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

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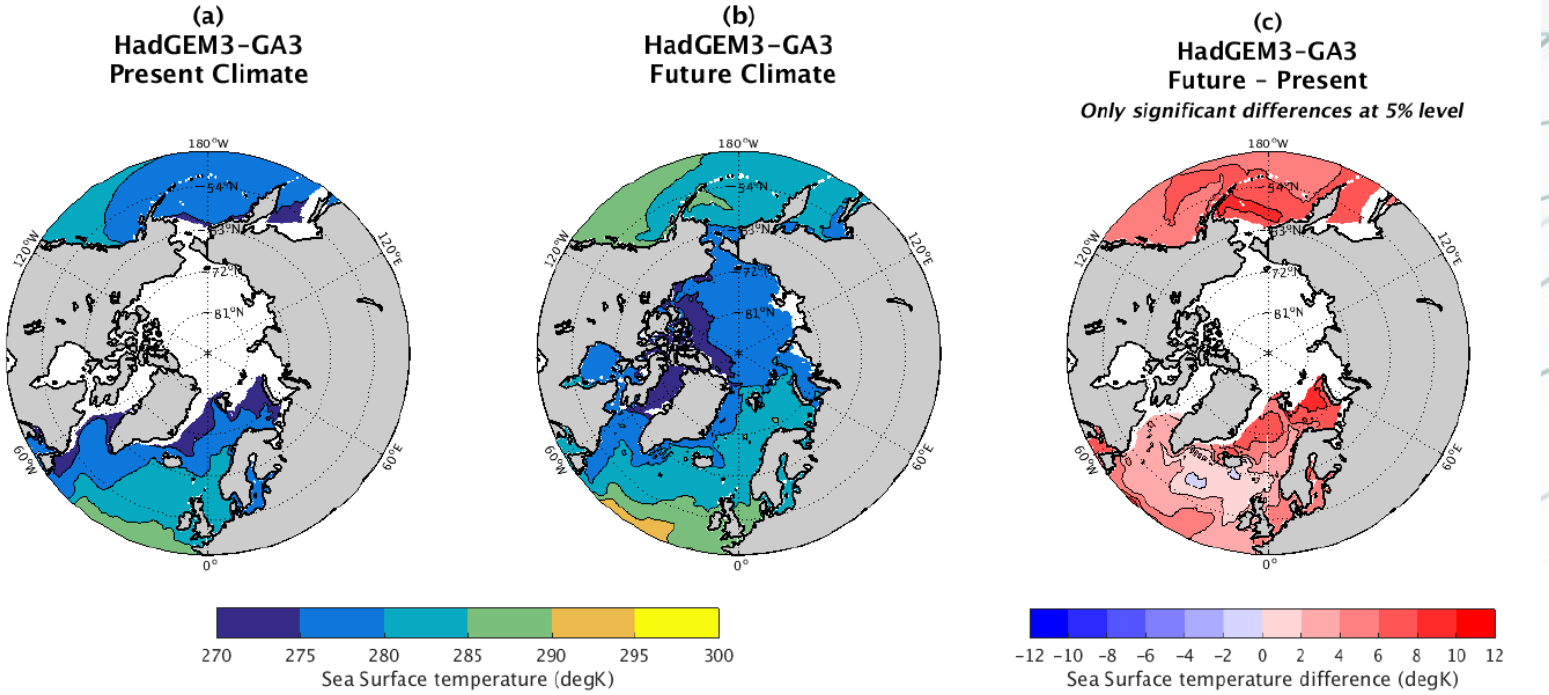
Methodology

Present & future experiments with atmosphere-only n512 (25km) HadGEM-GA3 from UPSCALE (Mizielinski et al. 2014)

Polar Low Identification

1. Tracking of Hodges (1995) on small-scale (T41-T100) 6-hrly 850hPa vorticity
2. T_{500}-T_{SST} < -43K
3. 10m Windspeed > 15ms^{-1}
4. Over open ocean
5. Radius of max wind < 2.5^{o}



Oct-March present-day and future (RCP8.5) boundary conditions for SST (colours) and sea ice (white areas)

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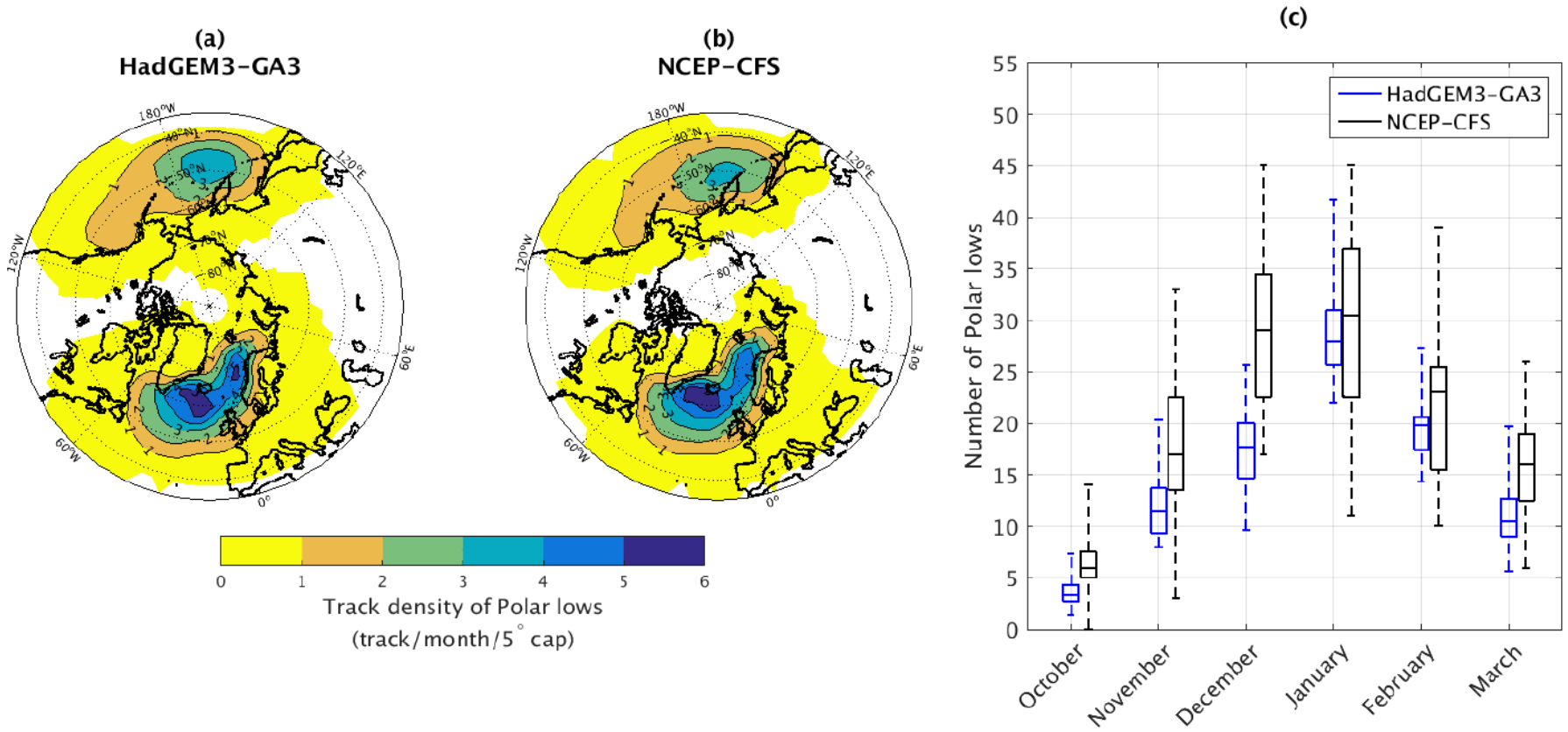
Polar Lows in 25km HadGEM3-GA3



The spatial distribution and seasonal cycle of Oct-March Polar Lows agrees well with the NCEP-CFS reanalysis. Polar Low numbers are slightly lower than observed.

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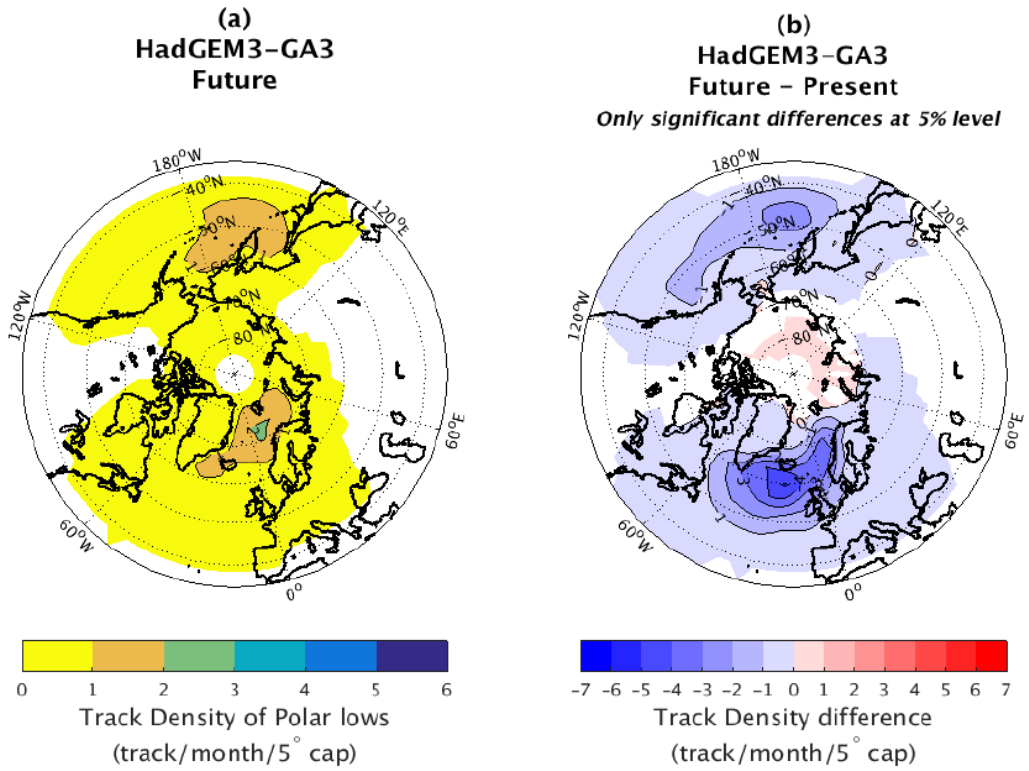
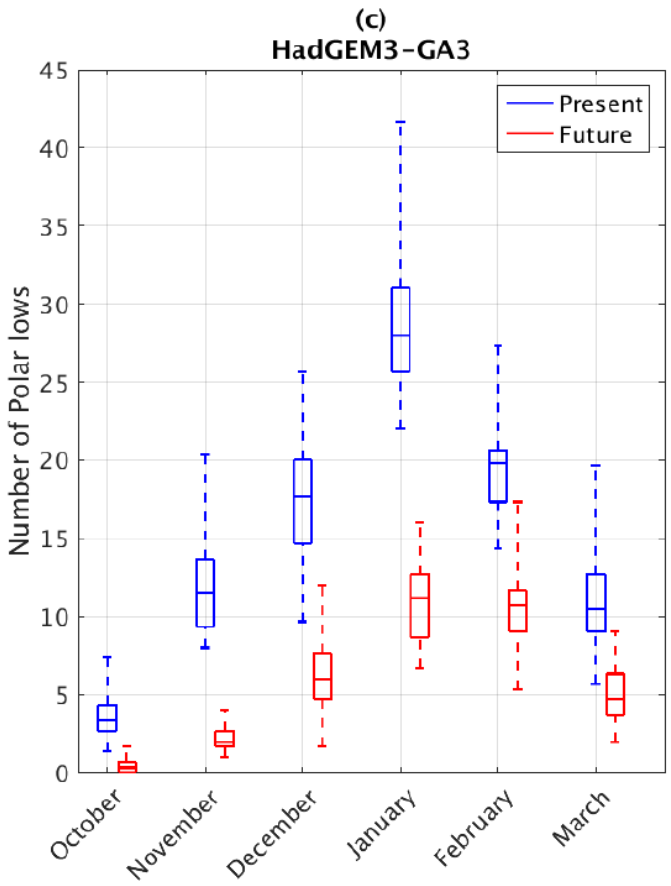
Climate change response of Polar Lows





Large future decrease (approx. 60%) in Polar Low number under RCP8.5. Increase in Polar Low number in the Arctic where Arctic sea ice retreats.

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Conclusions

1. The spatial distribution and seasonal cycle of Polar Lows in n512 (25km resolution) HadGEM3-GA3 agrees well with the NCEP-CFS reanalysis, although Polar Low numbers are slightly lower than observed.

2. Under climate change (RCP8.5) conditions there is a l**arge decrease (approx. 60%) in Polar Low numbers across the NH**. This is consistent with previous regional climate modelling studies and the increase in static stability see across Polar Low development regions

3. However, there is an **increase in Polar Low numbers in the Arctic** where Arctic sea ice retreats under the RCP8.5 scenario in HadGEM3-GA3. May have implication for future Arctic shipping

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