

**Variability and trends of the stratospheric subtropical barrier**

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In the present study, we focus on variability and trends in the dynamical barrier located in the subtropical stratosphere. We calculate PDFs of the long-lived tracers nitrous oxide and methane from different satellite instruments: the Microwave Limb Sounder (MLS) on board Aura, the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) on board Envisat, the Sub-Millimetre Radiometer (SMR) on board Odin and the Halogen Occultation Experiment (HALOE) on board UARS, overall covering the time period of 1992-2009. Bivariate PDFs allow to estimate the position of the region of minimum gradient (i.e. the edge of the dynamical barrier). The four satellite instruments offer an overall coherent picture of the subtropical barrier position and intensity. There is a strong seasonality coherently represented, characterized by the wintertime shift of the subtropical edge toward the summer hemisphere. During the westerly phase of the QBO, the wintertime shift of the subtropical edge toward the summer hemisphere is larger, in response to the enhanced stirring occurring in the subtropics during that phase with no substantial interhemispheric differences. The analysis of the combined time series allows to estimate trends in the position of the dynamical barrier. Significant trend is detected in the southern hemisphere subtropics above 600 K (25 hPa) with a shift toward the equator of 2.0° per decade from 1992 to present days. Similar narrowing is observed also in the Northern hemisphere but is not statistically significant.