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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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GENERAL COMMENTS: In this paper, the authors first establish a correlation between the number of dust storms in NE Asia and PM10 concentrations measured at 15 IMPROVE sites in western US over a 7-year period (2000-2006).

They next analyze, using the NARCM model, the production and transport of dust in the spring of 2005 & 2006, and seek to identify factors that explain the difference in production & transport between these two years.

They identify 3 factors that seem to be most significant in explaining the difference.

While the correlation between Asian dust storms and N American PM levels and the

three factors identified by the authors have been separately mentioned in various previous publications, the use of recent Chinese observational data on dust storms and the gathering together of both the correlation data (NE Asian dust storms and N American PM levels) and factor identification makes this paper a useful contribution.

The paper, therefore, functions primarily to solidify previous understandings of transPacific transport of dust and extend its quantitative analysis.

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.

(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: Youlin Yang, Victor Squires, and Qi Lu, eds., Global Alarm: Dust and Sandstorms from the World's Drylands (Bangkok: Asia Regional Coordinating Unit of the United Nations Convention to Combat Desertification, 2001).

L. Natsagdorj, D. Jugder, and Y. S. Chung, "Analysis of Dust Storms Observed in Mongolia During 1937-1999," Atmospheric Environment 37 (2003): 1401-1411. The paper

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does not mention any Mongolian data.

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.

USEPA (U.S. Environmental Protection Agency), “Impact of April 2001 Asian Dust Event on Particulate Matter Concentrations in the United States.” In National Air Quality and Emissions Trends Report, 2003 (Washington, D.C.: U.S. Environmental Protection Agency, 2003) THIS REFERENCE COMPLEMENTS THE OTHERS ON THE APRIL 2001 EVENT.

J. T. Merrill, M. Uematsu, and R. Bleck, “Meteorological Analysis of Long Range Transport of Mineral Aerosols over the North Pacific,” J. of Geophysical Research 94 (1989): 8584-8598; D. A. Braaten and T. A. Cahill, “Size and Composition of Asian Dust Transported to Hawaii,” Atmospheric Environment 20 (1986): 1105-1109; J. R. Parrington, W. H. Zoller, and N. K. Aras, “Asian Dust: Seasonal Transport to the Hawaiian Islands,” Science 220 (1983): 195-197; Mitsuo Uematsu et al., “Transport of Mineral Aerosol from Asia over the North Pacific Ocean,” J. of Geophysical Research 88, no. C9 (1983): 5343-5352; R. A. Duce et al., “Long-Range Atmospheric Transport of Soil Dust from Asia to the Tropical North Pacific: Temporal Variability,” Science 209 (1980): 1522-1524; G. E. Shaw, “Transport of Asian Desert Aerosol to the Hawaiian Islands,” J. of Applied Meteorology 19 (1980): 1254-1259; Tsunogai et al., “Chemical Composition of Oceanic Aerosol.” THIS IS A SET OF ‘HISTORICAL’ (IE, PRE-1990) WORKS ON TRANSPACIFIC TRANSPORT OF DUST.

John H. Seinfeld et al., “ACE-Asia: Regional Climatic and Atmospheric Chemical Effects of Asian Dust and Pollution,” Bulletin of the American Meteorological Society 85, no. 3 (2004): 367-380. AN ADDITIONAL GENERAL REFERENCE TO HUEBERT’S

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ON ACE-ASIA.

Richard A. VanCuren et al., “Asian Continental Aerosol Persistence above the Marine Boundary Layer over the Eastern North Pacific: Continuous Aerosol Measurements from Intercontinental Transport and Chemical Transformation 2002 (ITCT 2k2),” J. of Geophysical Research 110, no. D09S90 (2005): doi:10.1029/2004JD004973. AN ADDITIONAL REFERENCE TO THE VANCUREN CITED IN THE PAPER.

(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.

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 “question” also needs to be explicitly stated.

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

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all AERONET data.

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.

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

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.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 9663, 2007.