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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.

Anonymous Referee #3

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This paper deals with the effect of "aerosols-radiation feedback" and "decrease in turbulent diffusion" to "the Explosive growth of PM2.5 mass" in Jing-Jin-Ji area, northern China. Numerical experiments are carried out for three runs, the first run absents "Aerosols-Radiation Feedback", the second run is with normal Aerosols-Radiation Feedback, and the third run is with reduced Turbulent Diffusion in addition. A one-week haze event is modeled. Results of these runs, one by one, show improvement to reproduce the observed results.

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Discussion paper

My major concern and suggestion: 1)This paper proposes a sensitive test on factors that influence the model result. But in the paper, results are directly presented, no middle results or any more supporting materials. Therefore, the conclusions are not convinced. 2)Reducing DC may lead the meteorological model running unrealistically. Details about the change of wind field etc. need to be displayed. 3)Need description: synoptic background/weather condition for this haze event. 4)Details of the model are needed, particularly the parts of lower atmosphere, levels, PBL scheme, surface model, radiation, aerosol absorption, etc. 5)PBL is mentioned as an crucial part in the paper, but no information about PBL is illustrated.

Other points: 1)"Jing-Jin-Ji", not to be "JING-Jin-Ji" etc. different forms. 2)Too many abbreviates, and their combination, hard to read the text; There are only 3 experiment runs, number them as Run 1∼3, may be clearer. 3)Page 4, line 70-72:"One is that aerosols radiation feedback (AF) is not calculated online in the model run. AF can restrain turbulence by cooling surface and PBL while heating the atmosphere above it", Result of AF is mostly determined by absorbing aerosols, and by their vertical distribution. 4)Page 4, line 77: "A Red-alert Heavy Haze occurred on 15 to 17 December", 15-23 Dec. 5)Page 4, Section 2.1, the model GRAPES_CUACE need to be introduced more detail, as well the setup of the simulations. 6)Page 5, Section 2.2, just lists the air pollutants, not relevant information crucial to this paper is given. 7)Page 5-6, Section 2.4, too simple in description. Table 1, repeated, but still too simple. 8)Page 6, line 131: "which is named as the explosive growth (EG)", this is the first time mentions "explosive growth". Nothing is known what is the cause of EG: chemistry, transport, or accumulation of air pollutant? 9)Page 6, Section 3.1, only PM2.5 is investigated. What about its source: primary or secondary? What about other pollutants? And their effect on PM2.5 concentration? 10)Page 7, Section 3.2, directly presents result of temperature profile, no logic description about the relation of AF and inversion strengthening. No qualitative and quantitative assessment on question if the result is right or correct. 11)Page 8, Section 3.3, the text is very difficult to read through since too many abbreviates. 12)Page 9, line 220-221: " significant decrease in turbulent diffusion on PM2.5 during

EGS and DC_td_af was as low as 14m2/s on 20 December, which decreased about 50% comparing with DC_bk.", this sentence need to clarify. And "DC was 14m2/s", in where? What level? What time? Day or night? 12)Page 10, line 245: "...we name it as 'turbulent intermittent'", What do you mean the 'turbulent intermittent'? Does 'turbulent intermittent' really mean lower diffusion coefficient or mixing rate? 13)Page 10, line 253-254: "for the deficient description of extreme weak turbulent diffusion by PBL scheme in atmospheric models, are studied by analysing the changes of...", nothing about the PBL scheme is presented in this paper. 14) in Table 1, "retaining 20% (reducing 80%) of normal turbulent diffusion", How to do this? Reducing the value at all the model domain? 15)in Figure 5, the DC, at what position? What level/height?

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