

Interactive comment on “A fast H₂O total column density product from GOME - validation with in-situ aircraft measurements” by T. Wagner et al.

T. Wagner et al.

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First of all we want to thank this anonymous referee for the positive and constructive comments. In particular we agree that more details on the quantitative comparison between the GOME H₂O measurements and the model data are of great value; we included much more information of this kind in the text (abstract, chapter on GOME analysis, and conclusions) and we added an additional table (Table 2).

Our detailed comments on the reviewers suggestions are outlined below:

a) As suggested we added a second scale (g/cm^2) for the water vapour content to several figures (Fig. 4, 5, 6, 7). In Fig. 8 we didn't include a second scale, because is already a relatively complex figure and we think that adding an additional scale might rather confuse the reader than make the figure clearer. Nevertheless, we added a remark on the conversion factor in the caption.

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b) We replaced the subjective statements on the accuracy or other quantities by detailed quantitative information. In some cases we added such quantitative information to the (hopefully no more) 'subjective' comments. In addition, we included the effect of the temperature dependence of the O4 absorption to the total error budget. Thus the accuracies stated in the abstract, in the chapter on the GOME analysis, and in the conclusions are now consistent.

c) Validation: We agree that a limited comparison of GOME H2O measurements with independent information (model data, aircraft measurements) is not a comprehensive validation. We explicitly mention this now in the text. Nevertheless, we think that the presented comparisons give a very valuable first impression on the accuracy and usefulness of this new method. We thank the reviewer very much for pushing us to give more detailed quantitative information on our validation exercises. We calculated several quantities from the correlation of the different data sets and added a new table summarising these results. We investigated the dependence of the agreement of the measurements and the model results for different degrees of cloud cover (new Table 2). In particular we also included the cloud fraction in Fig. 6. These results confirmed the expected tendency of clouds (underestimation of the true atmospheric H2O VCD). Fortunately, this underestimation was found to be relatively small even for large cloud fractions (-18% for cloud fractions between 50% and 100%). This finding confirms in particular our assumption that the effect of clouds can be largely corrected for by our algorithm. The reviewer suggested to investigate also the influence of several other quantities (surface and atmospheric heterogeneity, difference in the absorption strength of H2O and O4). Such investigations will be of great value to further characterise and improve our algorithm. However, this will have to include the analysis of many other correlations between GOME measurements and model data and thus must be beyond the scope of this study.

d) Further technical comments:

Many thanks for these helpful comments, which we considered all.

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