

This study identified the dominant large-scale circulation associated with heavily polluted days for BTH, YRD and PRD through its effect on the most important regional meteorological variables, and propose specific circulation-based indices for these three regions. This work is meaningful. But there are still some places needing to improve.

1. The study reminded many times about the word “first”, but it is really not the first one to do these investigations. Such Hou et al. (2018, 2020), and so on. Hou et al. (2018) also did many statistical analyses about the indicators. Please cite them.

Hou, X. W., D. D. Fei, H. Q. Kang, Y. L. Zhang, J. H. Gao, (2018). Seasonal statistical analysis of the impact of meteorological factors on fine particle pollution in China in 2013–2017, *Nat. Hazards*, <https://doi.org/10.1007/s11069-018-3315-y>.

Hou, X., Zhu, B., Kumar, K. R., de Leeuw, G., Lu, W., Huang, Q., & Zhu, X. (2020). Establishment of conceptual schemas of surface synoptic meteorological situations affecting fine particulate pollution across eastern China in the winter. *Journal of Geophysical Research: Atmospheres*, 125, e2020JD033153. <https://doi.org/10.1029/2020JD033153>.

2. The dataset used in the study is very important. It determines the credibility of your work. Please add the simple introduction about the dataset in the section of Abstract.

3. About Figure 1, please give more detail description about the classification of three regions.

4. Discussion and conclusions should be a summary of the study. Please make the sentence more concentrated.