

Drift-corrected Trends in MIPAS Ozone Measurements

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MIPAS was a limb emission mid-infrared spectrometer on the European satellite Envisat. It was measuring temperature and atmospheric constituent profiles from June 2002 to April 2012. Ozone trends in the stratosphere (10-50 km) have been calculated from these data. Stratospheric ozone trends are a very important tool to determine the recovery of the ozone layer. Thus the reliability on these trends, e.g. the knowledge about the instrument's temporal stability, is desirable. Because the uncertainty of the trends lies in the possible temporal instability of the measurements, which we call an instrument drift, not only the ozone trends were calculated from monthly zonally averaged ozone profiles, but also possible instrument drifts were determined by comparison with other instruments. All trend and drift analyses were performed using a multilinear parametric trend model which consists of a linear term, several harmonics with period lengths from three to twenty four months and the quasi-biennial oscillation (QBO). Significant drifts were mainly negative for ozone relative to the satellite instruments Aura MLS and Odin OSIRIS and negative or near zero for most of the comparisons to Lidar measurements. Lidar stations used here include those at Hohenpeissenberg (47.8°N, 11.0°E), Lauder (45.0°S, 169.7°E), Mauna Loa (19.5°N, 155.6°W), Observatoire Haute Provence (43.9°N, 5.7°E) and Table Mountain (34.4°N, 117.7°W). Drifts against the satellite instrument ACE-FTS were found to be mostly insignificant. The assessed MIPAS ozone trends cover the time period of July 2002 to April 2012 and range from -0.5 ppmv/decade to +0.5 ppmv/decade depending on altitude and latitude.

From the drift analyses we derive that the real ozone trends might be slightly more positive/less negative than those calculated from the MIPAS data, by conceding the possibility of MIPAS having a very small (approx. within -0.3 ppmv/decade) negative drift for ozone. This leads to drift-corrected trends of -0.4 ppmv/decade to +0.55 ppmv/decade for the time period covered by MIPAS Envisat measurements with very few negative and large areas of positive trends. These results of the drift-corrected ozone trends are in good agreement with recent literature. Differences of the trends compared with recent literature could be explained by a possible shift of the subtropical mixing barriers.