

Review comments:

This study applied regional CTMs to study the future climate changes on the inter-regional transport of PM_{2.5} in China. The topic is very interesting. However, the methods described by the authors worried me. In the methods section, the authors listed the equation 2 for the future climate dynamical downscaling. I am not very convinced by the feasibility as described. Are those 5 CMIP6 model outputs were downscaled together and averaged out, or did the authors calculate the climate changes simulated by the 5 CMIP6 models and then add them into the FNL₂₀₁₅ data? If the latter, how is that possible?

When simulating the future climate changes, the authors only ran 4 months (Jan, April, July, October) for the two scenarios, with a few days as spin-up. This is not acceptable to consider the influence of climate variability on the simulation of air pollutants changes.

Editorial comments:

L22: “meteorology” to “climate”

L26: change to “suffer”

No Graphical abstract needed for the journal. The short summary is not needed in the manuscript either, but only during submission.

L42: distinguish the three “Wang et al., 2014”. Also the paper needs to update the recent studies about the PM_{2.5} pollution in China.

L46: add “annual mean”

L51: I assume the 411,000 premature deaths was in China?

L70: I am pretty positive that “Dedoussi et al., 2020” study has nothing with China’s carbon policy.

L82: distinguish the two Liu et al., 2021 studies. The same as in L116-117.

L88: please find the right reference for the CMAQ AER6 module.

L96: define “regional transport” and “regional level” here. This is very confusing to understand the authors’ motivations.

L108-109: The authors regrouped the 21 “quasi-provinces” into five regions, but then the authors claimed that they were studying the city clusters. This is very misleading for the readers.

L129: reorganize the sentence. “their” is not very clear for which was referred here.

L149: “defined as the sum of contribution except for local emission produced” describe how this was calculated.

L150: where are those “densely populated areas”?

L155-156: the explanation for this does not make any sense.

L166: “In general, the largest source of PM_{2.5} is local contribution,” I found this statement is not quite true. If you count the dark colors in Fig 1d, there are 11 out of 21 regions that local emissions dominates more than 50% of total PM_{2.5}. It seems to me that the local sources are as important as regional transport.

L199: these “inner-regional transport (from nearby provinces within the same region), and across-regional transport” should be defined earlier in the methods. So the readers will understand what the authors are trying to study.

Table 1:

Change “2050 friendly climate” to “2050 climate friendly”

Fig. 1. In Fig 1 (d), these abbreviations of provinces in China are hard for the authors to comprehend the message from this plot. The authors probably can add the full names in (b) or (c).

Fig. 6: put all the legends “(a) Source ” and “(b) Source” on the same levels.