Open Discussion: *Challenges and Potential Solutions for Marine Operations in the Arctic*

Sea Ice Structure Interaction Workshop

13 November 2017, BAS, Cambridge

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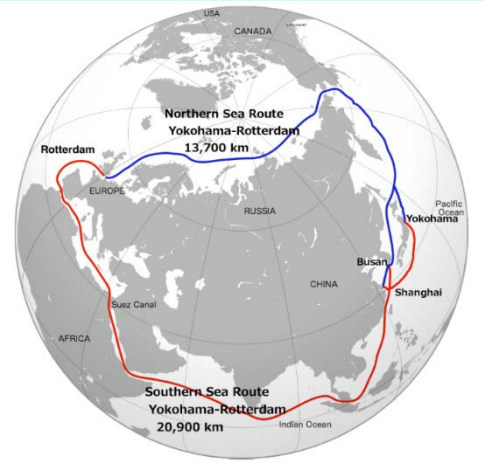
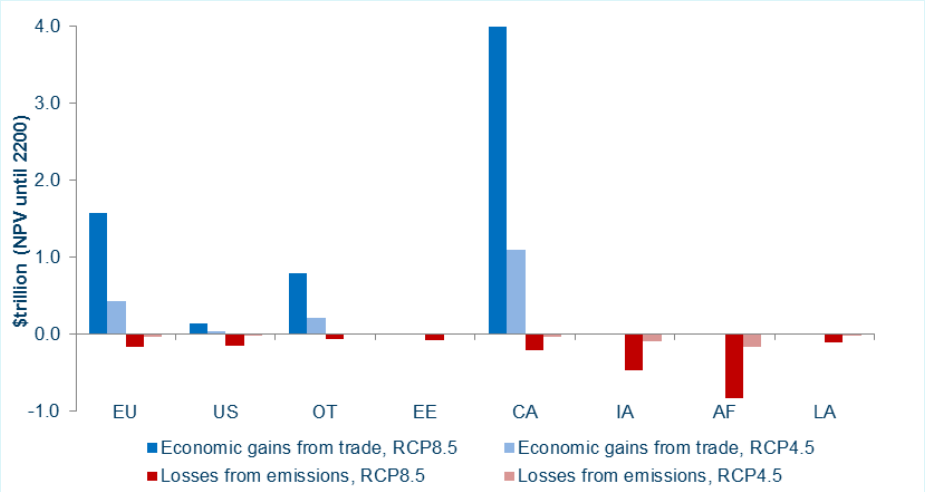
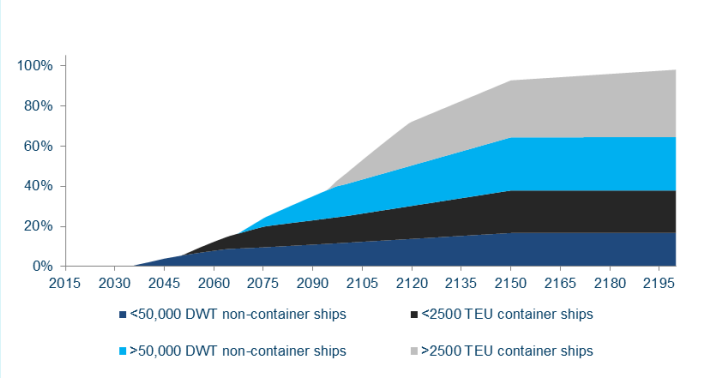
Itinerary

- **Overview of the Challenges and Solutions**
- **Open Discussion**







Source: Yumashev et al. (2017) Towards a balanced view of Arctic shipping. *Climatic Change*

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Sea ice projections for Arctic shipping routes

- **The importance of using correct tools for sea ice projections: CMIP5 vs CMIP6 vs Regional Arctic Ocean Models?**

- **Which physical parameters are relevant for navigation in the Arctic:**
  - **sea ice concentration/ type,**
  - **thickness,**
  - **ice pressure,**
  - **ridging,**
  - **icing events,**
  - **storms**

- **How to measure these parameters effectively to facilitate navigation?**

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Technological solutions and navigation

- Implications for vessels' design criteria
- Implications for port's design criteria
- Implications for navigation, i.e.
  - what real-time monitoring of sea ice is required
  - how to improve short-term sea ice forecasts and utilise them for navigation

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Economic viability of Arctic shipping for the operators

- Investing in ice-enforced vessels: when does it become viable? (Hansen et al., 2016)
- Investing in the infrastructure
  - ports,
  - ice-breakers,
  - search and rescue facilities,
  - secondary in-land trade routes
- Setting insurance premiums

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Economic drivers and effects of Arctic shipping

- **Global trade drivers for destinational and transit shipping on Arctic routes (Bekkers et al., 2016)**

- **Macroeconomic gains due to the enhanced trade enabled by Arctic routes (Bekkers et al. 2016; Yumashev et al., 2017)**

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Net climatic feedback of Arctic shipping assuming continued use of HFO

- Shorter routes, slow steaming => less warming from CO2, less cooling from sulphate aerosols
- The role of black carbon and other short-lived forcers (Fuglestvedt et al., 2014)
- Additional CO2 and non-CO2 emissions from the countries experiencing economic growth due to Arctic shipping (Bekkers et al. 2016; Yumashev et al., 2017)

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Climate costs vs macro-economic gains, policy implications

- **Translating the climatic feedback into additional climate costs: winners and losers (Yumashev et al., 2017)**

- **Policy implications and solutions**
  - **emissions control areas**
  - **emissions tax**
  - **toll charges**
  - **LNG**

- **The role of Arctic shipping in transitioning to the "low-carbon era" set out by the Paris Agreement**

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Open Discussion

- **What are the biggest challenges for operations in the Arctic and the Antarctic that industry faces currently?**

- **Solutions??**

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