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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimating the maritime component of aerosol optical depth and its dependency on surface wind speed using MODIS and QuikSCAT data" *by* Y. Lehahn et al.

Anonymous Referee #1

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Summary

This paper attempts to determine the marine component of the aerosol optical depth (AOD) by looking at its dependency with satellite derived wind speeds. The idea deserves to be explored and studied in detailed given that a number of studies have recently pointed out that such dependency probably exists. However, this paper limits it analysis to interpret correlations between AOT and winds and offers very little in depth justifications or consideration of the limitations of the instruments and datasets used. This important because the authors intend to analyze MODIS data in conditions that has not been well characterized and studied (clean marine conditions with low op-

tical depth). As result, I consider this work not suitable for publication as it is unless the major concerns and suggestions described below are addressed.

Main concerns:

The authors do not discuss the reliability of MODIS aerosol data in clean marine conditions. There have been a number of studies challenging the quality of MODIS aerosol clean marine data (Zhang et al. papers , see references) with proposed practical corrections.Such discussion is missing

Also, they do not discuss the fact that MODIS AOD retrievals assume a constant wind speed in the retrieval. For example, if the wind is calm, there is less or no foam but the MODIS algorithm assumes a constant 6m/s wind and assumes a higher ocean reflectance than the true one, as result it derives an AOD smaller than the real one. This is not mentioned in the paper and it must be included and discussed.

Further, the authors use the MODIS fine mode fraction product (FMF) which can be a unreliable when used at low AOD condition such as the clean marine conditions here studied. Because FMF critical depdend on the spectral dependance of the observed radiances, it is very sensible to small relative variations between MODIS bands. These conditions become more obvious at low aerosols conditions when the signal of interest becomes comparable with noise level of each band.

In support of the observed correlation between satellite AOD and wind, the authors show a similar correlation between satellite based Wind and surface based AOD (Aeronet in the Midway Island). The similarities between the MODIS-Quickscat and the AERONET – Quiskcat plots make an interesting point in support of the author's ideas. However, I find the analysis and approach insufficient to make the stated point:

Why is there a comparison with a single AERONET station? why is the Aeronet data used at level 1.5 and not 2.0 (ie the best quality)? Some of the papers referenced (Mulcahy et al for example) compared with a single sunphotometer too but had addi-

tional in-situ datasets in support of the comparison. In contrast the Zhang et al (see references below) papers did not have in-situ so they utilized several marine based Aeronet stations. The authors need to make a case for using a single station without additional information.

The time difference of 4 hours between Terra and Quickscat is problematic. The fact that Quickscat is earlier than MODIS is useful because it facilitates the causality assumption i.e. if Quickscat measured high winds early and then Terra sees high coarse mode AOD, it is very reasonable to assume that the aerosol seen by Terra was generated earlier. However in 4 hours, wind speed can change significantly in such period of time. With this regard I see the figure 2 of little value. It shows the autocorrelation between AOT and Wind at 24 hours intervasl (4,28,56hrs..) . . . long enough for a synoptic weather pattern to move in.What the authors need to determine is the time difference needed for studying causality in the wind-AOD correlation. In order to address this points, I think the authors should do a simple study using wind speeds from a couple stations in the remote marine environment and compare the wind variability with the time of MODIS pass and asses if the time difference of 4 hours is adequate or not.

Another important aspect is the choice of data set. Why the choice of MODIS and Quicskcat with 4 hours difference when Aqua carries another MODIS and AMSR-E which also measures wind speed collocated and simulatenously with MODIS? The use of the Aqua data set should remove the concern regarding time difference.

Minor Comments

Are Quickscat wind representative of the surface or 10 m above surface? Clarify

Abstract

Line 6: no clear the statement “correlation time”. What is the meaning?

p. 1985, line 2 : the Kaufman et al, 2002 reference does not address the issue “climatological implications”

p. 1985, lines 4-14: Authors omit to point out that biogenic aerosols (either primary or of secondary origin) make a significant contribution to the accumulation mode and it coexist with the usually seasalt dominated coarse mode.

p. 1985, line 27: Huang et al is a paper in review stage in ACPD. If it has not been published in ACP, it should be removed from here.

All references do are not properly formatted and they contain some extra number at each of them that do not seem to be page numbers.

References

Zhang, J., and J. S. Reid (2009), An analysis of clear sky and contextual biases using an operational over ocean MODIS aerosol product, Geophys. Res. Lett., 36, L15824, doi:10.1029/2009GL038723. Zhang, J., and J. S. Reid (2006), MODIS aerosol product analysis for data assimilation: Assessment of over-ocean level 2 aerosol optical thickness retrievals, J. Geophys. Res., 111, D22207, doi:10.1029/2005JD006898. Zhang, J., J. S. Reid, and B. N. Holben (2005), An analysis of potential cloud artifacts in MODIS over ocean aerosol optical thickness products, Geophys. Res. Lett., 32, L15803, doi:10.1029/2005GL023254.

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