

# Science for Environment Policy

## Arctic shipping access likely to vary for much of the 21<sup>st</sup> century

**A recent study** has considered 21<sup>st</sup> century changes in shipping access through the Arctic Ocean along three potential new routes linking the Atlantic and Pacific Oceans. As the sea ice melts, it is possible that high-strength vessels will be able to sail directly through the North Pole by the end of the century, its results indicate.

**The past 1450 years** have seen unprecedented declines in Arctic [sea](#) ice, with record lows in its extent recorded in 2007 and 2012. However, despite sea ice decline being a prominent symptom of [global warming](#), there is an economic incentive to exploit this phenomenon. Current estimates predict near ice-free summer conditions in the Arctic by mid-century, which would increase the possibility of navigable shipping routes that link the Atlantic and Pacific Oceans, potentially reducing shipping distances by thousands of kilometres.

Currently, the realistic extent of Arctic marine access throughout the 21<sup>st</sup> century under different warming scenarios is not well understood. To help improve this understanding, the researchers modelled Arctic sea ice conditions, including thickness, across early (2011-2030), mid (2046-2065), and late (2080-2099) 21<sup>st</sup> century periods, under three climate scenarios: Representative Concentration Pathways (RCP) 4.5, 6.0, and 8.5. Each RCP represents a different level of radiative forcing, (the amount of heat that is absorbed by the earth versus the amount that is radiated back into space), in watts per square metre, as detailed in the forthcoming IPCC Fifth Assessment Report<sup>1</sup>.

This exercise allowed the researchers to estimate navigation season length for three classes of ship: open water (OW) vessels which are non-ice strengthened, i.e. they cannot navigate through sea ice, Polar class 6 (PC6) vessels with moderate ice-strengthening, and 3 (PC3) vessels which have high ice-strengthening.

The study also considered three potential Arctic routes: the Northwest Passage through the Canadian Arctic Archipelago, the Northern Sea Route leading along the Norwegian and Russian coasts, and the Transpolar Route directly across the North Pole.

The results indicate a complex relationship between ship access and warming. Lower warming under RCP 4.5 gave slightly higher access than medium warming under RCP 6.0 at mid-century, although access for all ship classes would rise steeply for the highest warming scenario, RCP 8.5. No scenarios predicted ice-free Arctic winters by 2100, ruling out winter access for OW vessels.

On average, OW vessels would have access to 76% of the Arctic Ocean under the lowest warming late-century scenario during summers. At mid-century, PC6 and PC3 vessels would have access to 82% and 93% of the Arctic Ocean respectively. However, average increases mask large variations in local geographic and navigation conditions, which significantly affect the accessibility of routes for all three ship classes. The highest accessibility gains were seen through the Northern Sea Route. The Transpolar Route is only likely to become viable for PC3 vessels by late-century, and would remain inaccessible for the other two vessels.

Access to Arctic shipping routes will become increasingly viable as the century progresses. However, at least in the short term, Arctic shipping will continue to be high risk because the length of seasons are variable and unpredictable, and because narrow, obstructive passages, or 'choke points', will appear along shipping routes. Future exploitation of these routes is likely to rely heavily on ice-breaking technologies and investment in extensive ice level forecasting.

The study's authors note that the model used may be overly conservative, and that Arctic Ocean access could increase faster than predicted. They also acknowledge the difficulties of accurately modelling complex coastal areas, particularly through the Northwest Passage.



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10.1007/s10584-012-0685-0. This study is free to view at:

<http://link.springer.com/article/10.1007%2Fs10584-012-0685-0#>

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1. See: [www.ipcc.ch/activities/activities.shtml#.UgORvtK7Lgc](http://www.ipcc.ch/activities/activities.shtml#.UgORvtK7Lgc)