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Interactive comment on "Interpretation of FRESCO cloud retrievals in case of absorbing aerosol events" *by* P. Wang et al.

Anonymous Referee #2

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Wang et al. presents a study showing that FRESCO results using measurements in the O2A band region contain information on the aerosol height for pixels with elevated Absorbing Aerosol Index. This is a promising work as a first step towards a quantitative aerosol product from a UV sensor like GOME-2. Nevertheless I think the paper -in its current state- is a bit misleading and could be improved in several ways. In line with the comments of referee #1, it is not clear to me when FRESCO is really providing useful results. In my opinion, the author should establish the conditions where FRESCO provide information on the absorbing aerosols height.

Comment #1: In figures 1 and 2, only two values of AOT are presented for the sensitivity tests. I would recommend using a lot more of intermediate values so that the reader can have an idea of the range of AOTs where FRESCO is useful (the same

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holds true for the SSA values). For Figs 1 and 2, the results are plotted as a function of solar zenith angle but I have the impression that it doesn't really bring something to the discussion. Instead, the author might want to plot the results as a function of AOT for some representative SZA values.

Comment #2: In figures 1 and 2, the tests are performed for an aerosol layer high in the atmosphere (9-10 km). In my opinion, it is mandatory to show and discuss the results for an aerosol layer close to the surface as well. Indeed, the absorbing aerosol events of sections 4.2, 4.3 and 4.4 correspond to aerosol layers close to the ground (at least partly). E.g. on page 10, the author write: "Because we selected largely cloud-free areas, the FRESCO cloud parameters can be regarded as aerosol parameters." Strictly speaking, this is not true. Fig 1 only addresses the case where the aerosol layer is high in the atmosphere (9-10 km).

Comment #3: In section 3, all results are shown as a function of AOD and SSA while in section 4 all results are plotted as a function of AAI. This is misleading (AAI is a qualitative index). The author should provide some information on possible/typical values for AOD and SSA for the different types of events (ash, biomass burning, desert dust, wild fires). On page 6, it is written "The single scattering albedo of biomass burning aerosols is normally between 0.6 and 0.9". The reader really would like to know about the other types of aerosols and the typical values for AODs. For the sensitivity tests, it would be very nice to have a correspondence between the aerosol parameters used (AOD, height, SSA) and the AAIs corresponding to these aerosol settings. This information could be provided in a Table or using additional axis in Figs 1 and 2. All this should help the reader to estimate what are the conditions where the FRESCO is useful for the absorbing aerosols and if these conditions are often encountered or not.

Comment #4 (in relation with my previous comments): What is exactly the added-value of section 4.2? Of course close to the source, the height of the dust plume is close to the ground. The reverse would have been surprising. It would have been much better to make the exercise for an (aged) desert plume much higher in the atmosphere. I

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suspect that in this case the AOD is to small and the technique is not working anymore. In summary it is not clear from this paper what are the conditions where this technique is working (and thus useful). Similar remark for section 4.3.

Comment #5: Validation of the retrieved aerosol pressure is missing. - For Puyhue, the retrieved ash layer pressure might be validated using CALIPSO data or back trajectories (e.g. HYSPLIT). -In Section 4.4, page 12: "The cloud pressure and scene pressure values mostly vary between 400 hPa and the surface, which indicates the variation of the smoke plume height." Is there any validation possible?

Comment #6: AAIs are retrieved in the UV and FRESCO operates in the IR. Does it imply some difficulties? I wonder about the meaning of correlation plots like scene pressure vs AAI (e.g. for desert dust). AAI is a qualitative index and is retrieved in a region where the albedo is very different from the one in the IR (FRESCO).

Comment # 7: Page 9: "As shown in Figs. 4a and 4c, some pixels have small AAI values, small effective cloud fraction values and large cloud pressures. " It is not possible to identify these pixels. Generally speaking this is also true for all the correlation plots.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 32685, 2011.

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