

Aspects of Arctic-midlatitude linkages

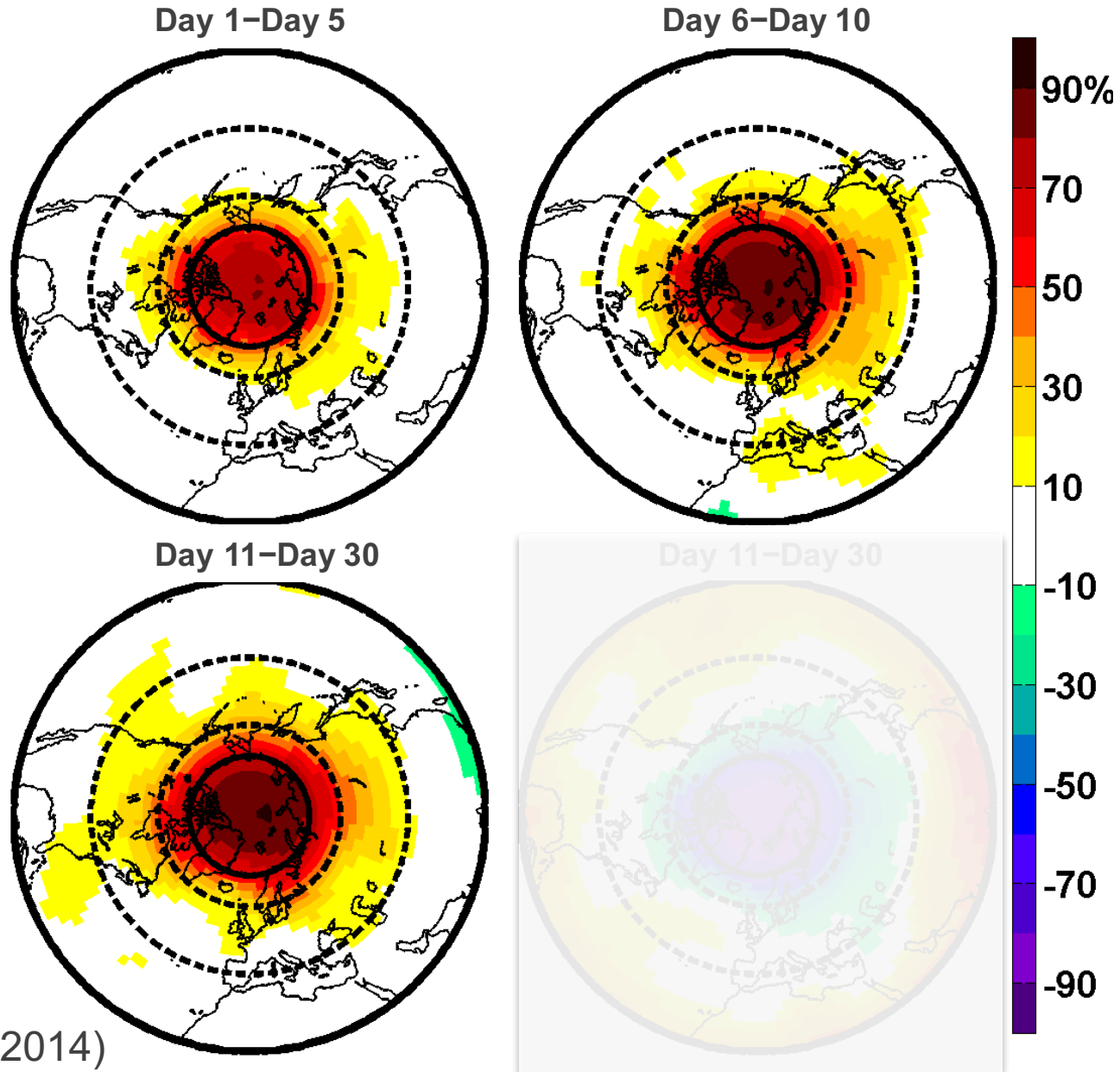
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Marta Kasper, Lukrecia Stulic, Soumia Serrar, and Natalia Talilina

*Alfred Wegener Institute
Helmholtz Centre for Polar and Marine Research
Germany*

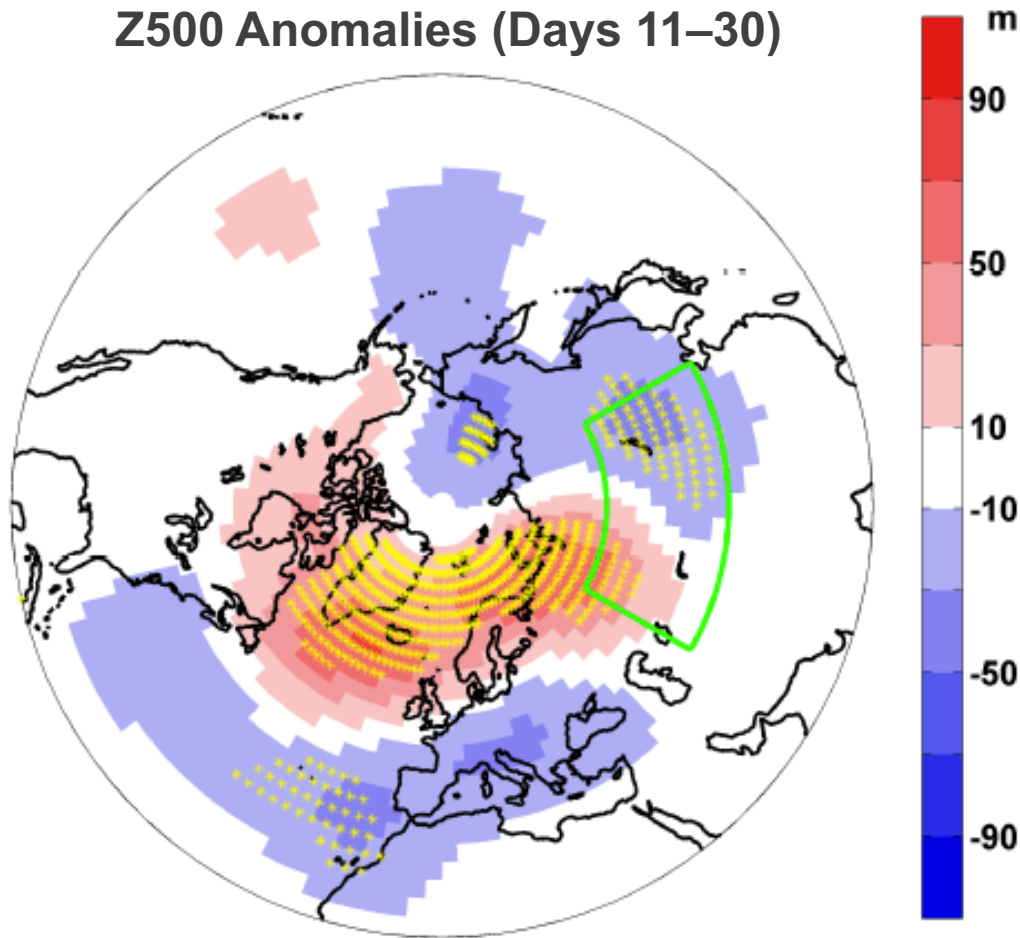
What is the influence of the Arctic atmosphere on the weather and climate in midlatitudes?

Relaxation approach:

Pull the model during the integration towards reanalysis fields in a certain region → study the impact of the relaxation on “remote” regions

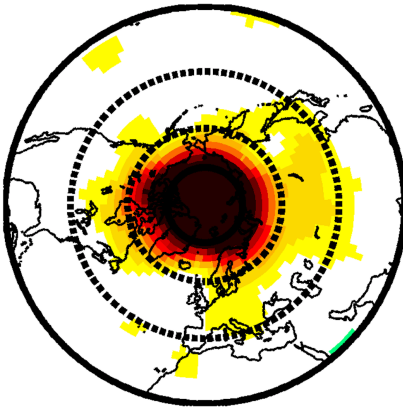


Z500 Anomalies (Days 11–30)

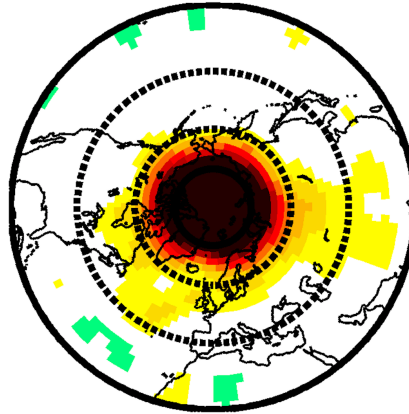


Z500 Forecast Error Reduction (D+8 – D+14)

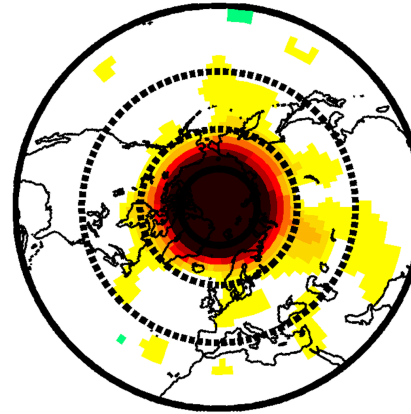
Winter



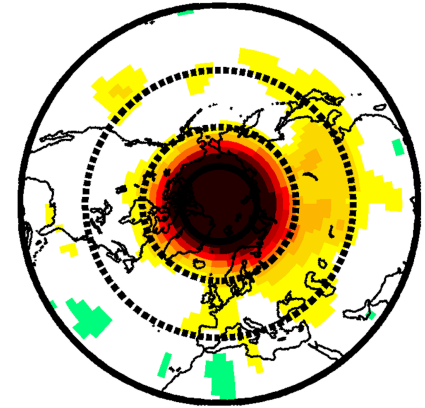
Spring



Summer

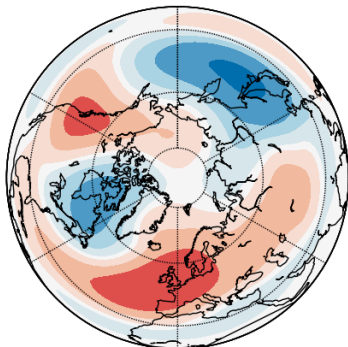


Autumn

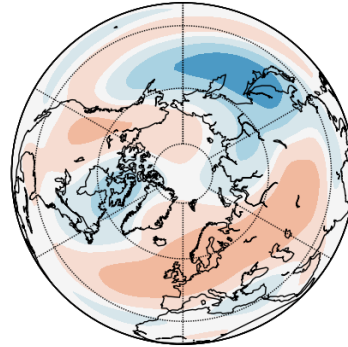


Stationary waves

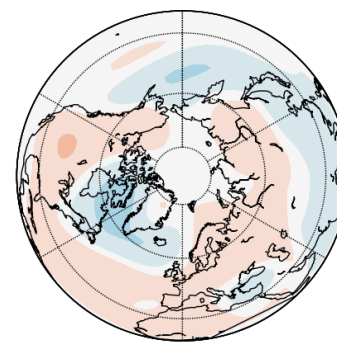
Winter



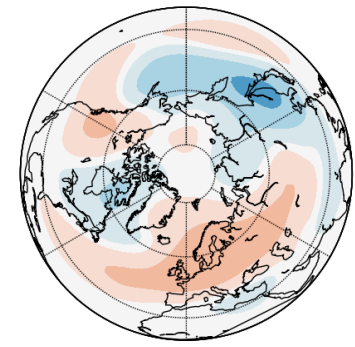
Spring

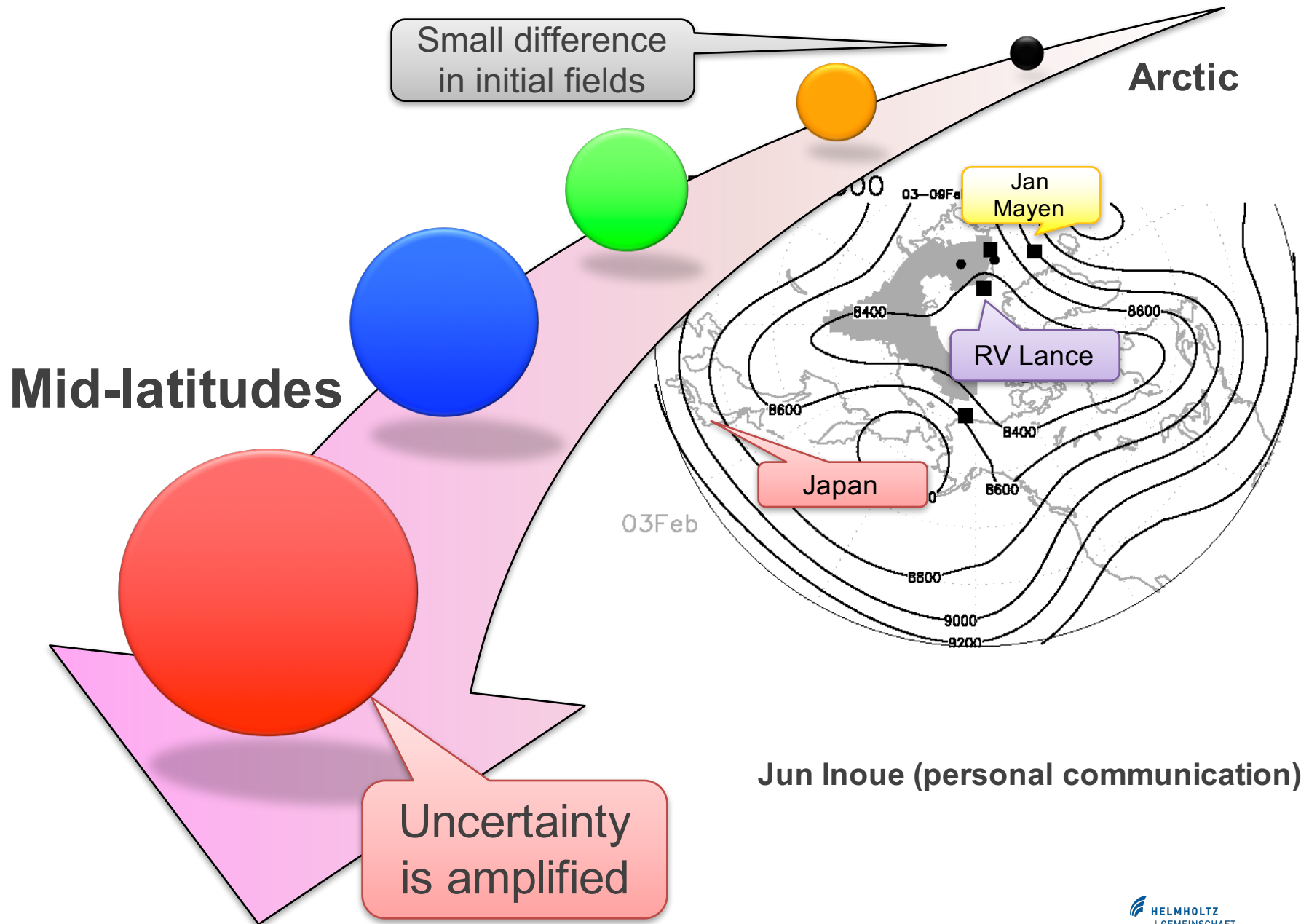


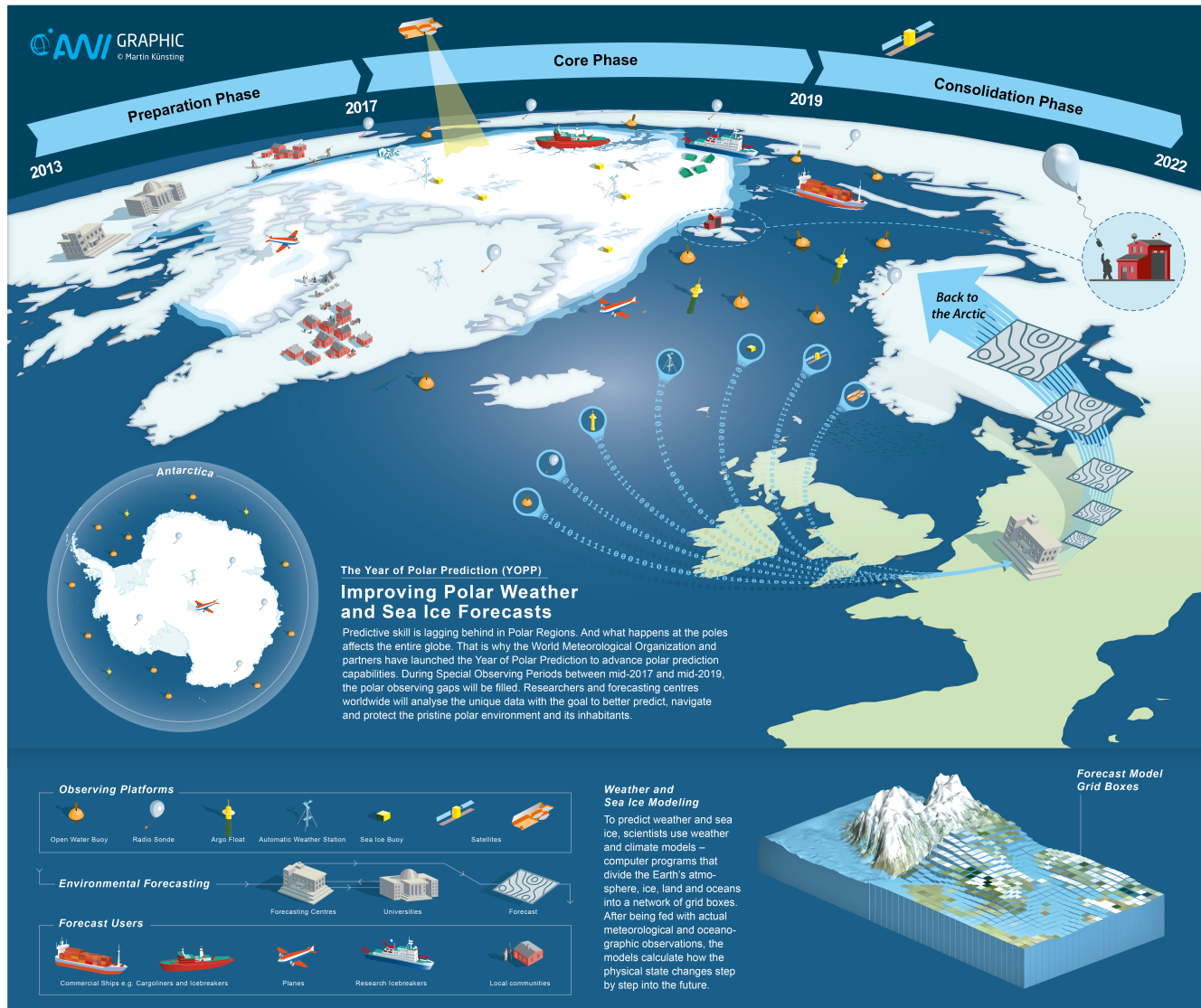
Summer



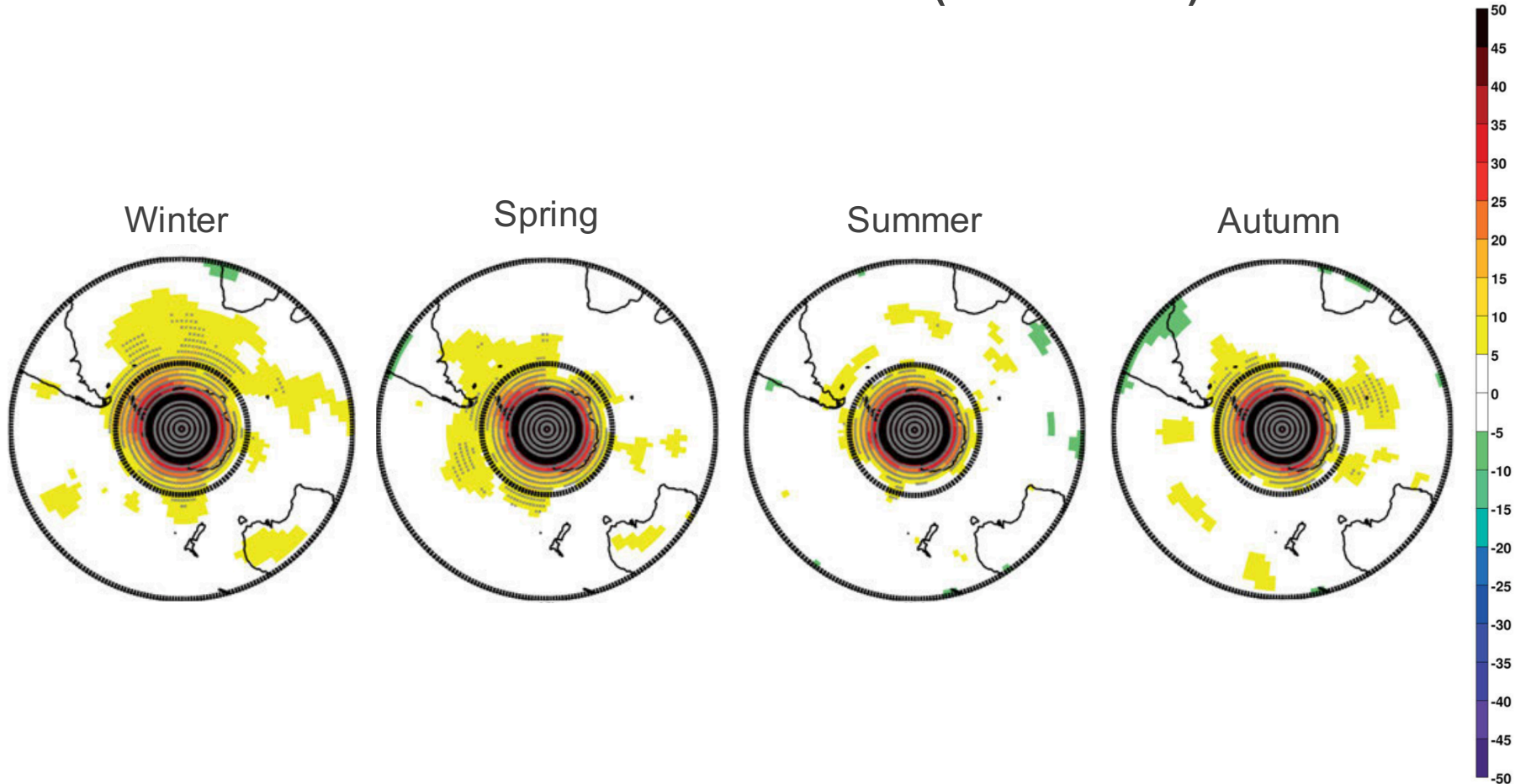
Autumn







Z500 Forecast Error Reduction (D+8 – D+14)

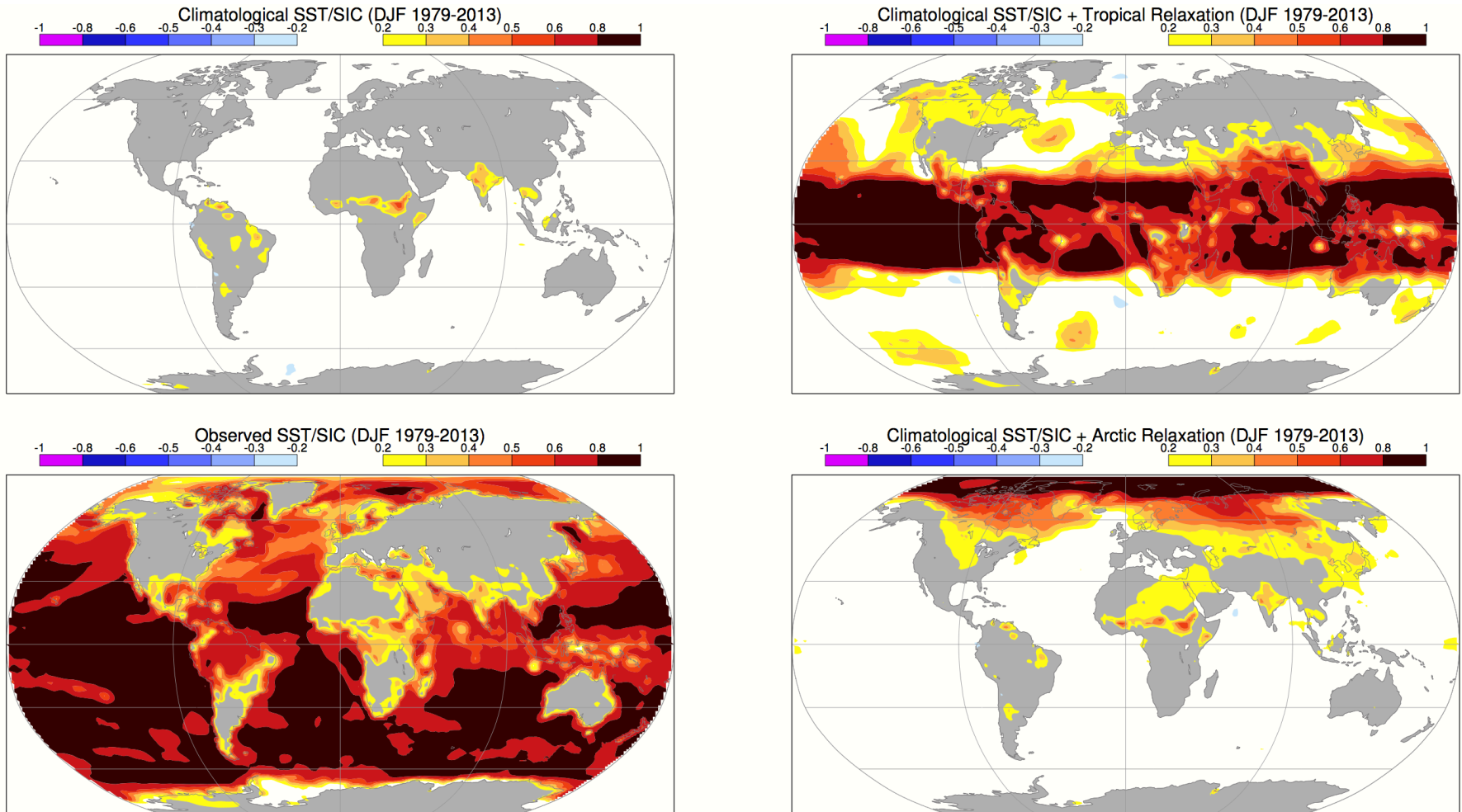


Semmler et al. (2016), Meteorologische Zeitschrift

Experimental setup:

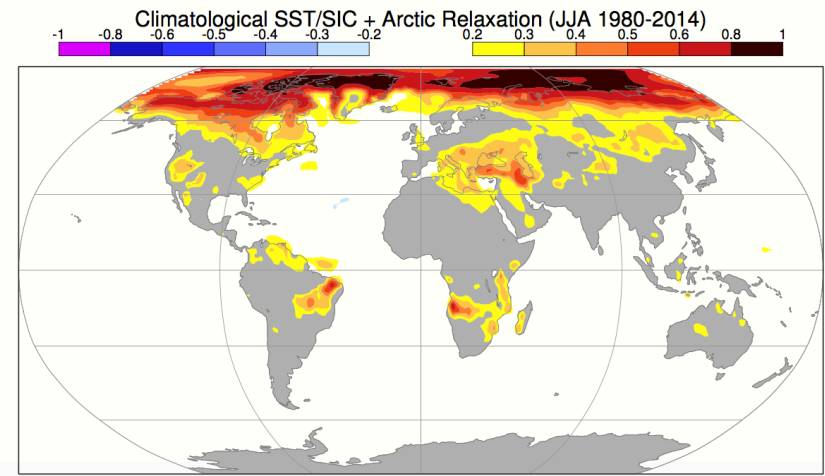
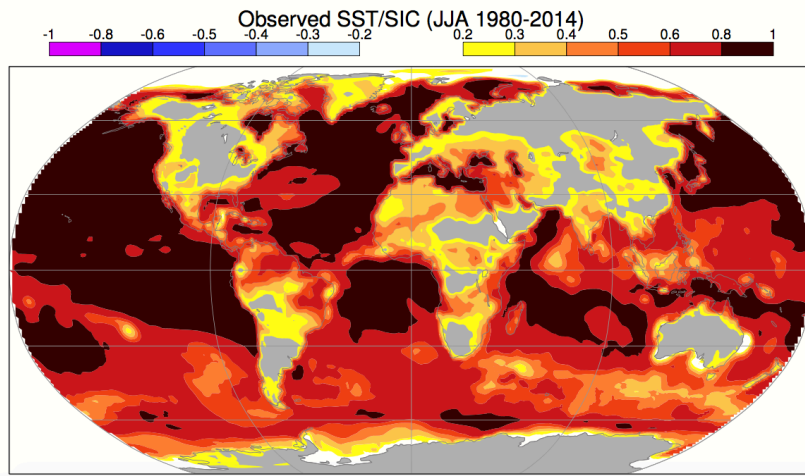
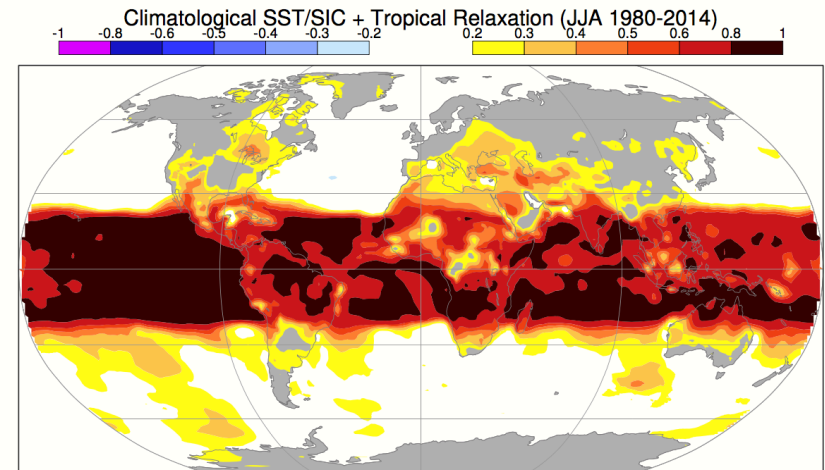
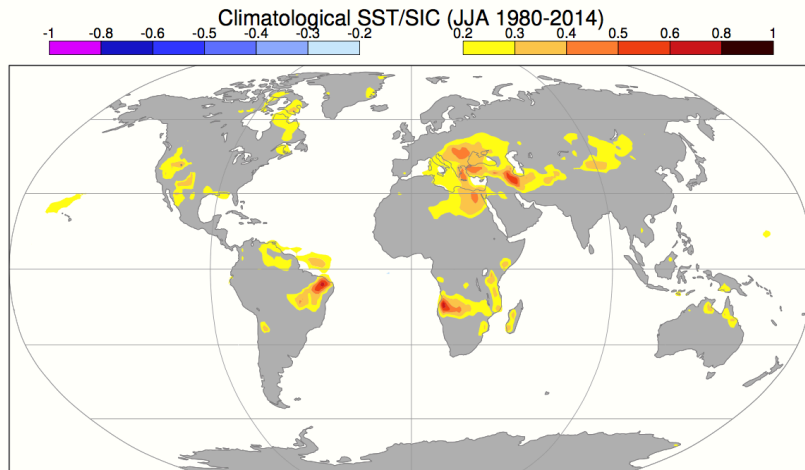
- Seasonal ensemble forecast experiments with the ECMWF model for winters and summers (1979–2014)
- Control experiments
 - Climatological SST/SIC
 - Observed SST/SIC
- Relaxation experiments
 - Climatological SST/SIC
 - Arctic relaxation
 - Lower-latitude relaxation
 - Tropical relaxation
 - Stratospheric relaxation (winter only)

Correlation of seasonal-mean SAT fields with ERA-I (Winter)



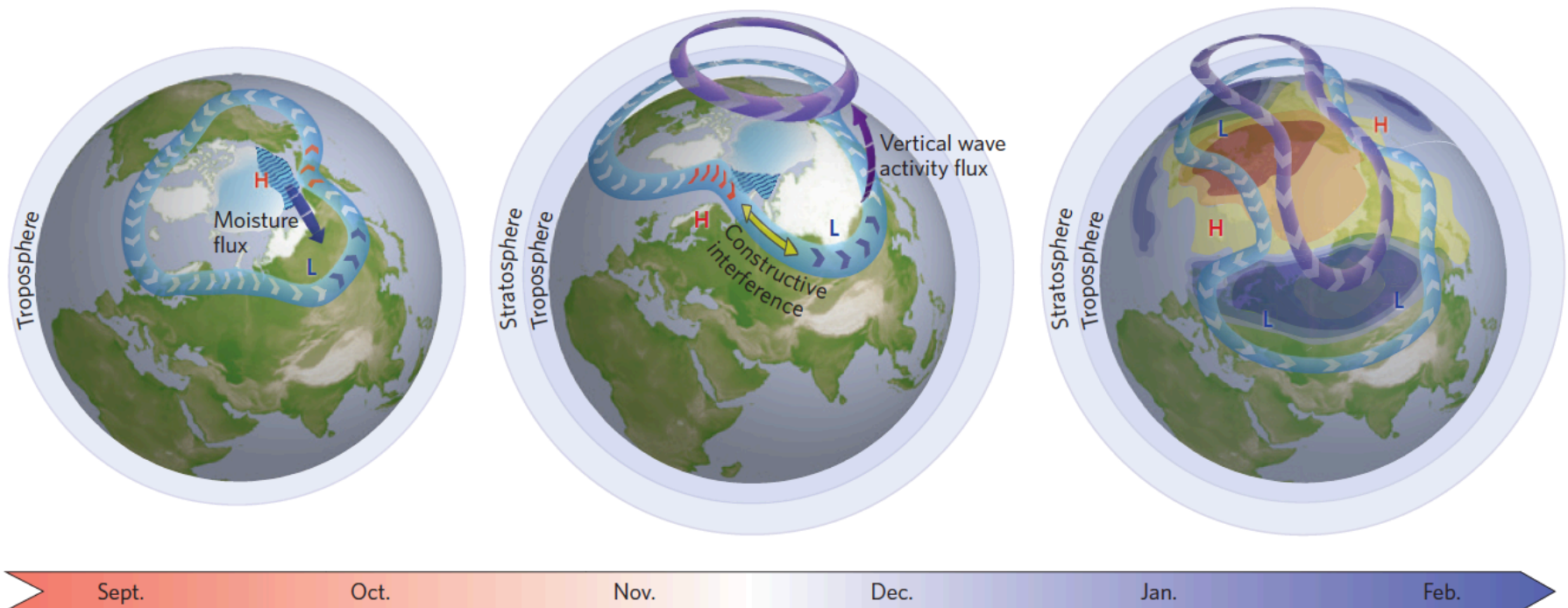
Correlations: Ensemble *members* with ERA-I

Correlation of seasonal-mean SAT fields with ERA-I (Summer)



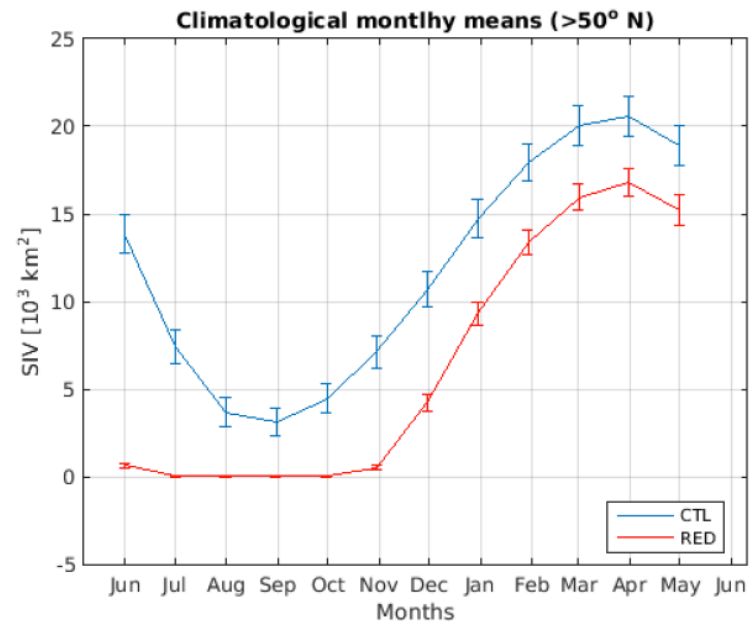
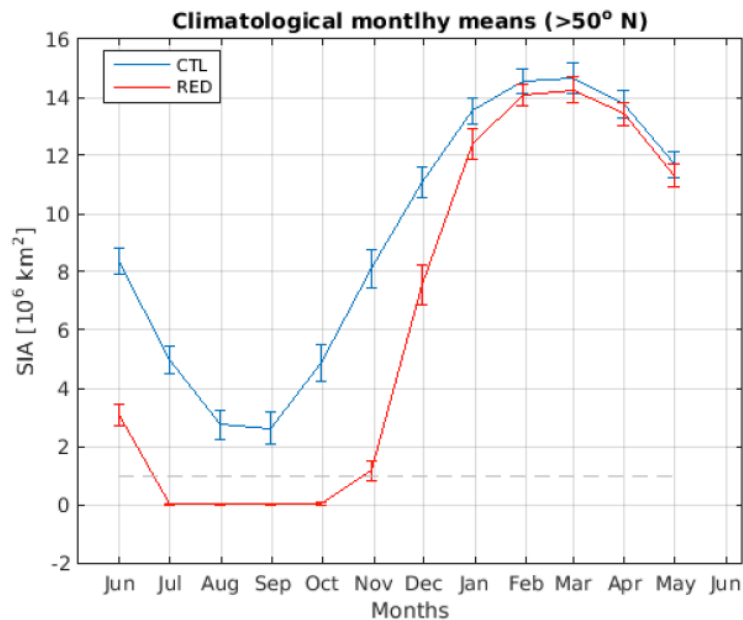
Correlations: Ensemble *members* with ERA-I

What is the impact of summer time sea ice loss on subsequent seasons?



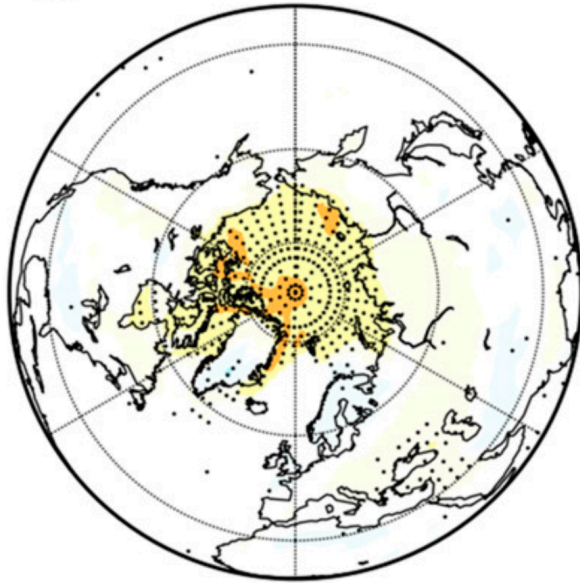
Semmler et al. (2016), J. Climate

- Coupled model ECHAM6-FESOM
- Long multi-centennial control run
- Sensitivity experiments
 - A total of 100 12-months experiments
 - Reduced Arctic sea ice thickness by 80% on 1 June

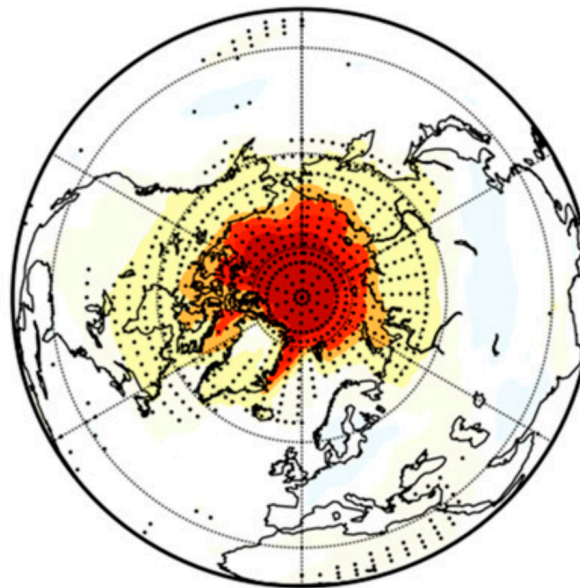


Surface air temperature response

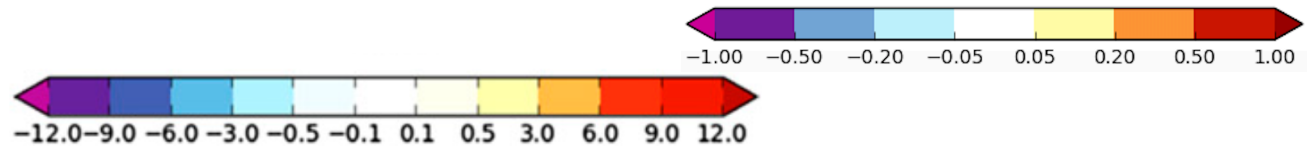
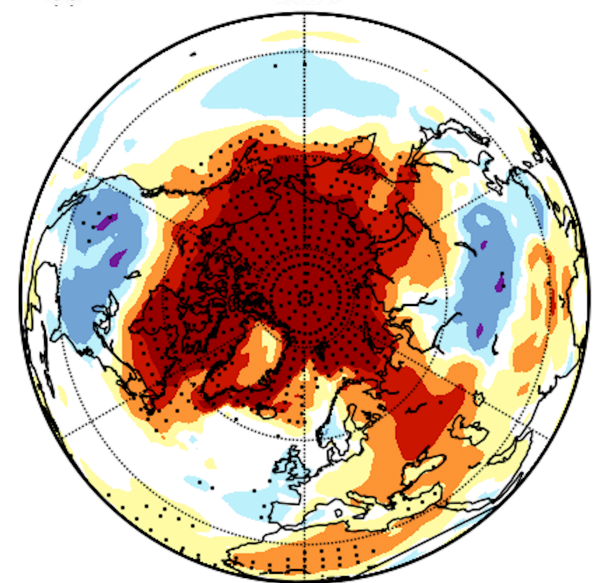
JAS



OND

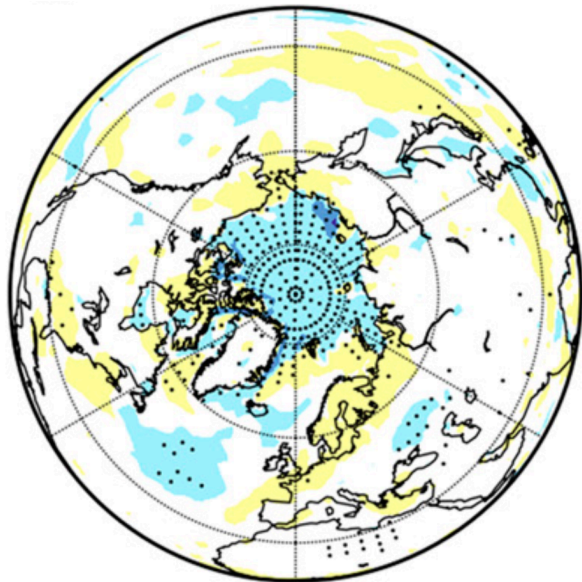


JFM

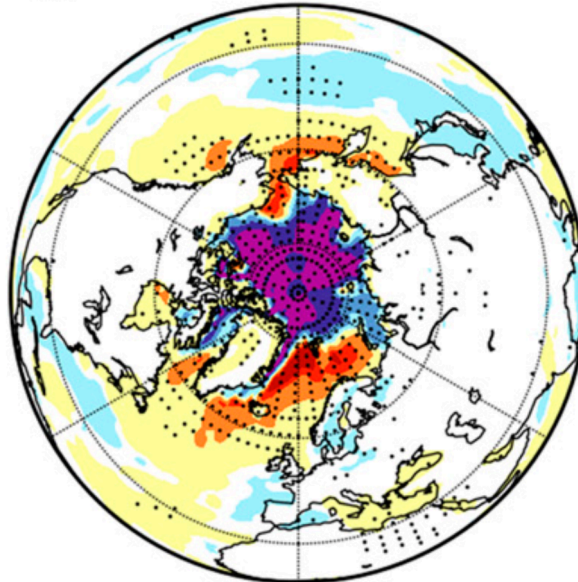


Turbulent surface heat flux response

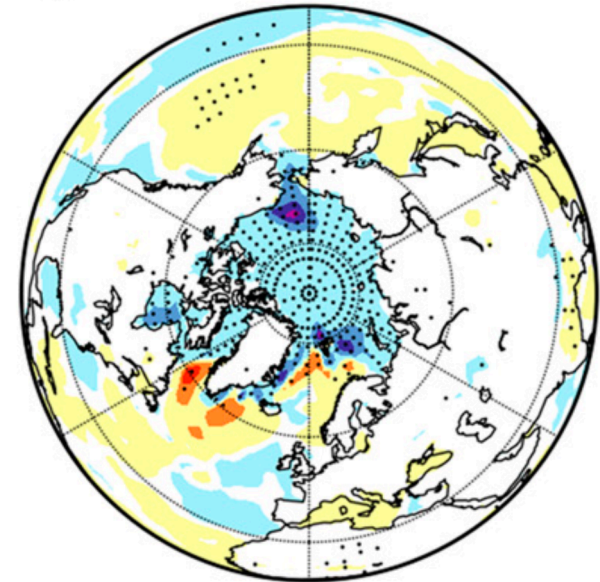
JAS



OND

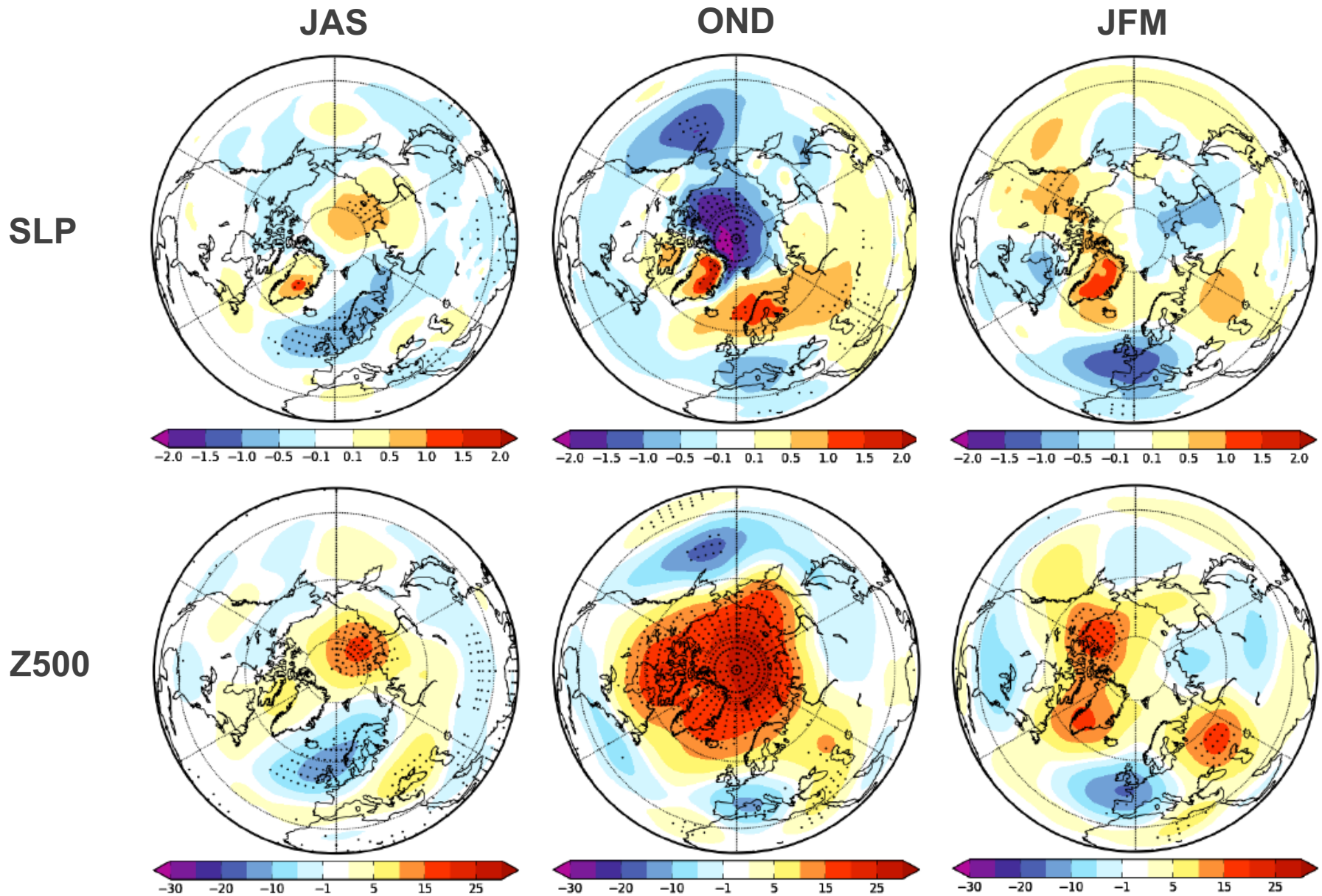


JFM



Negative values: Out of the ocean/sea ice

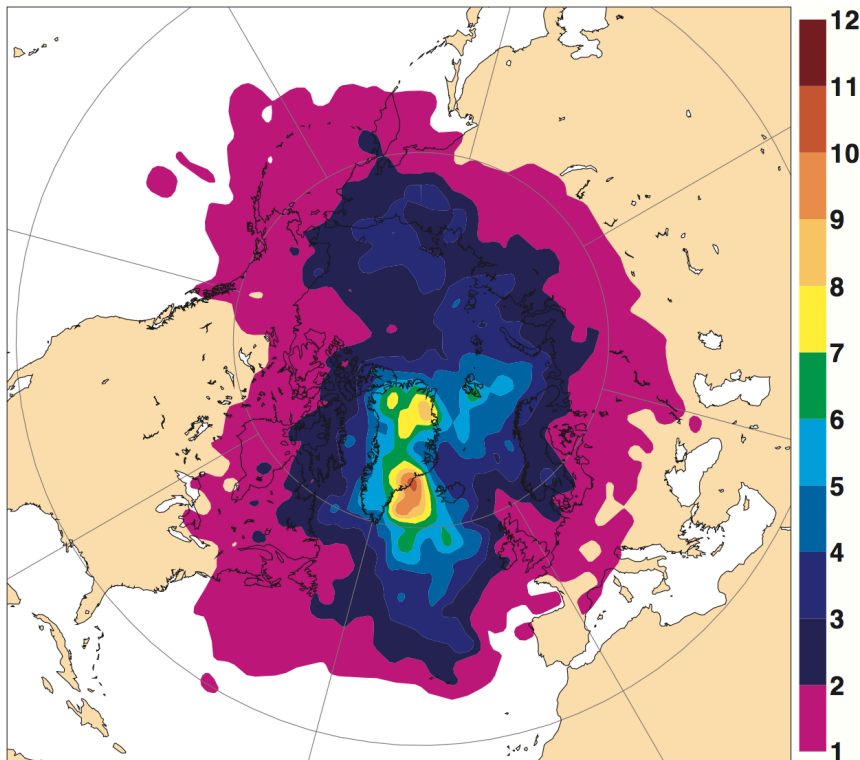
Atmospheric circulation response



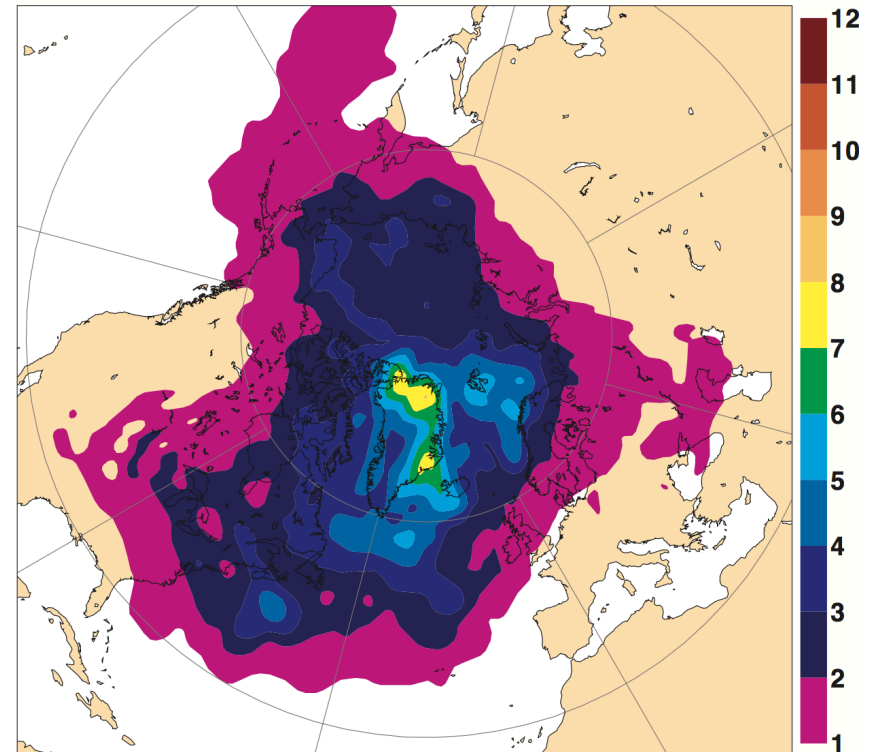
- Relaxation experiments
 - Preferred pathways out of the Arctic (Eurasia and North America)
 - Linkage looks weaker in summer and in the Southern Hemisphere
 - “Verification” in the framework of the Year of Polar Prediction
- Influence of low September sea ice on subsequent seasons
 - Strongest impact in late autumn/early winter (OND)
 - Combined baroclinic/barotropic response
 - Smaller response in (late) winter (DJF)
 - Results are not inconsistent with Cohen et al. hypothesis, but
 - Weaker
 - No evidence for snow anomalies in Siberia

Sensitivity of D+2 forecast error in the Arctic to temperature perturbations of the initial conditions

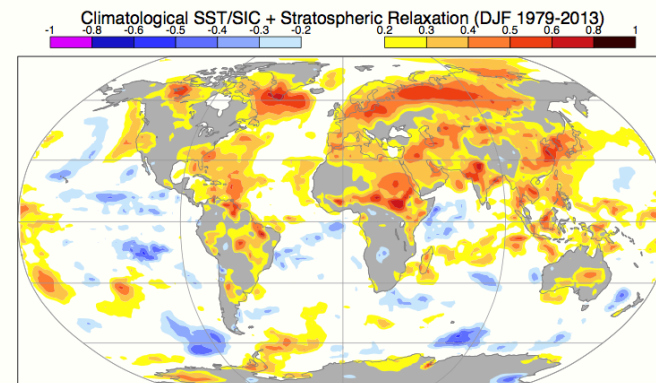
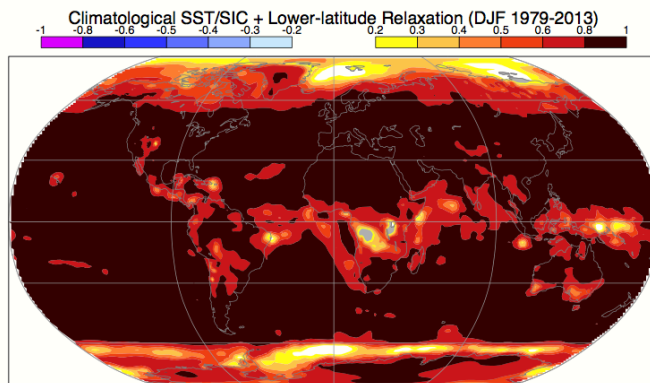
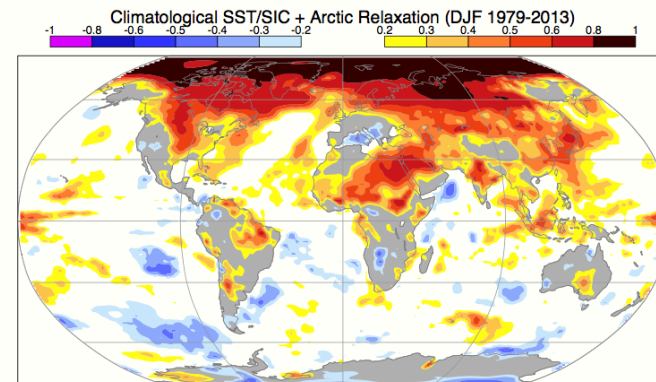
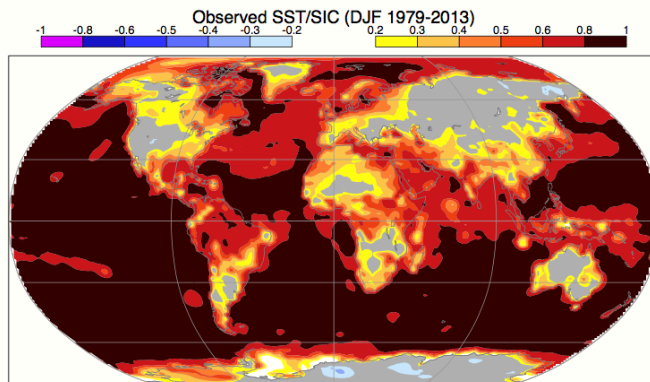
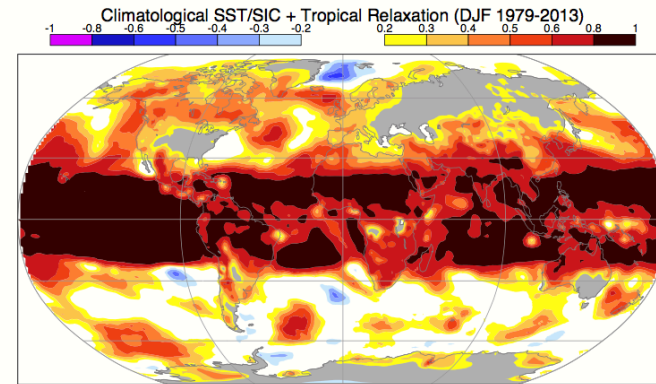
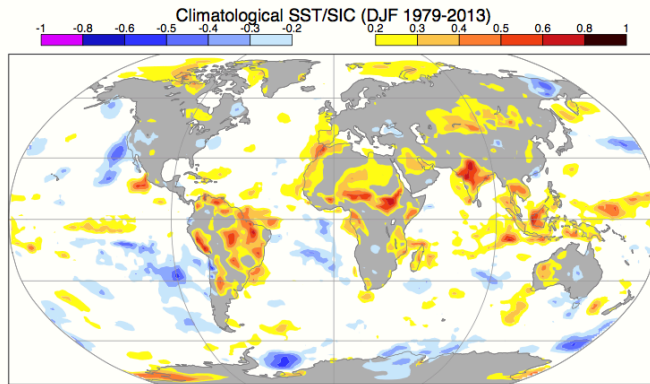
Dec–Mar 2001/02



Dec–Mar 2004/05



Seasonal relaxation experiments



Seasonal relaxation experiments

