



Supplement of

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

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In the supplement we show some additional figures that complement those in the main manuscript.

Figures S1, S2 and S3 relate to the time series examples shown in Fig. 1 of the main manuscript. In Fig. S1 the time series for the latitude band between 80°S and 70°S are shown for all data sets. Likewise, Figs. S2 and S3 show the time series for other two latitude bands considered in this work, respectively, i.e. 15°S to 15°N and 50°N to 60°N. Note that all three figures extend over multiple pages, which is also indicated in the page headers.

The remaining figures (Fig. S7-Fig. S10) correspond to figures shown in the main manuscript, but show results for the absolute and not the de-seasonalised data. Figure S4, S5 and S6 show the time series in the same way as Figs. 2, 3 and 4 in the main manuscript. Most prominently less agreement between the data sets is visible, given the biases and differences in the annual cycle which are removed by the de-seasonalisation.

Figure S7 corresponds to Fig. 5 in the main manuscript. As visible in the previous figure the absolute data exhibit less agreement among the data sets as the de-seasonalised data. In correspondence the spread estimates are larger, typically by a factor of two to five. However many of the typical patterns seen in the spread distribution for the de-seasonalised data remain the same for the absolute data.

Figure S8, S9 and S10 finally show the correlation matrices equivalent those shown in Figs. 7, 8 and 9 in the main manuscript. The correlation coefficients between the absolute time series are typically 0.1 larger than between the de-seasonalised time series. This is mostly prompted by the considerable and regular (sine-like) annual cycle in water vapour.

Figure S11, S12 and S13 are showing again results for the de-seasonalised time series. These figures show the drift matrices and are the same figures as Figs. 11-13 in the main manuscript, but are provided here in a larger size so that the additional information in the result boxes becomes better readable.



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Figure S1: Time series for the latitude band between 80°S and 70°S. The time axis is adapted for the individual data sets. White areas indicate that there are no data. The light grey and white lines show the tropopause based on the MERRA reanalysis data. The blacks dots indicate the average latitude of the monthly means, referring to the axis on the right.



time series contours for the latitude band $15^{\circ}S - 15^{\circ}N$ (1 of 7)

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Figure S2: As Fig. S1, but here the time series for the latitude band between 15° S and 15° N are shown.

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Figure S3: As Figs. S1 and S2, but here the latitude band between 50°N and 60°N is considered.

Figure S4: Absolute time series for the latitude band between 80°S and 70°S at 80 hPa, 10 hPa, 3 hPa and 0.1 hPa (bottom to top). In the legend in parentheses the mean latitude of the individual data sets is indicated.

Figure S5: As Fig. S4, but considering the tropical latitude band between 15°S and 15°N.

Figure S6: As the two previous figures, but here the time series for the latitude band between 50° N and 60° are shown.

spread

Figure S7: Altitude-time section of the difference between the maximum and minimum volume mixing ratio among the different data sets. The right axis indicates the maximum number of data set available for the spread determination at a given time.

Figure S8: The correlations between the absolute time series for the latitude band between 80°S and 70°S at 80 hPa, 10 hPa, 3 hPa and 0.1 hPa (bottom triangle to top triangle). The number in the result boxes indicates during how many months the compared data sets both yield valid data.

Figure S9: As Fig. S8, but here the correlations for the latitude band between 15°S and 15°N are shown.

Figure S10: As Figs. S8 and S9, but here the latitude band between 50°N and 60°N is considered.

Figure S11: Drifts between the different data sets ($80^{\circ}S - 70^{\circ}S$). Same Figure as Fig. 11 in the manuscript, but in larger size for better readability of the additional information given in the result boxes.

Figure S12: As Figs. S11, but here the latitude band between 15°S and 15°N is considered.

Figure S13: As Figs. S11 and S12, but here the latitude band between 50°N and 60°N is considered.