**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "Improved water vapour spectroscopy in the 4174–4300 cm^{-1} region and its impact on SCIAMACHY HDO/H$_2$O measurements" *by* R. A. Scheepmaker et al.

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First, we will add a few more sentences about the experimental setup of Jenouvrier et al. (2007) and the retrieval algorithm from Butz et al. (2011) in the revised manuscript.

> it is not clear for me why the authors keep fixed the self broadening coefficient. They specify that this approximation can change the deltaD retrieval up to 0.4%. It is weak, but not negligible. I would suggest to explain the choice of factor 5.

We didn't keep the self broadening coefficient fixed, but adjusted it to 5 times the fitted air broadening coefficient. This ratio of 5 is justified by the mean ratio of the strongest lines (Fig. 2). We kept the ratio fixed to stay consistent with the way the self broadening is accounted for in the SCIAMACHY retrieval algorithm. Even if we would leave self broadening as a free parameter in the laboratory fit, it would be fixed again to 5 times the air broadening coefficient in the SCIAMACHY retrievals. This is necessary due to way line broadening is taken into account in the retrievals by means of a single "effective pressure" in combination with a cross section look-up-table (also see Appendix A of Frankenberg et al., (2012, AMTD, http://www.atmos-meas-tech-discuss.net/5/6357/2012/amtd-5-6357-2012.html). Leaving self broadening free in the laboratory fit, but fixing the ratio again in the SCIAMACHY retrievals, can have an impact of at most 4 per mil on the retrieved deltaD, because of some degeneracies existing between self and air broadening (the freedom in *self* broadening causes the *air* broadening to be fitted differently compared to the case with fixed self broadening). Since the effect is relatively weak and can easily be accounted for in a subsequent bias correction, we chose to keep consistency in our overall setup and work with a fixed ratio in all algorithms. We will clarify this more in a revised version of the manuscript.

> I can suggest for future works to extend this study to the Band 2 (5800-6400 cm-1) and Band 3 (4800-5200 cm-1) of TANSO-FTS instrument (...) it would be very interesting to extend this work in the thermal infrared where the water vapour sensitivity is higher.

We appreciate this suggestion and agree that further improvements in H2O/HDO line parameters could be very useful for other spectral bands as well. In our conclusions, however, we would like to stress that more work is still needed in the spectral band of this study for reasons given in the paper. Moreover, we do not present anything on these other wavelength ranges so it is not something we can substantiate with this study.

Technical comments:

> Fig. 1, I think it would be interesting to distinguish the HDO and H2O lines in the top panel. For instance, you can use 2 different colors similarly to the Fig. 4.

We have considered this, but found it practically impossible to show the distinction on this scale. For almost all absorption lines visible in this spectrum, the H2O lines are stronger and overlapping with the weaker HDO lines, so the distinction would not be obvious even when using 2 different colors. Moreover, due to the low pressure the absorption lines are sharper than those in panel A of Fig. 4, of which the referees agree that readability is already not that good.

> Fig.2, the plot of black squares should be modified by red and blue squares and crosses to be consistent with the Fig. 3.

We will implement this in the revised version of the manuscript.

> Fig 4, the panel A is not really readable.

We are aware of this, but on this scale this was the best readability we could achieve. The main purpose of panel A is to show that there are many overlapping lines and that there is strong absorption by water. We think that this is clear from the current figure. We provide a zoom in Fig. 5, also to show some absorption lines and the overlap from Fig. 4 in more detail.

> For clarity, you have to use the same colors for the lines: actually, Hitran08 is blue in Fig. 4, but green in Fig. 6 and 7, updated line list is black in Fig. 4, but blue in Fig.6 and 7.

We will implement this in the revised version of the manuscript.