

What are the global impacts of Arctic climate change?

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<http://polarprediction.net/linkages>

International workshop on polar-lower latitude linkages and their role in weather and climate prediction



A joint initiative by WWRP-PPP and WCRP-PCPI. A workshop on invitation only.

**10 December, 1pm - 12 December, 5 pm,
2014, Barcelona, Spain**



An intense workshop:

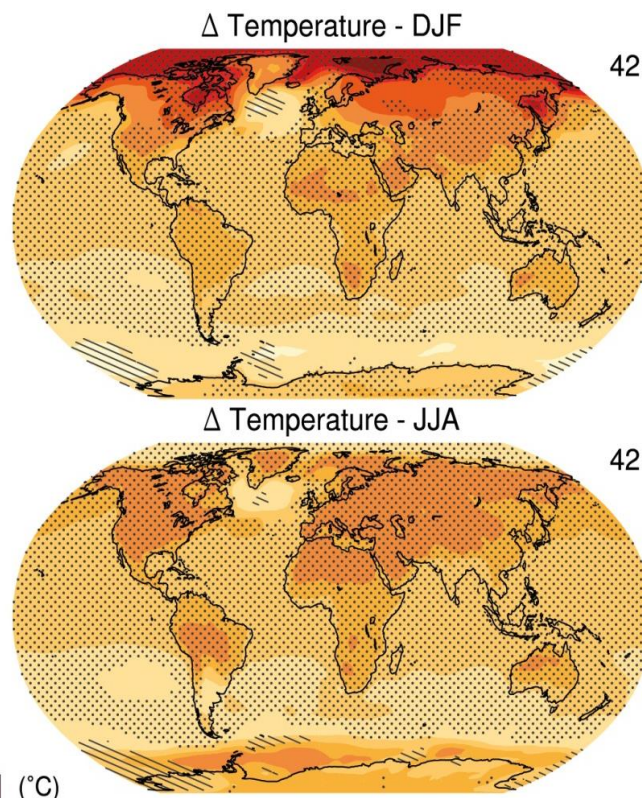
- **Keynote talks, breakout groups, posters, and plenary sessions**
- **Attendees:** 80 participants, scientists and representatives from international programmes, prediction centres and funding agencies
- **Three topics:** 1) Atmospheric Polar/Mid-latitude Linkages: Processes and Mechanisms, 2) Oceanic Polar/Mid-latitude Linkages: Processes and Mechanisms, and 3) Implications for prediction and services
- **Workshop guidance and a pre-workshop scientific documents**
- **Unique list of relevant literature**
- **Final report and outreach components coming up**

Some of the questions:

- Arctic amplification is zonally asymmetric. Can we identify thermodynamic aspects of polar influence?
- Can Arctic warming significantly influence mid-latitude weather?
- Has Arctic warming significantly influence mid-latitude weather?
- Will Arctic warming significantly influence mid-latitude weather?
- Can we understand why different people come to different conclusions from the same data?
- What is a significant change? How to define the null hypothesis?
- **The community needs to move from correlations to causality**

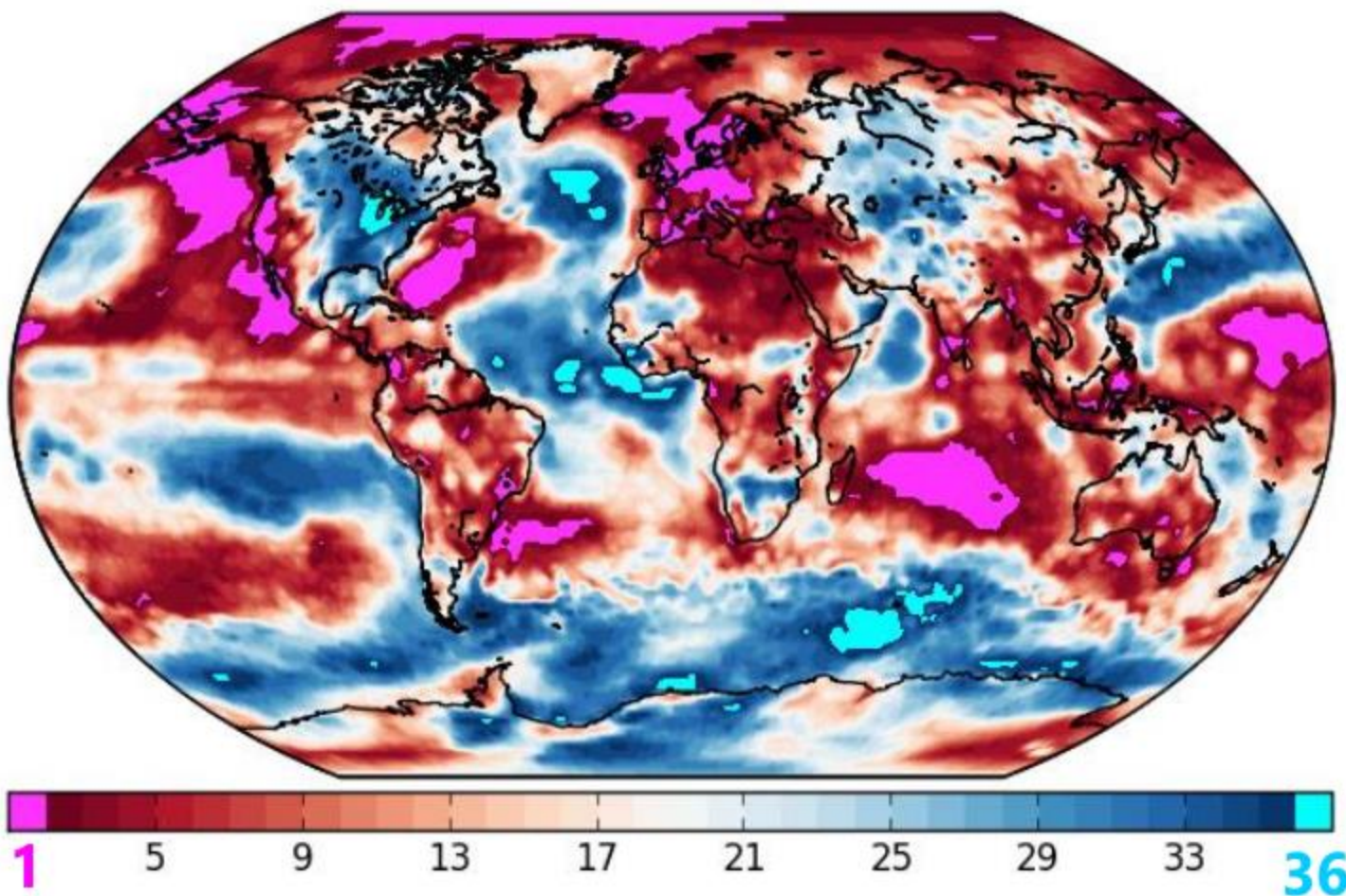
Near-term projections

Seasonal-mean air temperature change for the RCP4.5 scenario over **2016-2035** (wrt 1986-2005). Stippling for significant changes, hatching for non-significant. The meridional gradient decreases (it increases at the tropopause).



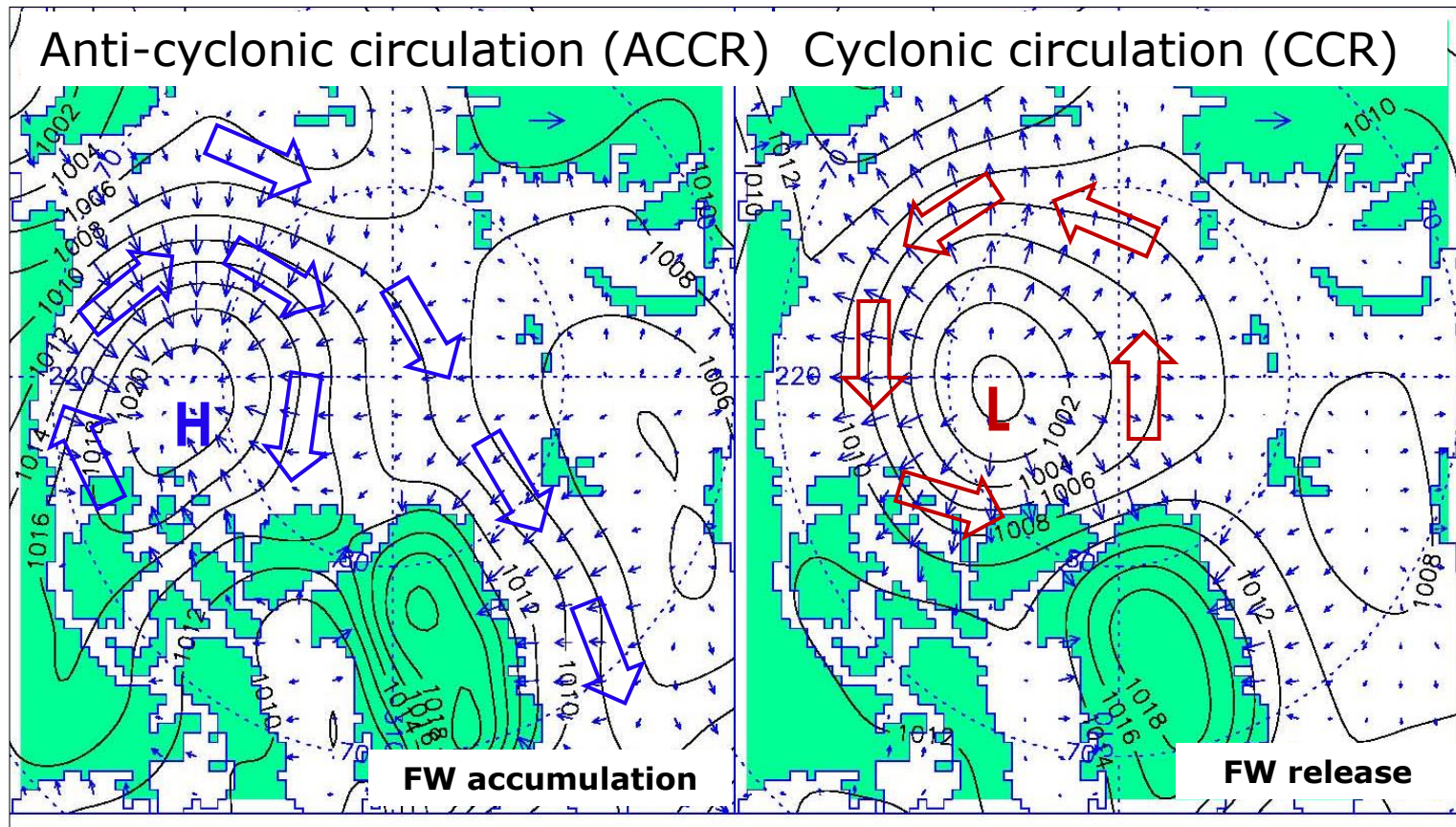
Specifics of the polar regions

Rank of the 2014 annual mean temperature over the last 36 years from ERA Interim.



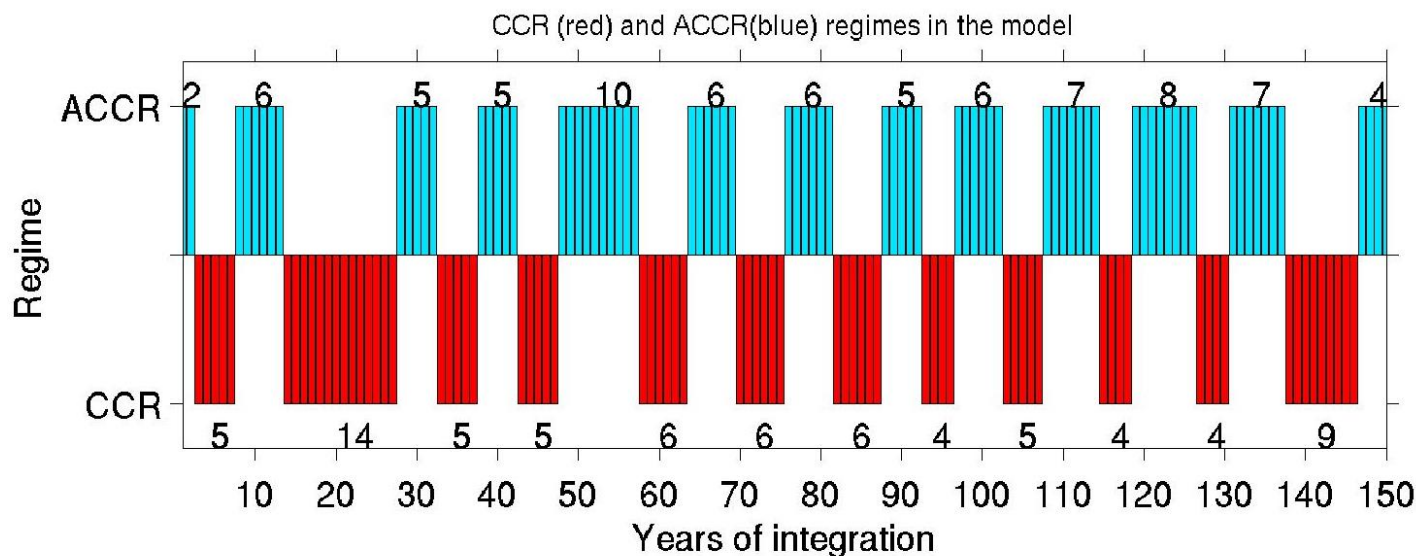
The role of the ocean

SLP (black lines, hPa), wind direction (large arrows) and Ekman transport (blue small arrows) typical for ACCRs (left, Ekman transport converging) and CCRs (right, Ekman transport diverging).



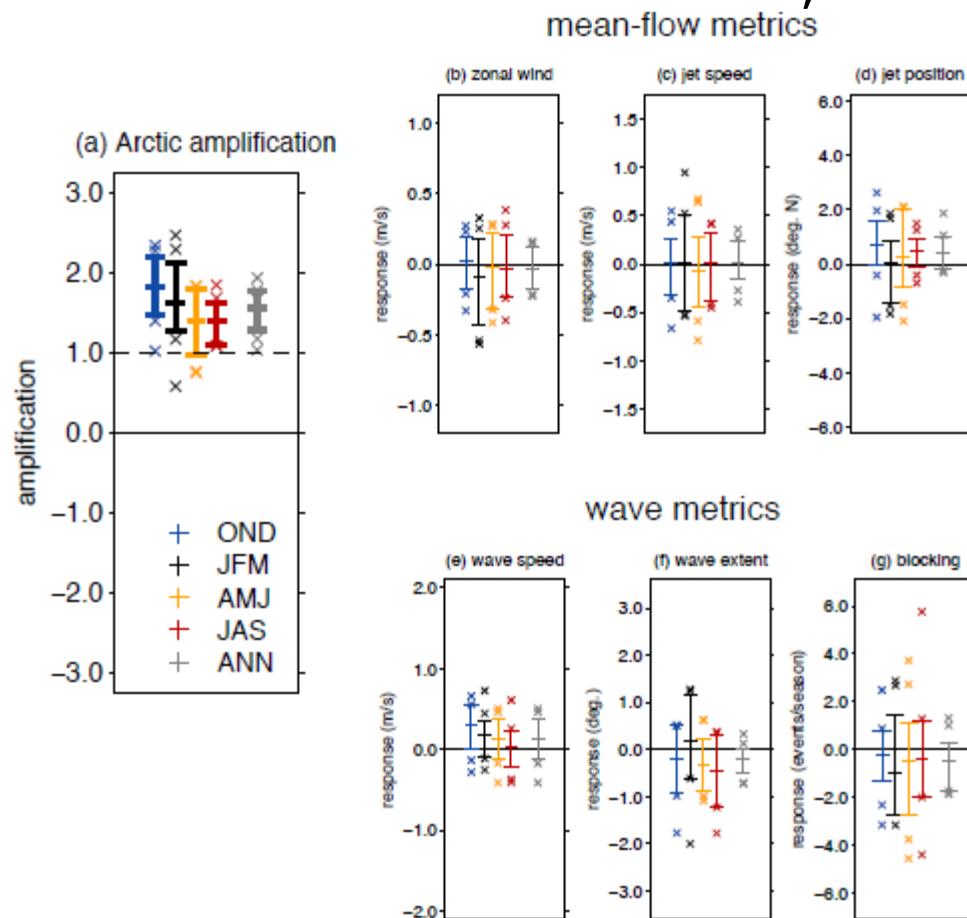
The role of the ocean

Transition between anticyclonic and cyclonic regimes in the Arctic before the XXist Century.



The atmospheric response

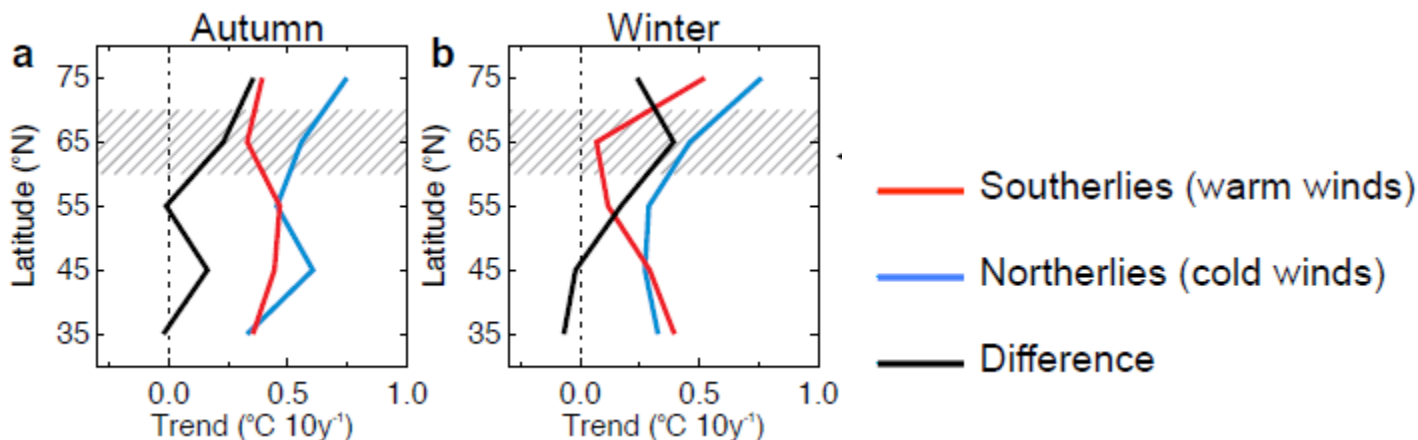
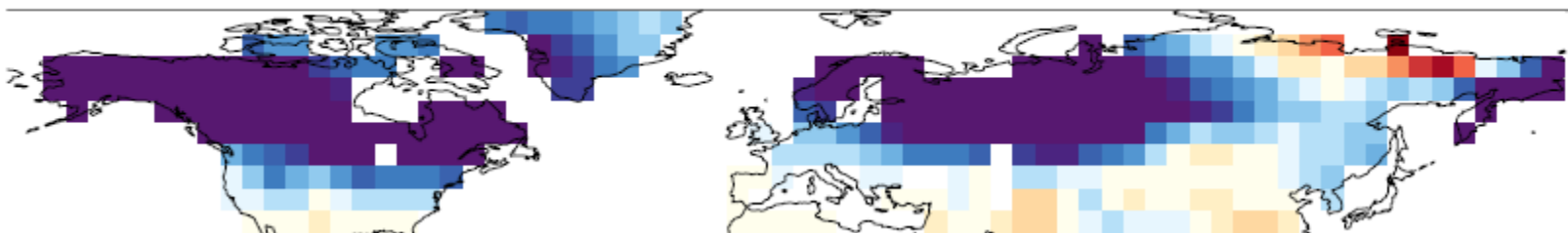
Differences between 2020-2044 and 1980-2004 over the North Atlantic region from CMIP5. Results do not support an impact of Arctic amplification on mid-latitude circulation, rather a modulation.



The atmospheric response

The decrease of intraseasonal temperature variance can be found both in reanalyses (below for 1979-2013) and simulations.

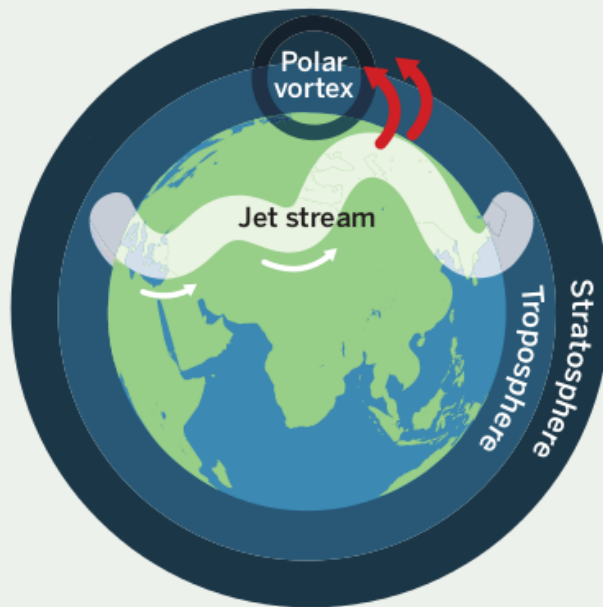
Winter variance change, 2070-99 minus 2006-35, from 34 CMIP5 models under RCP8.5



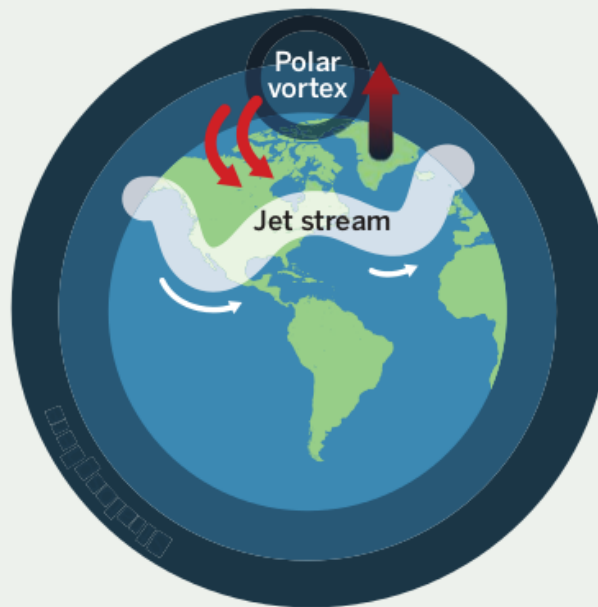
Snow and circulation

Conceptual model of the link between the Siberian snow in fall and the Northern Hemisphere winter circulation. A key mechanism for climate prediction, a challenge for current forecast systems.

Increased autumn snow in Siberia



Jet stream pushes south



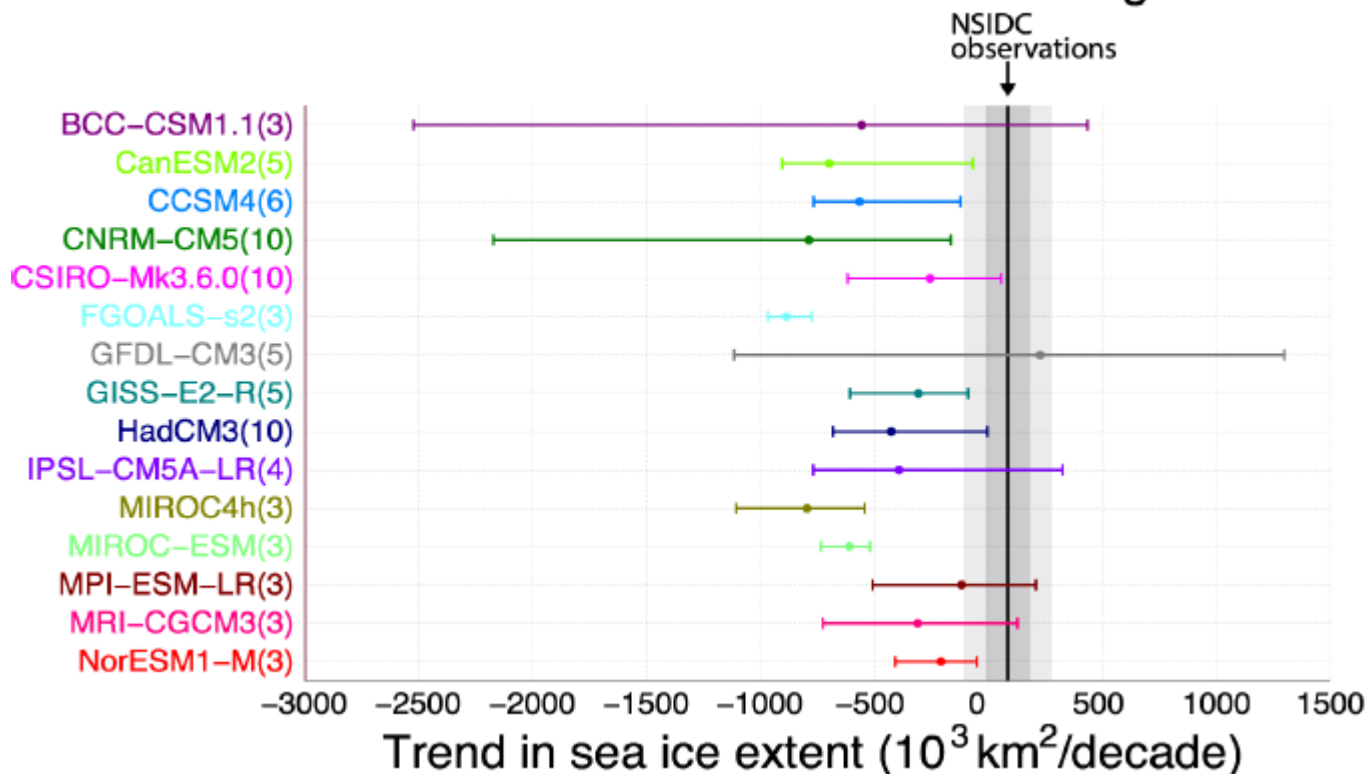
Colder winter in eastern United States and Europe



The Antarctic

Important changes, and substantial model disagreements, are occurring in the Antarctic. The symptom of an illness common to the Southern Hemisphere mid-latitudes?

1979–2005 JAS sea ice extent trend range



List of high-level recommendations:

- Improve our **understanding** of key processes in atmosphere, snow, sea ice and ocean responsible for the linkage.
- Ensure that these key processes are well represented in **models**.
- Link the research performed for **weather and climate forecasting** with that carried out to project future climate.
- Distinguish between the net seasonal response and the regional episodic amplification of existing long-wave patterns.
- Carry out **coordinated model experiments**, including data denial, prediction and relaxation.
- Explore the **limits of predictability** of polar weather/climate.
- Work with **YOPP** for a more adequate polar observing system.
- Create a working group to tackle the specificity of **polar service provision**.
- Simplify the **funding** process for research collaboration on an international level.

SUCCESSFUL CLIMATE SERVICE Principles



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