

## ***Interactive comment on “Validation of two independent retrievals of SCIAMACHY water vapour columns using radiosonde data” by A. du Piesanie et al.***

**Anonymous Referee #2**

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In this paper the authors present two independent SCIAMACHY total water vapour column (WVC) products retrieved using two different algorithms applied in the visible and short wave infrared spectral regions: the SCIAMACHY-ESA WVC (using AMC-DOAS) and the SCIAMACHY-IMLM WVC (using the Iterative Maximum Likelihood method). The two products are compared with integrated water vapour data obtained from radiosonde relative humidity measurements and with each other. Substantial conclusions are reached regarding the dependence of the bias on cloud parameters and selection criteria. The results are sufficient to support the interpretations and the conclusions. The manuscript is well written and the whole procedures and set of assumptions are clearly stated. Moreover, the knowledge of the global distribution of water vapour is

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fundamental for global atmospheric models aiming to predict weather and monitor climate. I therefore recommend this manuscript for publication in the AMT Journal after some minor corrections and clarifications addressed below.

1. In the Abstract, the authors describe clearly the aim and results of their work, however the time period used for the two validations are not clearly stated. Also in Section 1, 17 I find the sentence "respectively covering an 18 month and 2 yr period" confusing, and I would suggest to add a short comment on the choice of these two time frames.

2. In Section 3, the comparison between SCIAMACHY-ESA WVC and radiosonde is discussed. Following the work of Mieruch et al. (2010), the authors study the bias as a function of cloud parameters and show the differences for all individual collocated cases as a function of the AMF CF. The original result is that the bias increases rapidly with cloud top heights, and therefore depends on cloud water path. However, I would like to see in the paper a qualitative (and if applicable quantitative) comparison with previous findings, with a clear statement about the best selection criteria to use in the datasets, since the limitations of the AMC-DOAS were already studied extensively in the literature. Also, it would be interesting to investigate the bias using radiosonde profiles integrated from the top of the clouds, like was done for SCIAMACHY-IMLM.

3. The validation between SCIAMACHY-IMLM WVC data with radiosondes is presented in Section 4. The bias is computed using a number of selection criteria as suggested by Schrijver et al. (2009), and the measurement noise error shows a clear dependence on the signal strength. Both the SPICI and the FRESCO+ clouds product are used to determine cloud properties. Finally the authors suggest to select cloudy conditions with low cloud height or to use partially integrated radiosonde water vapour profile for the comparison in order to extend the data sample. However, in the first case the bias increases, and maybe other datasets could be more promising for the validation, while in the second case the selection would not be useful to retrieve the global distribution of total column water vapour. I would suggest to clearly distinguish the two different comparisons in the text of Section 4 (P 678), not to generate confusion in the

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reader.

4. The comparison between the retrieved SCIAMACHY-ESA and SCIAMACHY-IMLM datasets is performed for only one day and the authors infer a good correlation between the products with SCIAMACHY-ESA WVC generally higher than the SCIAMACHY-IMLM measurements over land for cloud free conditions. However, this result is in apparent contradiction with the validations results, since the authors state that the SCIAMACHY-ESA present a negative bias with respect to radiosonde measurements, while a mean difference of  $0.08 \text{ g cm}^{-2}$  is found for the SCIAMACHY-IMLM data. Even though the two validation are performed within different time frames and over land the bias is positive for SCIAMACHY-ESA, in my view the authors should extend the Section 5, and possibly also the time period of the inter-comparison between the two water vapour datasets and clarify the discrepancies between them. The quality of the paper would strongly benefit from a brief analysis on the advantages and disadvantages of the two datasets, and a statement about potential synergies of both method aiming to establish a reference water vapour product.

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