

Supplement 1

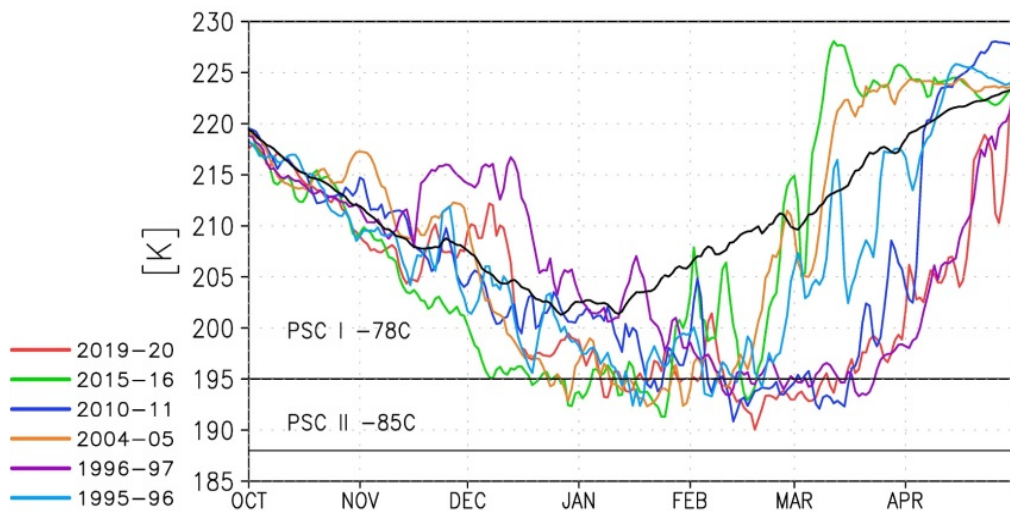


Figure S1.1 (Former Fig.2). Minimum temperature in the region 70-90° N at 70 hPa in October-April 1995-1996, 1996-97, 2004-05, 2010-2011, 2015-16, and 2019-20. Black line corresponds to climatological mean over 1981-2010.

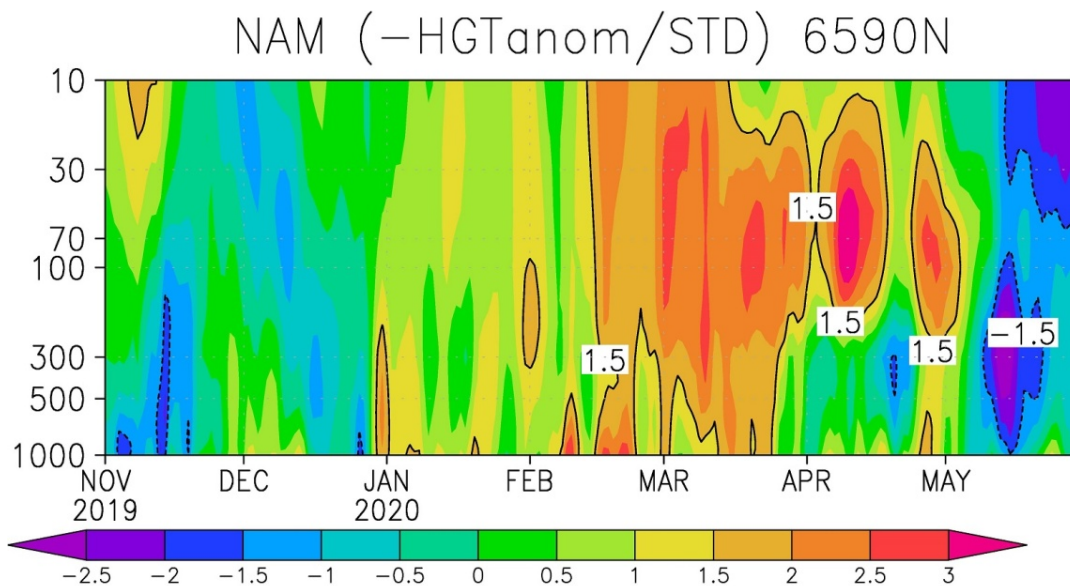
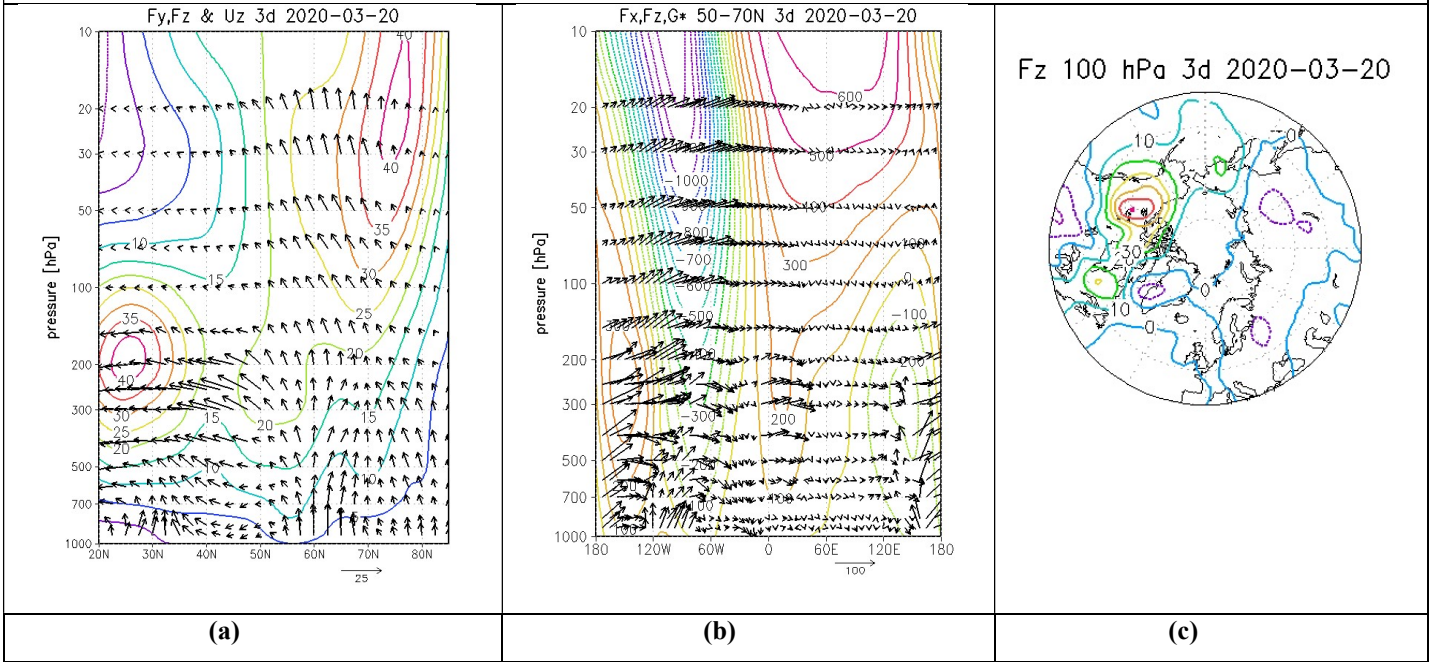


Figure S1.2 (former Fig.4a). NAM index in November 2019 - May 2020. Black solid and dashed contours correspond to +/- 1.5 σ respectively.

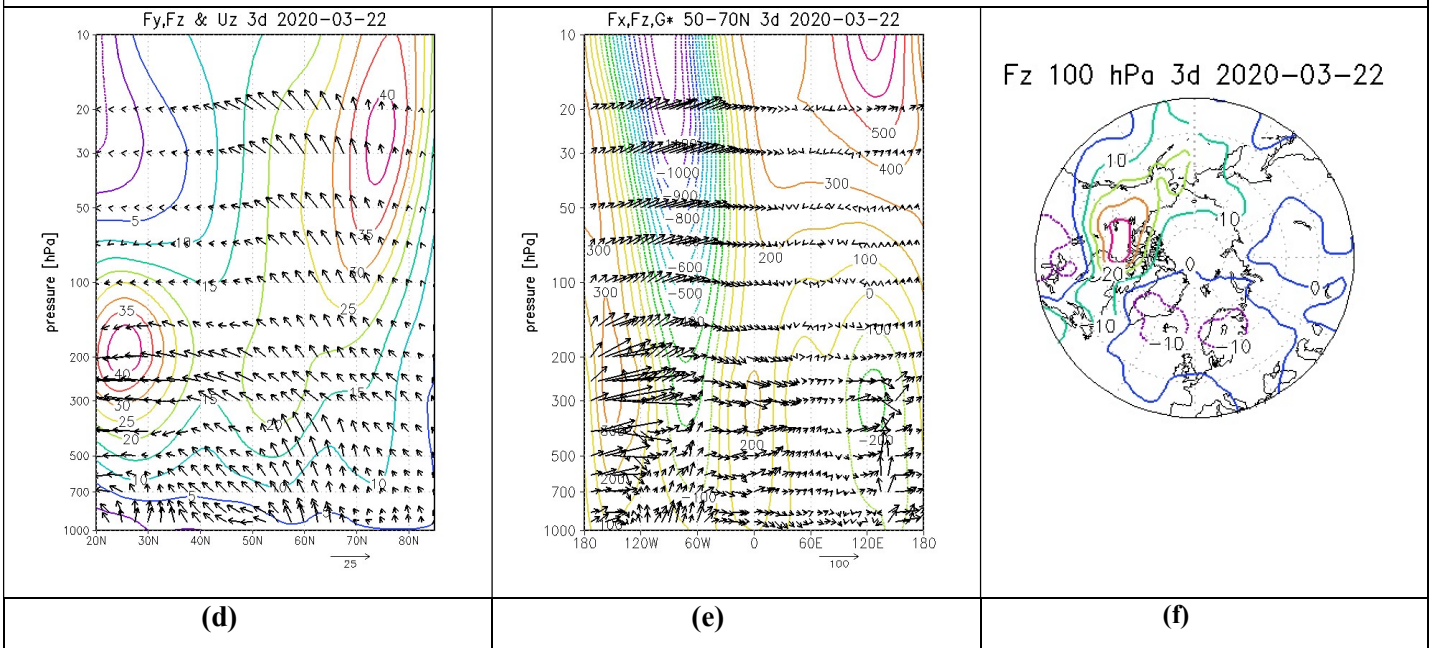
Monthly mean AO index in winter -spring 2019-20: Dec: 0.4; Jan: 2.4, Feb: 3.4, Mar: 2.6, Apr: 0.9.

https://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/monthly.ao.index.b50.current.ascii.table

18-20 March 2020



20-22 March 2020



22-24 March 2020

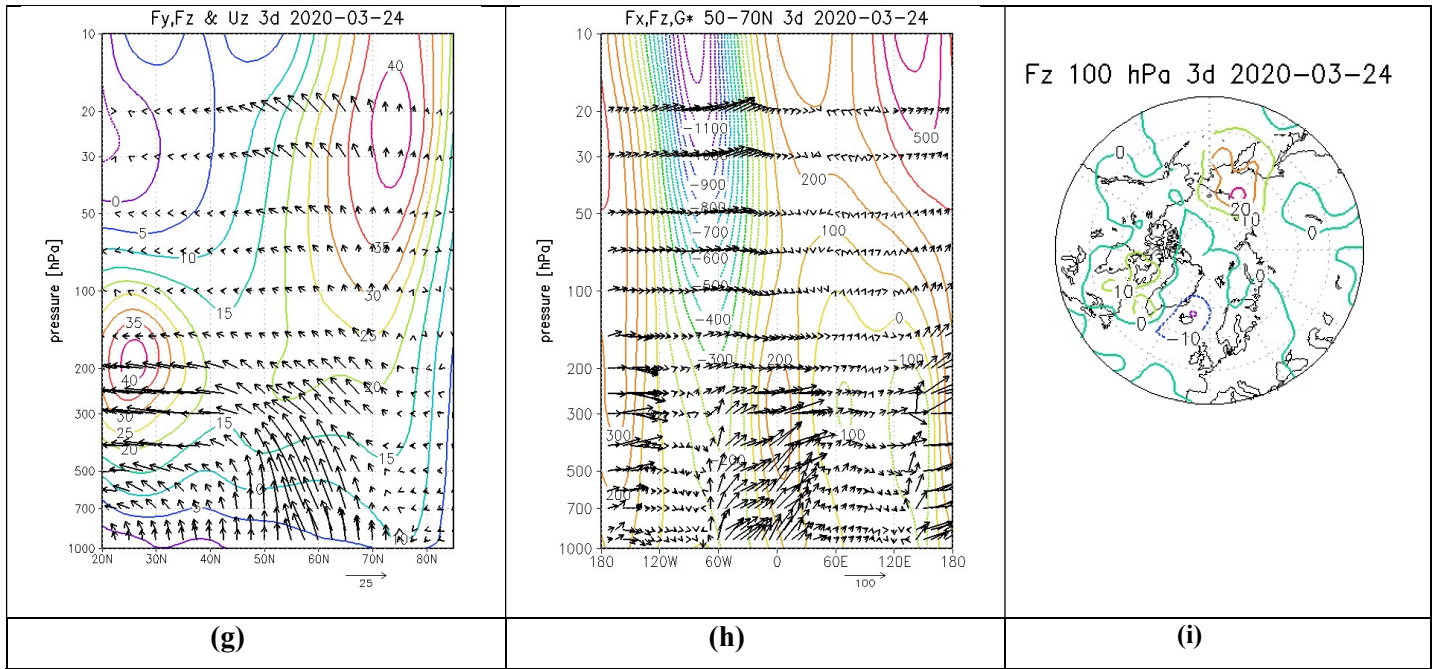


Figure S1.3. Altitude-latitude diagram of zonal mean Plumb fluxes (F_y , F_z components) and zonal mean zonal wind on March 18-20 (a), March 20-22 (d), and March 22-24 2020 (g). Altitude-longitude diagram of Plumb fluxes (F_x , F_z components) and geopotential height deviation from zonal mean (gpm) over 50-70° N and the same periods (b, e, h). Vertical component of Plumb fluxes F_z ($\text{m}^2/\text{s}^2 \cdot 10^{-2}$) at 100 hPa for March 18-20 (c, f, i). The vertical component of wave activity flux is multiplied by a factor of 100.

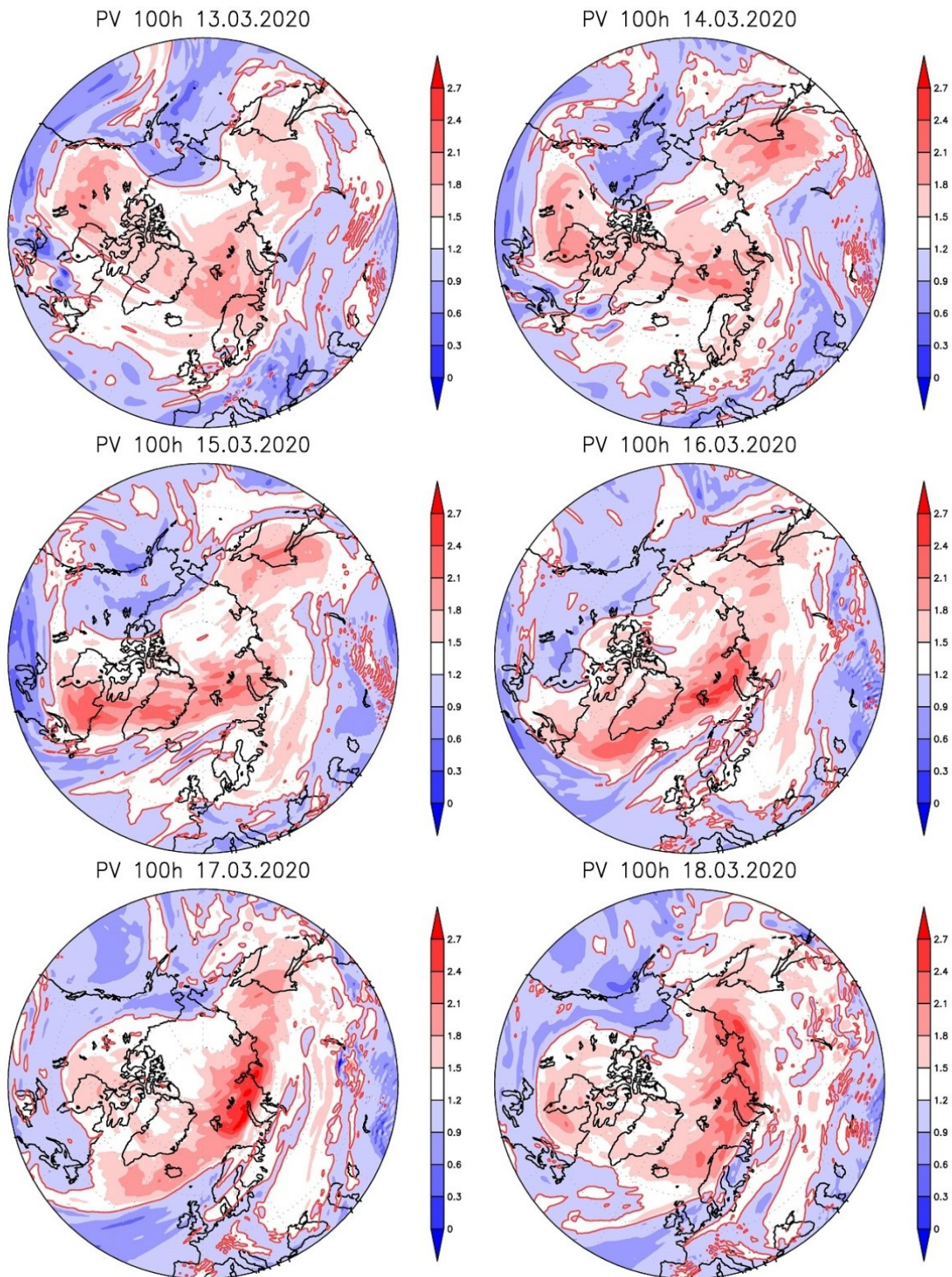


Figure S1.4. Potential vorticity ($\times 10^{-5}$) on 100 hPa at 00Z from 13 to 18 March 2020 (ERA5 reanalysis on pressure levels).

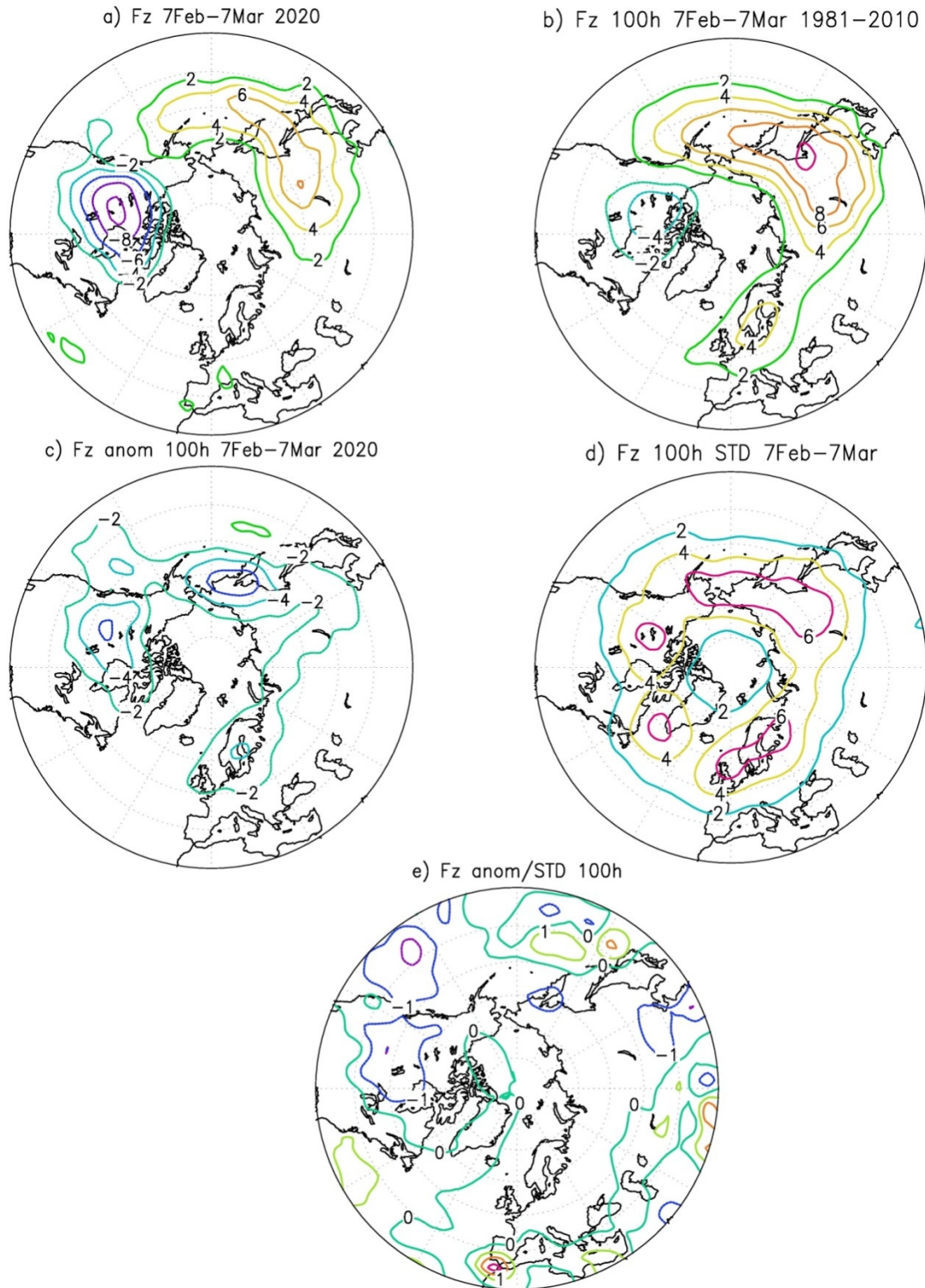


Figure S1.5. Vertical component of Plumb fluxes F_z ($\text{m}^2/\text{s}^2 \cdot 10^{-2}$) anomaly at 100 hPa averaged over the period of February 7 - March 7 2020 (a) and over mean from 1981 - 2010 (climatology) (b), Fz anomaly (difference (a)-(b)) (c), standard deviation of Fz (d), and Fz anomaly normalized on standard deviation (e).

MLS temperature and zonal mean zonal wind data demonstrate the features of the late March SSW event:

- temperature increase in the polar stratosphere is observed after 17 March. (NCEP-R data also display it)
- zonal wind decrease and its reversal in the upper stratosphere

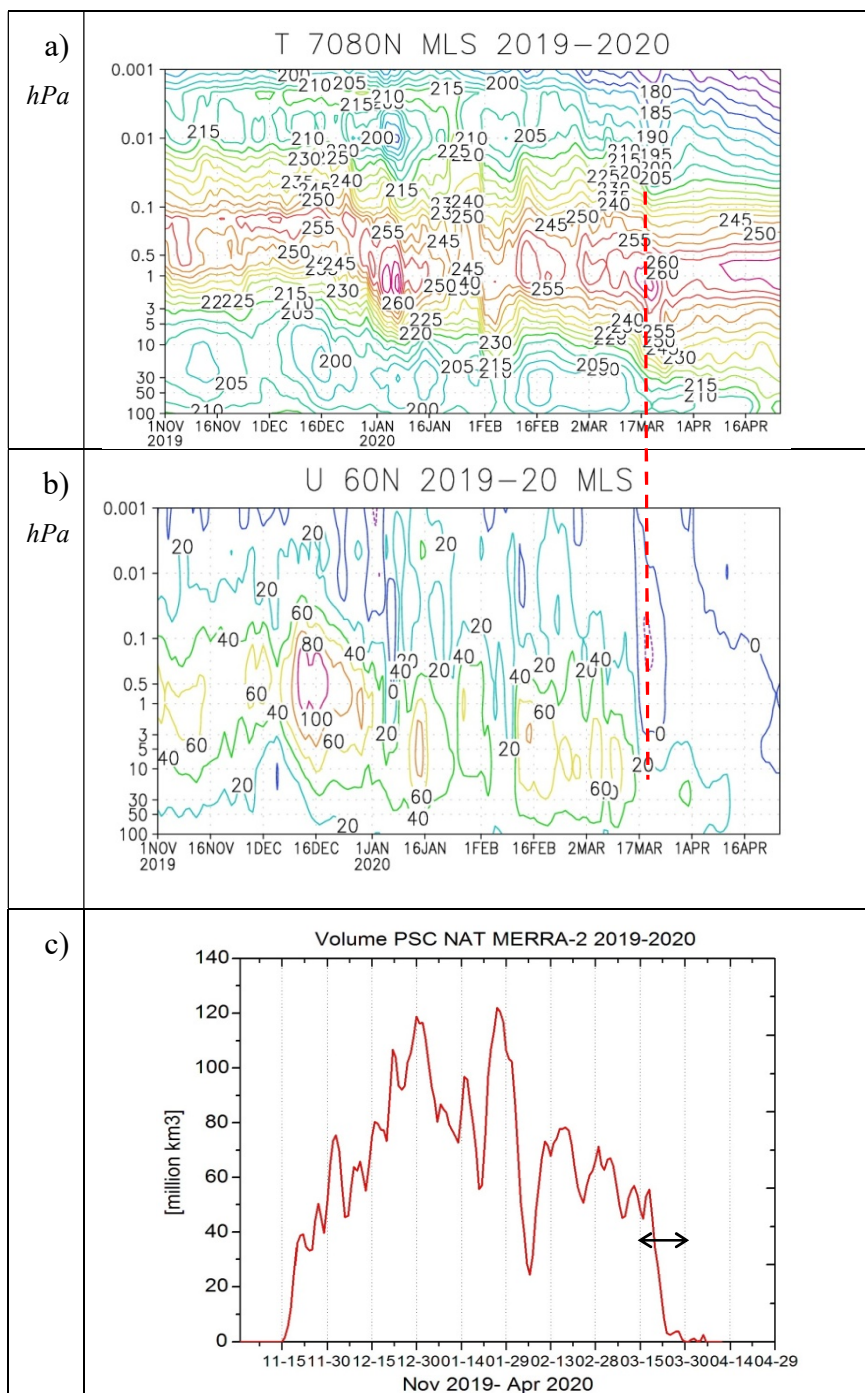


Figure S1.6. Polar cap temperature 70-90°N (a) and zonal mean zonal wind at 60°N from November 1, 2019 to April 30, 2020. PSC NAT volume from November 1, 2019 to April 30, 2020. The period of PSC NAT drop in late March is marked by black arrow.

Decrease of PSC NAT volume from ~ 55 mln km³ on 18 March to almost zero on 29-31 March 2020.
https://ozonewatch.gsfc.nasa.gov/meteorology/figures/merra2/temperature/natvn_2019_merra2.pdf

Therefore this SSW event led to the end of PSCs existence in the winter season 2019-2020.