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# Challenges in using earth system models for regional and sub-regional adaptation planning in Alaska

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## Abstract

Our research on the causal relationships among global to regional components of the Alaska northern coastal system reveals gaps such as mismatch in scales, and representation of variables affecting adaptation to change, and the capacity of earth system models to include these. Inclusion of human systems and activities at regional scales are only beginning to be considered in earth system models. As a result, such model output is not well-suited for use by governing bodies tasked with long-range planning, such as the North Slope Borough of Alaska. The Interdisciplinary Research for Arctic Coastal Environments is a US Dept of Energy project examining how earth system models, regional models, and studies of coastal change can be used to inform planning and response to future impacts on transportation, food security, and infrastructure in northern Alaska. The Multi-Sector Dynamics component of the project is grappling with how to include pertinent system variables for adaptation planning that are often not captured by earth system models. We argue that there are trade-offs between the scales of relevant decision-making and governance interests, and model-relevant considerations, such as the computing capacity needed for running earth system models. Sub-grid features such as a very complex coastal line, barrier islands, and landfast ice off the North Slope are becoming a high priority in the modeling community, because they affect essential community activities and they are changing fast in the Arctic. Similar examples may occur globally along the coast. We emphasize the importance of involving social scientists to contribute to future iterations of earth system models to support use for hazard mitigation and climate adaptation planning.

**Keywords:** society, regional model, coastal change, Arctic, planning, hazard mitigation, earth system model, decision making

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