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Trend analyses of the frequency in stratospheric and tropospheric PV-streamers over the ERA-40 period

F. Isotta (1), O. Martius (1), M. Sprenger (1), **C. Schwierz** (2)

(1) Institute for Atmospheric and Climate Science, ETH Zurich (2) Institute for Atmospheric Science, University of Leeds

A 44-year climatology of PV-streamers in the tropopause region, compiled using a potential vorticity based identification algorithm (Wernli and Sprenger, 2007), is used to determine the trend in the frequency of stratospheric and tropospheric intrusions. Trends in these dynamic features are of importance i) due to the link between these intrusions and a horizontal redistribution of water vapour, ozone and PV; ii) due to their dynamical relevance as positive and negative PV anomalies in the tropopause region and the implications for the tropospheric flow field; iii) due to their link to extreme weather events such as heavy precipitation in the Alps (Martius et al., 2006).

Two different methods are applied to determine trends. On the one hand conventional linear trends of the frequencies are determined for the four seasons. On the other hand a STL decomposition (a tool based on lowess filters) is applied to the complete data set to extract low-frequency trends. The trends are determined for breaking waves on several isentropic levels in the tropopause region (310K - 350K) and for the Northern Hemisphere.

The trends are horizontally and vertically variable. The ones over the Atlantic basin fit well the trends observed in the changes of the tropopause height due to trends in the NAO and the frequency of blocking (Croci-Maspoli et al., 2007). A good accordance is also found between trends in the total ozone concentration attributed to changes in the dynamics and the trends in the frequency of the intrusions (Hood and Soukharev, 2005) .