Supplement to the manuscript of Khosrawi et al.:

**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 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.

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time series contours for the latitude band 80°S – 70°S (2 of 7)

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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 black dots indicate the average latitude of the monthly means, referring to the axis on the right.

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time series contours for the latitude band 15°S – 15°N (2 of 7)

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time series contours for the latitude band $15^{\circ}\text{S} - 15^{\circ}\text{N}$ (3 of 7)

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time series contours for the latitude band 15°S – 15°N (4 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.

time series for the latitude band 80°S – 70°S

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.

time series for the latitude band 15°S – 15°N

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

time series for the latitude band 50°N – 60°N

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

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.

correlation for the latitude band 80°S – 70°S

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.

correlation for the latitude band 15°S – 15°N

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

correlation for the latitude band 50°N – 60°N

1: ACE-FTS v2.2	10: MIPAS-Bologna V5R MA	17: MIPAS-IMKIAA V5R MA	24: SAGE III
2: ACE-FTS v3.5	11: MIPAS-ESA V5H	18: MIPAS-Oxford V5H	25: SCIAMACHY limb
4: HALOE	12: MIPAS-ESA V5R NOM	19: MIPAS-Oxford V5R NOM	27: SCIAMACHY solar OEM
5: HIRDLS	13: MIPAS-ESA V5R MA	20: MIPAS-Oxford V5R MA	28: SCIAMACHY solar Orion
7: MAESTRO	14: MIPAS-ESA V7R	21: MLS	31: SMR 544 GHz
8: MIPAS-Bologna V5H	15: MIPAS-IMKIAA V5H	22: POAM III	32: SMR 489 GHz
9: MIPAS-Bologna V5R NOM	16: MIPAS-IMKIAA V5R NOM	23: SAGE II	

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