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Interactive comment on "Comment on the paper "Insignificant effect of climate change on winter haze pollution in Beijing" by Shen et al. (2018)" *by* Run Liu et al.

Y.H. Ding

dingyh@cma.gov.cn

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Comments: This paper entitled "Insignificant effect of climate change on winter haze pollution in Beijing" by Shen et al. used the first principal component (PC1) of V850 and RH as a haze proxy to investigate the effect of climate change on winter haze in Beijing. The relationship between PC1 proxy and the dipole structure of the Arctic sea ice and the Pacific SSTs is well documented. However, using the PC1 of V850 and RH as a haze proxy is arbitrary, thus derived conclusion claiming insignificant effect of climate change on winter haze pollution in Beijing is also questionable. The major comments are as follows:

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Discussion paper

1. 2010-2017 is a relatively stable period of pollution emissions. In this case, the role of meteorological factors is indeed relatively large, so the PC1 can well characterize the change of PM2.5. But what if there is an increasing trend in pollution emissions? Considering the limited length of PM2.5 data, it is suggested that haze days and visibility data should be compared with the PM2.5 and PC1 series, in order to determine whether the PC1 could be served as a proxy for haze under any pollution emission conditions.

2. In fact, climate change includes both human impacts (anthropogenic effect) and natural variability. It is unclear what the “climate change” in this paper refers to. The PC1 is a combination of V850 and RH anomalies. Their changes are related to PM2.5 during the period of 2010-2017, which is no problem. But their changes may also be related to human activities. A definite conclusion could be obtained only after the attribution analysis is carried out. However, there is no attribution analysis in this paper at present.

3. Some studies show that the increase of haze in Beijing was related to the weakening of winter monsoon over East Asia. Additionally, the Pacific and Atlantic SST showed interdecadal variations which are mainly AMO and PDO, which is mentioned in the paper. However, besides, the SST changes also include the climate warming trend and ENSO events. If the authors want to draw a conclusion on the effects of climate change on winter haze, the attribution analysis is needed to prove that the impact of human activities is insignificant or indirect on the physically-solid basis.

4. The paper claimed that in the future the PC1 had no significant trend under RCP8.5 scenario. We recommend that the trend analysis of PM2.5 simulated by ACCMIP (Atmospheric Chemistry and Climate Model Intercomparison Projection) should be carried out in order to see the future changes in PM2.5.

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