

## ***Interactive comment on “The Effects of El Niño-South Oscillation on the Winter Haze Pollution of China” by Shuyun Zhao et al.***

### **Anonymous Referee #1**

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The manuscript explores the potential for the ENSO to have influenced the winter haze days and contents of anthropogenic aerosols in China. The observational data and the numerical simulations that was designed to isolate the impacts of ENSO point to an contrasting effect between El Nino and La Nina conditions on changes in the haze days and aerosol concentration over the southern China. However, the analysis and presentation shown in this paper, I think, have several flaws. Therefore, the revision is required to improve the reliability of the results reported.

### General comments

1. Statistical significance: The significance of results has not been discussed except for Fig.4. I recommend the authors show the significance in the figures. Because the authors have conducted multiple ensemble experiments, I think it is possible to do so.

2. Use of emission data for the year of 2010: The aerosol emissions had a long-term trend, the decadal variability, and regional deference. So, I would encourage the authors to check and argue the results for the other years.

3. My understanding is that the effects of ENSO on the haze pollution (or haze seasonal prediction) in southern China depend on the changes in aerosol transport and precipitation associated with changes in the SST patterns. However, I am very confused about the contrasting features of “haze days” and “aerosol concentrations” (Fig.4 and Fig. 9, P1. L19-20, P12. L16-18). I have several questions. Which is a larger damage by haze pollution in El Nino years (less haze days but heavy) or La Nina years (many haze days but moderate) eventually? If it were less precipitation in El Nino years, one can assume that winter haze days in El Nino years increase?

#### Specific comments

1. P3.L13: According to the CAM definition of the haze, relative humidity (<80%) is included in it. Dose this definition implies that the haze days are hard to be counted in the El Nino years because of the rainy years?

2. Figs. 2,3: I ask the authors to show separately the haze days during the El Nino or La Nina years.

3. Representation of geographical names in China (Fig.2, P5): The paper makes use of many area names in China. However, since general readers don't know their location, I would request the authors to plot the important locations in Fig.2.

4. P5. L17-19: The three regions (JJJ, JGZ, GG) are hard to grasp for me. These areas should be shown in the Figures.

5. Fig. 5: I don't understand why the authors represent the mean states in JJA. I think the analysis of the JJA is unnecessary because the paper focuses on the winter season.

6. P10. L7, Fig.10: The authors make a point that “the winter-average wet depositions

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of aerosol over southern China are decreased by La Nina (Fig.10b)". However the wet depositions seem to be increased over the southern China during La Nina, although they are decreased over the south coast of China and the sea.

7. Fig.12: I suggest that the each number of days categorized by "moderate" or "heavy" aerosol concentrations are shown during El Nino and La Nina in addition to the PDF, because I have difficulty reading the small difference between the ENSO from the PDF.

8. P1. L20 and P12. L16-17: Do you use the "aerosol " as a synonymous term for "haze" ? It is confusing for me because the authors do not mention the relationship between aerosol concentration and occurrence potential of haze days.

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