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Interactive comment on "ENSO Effect on Interannual Variability of Spring Aerosols over East Asia" *by* Anbao Zhu et al.

Anonymous Referee #1

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General comments Given that most of the current studies on the effects of ENSO on aerosols focus on winter and very few on spring, the authors analyzed the effects of ENSO on spring aerosols in East Asia using MERRA2 reanalysis aerosol data from 1980-2019. It is pointed out that during the subsequent spring of El Niño (La Niña) event, dry (wet) air and less (more) precipitation favored an increase (decrease) in biomass burning activity in northern Indochina, resulting in more (less) carbonaceous aerosol emissions. At the same time, the El Niño (La Niña)-related anomalous anti-cyclone (cyclone) in the western North Pacific enhances (weakens) low-level south-westerly winds from the northern Indochina peninsula to southern Japan, delivering more (less) carbonaceous aerosols downstream. These result in above-normal (below-normal) aerosols in the Indochina Peninsula, southern China and the ocean south of

Japan. Moreover, the authors note that ENSO's impact on the ensuing spring aerosols is mainly attributed to EP ENSO rather than CP ENSO. The overall structure and layout of the manuscript is clear and the experimental design is reasonable. I will suggest it to be accepted after addressing my comments below.

Specific comments The authors used AOD to represent aerosols throughout the manuscript. It should be caution that AOD is only the optical property of aerosols, which is not fully representative as aerosol mass or loading. AOD depends on aerosol mass, relative humidity, aerosol size distribution, reflective index, and mixing state. . .

Page 3. Besides the impacts of ENSO on aerosols, aerosols can in turn affect ENSO through changing radiative balance and poleward heat transport (e.g., Yang et al., 2016; Lou et al., 2019).

Page 7, Line 25. "The differences between these two phases show similar anomalies to the warm phase but with a larger magnitude." Does the difference between the two phases mean warm phase minus cold phase or the opposite?

Page 8, Line 33. Here, ENSO mainly affects the diffusion process of the local aerosols over northern China in winter, which is incoherent with Zhao et al. (2018)'s result that ENSO influenced the wintertime aerosols over southern China more obviously than it did over northern and eastern China. What caused the differences?

Page 9, Line 9. When calculating the zonal average, the longitude range is 110°∼125°E, while the range taken in the legend in Figure 9 is 105°-120°E.

Typing errors: Page 3, Line 31. The aerosol data are "from" Page 7 Line 4. 1. Large-sale -> Large-scale Page 26, Line4. "nagetive values" should be replaced by "negative values".

References:

Yang, Y., L. M. Russell, S. Lou, M. A. Lamjiri, Y. Liu, B. Singh, and S. J. Ghan, Changes in Sea Salt Emissions Enhance ENSO Variability, J. Climate, 29, 8575–8588,

doi:10.1175/JCLI-D-16-0237.1, 2016.

Lou, S., Y. Yang, H. Wang, J. Lu, S. J. Smith, F. Liu, and P.J. Rasch, Black carbon increases frequency of extreme ENSO events, J. Climate, 32, 8323–8333, doi:10.1175/JCLI-D-19-0549.1, 2019.

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