Air pollution is a complicated question, which is caused by both anthropogenic emissions and meteorological conditions. In this study, the authors investigated the possible mechanism for the several haze in December 2016 from the meteorological aspect. They concluded some atmospheric, oceanic, and snow cover factors which are related to the haze in eastern China. The results are interesting and important for us to understand the variability of haze over eastern China. I recommend the publication of the manuscript. However, the manuscript needs some revisions before it can be considered for publication, which can potentially contribute to enhance the value of the manuscript.

Specified comments:

1. The abstract should be reworded to including more physical processes.

Reply:

Following the advice, the "Abstract" was reworded to include the physical processed.

Revision, in the Abstract

……The atmospheric circulations must play critical roles in the sub-seasonal haze events. Actually, the positive phase of East Atlantic/West Russia pattern in the middle troposphere strengthened the anomalous anti-cyclone over NH area that confined vertical motion below. The associated southerly anomalies made the cold air and surface wind speed weaker, but enhanced the humid flow. Thus, the horizontal and vertical dispersion of atmospheric particulates was suppressed and the pollutants gathered within a narrow space. In December 2016, these key indices were strongly beneficial for haze occurrence and combined to result in the severest haze pollution. The influences of preceding autumn sea surface temperature near the Gulf of Alaska and the subtropical eastern Pacific, October-November snow cover in western Siberia and associated physical processes on haze pollution were also discussed.

2. Datasets and method: what is the variable of "surface"? The NCEP/NCAR data are from 1948 onward, not from 1979.

Reply:

The variable on surface is wind.

The available period of NCEP/NCAR data was changed to "from 1948 to 2016".

Revision, in section 2:

The geopotential height at 500 hPa (Z500), zonal wind at 200 hPa (U200), wind at 850 hPa, wind at surface, sea level pressure (SLP), surface air temperature (SAT), surface relative humidity and vertical wind (omega) were available on the website of the National Centers for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR). These NCEP/NCAR reanalysis I datasets had a horizontal resolution of 2.5 °×2.5 °from 1948 to 2016 (Kalnay et al. 1996).

3. For the reanalysis data, I recommend the authors use the NCEP/NCAR or ERA-Interim for analysis. Using a dataset across the study can assure the match guarantee the consistency among the variables.

Reply:

Almost all of the datasets was downloaded from NCEP/NCAR across the study. However, the website of NCEP/NCAR did not support the height of PBL. Thus, only the PBLH was derived from ERA-Interim and the reason was explained the Section 2.

Revision, in section 2:

……For the representativeness of vertical dispersion, the $1^{o} \times 1^{\circ}$ height of PBL (not available on the website of NCEP/NCAR) was also used here, but derived from the ERA-Interim dataset (Dee et al. 2011). ……

4. What time period for the correlations in Table 1?

Reply:

The period was from 1979 to 2016.

Revision:

Table 1 The correlation coefficients between the DHD_{NH} and key indices from 1979 to 2016 and the ranks of key indices in 2016. The Corr Coe[1] and Corr Coe[2] indicate the correlation coefficients that were calculated after and before detrending. The AC was the anticyclone index that was defined as the mean Z500 over 105–125°E, 30–50°E. The local PBL, surface wind speed and relative humidity were calculated as the mean over the NH area. All the correlation coefficients were above the 99% confidence level. The rank was sorted from largest to smallest, when the Corr Coe was positive. If the Corr Coe was negative, the rank was calculated from smallest to largest.

Index	EA/WR	AC	PBL	Wind Speed	Humidity	SST_{EP}	$Snow_{WS}$
Corr Coe[1]	0.66	0.62	–0.59	–0.63	0.49	0.55	0.52
Corr Coe[2]	0.66	0.62	–0.54	–0.62	0.46	0.54	0.50
Rank	3	1	1	6	6	4	1

5. There is no (a) and (b) in Figure 3.

Reply:

The (a) and (b) was not clear in the submitted Figure 3 and they were revised now.

Revision:

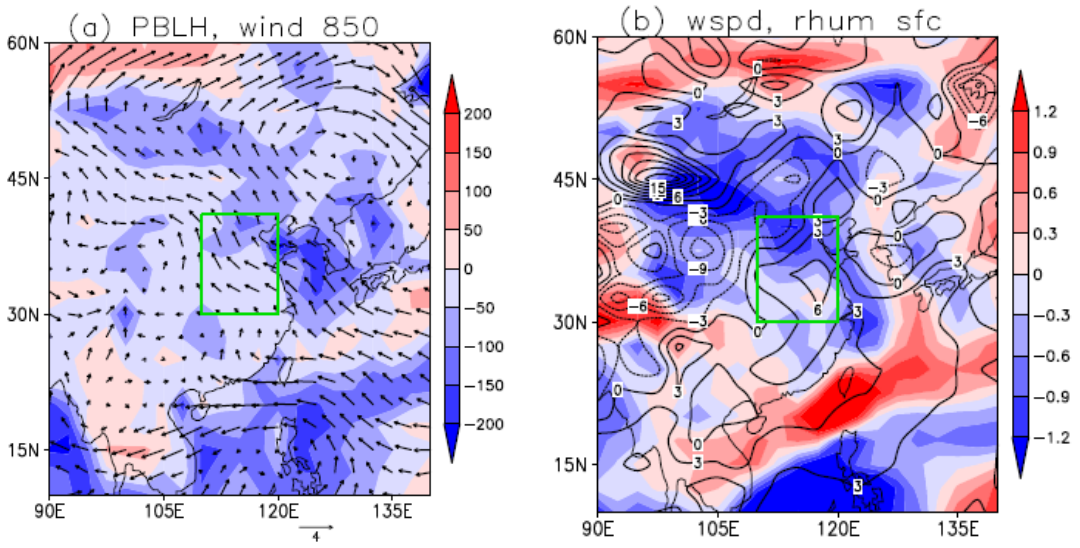

Figure 3 Distribution of the regional atmospheric circulation anomalies, (a) the height of PBL (shading) and wind at 850 hPa (arrow); and (b) the surface wind speed (shading) and surface relative humidity (contour) in December 2016. The anomalies here are calculated with respect to the period from 1981–2010.

6. Figure 6 is the averaged mean over 16-21 December 2016? How did the authors calculate the significant test in Figure 6? Similar question is also to Figure 7, 9, and 10.

Reply:

The data to plotted Figure 6, 7 and 9 was daily reanalysis and long-term-mean daily reanalysis. Thus, the significant test was calculated **basing on the daily data** to evaluate whether the atmospheric circulations in 16–21 December 2016 was significantly different from the climate mean status.

7. The authors should clearly show the definition for the EA/WR pattern, haze event, and surface lift index.

Reply:

(1) The definition of EA/WR pattern was clearly showed in the revised versiom..

(2) The definition and calculation process of haze event was revised and briefly introduced. The full calculation method was well introduced in the referred work of the authors, i.e. Yin et al. 2017. If we repeated the similar content here which is not necessary, the manuscript would become too long.

(3) **To make the Figure 3(a) clearer, the surface lifted index was unused in the revision version.** The indicative function of surface lifted index was repeated with PBLH and anti-cyclone anomalies. The definition of surface lifted index was also

showed below.

Surface lifted index is the lifted index at 500-mb based on the surface parcel and was calculated as the difference between the temperature of the parcel when it was lifted to the upper level and the surrounding temperature. The surface lifted index is a measurement of the stability of an air mass at a given moment.

Revision:

(1) ……The EA/WR pattern consisted of four anomalous centers and the positive phase is associated with positive anomalous height over Europe and northern China, and negative anomalies over the central North Atlantic and north of the Caspian Sea. The EA/WR index was computed by the NOAA climate prediction center according to the Rotated Principal Component Analysis used by Barnston et al. (1987)…….

(2) ……The routine meteorological measurements included relative humidity, visibility and wind speed at surface that were collected eight times per day. The temperature profile was collected with a sounding balloon twice per day. The calculation procedure for the haze data was consistent with that of Yin et al. (2017), which was mainly based on the observed visibility and relative humidity…….

(3)

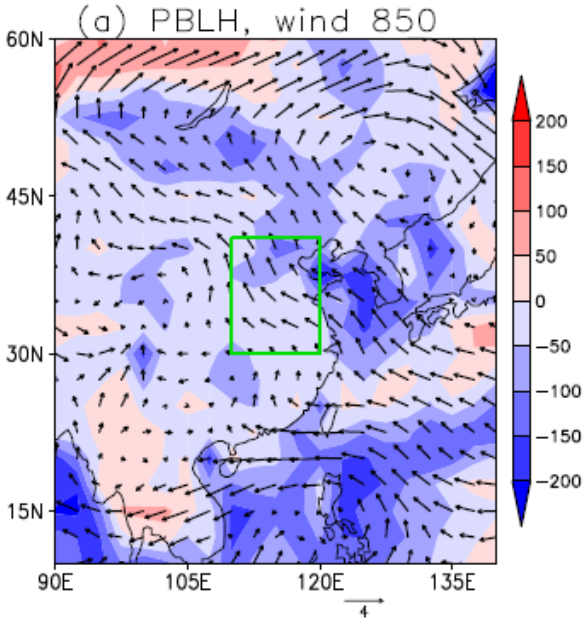

Figure 3 Distribution of the regional atmospheric circulation anomalies, (a) the height of PBL (shading), and wind at 850 hPa (arrow);