

Interactive comment on “Analysis of a winter regional haze event and its formation mechanism in the North China Plain” by X. J. Zhao et al.

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This manuscript investigated the regional haze occurred over the North China Plain, provided the reliable data and revealed the formation mechanism of this episode. I do think that this manuscript can be published in ACP with the minor revision.

Some revisions are suggested as below:

1. How the site of SDZ can be the background site? This needs to be clarified. “At SDZ, the photochemical reaction, regional transport and heterogeneous reaction process probably together caused the increase of sulfate and nitrate.” At this so-called background site, it seems there were no sufficient data to support this conclusion. I do not think that it is needed to discuss this background site, if it can really be considered

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to be a “background site”. The weighing of filter does not indicate the condition of weighing, which required constant temperature and humidity, and this is tremendous important for the reliability of those data provided. Page 913, Line 17-19, “Organic material (OM) was obtained by multiplying OC concentrations by a factor of 1.2, accounting for hydrogen and oxygen in the organic compounds...” The factor of 1.2 here seems lower than the real situation. If this can be corrected to be a more reliable number, the role of the OM in the formation of the haze can be seen more significantly. In general, the writing should focus on the “3.3 Chemical characteristics and secondary formation of this episode”, and section 3.1 can be combined in 3.4 section. The abstract seems too long and it can be shortened by one third. I tried to revise as below:

A regional haze episode occurred in the Beijing, Tianjin and Hebei province (BTH) area in the North China Plain (NCP) was investigated. The increase of secondary inorganic pollutants (SO_4^{2-} , NO_3^- , NH_4^+) was observed simultaneously at four sites, especially in the plain area of BTH, which could be identified as a common characteristic of pollution haze in east China. The sulfate and nitrate in $\text{PM}_{2.5}$ were mainly formed through the heterogeneous reaction process in the urban area. The fact of the organic matter (OM) increased more significantly at Chengde (CD) site than the other three sites in plain area suggested the greater regional impact during haze episode. The secondary formation of aerosol was one important formation mechanism of haze. The strong temperature inversion and descending air motions in the planetary boundary layer (PBL) allowed pollutants to accumulate in a shallow layer. The weak surface wind speed produced high pollutants concentration within these source regions. The accumulation of pollutants was one main factor in the haze formation. The enhanced southwest wind in the last period of this episode transported pollutants to the downwind area and expanded the regional scope of the haze.

The saying in page 904, Line 14 “The organic matter (OM) was different from secondary inorganic pollutants, which increased more significantly at Chengde (CD)

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site than the other three sites in plain area.” can be revised as “The fact of the organic matter (OM) increased more significantly at Chengde (CD) site than the other three sites in plain area suggested the greater regional impact during haze episode”

Minor corrections: 1. Page 2. Page 908, Line 14 An Aerosol lidar (ALS300, EZ manufactured by Leosphere) has (here “has” should be deleted) was employed in this field campaign at SDZ. 3. Page 914, Line 7 “However, the percentages were comparable at threes sites” Page 918, Line 13, “. . .was comparable at threes sites. . .”, The word “threes” ,should be corrected to be “three”.

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