

## ***Interactive comment on “Validation of ENVISAT/SCIAMACHY columnar CO by FTIR profile retrievals at the Ground-Truthing Station Zugspitze” by R. Sussmann and M. Buchwitz***

**Anonymous Referee #2**

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I had been hoping to see some other comments on this paper before writing this review . I see it as the first few steps of what should eventually be a longer journey, and would normally expect a paper on validation to go further. However, if further retrievals from SCIAMACHY are slow to come, then it is worthwhile publishing these few steps.

It is a positive result that the retrievals of CO from SCIAMACHY that have been made available are shown to be of value and show some features that are consistent with ground-based data, and given the small sample of available coincidences with ground based data the paper demonstrates this value in an appropriate way.

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The idea of pressure normalising the data from both sources to eliminate the effects of altitude is a good one. My understanding is that it is only required because of the differing altitude of the ground-station and a given pixel in the satellite data. Without these differences it would be unnecessary as there is an overall normalisation to each dataset. While the ground-based data is normalised with independently measured pressure (in which we can assume the error is negligible compared with other errors), the satellite data is normalised with O<sub>2</sub> retrieved from the same instrument. Nothing is said concerning the reliability of these O<sub>2</sub> data.

Several questions remain, and should be either answered as more retrievals from the satellite become available, or acknowledged as issues or limitations in the current work

These include.

Is the seasonal cycle in CO captured correctly when there is a full year of data available? The treatment of a linear slope for the sample period is a simple convenient proxy for the seasonal behavior in this sample, given the apparent data quality, but is not a demonstration that the satellite can see this behavior correctly. This is already acknowledged by the authors as a point for further investigation.

Just how big is the vertical smoothing errors in this comparison? The averaging kernels certainly look similar and may well justify ignoring the smoothing error, but there *are* differences. The smoothing error is also dependent on the variability of CO in the atmosphere, and this will be at a maximum in the boundary layer, which is one of the places where there *is* a noticeable difference in the averaging kernels. This difference at the boundary layer probably has a larger effect on the smoothing error in retrieved columns than the apparently larger differences at 300 hPa. Can some attempt at estimating smoothing error be made, assuming a realistic estimate of variability in the CO?

How big are differences from horizontal variation in CO? with a small sample there's

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pressure to extend the coincidence criterium to a larger distance in order to get a statistically meaningful sample. However there will be differences introduced from horizontal variation in CO. The reader isn't sure whether the large scatter in the SCIAMACHY retrievals is from this or from measurement noise, so something should be said about the likely magnitude of these two things.

Obtaining more satellite measurements will allow these differences to be better characterised and accounted for in comparing satellite and ground based data. Until more is done I would hesitate to use the word "validation" in this exercise, perhaps "early characterisation" might be more appropriate. A compromise might be "preliminary validation".

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 557, 2005.

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