

Interactive comment on “Asian dust storm influence on North American ambient PM levels: observational evidence and controlling factors” by T. L. Zhao et al.

T. L. Zhao et al.

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We are very grateful to Referee #2 for the encouraging comments and suggestions which helped to improve the quality of the paper. In the following we quoted each review question in the square brackets and added our response after each paragraph.

[There are three major weakness in the paper. (1) Why only two years analyzed? The authors do not explain why only 2005/06 were used for the interannual comparison, and why a more extensive analysis of multiple years was not undertaken. The authors' conclusions were based on comparison of only 2 years. They would be greatly strengthened by an extended multi-year analysis.]

Currently, we only have 7 years of data for the Asian SDS-process numbers from spring

2000 to 2006 which the correlation studies were based on. We chose 2005/2006 as the contrasting years to investigate the factors that control the trans-Pacific transport of soil dust. It is evident that springtime dust aerosols were transported to North America in greater amounts in 2005 than in 2006 relative to their SDS process numbers in China. We analyzed the reason for this difference by investigating three major factors controlling Asian dust trans-Pacific transport.

This is to increase our understanding of the relationship between Asian dust and the ambient PM levels in North America. We agree that if we advance this research with the extended observation data of SDS-process in East Asia and PM in North America for a longer time period, the conclusions would be greatly strengthened.

We have added the above-mentioned explanation in the section "Conclusion".

[(2) Insufficient reference to prior literature. The literature on transPacific transport of dust is not huge, although it continues to grow. Below are some additional references the authors may wish to consider including. Also, the authors should specifically state what prior literature mentions/discusses one or more of the issues that they address (namely, the correlation between Asian dust storms and N American PM levels and the 3 controlling factors). As the paper stands now, the reader does not get a good idea of what previous work the authors are building off of. In other words, the paper should state clearly what previous has been done (in relation to the correlation and 3 factors) and how the present work builds on and extends this previous work. Suggested addition references:]

Thanks to Referee 2 for the suggested references, we have incorporated relevant references into the corresponding sections of the paper (see attached lists of references).

[(3) Writing quality poor. The quality of the English in the paper is poor. The logic and reasoning is often difficult to follow. The paper requires substantive editing. The authors make great demands on the reader to untangle the logical organization of the paper.]

The paper is substantively edited, and the English grammar and style are carefully checked and improved.

[Jie Xuan et al., "Identification and Characterization of Sources of Atmospheric Mineral Dust in East Asia," Atmospheric Environment 38 (2004): 6239-6252. LOCATION OF DUST SOURCE REGION IS ANOTHER FACTOR THAT THE AUTHORS DID NOT ADDRESS. IT MAKES A DIFFERENCE, FOR INSTANCE, IF THE SOURCE REGION IS THE TAKLAMAKAN AREA OR GOBI.]

We agree with the reviewer that the starting location of any SDS in China is another factor that may influence the correlation between SDS process number and ambient PM in North America. Furthermore, the importance of the weather pattern between northeast Pacific and western North America should also be emphasized in determining the amounts of Asian aerosols arriving into western North America. In view of the uncertainty in the SDS transport in China [Xuan, et al., 2004], we only used the total dust emission from the all locations and source strengths for Asian Dust and its trans-Pacific transport in spring 2005 and 2006.

[SPECIFIC COMMENTS: p 9665, lines 27-29: The authors state that "one question that remains . . ." is the relationship between Asian dust and N American PM levels. This statement is too general. The gap in knowledge that the authors are addressing should be stated more precisely. Previous work has established a 'loose' connection between the frequency and strength of Asian dust storms and the frequency and strength of dust transported to N America (eg, Jaffe, D; McKendry, I; Anderson, T; Price, H. 2003. Six 'new' episodes of trans-Pacific transport of air pollutants Atmospheric Environment. 37(3): 391-404). [Note: Given that Jaffe is one of the authors of this article, I am surprised that this reference wasn't cited in the article.] However, what the authors are doing is increasing the quantitative precision of our understanding of the relationship. In addition, there is another "question that remains" that the authors have addressed - "what are the factors controlling the relationship?" This is the second area where the authors are seeking greater precision of understanding. This second

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"question" also needs to be explicitly stated.]

We agree with the reviewer's comments and have changed the statement into " .. one question that remains unsolved concerning the Asian SDS is the quantitative relationship between the frequency and strength of SDS in Asia and the frequency and strength of dust aerosol transported to North America".

The other remaining question is the relative amount of dust aerosol transported into North America with respect to the dust frequency in China. In other words, if the correlation between Asian SDS and North American PM level are less significant in some years, why? We tried to investigate the three major factors controlling the transport and deposition of dust aerosols over the Pacific using the 2005/2006 cases as an example to illustrate the difference.

[p 9668, lines23-25 The sentence about "good agreement" between model and AERONET needs to include a statement that the agreement was for AERONET data at Trinidad Head and Saturna Island. Without this, the sentence implies agreement for all AERONET data.]

We have added "at Trinidad Head and Saturna Island" in the sentence.

[TECHNICAL CORRECTIONS: Table 1. This table is confusing to read. Need to make clearer the "dust budget". (ie, emission - removal = remainder). "Dry deposition" should not appear on the line above "East Asian subcontinent" and "North Pacific". This is what makes it confusing to read. Also, need to state that "remaining after removal over Asian continent and Pacific Ocean" = "amount contributing to N American background". This is implicit but need to state it explicitly.]

To avoid the confusion we have modified the form of table 1 and added "Remaining after removal by Dry and Wet Deposition over East Asia and North Pacific is Asian dust amount contributing to North American PM-background" in the title of table 1.

[Figs 1 and 2a. Include names of all 17 Chinese sites as was done for the 15 IMPROVE

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sites. Might be a good idea to include a map of all the stations on both sides of the Pacific. This will be a good aid to visually understanding the data on both sides of the Pacific that is being compared.]

We have added the table as the following table 2 to aid to understanding the data on both sides of the Pacific that is being compared.

[Why doesn't Fig 2a (or another figure) contain a comparison between the modeled concentration and measured concentration for the 17 Chinese stations? Fig 2a only compares modeled concentrations. Nothing is said about measured concentrations at the Chinese sites.]

We have exchanged figure 2a with 2b so that figure 2a compares the modeled surface dust concentrations with observed PM10 at the 17 stations (table 2) in northern China for spring 2005 and 2006, and figure 2b is interannual variations of modeled surface dust concentrations at the 17 observation stations between spring 2005 and 2006.

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