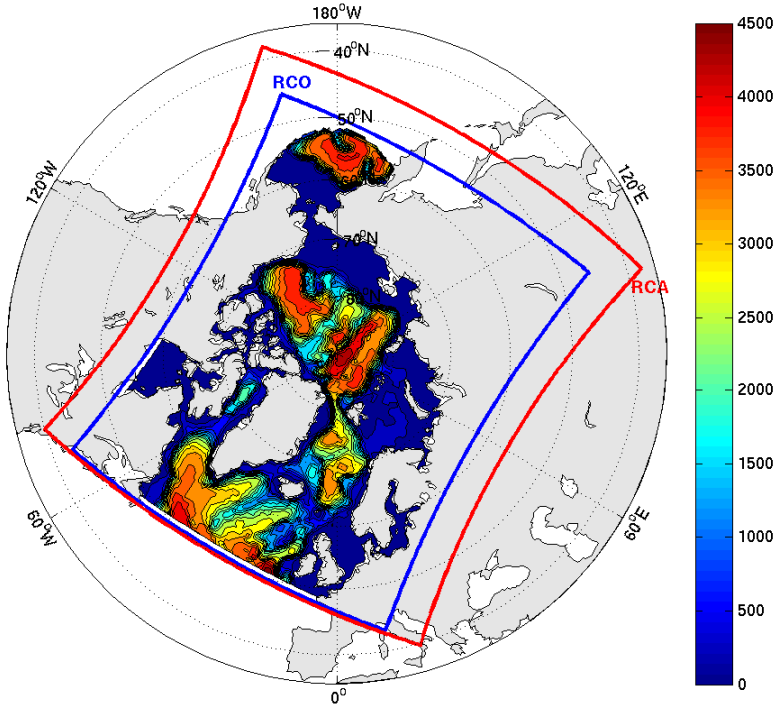
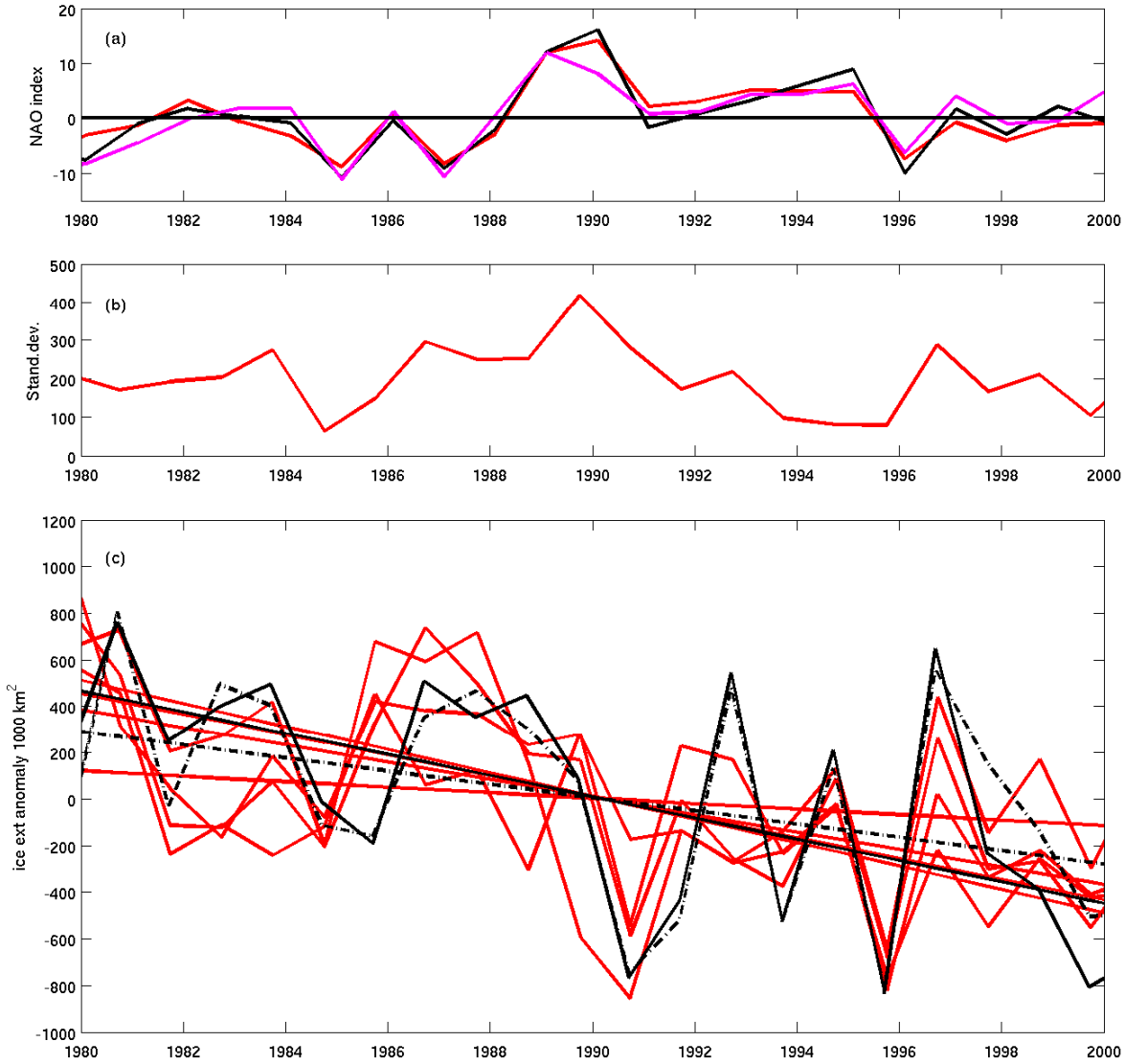
Climate Predictability of the Arctic in a regional coupled ocean-ice-atmosphere model

Ralf Döscher*, Klaus Wyser*,
H.E.Markus Meier and Minwei Qian*****

*** SMHI (Swedish Meteorological and Hydrological Institute)**
**** SMHI and Stockholm University**
***** UQAM (Université du Québec à Montréal)**

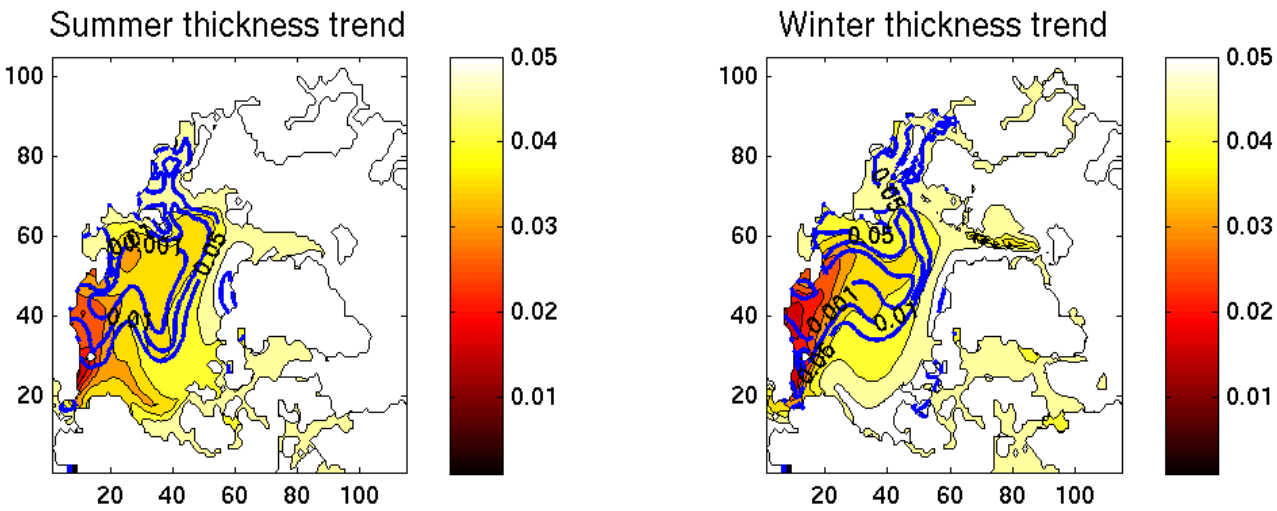
Model domain of RCAO

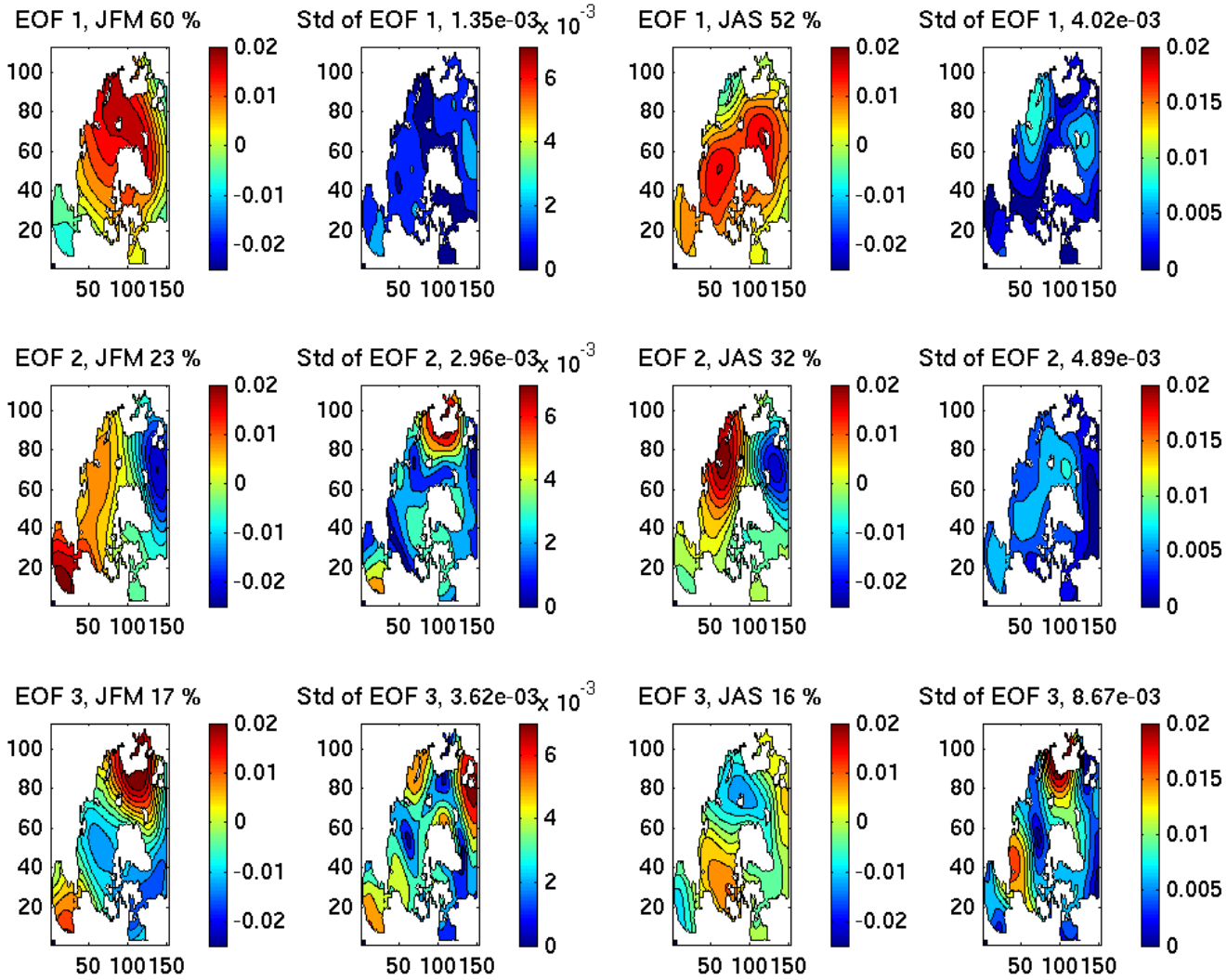




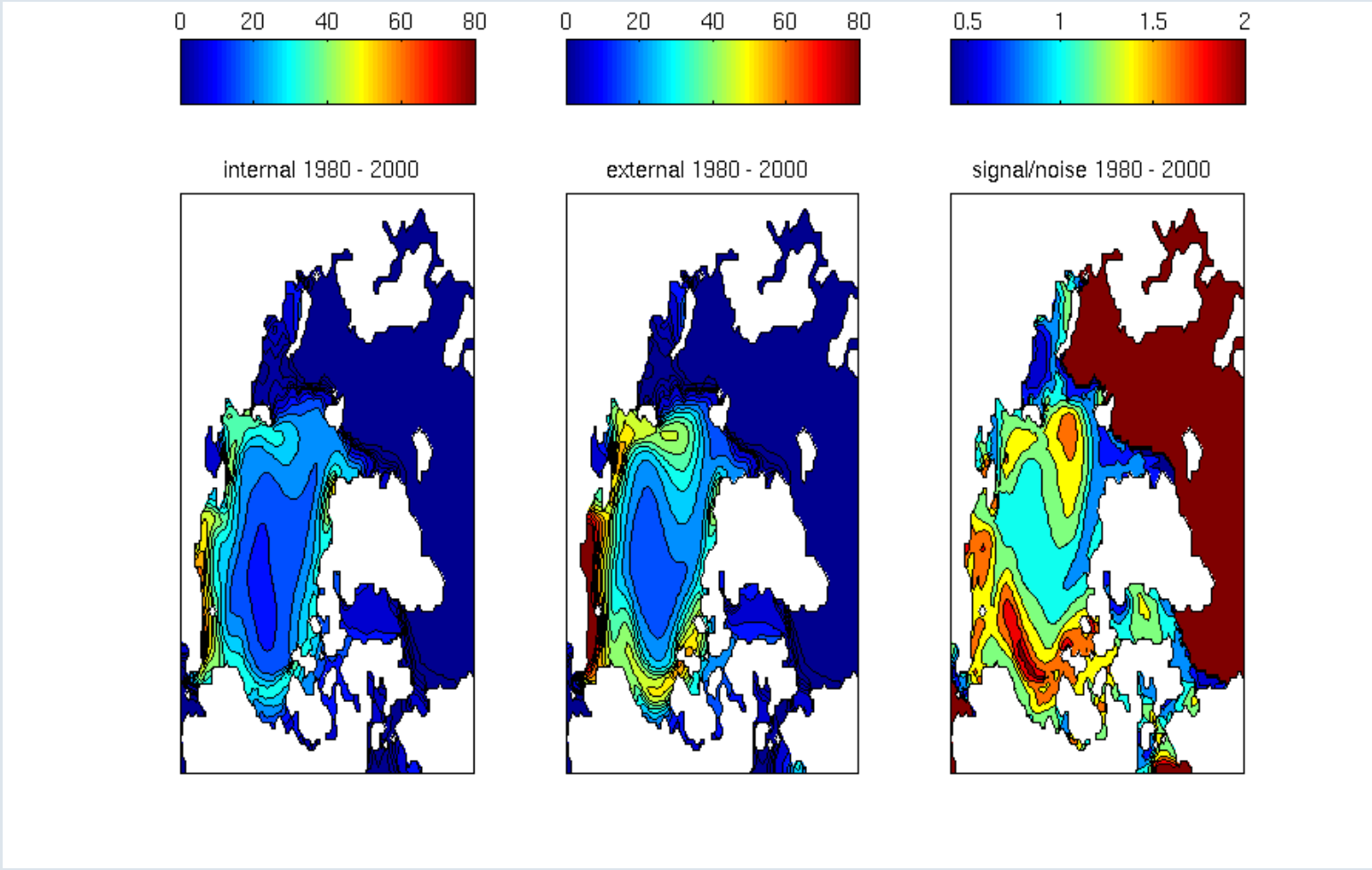
Time series of winter NAO as pressure difference from the RCAO ensemble mean (red line), ERA-40 reanalysis (black line, pressure difference, see text) and Climate Prediction Center NAO index multiplied by 10 (cyan line). See more information in the text. b): intra-ensemble standard deviation of Arctic summer sea ice extent anomaly. (c): Arctic summer sea ice extent anomaly for the period 1980 – 2000. Ensemble simulations and trends are depicted in red and observations (Rayner et al. (2003) full line, Cavalieri et al. (2003) dotted lines) are depicted in black. All observed extent values are adjusted to the regional RCAO domain, i.e. norther hemisphere ice outside the RCO domain is omitted. Note that NAO values (a) are given during winter (1990 means winter 1989/90), while standard deviations (b) and sea ice extent anomalies (c) are given for September.

Ensemble mean sea ice thickness trends for summer (left) and winter (right) in cm/year. Overlay blue contours indicate statistical significance



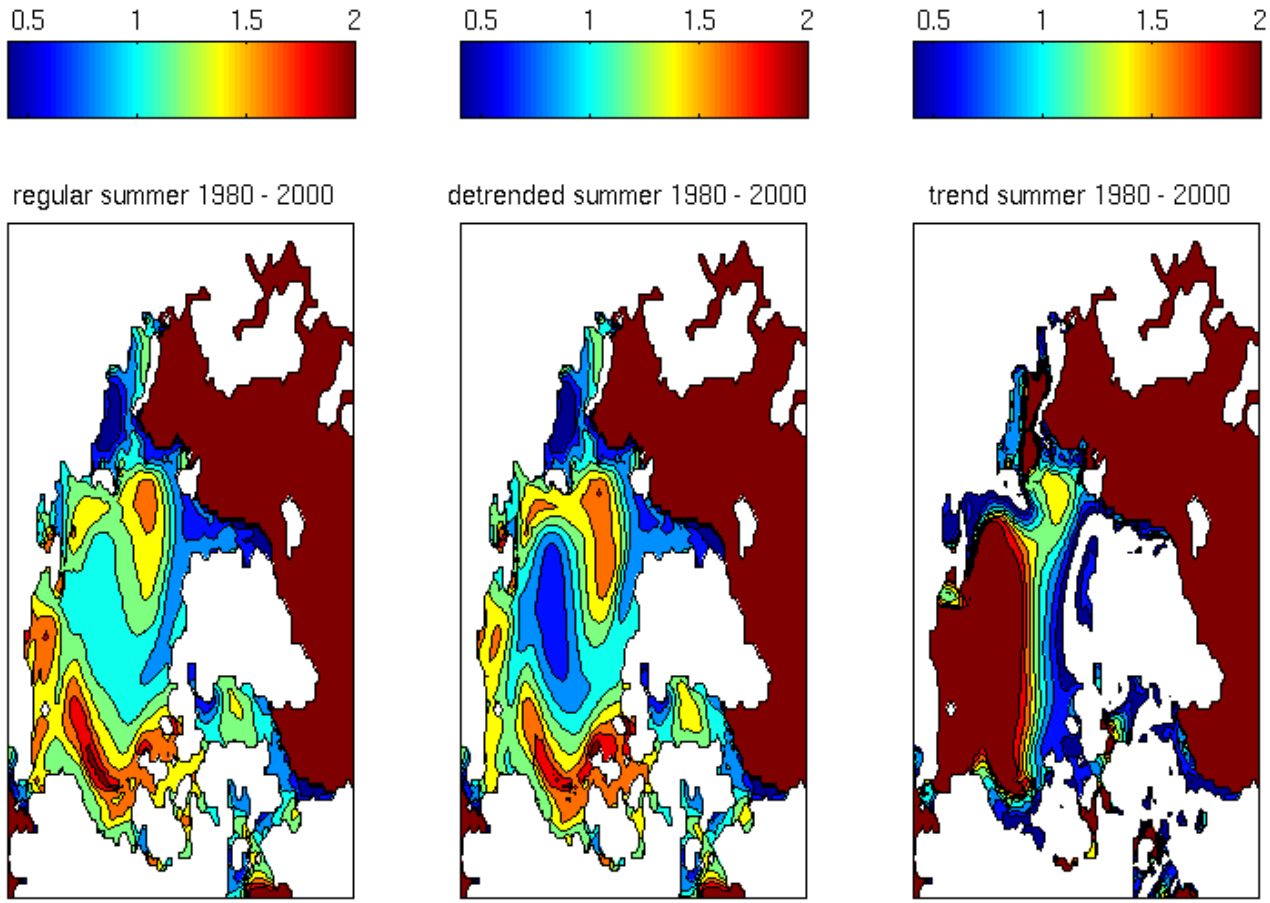

EOF 1, JFM 60 %
Std of EOF 1, 1.35e-03
x 10^-3
EOF 1, JAS 52 %
Std of EOF 1, 4.02e-03
EOF 2, JFM 23 %
Std of EOF 2, 2.96e-03
x 10^-3
EOF 2, JAS 32 %
Std of EOF 2, 4.89e-03
EOF 3, JFM 17 %
Std of EOF 3, 3.62e-03
x 10^-3
EOF 3, JAS 16 %
Std of EOF 3, 8.67e-03
100
80
60
40
20
50 100150
0.02
0.01
0
-0.01
-0.02
6
4
2
0
0.015
0.005

Internal (left), external (center) variability of Arctic summer (JAS) sea ice thickness for the period 1980-2000 in cm, and signal/noise ratio (external/internal)

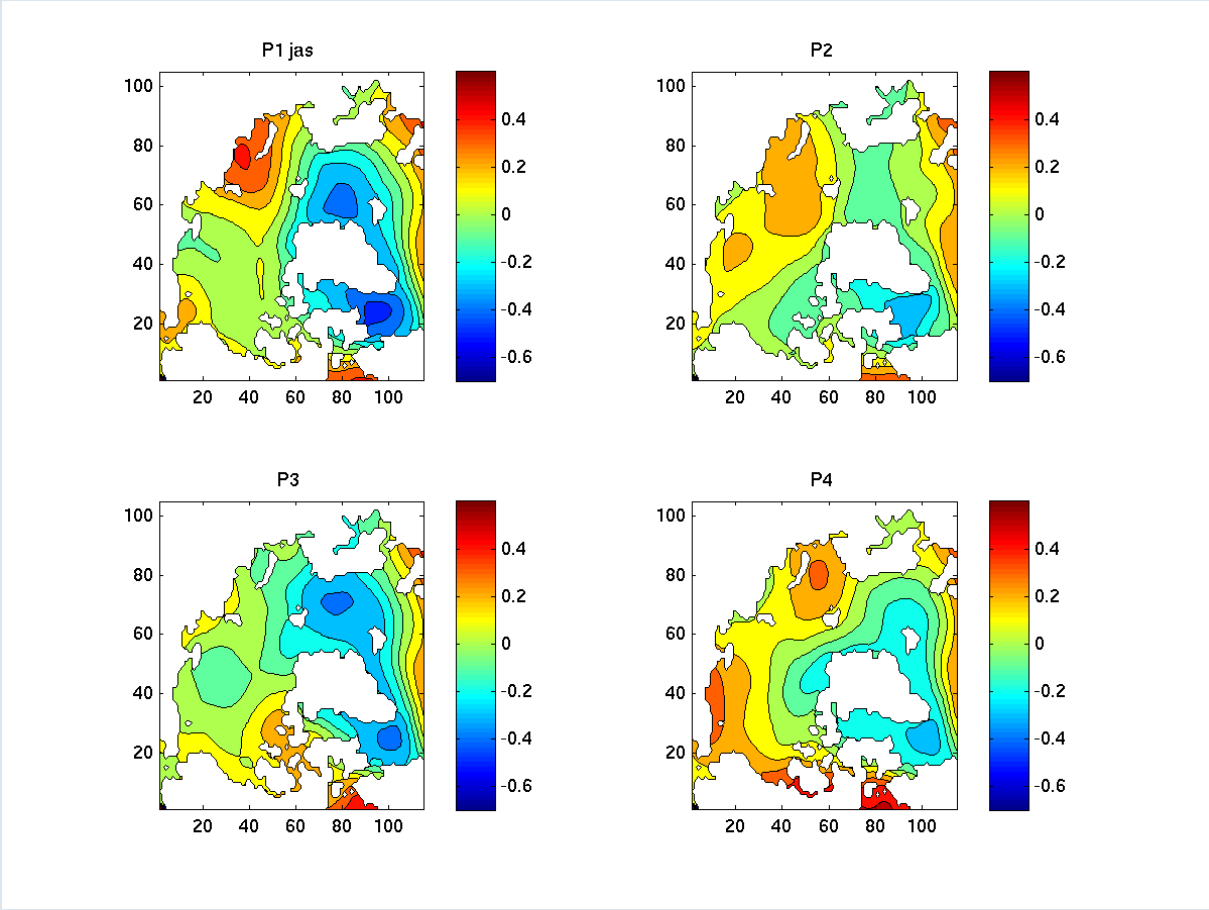


SMHI

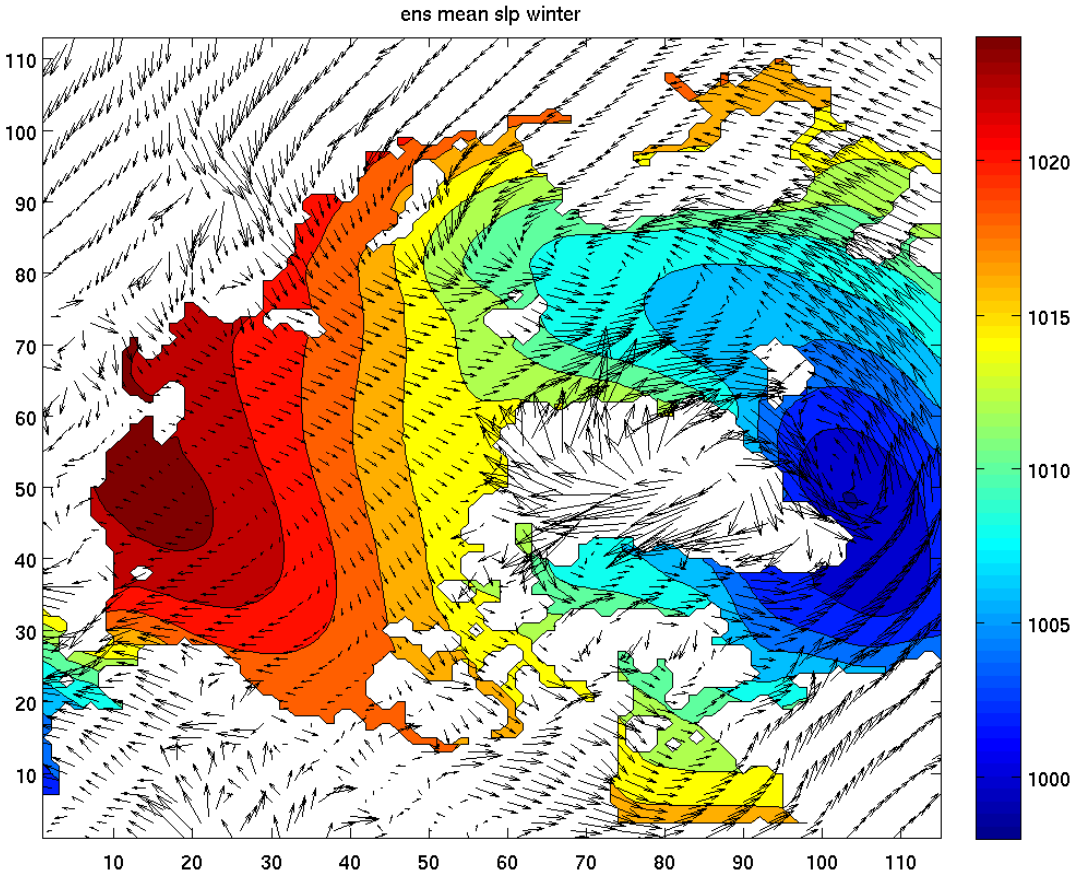
Signal/noise ratios for sea ice thickness during summer based on complete thickness fields (left), detrended fields (center) and trend (right). Contour levels are limited to ensure comparability.



Correlation between intra-ensemble spread (Fig.3b) and sea level pressure (SLP) during summer (JAS) for the ensemble members P1-P4.



Ensemble mean winter sea level pressure (SLP, in HPa) and wind field



SMHI

Summary

Predictability results indicate that the variability generated by the external forcing (large-scale trend, AO) is more important in most regions than the internally generated variability (DA). However, both are in the same order of magnitude. Local areas such as the Northern Greenland coast together with Fram Straits and parts of the Greenland Sea show a strong importance of internally generated variability, which is associated with wind direction variability due to interaction with atmospheric dynamics on the Greenland ice sheet.