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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An overview of regional and local characteristics of aerosols in South Africa using satellite, ground, and modeling data" *by* S. P. Hersey et al.

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Summary Review report on " An overview of regional and local characteristics of aerosols in South Africa using satellite, ground, and modeling data" The authors present an overview of particulate air quality across some areas of areas of South Africa using satellite and ground-based data. The authors built their conclusion on level 3 data which is coarser than level 2 data. So primarily I suggest using level 2 data which has better resolution and average data on about 75-100 km and compare the results. Also the results and discussion section needs to be improved as it too many details from literature and sometimes discussions are not in concurrent with fig-

ures. Accordingly I suggest that the manuscript can be published with major correction. Here are some points which are needed to be fixed.

- Regarding level 2 versus level 3 data, the only conclusion we draw that might possibly be different with level 2 data is the poor agreement between satellite AOD and ground PM based on spatial resolution. Use of level 2 data would require a complete re-analysis of satellite data and ground-satellite correlations, which we have not done for the following reasons:

- First, the discrepancy between satellite aerosol data and ground-based PM concentrations is primarily due to vertical inhomogeneity - with stratified aerosol layers aloft (previous studies cited in the text). Level 2 data makes no difference here.

- Second, the localized gradients between sites of different types occur on orders of 10 km or less. Level 2 data are still an order of magnitude coarser than these gradients.

- Finally, we did perform an abbreviated analysis of AOD and Ängström exponent with level 2 data, and calculated correlation coefficients with ground-based PM concentrations. Level 2 data displayed no better agreement than level 3 data, and annual means were no different with level 2 data. So while theoretically it may make sense to use level 2 data, a complete re-analysis of our data is not warranted. We have added a note in the text that we did look at level 2 data, but that agreement was no different.

- The abstract and results and discussion have been abbreviated substantially, and our main conclusions have been stated more clearly. Where there was unnecessary detail, it has been removed. The paper should now read more succinctly. Discussion of figures has been improved to make sure it is aligned properly with figure mention, and figure labeling has been improved.

General

Page 24702 Line 8, do you mean AOD from MODIS Aqua and Terra ?, please clarify

- Yes, and this has been clarified.

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Page 24702 Line 9, the same for Ängström Exponent do you mean MODIS Aqua and Terra? Please clarify

- Yes, and this has been clarified.

Page 24702 Line 25, too much details, I would place put the sites description somewhere else rather than abstract

- This has been shortened substantially, and the descriptions are left to the results section. We only name the types in the abstract, as necessary to present main findings that follow.

Page 24702 Line 28, the statement "PM10 concentrations in. . .. . ." is too long and not clear. Split it and make it clear

- The statement has been split and clarified.

Page 24703 Line 11 instead of "– and underscore" change it to "which reflects.."

- Change made.

Page 24703 Line 13, make this statement shorter as it is too long" These results from the urban/industrial Gauteng area quantitatively conïn ËŻArm ËĞ . . .", summarize.

- This has been summarized and clarified.

In general the abstract is too long and has many details that should be removed, I suggest rewrite the abstract in a more proper way.

- The abstract has been substantially shortened, and details beyond the main conclusions of the paper have been removed. It now reads clearer and more succinct.

Please identify the objective of research at the end of introduction section I a clear way.

- A clear statement of objective has been added to the end of the introduction.

Page 24707 Line 27, please rephrase "MODIS data included daily. . .", it has something

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missing..l

- This has been rephrased and clarified

Page 24708 Line 4 The same of “Data from MISR included..” it has something missing, rephrase.

- This has been rephrased and clarified

Page 24707 Line 27, why data till 2009?, Giovanni has aerosol MODIS data till Dec 1 , 2014.

- When we started analysis, data were available until July 2012. As we are interested primarily in describing seasonal trends typical of column aerosol above the major metropolitan areas of South Africa (as opposed to the most recent data), we chose data from the last complete decade available (2000-2010). Adding the additional 18 months is does not change any results or conclusions, and our choice of exact start end end dates to the decade was a matter of preference.

Page 24708 Line 10 , what is the source of GOCART data?

- Data were obtained from Giovanni, and this has now been noted in the text.

Page 24708 Line 18, please provide the URL of FIRMS data that you used in the study.

- The URL has been included in the methods section

Page 24710 Line 14, add “there” after “In every region”

- Change has been made

In the Results and discussion section, I do not understand why long introduction about Aerosol Optical Depth and other parameters, it looks like text book. I think that it should be shorter and cited to references if anybody wants to get more details.

- The discussion of AOD has been shortened substantially, and only a brief description of the parameter is presented to give context for measurements.

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Also I suggest just start discussing the results and in the interpretation part you can use literature for discussion.

- This is a nice suggestion, and we tried to integrate the interpretation part into the results. Doing so, however, distracted from the first main conclusions presented in the results. The results flow significantly better, and are presented with better context, with the physical basis of the measurement presented before the main results. That said, the discussion of the physical basis of the satellite measurements have been substantially shortened, and flows better now.

Page 24712 Line 25, here you are talking about correlation, Is not shown? Why there are no correlation plots.

- The paper is already heavy in figures, and the correlation between different satellite platforms is a minor point that does not deem representation in a figure. Correlations are only presented to demonstrate that satellite parameters from different platforms, which appear correlated in figures, are indeed statistically well-correlated. A detailed comparison of satellite platforms is beyond the scope of this work.

Page 24713 Line 25, If you want to discuss Figure 2 after Figure 3, why you do not switch them?

- They have been switched.

I noticed that sometimes you write Fig. and sometimes it is Figure, please unify

- “Figure” is now consistently used at the first mention of a particular figure, and “Fig.” is used thereafter, in accordance with ACP standards.

Page 24715 Line 9, Are you here talking about Figure 4? If yes please refer to it.

- Yes, and we have made reference.

Page 24725 Line 17, what do you mean by Terra and MISR? Terra is the satellite and MISR is the instrument.

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- We are referring to MODIS-Terra and MISR instruments. This has been clarified in the text.

Where are the correlation plots of water vapor with aerosol parameters?

- We feel that inclusion of correlation plots would be cumbersome and would add more figures to an already figure-heavy paper. The main point of the paper is not to explore correlations between satellite platforms or provide a detailed analysis of CWV correlations. We present CWV as one possible explanation for the trends observed, and state correlation coefficients as support. If the reviewer feels that it is absolutely necessary for publication to include correlation plots, we are happy to oblige. But if the correlation coefficients themselves are sufficient to establish statistical significance, then we would prefer - for readability sake - not to include the plots.

You mentioned that spatial resolution of satellite data is a factor that prohibits satellite data to capture trends in ground PM concentration, so why do you not try level 2? , level 2 data has much better resolution than level 3 that you used in this study.

- As noted above, the only conclusion we draw that might possibly be different with level 2 data is the poor agreement between satellite AOD and ground PM based on spatial resolution. Use of level 2 data would require a complete re-analysis of satellite data and ground-satellite correlations, which we have not done for the following reasons:

- First, the discrepancy between satellite aerosol data and ground-based PM concentrations is primarily due to vertical inhomogeneity - with stratified aerosol layers aloft (previous studies cited in the text). Level 2 data makes no difference here.

- Second, the localized gradients between sites of different types occur on orders of 10 km or less. Level 2 data are still an order of magnitude coarser than these gradients.

- Finally, we did perform an abbreviated analysis of AOD and Ängström exponent with level 2 data, and calculated correlation coefficients with ground-based PM concentrations. Level 2 data displayed no better agreement than level 3 data, and annual means

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were no different with level 2 data.

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