Atmos. Chem. Phys. Discuss., 9, C7239–C7242, 2009
www.atmos-chem-phys-discuss.net/9/C7239/2009/

Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

Received and published: 18 November 2009

General This paper presents the results of an analysis of effects of over-ocean winds on AOD over remote oceans based on satellite-derived data of AOD and ECMWF winds. The information of modification of aerosol properties (in the MABL as well as in the vertical column) by winds in important, considering that more than 30% of the global aerosol abundance is of marine origin. The authors demonstrate that exponential and liner functions would explain the effects over a wide range of wind speeds with high accuracy. Though effects of wind speed on AOD and extinction have been examined in the past by several investigators over different oceanic region, in this work the attempt is to covering several oceanic regions concurrently, and separating out more pristine oceanic regions, and spanning over a very wide wind-speed range. This study concludes that the effect of winds on AOD is rather weak. While this work has scientific merit, there are several concerns, detailed below, which the authors need to examine

carefully and discuss in a revised version of this paper, before it might be qualified for publication

Detailed and major Comments: 1. The authors basically examine the effects of wind speed on AOD at 500 nm. It is well-accepted and demonstrated (innumerable literature available right from the 1950s; based on model simulations, analytical considerations as well as in-situ measurements) that the wind-generated sea-salt aerosols are in the coarse mode regime (with the concentration peaking at dia $>\sim$ 2 micrometer). The mode radius shifts to higher values at stronger (>10-12m/s) winds. As such, the impacts would be higher at coarse mode optical depths or AOD at longer (near IR) wavelengths, and also the Angstrom wavelength exponent, than at 550 nm.. This would be more so when wind speeds exceed 8 to 10 m/s, when in addition to film and jet droplets, spume droplets will be directly produced by shearing off the wave-crests and these would be at still higher sizes even after equilibrating with ambient RH. This is also indicated in the authors' figures 6, 8 and 9, where the points show a leveling off tendency above wind speed $\sim$10 m/s. It would be appropriate to examine AODs at longer wavelengths if available, or at least discuss this possibility and modify the conclusions accordingly.

2. There are also in situ measurements, in the southern ocean, of decrease in the concentration of accumulation mode aerosols, during very high winds (exceeding 20 m/s). The consequence of such events will be reflected as a decrease (or less increase) in the extinction at the shorter (mid-visible) wavelengths and thereby assumes adds to comment #1

3. In this paper the authors first classify / define the oceanic regions, which can be considered as remote based on the wind directions and AOD and this is approach is praise-worthy.

4. The section dealing with data needs to be tightened up. Authors should state the accuracy of AATSR derived AODs, especially when the AOD s are very low and com-

parable to the uncertainties (instrumental + retrieval + spatial averaging). What will be effect of such an averaging in smoothing off of the wind-induced effects on AOD, especially close to the grids where the winds have large spatial gradients? Second concern here is the accuracy of ECMWF winds. What the measurements that go into this, and what are effects of modelling to interpolate/ extrapolate over no-measurement regions? What is the effect of averaging in space and time domains? What would be the possible effects of the interpolation of these winds to the satellite times (which should also consider the residence times of coarse aerosols in the MABL)?

5. While binning the AOD data in terms of wind-direction, how long back the authors go in time for the direction? And what is the rationale? An earlier wind, favoring continental transport would have brought-in some (possible different type of) aerosols, which would still remain in the atmosphere? This possibility, at least, is to be discussed, though it is difficult to totally eliminate.

6. Another concern is the possible elimination of real data, caused by changes in the wind speed, by the elimination procedure adopted in this study. In the case when the wind-induced effects are variable in a 1degx 1 deg bin, it is possible that the sigma value could be genuinely high, even if there is no transport. And the threshold of 0.035 appears too small, especially if we consider the uncertainties in the retrievals of winds and AOD

Minor & Technical Comments:

1. Multiple references appearing in the same context are to be cited chronologically; applicable for the entire paper

2. Introduction, Second Paragraph: There is an excellent work by Satheesh et al., (GRL, VOL.33,L03809,doi:10.1029/2005GL024856,2006), which used MODIS-derives AODs and NCEP winds over different oceanic regions, very much similar to case here. This paper should be referred in the text, and also it is suggested the authors may examine their results in the light of this paper also.

3. The same paragraph, the sentence “The link between marine aerosol optical properties and wind speed is not difficult to. . ..” Did the authors mean it is difficult or not difficult, because of the effect of long-range transport?

4. Next paragraph, second line (and elsewhere): replace ‘locates’ by ‘located’

5. Discussion of Fig. 2 : It appears that variation of the standard deviation is examined in the figure as a function of the wind direction. Then should the ordinate be st, rather than t? It would be nice if the ordinate is specified as wind direction (in degrees) rather than by a symbol q. I take that it is the arrival direction of the wind. Better it is stated explicitly

6. In the analytical parameterization, what is the error in ‘s’?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 24511, 2009.