

Interactive comment on “Simulating aerosol–radiation–cloud feedbacks on meteorology and air quality over eastern China under severe haze conditions in winter” by B. Zhang et al.

Anonymous Referee #1

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This study attempts to quantify the influences of the aerosol feedbacks on meteorology and air quality during a severe haze episode which occurred in January 2013 over eastern China. Three scenarios of WRF-Chem simulations were conducted to further differentiate the aerosol radiative and indirect effects. In general, it is a worthwhile analysis which should be published. I have two concerns about the manuscript as it stands. First, estimates of feedbacks were filtered in a statistical way, as shown in Figure 7–10. More discussion is needed to explain how the Student's *t* test was employed to distinguish the aerosol-induced changes from the system noises. To my understand-

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ing, aerosol indirect effects may not be that straightforward as direct effects which can be simply attributed to the aerosol loading. Second, as claimed in the manuscript, the PM_{2.5} was wrongly calculated by the model after the inclusion of aerosol indirect effects. Assuming that is true, I don't think the PM_{2.5} in BASE scenario is appropriate to be used for comparisons against observations, as presented in Figure 11 and 13. Considering large uncertainties in the estimation of aerosol indirect effects which are also less important than radiative effects during this particular episode, I would recommend the authors just focus on the discussion of radiative effects.

Specific:

P 26089, L29: “The model's meteorology is re-initialized every five days based on NCEP”, why need to be re-initialized? Any nudging technologies was adopted?

P 26092, L13: any explanation about the high-bias? Such as land-use type? Lack of aerosol radiative effects?

P 26092, L17: the figures for “00:00” and “12:00” look quite similar, might consider to combine them as one

P 26093, L20: it might be better to do the analysis on daily-averages instead of hour-averages, because of the diurnal pattern

P 26094, L5: lack of the inclusion of aerosol feedback in traditional modeling might also contribute to such low-biases.

P 26096, L7: “are less significant than solar radiation”, how to qualify, in percentage?

P 26096, L20: “aerosol indirect effects play a much more significant role in changing cloud properties”, but mostly in the south, please clarify it

P 26096, L22–25: “The reduction over these relatively clean areas may be explained by the lower particle number concentrations in the BASE scenario than the default droplet number mixing ratio of $1.0 \times 10^6 \text{ kg}^{-1}$ in scenarios without aerosol indirect effect.”, I

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don't understand the sentence, please clarify it.

P 26097, L4: "the most parts of the domain", should be the north of the domain.

P 26097, L10: "indicating similar sources of these pollutants", not true, suggest to delete it

P 26097, L12: "CO is enhanced by up to 446 ppb", is that domain-average? Please clarify it

P 26098, L17: "The reduction of PM_{2.5} in WRF-Chem simulations with aerosol indirect effects mainly comes from two aspects". More intensive precipitations may also help reduce the particles, particularly in the south.

P 26111, Table 2: NMB for T₂ is "-83.3%", the number does not make any sense. Using "K" unit would be better

P 26114, Figure 2: lack of the label for x-axis

Editorial:

P 26088, L18: "the model" should be "the model's performance"

P 26089, L14: "such as" should be "including"

P 26090, L8: "etc" should be deleted

P 26090, L9: "(BASE-EMP)" should be "(i.e., BASE-EMP)"

P 26093, L1: "evaluate" should be "evaluated"

P 26096, L14: "is conducive for" should be "enhances"

P 26097, L9: "the" should be "these"

P 26097, L30: "Reduction" should be "Reductions"

P 26098, L3: "respond" should be "responds"

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P 26116, Figure 4: "stands for" should be "stand for"

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