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Atmospheric Measurement Techniques Discussions

Interactive comment on "Long-term aerosol optical depth datasets over China retrieved from satellite data" *by* Y. Xue et al.

Anonymous Referee #1

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Review of "Long-term aerosol optical depth datasets over China retrieved from satellite data" by Xue et al. (for AMT)

Summary: This paper employs the Synergestic Retrieval of Aerosol Propertes (SRAP) algorithm to use Terra and Aqua MODIS data together to retrieve AOD climatology over China. The results suggest no major changes in AOD overall, but some decrease in Beijing.

Assessment: I find the SRAP technique a potentially useful method for deriving AOD, especially in places where traditional pixel-by-pixel MODIS retrievals (e.g. Dark target or Deep Blue) will not work. Unfortunately, I find the discussion confusing and there are too many holes in the logic. I cannot recommend this paper for publication. I also

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wonder whether this paper should be submitted to ACP (as it shows "results") rather than AMT (which describes techniques). How does climatology of SRAP compare with other satellite climatologies? (either from MODIS or other instruments?). Can trends in AOD be justified compared with AERONET sites? How are the data "averaged" into monthly means? Are there quality controls related to retrieval confidence? Finally, if this paper is supposed to be focusing on long-term AOD trends over China, then the aerosol transport case-studies (using HYSPLIT) are superfluous to the main message. Seventeen figures are far too many. Figure 3 (computer photograph) is completely unnecessary. I hope my comments will be helpful when resubmitting this paper at a later date.

Specific questions:

1. The Tang et al (2005) reference is used as a justification/description for the methodology. This paper could use a much more in depth summary because not all readers will be familiar with this "alternative" MODIS retrieval history. 2. What is the "physical" interpretation of Eq (1)? What is θ? Why 0.1 for ε? Why sec θ? 3. What are terms in Eq 4? How does one derive values for β and α? Presumably, one must know what "type" of aerosol in particular situations, and that will make a huge difference when matching to MODIS visible bands. Can you justify why α should not change during time interval. What is the difference between Terra and Aqua overpass time over China? 4. Page 6649 line 8. MODIS is not a "next generation" satellite anymore. It is now old technology! 5. Page 6649, section 3.2. Why not use Level 2.0 AERONET data? Also, it is probably justified to interpolate between AERONET wavelengths (see T. Eck et al., 1999) using quadratic fits, and then there won't be problems of missing wavelengths. 6. Page 6650 Section 3.3: Why HYSPLIT? What levels are being calculated? 7. Page 6650: The bullets in section 3.4 are insufficient. a. Why cloud mask of MOD35? Note that the "dark-target" aerosol algorithms (e.g. Remer et al., 2005,; 2008) use their own cloud masks because MOD35 has real problems identifying and separating clouds from dust and smoke. b. What do you mean by "geo-reference?"

AMTD

4, C2371–C2374, 2011

What happens if Terra has a measurement and Aqua does not? What happens if Terra and Aqua retrieve at slightly different locations? Is there a spatial/temporal tolerance? c. What is LEvenberg-marquardt (need reference)? And what kind of errors does it produce? Note that my comment #3 is very relevant here. d. What is "Grid" workflow, and why does the reader need to know about the computer hardware? 8. Page 6651: Validation strategy: a. AERONET is quality controlled, are the SRAP retrievals also quality controlled in some way? b. Why are there differences between Terra and Aqua? Any suspicions? Note that the MODIS calibration team has recently discovered that the calibration of MODIS-Terra may not be as stable as once believed. They are working on "corrections" that may, in part, reduce the differences between Terra and Aqua. c. How are the error envelopes picked? Note that both the MODIS and the MISR aerosol teams use a combination of relative (e.g. %) and absolute error. For example, MODIS dark-target uses $\pm(0.05 + 15\%)$ to account for differing types of errors at low range (precision) and high range (accuracy). 9. Page 6652: Section 5.1: Again, I find the case study of aerosol transport as being superfluous to the main message (long-term AOD, section 5.2). Except for showing details of satellite/sunphoteomter "validation". Plus many items need discussion. What is API (reference?). There is a lot of meteorology that needs discussion. 10. Page 6654: Summary of AOD over 9 years. a. How are the satellite data "averaged?" Levy et al., (IEEE-TGRS, 2009) show that "how" you average data (what assumptions) make a huge difference. How are data quality controlled? Are they quality controlled at all? b. Page 6655: These are some interesting speculations about the links between meteorology and aerosol transport. If the sections 5.1 should be kept within the discussion, I would like to see these concepts linked. 11. Page 6656: Lines 20-30, seems like wild speculation. Especially, the link to May 2008 earthquake? 12. Page 6657: There is an AERONET in Beijing. Does temporal variability of AOD from satellite match AERONET? The speculation is that socio-economic trends caused aerosol trends, but what if changes in dust transport affected AOD over Beijing? 13. Discussion/conclusion: One paragraph does not make discussion/conclusion. Needs more. 14. Figures: a. Fig 1: Could be chopped at 60°E

AMTD

4, C2371–C2374, 2011

so that text can be magnified b. Fig 2: needs more of a caption c. Fig 3: Unnecessary d. Fig 4: Interesting that AERONET is interpolated here, but it is not discussed in main text. Please make legends bigger and/or better resolution. What are spatial/temporal "tolerances" of satellite and sunphotometer? e. Fig 5: Cannot read at all. Much too small. Maybe can be summarized in small table. f. Fig 6: See comment #10a. What are spatial/temporal tolerances? g. Fig 7: Again, small fonts are unreadable. h. Fig 8: If deciding to keep HSYPLIT discussion. Would be nice to also provide RGB (like in Fig 7) i. Fig 9: What is API (should be discussed in text). Also, where in text does it describe how to retrieve dust-type AOD? j. Fig 10: k. Fig 11: Pretty picture, but see comment #10a. Do you believe high AOD values over Tibet? I wonder if it is snow? l. Fig 12: Comment #10a. An entire paper could be made based on this figure. The seasonal variation of aerosol in China is very interesting. How does this "climatology" compare with other datasets? m. Fig 13: Probably unnecessary vis-à-vis Fig 12. (Or if you really want, write the "average" values on Fig 12). Are there error bars? n. Fig 14: By now, the reader is tired of these kind of plots. How about one plot, which shows AOD "trends", that are separated by statistical "significance". To make this plot, you would have to take into account aggregation, averaging, quality control, and instrument calibration, but I think ,well worth the effort. It would be even more interesting to separate trends into seasons. One can then begin to answer questions of what "type" of aerosol may be dominating all-China trends. o. Fig 15-16 could be combined in one plot. The column graphs could be substituded for the scenic pictures. Although, I still think "seasonal" plots are more informative then entire year plots. Standard deviation probably does not mean much for the entire year. p. Fig 17: What happens during "July?" or "September?" I believe that the discussion would be better justified by presenting a "null" case of some kind.

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