

Trends and variability of planetary wave activity in the stratosphere in a changing climate

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Planetary waves are global scale waves in the lower and middle atmosphere which lead to a more or less periodic change of weather patterns in the middle latitudes. This already indicates that planetary waves couple atmospheric layers and can lead to extreme weather events. Climate change is supposed cause changes of planetary wave activity.

The question is whether the planetary wave activity has already changed during the last ~ 40 years and –if so – if this can be attributed to a possible weakening of the meridional temperature gradient.

To check this we calculated a dynamical activity index (DAI) that serves as a measure for the planetary wave activity based on total ozone column measurements and ERA-Interim temperatures. We found that the DAI based on total ozone column measurements is not reliable for quantifying long term changes in planetary wave activity. Despite we found the ERA-DAI trustworthy. The planetary wave activity has already changed, but significantly only in the stratosphere. The change of the planetary wave activity with highest wavenumbers turned out to be strongest. We also found that also multi-decadal periodic oscillations might have an impact on the wave activity. We especially looked into the consequences of a changing planetary activity into the occurrence of stratospheric warmings and we found evidence that the observed change in the temporal occurrence of stratospheric warmings might be coupled to the detected change in planetary wave activity.