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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling analysis of the seasonal characteristics of haze formation in Beijing" *by* X. Han et al.

Anonymous Referee #3

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General Comments:

This paper presents a model study upon the haze formation in Beijing, China. It concluded that high PM2.5 loading was the main cause of haze events in Beijing, and that water uptake by aerosols resulted in the frequent formation of haze in Beijing, particularly during summertime. In general, this paper is well organized except some technical defects. However, my major concern is that this paper did not provide new concept or scientific findings relevant to haze. Coupling RAMS-CMAQ with an aerosol optical scheme is not a new idea as a similar study from the same group has been published in another Journal (Atmospheric Environment, 2013, 72: 177-191). Moreover, It is well known in atmospheric physics that high levels of aerosol concentration will resulted in cases of low visibility, and hygroscopic growth of aerosols will enhance the light scat-

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tering capability, or mass-specific light extinction efficiency of aerosol particles. The case of Beijing is interesting because the microphysical properties of aerosols could be different from those observed in US or Europe. Unfortunately, the authors stopped at a general description of the phenomena of haze formation and did not advance further into the details of aerosol chemistry and/or physics. Therefore, I suggest reject this paper from ACP because lack of scientific merits.

Specific Comments:

1. Method Sec: Calculation of light extinction coefficient of aerosols is the key component of this task. In addition to citing references, it is worth a detailed description in this Sec, so that readers know what parameters were used in the model and thereby can make judgment.

2. Model evaluation: it was indicated that the model performed well as shown in the figures. However, there were indeed some cases where the model value was inconsistent with the observation. To perform a model validation, I suggest make the comparison in terms of statistics and refer to Eder and Yu (AE, 2006) and Appel et al. (AE, 2012).

3. Sec 4.1: It was indicated that "the heavy mass burden of PM2.5 was mainly concentrated in four urban areas. . .". However, the urban hot spots were not shown in the figures. Actually, the pattern shown in those figures are more likely caused by a regional pollution event.

4. Sec 4.1: It was indicated that "the distribution patterns of visibility broadly followed those of PM2.5. . .". Don't you think this is a result as expected and is determined by the calculation of visibility in model (i.e. EQ1)?

5. Sec 4.2: Decline in pollution caused by the enhanced vertical convection is a classical case in PBL dynamics. I suggest move forward to investigate factors that were controlling the convection and, in turn, influencing air quality.

6. Sec 4.3: The method for "contribution ratio" calculation is unclear. Are you turning

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off the formation of a specific compound in the model to investigate the corresponding effects? In that case, there could be some bias in the results. For instance, if you turn off the formation of ammonium sulfate then the ammonia will go to nitrate and change the partition and fate of N-containing species in the atmosphere.

7. Sec 4.3: Regarding the case study of size distribution, the mass fraction of accumulation mode was still ∼80% despite the increases in Aitken mode. Thus the changes in the cross section should be rather limited. I'm not convinced that the spike of "mass threshold" was due to increases of Aitken mode aerosols. Moreover, in terms of size distribution, I think that the cases of high coarse mode fraction also worth to be investigated further.

Technical Corrections:

1. Figure 4 contains two identical plots for Baotou, obviously one of them should be for Taishan.

2. In many cases the "diffusion" mentioned in the article should be "dispersion".

3. The caption of Figure 8 is inconsistent with the plots. (circle? line?...)

4. As talking about "pollutant scavenging" I think you are actually talking about "dilution" or "dispersion".

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 30575, 2013.