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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Relationship between wind speed and aerosol optical depth over remote ocean" *by* H. Huang et al.

H. Huang et al.

huang@atm.ox.ac.uk

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1. The authors failed to mention the positive correlation between the wind speed and AOT in remote oceanic areas identified in the following publication based on long-term Full Screen / Esc AVHRR retrievals: Mishchenko, M. I., and I. V. Geogdzhayev, 2007: Satellite remote sensing reveals regional tropospheric aerosol trends. Opt. Express 15, 7423–7438.

Reply: *Based on long term (1988-2005) aerosol data from AVHRR, Mishchenko and Geogdzhayev (2007) identified an increasing time trend of aerosol optical depth in the region of , 45° S–60° S as well as a positive correlation with the wind speed from the Special Sensor Microwave/Imager. It is a worthy paper and we have cited it in the*

introduction part.

2. The authors should analyze specifically the effect of the following factors caused by increasing wind speed that may make the AOT-wind speed correlation artificial:

(i) increasing wind speed causes increased surface reflectivity via increasing the number and size of white caps and making the surface rougher;

(ii) increasing wind speed causes increased cloudiness and increased cloud contamination of cloud-free pixels used for aerosol retrievals.

Reply (I) *The wind speed dose influence the sea surface roughness which closely relates with aerosol retrieval. However, the retrieval algorithm (Oxford-RAL Retrieval of Aerosol and Cloud, ORAC) we used in the paper dose not try to separate the contributions of surface and atmosphere to the TOA signal. Instead, it is an optimal estimation (OE) scheme, the main principle is making use of Levenberg-Marquart iteration to find the best fit of modelled radiance based on the state of atmosphere and surface to the first four of AATSR's channels in both views. The algorithm uses a forward model, which is composed of sub-models of aerosol, gases and surface reflectance, to simulate the radiance at the top of atmosphere. ORAC retrieves AOD at* 0.55μ*m, aerosol effective radius and surface reflectance for each of the retrieval channels (under the constraint that the ratio of the surface reflectance in the forward and nadir views is fixed). The retrieval of effective radius is achieved by varying the mixing ratios of the different size modes (eg. fine, accumulation and coarse) in externally mixed aerosol classes of fixed composition. In the surface reflectance model, the Bidirectional Reflectance Distribution Function (BRDF) is used to describe the angular variation of the surface reflectance and the effects and variations of white caps, under light and sun glint are considered. More detail descriptions of the algorithm and forward model are given by Thomas et al. (2009a,b,c); Sayer et al. (2010).*

In the date section of paper, we have added a brief description of the algorithm as well as many references.

Reply (ii): *As the aerosol retrieval is only possible in clear sky condition, it is vital that pixels containing cloud are not included in the retrieval. The GlobAEROSOL AATSR product makes use of ESA's operational sea surface temperature cloud flag (Zavody et al., 2000). The scheme, which uses a combination of thresholds on the thermal infrared channels, spatial coherence and ratios between different channels, consists of a series cloud detection tests which are applied to individual pixel and are classified as clear if all the tests indicate no cloud is detected. This scheme is believed to be quite reliable over the ocean.*

This statement has been added to the data section of the revised manuscript.

3. I believe that it is an overstatement to say that double AATSR views allow one to completely decouple the AOT and surface reflectance retrievals. This needs to be discussed specifically

Reply: *We agree with the referee. The statement in the paper have been removed. In the retrieval algorithm, the surface reflectance is known as a priori from sea surface model(Sayer et al., 2010). And the surface reflectance is retrieved with the constraint that the ratio of surface reflectance between nadir and forward views is fixed by the* ***a priori****.*

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