

Maritime transportation in a changing Arctic: Navigating climate and sea ice uncertainties

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Project Objectives:

Goal: This project is developing and applying a risk-based framework integrating an analysis of environmental conditions, an assessment of navigation risk, and an evaluation of the consequences of incidents. *Specific Aim:* Identify climate and sea ice risk factors and calculate the likelihood and impact of Arctic maritime navigation incidents. *Method:* Probabilistic analysis of climate and sea ice projection models to evaluate environmental and navigability conditions. Predictive and economic models will integrate such projections with multiple data sources to evaluate the probability of an incident and assess the local and global economic impacts. *Broader Impact:* Support a safe, reliable, and resilient navigation system for shippers, emergency responders, local communities, and Arctic researchers.

Keywords:

Maritime navigation, sea ice, climate models, risk analysis, interdependent economic modeling

Progress to Date/Future Plans: We have started collecting and evaluating necessary model data (CESM-LE and others). Currently we are evaluating sea ice concentration in these climate projections against observed sea ice concentration for the period 1980-2019 to establish a baseline for the validity of the models in the context of this study.

Highlights or Expected Outcomes: Recommendations will be provided for how climate models can be useful to stakeholders assessing the risk and weighing the costs and benefits of Arctic navigation. The outcome of this research will guide the scientific community towards providing information to stakeholders on safe and reliable Arctic maritime expedition. While the focus of this proposal will be on specific Arctic routes, the framework can be applied to any maritime shipping route.

NNA Community Collaboration and Research Coordination: The NNA community can help us build a network of connections with shippers and other Arctic navigation stakeholders. Given the lack of data for such extreme events, some of the model parameters for the risk factors will rely on stakeholders' elicitation.

Advice for Overcoming NNA Project Challenges: The project just started, the main challenge at this point has been in the recruitment of personnel.