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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The Contributions to the Explosive Growth of $PM_{2.5}$ Mass due to Aerosols-Radiation Feedback and Further Decrease in Turbulent Diffusion during a Red-alert Heavy Haze in JING-JIN-JI in China" *by* Hong Wang et al.

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Interactive comment on "The Contributions to the Explosive Growth of PM2.5 Mass due to Aerosols-Radiation Feedback and Further Decrease in Turbulent Diffusion during a Red-alert Heavy Haze in JING-JIN-JI in China" by Hong Wang et al. Anonymous Referee #1 Received and published: 22 July 2018 The understanding of atmospheric boundary layer and its impact on air quality is an important issue in atmo-

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Discussion paper

spheric environment study. Focusing this scientific issue, this paper investigated the effect of aerosols-radiation feedback on turbulent diffusion during a Red-alert Heavy Haze in JING-JIN-JI in China, by employing the atmospheric chemical model GRPAES_CUACE with three simulation experiments. It is interesting to investigate the impacts of aerosols-radiation feedback on PM2.5 changes between the climbing stage and explosive growth stage. This study results illustrated that the PBL scheme in current atmospheric chemical models is probably insufficient for describing the extremely stable atmosphere in explosive growth of PM2.5 during severe haze events in JING-JIN-JI in China, which may involve in two important reasons: One is the absence of online calculation of AF, another is the deficient description of the extreme weak turbulent diffusion in the PBL scheme in the atmospheric chemical model. This manuscript presenting the interesting results could improve our understanding on environment changes and fall within the scope of ACP. I suggest the minor revisions before it is published as follows:

Response: We would like to heartily thank the reviewer for his serious review on our work and the valuable comments. We carefully considered comments of the reviewer and revised the paper accordingly, one by one of the following:

Comment 1 The paper needs to give the model settings of GRPAES_CUACE, such as physical and chemical parameterizations.

Response: The model settings including dynamic frame, physical and chemical parameterizations is summarized in Table 1 and the related text is rewritten in line 92-128 in section 2.1 in the revised manuscript.

Comment 2. It needs to add meteorological factors evaluation, especially wind speed, because wind speed has a deeply influence on diffusion of PM2.5, and temperature inversion in PBL.

Response: Wind speed evaluation and study (figure 3) are added in the revised manuscript; Geopotential height and temperature are also offered in figure 2 in the

revised manuscript. The related text is also added in the manuscript.

Comment 3. It could be better to add turbulent diffusion coefficients calculated by observation data if possible.

Response: YesïijŇit is better if the turbulent diffusion coefficients based on observation data is calculated and compared with simulated ones. This need the daytime observation data of vertical profiles of PBL meteorology including wind, potential temperature, and PBL height ect. Unfortunately, the sounding meteorology data in the study area are at 00 UTC(early morning in local time) and 12 UTCïijĹdusk in local timeïijĽ, so it is very difficult to add turbulent diffusion coefficients calculated by observation data at present.

Comment 4. Please compare the downward long radiation in three experiments to figure out the contribution of aerosols.

Response: The downward shortwave radiation fluxes due to AR and DTD (figure 5 and the related text) are added in the revised manuscript according to the reviewer's comment.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-512/acp-2018-512-AC1-supplement.pdf

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