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

Laurna Kaatz, Denver Water / WUCA
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
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
Important considerations:

• Sophisticated or simple assessment?
• Even if what you want to do is possible, should it be done?

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**

- **Stochastic hydrology**
  - Connect models in a chain
  - Figure 1.4: Concept of Monte Carlo experiments. Bras and Rodriguez-Iturbe, 1985; generate synthetic timeseries using statistics from the past

- **Climate-informed vulnerability analysis**
  - Brown et al., WRR, 2016; explore system vulnerabilities with perturbations

**Paleoclimate studies**

- Clark et al. 2016; connect models in a chain
- 1250-year Streamflow Reconstruction
  - Vano et al., BAMS, 2016; generate timeseries using reconstructions of the distant past

80% confidence intervals
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?
I. It is important to evaluate climate risk
II. Models can be helpful tools, if used appropriately
III. Uncertainty is everyone’s responsibility

**Guiding Principles**

- **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
- **Downscaling method(s)**: e.g. BCSD
- **Hydrologic Model(s)**: e.g. BCSD
- **Decision**
  - **Management/Operations Models(s)**: e.g. WEAP, SWMM

Later

Joel

Julie
Classic “Top-Down” Chain of Models

Four Steps:
Understand
Assess
Plan
Implement

Emissions Scenario(s)

Decision

Management/Operations Models(s)

Global Climate Model(s)

Downscaling method(s)

Hydrologic Model(s)

Later

Joel

Julie

13
Questions?