



## **Trends and variability in the upper troposphere/lower stratosphere 1990-2008: Insights from stratospheric water vapour**

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Stratospheric water vapour strongly affects Earth's radiation budget, and plays an important role for stratospheric chemistry. The processes that control its variability and long-term trends remain a topic of debate despite significant progress in our understanding of the processes controlling dehydration in the tropical tropopause layer (TTL). Here, we combine measurements of stratospheric water vapour from HALOE (1991-2005), MIPAS (2002-present) and MLS (2004-present) to derive a timeseries of water mixing ratios of air entering the stratosphere. We use trajectory calculations based on the newly available reanalysis data ERA-Interim provided by ECMWF to estimate water vapour concentrations at entry into the stratosphere. We show that this Lagrangian approach successfully reproduces observations, including a sharp drop in mid-2000 and a prolonged period of dryness thereafter. The successful reproduction of observations allows identification of the processes that control variability and trends. It is shown that stratospheric water vapour is a very sensitive indicator of changes in the global climate system that affect conditions, i.e. temperature structure and circulation, in the TTL, and as such elucidates connections in the climate system that may be far less evident in other tracer or meteorological data.