Supplementary

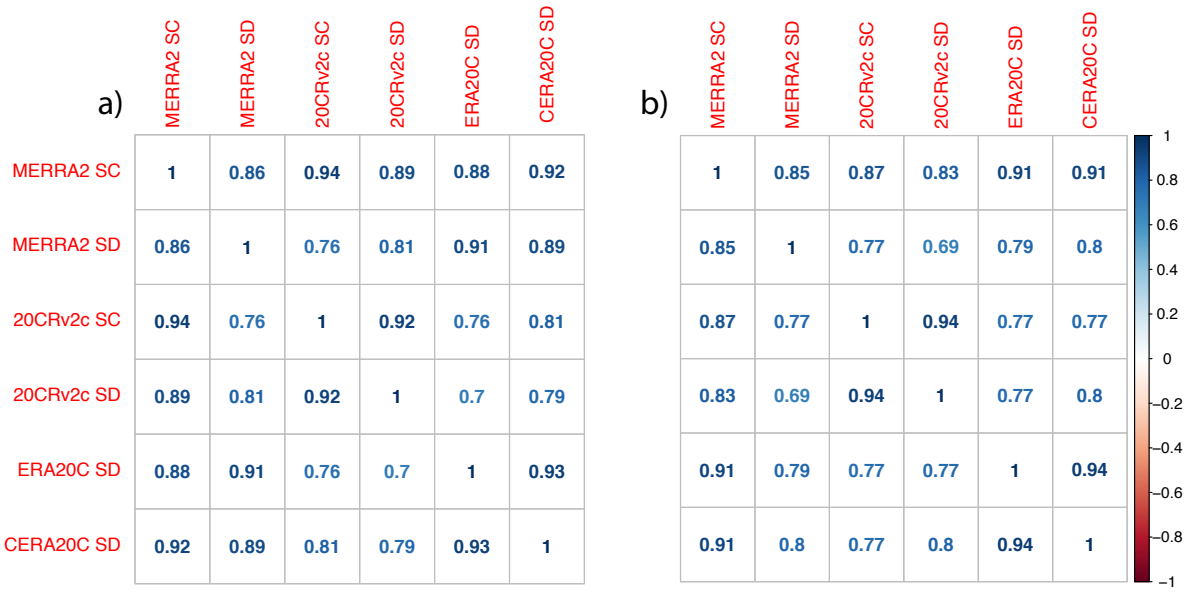


Figure 1: Correlation of snow depth (SD) and snow cover (SC) indices for different reanalyses products for a) October snow indices and b) November snow indices. The correlation coefficient is computed for the respective shared time period among two products (see also Fig. 1).

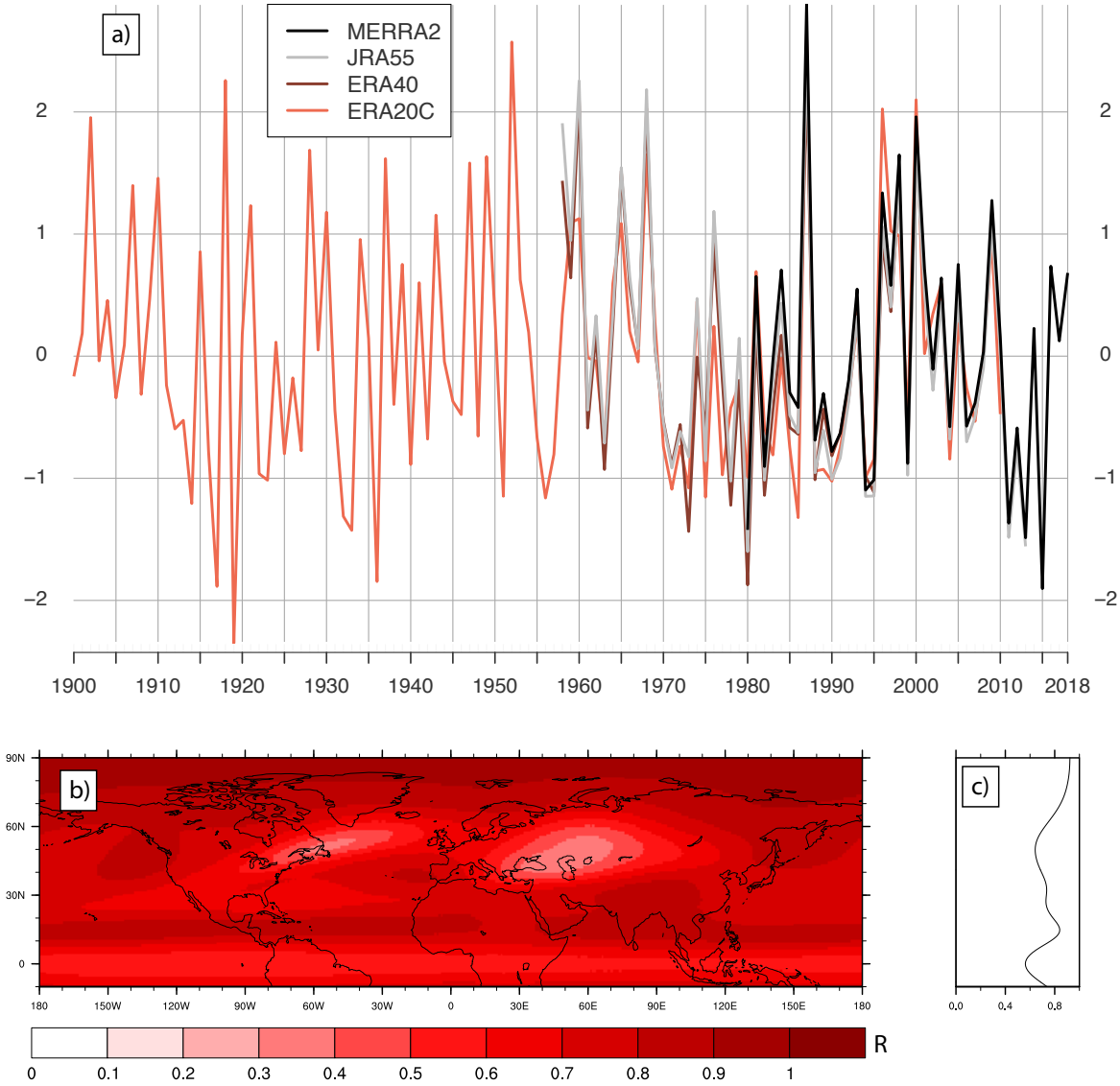
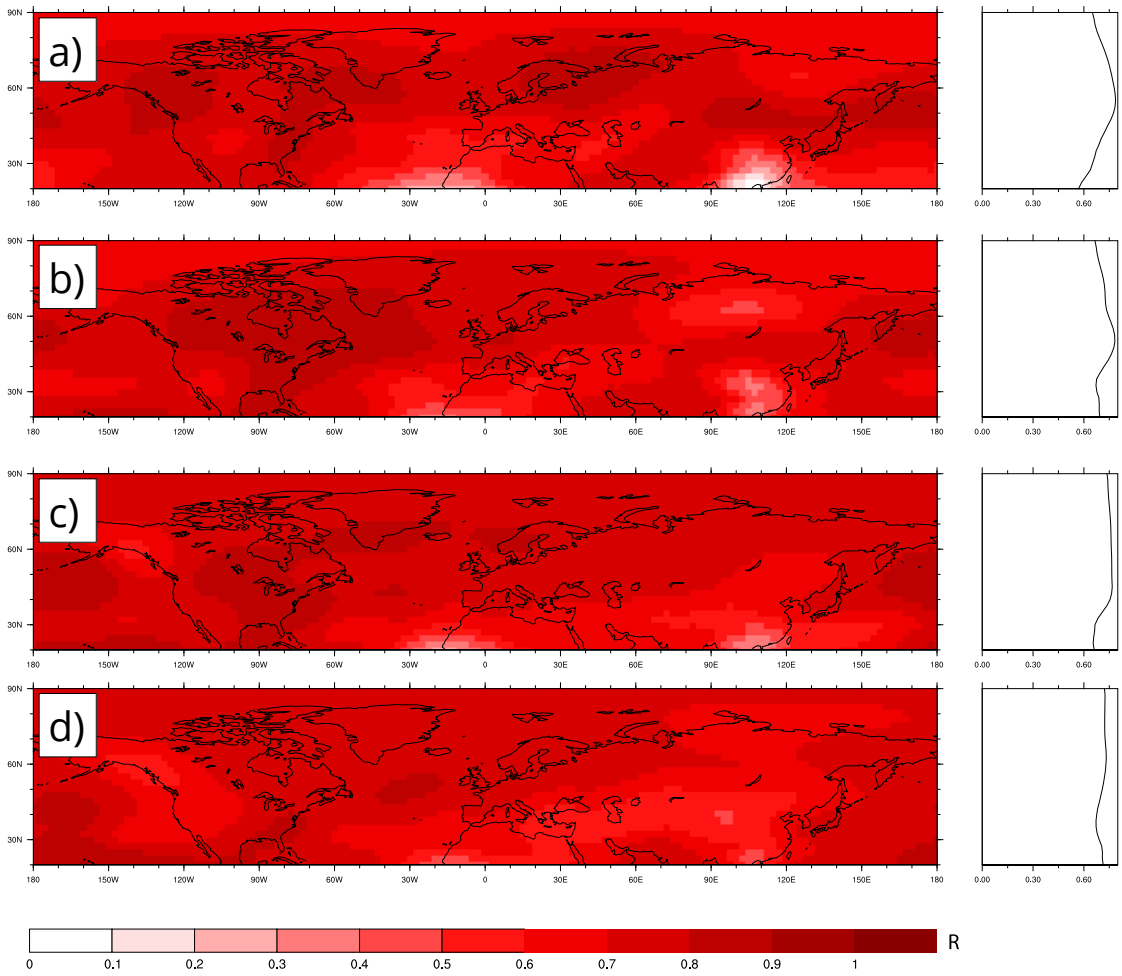


Figure 2: Evaluation of November December mean of polar cap 10 hPa GPH in ERA20C. a) Field mean November December 10 hPa GPH normalized index comparison between MERRA2, JRA55, ERA40 and ERA20C, b) correlation of November December 10 hPa GPH anomalies between MERRA2 and ERA20C with c) the zonal mean of the correlation coefficients.



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14 *Figure 3: Correlation of 100 hPa GPH anomalies between ERA20C and a merged product of JRA55 fields*
15 *(1958–2010) and statistically reconstructed monthly geopotential height fields for the period 1880–1957*
16 *(Griesser et al. 2010) for a) November, b) December, c) January and d) February for 1901–2010*

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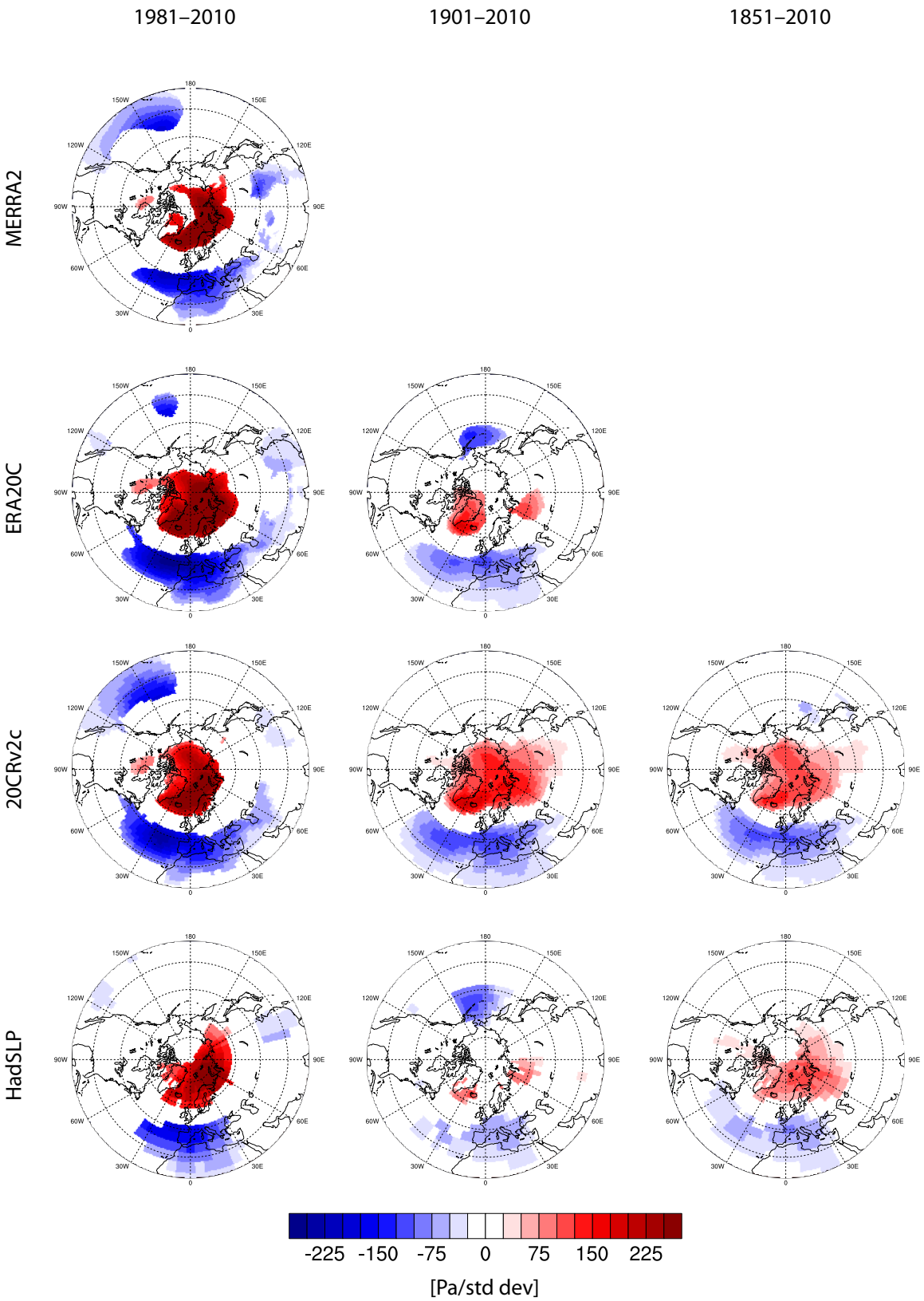

Figure 4: DJF sea level pressure [Pa/std dev] anomalies projected onto snow index in November MERRA2, ERA20C, 20CRv2c and HadSLPr2 covering different time slices.

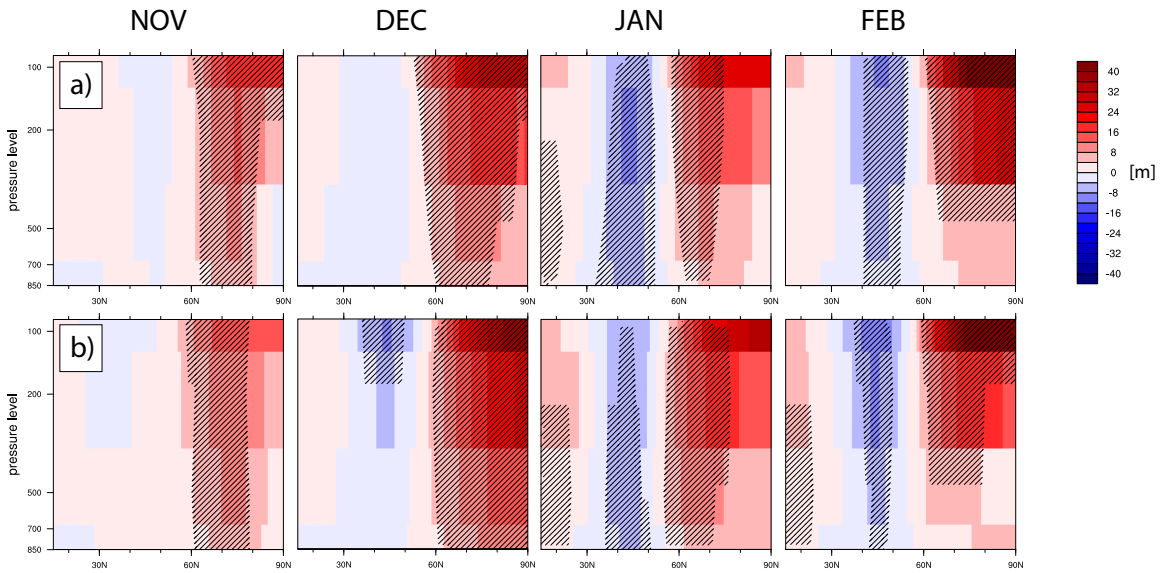

Figure 5: Zonal mean (180°E–180°W, 15°N–90°N) geopotential height anomalies on 100, 200, 500 and 850 hPa projected onto snow indices in November for a) a merged product of JRA55 fields (1958–2010) and statistically reconstructed monthly geopotential height fields for the period 1880–1957 (Griesser et al. 2010) and b) ERA20C covering 1901–2010. Shading indicates 95% significance level.

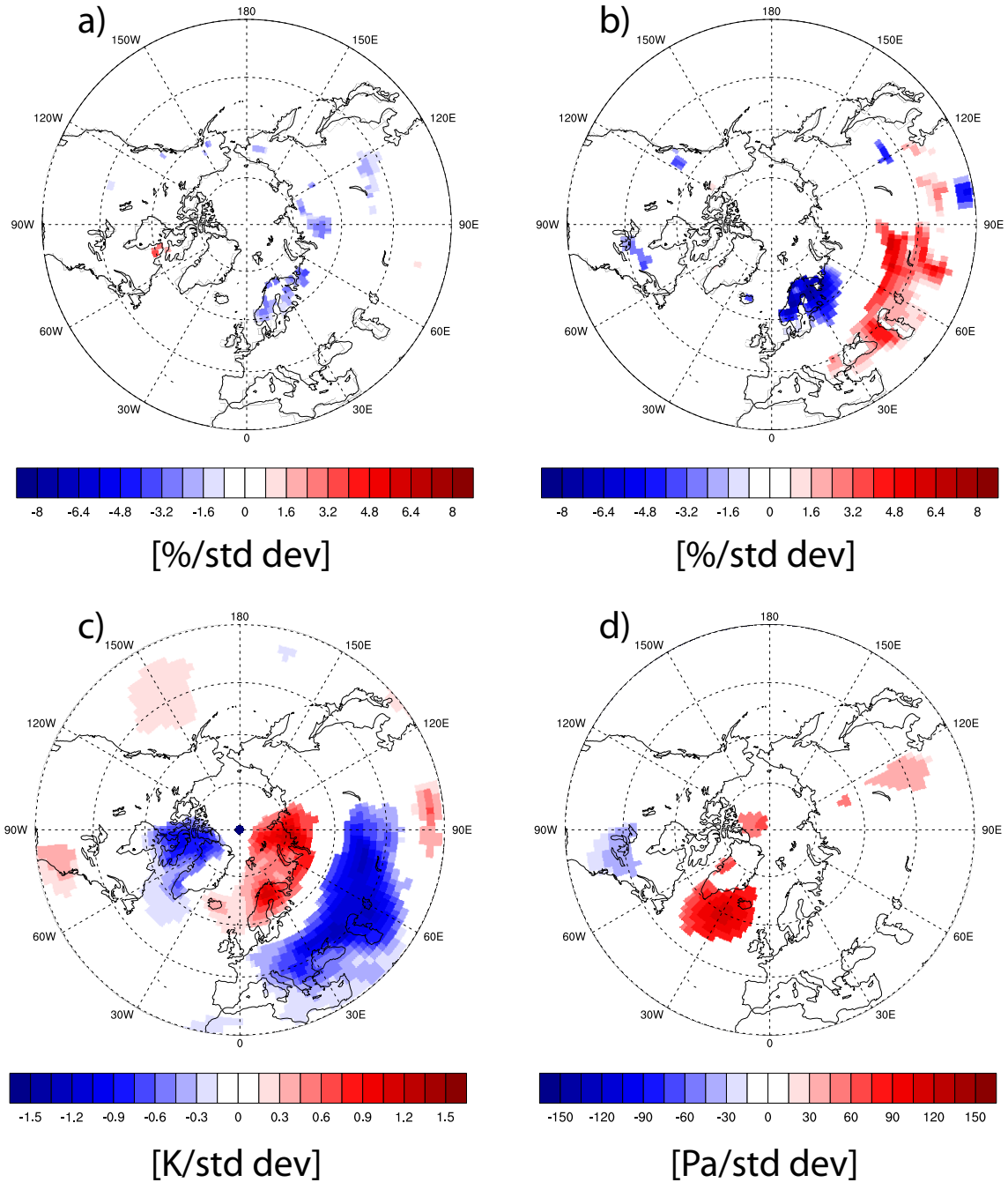

Figure 6: a) October snow cover anomalies [%/std dev] projected onto the field averaged November blocking frequency , b) November snow cover anomalies [%/std dev] projected onto the field averaged November blocking frequency, c) November 2m temperature anomalies [K/std dev] projected onto the field averaged November blocking frequency and d) b) DJF SLP anomalies [Pa/std dev] projected onto the field averaged November blocking frequency. Field averaging was performed for the region, (-10-80°E, 45-80°N) according to Peings 2019.

41 *Table 1: Partial correlation and multiple regression for sea ice, PV ND and snow*

	Estimate	P-Value	Statistic	N	GP	Method
partial correlation between NAO DJF and 20CRv2c November snow index given BKS November sea ice index	-0.296866	0.0017207	-3.215778	110	1	Pearson
partial correlation between NAO DJF and ERA20C November snow index given BKS November sea ice index	-0.211391	0.0273459	-2.237205	110	1	Pearson
partial correlation between NAO DJF and BKS November sea ice index given 20CRv2c November snow index	0.182415	0.0576334	1.919118	110	1	Pearson
partial correlation between NAO DJF and BKS November sea ice index given ERA20C November snow index	0.216711	0.02360975	2.296252	110	1	Pearson
partial correlation between NAO DJF and ERA20C November December mean polar 10 hPa GPH given 20CRv2c November snow index	-0.041280	0.6699642	-0.427376	110	1	Pearson
partial correlation between NAO DJF and 20CRv2c November snow index given ERA20C November December mean polar 10 hPa GPH	-0.318160	0.00074774	-3.471462	110	1	Pearson
partial correlation between NAO DJF and 20CRv2c November snow index given BKS November sea ice index and ERA20C November December mean polar 10 hPa GPH	-0.274639	0.00402170	-2.940663	110	2	Pearson

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