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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sea surface wind speed estimation from space-based lidar measurements" *by* Y. Hu et al.

Y. Hu et al.

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Response to reviewer #3

1. The impact of swell is one of uncertainty sources. If the incidence angle of the beam goes to 5 degrees, the relative change in light wind surface backscatter may reduce significantly. As the average impact of swell over the 70 meter footprint is always a net reduction in backscatter, that can result in a slight over-estimation of wind speed at the presence of swell. As we do not have a reliable climatological slope distribution database of swell, we choose to leave this as part of the final response to the comments instead of putting it into the paper.

2. I changed the sentence to “The light reflected from the surface is co-linearly polarized when the lidar backscatter contribution from multiple scattering between

waves is negligible”. 3. I appreciated the reviewer’s interest and in-depth knowledge in the scaling issue. Actually this is one of the area I have spent most time on. Here is what I think. The wave slope over a unit sea surface area is normalized to 1 (equation 1), but the backscatter coefficient does not have to be normalized to 1. Thus, we added “For unit sea surface area, the integration of probability F over all slope (0 $\le$ tanθ $\le \infty$) and all azimuth (0 $\le \varphi$ $\le 2\pi$) equals 1.” To illustrate the difference between the definition of integrated lidar backscatter and backscatter cross section, First, we can look at a slice of an infinitely thick layer of particles with extinction optical depth d\tau and lidar backscatter cross section b*d\tau; Assume the lidar-field-of-view as infinitely small and the media is a strongly absorbing media thus with very little multiple scattering, then the backscatter of the media and the integrated lidar backscatter are, . The conventional extinction scatter cross section for the infinitely thick object is 1 and the backscatter cross section is b. Thus, by definition the integrated lidar backscatter coefficient is half of the backscatter cross section. We have made the changes accordingly. 4. We added the sentence “Ideally, the lidar backscatter from sea surface comes from the surface range bin. Here the sea surface lidar backscatter is a sum of the surface bin plus one range bin above and 3 range bins below because of CALIOP's low pass filter and detector transient response.” 5. Although it is more traditional to use the style as the reviewer suggested, I ended up not changing it after trying it a few times since I prefer to state the result earlier so that it does not get lost in the data analysis descriptions. 6. Done as suggested. 7. Made a lot of changes to the text to address most of the questions. The ones that we did not address are: 1. AMSR-E wind accuracy at glint region was not mentioned here since we are using night-time AMSR-E and CALIOP. 2. We have not found a journal article specifically mention bias of AMSR-E wind at lower wind speed. I did compare TMI wind speed (the same algorithm as AMSR-E) with buoy results before and did not find bias. We added a few sentences discussing the 15% depolarization for foam and whitecap correction. 8. We pointed out that the Menzies paper for the pioneering calibration study, which is the first of such study. 9.

The reviewer is correct that part of the reason for the global unbiased wind speed is related to the fact that we are using the surface with wind speed between 7 and 9 m/s and for clean atmosphere for calibration correction. 10. We added the color scale in the figure caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2771, 2008.

ACPD

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Interactive Comment