

Interactive comment on “Attributions of meteorological and emission factors to the 2015 winter severe haze pollution episodes in Northern China” by Tingting Liu et al.

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sunling@camsma.cn

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1. More evidence or discussion is needed to support the authors' argument that the meteorological difference between winter 2014 and 2015 over North China is related to the strong El Niño in 2015. The analysis presented in the manuscript is all confined to North China, so it's difficult to judge whether the meteorological difference is due to the intrinsic year to year variability on local and regional scale or indeed something related to ENSO. For example, the authors can discuss if prior El Niño winters have seen similar changes in the wind convergence zone over North China. In addition, previous analyses have analyzed the role of winter monsoon on wintertime PM pollution in North China (e.g. Jia et al., A new indicator on the impact of large-scale circulation

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on wintertime particulate matter pollution over China, ACP, 2015). The authors should give a more comprehensive summary of those prior studies that link region- and local-scale meteorology changes to larger-scale variability. In this context, this manuscript might be the first to investigate the role of El Niño on winter time PM pollution in China.

Response: Very good question. To fully answer these questions, we have used the EAR-Interim data from European Centre for Medium-Range Weather Forecasts (ECMWF) in December 1979-2015, including sea surface temperature (SST), mean sea level pressure (MSL), 2-m temperature (T2), 10-m U and V wind component (U10 and V10), to investigate the relationship between ENSO and the air quality in North China. Area averaged SST anomalies (SSTA) over the Niño3 region (5°N-5°S, 150°-90°W) provide an index typically used to represent ENSO variability (Tang et al., 2016). Time series of monthly averaged SSTA over the Niño3 region are shown in Figure S3. Significant ENSO events were found in 1982, 1997 and 2015. The MSL and 10-m wind anomalies over North China region are shown in Figure 7 in the revised manuscript. It is found that ENSO (SSTA>0) results in weaker cold air and northerly wind, vice versa for the La Niña (SSTA<0) periods. These relationships indicate that the worse air quality in December 2015 over North China was correlated with significant ENSO event. Reference: Tang Y. L., Li L. J., Dong W. J., and Wang, B.: Tracing the source of ENSO simulation differences to the atmospheric component of two CGCMs. Atmospheric Science Letters, doi: 10.1002/asl.637, 2016.

2. The manuscript focuses on North China, but only four cities are analyzed. Are these cities representative of the whole region? What is the specific domain of North China? Better to include a regional mean comparison between the two winters in the tables and discussion.

Response: To make study area clearer, the revised manuscript focuses on the severe haze pollution in December 2015 over Jing-jin-ji area. Three important cities, i.e., Beijing, Tianjin, and Shijiazhuang, were selected for the analysis. The regional mean comparison over 13 cities has also been supplied in the revised manuscript.

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3. Pg 2, line 12: change 'drop' to 'dropping' Response: It has been corrected in the manuscript.

4. Pg 3, line 5: change "as high" to "as high as" Response: It has been corrected in the manuscript.

5. Figure 1: missing symbols and legends Response: It has been corrected in the revised manuscript.

6. Pg 7, line 6: what are the emissions control measures implemented between the two years? How significantly are these measures expected to reduce emissions? It will be helpful to describe them in the context of changing pollution levels between the two years.

Response: Thanks for your suggestion. The emission control measures implemented in Jingjinji area have been provided in the revised manuscript. Although the emission reduction in 2015 over China has been released to the public (<http://www.zhb.gov.cn/hjzl/zghjzkgb/lnzghjzkgb/>), the emission reduction over Jingjinji area is still unknown.

7. Pg 7, line 14: change "gathering" to "accumulation" Response: It has been modified in the manuscript.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/acp-2016-798/acp-2016-798-AC2-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-798, 2016.