**Atmospheric
Measurement
Techniques**
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Discussions

Interactive comment on "Total columns of H_2O measured from the ground and from space at Observatoire de Haute-Provence in France (44 N)" *by* S. Alkasm et al.

Anonymous Referee #2

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This study is interesting and relevant because it combines long-term data records of water vapor columns from three satellite instruments and two ground based instruments. The use of five instruments increases the robustness of the validation results presented.

General comment about the methodology used to select satellite data (Section 3): The selection of spatial domains (by optimizing the correlation) seems to me a bit ad hoc. I would recommend to use a single domain (e.g. latitude: 40-48N, longitude: 3-10E) for all three satellite instruments. With the method currently used, you not only have three satellite instruments to compare, but in addition three spatial domains. This increases

the complexity and makes interpretation of the (mean) differences more difficult. In my view this is unnecessary, unless there are strong arguments in favor of this approach other than the optimization of the correlation. If so, then please give them. Then also explain in more detail how exactly you searched for these domains: did you also search outside of the lat/lon box of figure 1? Why (not)? The list of boxes that you tested is quite arbitrary and does not seem to be systematic. Did you also test boxes that are not listed in Table 1? If there are no additional strong arguments in favor of using different spatial domains for the three satellite instruments, then (as mentioned above) I would select one larger spatial domain, or (optionally): (A) one domain to compare the three satellite sensors to SAOZ; (B) another domain (probably over sea) to compare the three satellite sensors to Elodie. As it is now, it is not clear to me what the differences found between e.g. GOME and GOME-2 actually tell me. Do the represent differences between the instruments, or differences between the selected spatial domains?

I think that the article should be improved substantially with respect to the English writing (grammar, wording), accuracy of argumentation and layout of figures. Some examples of writing that can be improved:

-p.4250 l.2 change "density" to "densities"

-p.4250 l.6: add "the" before total column density

-p.4250 l.19 "It represents two-thirds of the greenhouse gases ..." Two thirds: is that in terms of radiative forcing, or in terms of mass, number of molecules, ... ?

-p.4251 l.21-22 "This challenge ... be explored" This sentence is unclear to me. Please rephrase.

-p.4251 l.22-24. "Promising infrared ... this study" In my view, this sentence is not at its place here. It should be put above line 11 (This paper....).

-p.4252 l.5 Please put "absorption" between "optical" and "spectroscopy".

-p.4252 l.10-12. "Note that ... corrected accordingly." Please add a reference.

-p.4252 l.13-15. "One of ... SAOZ database." This sentence is vague and maybe should be part of Section 1. Please rephrase and avoid the use of "feedback from the community". Which community?

-p.4252 l.24-26. "H2O is .. the horizon" Please remove "visibly". Please change "at higher possible elevation from the horizon" to "at the highest possible elevation above the horizon".

-p.4253 l.19 Please write "long wavelength" instead of "large wavelength".

-p.4253 l.23 Please write "using the AMC-DOAS method" instead of "using AMC-DOAS method".

-p.4254 l.8 Please remove "via CD ROM and internet".

-p.4254 l.12-15 "Each satellite ... of OHP." Please rephrase. Suggestion: "Satellite observations are included in the comparison if their pixel centers fall within a specifically selected spatial domain (bounded by latitude and longitude ranges). The optimal choice...."

-p.4254 l.23-24. "Then, the ... Fig. 1." This sentence is vague. Suggestion: "The optimal quadrangle around OHP was different for each satellite, as illustrated in Fig.1."

-p.4255 l.21-24. "The measurements ... of measurements" I would suggest to rephrase to "Elodie and SAOZ show a reasonably good agreement: a correlation of 0.8 and a quite similar yearly cycle."

-p.4255 l.24-27. "We can see ... spectrometer slit)." Remove "We can see also" and start the sentence with "Note that ... ".

-p.4255 l.24-27. "We can see ... spectrometer slit)." I would suggest to replace "due to ... spectrometer slit)." by "due to instrumental problems affecting the spectrometer slit and therefore the effective absorption cross section".

-p4257 l16: "The following table ... " Please write "Table 3"

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-p4258 l6-7: Please change "the origin of these differences have been" to "the origin of these differences has been" or "the origins of these differences have been".

-p4259 l12-14 Please rephrase. It is not clear what is meant here.

-p4259 l15-21 "An alternative approach..." Alternative to what? Please be a bit more elaborate. Discuss in more detail differences reported in study by Bock et al. and differences found by you.

-p4260 l1-2: "However in our case ... are different." Please change to something like. "Also in the case of our ground based observations the water vapor column is not determined for the same air mass."

-p4260 l21: Should this not be 3-10 instead of 3-5?

-p4260 l.2 & l.18: I would suggest to use "viewing geometries" or "viewing directions" instead of "observation modes"

-p.4261 l. 22. Please replace "determined" by "indicated".

-p.4261 l. 22-25. Please explain in a bit more detail how you derived the values in Table 5.

-p 4262 l. 2-3 "Based on ... Table 4)." This sentence is confusing because it suggests that Table 4 gives a list of sources of biases, which it does not.

General remark on Section 2: Please provide literature references for each instrument in the beginning of each subsection (Sect. 2.2, 2.3,2.4).

General remark on Section 5: I would suggest to reduce the number of subsections. The sections 5.1 and 5.4 are very short, and in my view do not need to be separate subsections. Alternatively, Section 5.4 could be enlarged with a more quantitative interpretation.

Remark on Section Conclusions: In my view, the conclusion that the difference be-

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tween SCIAMACHY and Elodie is due solely to a different time of observation is not supported by strong arguments. A potential argument could be: (1) we see in summer no systematic bias, (2) the histogram of differences observed follows a Gaussian distribution (please check), which indicates that the differences are random, (3) we see the same random differences if we compare model results (over the same period as the observations) of water vapor columns between two times of the day or night (please check).

Some suggestions to improve figures:

Fig. 1: Please write "Land" instead of "Earth"

Fig. 3: Please use a larger font size

Fig. 4: Please align figure on lower left with others; increase font size of all figures

Fig. 5: This figure could be more interesting if the monthly averagd diurnal cycle is plotted for one month in winter (left panel), and one in summer (right panel), with error bars (or a grey band below the curve) indicating e.g. the standard deviation. As it is now, the figure does not tell a lot: the variability may be high, and on the eye it may not show a systematic pattern, but when averaged over more days the systematic pattern might be visible (or not). Showing just a few days does not justify a conclusion as: "Figure 5... to another" (p.4258 l.22-24).

Fig. 6: Please zoom-in on the region of interest and remove the part with the zoom button of google maps. It is confusing that some arrows refer to the viewing directions and others to Cardinal directions, or to the name of the site. I would suggest remove the arrows for the the Cardinal directions (only one arrow pointing North in the corner of the map), and to reverse the arrow pointing to OHP. The blue arrow is almost invisible. Either remove it (you can just mention in the caption or text that Elodie is looking in the southward direction), or make it more visible.

Fig. 7: It is a bit confusing that in the caption it is mentioned that the figure shows

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the gradient measured by GOME, whereas in the figure GOME is only indicated to contribute to a limited latitudinal range. One could (erroneously) think that the red and blue lines are 'composites' of data sets from several satellite instruments. Please change the caption or figure such that the confusion is taken away.

Some suggestions to improve the tables:

Instead of Table 1, I would prefer a more accurate description of your search procedure in the text, and in addition just the outcome for the three satellites in a small table with one row for each satellite.

Table 3, column 3: Please write "mean difference". Standard deviation: "standard deviation of differences" Please also report the number of data points in each comparison as a fifth column.

Table 5, see comments Table 3. Replace "0" in the second line of the second column by "0.0" Why is the order of "SCIAMACHY-Elodie" changed when compared to Table 3 "Elodie-SCIAMACHY"?

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Interactive comment on Atmos. Meas. Tech. Discuss., 6, 4249, 2013.

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