Building Resilience to a Changing Climate:

A Technical Training in Water Sector
Utility Decision Support

WUCA
Water Utility Climate Alliance

Practical Considerations for Climate Analysis and Adaptation: Know before you go …

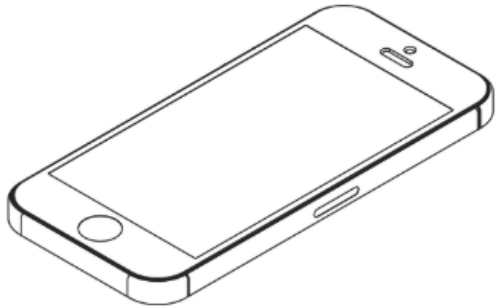
Laurna Kaatz, Denver Water / WUCA

All images provided by the presenter

Group Polling

1. **How are you feeling about scientific uncertainty in the context of climate adaptation decision making?**
2. **How confident are you in your ability to effectively use climate science in long-range planning?**

Go to **www.menti.com** and use the code **90 34 91**

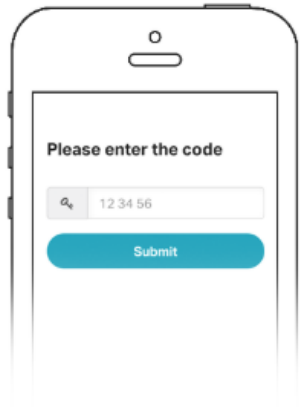


1

Grab your phone

2

Go to www.menti.com



3

Enter the code 90 34 91 and vote!

Climate Adaptation Conundrum

- Can’t be prepared for everything
- Can’t afford to be prepared for the worst case
- Can’t afford to be unprepared

How do you approach this challenge?

Four Adaptation Steps

- **Understand:** Climate science and model projection capabilities and limitations
- **Assess:** Water system vulnerability to potential change
- **Plan:** Incorporate climate uncertainty into water utility planning
- **Implement:** Adaptation strategies

Source: www.wucaonline.org

Before You Jump In – Clearly Articulate…

- What is your end game? What question(s) do you want to answer?
- How will you get there?
  - Method – simple, sophisticated
  - Data – type, scale
  - Tools – current, new?
  - Will it be useful?
- New science?
- Messaging – internal, external

Source: L. Kaatz, Denver Water

Goal is to Avoid Analysis Paralysis

Do Understand How the Decision Being Evaluated is Important to Model and Approach Selection

What are the questions we are trying to answer?

How will flows in April-September change in the future?

How should facilities be sized to prevent sewer overflows?

How will the magnitude, duration, and frequency of drought change?

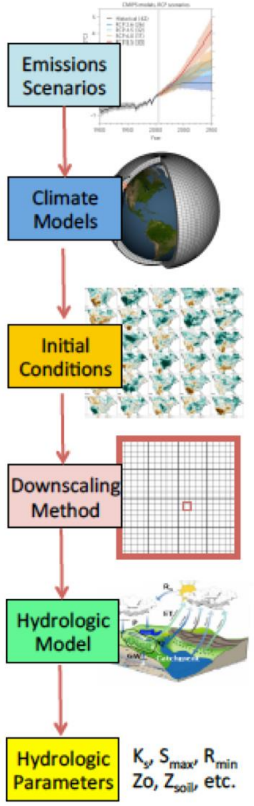
How much warmer will streams be in 20 years?

water supply, streamflow timing, drought, stormwater, wastewater

FIT FOR PURPOSE

Do Be Aware of Multiple Ways to Evaluate Future Changes

Scenario studies



Clark et al. 2016; connect models in a chain

Stochastic hydrology

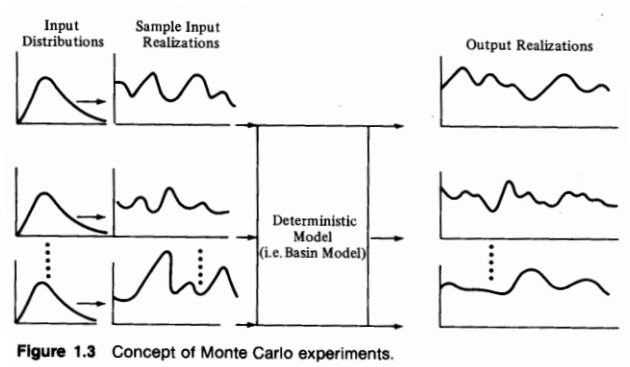
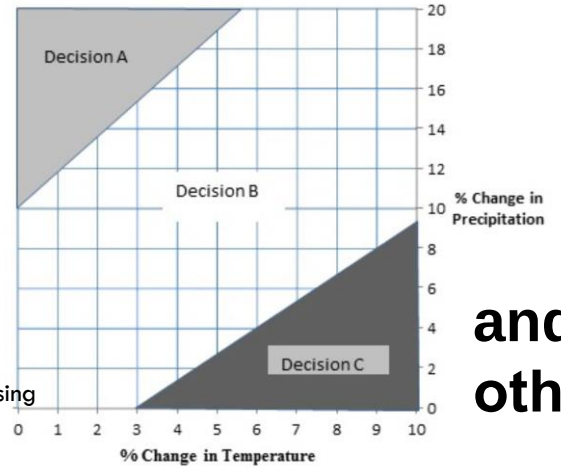


Figure 1.3 Concept of Monte Carlo experiments.

Bras and Rodriguez-Iturbe, 1985; generate synthetic timeseries using statics from the past

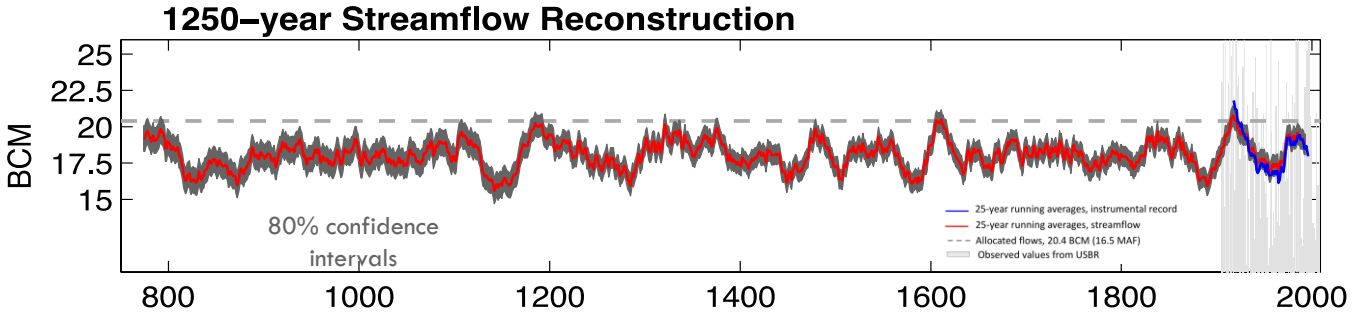
Climate-informed vulnerability analysis



Brown et al., WRR, 2016; explore system vulnerabilities with perturbations

and others…

Paleoclimate studies



Vano et al., BAMS, 2016; generate timeseries using reconstructions of the distant past

Do Start by Determining the Level of Details that Fits Your Need and Resources

Additional Considerations:

- How much will it cost?
- How long will it take?
- To what extent will the analysis improve the decision?
- Can appropriate data and information be obtained?
- Who will undertake the analysis?
- How much information can you manage?

List from UK Climate Impacts Programme's report Climate adaptation: Risk, uncertainty and decision-making (+ one from WUCA)

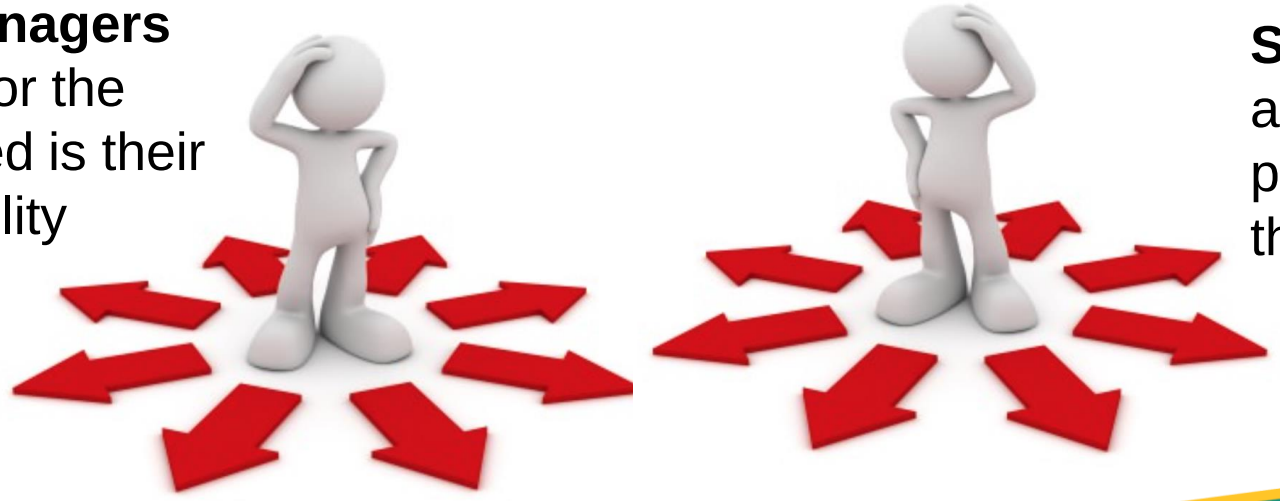
Guiding Principles

I. **It is important to evaluate climate risk**

II. **Models can be helpful tools, if used appropriately**

III. **Uncertainty is everyone's responsibility**

Water managers planning for the unexpected is their responsibility



Scientists being clear about uncertainties and placing them in context is their responsibility

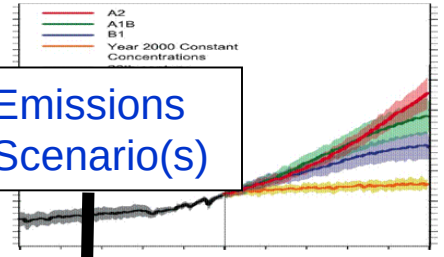
Source: J. Vano, NCAR

Classic "Top-Down" Chain of Models

Note:

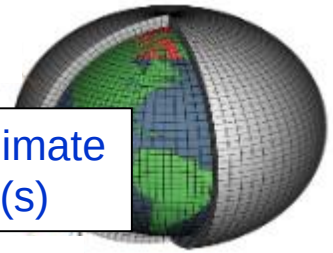
This is not an endorsement of a top-down approach.

It is to orient participants to the upcoming training topics.



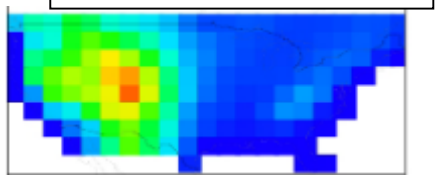
Emissions Scenario(s)

e.g. RCP8.5



Global Climate Model(s)

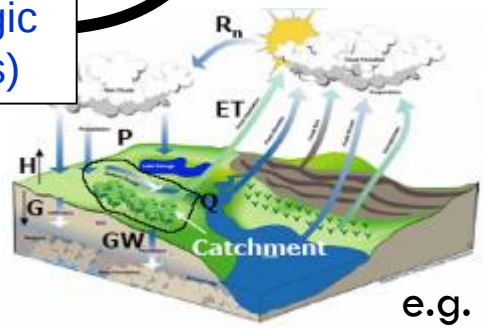
e.g. CESM



Downscaling method(s)

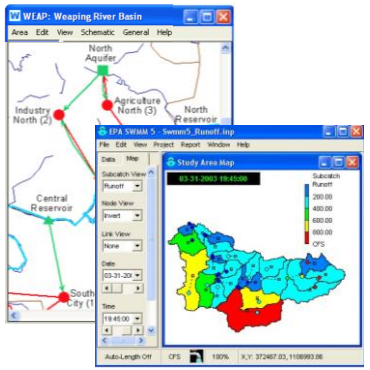
e.g. BCSD

Hydrologic Model(s)



e.g. Sac-SMA

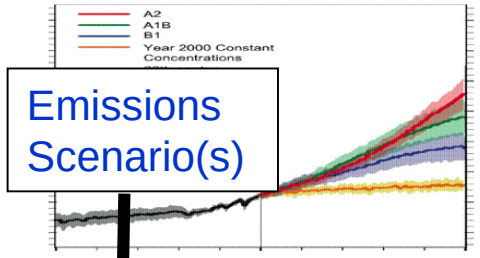
Management/Operations Models(s)



e.g. WEAP, SWMM

Decision

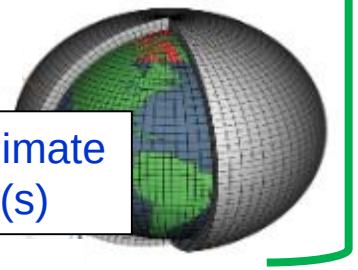
Classic "Top-Down" Chain of Models



Emissions Scenario(s)

e.g. RCP8.5

Global Climate Model(s)

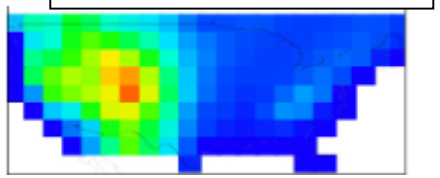


e.g. CESM

Joel

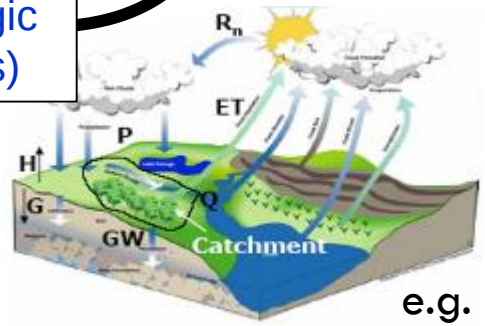
Julie

Downscaling method(s)



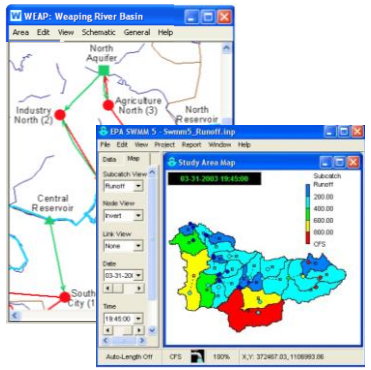
e.g. BCSD

Hydrologic Model(s)



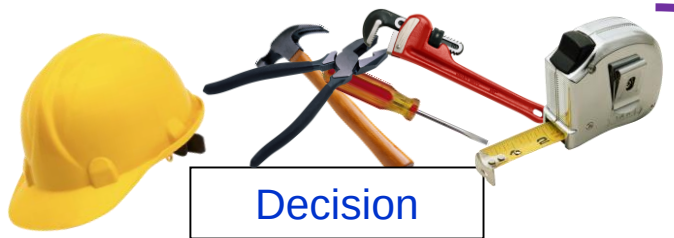
e.g. Sac-SMA

Management/Operations Models(s)



e.g. WEAP, SWMM

Decision



Later

Classic "Top-Down" Chain of Models

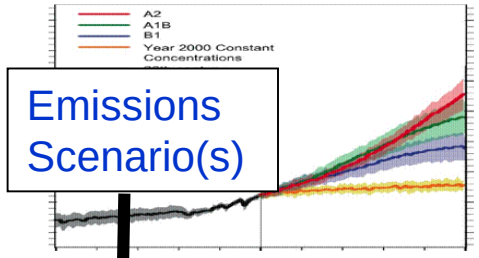
Four Steps:

Understand

Assess

Plan

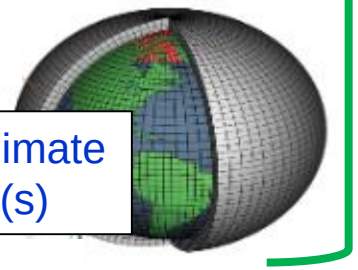
Implement



Emissions Scenario(s)

e.g. RCP8.5

Global Climate Model(s)

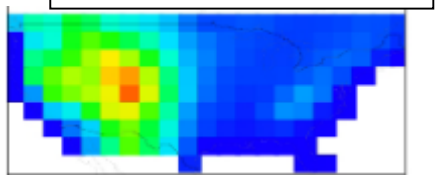


e.g. CESM

Joel

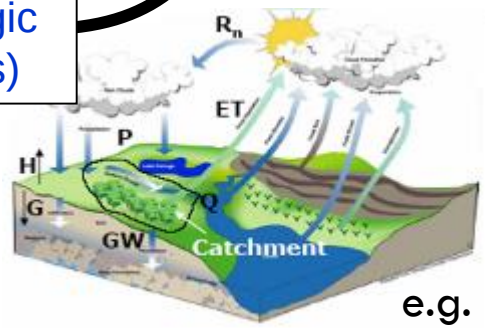
Julie

Downscaling method(s)



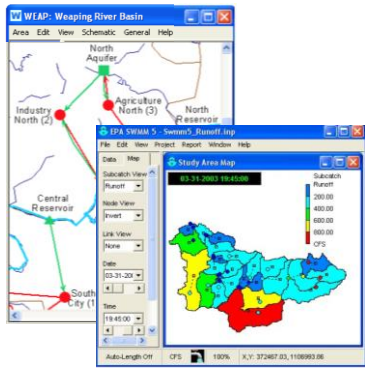
e.g. BCSD

Hydrologic Model(s)



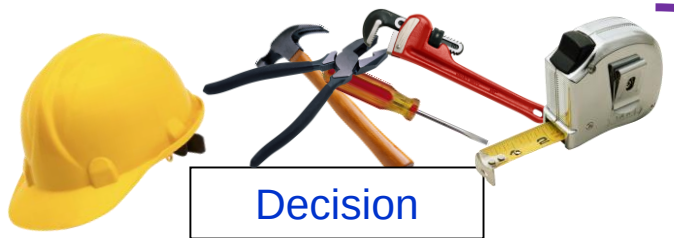
e.g. Sac-SMA

Management/Operations Models(s)



e.g. WEAP, SWMM

Decision



Later

Questions?