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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Recommendations on benchmarks for photochemical grid model applications in China: Part I – $PM_{2.5}$ and chemical species" *by* Ling Huang et al.

Anonymous Referee #2

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The manuscript compiles 128 prior publications of chemical transport modeling studies on PM air pollution in China and summarizes model performances in commonly used statistics such as correlation, bias, quantile distribution, etc. I have three major concerns of the manuscript which makes it unsuitable for publication in ACP.

First, treating it as a research article I do not find the manuscript contains new knowledge in its current form. All the graphs and tables are simple summaries of the results from published papers. To justify their study, the authors make an affirmative statement in the introduction that benchmark metrics developed based on US and European studies may not be suitable for model evaluation in China (pg 7, line 5-7) but they do not

show scientific evidence or conduct their own analysis to support this claim. On the contrary, all the benchmark metrics the manuscript recommended have been proposed and used in the US or Europe and none of them is specific to China. The authors made an argument on the correlation coefficient being inconsistently used in prior studies (pg 4, line 10-15). I found this a trivial matter which can be easily reconciled by a careful reading of the reference of interest.

Second, treating it as a review article I do not find the manuscript conducts an objective and comprehensive review. It does not provide any justification for the selection criteria of publications included in the review. For example, what keywords did the authors use to search those 128 papers included in the manuscript? Why was the period of publication limited to be between 2006 and 2019? Why were only four models included?

Third, being a summary of prior modeling studies, the manuscript does not make any attempt to provide useful insights on why the published model performances on PM2.5 in China vary so much as shown in their figures. Is it due to different inventories, chemistry mechanisms, or meteorological fields used? Without this type of discussion, the manuscript would not provide much value to readers.

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