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Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of an AOT product over land at the 0.6 µm channel of the SEVIRI sensor onboard MSG" *by* E. Bernard et al.

Anonymous Referee #1

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The manuscript of Bernard et al. describes the estimation of aerosol optical thickness (AOT) from the geostationary SEVIRI sensor over land (but also water) surfaces with high temporal resolution suitable for an operational implementation. The authors follow a multi-temporal approach to estimate surface reflectance which is then used together with the measured Top-of-Atmosphere reflectance (corrected for the effects of gases) and a radiative transfer code to invert AOT. The authors compare their SEVIRI derived AOT from three month in spring 2006 with corresponding values from AERONET sites in Europe and with the MODIS level 3 aerosol product and find a generally good agreement. High temporal resolution and spatially homogenous aerosol information are of interest for different applications, especially when the atmospheric aerosol load exhibits a high diurnal variability like the authors demonstrate. The near real time and

operational high resolution AOT product that the authors aim at could therefore be of great interest for different applications and studies.

The topic of this manuscript fits well into the scope of AMT and the paper is well organized but needs English proof read. I have no general concerns with this manuscript but a few comments which should be addressed before the paper can be published in AMT.

General comments:

The aim of this manuscript should be stated more clearly. Is it the development of the methodology or is it supposed to be a "reference paper" for an operational aerosol product which will be publicly available?

With regard to the first, the feasibility of multi-temporal approaches for the AOT retrieval over land from geostationary sensors (e.g. GOES, SEVIRI) has been already demonstrated in previous papers. However, the authors make also use of the 0.8 and 1.6 micron channels in order to determine the best-fit aerosol model for the AOT inversion which is important and (for over land retrievals) novel to my knowledge. However, this aerosol model selection is not elaborated sufficiently. It should for instance be demonstrated that the aerosol selection leads to superior AOT retrievals than if a (fixed) aerosol model from a predefined or AERONET-derived climatology is used. Further, certain estimated model parameters (e.g. single scattering albedo or Angstrom exponent) could be compared to the ones from AERONET. While water surfaces are usually very dark in the 0.8 and 1.6 micron wavelength region, vegetation is much brighter which might considerably decrease the sensitivity of the sensor to detect an aerosol signal in the NIR. Does that have an impact on your best-model selection?

With regard to the introduction of an operational aerosol product, I wonder why only data from three months and only over Europe are shown. Second paragraph of the abstract and p.3161, l27 indicate that AOT is derived over the entire SEVIRI disk. There are also other interesting regions with regard to aerosols and I think that the paper can

benefit a lot if at least one figure is included illustrating the AOT distribution over the entire SEVIRI disk (e.g. similar to Fig. 8). This figure could also be used to extend the discussion on limitations and potentials of this product.

The error discussion is not sufficient and in general quite speculative. Sure, it is known from numerous previous studies that surface reflectance estimates and cloud contamination (especially with the relatively coarse resolution of SEVIRI) are major error sources but no attempts are made by the authors to quantitatively describe and estimate the contribution of these error sources to the total error. With regard to future algorithm improvements, to do so is important. For example, AERONET data can be used for a better error assessment or spatial consistency tests might be applied to investigate the cloud influence. There are also additional sources of errors not or only marginally mentioned in the manuscript which should at least be discussed, e.g. the estimation of the background AOT, estimated aerosol properties or, like Dr. Ham pointed out, calibration issues. In addition, I wonder a little that you rely on a "rather simple cloud mask" (P.3156) if cloud contamination is a major error source. So why not using just the best cloud mask available?

Specific comments:

Please write out all abbreviations (including sensor names) the first time they are mentioned and use the abbreviations afterwards. Please also check the notation of (mathematical) products throughout the manuscript, probably better use the "x" sign.

P. 3151, l8: the King et al. (1999) reference is a little old considering all the progress achieved in the field of aerosol remote sensing in the past decade. You could probably also mention a more recent review paper or book besides King et al. (1999).

P. 3151, l12: The daily sampling increases for geostationary satellites, doesn't it? Or do you want to say that geostationary satellites are only capable to observe a specific part of the entire planet? In addition, the spatial resolution is not necessarily lower than polar orbiting satellites (e.g. OMI).

P.3152, l8 – P. 3153, l1: Think about moving these three paragraphs to section 3 or shorten it otherwise.

P.3153, l23-l24: Do not most of the gases in the atmosphere consist of molecules? I guess you are referring here to the radiative effects of gases and aerosols, so it would be better and clearer to use here terms like gaseous absorption, Rayleigh scattering, aerosol scattering and aerosol absorption.

P.3156, l2: In principle, meteorological parameters from model forecast could also be used in a near real time operational aerosol retrieval from SEVIRI. As it is argued in this study that cloud contamination is a major error source in the AOT retrieval why relying on a "rather simple cloud mask" instead of just using the best one available?

P. 3156, l27: Please clarify to what the subscripts 0 are referring to.

P.3158, l23: Better: . . . depending on the latitude . . .

P.3159, l21: What is a pseudo-BRDF?

P.3161, l23, 24: Do you mean 2x10ˆ(-5) etc.?

P.3162, l21 and P.3163, l20: What happens to isolated pixels? Are they masked out? Please clarify.

P.3163, l5: Is there a reason why you don't interpolate the AERONET AOT (available at different wavelengths) to the SEVIRI wavelength at 630 nm? Doesn't this potentially introduce a small bias?

P.3164, l7: 4x10ˆ(-2) or 4.1ˆ(-2)?

P.3164, l7 and elsewhere: As far as I understand you don't allow your algorithm to derive negative AOT, do you? While this is physically absolutely correct it would make sense with regard to the statistical analysis to also include slightly negative AOT values (e.g. similar to the MODIS operational algorithm).

P.3164, l17,18: The statement "... comparable to results obtained for the MODIS algorithm ..." is a little strong and I doubt that a meaningful comparison is possible on the basis of comparing three month of SEVIRI AOT over Europe with a decade of worldwide MODIS aerosol retrievals. For example, the study of Levy et al. (2007) reports MODIS/AERONET correlation of 0.9 and a linear regression equation of y=1.01x + 0.03 globally, compared to the correlation of 0.63 and slope of 0.81 in Fig. 4. With regard to the study region of this manuscript, the study of Riffler et al., Atmos. Meas. Tech., 3, 1255-1270, 2010 showed that the MODIS-AERONET correlation is for a majority of (central) European sites better than 0.9 while the slopes vary somewhat between 0.9 and 1.1. Therefore I don't think that "comparable" is the right word here. You might refer to these or additional publications to give a better impression of the SEVIRI performance.

P.3164, l19-27: Please quantify the contribution of the different error sources, c.f. general comments.

Section 5: What is the source of this enhanced aerosol loading you describe here?

P.3169, l20 and elsewhere: AERONET in capital letters.

P.3175, l6: I think this statement is a little misleading. Certainly do the SEVIRI 0.1° resolution AOT maps allow a more detailed picture than the MODIS level 3 product at a resolution of 1°x1°. But if you want to, you can also construct MODIS 0.1° maps from the level 2 data available at 10 km x 10 km which also are suitable for regional studies. So how do you justify to use MODIS level 3 data instead of level 2 data in this study?

P.3175, l27: This can relatively easily be confirmed or rejected by using AERONET AOT values.

Figures:

Fig.4: Please add a colorbar with the corresponding density values.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 3147, 2011.