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Regions of low Variability in the Middle Atmopshere

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For the investigation of climate change it is important to distinguish between effects which are attributed to dynamical variability and a possible steady change of climate. In other words, it is necessary to determine regions of the atmosphere where daily dynamical processes are rather weak and the climatic background dominates. These regions are also interesting for the discrimination of chemical and dynamical processes or for satellite validation.
In order to determine regions of low variability, so called quiet layers, temperature and ozone data are investigated. These data originate from ERA40-observations (investigated height interval: ca. 38km – 65km) and the GOME-instrument (Global Ozone Monitoring Experiment) on the ERS2-satellite which measures the total column ozone. In order to get vertically resolved ozone data the GOME-measurements are assimilated into the 3D-ROSE-CTM (covered height interval: ca. 3 - 50km).
The variability of the ERA40-temperature-data is calculated with regard to the zonal mean along the circles of latitude for different heights. The analysis shows horizontal as well as vertical regions of low variability. While the vertical ones can be attributed to the zero-crossing of planetary waves, the horizontal ones seem to be quiet layers proposed by Faust. Following his theory a meridional wind extremum is related to a vanishing zonal temperature gradient and vice versa. In order to check whether this relation is the explanation for the horizontal quite layers, a case study of meridional and zonal wind data from falling sphere experiments (covered height interval: ca. 33km – 68km) which were flown during the DYANA-campaign in January and February 1990 at Andøya (69°N), Northern Norway is performed. Additionally, zonal and meridional temperature gradients between 70°N and 60°N using the above mentioned ERA40-data are calculated. The comparison of these analyses proves our hypothesis that the horizontal quiet layers can be attributed to Faust.
A similar analysis is performed using the assimilated ozone data. Here, horizontal and vertical quiet layers can also be found.