

Interactive comment on “A seesaw haze pollution in North China modulated by sub-seasonal variability of atmospheric circulation” by Ge Zhang et al.

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Comment on “A seesaw haze pollution in North China modulated by sub-seasonal variability of atmospheric circulation” by Ge Zhang et al. This paper described distinct pollution levels in two consecutive months of winter 2015 in North China. and argued that such a feature is regulated by meteorological patterns connected to the El Nino and Arctic Oscillations (AO). The study uses observations of one single super El Nino year to raise the hypothesis on ENSO/AO influence on haze distribution. The study then used WRF model simulations of three other super El Nino years to test those hypotheses. In terms of mechanism, this paper claims that the combination effect of El Nino

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and AO can influence the intensity of EAWM and thus result in an anomalous PM_{2.5} levels. I found the overall presentation straightforward and the topic is within the scope of ACP. However, the following concerns shall be addressed before its publication. Major comments: 1. This paper states the importance of boundary layer height several times without mentioning the schemes and calculation used in the model. Please clarify. 2. The simulation domain was not specified at all. It says “. . .with physics options same as those discussed in Gao et al. (2017). . .”. However, in Gao et al. (2017), the simulation was conducted in U.S. but this study is done for East Asia. Please specify the basic domain information. 3. For biomass burning, the paper states “. . .biomass burning emissions include open burning of agricultural residue, calculated based on crop yields, fraction of biomass burned in the open field. . .”. But the paper did not specify the inventory used in this case. So which inventory did you use? FINN, GFED or any other self-developed source specified for this region? 4. The length of spin-up time is questionable. In this paper, the spin-up time for each simulation is only one week. Kumar et al. (2013) shows that it takes WRF-Chem about 10 days to spin-up for free atmosphere and 20 days to spin-up for surface level. 5. Fig. 3, 4 and 5 all stated that “Stippled areas indicating exceedance of 90th confidence interval.” But what kind of statistical test was applied here? Also what are the samples? 6. The last paragraph on future research is also a bit puzzling, running SST forced experiment can be helpful for ENSO, but AO is difficult to be forced by SST. Minor Comments: 1. Please consider to replace the sequential color schemes with divergent color schemes when showing the anomalies (e.g., Fig.1 and Fig.7). Fig 3 is a better example. 2. When drawing the boundaries of NCP in Fig.1, please be more rigorous. The box area is not entirely NCP. It also contains part of Bohai Sea and Inner Mongolia Plateau. Although this may not affect your final results but can cause misleading when saying this is NCP. 3. What is the unit of the wind vector in Fig. 3? m/s? 4. The captions of this paper need to be clearer. There are lots of figures with sub panels (e.g., a,b etc.) but they are not specifically mentioned in the caption. This way of description can be very confusing. 5. Line 204-205: “the emissions of SO₂ in January is usually higher than December

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primarily due to a higher power demand” this statement needs a reference. 6. Fig. 6b shows very low PM2.5 concentrations for major cities other than China and India. Why is this the case? How about cities like Tokyo, Osaka, Seoul and Bangkok etc.? 7. In Table 1, can you explain the large bias of 201512 WD10? It is almost 20 degrees and should not be treated as negligible. 8. Line 62. “Formation” should be distribution. A relevant reference is Chen et al., (2018)

Reference: R. Kumar, M. Naja, G. G. Pfister, M. C. Barth, and G. P. Brasseur (2013), Source attribution of carbon monoxide in India and surrounding regions during winter-time, *J. Geophys. Res. Atmos.*, 118, 1981–1995, doi:10.1002/jgrd.50134
Chen, H., Wang, H., Sun, J., Xu, Y., and Yin, Z.: Anthropogenic Fine Particulate Matter Pollution Will Be Exacerbated in Eastern China Due to 21st-Century GHG Warming, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2018-761>, 2018.

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