

The SPARC water vapour assessment II: Comparison of stratospheric and lower mesospheric water vapour time series observed from satellites

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Time series of stratospheric and lower mesospheric water vapour using 33 data sets from 15 different satellite instruments were compared in the framework of the second SPARC water vapour assessment (WAVAS-II). This comparison aimed to provide a comprehensive overview of the typical uncertainties in the observational database that can be considered in the future in observational and modelling studies addressing e.g. stratospheric water vapour trends. The time series comparisons are presented for the three latitude bands, the Antarctic (80°-70°S), the tropics (15°S-15°N) and the northern hemisphere mid-latitudes (50°-60°N) at four different altitudes (0.1, 3, 10 and 80 hPa) covering the stratosphere and lower mesosphere. The combined temporal coverage of the 15 satellite instruments allowed considering the time period 1986-2014. In addition to the qualitative comparison of the time series, the agreement of the data sets is assessed quantitatively in the form of the spread, the (Pearson) correlation coefficient and the drift. Generally, good agreement between the time series was found in the middle stratosphere while larger differences were found in the lower mesosphere and near the tropopause. Concerning the latitude bands, the largest differences were found in the Antarctic while the best agreement was found for the tropics. From our assessment we find that all data sets can be considered in the future in observational and modelling studies addressing e.g. stratospheric and lower mesospheric water vapour variability and trends when data set specific characteristics and restrictions are taken into account.

Key words: water vapour, time series, satellite observations