RESPONSE TO ANONYMOUS REVIEWER #1

We would like to thank reviewer for his/her comments. We have done our best to address each of the points as detailed below.

Note: All reviewer comments in *italics;* all responses by the authors in normal font.

#1. Somewhat surprisingly to me the paper states: "Figure 6 shows that the relationship derived here is generally comparable to previously published data," though it goes on to note, however, "some considerable differences" which are subsequently discussed and speculated upon. However at page 4614, first para, the manuscript suggests that the leveling off of the AOD at higher wind speed may be a retrieval artifact arising from multiple scattering effects from whitecaps, "correction for which is not included in current CALIPSO aerosol algorithm." The manuscript calls for further study "to evaluate the maritime aerosol AOD behavior under very high wind conditions." These caveats are absent from the abstract, which explicitly calls attention to the leveling off at high wind speed and a maximum value for maritime AOD.

Discussion of caveats due to multiple scattering under very high wind condition has been added to the abstract.

#2. *Maps of seasonal marine AOD (Figure 1) are also of interest. One might imagine this data set to be useful to modelers. The manuscript reports (page 4608, line 25) that "The global mean AOD 532 for single-layer marine aerosol is found to be 0.052 _0.038." It is not specified whether the uncertainty represents a standard deviation or standard error of the mean.*

We have clarified this problem in the manuscript.

#3. The histogram of height of the top of the marine aerosol layer, Figure 3, is also interesting; I expect that there is much variability of the layer thickness with wind speed (and also season, location) that is not examined. No representation appears to be made whether this histogram is meant to be representative of the global marine aerosol, which would make it of interest analogous to the reported optical depth.

We thank the reviewer for bringing up this point. Discussion for the dependence of aerosol layer thickness on both wind speed and seasons has been added to the manuscript.

#3. *This paper simply correlates freely available data products supplied by NASA but provides little insight. There is no theory of why one would expect loading or optical depth of primary marine aerosol to increase with wind speed or what relation might be expected. An increased wind speed would increase both the production rate of the aerosol (from bubble bursting associated with whitecaps or from spume) but increased wind speed U will also dilute the aerosol such that for a given production flux density the column burden would decrease as 1/U. Details would depend on factors such as upwind fetch. No consideration is given to the fact that the aerosol present at a given observation time will have been produced upwind and at earlier* *time (and likely, therefore, with different wind speed) and how this might affect the correlation with local wind speed that is presented.*

We disagree with the reviewer. The paper does not "simply correlate freely available products supplied by NASA." The data used in the current manuscript required very complex and computer intensive post-processing. To estimate how aerosols produced upwind at an earlier time and different wind speed can affect correlation with the local wind speed we have conducted the following exercise. For the regions selected in the Northern Hemisphere (NH), Southern Hemisphere (SH) and tropical waters (see Fig. 1 below) we have looked at the median daily percentage differences in AMSR-E-derived surface wind speed (in each 0.25x0.25 degree grid) and the 0.5x0.5 degree grid in the middle of the region. The data was then averaged over 2006 to 2011. Considering that the sea salt lifetime in the marine boundary layer is less than three days and that wind is the major source of sea salt aerosols, selected boxes should give a reasonable estimate for the concentration footprint upwind from the retrieval point. Large percentage differences in the wind speed would indicate that aerosols produced upwind may influence the correlation between the local wind speed and AOD reported in the paper. Figure 1 shows that the expected uncertainty due to differences in wind speed is ~ 5% and therefore should not have a considerable effect on derived five year mean AOD vs. wind speed regression. However, one should keep in mind that for any given retrieval inside the selected boxes there can be rapid variations in the surface wind speed and that local instantaneous wind speed may not always be a good indicator of sea salt aerosol AOD (e.g., Bates et al., 1998; Smirnov et al., 2003). It is well established that sea salt aerosol production in an arbitrary situation involves complex interaction of meteorological processes and air-mass history (e.g., Bigg et al., 1995). See also our response to comment #4 below.

#4. The correlation that is presented (page 4611, line 11) contains 5 parameters with as many as 4 significant figures. I have no doubt that this is statistically significant (the authors state that R2 = 0.97), but I question whether it is scientifically significant. The standard deviations presented in Figure 5 at any wind speed range from almost 50% of the value given by the equation (at higher wind speed) to almost 100% of the value (at low wind speed). As such, the expression presented, especially as presented without uncertainty range, lends a misleading sense of confidence.

We agree with the reviewer. For AOD-wind speed relationship now we report two different r^2 values. The first one ($r^2 = 0.97$) shows correlation between logistic regression line and wind speed bin-averaged AOD values (indicator of curve fitting) (e.g., Mulcahy et al., 2008). The second one ($r^2 = 0.25$) shows relationship between logistic regression line and all the available data (e.g., Smirnov et al., 2003).

References:

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Bates, T. S., Kapustin, V. N., Quinn, P. K., Covert, D. S., Coffman, D. J., Mari, C., Durkee, P. A., DeBruyn, W. and Saltzman, E.: Processes controlling the distribution of aerosol particles in the lower marine boundary layer during the First Aerosol Characterization Experiment (ACE-1), *J. Geophys. Res.*, 103, 16,369–16,384, 1998.

Mulcahy, J. P., O'Dowd, C. D., Jennings, S. G., and Ceburnis, D.: Significant enhancement of aerosol optical depth in marine air under high wind conditions, Geophys. Res. Lett., 35, L16810, doi:10.1029/2008GL034303, 2008.

Smirnov, A., Holben, B., Eck, T., Dubovik, O., and Slutsker, I.: Effect of wind speed on columnar aerosol optical properties at Midway Island, J. Geophys. Res., 108, D24, 4802, doi:10.1029/2003JD003879, 2003a.

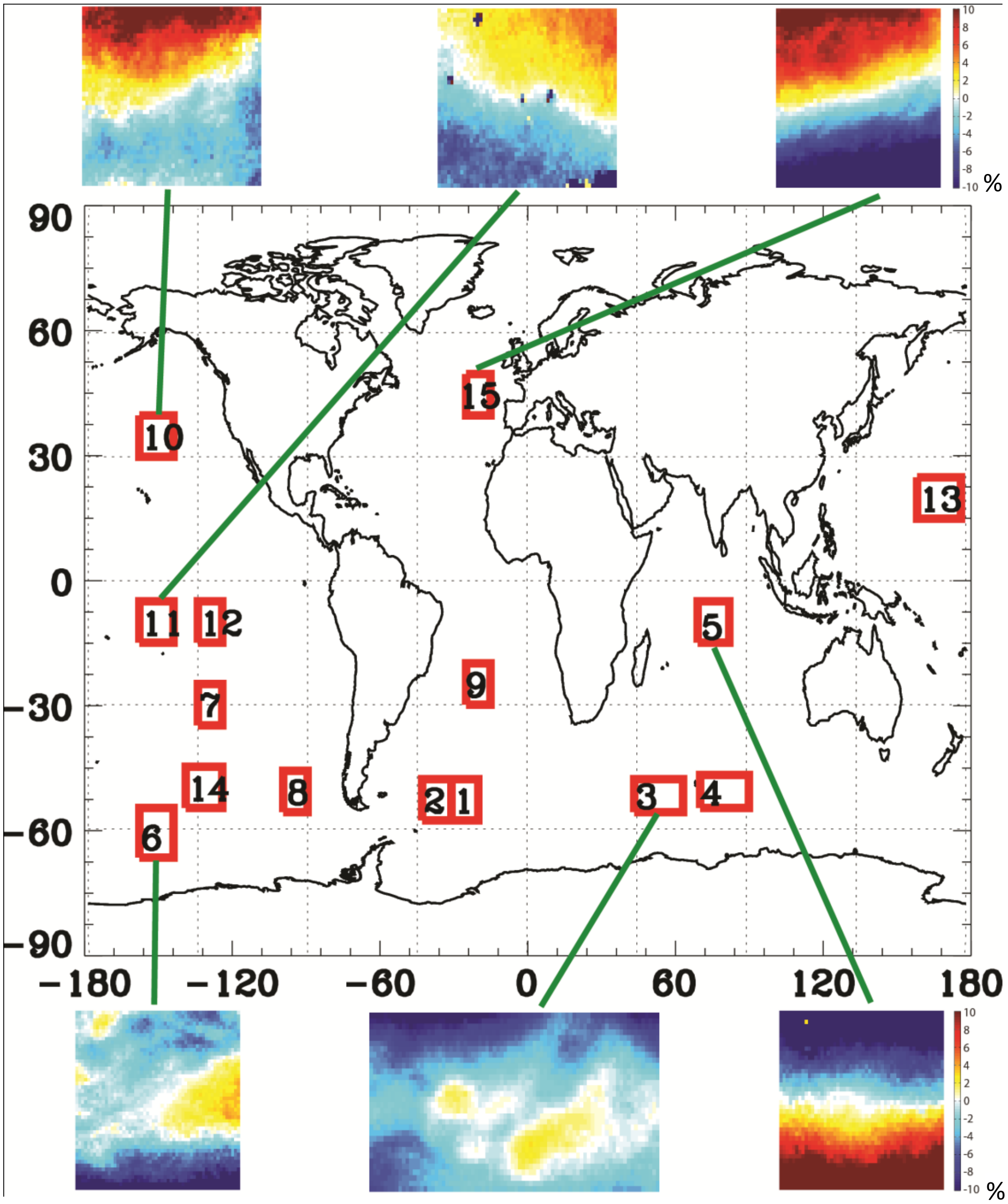

Fig. 1. Median daily percentage differences in AMSR-E-derived surface wind speed (in each 0.25x0.25 degree grid) and the 0.5x0.5 degree grid in the middle of the region.