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Supplement of

A reassessment of the discrepancies in the annual variation of δD-H_2O in the tropical lower stratosphere between the MIPAS and ACE-FTS satellite data sets

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

Figures S1 and S2 focus on the temporal variation of δD in the tropical lower stratosphere. Unlike in Fig. 1 in the main manuscript, in Fig. S1 observational gaps are not removed. This concerns primarily the ACE-FTS data set which typically covers the tropics only in February, April, August and October. For the SMR data set there are gaps in 2005 and 2006. Figure. S2 shows again the temporal variation of δD, but here for the ACE-FTS, SMR and EMAC data sets only time periods of two years are considered. These time periods have been chosen arbitrarily and are indicated in the panel titles. On one hand this aims to provide a clearer picture primarily for the ACE-FTS and SMR data sets that cover long time periods. On the other hand this yields a better comparability with the shorter MIPAS data set. Nonetheless, the essential differences among the individual data sets, as described in Sect. 3 of the main manuscript, remain.

Figure S3 shows in dark colours the tropical, monthly mean time series of δD (top panel), HDO (middle panel) and H_2O (bottom panel) for the individual data sets at 30 hPa. The error bars show the corresponding standard mean errors. In light colours the fits of the time series are shown, according to the regression model described by Eq. 5 in the main manuscript. As such this figure complements Fig. 2 in the manuscript that focuses on the time series at 70 hPa.

For the sake of comparability in the main part of this manuscript consistently δD results based on the "separate" approach (see Sect. 2.2) are shown. For completeness we show here δD results from the MIPAS and ACE-FTS data sets that were derived with the "individual" approach. Figure S4 shows the characteristics of the annual variation in tropical δD for the different data sets in correspondence to Fig. 3 in the main manuscript. A visual comparison of the amplitude results does not indicate any substantial changes. For the MIPAS data sets the "individual" approach yields slightly lower amplitudes below 70 hPa. Higher up the amplitudes are actually larger. Overall, the differences are typically within 2 ‰. This is also the case for the ACE-FTS data sets, however there is no systematic altitude-dependence as observed in the MIPAS data. Like for the amplitude, the phase results exhibit no substantial differences between the two approaches to calculate the δD distribution.

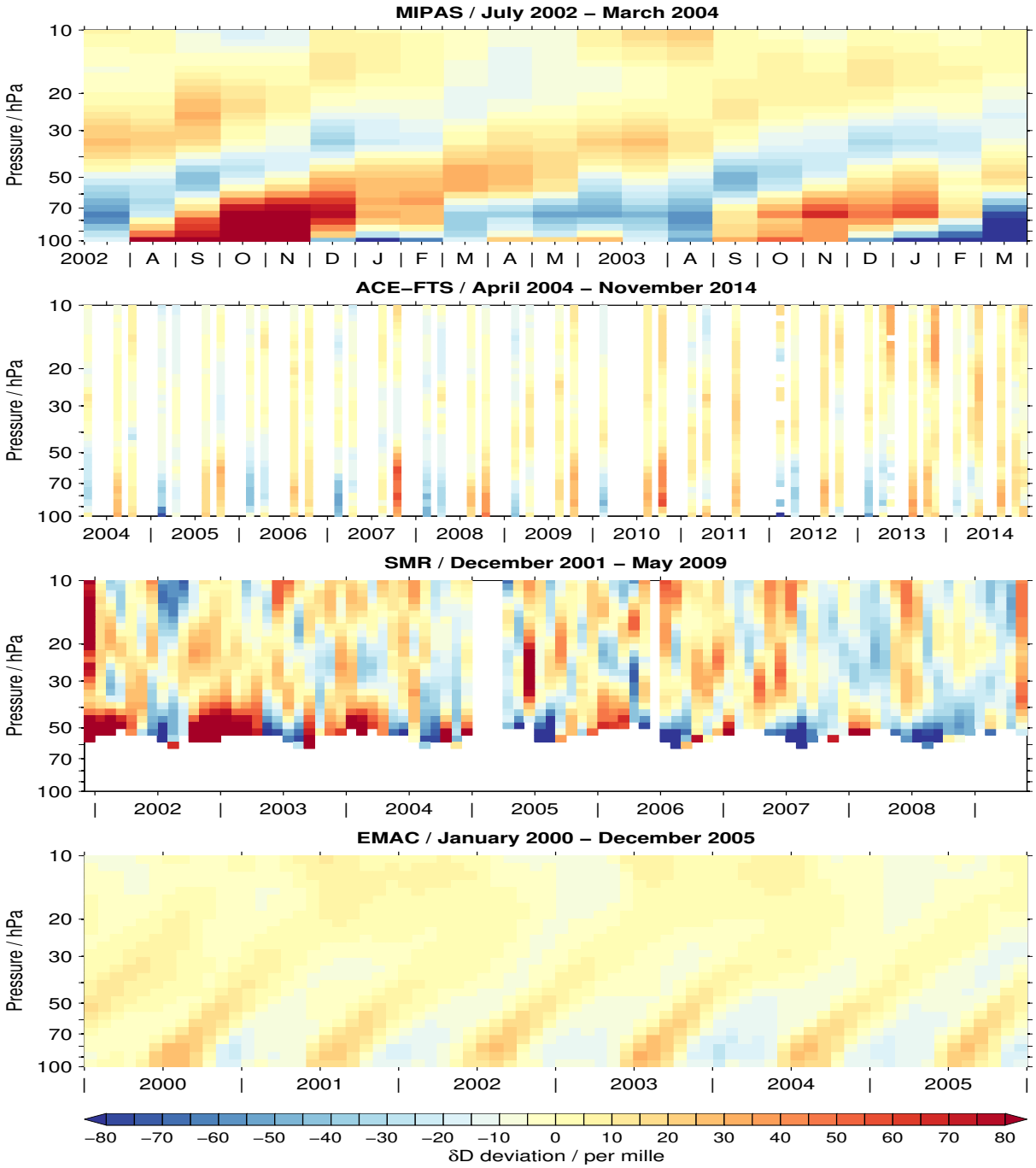

Figure S1: Temporal variation of δD in the tropical (15°S to 15°N) lower stratosphere for the individual data sets. Unlike in Fig. 1 in the main manuscript observational gaps (white) in the data sets are here not removed.

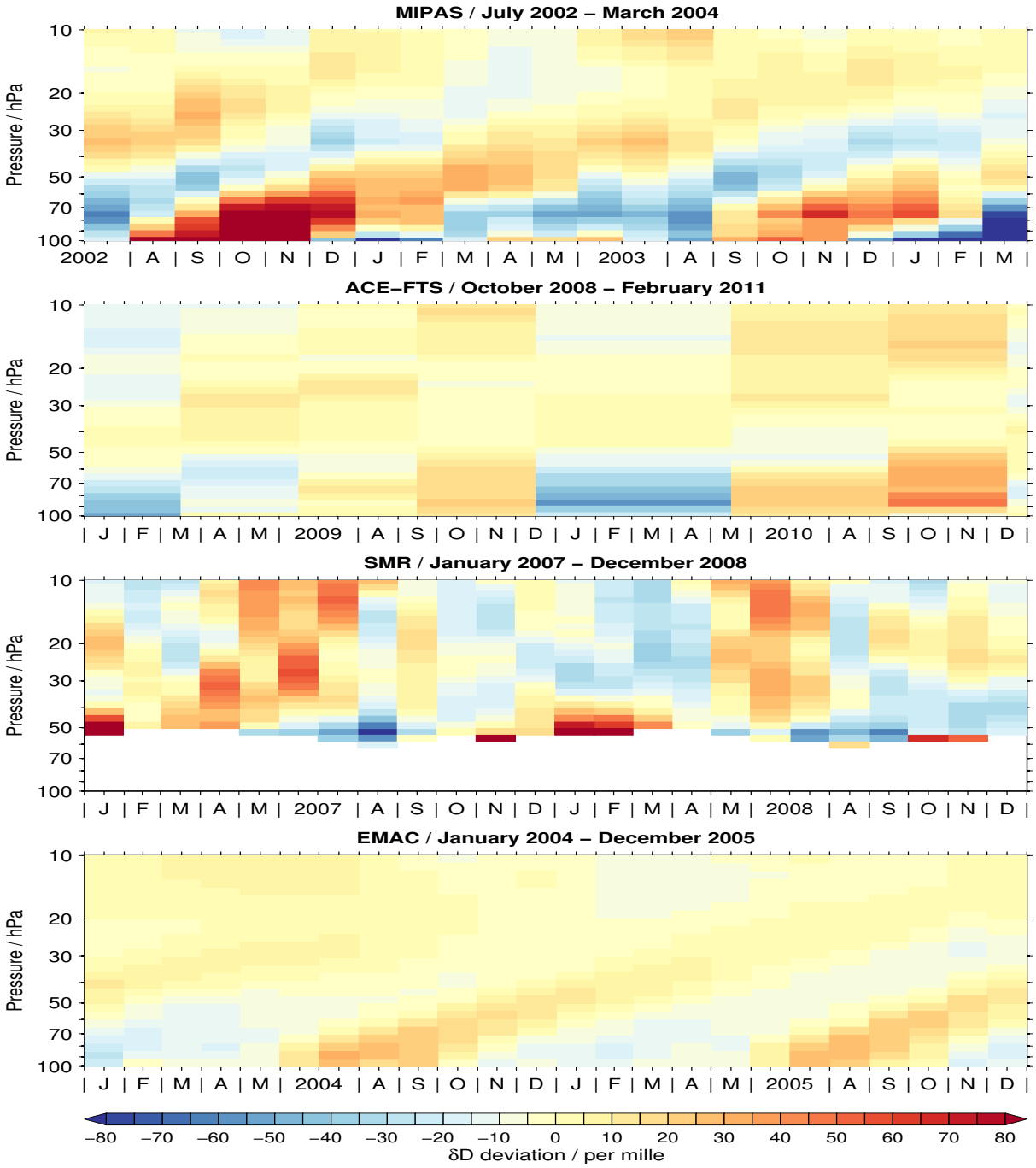

Figure S2: Again the temporal variation of δD in the tropical lower stratosphere. For the ACE-FTS, SMR and EMAC data sets only an arbitrarily chosen time period of two years (see panel titles) has been considered, better comparable with the temporal coverage of the MIPAS data set. Observational gaps in the data sets have been removed (see Fig. S1).

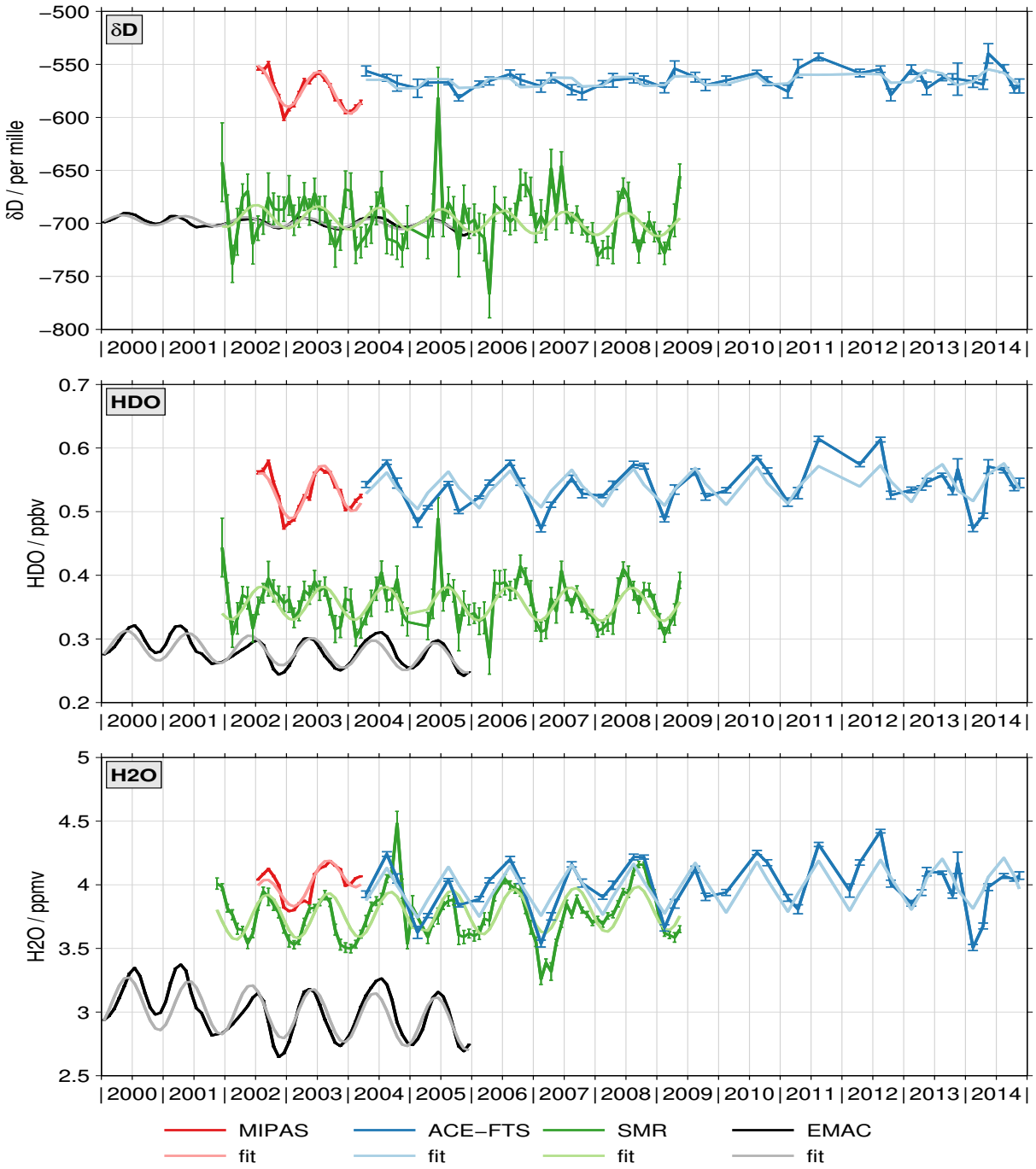

Figure S3: Monthly mean time series of δD (top panel), HDO (middle panel) and H_2O (lower panel) at 30 hPa for the different data sets (darker colours). The shown error bars correspond to the standard mean errors. The fits of these time series using the regression model described in Eq. 5 of the main manuscript are shown in light colours.

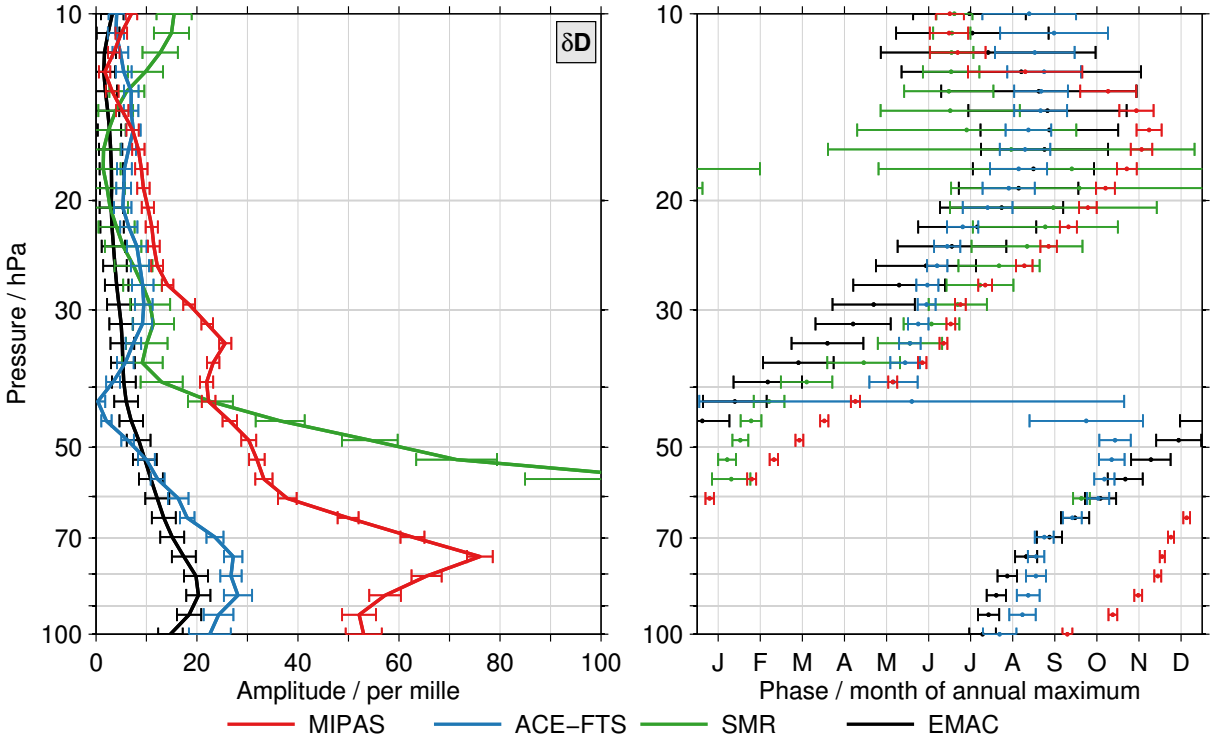

Figure S4: Characteristics of the annual variation in tropical δD for the different data sets. In the left panel the amplitude is shown, in the right panel the phase. For MIPAS (red) and ACE-FTS (blue) these results are based on the "individual" approach, whereas the SMR (green) results can only be derived with the "separate" approach. Like in the main manuscript the EMAC (black) results are shown in addition.