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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Extreme haze pollution in Beijing during January 2013: chemical characteristics, formation mechanism and role of fog processing" *by* K. Huang et al.

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This manuscript reports the observations as short as only 15 days covering two haze events at an urban site in Beijing in January 2013. Characterization of regular air pollutants (PM2.5, SO2 and NO2) and major compositions (water-soluble ions and elements) of PM2.5 were discussed. Anomalous meteorological conditions in January 2013 were suggested to play a critical role in the formation of the observed extreme haze. That study aims to investigate chemical characterizations and the formation mechanism of the two haze cases in relation to the meteorology, but contents discussed in that manuscript are mostly irrelevant. Apparently, authors believed the se-

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rious haze events were attributed to fog processing, even though RH was often lower than 93% during the study period, which is taken as a threshold of defining a fog event. Based on the threshold, fog took place only in a short period, as seen in Figure 4a. Obviously, the haze formation was controlled by the hygroscopic growth of aerosols under higher ambient RH rather than fog processing. In addition to the fundamental definition of critical concerns, there are other comments as given below. 1. First, the essence for forming haze in China is light extinction effects by particles (too many references to list here) rather than abnormal meteorology, as suggested in this manuscript. The adverse meteorological conditions affect the formation processes of haze through accumulation of air pollutants, especially PM2.5. This point can be referred to previous studies in Beijing (Liu et al., 2013; Quan et al., 2014). However, RH is a very important parameter for haze evolution, but there is little explanation or discussion in this manuscript (Malm et al., 2003; Liu et al., 2013). At least, the effect of RH on visibility should be evaluated. Accordingly, I think the results of section 3.2 in current version are flat. 2. Coarse particle is also important in haze weather formation, although fine particle is the determinant. Thus, PM10 data in January should also be discussed. Moreover, OC and EC account for a substantial fraction in PM2.5, and they are playing an important role in haze formation. They should examine what pattern both OC and EC exhibited in the haze processes. 3. The E-AIM model (IV version) is used to simulate the chemical species in aqueous state based on H+-NH4+-Na+-SO42–NO3–Cl- equilibrium system. However, this version is allowed to be operated only when RH>60%. However, RH indeed was not always higher than 60% during the study period (Figure 4a). The authors also claimed that H+ was estimated by all ions including Mg2+ and Ca2+. Therefore, the input H+-NH4+-Na+-SO42–NO3–Cl- data should not be in charge balance. The authors should provide detailed information on running the E-AIM model. 4. Logical relationship between aerosol acidity and the haze is considerably confused in Section 3.5. This section could not be helpful to address the question how to form the serious haze. 5. How did the authors conclude sulfate and nitrate present in the forms of (NH4)2SO4 and NH4NO3? In fact, ammonium was not enough to neutralize sul-

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fate and nitrate at all, as demonstrated by the data in Table 1. The chemical species (e.g. (NH4)2SO4, NH4NO3, K2SO4) should be derived from the aerosol thermodynamics model results rather than their assumption (Malm et al., 2003). Liu X G, Li J, Qu Y, et al. Formation and evolution mechanism of regional haze: a case study in the megacity Beijing, China. Atmos. Chem. Phys., 13, 4501–4514, 2013. Malm, W.C., Day, D.E., Kreidenweis, S.M., Collett, J.L., Lee, T. Humidity-dependent optical properties of fine particles during the Big Bend Regional Aerosol and Visibility Observational Study. Journal of Geophysical Research, 108, D9, 2003. Quan J, Tie X, Zhang Q, et al. Characteristics of heavy aerosol pollution during the 2012-2013 winter in Beijing, China. Atmospheric Environment, 88,83–89,2014.

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