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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Local and regional contributions to fine particulate matter in the 18 cities of Sichuan Basin, southwestern China" *by* Xue Qiao et al.

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Response to RC # 2

Dear reviewer,

Thank you for the comments to help improve the quality of the paper. We have revised the manuscript to address your comments and a detailed response to each comment is provided in this file. The comments are in regular font and the responses are in blue.

Referee 2: This is an interesting study about the relative PM2.5 contributions from local and nonlocal emissions. It is well written and provides valuable information for

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understanding the air pollution over Sichuan Basin. I recommend its acceptance for publication after minor revisions.

Response: Thanks.

General Comments (1) For study reviews regarding the relative contributions from local and non-local emissions, a recent paper by Zhao et al. (2019, DOI: 10.1029/2018JD028888) could be cited, which showed the significant local emission contributions in an industry city over North China Plain region. In this study, they proposed an observation-based method: they determine the local primary emission contribution based on network observations of PM2.5 in a city. Moreover, Zhao et al. (2018) also estimated the contributions of local primary emission, transport, and secondary formation based on a dispersion model. It could be also cited in Lines 58-60, 63- 66, 216-218.

Response: We have cited these references in the introduction section.

(2)The reasons for your source region classification should be provided. Moreover, uncertainties in the analysis results caused by potential errors in the a priori emission maps should be investigated, or at least briefly discussed.

Response:

The reasons for source region classification are presented in the first paragraph of section 2.2: “The geographical regions of emissions are classified into nine source-regions. As Chengdu and Chongqing are the two largest cities in western China and within the SCB, we classified Chengdu, eastern Chongqing, and western Chongqing into three individual regions (R4, R5, and R1, respectively). Western Chongqing is well urbanized and eastern Chongqing is mostly rural areas. The five cities in the north-eastern SCB (Bazhong, Dazhou, Guangyuan, Guang’an, and Nanchong) are grouped into R2, as they have relatively lower anthropogenic emission densities compared to most of the other SCB cities and they are located in the upwind areas within the SCB

(Qiao et al., 2019). The rest SCB cities are grouped into R3. Sichuan Province excluding those cities within the SCB is R8, most of which remote rural areas. R6 includes three provinces to the south of the SCB and R7 has the Chinese provinces to the east and northeast of the SCB. R9 includes the other jurisdictions to the west of the SCB, including Xinjiang, Qinghai, Gansu, Tibet, and other countries."

We do not have uncertainty data of emission inventories, so we cannot analyze the potential errors due to the uncertainties from emission data. We added a sentence to note the readers regarding this at the end of second paragraph in section 2.2: "It should be noted that the uncertainties in emission inventories potentially lead to uncertainties in the contributions."

(3) If possible, comparisons with observation-based results will be very helpful and necessary.

Response: To date, there is no observation-based results to quantify source-region contributions to PM2.5 for the Sichuan Basin. The HYSPLIT and PSCF models were used to understand the potential source regions only for some pollution events in the cities of Sichuan Basin, and the source-apportionment results of the HYSPLIT and PSCF modeling were not quantitative. Thus, no changes were made.

(4) The paper is well written. However, a few writing issues could be solved with a careful revision. For example, blank space is needed between references in the context.

Response: We went through the manuscript carefully for a few times and modified where needed.

Detailed comments: Line 46-48, Before diving into aerosol transport, the potential sources for aerosols should be introduced, such as local emission, transport, and secondary formation. Actually, Zhao et al. (2018, Growth rates of fine aerosol particles at a site near Beijing in June 2013) have shown strong fine aerosol growth rates, which could contribute a lot to measured aerosols. Zhao et al. (2018) mentioned earlier also

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showed strong local emission contributions in an industrial city.

Response: We have added a paragraph in the beginning of this manuscript: “Particulate matter (PM) is one of the major air pollutants in China, including primary and secondary components. Primary PM (PPM) is directly released from emission sources, while secondary PM is formed from their precursors, such as sulfur dioxides (SO2), nitrogen oxides (NOx), and ammonia (NH3). All of them are released from local sources or transported for a long distance (Ying et al., 2014; Zhao et al., 2018). The relative contributions of secondary components to total PM2.5 (PM with an aerodynamic diameter less than 2.5 μm) usually increases as PM2.5 concentration elevates in megacities (Huang et al., 2014; Qiao et al., 2018).”

Line 63-65, Qiu et al. (2019, DOI: 10.1021/acsearthspacechem.8b00155) could be cited, which made the source appointment analysis based on PMF method.

Response: Cited.

Line 67-68, This is not a complete sentence.

Response: We have modified this sentence: “There are many types of source apportionment methods, such as receptor-based models, air parcel trajectory models, remote sensing, and chemical transport models (CTMs)”

Line 100-104: Shi et al. (2017, Spatial Representativeness of PM2.5 Concentrations Obtained Using Observations From Network Stations) indicated the spatial representativeness of local PM2.5 observations using observations from network stations, which shows that PM2.5 varies a lot with space and the spatial representation of surface site PM2.5 observations are generally small (0.25-16 km2), which could be used to support the point proposed here - the spatial resolutions of meteorology are too coarse to meet the study goal.

Response: Cited. Thanks.

Section 2: How did you set up the 9 source regions? What are your basis, climate

basins?

Response: In the revised manuscript, we have clarified this in the first paragraph of section 2.2.

Line 137, “domains” -> “domain”

Response: Done.

Line 174, “CMAQ default profiles”

Response: Done.

Line 183-186, “were downloaded” -> “downloaded” or “that were downloaded”

Response: Done.

Line 191, unit should be provided for 2.0.

Response: Done.

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