

Modeling Risks in the Arctic System

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The complexity of the Arctic, the intricacy of its systems, and the challenges that come with assessing the vulnerability of its components to natural and anthropogenic drivers of change require a framework that can integrate Indigenous knowledge, scientific data, engineering assessments, and the expert opinion of governance bodies. Here we present the first version of the Arctic Bayesian Network (Arctic BN), a causal-probabilistic model that assimilates and combines these different types of information. The Arctic BN is a community-based, adaptable, and transparent model that provides spatially-explicit, cause-effect relations to assess the state of risk for each component of the system and its vulnerability to each driver of change. Diagnoses can also be obtained by running the model backwards, such that a state of risk can be assigned to any given component of the model and used to back-calculate the strength of the driver needed to induce that consequence. Overall, we argue that such a framework is much needed to illuminate the interconnectedness of the Arctic System, help coordinate and further document Arctic changes, harness the power of existing but disparate datasets, identify key knowledge and data gaps, drive technological advancements, assess the state of risk of natural and anthropogenic systems, facilitate clear and coordinated actions between stakeholders, and help prepare visionary leadership for the future.