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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimation of the aerosol radiative forcing at ground level, overland, and in cloudless atmosphere, from METEOSAT-7 observation: method andfirst results" *by* T. Elias and J.-L. Roujean

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1) The definition of ARF was given first sentence of the abstract

2) Identifications a and b were included in Figure 1.

No unique notation exist in literature for unit of ARFE: e.g. Redemann et al. [JGR 111, 2006] and Markowivz et al. [JGR 108, 2003] define ARFE with Wm-2 while e.g. Li et al. [JC 17, 2004] write ARFE with Wm-2/aot. We prefer to use Wm-2 as unit of ARFE, and always specifying 'per unity of AOT', therefore we harmonize the notations between the abstract, Section 4.3 and the conclusion, and we feel indebted to the reviewer for this

suggestion.

3) I do not find reference to the dependence of TOA signal to SZA in literature. Therefore I made 6S simulations of UTVR (varying time on 21 July in Carpentras, scene viewed from METEOSAT-7), and results are plotted in Figure AC1. Unfortunately, I do not manage to include the Figure in this response to the referee comments. UTVR is plotted in function of SZA for 2 values of SAL and 2 values of AOT. It shows strong effect of surface albedo when SZA=30° (reduction of SAL from 0.20 to 0.05 generates a 50% decrease of UTVR), and decreasing effect when SZA increases. In contrary, the effect of AOT is smaller at SZA=30° than at SZA=70° (decrease of UTVR by 30% for decrease of AOT from 0.50 to 0.05). However in our opinion, there is no place for the figure in the paper, indeed necessary description of computation of viewing, solar and scattering angles would require a whole section. Nevertheless, the success of the method shows the relevance of our approach.

Following your suggestion, we inquired the geoland directorate with the possibility to make the ATBD available on the web. The result is that a web access will be given to an electronic version of the document within one month on the geoland webpage (http://www.gmes-geoland.info/index.php).

As for atmospheric fields (pressure, temperature, ozone and water vapour concentrations), the vertical profiles follow the US62 standard atmosphere [Mc Clatchey et al., 1971] implemented in the 6S code. The aerosol profile is exponential with a scale height of 2 km. We added these precisions in Sec. 3.2.1. Vermote et al. [1997] state an uncertainty of 1.6% on computed radiance. Moreover 6S "cannot handle spherical atmosphere and as a result, it cannot be used for limb observations". As computations are made by Vermote et al. [1997] for viewing zenith angles reaching 70°, our computations for SZA $< 70°$ remain in the reasonable angular range. In our paper, no mention is given on uncertainty in 6S computations (due to simplified surface reflection properties, vertical profiles, aerosol size distribution, ...) because we judge that only the uncertainty on final result is relevant to the paper.

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The transmission function of the METEOSAT-7 channel is directly an input of the 6S radiative transfer code. Data were obtained from the EUMETSAT website. Therefore UTVR is specifically calculated according to METEOSAT-7 spectral characteristics.

We deleted the mention to Table 2 of section 3.1.

We force the size distribution to follow the Junge law, which requires only the slope parameter to be defined. Further, we assigned two values of the slope in order to be representative of either pollution particles or desert dust particles.

Accuracy on SALmax is not necessary to estimate as we are only interested by DSSF. SALmax is an empirical estimate used as an internal parameter: SALmax is defined from SALmo which is the maximum occurrence of SAL values in SAS models capable to reproduce UTVR measured at noon (within 10%).

The cloud-sky screening ensures the total absence of clouds in each image pixel, despite of course some residual cloud coverage may remain.

A thorough evaluation of both AOTmin and SALmax is clearly out of the scope of this paper (while we agree it would require more investigation). The fact is that one spectral measurement can not lead to a retrieval of several variables. At this point, AOTmin and SALmax can not be used in an autonomous way to calculate DSSF, they are dedicated to remain internal parameters of the algorithm. However equivalent method applied to SEVIRI could give a larger set of information on aerosol optical AND radiative properties.

4) Acronyms were replaced in the titles.

ARF depends on SZA. We opted for 07:20 GMT as DSSF sensitivity to aerosols is maximum around this time (Sect. 2). Nonetheless the ATBD [Elias and Roujean, 2006] shows satisfying results at other times of the day.

We modified the sentence as "The agreement between ARFres and ARFmeas, as well as the coincidence with the variability in measured aerosol optical thickness, show that

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our method is sensitive to the high temporal variability of aerosol radiative impact.".

Figure 9. Applying a linear regression is indeed uncertain and useless and we decided to remove it.

We prefer working with differences per day, then we changed the text of Sect. 4.4 accordingly.

Reference to OMI has been added.

This reference has been added:

Mc CLATCHEY R.A., FENN R.W., SELBY J.E.A., VOLZ F.E. and GARING J.S., Optical properties of the Atmosphere, AFCRL-TR- 71-0279, Enviro. Research papers, No 354, L.G. HANCOM FIEL Bedford, Mass. U.S.A., 1971.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13503, 2007.