

Interactive comment on “Evidence of systematic errors in SCIAMACHY-observed CO₂ due to aerosols” by S. Houweling et al.

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General comments

This manuscript connects the large variation in atmospheric CO₂ values retrieved from Sciamachy with variations in aerosol as observed by the MISR and TOMS instruments. Statistical analysis shows that there is a significant correlation between aerosol optical depth and the retrieved CO₂ values. This is then further investigated by performing some radiative transfer calculations. Although the effect of aerosol on SWIR CO₂ retrievals has been investigated before, this paper presents very interesting results by taking multiple scattering into account. In interaction with the assumed surface albedo, multiple scattering by aerosols can either increase or decrease the retrieved

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CO₂ values. I am a bit puzzled though by the inclusion of a simulated flux inversion taking the aerosol errors into account. I think it is already well known that systematic errors on the order of 5 - 10 % are devastating for flux inversions and I don't see the value of showing this again. Instead, I would like to see a little bit more detail about how the authors expect to correct for the aerosol interference, either for Sciamachy or for the forthcoming OCO and GOSAT missions.

Specific comments

P 3314, line 15 - 17: as already said above, I do not think this is a very surprising result.

P3315, line 9: please quantify 'high measurement accuracy'

P3315, lines 10 - 11: add something like 'for SWIR observations'

P3315, line 13: I would appreciate adding Engelen et al., 2004, JGR, doi:10.1029/2004JD004777 as a reference for AIRS CO₂ estimates

P3317, line 18: please add some information about the cloud detection, especially the apparent difference between the detection of cirrus clouds and aerosol

P3324, section 3.3: The first part of this section (retrieval errors) is useful information that fits within the paper, but the second part (inversion errors) does not add anything to what we already know.

P3326, line 23: 'If the same procedure...' It is not clear to me what procedure the authors mean.

P3326, line 24: what does 'they' refer to?

P3327, lines 5 - 7: please expand on the seasonal cycle effect. Is it much larger than what is already shown in Figure 2 due to aerosol?

P3327, lines 13 - 17: I find this the most interesting bit of the paper!

P3327, line 25: do the authors really mean to use the word 'although' here?

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P3328, lines 6 - 16: I think this really needs further investigation, if not in this paper than in a follow-up paper.

P3328, lines 16 - 17: how would one detect the aerosol to distinguish between low and high aerosol loads? Please, expand.

P3328, lines 25 - 26: please, expand a bit on this suggestion. How do the authors envisage the use of Sciamachy data to verify certain assumptions of theoretical performance assessments?

Technical comments

P3315, line 5: add the following: 'parts of THE world, particularly'

P3329, line 1: replace 'to' by 'the'

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