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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of the Level-3 MODIS daily aerosol optical depth in the context of surface solar radiation and numerical weather modeling" *by* J. A. Ruiz-Arias et al.

Anonymous Referee #3

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Review of acp-2012-457 Assessment of the Level-3 MODIS daily aerosol optical depth in the context of surface solar radiation prediction and numerical weather modeling by: J.A. Ruiz-Arias, J. Dudhia, C.A. Gueymard, and D. Pozo-Vázquez

This paper attempts to validate daily "Level 3" (gridded, aggregated) MODIS aerosol retrieval products against daily averages of AERONET sunphotometer data. Whether or not the errors of Level 3 can be quantified has relevance to such applications as numerical weather prediction and solar energy forecasting. The results suggest that when the Level 3 product indicates AOD < 0.5, that the uncertainty for Direct Normal Irradiance (DNI) is < 15% and for Global Hemispheric irradiance (GHI) is < 5%. These

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uncertainties are small enough that the L3 AOD is of sufficient quality to produce "good enough" GHI (but not DNI).

Overall, I think this paper is interesting and useful, but could use some clarifications. I would also like to commend the authors on their figure presentations. I think they are dense with information, yet readable. However, I would like more figure caption information for Fig 6. Having the benefit of also reading comments from other reviewers, I am generally happy with the authors' responses.

Major comments: 1) As indicated clearly by another reviewer, there are aspects of ill-posed problems here. It is hard to justify comparing rather large spatial boxes (1° x 1°) with single point AERONET measurements, even if these AERONET measurements were averaged over an entire day. Aerosol may be spatially homogenous on the 40 - 100km scales, but only if there are no clouds (almost never). More likely there are heterogeneous cloud fields, surfaces, etc, in 1° that would make this assumption generally false. So "apparent error" or just plain "difference" is a better term, and the relationship between this "difference" and cloudiness (or un-retrievable pixels) should be more quantified. There is enough information in the MODIS Level 3 dataset (histograms, pixel counts, etc) that some of these questions could be explored more fully.

2) I am a little confused by the title. It is clear to me how estimation of GHI and DNI can help with applications such as solar energy forecasting. I am a little less clear how any of this information pertains to numerical weather modeling. Unless, I see that link explictely, I would recommend, dropping the "and numerical weather modeling" from the title.

3) Which Level 3 products are actually being compared with AERONET? The separately retrieved data over land and ocean (e.g. "Corrected_Optical_Depth_Land_Mean" and "Effecitve_Optical_Depth_Ocean_Mean") or the already joined "Optical_Depth_Land_And_Ocean"? Presumably the already joined data includes only data with higher quality, but the other two parameters have

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no filtering for quality. Also, it is hard to tell whether any Deep Blue measurements are compared in this exercise (it is mentioned in section 1.1 that there is Deep Blue data, but I don't see what happens to them).

4) One more assessment of Level 3 variability (and bias) might be to compare Terra against Aqua daily data? or Terra compared to MISR, or some other satellite dataset with spatial sampling? It turns out there may be calibration and aggregation issues that may make absolute differences hard to interpret, but one could compare L3-daily from two separate datasets.

Other comments: 1) I want to point out that there is a recent focus for AERONET group to collect data in high resolution "grids". For example, there was the DISOCVER-AQ experiment performed in 2011, where 44 AERONET sites were deployed in an area about 1° x 1° (see AERONET web site). Other similar experiments have been and will be held in other parts of the world. One upshot is that 40-100 "homogeneity" (e.g. Anderson et al, 2003) is definitely not a universal truth (especially in the vicinity of clouds and frontal systems).

2) Page 23224, lines 16-27. I understand what is being said here, but maybe a figure would help?

3) Page 23226: line 1. I think "annual" should be removed.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23219, 2012.