Modeling Risk from Black Carbon in a Coupled Natural-Human System at the Arctic Ice Edge

Key Project Contacts:

Amanda Lynch, David Bailey, Michael Goldstein, Xueke Li, Scott Stephenson, Siri Veland

Project Website/Social Media:

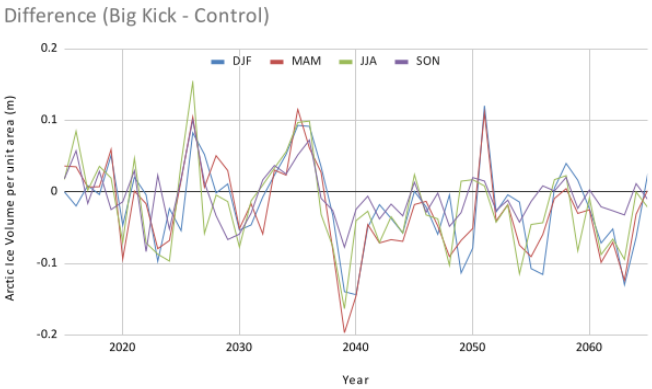
Some results have/will be posted at:
https://www.amandalynch.org/research/

Project Objectives:

The project is designed to address four hypotheses:

- BC emissions from all classes of shipping contribute a positive feedback affecting the rate of retreat of sea ice.
- Pricing the interannual variability in shipping access affects the financial risk and expected value of Arctic shipping and investments.
- Regulation of BC emissions will affect the near-term profitability of Arctic shipping routes.
- Expectations of Arctic shipping viability are conditioned on time scales that are influenced by natural system variability.

Time series of ice volume per unit area for control and "big kick" experiments.



Methods:

- Shipping modeling using ATAM (Stephenson et al. 2011)
- Climate modeling using CESM2 (Danabasoglu et al. 2020)
- Estimating financial risk using modified option pricing (Sturm et al. 2017)
- Interviews and surveys (Lynch et al. 2014)

Keywords: shipping, risk management, climate simulation and analysis

Progress To Date/Future Plans:

- First round interviews with shipping company managers, port operators, and financial services providers conducted in Oslo, Svalbard and Bodø.
- Winter Session field course held with 18 students (from Brown, Babson and Nord universities), one teaching assistant, and three professors. The experience was reported on in the following, among others (Wellesley local newspaper, newsbreak.com, etc):
  - https://www.brown.edu/academics/institute-environment-society/news/story/students-visit-arctic-pioneering-wintersession-course
  - https://www.browndailyherald.com/2020/01/30/newbury-wintersession-course/
- BC emissions for SSP scenarios refined.
- Control simulation and ensemble of BC perturbation experiments have been completed (see figure above) and are being analyzed.

Highlights or Expected Outcomes:

- Arctic-specific social and economic insight for investment and policy.
- Harvesting experience for risk management in systems with high natural variability.
- Training environmental sciences, finance and business students in inter-disciplinary complex systems analysis, using the Arctic as a natural laboratory.

NNA Community Collaboration and Research Coordination:

- Sharing of open source simulation capacity and data sets
- best practices for inclusive education
- facilitation of networking among Arctic communities

Advice for Overcoming NNA Project Challenges:

- hiring junior scientists with appropriate skills is a real challenge, especially in the context of slow and uncertain working visa processes.
- Regular virtual communication is obviously key.