

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-201

Anonymous Referee #1

Referee comment on "High-resolution modeling of the distribution of surface air pollutants and their intercontinental transport by a global tropospheric atmospheric chemistry source-receptor model (GNAQPMS-SM)" by Qian Ye et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-201-RC1>, 2021

General Comment:

The manuscript of 'High-resolution modeling the distribution of surface air pollutants and their intercontinental transport by a global tropospheric atmospheric chemistry source-receptor model (GNAQPMS-SM)' written by Qian Ye presented the source-receptor analysis based on the developed model of GNAQPMS. This topic is highly important to understand the intercontinental transport and toward the emission regulation for better global air quality. At the conclusion section, authors claimed that "We give our opinions on the controversial topic of the intercontinental transport of pollutants. The model that we developed creates a link between the scientific community and policymakers". Nonetheless to this statement, this manuscript mainly focused on the presentation of model evaluation and the source-receptor results within this study. Regarding the source-receptor analysis, comparison with HTAP outcome have been provided, but it is insufficient. Because the result of source-receptor analysis depends on its mathematical configuration, careful interpretation and detailed comparison and its discussion to other relevant studies are essentially requested. I would like to request the major revisions to consider the possible publication of this manuscript from GMD.

Major comment:

Even though this manuscript entitled "source-receptor model", the discussion in the result of source-receptor relationship with other relevant studies are immature. As we can follow from the configuration presented in Eq. (3), the tagged method will trace the geographical location where produced. This study presented the global-scale source-receptor relationships; however, how can we understand the air pollutants' production during long-

range transport? The presented Figure 14 shows large impact by "OCN" source for O₃. For example, NAM was dominated approximately 20% by OCN. In this case, where this O₃ transported from and produced? As seen from Figure 15, the contribution of EA is penetrated in NAM region; therefore, direct transport of O₃ produced over EA and additional O₃ impact produced over Pacific ocean could be found over NAM? If this is true, EA posed only 3.6% contribution over NAM but EA should be considered important source over NAM. Despite this large contribution by OCN, discussion was insufficient. Ultimately, how can we apply this OCN impact on policy making?

Specific comments:

line 67-69, 82, 85: The models name of "STEM", "CAMx", "MOZART-4", "GEOS-Chem", "CHASER", "TM5" (ant other models if used) are needed to be explained.

line 89-90: This sentence should be revised to define "GNAQPMS" first.

line 141: "each pollutant" (CT in this context) is "each tagged pollutant"?

line 145: After Eq. (1), the wording of "labeled" is used. Is this same to "tagged"? If this is different, the meaning of "label" should be explained. If this is same, it is better to unify the expression to avoid the confusion.

line 184: It seems to be better to define all abbreviations used in Fig. 1a here, or please prepare the table information (possibly within Table 1). It is confusing to be defined it every time used in discussion section.

line 198: Why NH₃ and NMVOC were prepared from different emission inventory? The description of these emissions have been provided; however, there is no reason to conform them. It should be stated. In addition, these emission years are also different from the simulation year (2018). I understood that the time-lag in emission inventories, but do the authors have reasonable reason (e.g, negligible change between 2015 and 2018) to use different emission in this simulation?

line 241-242: The information for MODIS is not sufficient. Which satellite, products and its resolution? In addition, the appropriate reference should be stated.

line 269: What stands for "BCC"?

line 274-275: When did we find this injection? JJA? Figure 3 only represents annual averaged data and where can we trace the seasonality?

line 308: What is the target year of these studies for CO? Remind that the simulation in this study is not consistent to the year of emission inventory.

line 314 and Figure 4: I guess that white color indicated the deficit of measurement. The simulation result did not show such deficit, so are there no treatment to consider the measured deficit grid in the model comparison? There is no available information of AK in TROPOMI retrieval? The comparison methodology was not provided enough.

line 326 and Figure 5: Same comment on Figure 4, but in this case, model simulation was not shown over high-latitude region. Again, in addition to the lack of description on MODIS dataset, the comparison methodology was not given appropriately.

line 373-375: It is ambiguous that whether this is the additional experiment or included as presented study. If modeling results have been presented by including this emission inventory, this statement have to be explained in Section 2.4.

line 453: What means "large-scale"?

line 472-473: Here mentioned on dust and sea-salt, but the analysis is focused on PM2.5. I guess that PM10 could be largely affected by these natural sources whereas PM2.5 would be mainly composed by anthropogenic sources. I can partly understand the following discussion, but for example, approximately half of PM2.5 source over NAM is attributed to natural sources. Are these consistent to or different from other researches? Moreover, the configuration of source-receptor analysis posed "OCN". Did "OCN" source represent sea-salt sources? Why it was separated as natural sources?

line 502 and Table 2: There is no citation for relevant studies of source-receptor relationship in South Korea and Japan. It is requested to be carefully reviewed other source-receptor studies. What is the consistency and/or difference from the result of this study?

line 615 (caption of Table 3): "The median and range of the annual averages of the 6 models are given below." Is stated, but where is indicated? Is this statement mention on

"reference" column?