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Interannual variability of the stratospheric wave driving during northern winter

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Abstract. The strength of the stratospheric wave driving during northern winter is often quantified by the January–February mean poleward eddy heat flux at 100 hPa, averaged over 40°–80° N (or a similar area and period). Despite the dynamical and chemical relevance of the wave driving, the causes for its variability are still not well understood. In this study, ERA-40 reanalysis data for the period 1979–2002 are used to examine several factors that significantly affect the interannual variability of the wave driving. The total poleward heat flux at 100 hPa is poorly correlated with that in the troposphere, suggesting a decoupling between 100 hPa and the troposphere. However, the individual zonal wave-1 and wave-2 contributions to the wave driving at 100 hPa do exhibit a significant coupling with the troposphere, predominantly their stationary components. The stationary wave-1 contribution to the total wave driving significantly depends on the latitude of the stationary wave-1 source in the troposphere. The results suggest that this dependence is associated with the varying ability of stationary wave-1 activity to enter the tropospheric waveguide at mid-latitudes. The wave driving anomalies are separated into three parts: one part due to anomalies in the zonal correlation coefficient between the eddy temperature and eddy meridional wind, another part due to anomalies in the zonal eddy temperature amplitude, and a third part due to anomalies in the zonal eddy meridional wind amplitude. It is found that year-to-year variability in the zonal correlation coefficient between the eddy temperature and the eddy meridional wind is the most dominant factor in explaining the year-to-year variability of the poleward eddy heat flux.

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