What is coming up for global climate?

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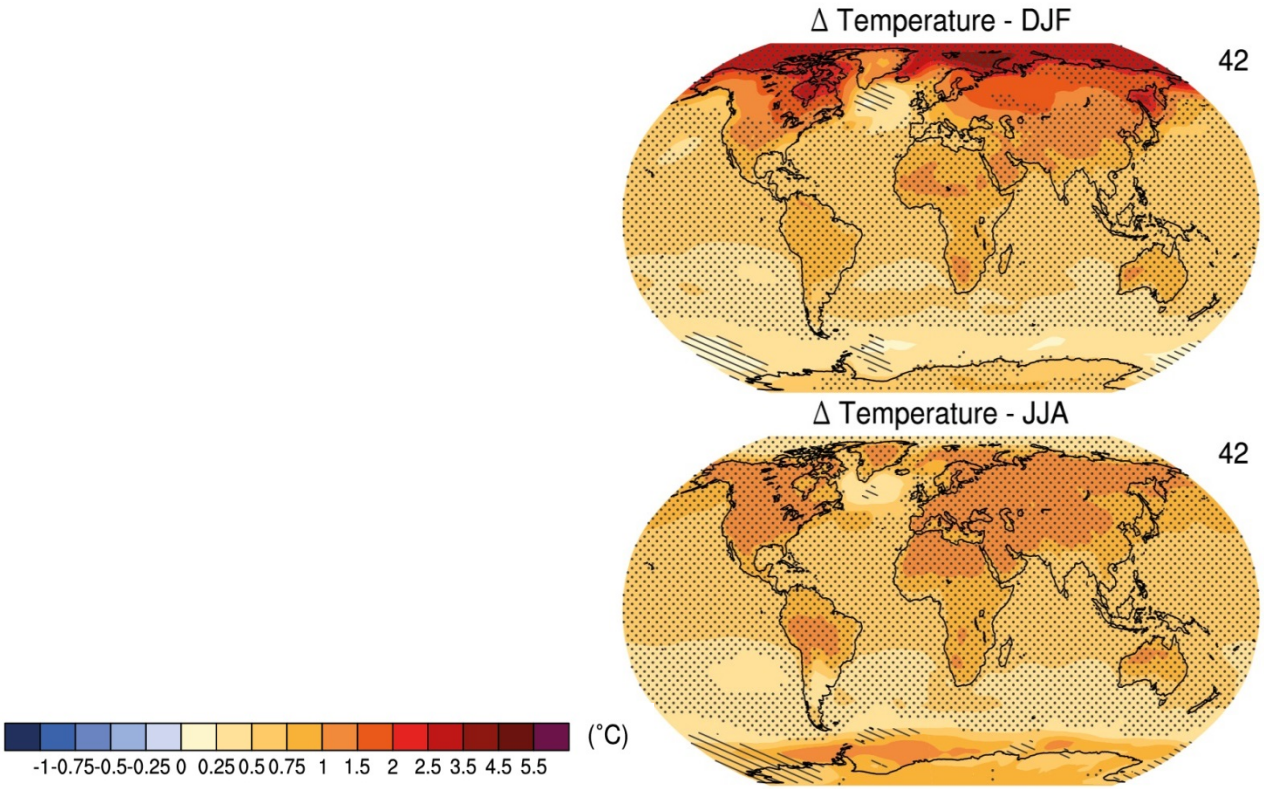
Centro Nacional de Supercomputación
EXCELENCIA SEVERO OCHOA

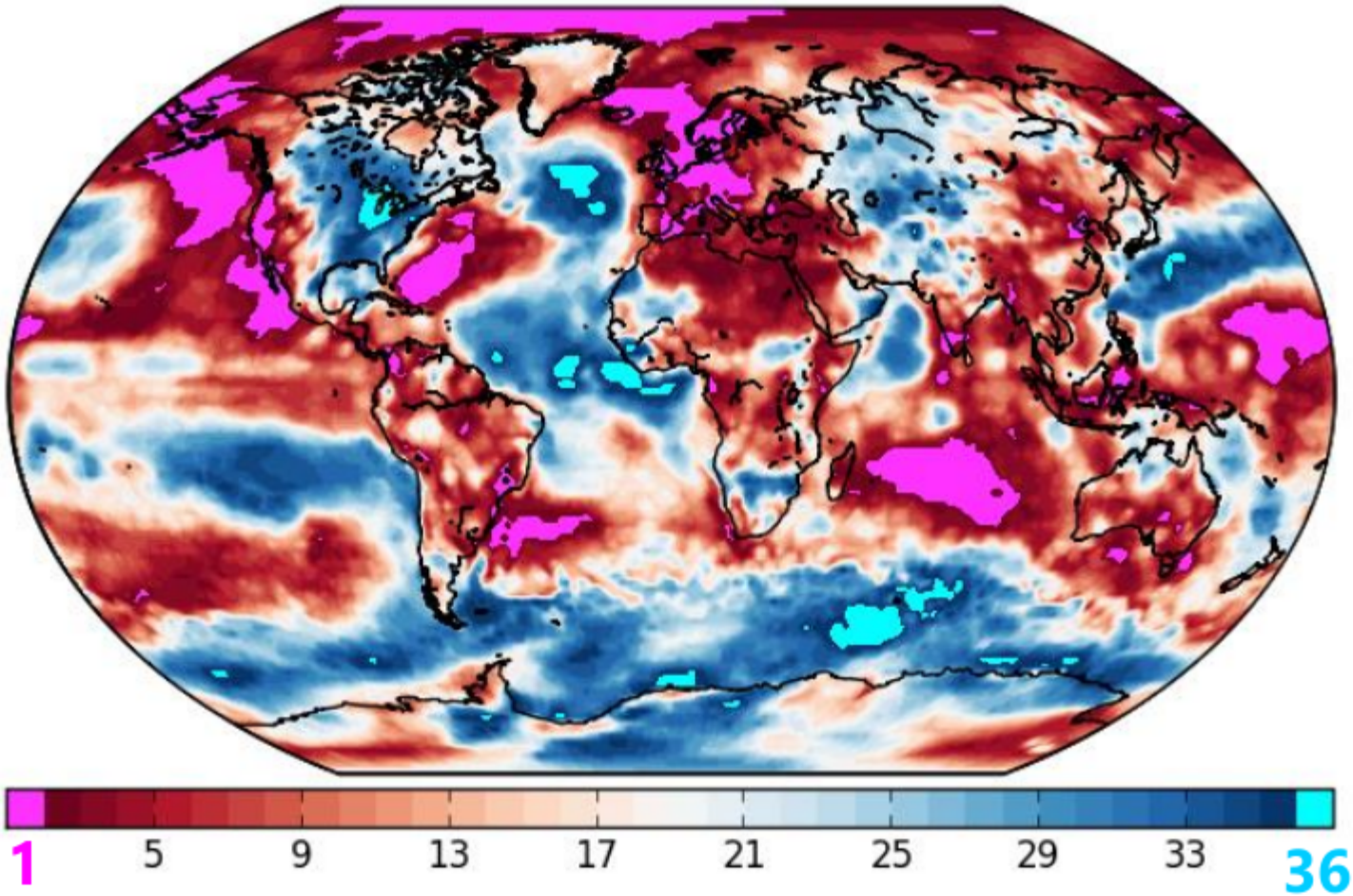
Seasonal-mean air temperature change for the RCP4.5 scenario over 2016-2035 (wrt 1986-2005). The meridional gradient decreases (it increases at the tropopause). Stippling for significant changes, hatching for non-significant.



IPCC AR5 WGI (2013)

What is currently happening?

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



François Massonnet (IC3)

The linkages workshop

Summary to appear soon in BAMS.

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

The linkages workshop

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**

The linkages workshop

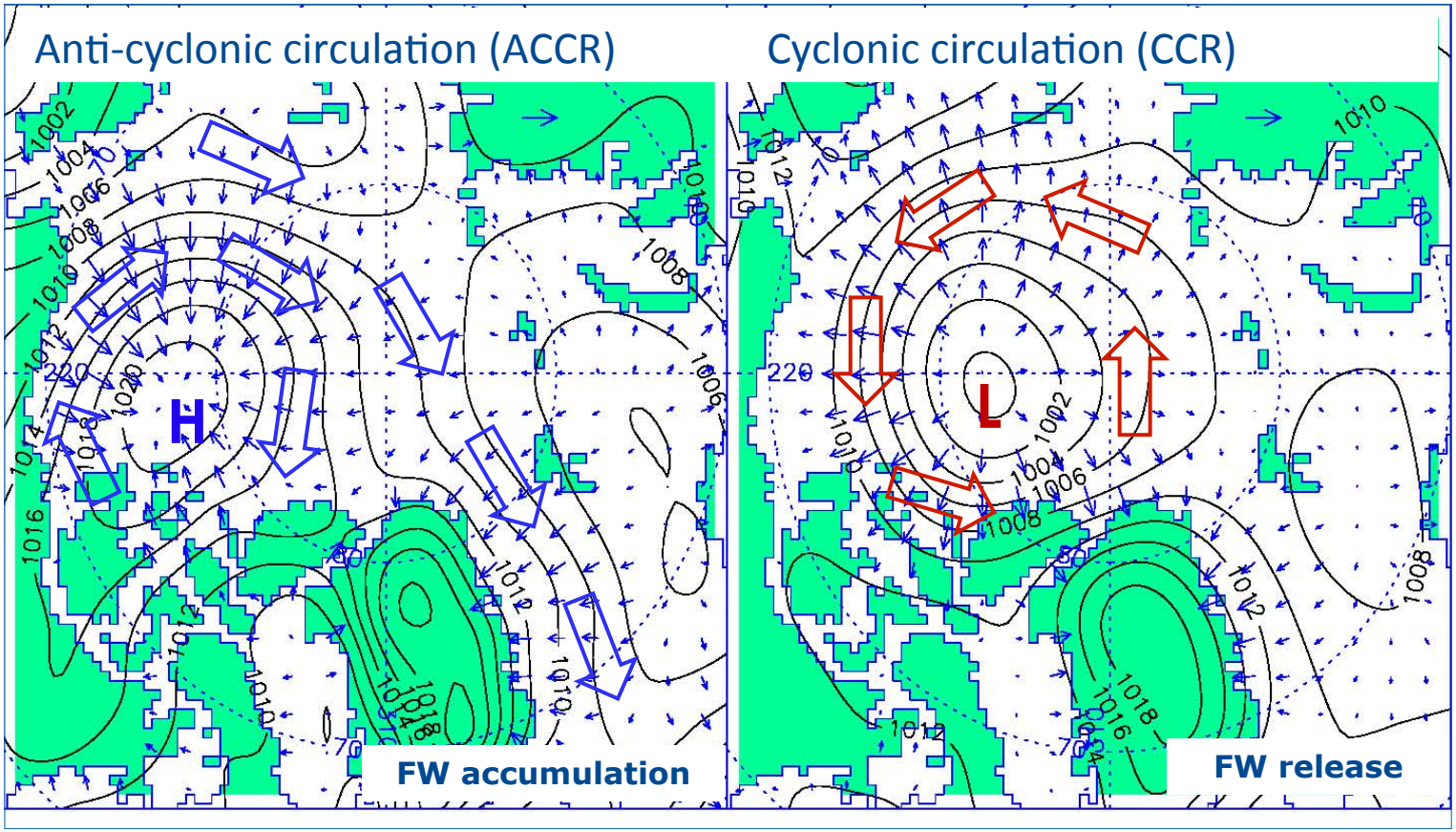
Some of the questions:

- 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 influenced 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

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).



Andrey Proshutinsky (Woods Hole)

Sea-ice decadal prediction

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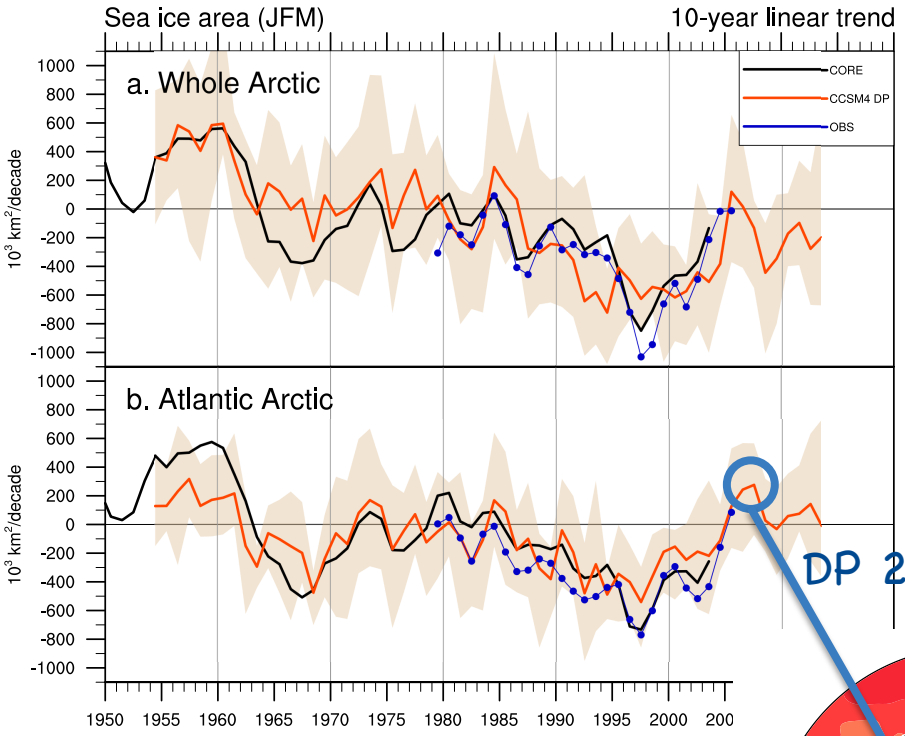
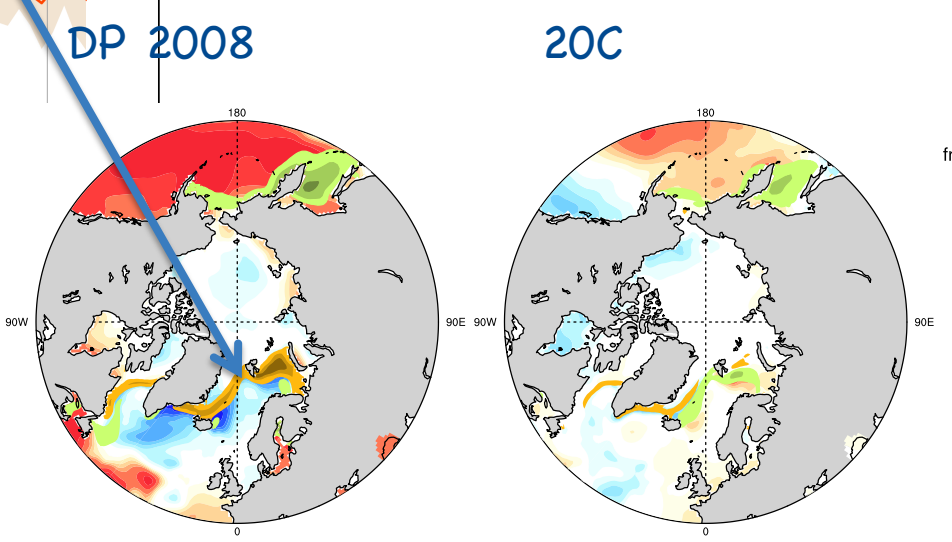
2008-2017 trends in SST and winter sea-ice extent from CCSM4 initialized decadal prediction (DP 2008) and uninitialized ensembles.

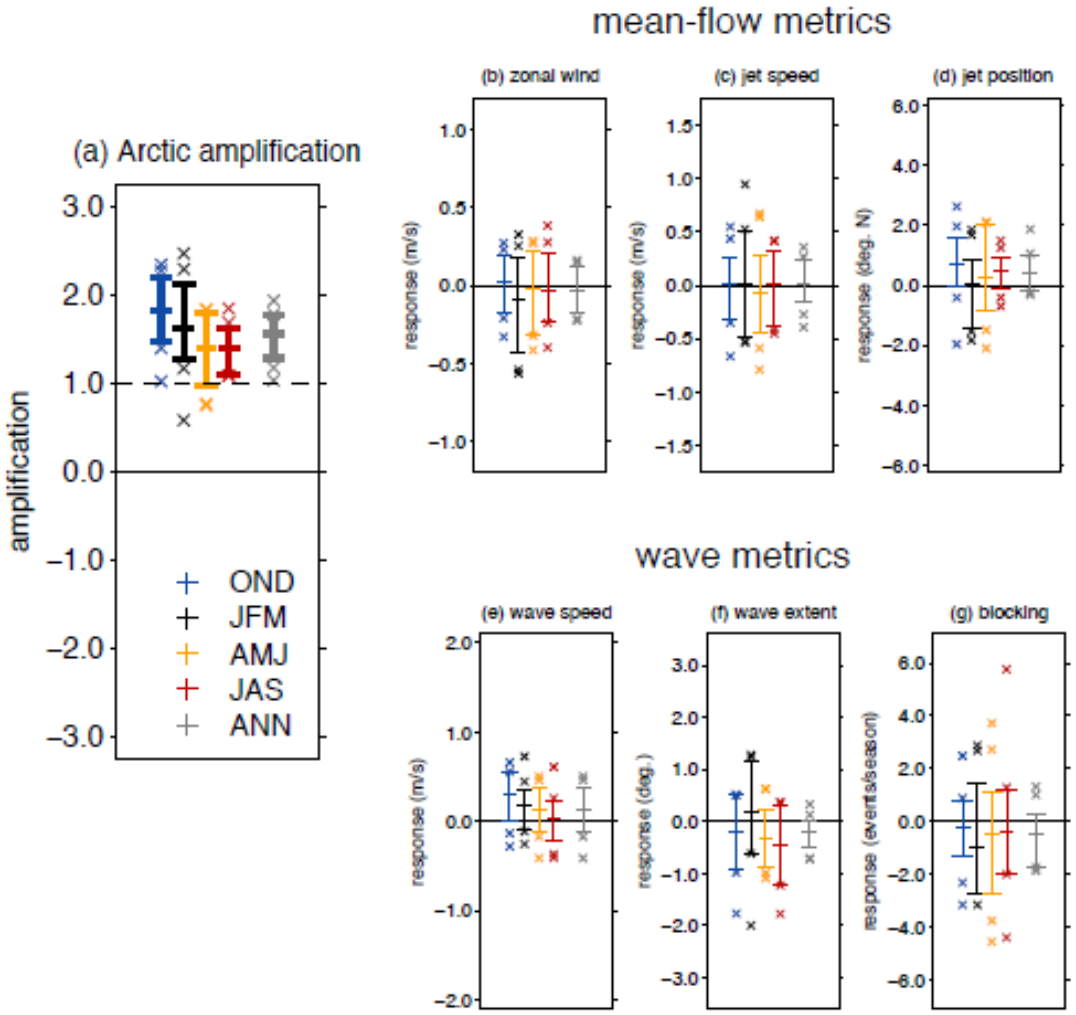




Yeager et al. (2015)

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.

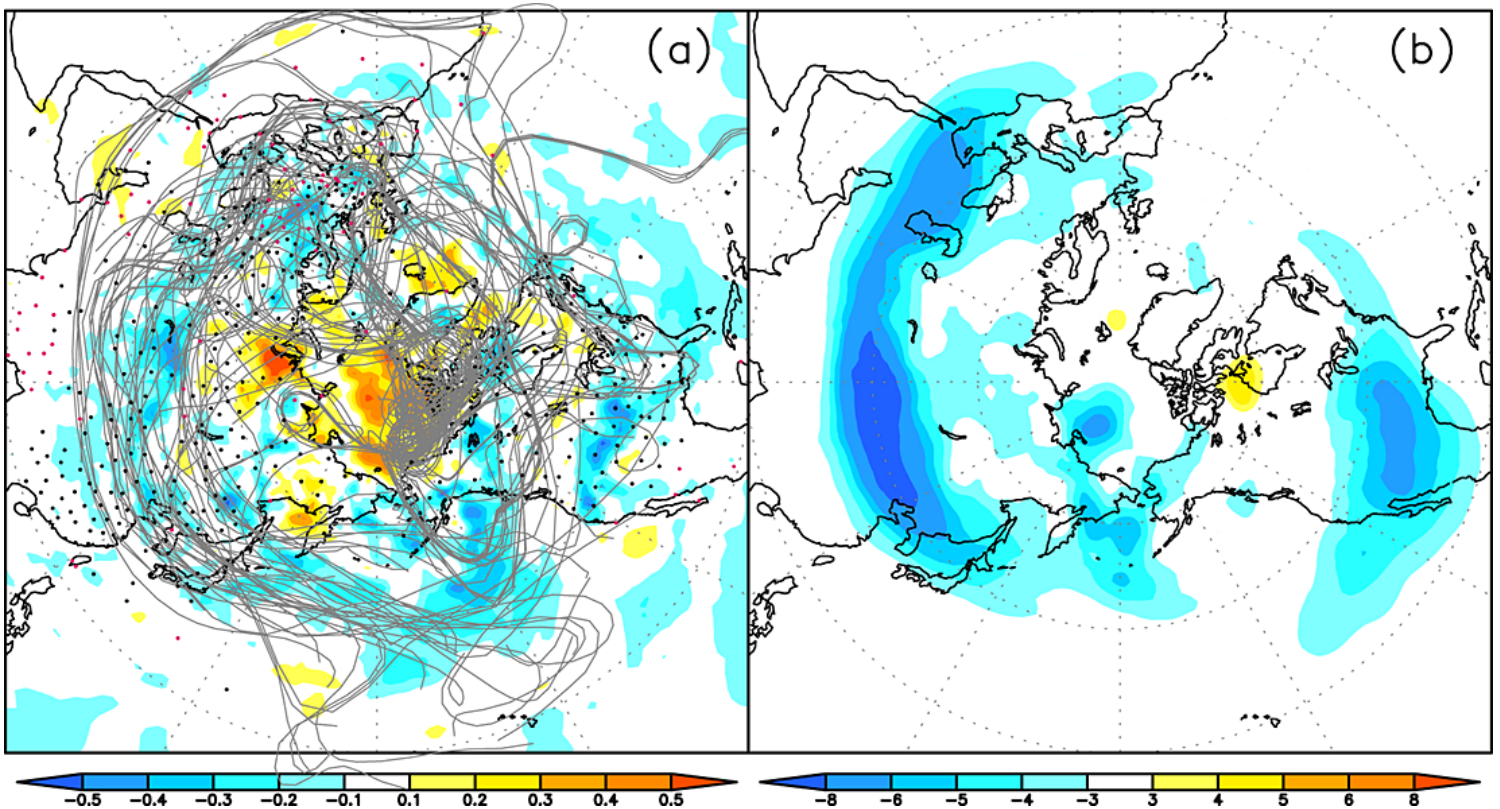


Elizabeth Barnes (CSU)

Data denial and linkages

(Left) 250 hPa temperature difference for CTL and OSE for forecasts between 24/09 and 13/10, and (right) Sept.-Oct. 2010 average.

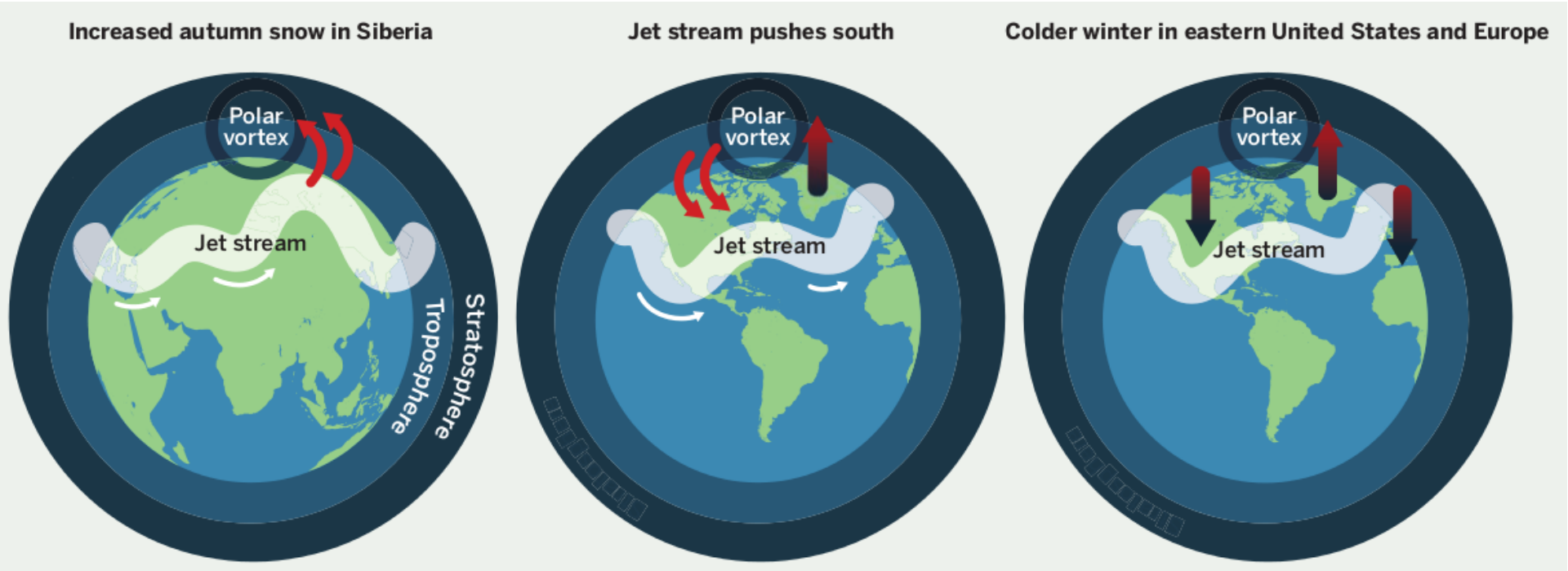
Data denial experiments for linkages will need 1) OSE and OSSE, 2) large ensembles, 3) relaxation experiments.



Inue et al. (2013)

Other components: The snow forcing

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.



Carolyn Gramlin (Science)

Other components: The snow forcing

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SNOWGLACE is a WGSIP-sponsored initiative that aims at assessing the predictability of the climate system where the snow initialization plays a role.

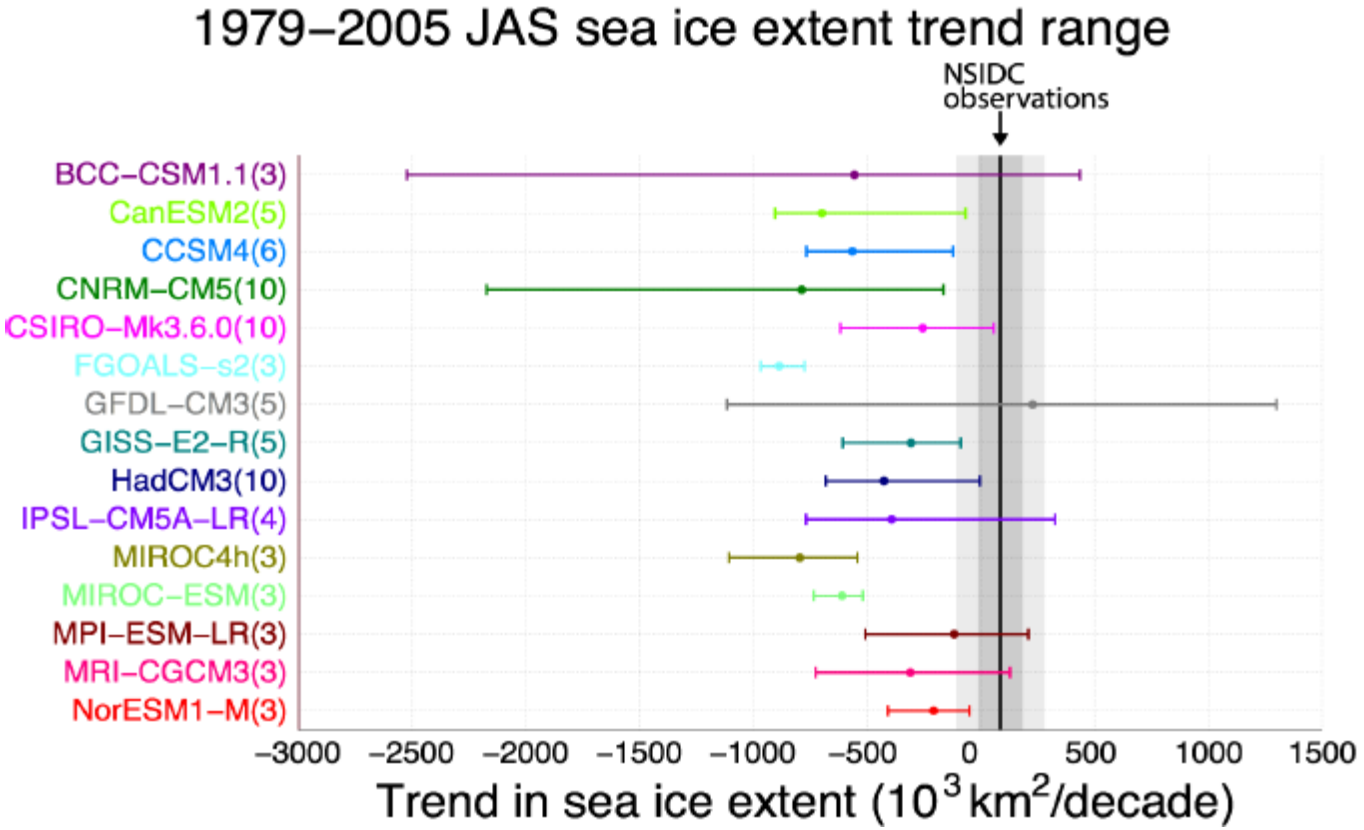
The targets are Europe (e.g. the winter North Atlantic Oscillation) and Asia (e.g. cold spells).

Several models (NorCPM, EC-Earth, CNRM-CM) have committed to make the simulations, where sets of hindcasts are performed with either the best or random snow initial conditions.

A link to LSMIP-CMIP6 is being stablished.

The Southern Hemisphere

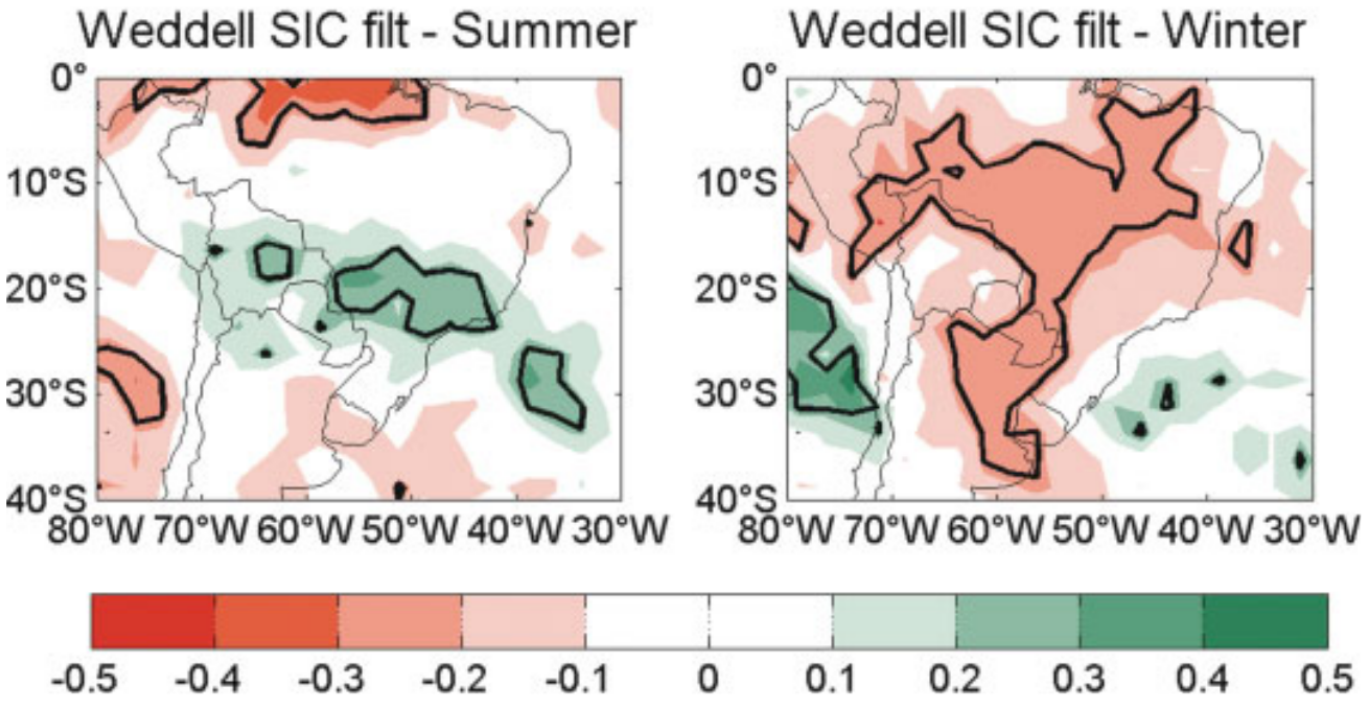
Important changes, and substantial model disagreements, are occurring in the Antarctic. The symptom of an illness common to the Southern Hemisphere mid-latitudes?

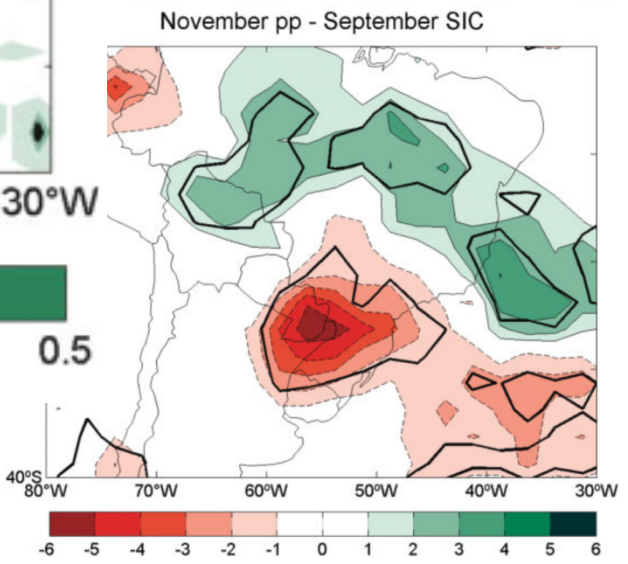


Hugues Goosse (UCL)

The Southern Hemisphere

Correlation of South American precipitation with Weddell Sea sea-ice concentration for summer and winter (SAM and ENSO signals filtered out) and precipitation composite of November precipitation for high minus low Weddell Sea sea ice. Contours for significant signals (99%).

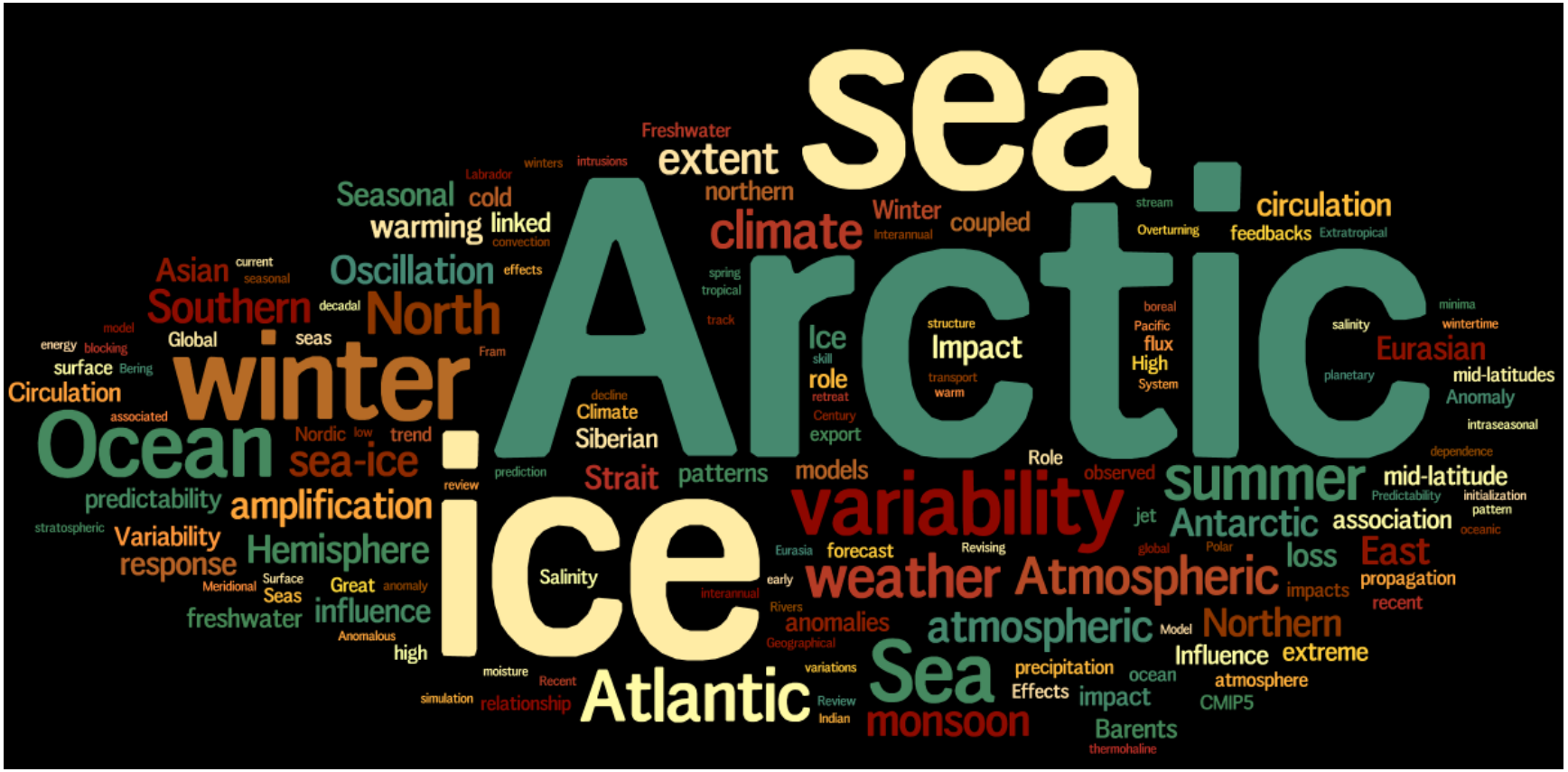




Saurral et al. (2014)

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 atmospheric long-wave patterns.
- Carry out **coordinated model experiments**, including data denial, prediction and relaxation.
- Explore the **limits of predictability** of polar weather and climate.
- Contribute to **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 at an international level.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Southern
North
Oscillation
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linked
cold
Labrador
winters
intrusions
Freshwater
extent
northern
climate
Winter
Interannual
coupled
stream
Overturning
circulation
feedbacks
Extratropical
Asian
current
seasonal
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spring
tropical
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boreal
Pacific
flux
High
System
minima
wintertime
salinity
Eurasian
planetary
mid-latitudes
Anomaly
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dependence
mid-latitude
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East
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