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## The response of Northern Hemisphere polar lows to climate change in a 25 km high-resolution global climate model

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Polar lows are small, intense cyclones that form at high latitudes during winter. Their high wind speeds and heavy precipitation can have substantial impacts on shipping, coastal communities and infrastructure. However, climate models typically have low resolutions and therefore poorly simulate Polar Lows. This reduces the confidence that can be placed in future projections of extreme high latitude weather and associated risks.

In this study, Polar Lows are assessed for the first time in a high-resolution (25 km) global climate atmosphere-only model, N512 HadGEM3-GA3, for both present-day and future RCP 8.5 climate scenarios. Using an objective tracking algorithm, the representation of Polar Lows in the N512 HadGEM3-GA3 present-day simulation is found to agree reasonably well the NCEP-CFS reanalysis. RCP8.5 scenario conditions are generated by adding SST changes between 1990-2010 and 2090-2110 from the RCP8.5 experiments with the HadGEM2-ES model to observed SSTs from the present-day climate. In the RCP8.5 N512 HadGEM-GA3 simulations, the number of Northern Hemisphere Polar Lows are projected to substantially decrease (by over 60%) by the end of the 21st century, which is largely due to an increase in atmospheric static stability. However, new regions of Polar Low activity along the northern Russian coastlines are found where the Arctic sea ice is projected to retreat.