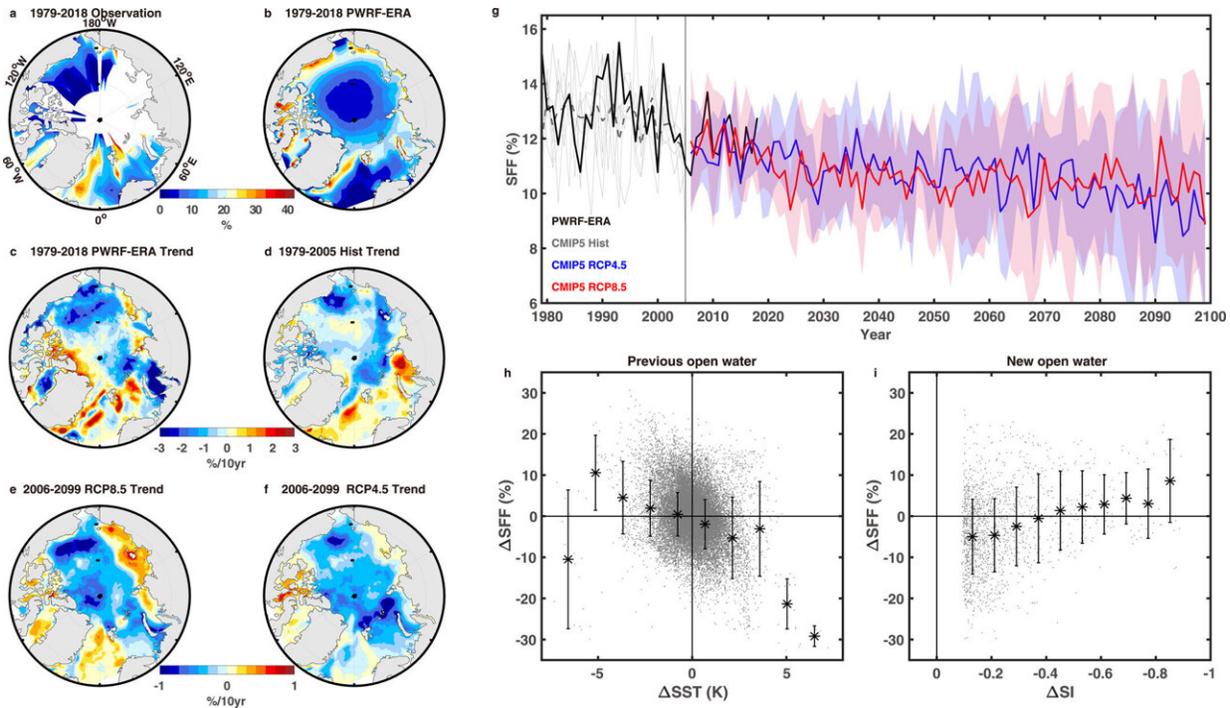


# The future is foggy for Arctic shipping

April 27 2023, by Kirsten Steinke



Climatological distribution of summertime Arctic sea fog frequency (SFF). (a) and (b) are the SFF climatology derived from ship observations and the PWRF-ERA, respectively. The shaded grid in (a) represents observation with data more than 10 years. (c), (d) are spatial pattern of the linear trend of the SFF derived from the PWRF-ERA and the historical run of the Coupled Model Intercomparison Project (CMIP5) models during 1979–2018. (e) and (f) are the linear trend of the projected SFF under RCP4.5 and 8.5 scenarios during 2006–2099. (g) Shows the time series of regional averaged SFF over the ocean north of 70°N based on PWRF-ERA (black), the historical CMIP5 (gray), the RCP4.5 (blue) and 8.5 (red). Shading indicates  $\pm$  one standard deviation. (h) Shows the fog change and SST change over regions which are open water in previous and current years. Error bars show the mean and one standard

deviation. (i) Is the relationship between fog and sea ice change over regions where sea ice in the previous year is larger than 10% but melts into open water in the current year (sea ice less than 1%). (h) and (i) are based on PWRP-ERA. Credit: *Geophysical Research Letters* (2023). DOI: 10.1029/2022GL102395

As the Arctic warms and loses sea ice, trans-Arctic shipping has increased, reducing travel time and costs for international trade. However, a new study finds that the Arctic Ocean is getting foggier as ice disappears, reducing visibility and causing costly delays as ships slow to avoid hitting dangerous sea ice.

The study was published in *Geophysical Research Letters*.

Arctic sea ice has been shrinking for decades. That loss has opened shipping channels in the Northwest Passage and the Northern Sea Route, allowing even non-icebreaker vessels to skip the time-consuming Panama and Suez Canals farther south. But as the ice recedes, cold air is exposed to more [warm water](#), and warm vapor condenses into fog in those new passages. Hidden chunks of ice already pose risks to vessels making their way through foggy, low-visibility routes.

"The future of shipping in the Arctic is unclear, but fog could pose a significant challenge," said Xianyao Chen, a physical oceanographer at the Ocean University of China and author of the study. "When designing shipping routes across the Arctic, we need to consider the impact of fog."

To examine how [climate change](#) has impacted fog conditions along Arctic shipping routes, and to see how conditions will change during the 21st century, researchers used data on Arctic fog collected from 1979 to 2018 and climate projections from the Fifth Phase of the Coupled

Model Intercomparison Project. The researchers also modeled alternate routes that could minimize foggy days during transit.

They found that ships crossing the Northwest Passage are more likely to encounter fog than ships in the Northern Sea Route. Fog in the Northwest Passage, which avoids the Panama Canal, is more frequent and persistent and so likely to increase sailing time by up to three days. Sailing time for the less-foggy Northern Sea Route, avoiding the Suez Canal, is projected to be no more than one day longer. According to the study, both proposed passages would encounter less fog if the routes shifted farther away from the sea ice edge.

Fog is already cutting into time gained by taking the much shorter Arctic routes; shipping speeds on foggy days are slower than on clear days, Chen found. As the Arctic gets foggier, shipping could continue to slow unless routes are adjusted. With daily operating costs for large container ships typically reaching \$50,000 to \$150,000, a multi-day delay due to fog quickly increases the costs of a trans-Arctic crossing.

"Avoiding ice is critical," said Scott Stephenson, a physical scientist at the RAND Corporation who was not affiliated with this study. "This study did a good job at identifying the risks of fog—an important environmental constraint in the Arctic, and one that has largely been ignored."

**More information:** Shutong Song et al, Adapting to a Foggy Future Along Trans-Arctic Shipping Routes, *Geophysical Research Letters* (2023). [DOI: 10.1029/2022GL102395](https://doi.org/10.1029/2022GL102395)

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