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Geoscientific Model Development Discussions
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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.

Anonymous Referee #3

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This manuscript presents the model evaluation of 5-year quasi-global WRF-Chem simulations using various surface and satellite observational and reanalysis datasets. Despite the lack of direct aerosol measurement data especially over East Asia and Pacific Ocean, authors are able to use available satellite or ground-based retrieved aerosol optical properties such as AOD, AAOD, and EAE to compare with simulations and draw the conclusion that WRF-Chem model can well simulate the spatial and seasonal variability of aerosol properties and transport and evolution of aerosols over the trans-Pacific domain during the 5-year time period. This manuscript is generally well written with many interesting analyses. It's definitely of scientific interest to the research community and I would recommend it to be accepted after a minor revision.

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Discussion paper

Specific comments:

Lines 110-111: Using in-situ observational aerosol (including dust) data to evaluate the simulations especially over pollutant source regions such as East Asia for the trans-Pacific domain is critical to demonstrate the model's capability in accurately simulating aerosol transport/evolution. There are actually a few regular networks from China, Japan, and Korea that provide long-term observational or observational-derived data for PM2.5 or PM10 to the public. However it takes some efforts in order to collect those data and might be out of the scope of work to the authors. At least I would like to see this lack of evaluation using in-situ data to be acknowledged as a limitation in the summary section.

Lines 338-339: What may cause this large overprediction for precipitation (authors didn't show any statistics, however from the plots alone it seems that the overprediction is more than 50% for some seasons)?

Line 344: WRF-Chem provides AOD on several wavelengths, none of which are exactly 550 (for AERONET and MODIS) or 500 nm (for OMI). I am curious if any interpolation has been done to match with satellite or ground-based retrievals?

Lines 366-367: There are large discrepancies between MODIS and MISR AOD over western U.S. What are the exact causes? Could authors provide the retrieval uncertainties between two retrievals? Also it seems that high AOD values over western U.S. is collocated with some dust source regions. I would like to see some linkage between the dust performance of the model and AOD here over western U.S.

Figure 8: It should be filled dots instead of black dots. Are there any meaning of the positioning of triangles and circles in addition to representing MODIS and WRF-Chem, since the positioning looks to me quite random?

Lines 428-429: The larger EAE over West Pacific reflects smaller aerosol sizes and should be due to that large particles have been deposited (through either dry or wet

deposition) during the long-range transport.

Line 438: Again any interpolation here?

Lines 556-557: Uncertainties in the model treatment of aerosol thermodynamics/dynamics (e.g., condensation) may also significantly contribute to the nitrate biases.

Line 583: Are biogenic emissions from MEGAN? This information should be added in the model description.

Technical notes:

Figure 5: The variation bar is out of bound in the figure for MODIS in some seasons. This should be fixed. Similar issues also occur in Figures 8 and 9.

Line 409: higher AOD than MISR.

Line 544: sulfate.

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