

Interactive comment on “Trans-pacific transport and evolution of aerosols: Evaluation of quasi global WRF-Chem simulation with multiple observations” by Zhiyuan Hu et al.

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Using various observational datasets, the present study has evaluated the performance of the quasi-global WRF-Chem model in terms of simulating both meteorological fields and aerosol properties over the Pacific region. Code modifications for a quasi global WRF-Chem simulation were conducted at the Pacific Northwest National Laboratory (PNNL), and the modifications are planned to be incorporated in the future available release of WRF-Chem. The overall conclusion of the present study is that the model well simulated spatial and seasonal variability of both meteorological fields and aerosol

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properties across the Pacific region. Apart from running the WRF-Chem model on the quasi-global scale, which has already been conducted and its performance evaluated by Zhao et al. (2013b), the present study does not provide any new insights into the concept of transport of aerosols across the Pacific Ocean. Nevertheless, the observed datasets that have been gathered and the conducted numerical simulation have the potential to extend the current knowledge of the scientific community on the meteorological influences on transport of aerosols across the Pacific Ocean in different seasons. My general comment is major revision of the manuscript, both in the review provided in the introduction and in the analysis of the results. More details are provided below.

Specific comments: 1. The first paragraph of the introduction section discusses about the trans-Pacific transport of aerosols which has already been well known, and with much more details have been already discussed in previous articles. Seasonal variations in aerosol optical depth across the Pacific that have been later discussed in Section 4.2.1 do not add any new insights into the current understanding of the subject. What is more important and should be discussed in the introduction and later on in the results section of the manuscript are different meteorological mechanisms that are responsible for both emission (particularly for natural aerosols such as dust) and transport of aerosols in different seasons. In this way, part of the strong seasonal variations in aerosol optical depth that have been presented in Figs. 4 and 5 can be explained. For example, as discussed by Alizadeh-Choozari et al. (2014) both shifting and strength of the prevailing wind over the Pacific Ocean are responsible for the transport pathway of aerosols and the extent that they can travel. In addition, as depending on the season, aerosols are transported at different elevations across the Pacific Ocean, the meteorological conditions behind such seasonal variations can be fully discussed. As an example, such factors for May 2007 are discussed by Uno et al. (2009). 2. The averaged methods that have been used in the study caused the observed and simulated data to be missing over large areas in summer. This has led to the wrong conclusion that summer is the cleanest season in Regions 2 and 3 (lines 355 and 406, and Fig. 5), while in reality this is not the case. 3. As the authors

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mentioned, there have been some modifications to run the WRF-Chem model on the quasi-global scale. Please briefly discuss these changes in the model description as this is a quite new aspect and novelty of the present study. 4. Due to many writing problems, the manuscript should undergo a language revision. 5. Last paragraph in page 5: The work of Alizadeh-Choobari et al. (2015) can be cited and discussed here. They conducted the WRF-Chem model to study the global distribution of mineral dust and its radiative forcing on the global scale.

Technical corrections: Line 23: Write the WRF-Chem in full as it appears the first time in abstract. Line 25: Add “the” before “first time” Line 57 and in other parts of the manuscript: Add “the” before “Pacific Ocean” It is better to remove lines 127 to 131. The version of WRF-Chem can be mentioned in Section 2.1. Line 147: You have mentioned that “cloud-ice-borne aerosols are not explicitly treated in the model”. Is it parameterized? Please specify that. Line 325: Remove “of” before “2010-2014” here and throughout the manuscript. Line 338: Discuss possible explanation for the overestimation of model simulation in the specified regions. Line 548: You mean “the total aerosol amount”? Line 593: remove “for first time”

References Alizadeh-Choobari O., Sturman A., Zawar-Reza P. (2014) A global satellite view of the seasonal distribution of mineral dust and its correlation with atmospheric circulation. *Dynamics of Atmospheres and Oceans* 68, 20-34. Alizadeh-Choobari O., Sturman A., Zawar-Reza P. (2014) Global distribution of mineral dust and its impact on radiative fluxes as simulated by WRF-Chem, *Meteorology and Atmospheric Physics* 127, 635-648. Uno I., Sugimoto N., Eguchi K., Yumimoto K., Takemura T., Shimizu A., Uematsu M., Liu Z.Y., Wang Z.F., Hara Y. (2009) Asian dust transported one full circuit around the globe. *Nature Geosciences* 2 (8), 557–560. Zhao C, Chen S, Leung LR, Qian Y, Kok J, Zaveri R, Huang J (2013) Uncertainty in modeling dust mass balance and radiative forcing from size parameterization. *Atmospheric Chemistry and Physics* 13(7), 10733–10753.

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