Risk and Insurance Studies Centre

Team

06.

Climate Risk Integration for Arctic Shipping Operations

What climate risk tools can enhance resilience in Arctic shipping operations?

Although melting ice opens new Arctic shipping routes, it paradoxically increases operational risks.



Fast-changing ice conditions increase ship vulnerability, yet many companies use traditional risk methods that ignore dynamic climate risks. This gap threatens supply chains and crew safety. Our data-driven framework helps insurers and shipping companies reduce budget waste, optimize icebreaker contracts, and lower insurance premiums.

Methodology

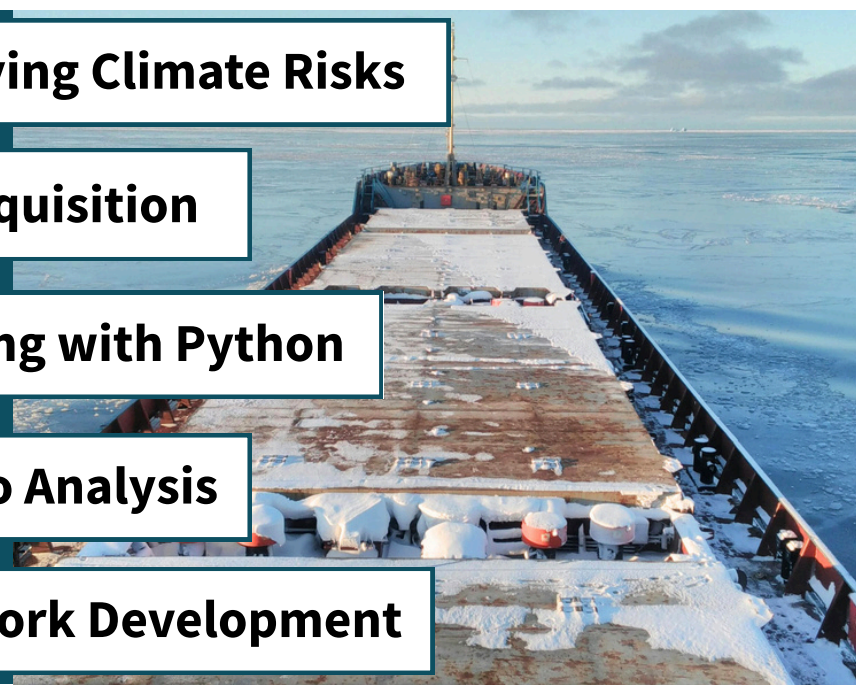
Step 1: Identifying Climate Risks

Step 2: Data Acquisition

Step 3: Modelling with Python

Step 4: Scenario Analysis

Step 5: Framework Development



A collaborative project with:

UNIVERSITY OF TORONTO

Jacobs

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Insights

Current Arctic shipping relies on icebreaker operations, with the data supporting the **“convoy icebreaker escort effect”** as a key operational model.

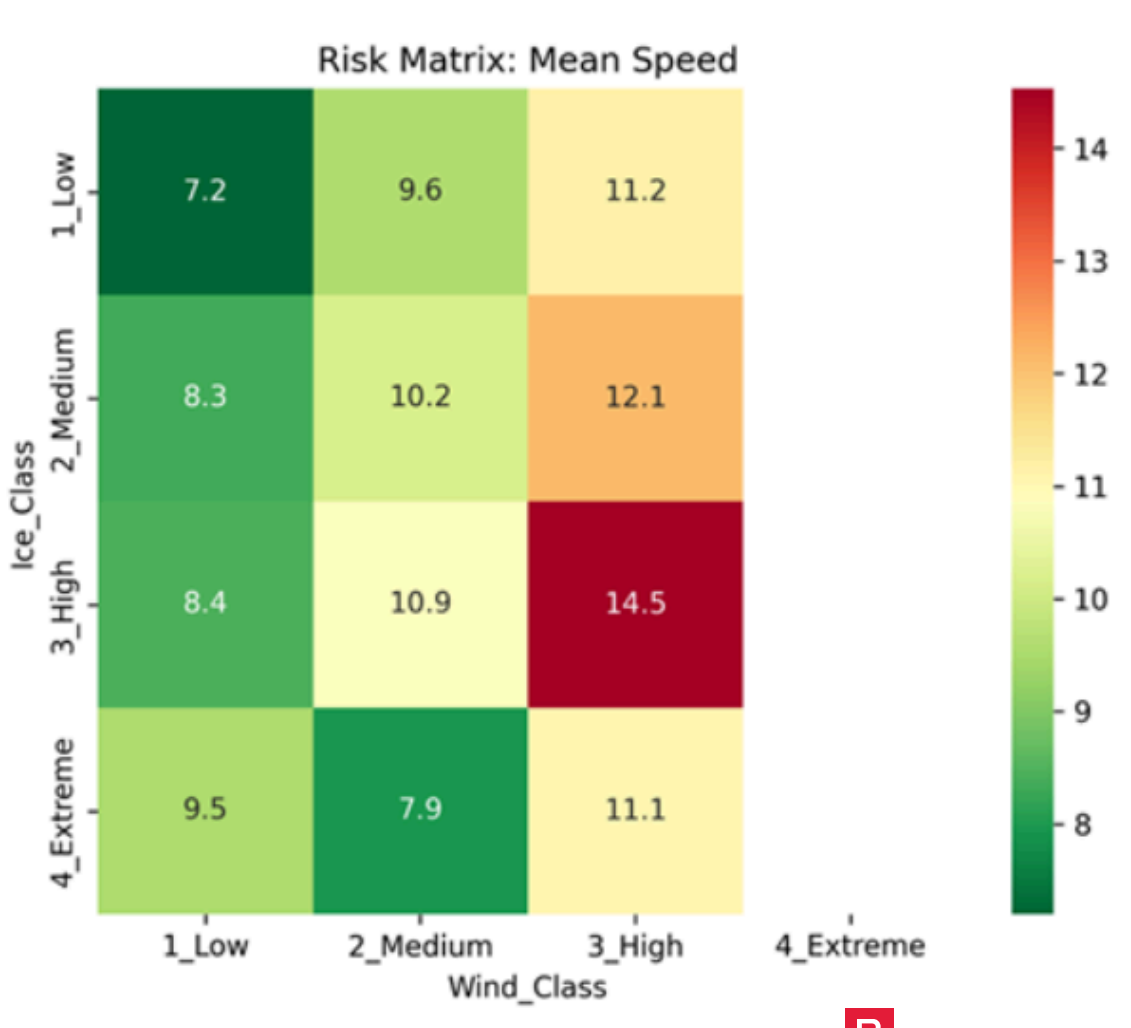
1. **Icebreakers** enable Arctic shipping vessels to **maintain or even increase speed** under deteriorating sea conditions.
2. However, even if escort support is in place, areas that have sea-ice thickness more than around 2.8 m seem essentially non-navigable.
3. Future projections indicate that **significant operational risks will persist for more than a decade.** Model based estimates suggest that high risk areas will remain at around 4.5% through approximately 2040. This challenges the common assumption that the Arctic will soon become ice free.

Recommendations

The team developed **a dynamic risk matrix** that converts sea ice and weather data into shipping rules to optimize icebreaker use and emergency spending.

Next steps?

Limited access to high-resolution hyperspectral data andinstitutional hesitation to adopt new technologies, highlights the need for improved datasets and on-the-ground validation.



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