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Atmospheric Measurement Techniques Discussions

Interactive comment on "MODIS 3 km aerosol product: algorithm and global perspective" *by* L. A. Remer et al.

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The manuscript describes the algorithm and preliminary assessment for the first-ever global MODIS 3km aerosol product that soon will be available to the public as part of MODIS Collection 6 release. The algorithm essentially is the same as the one used for MODIS 10-km aerosol product in the Collection 6, but operates at a finer spatial resolution (6X6 0.5 km pixels). Based upon the comparison of 6-months of retrievals with AERONET counterparts, authors found that:

(1) 3 km AOD has similar uncertainty as that of 10 km AOD over ocean, and higher uncertainty than 10km AOD over the land;

(2) 3 km AOD is more capable than 10 km AOD to capture fine-scale features of coastal

AOD, as well as high AOD associated with smoke plume and urban pollution;

(3) Artificially high AOD spikes can be found in the 3km AOD;

(4) 3km AOD also appears to have largest uncertainty over the urban regions, albeit one of key motivation for having 3km product is to monitor urban pollution from this product.

The manuscript overall is well written, and the assessment of the product are conducted objectively. In addition, as authors pointed out, the 3km product fits nicely with the recent growing interests in applying satellite data for particulate matter air quality studies. I recommend this paper be accepted after revisions suggested below.

P77, Line 16. Provide reference for MOD/MYD35, and perhaps briefly mention what is new or expected to be new in MOD/MYD35. Will it be more conservative in masking clouds?

P78, Lines 6-10. I am confused here. Do MOD/MYD35 use other information (in addition to the spatial variability) to mask cloud? Smoke and clouds can also be separated from multispectral information. So, why the cloud identification should be based upon spatial variability alone?

P80, Lines 5-10. How does the global average of AOD is computed? Is it weighted by surface area of the pixel? The issue related to the number of valid AOD retrievals is mentioned several times in the manuscript. So, it will be good to add # of valid retrievals in Figure 7, or the ratio of # for valid retrievals between 3km and 10 km.

P82, Lines 10-20. As a validation strategy, the idea of using spatial average needs to consider how long (time) should be applied to average AERONET point measurement? this averaging time depends on the wind speed, or how fast the aerosol plume is moving within the spatial coverage of our interest. Hence, the average time and spatial area used in the AOD inter-comparison should be paired optimally, and consistently if they are used to evaluate different product. In the validation of 10km product, 25km radius circle is used to match the time of 1 hour; in proportion, in 3 km product, a 7.5 km radius circle should correspond to time of $\sim$20 minutes. Consistent assumption of wind speed needs to be used for validation of both 10km and 3km product; otherwise, this could be a factor contributing to the differences in the comparison statistics. It will be interesting to compare averages of 15*15 3km-pixel (roughly same as size as 5*5 10km) AODs with 1-hour AERONET AOD. Will this give better agreement with statics of 10km AOD evaluations?

Table 1. what is image optical depth land and ocean?

Table 2. what is PSML003?

Table 3. What is aerosol_cloud_fraction land? Is mean_reflectance_land the average of top-of-atmosphere reflectances of all cloud-free pixels?

Figure 2. bottom-right. ‘and’ should be ‘or’? anyhow, the top-right and bottom-right should be consistent. Also, be clear if 5 here is for number of 0.5 km resolution pixels. In addition, when discussing Figure 2, it will be good to discuss retrievals over the coastal region. Since in 10 km retrieval over the coast, if there is a land pixel, the land algorithm will be used. Is my understanding correct? If the same is true in 3km retrieval, will minimum requirement of 5 pixels still need, especially in cases when significant portion in 3X3 km2 is over the over ocean?

Figure 11 & 12. Add best-fit equation and R (like in Fig. 8 and Fig. 14).

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