# Question

How do we manage water infrastructure investment, water allocation decisions, and land use decisions under novel hydrological regimes given existing environmental regulations?

User/stakeholder: State water agency, cities/counties, regional water managers, river basin commissions.

# Example

- State of Florida
  - Should Florida be planning for more drought or more precipitation or both?
  - Flooding problems compounding by localized intense storms
  - Protecting Everglades
  - Impacts on agriculture
  - Urban development; adaptation by densifying cities
  - Sea level rise causing salt water intrusion
  - SLR: Losing gravity feed and therefore drainage—extensive flooding
  - Infrastructure: e.g., can't build sea walls—septic tanks compromised by SLR
  - Extreme events—hurricanes
  - Migration
  - Lots of fresh water in north, and low topography (interbasin transfer potential)

# Framework modeling components

- Migration
- Climate—long-term T &P, hurricane prediction (sign posts) , uncertainties, seasonal forecast, hours/days
- Sea level/ land subsidence
- Groundwater supply, flow, withdrawal
- Surface water
- Infrastructure—reservoirs, inter-basin transfers, desalinization, reuse, wastewater mgt, floodwater mgt, water distribution
- Beach/coast sedimentology/erosion
- Ecosystem quality/services
- Water quality
- Governance
- Water use policy for adaptation
- Economic growth
- Industry composition
- Intra- interregional trade
- Human health
- Human preferences

# Questions to be addressed

1. Identify the configuration of models, data, and capabilities needed to answer your chosen question. Which elements need to be highly resolved, and which could be represented in aggregate or reduced form? Where is coupling required and what type should be used? What capabilities other than models would be needed? If there are missing data, how difficult will they be to obtain?
   - Optional: produce an influence diagram, model flow chart, or other visual that depicts the system you would model.
   - If you have time, think about challenges of representing impacts of extreme events.
   - Be specific on coupling

   SEE SPREADSHEET (*Water breakout group, model components.xlsx*)

2. If you were to implement this model, how difficult would it be to balance tradeoffs between completeness/resolution and tractability of the modeling effort? What would your strategy be to manage the tradeoffs?

# Questions to be addressed

3. Would it advance useful IAV modeling to establish a community of practice to develop a framework of model standards, software tools, data, analytic resources, and other elements that could be integrated to address particular use cases? What other or additional ideas do you have to make progress in developing a framework?

- YES! Requires communities to work with each other and with interoperable models—models that talk nicely with each other. Trade-off between needing to use context or location-specific models (many use cases would be specific, and have existing models) and generic or global models designed to be coupled.
- Would be useful to have fast ways to determine whether coupling would be important—sensitivities/ screenings.; e.g., change boundary conditions to see if it would be important to couple to another model. Develop checklist for location specific applications that would allow you to identify important couplings and existing studies—would come from scientific community and community of practice
- Base initial/pilot projects on this sensitivity work.

# Research agenda suggestions

## Near Term:

- Pilot projects
- Develop initial set of best practices (evolving) related to model coupling. Lessons learned from, say, iESM
- Examine sensitivities to determine where couplings are strong/ required
- Develop tools to be able rapidly test sensitivities (e.g., water quality under drought conditions)

## Medium term:

- Develop a toolkit to facilitate model coupling
- Better groundwater modeling/better geological data
- Better models on governance/decision making/land use/social transformation and how to couple with existing models
- Better balance between model realism and UQ
- Better modeling of SLR and storm surge
- Better understanding and ability to evaluate options for managing the system/resilience
- Better data on water use and water allocations
- Better understanding on how to use the models to inform decisions and to communicate results

## Long term:

- Better understanding of uncertainty of propagation through causal network—particularly including human response

# Question – long-winded version

How do we manage water infrastructure (storage, desalination, waste water management, reuse, interbasin transfers) investment , water allocation decisions, and land use decisions under novel changing hydrological regimes (e.g., changing seasonality of runoff; a situation of drought combined with diminishing fresh water due to sea level intrusion; changes in demand (municipal, industrial, energy, rural; storms)) given existing environmental regulations (e.g., Endangered Species Act, CWA)? (User/stakeholder: State water agency, cities/counties, regional)