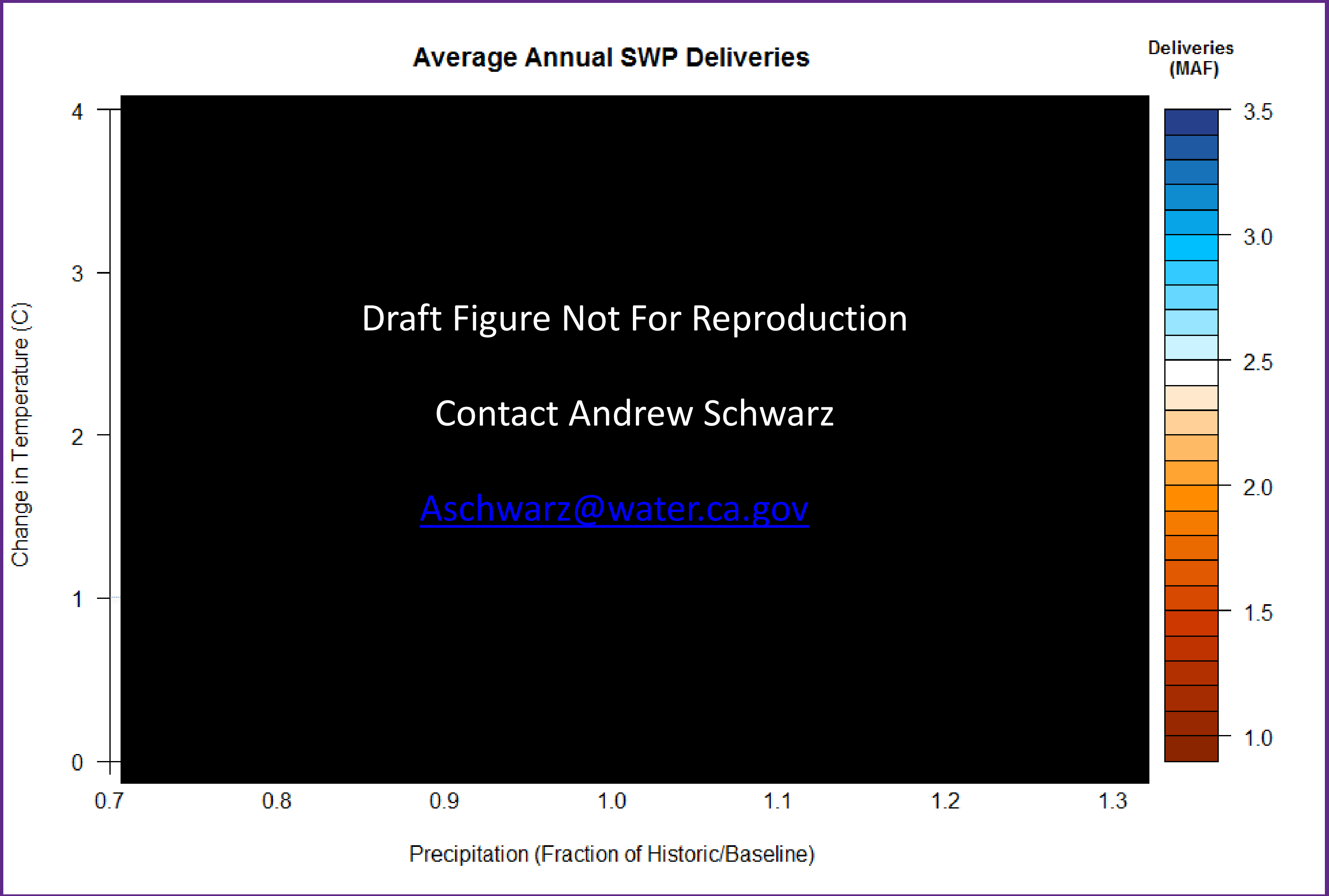
Preliminary Results

Unverified/QA-QC'd

For Discussion Purposes Only

Not for Reprint

Exploration of Changes in Average Conditions



Exploration of Drought Conditions

Thanks

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