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Atmospheric Measurement Techniques Discussions

Interactive comment on "How big is an OMI pixel?" *by* Martin de Graaf et al.

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Reviewer #1
Quick Review for ***How big is an OMI pixel?*** *by M. de Graaf, H. Sihler, L.G. Tilstra, and P. Stammes (amt-2016-61)*

Graaf et al. present a study on quantifying the spatial size of OMI ground pixels, by matching OMI and co-located MODIS radiances in the visible spectrum. They fit a range of flat-top super-Gaussian spatial functions to match OMI and MODIS under a range of conditions, and compare the results to the OMI OMPIXCOR ground pixel product, the results of which show that the (visible channel) 75FOV OMPIXCOR pixels are a good approximation for the true ground pixels as determined by Graaf et al. The manuscript is clearly organized and well written. It has benefitted greatly from the initial 2015 review and subsequent improvements made by the authors. Thus, very

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little remains to be criticized. The manuscript is well suited for AMT, and I propose to accept it for publications with a few minor, essentially technical corrections, as outlined below.

The reviewer is thanked for the thorough review and clear assessment. The manuscript has greatly benefitted from this and earlier reviews, and we feel that the manuscript is now in a much better shape, for which we are greatful. The remaining corrections have been performed and addressed below.

1 Comments/Corrections

Page 5, Equation (1):ÂÍThe 2D super-Gaussian, as stated here, is not the most general form, since both dimensions use the same exponential power n. I assume that this is being done to (a) reduce computational requirements for the study, and to (b) use, and compare more easily with, the OMPIXCOR values without having to treat along- and across-track dimensions seperately. Later in the manuscript, the authors make mention of the fact that the two dimensions can be treated independently, but that this hasn't been attempted. I suggest adding a short sentence after Equation (1) to make that point clear right at the place of definition of the super-Gaussian.

In fact, this was one of the major flaws of the paper, which has been corrected. The super-Gaussian shape has been redefined to use different exponents in along and across-track directions. All the correlations have been recomputed using these new shapes.

Page 5, Equation (2):ÂÍDouble-check that the weights are correct as written. In particular, whether the power of 1/n should not rather be a 1/2. What prompts me to suggest

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this is that a Gaussian's Full-Width at Half Maximum (FWHM) and its Half- Width at 1/e (HW1E) are related by

$$HW1e = \frac{FWHM}{2\text{Sqrt}(ln(2))}$$

The weights in the manuscript are correct. The weights mentioned here are only valid for a normal distribution with n=2. In the new manuscript the FWHM in both directions are now defined separately.

Page 6, Line 197: Delete So, . Done.

Page 8, Line 246:Âĺ2006 Sahara should be 2008 Sahara, since the 2006 case is not shown. Changed.

Page 11, Line 364: changes due to time differences Changed.

Page 11, Line 370: optics like those of OMI Changed.

Page 11, Line 377: presented in this paper Changed.

Page 14, Figure 3:ÂĺAre the Quadrangular OMI pixels from the 75FOV OMPIXCOR product? If so, mention this explicitly since the essentially identical performance of OMPIXCOR and the super-Gaussians are an important result of the paper. If they aren't from OMPIXCOR, add some explanation on the significance of the close performance. Added.

Page 15, Figure 5:Âĺ[1] Remove the color bar from each plot and add a larger version *outside the individual images. As is, the color bar is too small to read.ÂÍ[2] Add indications of (a), (b), ..., (f) in the figure caption.* Done.

Page 19, Figure 12:ÂÍ[1] Move the color bar outside the figure and make it larger.ÂÍ[2] As is, this figure conveys very little information, particularly in regards to the color-coded VZA values, since the data points essentially fall on the 1-to-1 line. Here is a suggestion to improve the plot: As X-axis, choose average reflectance values R = (R_{MODIS} + R_{OMI})/2; these aren't physical, but they provide a common axis. Against this R, plot the difference in reflectance dR = R_{OMI} - R_{MODIS}, either absolute or normalized to either R_{MODIS} or R_{OMI}. In that way, the range of the Y axis will become more suitable to the small differences in reflectance, and the color-coding may actually become instructive. N, y, r, and can still be included, as well as the dashed line, though it should be fitted to dR in that case.
This is a nice suggestion. We have added it, instead of replacing, even though the new figure conveys no new information compared to the original one, but the original plot clearly shows the behaviour of the simulations compared to the measurements (Figure 3), while the new plot, added as an extra panel, clearly shows the VZA dependence.

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