

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

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Comment 1: ‘About the discussion at the right part of page 6. Why the overestimation of CO₂ over Middle East to China is not so large as North Africa? It is probably due to smaller albedo there although the aerosol density judging from Fig.1 is similar. Isn’t it better to explain more about Fig.5 (a), and notify that not only the aerosol intensity but the combination with albedo is important?’

The authors agree that the surface albedo is an important factor explaining the difference in CO₂ error between the Sahara and the Middle East to China. The following text has been added:

‘Not surprisingly, the largest errors are found over the deserts, owing to the high surface

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albedo in combination with relatively large aerosol loads. These conditions are satisfied the most over the Sahara desert. High aerosol optical thicknesses are also predicted for some parts of Asia but the errors in CO₂ are lower because of a lower surface albedo (see Figure 1).’

Comment 2: ‘Nothing is written about the discrimination between aerosol and cirrus cloud, which is difficult by normal cloud contamination analysis. Is there no possibility of cirrus cloud over North Africa?’

It is possible to have undetected cirrus clouds over the Sahara. To clarify this point the following sentence has been added to the discussion: ‘Part of the remaining variance may also be explained by undetected cirrus clouds, although this should only play a minor role over the Sahara owing to the large scale subsidence of air at these latitudes suppressing cloud formation.’

Comment 3: ‘Why there is no data over ocean near Sahara desert? The signal from surface reflection at 1.6 micron is close to zero, and only the aerosol path radiance part is observed over ocean. If there are data over ocean, the consistency of (AOD + aerosol height -> radiation transfer) and the CO₂ retrieval results can be checked. If not, it is better to be explained in the section of “Method”. This information appears only at the later part, but it is not clear whether it is not available from instrumental reason or simply data right now is not available.’

It is mentioned in the text that the oceanic measurements are not considered because of a too low surface albedo, neglecting the potential use of occasional sun glint measurements. However, the experiment that is suggested by the reviewer is interesting and has in fact been carried out. Measurements over the Atlantic just west of the Sahara have been studied during dust storm events. During intense storm events the aerosol optical thickness is high enough to increase the apparent surface albedo to levels where accurate retrieval is feasible. The events that were studied showed on average an underestimation of the SCIAMACHY retrieved CO₂ column, confirm-

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ing the model calculations for dust aerosol over a dark surface. Some events, however, showed unexpected behavior, which is not fully understood at present, but likely caused by a vertical profile consisting of a few distinct layers. Because we lack the information to study these exceptional conditions in more detail it was decided not to include these experiments in this manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 3313, 2005.

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