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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of data quality and surface-to-column representativeness on the $PM_{2.5}$/satellite AOD relationship for the Continental United States" *by* T. D. Toth et al.

Anonymous Referee #1

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The paper studies issues when estimating surface particulate matter concentrations from satellite observations by converting AOD to PM2.5 over continental US. Data from MODIS, MISR and CALIOP are explored together with ground-based PM2.5 measurements. This topic is of clear relevance to ACP, since spatial PM2.5 distributions are definitely of high interest to environmental monitoring and on the other hand AOD-to-PM2.5 conversion is a challenging task. The issues investigated concern AOD data quality and representativeness of column AOD or distinct layers for surface PM values.

However, the paper does not make clear, how the different aspects studied relate to earlier published work (what is confirmed, what is different, what is new) and how the

combined use of the three satellite instruments can be beneficial. Here the integration of the different aspects into a comprehensive conclusion and recommendations for a way forward is missed. The conclusions presented seem to say that direct attempts to convert MISR or MODIS AOD or CALIOP layer AOD into PM2.5 will always exhibit too large uncertainties and a better way forward will be to assimilate AOD from MODIS, MISR and extinction profiles from CALIOP into a chemistry transport model, which is then used to calculate PM2.5.

I suggest that the authors consider using common point filters, where possible, when different datasets are compared – this could strengthen their conclusions by avoiding to draw weak or misleading conclusions based on different samples (e.g. between operational and DA-quality datasets, between daily and hourly datasets).

Overall, the discussion and conclusions need to be firmed up and extended and the relation to other studies clearly be identified and discussed.

Detailed comments p. 31638, l. 12: add that satellite measures "ambient" p. 31640, l. 7: does this unavailability not apply to TERRA? p. 31641, l. 12-15: the sentence "For comparison purposes with the PM2.5 data available (described further below), we have constructed daily-averaged "Level 3" AOD data using operational MODIS and MISR aerosol products after applying first-order QA as described in Sect. 2.1." belongs into section 2.1 headlines section 3-5: I would reformulate without question (e.g. "impact of . . .")

frequent repetition of using quality flags, unavailability of hourly DA-quality data, etc. can be removed

p. 31643, l. 15-21: why are the numbers of the other studies higher than your numbers (also upto a factor of 2)?

p. 31644, l. 4: why are December 2007 data absent? – mention this in 2.1

sec. 3.1: no discussion at all of hourly vs. daily analysis, what can we learn from it?

sec. 3.1 and 3.2: to draw firmer conclusions and make a closer link between hourly / daily as well as operational / DA-quality datasets, you should apply common point filters – otherwise you risk that data points falling out contain specifically difficult or easy cases / outliers, which spoil the analysis – then you can make a clearer statement on p. 31644, l. 26 as currently done ("We believe that . . .").

p. 31646, l. 19-23: this finding confirms one reason for the differences in AOD/PM2.5 correlations between eastern and western US – it is important to state so in the conclusions

p. 31647, l. 20-24: this agrees well with Hoff and Christopher 2009 – state so

p. 31648, l. 7-10: this sentence is incomplete (of what?) and can thus not be understood

p. 31649, l. 24-29: why now such high correlations of 0.8? explain!

p. 31651, l. 13 (bullet point 1.): but this reduces coverage significantly by a factor of . . .

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31635, 2013.