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Supplement of

Impact of Eurasian autumn snow on the winter North Atlantic Oscillation in seasonal forecasts of the 20th century

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Supplementary Material

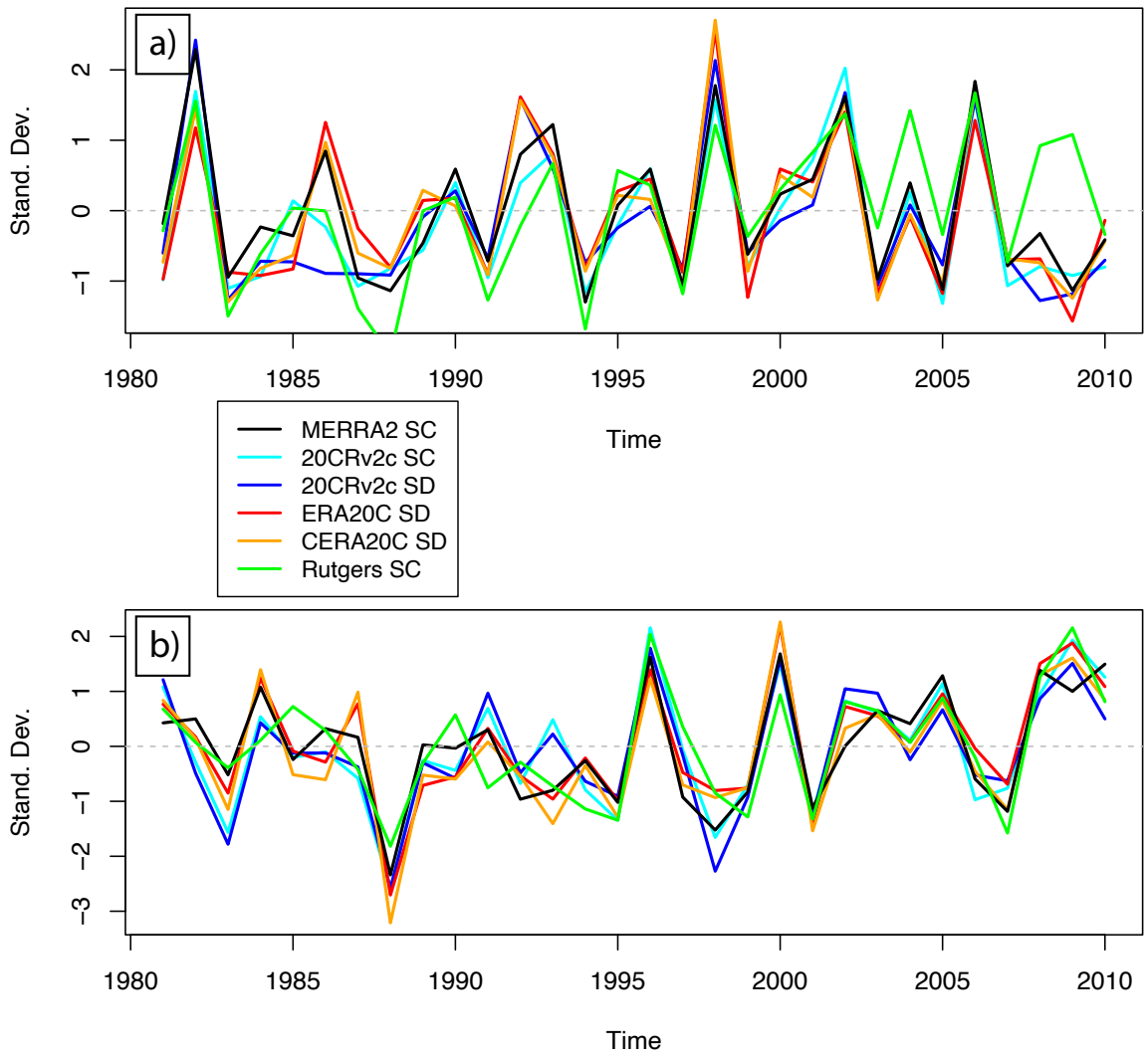

*Figure S1: Comparison of a) October snow indices and b) November snow indices for the period 1981-2010 in multiple reanalysis products as well as the Rutgers snow laboratory satellite–based snow cover product (**Robinson et al. 2012**).*

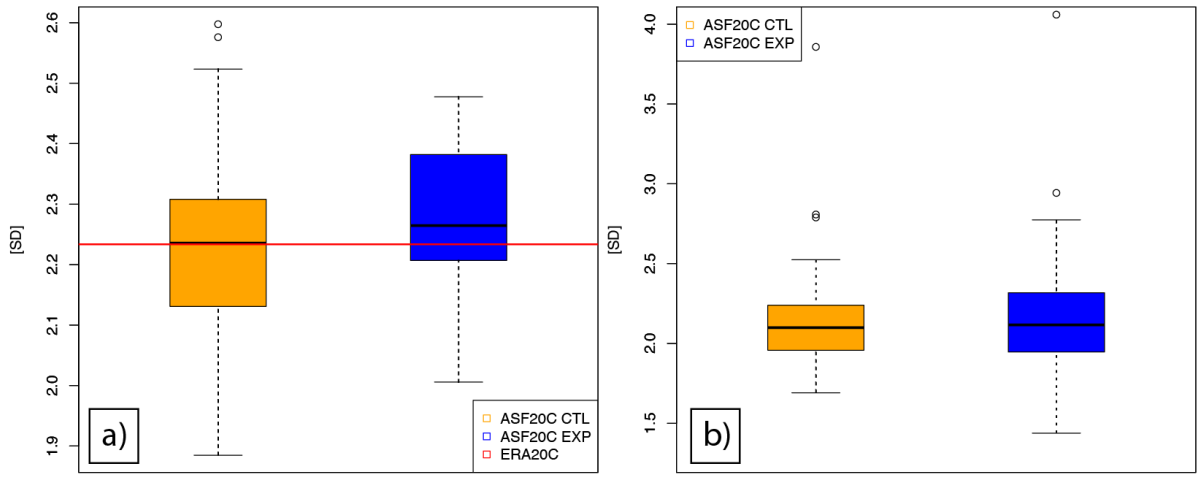

Figure S2: Comparison of a) DJF NAO inter-annual standard deviation for all members in ASF20C CTL, ASF20C EXP and the deterministic ERA20C. b) DJF NAO inter-member standard deviation over all 110 years.

Table S1: Correlation coefficient for 110 years between reconstructed NAO index values and ERA20C, ASF-20C CTL ensemble mean and ASF-20C EXP ensemble mean NAO index values

	DEC	**JAN**	**FEB**	**DJF**
ERA-20C	0.67	0.88	0.9	0.83
ASF-20C CTL	-0.09	0.25	0.19	0.33
ASF-20C EXP	-0.13	0.2	0.16	0.34

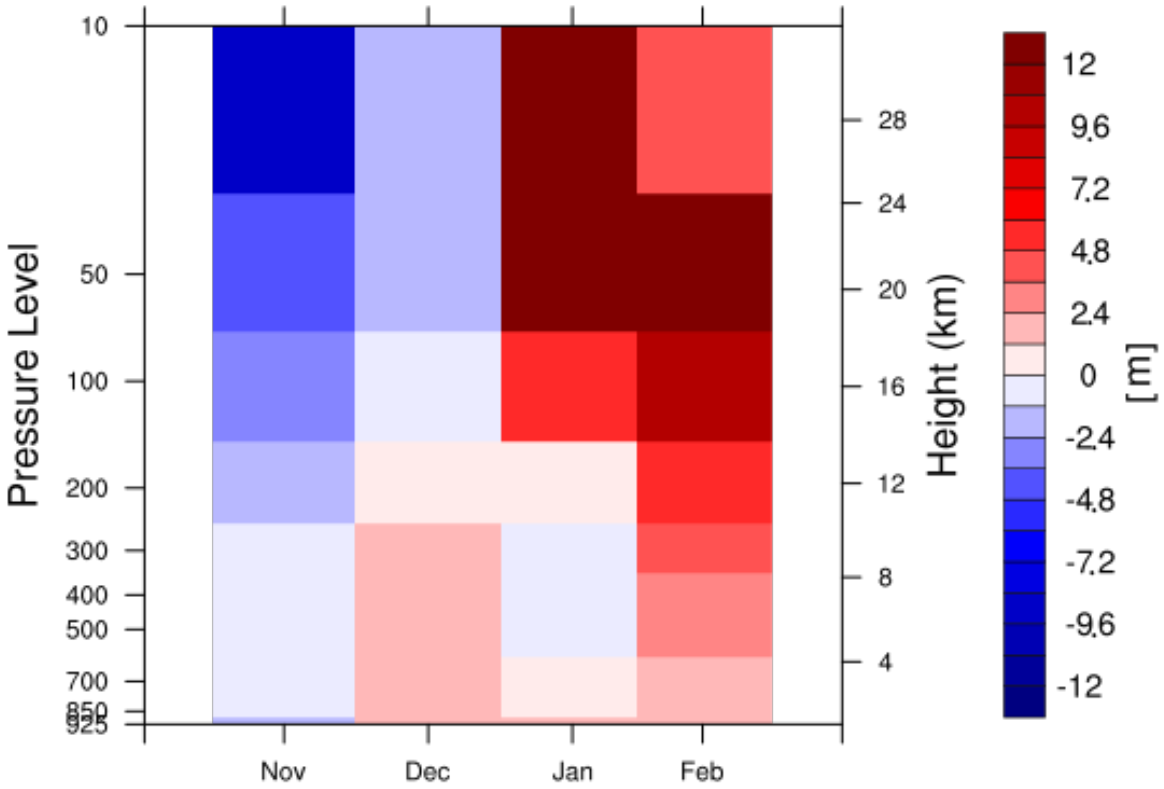

Figure S3: Polar-cap averaged (180°E–180°W, 60°N–90°N) geopotential (height) anomalies for the period 1901-2010 between high-snow and low-snow ASF-20C EXP ensemble means. Shading indicates 90% significance level.

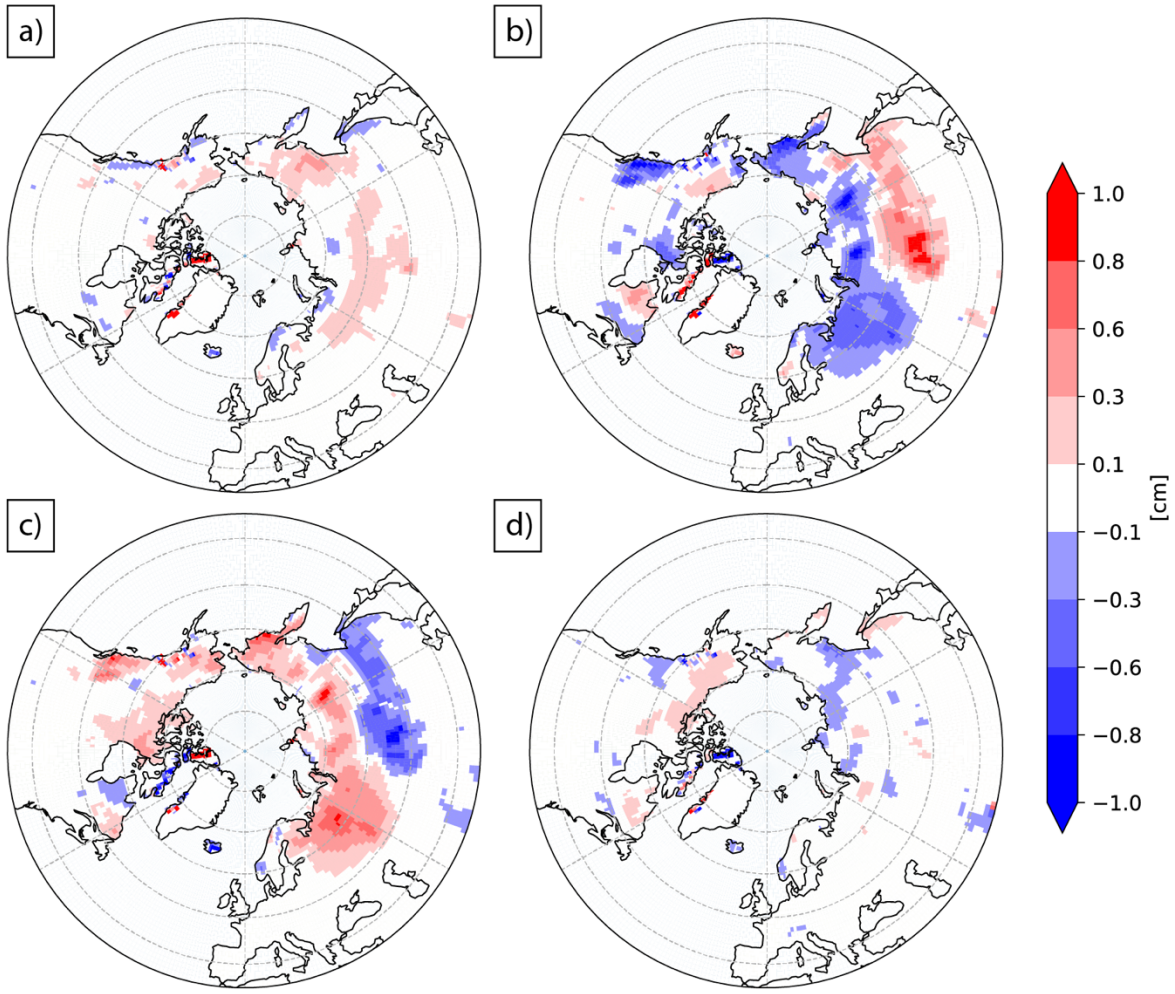

Figure S4: a) Represents November snow depth differences between high-dipole ASF-20C EXP ensemble mean and ASF-20C CTL ensemble mean after positive snow dipole 1st November (see Figure 1a). b) as a) but for ASF-20C CTL ensemble mean after negative snow dipole 1st November. c) as a) but for the low-dipole ASF-20C EXP ensemble mean and d) as b) but for the low-dipole ASF-20C EXP ensemble mean.

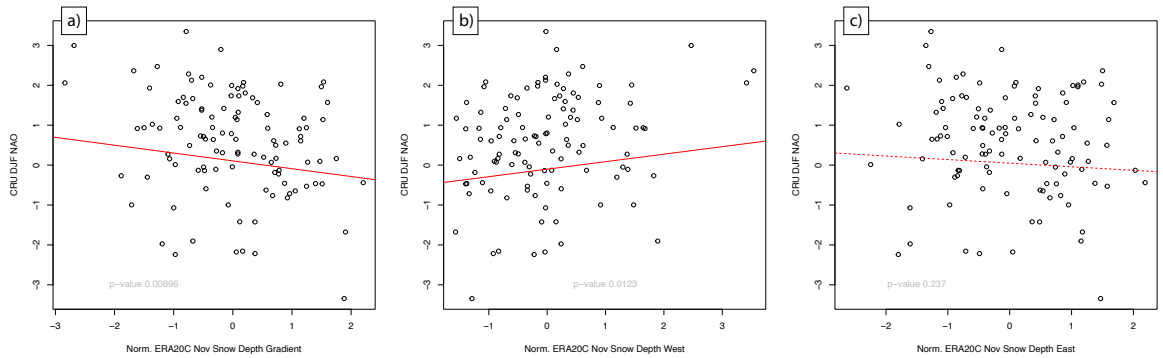

Figure S5: a) Regression between normalized ERA20C November snow depth gradient from western to eastern domain and CRU DJF NAO index, b) same as a) but only using the western domain and c) same as a) but only using the eastern domain.

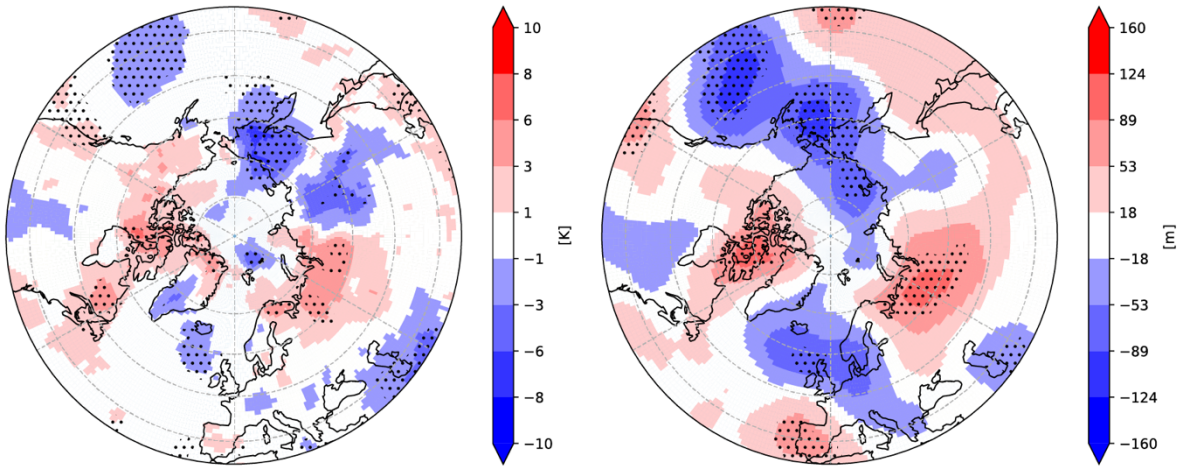

Figure S6: November 1st precondition composites where the NAO DJF of the AFS20C CTL ensemble mean is < -1 stand. dev. minus composites where the NAO DJF of the AFS20C CTL ensemble mean is > 1 stand. dev. (for a list of years see below). From left to right: 2m temperature and 500 hPa GPH anomalies. Stippled areas represent 90% significance.

+ NAO DJF years:1901,1904,1908,1909,1915,1919,1920,1922,1925,1927,1930,1932,1945,1964,1973,1978,1989,2000,2002

- NAO DJF years: 1917,1918,1924,1931,1934,1940,1941,1950,1951,1977,1980,1982,1998,2010

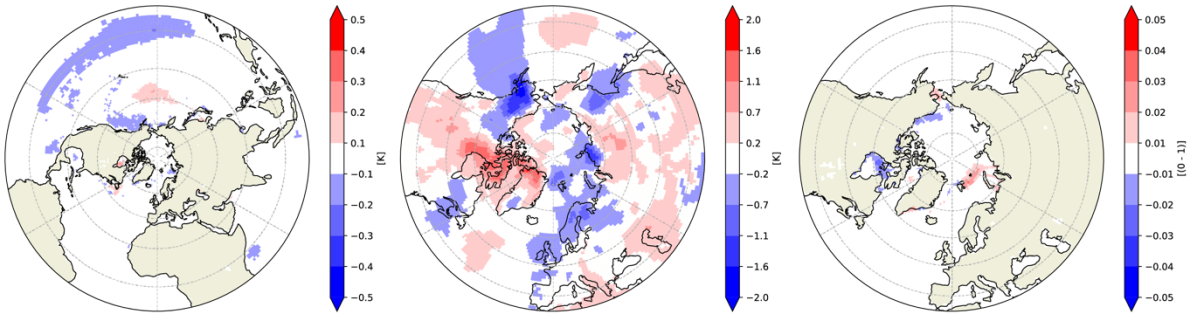

Figure S7: ERA20C climate anomaly composites of November 1st preconditions after which a positive snow dipole forcing resulted in a negative DJF NAO signal (based on Figure 3c): From left to right: SSTs, 2m temperature and sea ice concentration anomalies. Anomalies are computed with respect to the 1901–2010 average.

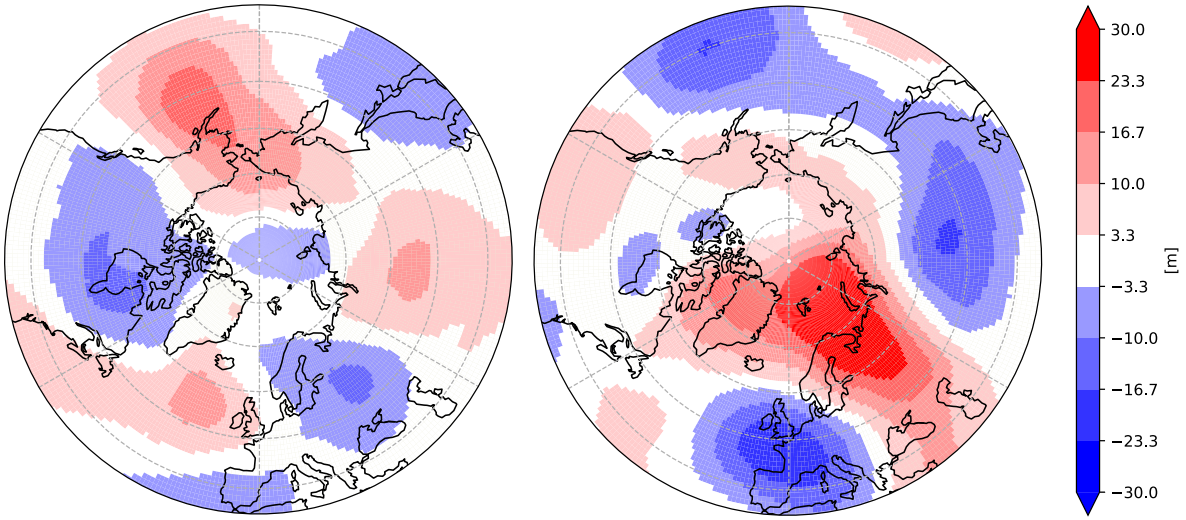

Figure S8: Averaged 500 hPa geopotential height anomalies for left) the period 1921–1941 and right) 1991–2010 between high-snow and low-snow ASF-20C EXP ensemble means in December.

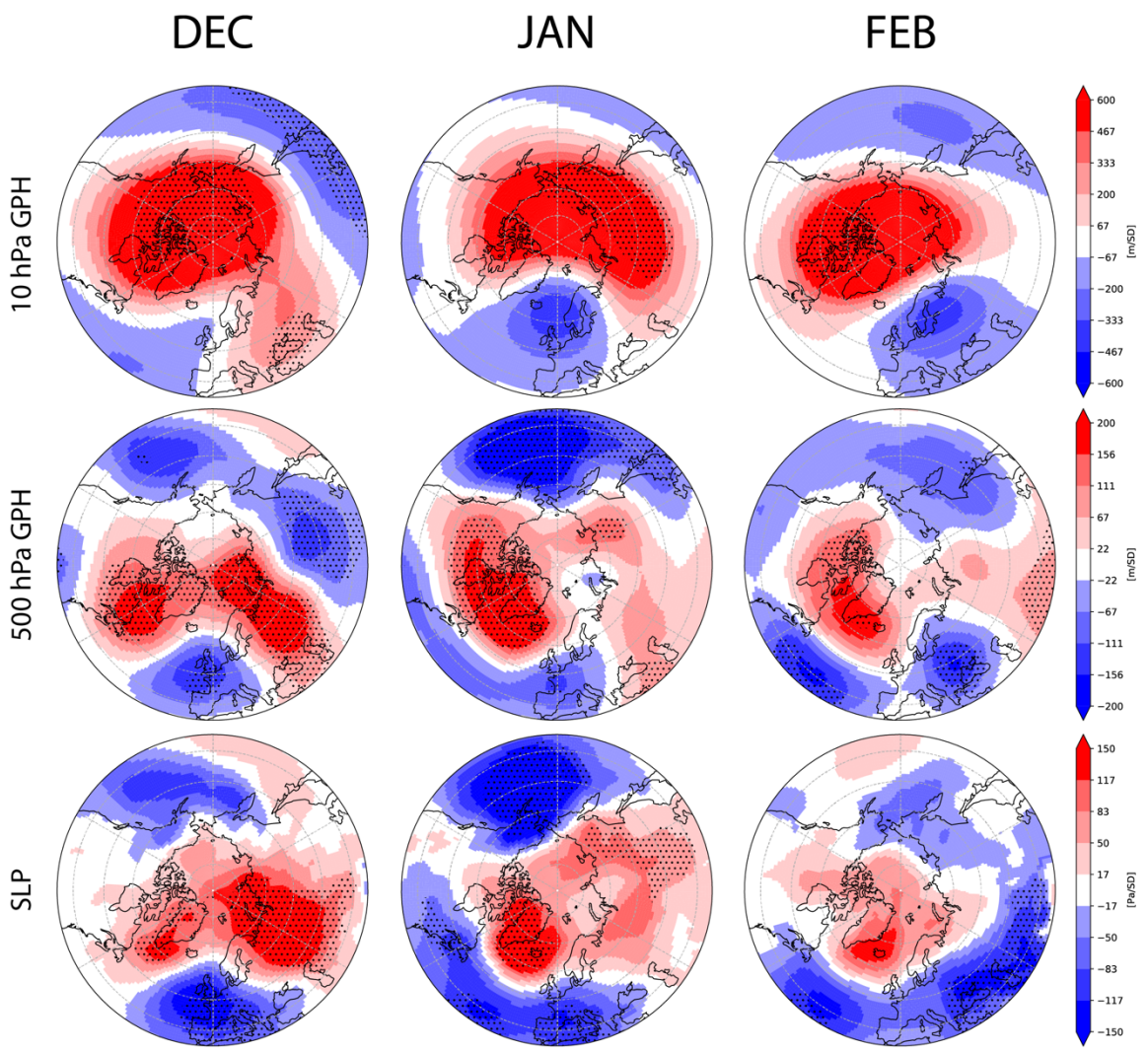

Figure S9: As Figure 5 but for individual months.

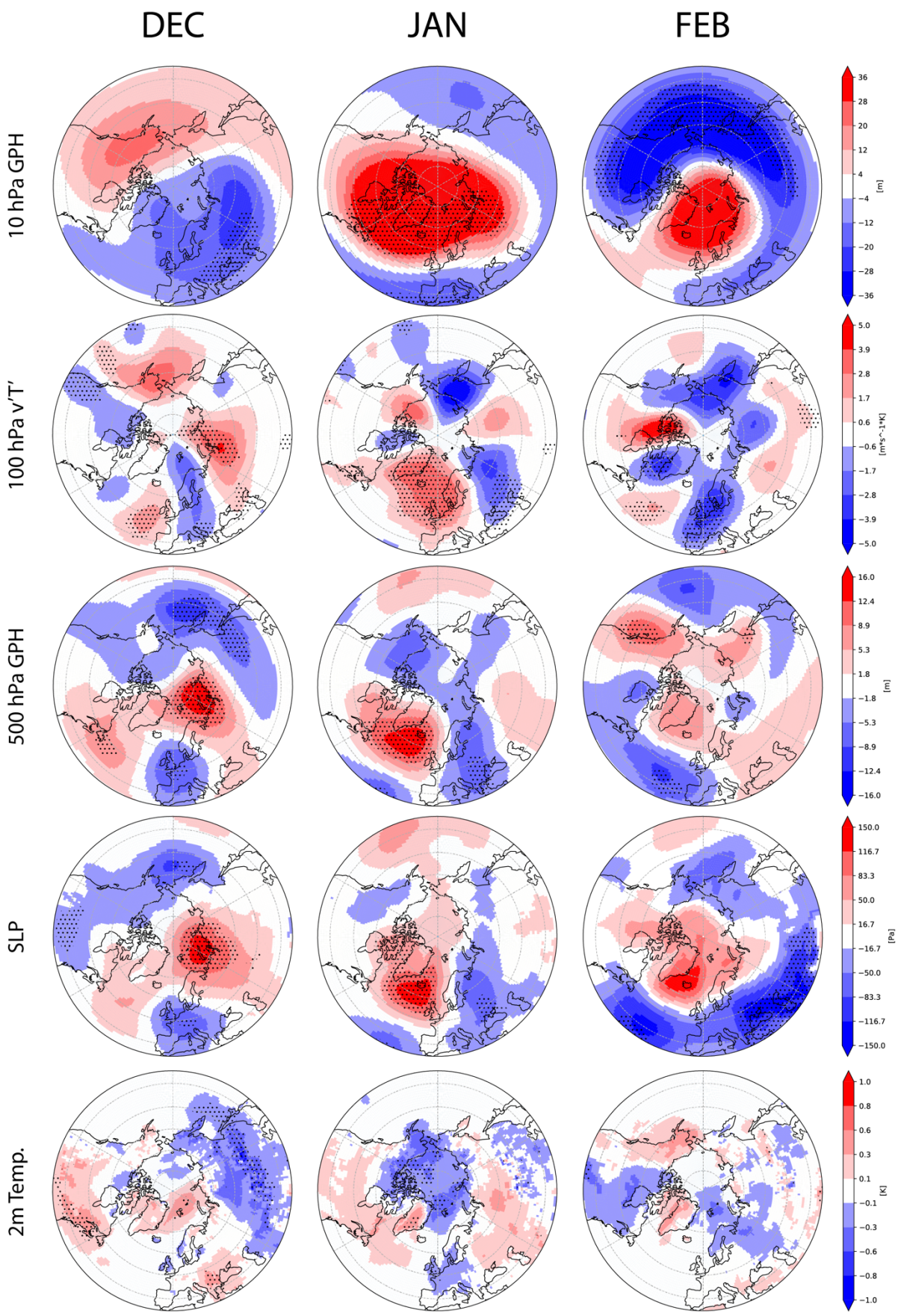

Figure S10: As Figure 6 but for individual months.