Coast-to-Coast Examples of Integrated Natural-Human System Models for Consequence-Based Climate Analysis

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Flooding remains amongst the most prevalent natural disasters often resulting in both short- and long-term social, economic, and infrastructure impacts. This is true for all components of flooding (pluvial, fluvial, and coastal) and changes in intensity and frequency of these events (including changes in precipitation and sea level) create challenges for the planning and management of resilient infrastructure and communities. Older federal policies regarding the Federal Flood Risk Management Standard (e.g., EO 13690) are getting renewed emphasis, requiring that new infrastructure design account for future climate change. However, there remains a need to demonstrate methods and approaches that develop actionable climate information to community planners and designers to ensure resilient design considering an uncertain climate future.

This presentation presents two case studies which bring together multiple models representing natural systems (e.g., climate, hydrology) and human systems (e.g., infrastructure systems, buildings) to quantify social, economic, and infrastructure impacts that can be used to inform decision, including policy. The first case study evaluates relative change in flood frequency (historical versus future) resulting in changes in precipitation (rain, snow, rain on snow) and urbanization (land use changes and market dynamics) to derive estimates of annualized risk changes for a location in the Pacific Northwest. A second case study, focused in Norfolk, Virginia, characterizes the changes in coastal flooding due to changes in sea level and quantifies the expected impacts to transportation systems, electric power systems, and the potential workforce impacts.

This presentation presents the results of the consequence-based analysis. In the Pacific Northwest use case, we will show that flood risks do change due to climate change, but that there are also human-induced urbanization changes that act to compound the flood risk. In the Norfolk use case, we will show that even small changes of sea level risk have in increasing the flood risk and that the associated transportation impact acts to prevent access for workforce who reside outside the local area.