

Interactive comment on “Study on long-term aerosol distribution over the land of East China using MODIS data” by Q. He et al.

Anonymous Referee #1

Received and published: 17 May 2011

This paper analyzes aerosol distributions in East China using MODIS level 2 aerosol products for years between 2000 and 2007. They classify aerosols into six different types using AOD and FMF values. They analyze three regions within East China and provide their analyses of seasonal and inter-annual variabilities. The idea of trying to understand the sources of aerosols in China is important and interesting, but there are significant problems in their data analysis and some of the logics are simply difficult to follow. In addition, a lack of clarity as well as presentation and English errors call for a significant improvement for this to be published in ACP. I provide some major issues I see in this paper and then comment on some minor details.

First, their explanation of methodology is not very clear, and it is difficult to understand what has already been done and what is new in their paper. I believe more explanation

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is essential in section 2. For example, on p. 10494, they explain their methodology as following previous studies, but I believe this should be explained in the methodology section, rather than inserting it in results.

The lack of reasoning also makes it difficult for readers to follow their logic. For example, they state on p. 10490 l. 19-21: “Though MODIS derived FMFs have not been validated over large area on land, they provide a good indication of the type of aerosol (fine or coarse) that dominates the size distribution.” I believe that differentiating fine/coarse aerosols versus the source types as they do in the paper is different, and more reasoning is needed why their methodology can be utilized. The assumption that authors make that the aerosol properties in China being similar to those over North India also needs further support. Also, if this is indeed the case, which of the three Chinese regions is similar to North India? If their findings are that these regions show different source types, does their assumption hold? Later in the paper, they also mention that “[t]he industry is flourishing in Brazil, similar to East China (p. 10494, l. 11)” and they categorize biomass burning type and urban/industrial based on Brazil. However, is it valid to assume that there is more industry in Brazil than North America as they mention in the paper? I do not follow why Brazil is more similar to East China, and I think it is too rough to state that Brazil and North India have similar aerosol properties as East China, when the authors themselves argue that there is a variation among the three regions within East China. I thus believe their categorization needs reconsideration.

Second, although they mention the problem of bias using the MODIS data, they do not analyze the uncertainties or biases in their methodology, which leaves readers into questioning the validity of their analysis. For example, on p. 10493 l. 24-26 they write: “However, caution must be note (this needs to be change to “noted”) here that the alpha is even more sensitive to the assumptions on the spectral dependence of the land surface than the AOD, and may be biased for specific surface type or season”, but there is no further analysis regarding how this might affect their analysis.

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Third, their data analysis needs improvement. On p. 10498, l. 11-12, they argue that the “results clearly indicate that AOD is considerably higher during spring and summer than in winter”. However, when I look at the values including the standard bias, I do not find a significantly different values between the two, as in region I, spring AOD value appears to be 1.01 ± 0.61 whereas for winter, it is 0.49 ± 0.31 . I would appreciate more explanation on how we should understand this standard bias.

The correlation does not mean causation. The authors state that “strong southeasterly winds result in heavy aerosol loading (p. 10502, l. 7-8)”, but to me the Fig. 8 only shows correlation. Also, is Fig. 8 the mean of all months and years for each zone? How are we to understand the seasonal variations?

Figures need some improvement. The curves and lines in Fig. 9 do not appear to explain the variations much. What are the R^2 ? For Fig. 10, please explain what these dots are. (Why are there 12 dots for spring and 14 for summer? Are they some kind of mean values? If so, please mention how they were calculated.) Also, how were the thresholds chosen for wind speed and direction for Fig. 10? Was it based on Fig. 8? Why was it not good enough to analyze the values as they were per season? The threshold values appear very ad-hoc, so please provide reasoning behind them. Also, I would like to see the R^2 values here too.

The authors mention that Liu et al. (2003) found that the AOD maximum appearing in spring using the derived MODIS AOD between 2001 and 2002. They speculate that this might be because the Asian dust is weakening, but I believe it is possible to test this using their data. Could they show the change from 2000 to 2007 in their spring AOD values? Do they find spring maximum in 2001 and 2002 that show a decrease in later years? I believe such an analysis is necessary for them to state the weakening of Asian dust.

Minor comments:

1) Overall, please explain the abbreviations when they are first introduced in the paper

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2) P. 10487 l. 7 – does this mean human health or human welfare?

3) P. 10487 l. 7 – “affect the visibility” – take out “the”

4) P. 10487 l. 10 – aerosols temporal → aerosols’ temporal

5) P. 10488 l. 10 – “were suggested to relate to” → were suggested to be related to

6) P. 10488 l. 23-25 – Please make a citation to support this statement.

7) P. 10488 l. 27 “using the observation data” → take out “the”

8) P. 10489 l. 1-6 This part is really difficult to understand, and it appears tautological to me. Also, it should be “the mean value” rather than “meaning value”

9) P. 10490 l. 1 put (e.g., vegetation and soil moisture) right after “surface type” rather than where it is right now.

10) Please support the sentence of the source and the types of aerosols on p. 10490 lines 16-19 by citing appropriate paper(s).

11) P. 10493 l. 14-15: Please show how anti-correlated the angstrom exponent is with AOD by indicating the r value.

12) P. 10501 l. 2-5: It seems like there are contradicting arguments. On l. 2-3, they mention that the “contribution from urban/industrial aerosols increased from June to December”, but then on l. 5, they write “However, high AOD values were measured over eastern China in summer”. Please clarify.

13) P. 10503 l. 17 Plenty of urban/industrial aerosols ARE suspended over zones I and II.

14) Figure 1 and 6 might be able to be combined, and if cordilleras appear as they do in the paper, they might be shown on the figure too.