EMF Snowmass Workshop on Multi-Sector Dynamics

BREAKOUT SESSION ON

Coastal Systems: Complex Natural & Infrastructural Landscapes

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Key Research Questions and Challenges

1. What do coastal communities (people, firms, policymakers) know about risk - how do they obtain this information (especially about uncertainty), and what interventions can improve their understanding?
2. What are the water quality aspects of global change in the coastal setting, and are there synergies between water quality and other concerns?
    a. Both flooding and water quality are related to impervious surface.
    b. Water quality, health aspects of flooding/inundation in areas with toxic sites, nuclear plants, etc.
3. What risks are correlated in the coastal context, and how important is it to account for these correlations?
4. Do we need tools or methods for defining geographic scope of coastal analyses?
    a. e.g., upstream policies (infrastructure, water rights, etc.) contribute to what happens at the coast.

Key Research Questions and Challenges, cont.

5. How can we incorporate risks associated with economic and population dynamics, in addition to risks associated with physical systems and events?
6. What options for protection will communities consider?
    a. For infrastructure, is there any evidence of the "levee effect"?
    b. How can natural systems help mitigate the impacts of long-term changes (e.g., sea-level rise) and short-term shocks (e.g., storms) in coastal areas?
7. What happens when in-situ adaptation is not viable? How can we understand when/where this will occur and communicate this to stakeholders?
8. What approaches do we have for systematically organizing socioeconomic information for making predictions?
9. What observation networks are needed to generate the data to answer some of these questions, and if they are not available, who could establish them?
    a. Is there a role for citizen science, with sufficient quality control, or for expert elicitation?

Key Research Questions and Challenges, cont.

10. How can we identify institutional frameworks in coastal systems that are important for resilience & incorporate these into our modeling frameworks?

11. Do we actually need all of the complexity that many projects may try to build in? May need a critical assessment of the pursuit of higher and higher resolution, and some careful cost-benefit thinking about the tradeoffs between this and sampling of uncertainties within each process to get the tails right.
    a. What are the questions for which high resolution is not going to give you much additional value?
    b. Are there questions for which high resolution may even provide worse answers, if uncertainty is mischaracterized?
    c. Which questions require or benefit from high resolution and additional complexity?

What new capabilities are needed?

- End-to-end uncertainty characterization. Need support for uncertainty characterization that can be used across models, platforms and projects being developed in the community.
- Most projects are still stovepiped; need to work more on connecting across projects. MSD user facility might help with this.
  - Role as curator of data and models, knowing how models work and can link.
- Need additional capacity to project future coastal development patterns, especially to quantify damages and changes in damages going forward.
- Comprehensive and consistent multi-method downscaled climate data.
  - Need to articulate a set of MSD needs for downscaled data in the coastal setting - for example, variables beyond precipitation and temperature, such as wind - and figure out who can do this.
  - Downscaling needs extend to socioeconomic variables, as well as physical variables.

Opportunities for Partnerships Beyond DOE MSD

- Research groups working on hurricane models, storm-surge models
- Utilities
- Insurance and reinsurance companies
- Bond-rating agencies
- Emergency management agencies - federal, state and local
- American Society of Civil Engineers
- Army Corps of Engineers
- NGOs with a coastal focus
- Modelers in the National Estuary Programs
- Regional and local planners
- Research groups in other countries with significant interest & experience in modeling coastal systems and thinking about risk (e.g., the Netherlands)