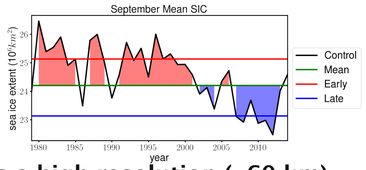
Impacts of Changing Sea Ice Cover on Northern Hemisphere Atmospheric Conditions

J.V. Mecking[1], S.S. Drijfhout[1], M. Roberts[2]

[1] Ocean and Earth Science, National Oceanography Centre Southampton, University of Southampton, UK
[2] Met Office Hadley Centre, Exeter UK

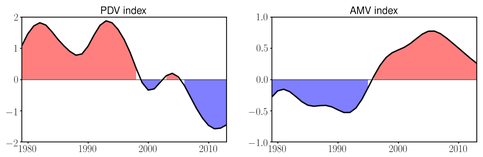
Motivation

Over the last decades the global sea ice cover (SIC) has been declining. Various studies have shown that not only does a reduction of sea ice cause warming in most areas of the Northern Hemisphere but there are also areas that exhibit cooling in response to these changes.



How does a high resolution (~60 km) atmospheric model respond to the changes in sea ice?

Furthermore, the late 90's saw a change in sign of both the Pacific Decadal Variability (PDV) and the Atlantic Multi-decadal Variability (AMV).



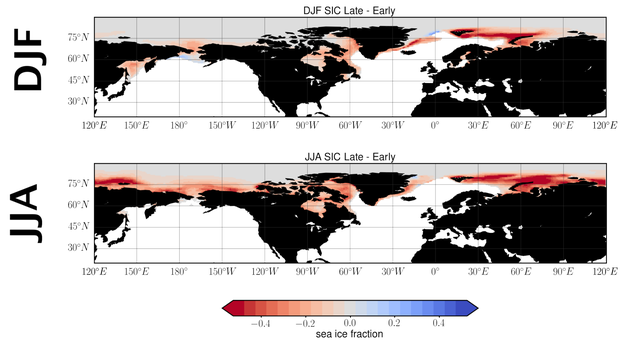
In addition to the changes in sea ice, how do changes in PDV and AMV impact Northern Hemisphere temperatures?

Experiment Set-up

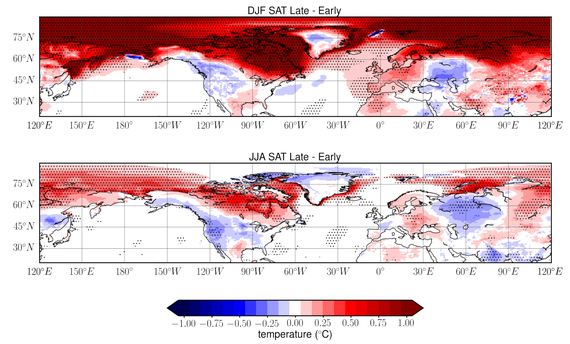
- Atmosphere model setup: Unified Model (UM), GA7.1, N216, approx. ½° latitude by ¾° longitude, 85 vertical levels, top level 0.1hPa
- SST and SIC prescribed from HadISST daily

	SST	SIC	# ensemble members
Control	inter-annual	inter-annual	10
Mean	inter-annual	mean 1979-2014	10
Early	inter-annual	mean 1979-1983	5
Late	inter-annual	mean 2010-2014	5
noPDV	no PDV	inter-annual	5
noAMV	no AMV	inter-annual	5

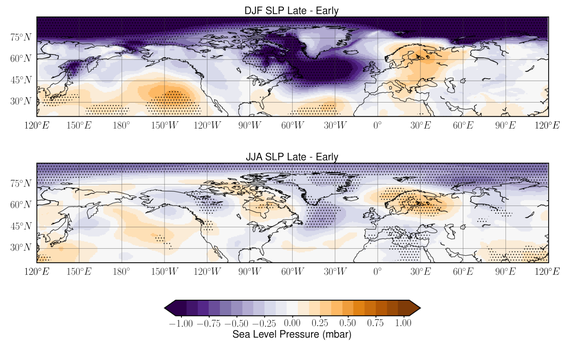
Sea Ice Late - Early



Surface Air Temperature Late - Early

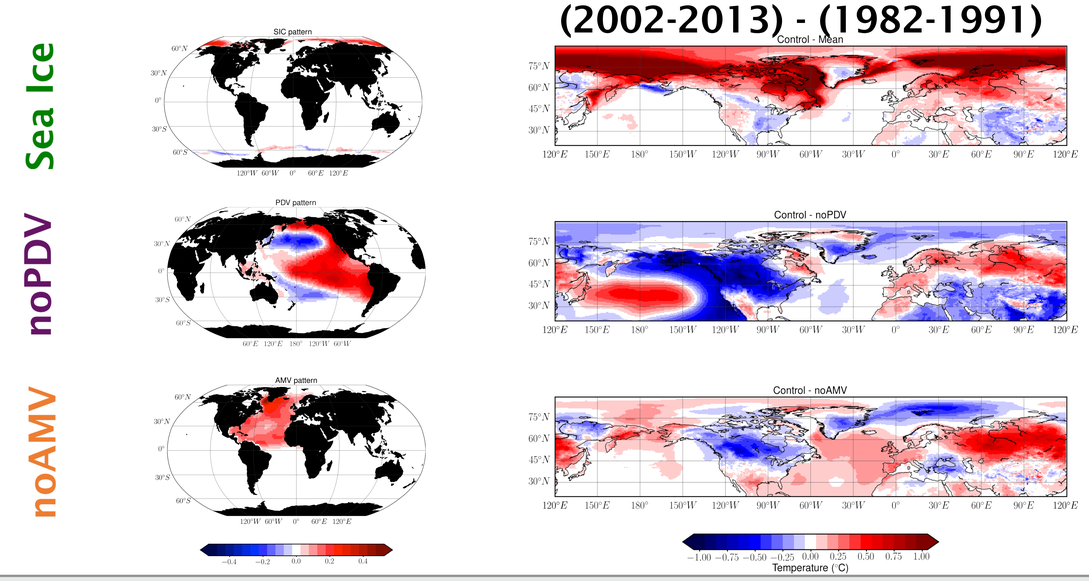


Sea Level Pressure Late - Early

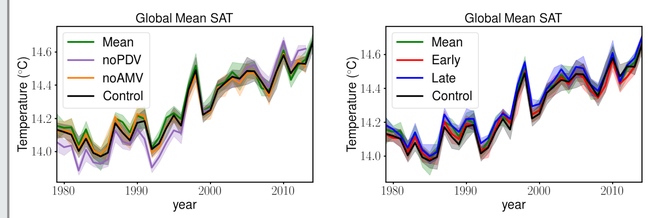


Pattern

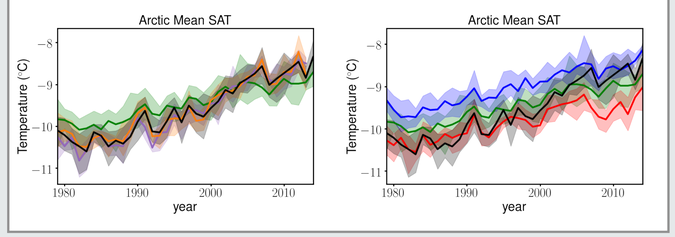
Control – Exper. (2002-2013) - (1982-1991)



SAT Response Global



Arctic



Conclusions

- Reductions in sea ice cause warming in Arctic along sea ice edge with largest warming in winter
- Decreasing sea ice leads to cooling in Eurasia as well as west coast of North America, aligning with SLP anomalies
- Recent changes in AMV and PDV cause warming over most of Europe and Asia and cooling over North America
- The decreasing sea ice has largest impact over Arctic with very little impact globally while PDV has largest global impact to SAT

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Email: j.v.mecking@soton.ac.uk

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