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Title: The distribution of stratospheric water vapor observed by an airborne microwave radiometer

Abstract:

Since 1998, the Institute of Applied Physics has observed stratospheric water vapor with an airborne microwave radiometer. Altitude profiles of stratospheric H₂O in the range of 15-70 km above the flight track were derived from the measured spectra. The instrument has taken part in several campaigns, which typically took one week and covered almost all of the northern latitudes from the tropics to the arctic. Flights in summer show mostly climatological distributions of stratospheric H₂O which are good for estimate long-term changes. Flights in winter and spring show a high variability, both in altitude as well as horizontally. The profiles show interesting dynamic features especially in the arctic stratosphere. Downward motion of air masses and evidence of the polar vortex are visible up to an altitude of more than 50 km. In the tropics, our measurements allow us to observe the very interesting upper troposphere/lower stratosphere region. Our latest results confirm a change in the overall distribution of stratospheric water vapor by roughly 1% per year which has also been observed by other instruments during the last decade. However, our observations show that the trend is not uniform but depends on latitude as well as altitude. Near the tropical stratopause, as much as 5% increase per year have been observed. The trend in mid latitudes and the arctic is considerably smaller and positive at lower altitudes. Even though this sudden increase in stratospheric water vapor has been observed by several instruments, its reasons have remained unexplained.

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