

Influence of autumn snow cover variability on atmospheric conditions the following winter in Siberia

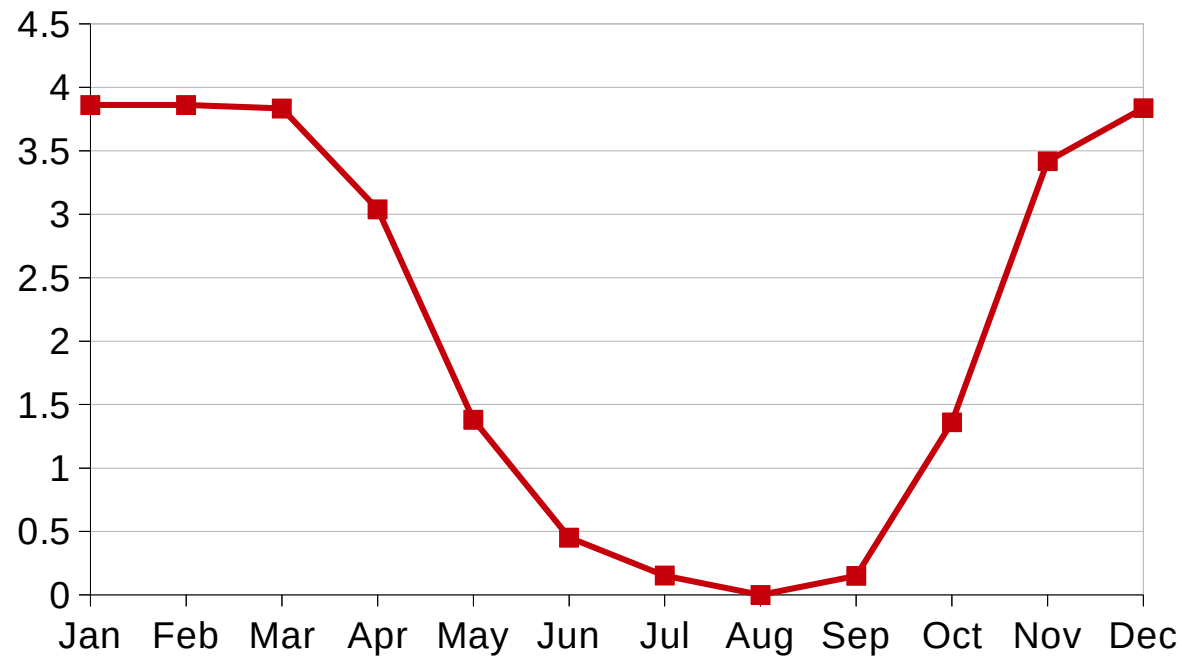
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Research topic

Siberia - «Hot Spot»

Siberian snow cover area, mln. km² (GSL)



Motivation

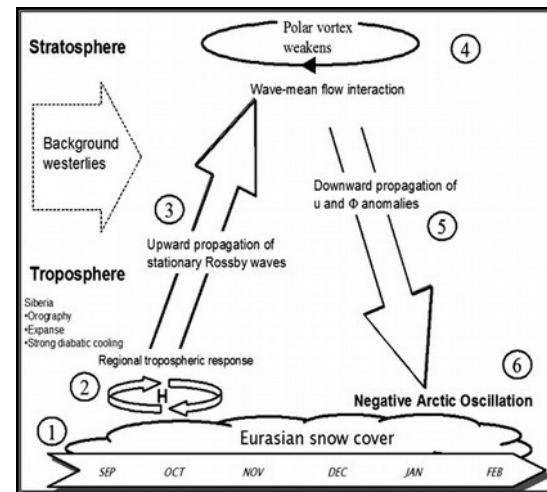
I Foster J. et al., 1983:

Snow cover: NOAA satellite data,
T: observations (6 stations in Eurasia
and 7 stations in N. America)

Period: 1970-1982

Result: *significant relationship*

II Cohen J. et al., 2007:



NCEP/NCAR
1948-2004

III Popova V.V. et al., 2014:

Observations, 1950-2008

15-years sliding correlation
coefficients

Result: *not all periods*

IV Furtado J.C. et al., 2015:

ERA-Interim, NCEP/NCAR, MERRA,
CMIP5 piControl

Ensemble average

Time periods: 30, 40, 50 years

Result: *models don't catch the
relationship*

Methodology

Region

Siberia: 50-70N 70-90E

Data

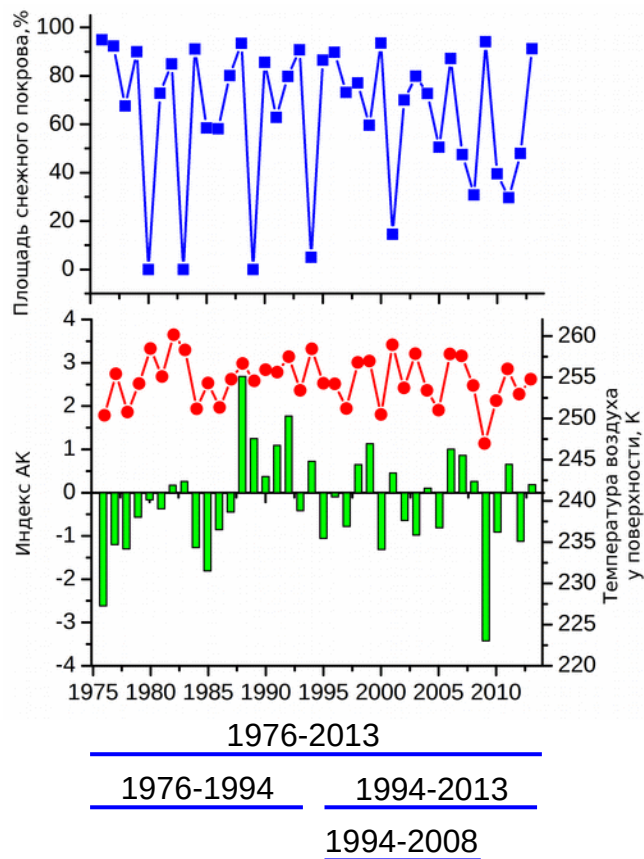
- RIHMI-WDC (observations)
- NOAA (observations and satellite data)
- Reanalysis: NCEP/NCAR (2.5 x 2.5), ERA-Interim (0.75 x 0.75)
- Model data: INMCM4, INMCM5

Methods

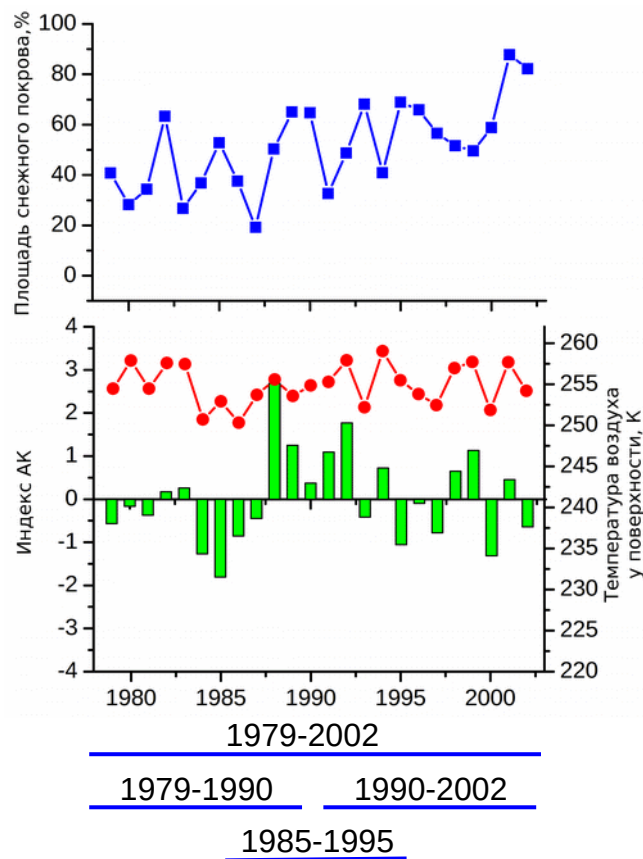
- EOF analysis (AO Index)
- Original data and detrended data
- Correlation analysis

Results: interannual variation

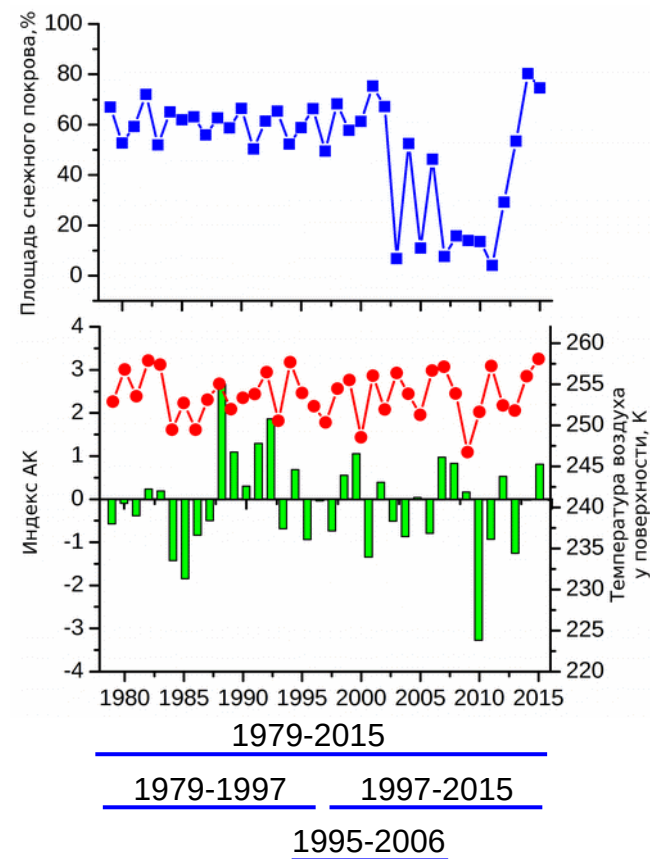
Observations



NCEP/NCAR

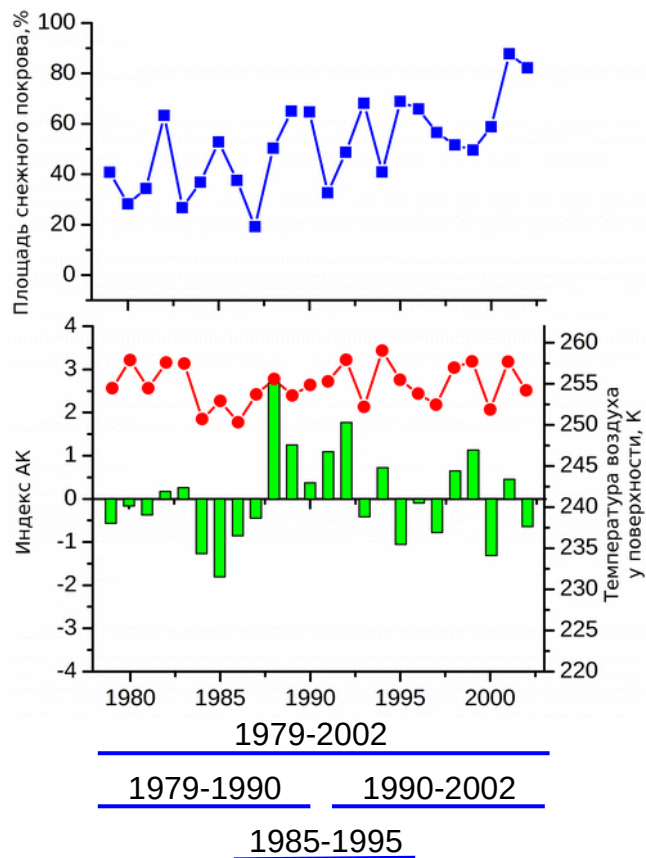


ERA-Interim

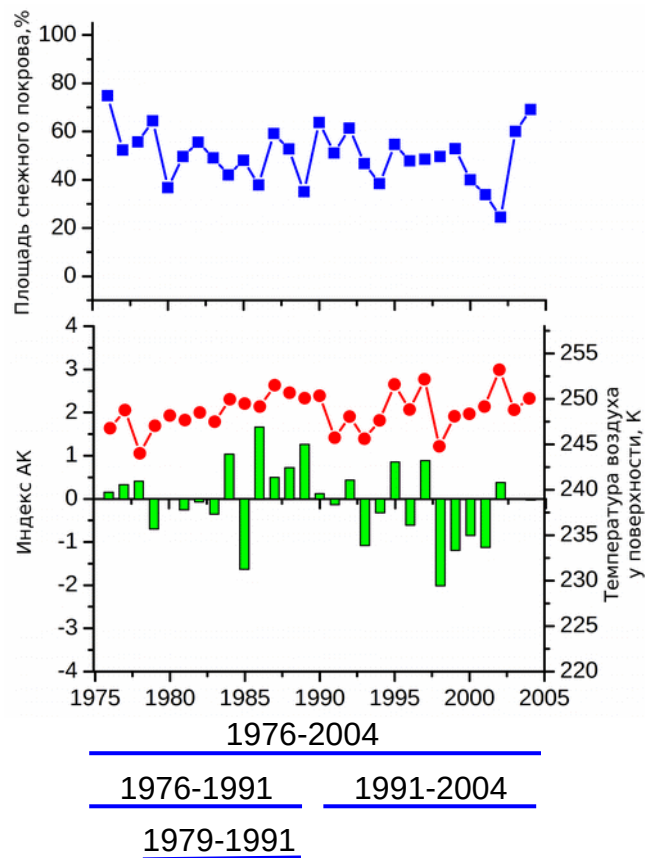


Results: interannual variation

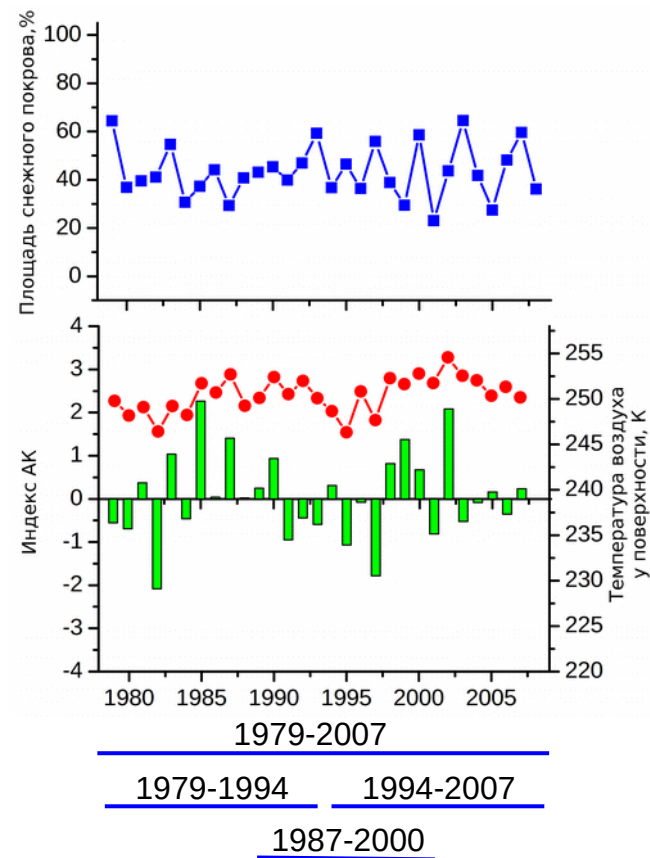
NCEP/NCAR



INMCM4



INMCM5



Results: Orig. / deTr.

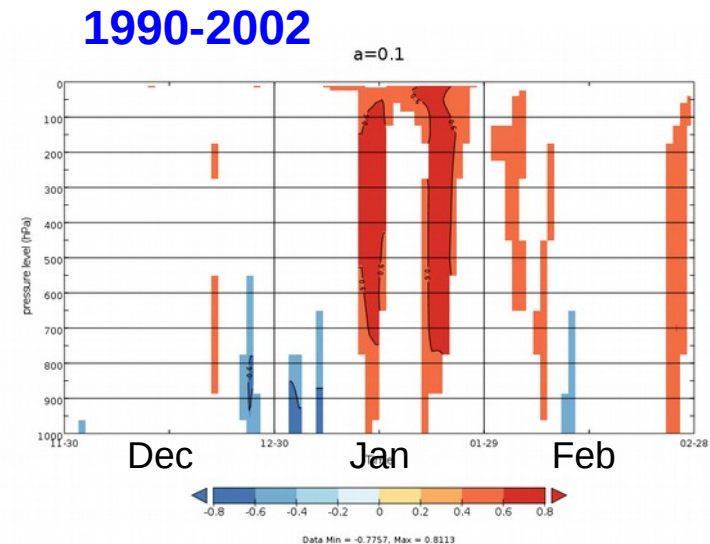
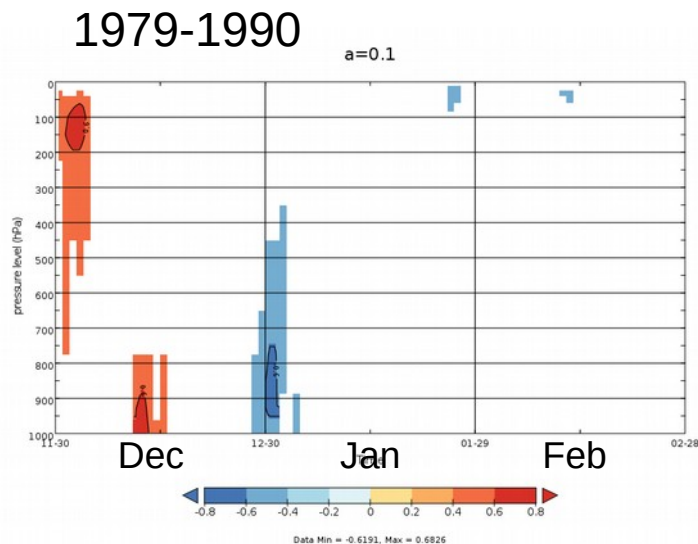
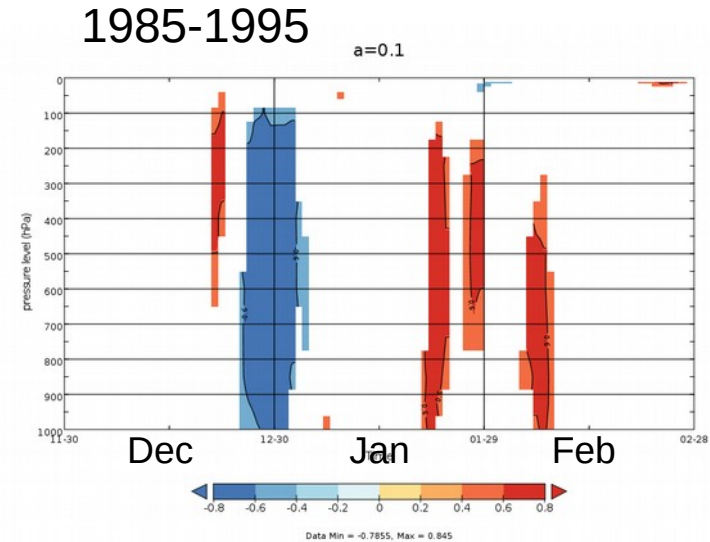
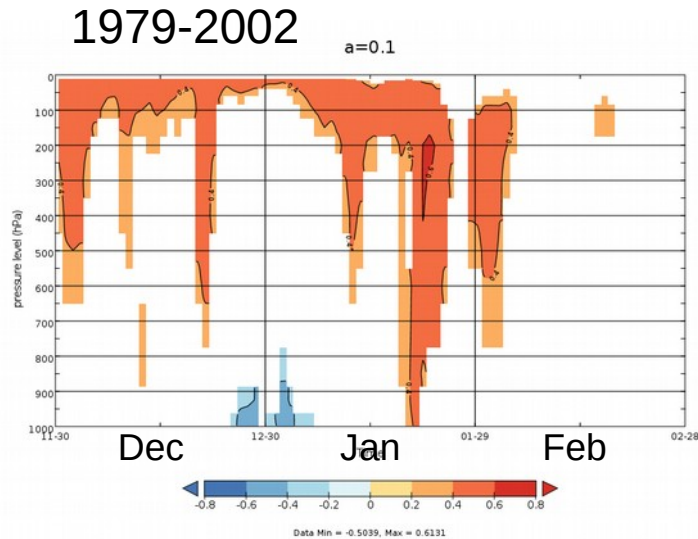
Period	S_{sn} vs. AO	S_{sn} vs. T_{as}	AO vs. T_{as}
S_{sn}, T_{as} — observations , OA Index - NOAA			
1976-2013 (38)	-0.277 / -0.271	-0.342 / -0.353	0.711 / 0.725
1976-1994 (19)	-0.231 / -0.160	-0.384 / -0.356	0.623 / 0.602
1994-2013 (20)	-0.406 / -0.422	-0.401 / -0.429	0.823 / 0.819
1994-2008 (15)	-0.440 / -0.433	-0.409 / -0.410	0.700 / 0.709
S_{sn} — <i>GSL</i> ; T_{as} , AO Index — NCEP/NCAR			
1979-2002 (24)	-0.013 / -0.098	-0.017 / -0.073	0.597 / 0.594
1979-1990 (12)	0.330 / 0.190	0.023 / 0.194	0.446 / 0.672
1990-2002 (13)	-0.508 / -0.393	-0.266 / -0.274	0.765 / 0.804
1985-1995 (11)	-0.049 / -0.130	-0.048 / -0.376	0.547 / 0.557
ERA-Interim			
1979-2015 (37)	0.227 / 0.222	0.047 / 0.060	0.654 / 0.656
1979-1997 (19)	-0.119 / -0.085	-0.179 / -0.231	0.509 / 0.562
1997-2015 (19)	0.326 / 0.324	0.115 / 0.157	0.810 / 0.835
1995-2006 (12)	0.339 / 0.491	-0.074 / 0.065	0.676 / 0.667

Period	S_{sn} vs. AO	S_{sn} vs. T_{as}	AO vs. T_{as}
INMCM4			
1976-2004 (29)	-0.032 / -0.090	-0.217 / -0.158	0.475 / 0.592
1976-1991 (16)	-0.348 / -0.302	-0.225 / -0.087	0.273 / 0.192
1991-2004 (14)	0.176 / 0.171	-0.194 / -0.190	0.718 / 0.852
1979-1991 (13)	-0.442 / -0.478	-0.015 / -0.020	0.424 / 0.343
INMCM5			
1979-2007 (29)	-0.191 / -0.196	-0.020 / -0.053	0.643 / 0.689
1979-1994 (16)	-0.186 / -0.183	0.027 / 0.051	0.629 / 0.655
1994-2007 (14)	-0.209 / -0.243	-0.029 / -0.139	0.673 / 0.694
1987-2000 (14)	-0.554 / -0.559	-0.213 / -0.215	0.725 / 0.725

- Short-term manifestation
- S_{sn} vs. AO — negative relationship
- S_{sn} vs. AO doesn't link with S_{sn} vs. T_{as} .
- Relationship for orig. and deTr data: different periods

$\alpha=0.1$; $\alpha=0.05$

Results: S_{sn} and HGT anomaly

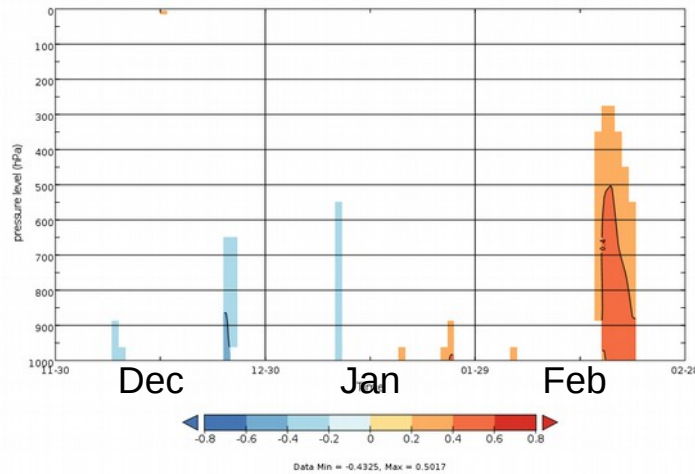


Correlation between October S_{sn} (GSL) and HGT anomaly (NCEP/NCAR)

Results: S_{sn} and HGT anomaly

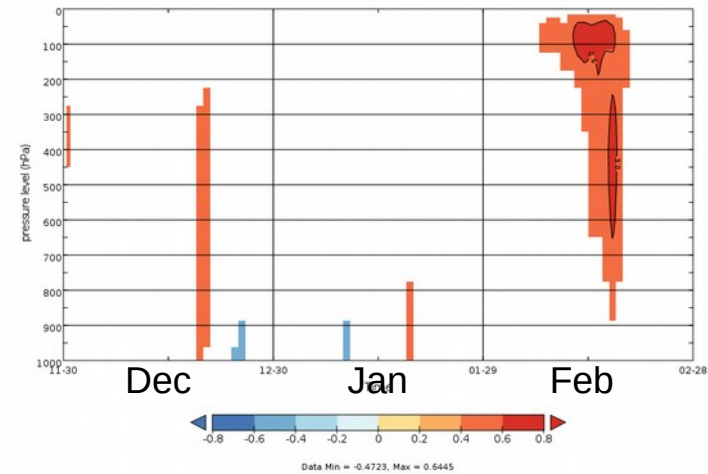
1979-2007

$a=0.1$



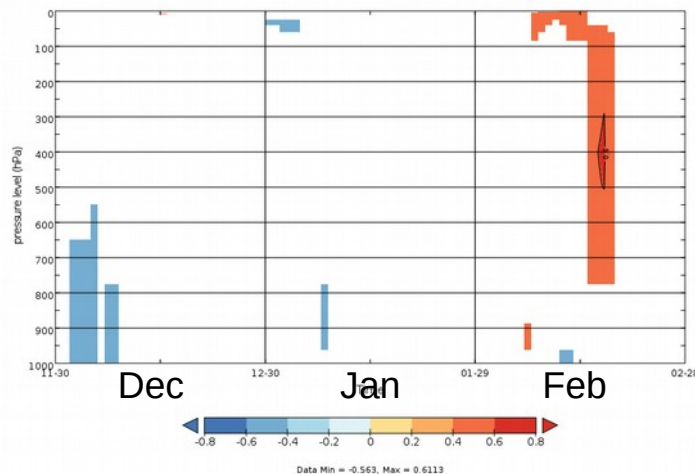
1987-2000

$a=0.1$



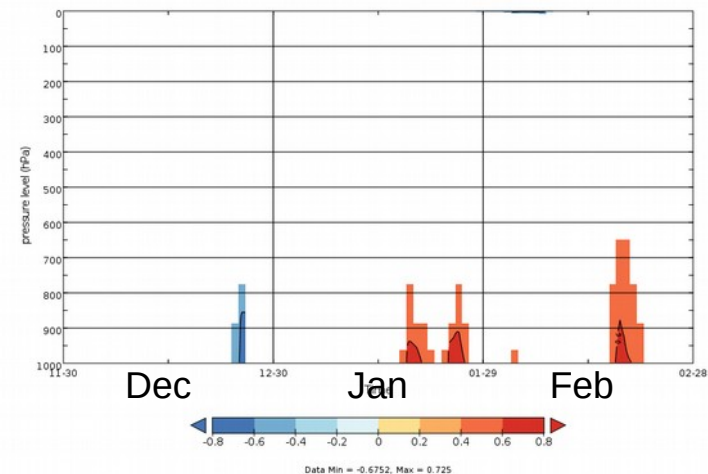
1979-1994

$a=0.1$



1994-2007

$a=0.1$



Correlation between October S_{sn} and HGT anomaly, INMCM5

Conclusion

A stable significant linear relationship between the October snow cover and atmospheric conditions near the surface in the following winter in Siberia was not detected.

Future plans

To investigate the causes
of the non-stationarity

Thank you for your attention!