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Interactive comment on "Temporal and spectral variation of desert dust and biomass burning aerosol scenes from 1995–2000 using GOME" *by* M. de Graaf et al.

Anonymous Referee #1

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In this paper, the authors propose a method that allows distinguishing between two kinds of absorbing aerosols, i.e., desert dust and biomass burning, using GOME spectral measurements. The classical Absorbing Aerosol Index (AAI) allows detecting absorption by aerosols from UV measurements, but the authors show that it is in addition possible to distinguish between mineral and biomass burning aerosols by using two criteria on GOME measurements in the UV and in the blue. They have applied this original method to six months of GOME daily data in 1997 and 1998 to generate global maps of the geographical distribution of both aerosol types in summer and in winter.

My overall opinion is that this manuscript does not contain sufficient material and scientific results to be published in ACP.

I am not convinced by the potential of the method itself, and it seems to me that the authors themselves hesitate to conclude on its applicability. This shows up in the conclusion where the global results shown in figure 7, which is the "scientific heart" of the paper, are discussed in great details, but where, in the meantime, the authors acknowledge the fact that the method provides only "geographical information" over land and fails for 48% of the cases over oceans.

I fully agree with this last analysis about the method. Changes of the residue between 380 and 440 nm over land are primarily controlled by differences in the surface spectral reflectances between desert and vegetation (figure 5). This is confirmed in figure 7 which really looks like a vegetation map: desert dust are found over deserts and biomass burning are found everywhere else. It is impossible to say whether this is right or wrong using this dataset. The same problem arises over oceans where the major criterion relies on the TOA reflectance measured at 380 nm. There is no reason to believe that biomass burning aerosols lead to higher reflectances than desert dust (actually there are reasons to believe that it should be the opposite considering the intensity of most dust episodes) has suggested by the chosen threshold. The criterion chosen to distinguish between desert dust and biomass burning thus only accounts for an higher cloud contamination in the southern Atlantic that artificially increases the TOA reflectances. Since there is no physical basis related to the aerosols themselves for this criterion, it is not surprising that the results for winter are less convincing than those for summer for which the threshold have been selected: the cloud cover and structure are likely different in both seasons.

Even if I am aware that the authors give all these arguments in the text, they are so "diluted" within other considerations that tend to confuse the reader that it is difficult to know whether the method works or not without a careful analysis of the whole paper. My opinion is that it does not work very well.

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