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Influence of the tropospheric teleconnection patterns on the stratosphere in winter

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In polar winter, the ozone distribution in the stratosphere ist governed by the chemical loss and dynamical redistibution. Dynamical redistribution including net supply of ozone to high latitudes is largely controlled by the propagation and dissipation of waves that originate in the troposphere and are subject of tropospheric climate variability. The coupling occurs on two time scales: (1) the direct, non-zonal, and nearly instantaneous coupling, and (2) the coupling due to the modulation of the stratospheric residual circulation by the dissipation of waves. Our study focuses on (2). The effect is lagged to the tropospheric forcing by one month. The tropospheric teleconnection patterns, which show the tropospheric variability, have been identified by applying a rotated EOF-Analyses to the geopotential height fields (NCEP/NCAR Reanalyses) at the 500 hPa level. We show significant correlations between individual PCs and the geopotential height and temperature on various stratospheric levels, clearly showing the impact of tropospheric variability on the stratosphere. We have split our analysis into four separate time periods: 1948-2002, 1948-1977, 1978-2002, 1990-2002. Some patterns, i.e. "North Atlantic Oscillation", "Scandinavian Pattern" and "Polar Eurasia", demonstrate significant changes between the different time periods, and shift in the later periods to an annular mode which is connected to the residual circulation. One reason for that is the change in the properties of wave number 1. The annular pattern arises when the amplitude of wave number 1 is high and the polar vortex is shifted to Europe. A comparison with the data of the coupled chemistry-climate model ECHAM4(DLR)/CHEM will be presented.