

Review of “**Evaluation of CMIP6 model simulations of PM_{2.5} and its components over China**” by Ren et al.

This paper explores the performance of 14 CMIP6 models in simulating the spatial distribution, temporal variations, and components of PM_{2.5} concentrations in China by comparing the models' historical run from 2000–2014 with satellite-based total PM_{2.5} concentrations and ground-based PM_{2.5} components data derived from the literature. It is found that PM_{2.5} concentrations are generally underestimated, especially in eastern China. The concentrations of five individual components (OC, BC, sulfate, nitrate, and ammonium) are also largely underestimated. The potential causes of model biases and climate impacts on aerosol radiative forcing are also discussed. Overall, the paper is well-written, offering a thorough analysis and discussion that enhances our current understanding of the capabilities of the latest Earth system models. I have a few minor suggestions for the authors to consider.

1. Since the satellite-based PM_{2.5} is one of the primary datasets used to validate CMIP6 output, it would be informative to include details about the dataset in section 2.2. This could involve specifying the aerosol species simulated by the GEOS-Chem model, discussing the accuracy of this dataset in comparison with PM_{2.5} ground observations (if available), and providing information on the ground observations in China used in the dataset.
2. It may be helpful to explain why dust and sea salt concentrations are excluded from the PM_{2.5} component analysis. For instance, are the ground observations available for these components?
3. In Section 3.2, is the positive trend in PM_{2.5} concentrations in eastern China consistent with findings from previous studies? Do the emissions also show a positive trend in the same period?
4. In line 85, I'm not sure Sockol and Griswold (2017) examined PM_{2.5} concentrations.
5. In line 214, none of the correlations in Fig. 2 are greater than 0.9.
6. In Fig. 2, what does NMB stand for? Normalized mean bias?
7. In Fig. 4, consider marking the area where correlations are statistically significant.
8. In Fig. 6, what do the dotted black lines denote?