

## ***Interactive comment on “Increasing persistent hazes in Beijing: potential impacts of weakening East Asian Winter Monsoons associated with northwestern Pacific SST trend since 1900” by Lin Pei et al.***

**Anonymous Referee #2**

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### **General comments**

This paper studies in detail the statistics of persistent haze events in the Beijing region in China, i.e. of at least 4 consecutive days with haze at more than one station in the region. After discussing the statistics and trends in the duration of the haze events, the study links the occurrence of haze to changes in the meteorological situation, mainly the wind regime connected to the East Asian Winter Monsoon and correlated changes in the northwestern Pacific sea surface temperature (SST). They find that a shift from fresh northerly to more southerly winds in the Beijing region favors the trapping of

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pollution. The southerly winds also transport more moisture into the region further supporting the occurrence of haze.

The study puts together different data sets in order to show correlations of haze occurrence and wind speed and direction, geopotential height and SST. The correlations give support to the explanations for the occurrence of haze days in the region without showing that they are the only reason (as mentioned by the authors in the title “potential impacts of...” and in the outlook in line 341-343). The caveats and open issues should receive some more space in the discussion section.

The English language needs some improvements as already promised by the authors in the online discussion and as suggested in the “Technical corrections:” below.

### **Specific comments**

Line 152-155: Please clarify what kind of wind values you are using. Are you calculating mean and standard deviation of the daily NCEP/NCAR winds and do you do this month by month or using one mean and standard deviation for the whole winter ?

Lines 199/200: “The duration of haze events have tended to be longer in the past decades.”

This sentence is difficult to understand. Probably you mean something like:

“The duration of have events tends to get longer over the last decades from 1980 to 2016.”

From Fig. 2b it looks like if the largest shift in the maximum of the PDF occurred from the 1980s to the 1990s. From the 1990s to 2000s the maximum of the PDF does not shift to longer durations but rather there are more events with durations longer than 5 days than before and the maximum only gets lower. Interestingly, in Fig. 4c the largest shift in the PDF distribution of extreme southerly episodes seems to occur from the 1990s to the 2000s. Do you have an explanation for this somewhat different

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behavior ?

### Technical corrections

#### Title:

I suggest to write “..associated with the northwestern Pacific SST trend...” or “..associated with northwestern Pacific SST trends...”

#### Abstract:

Line 13: probability of persistent haze events

Line 15: and a weakened East Asian Trough

Line 18: We propose a practical

Line 20: increasing occurrence of persistent

Line 20/21: closely related to an increasing frequency

#### Introduction:

Line 31: encountered an increasing frequency

Line 36: Li et al., 2016 (insert missing blank)

Line 42: highest level of air pollution on record

Line 54/55: cross-regional transfers are equally important sources of PM2.5

Line 61: mainly formed by southerly transport

Line 66: giving rise to descending air motion

Line 68/69: However, the large-scale atmospheric circulation backgrounds of PHEs around Beijing remained unclear from a perspective

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Line 75: the reduced Arctic Sea ice

Line 77: remove “, etc,”

Line 81: possible influences of

Line 92: observations and the associated

Line 94: shouldn't that be “EAWM” not “EASM” ?

Line 120: the instrumental visibility observations

Line 122: occurring occasionally

Line 137: monthly data of wind

Line 148: Fig. 1 (insert missing blank)

Line 151: We propose

Line 152: 850 hPa (insert missing blank after 850)

Line 162: In this study the EEMD method

Line 172: with an amplitude of 0.2 times

Line 204/Figure 3): I think you show in panel (b) the “correlation coefficients of persistent haze days and wind speed (shading) and in addition the wind (arrow) at 850 hPa” (but not the correlation with the wind arrows. Please clarify this in the caption as it also applies to panels (c) and (d))

Line 251: It suggests that the anomalous southerlies are a good indicator for an increased risk of haze occurrence in Beijing. (or is there *always* haze in Beijing when there are southerlies ?)

Line 260: persistent hazes in Beijing (see Fig. 2).

Line 281/282: wind anomalies at 850 hPa over North China co-varied well,

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Line 284/285: showed a secular warming trend

Line 292/293/Figure 7: Schematic diagrams summarizing the dynamical linkage, via the weakening East Asian winter monsoon system, between positive SSTA in the north-western Pacific and increasing PHEs in Beijing.

Line 296/Figure 7: height at 40°N and 500 hPa

Line 298/299/Figure 7: in base map indicate the anomalous low-pressure and high-pressure systems, respectively.

Line 307/308: northwestern Pacific which leads to an anomalous high-pressure

Line 309: interaction. This in turn induces anomalous southerlies.

Line 310/311: Particularly in the lower troposphere, (omit first comma)

Line 320: haze occurrences are the weakened

Line 322/323: probability of longer extreme southerly

Line 331: notable secular warming trend.

Line 332: warming regions, which is a part of global warming

### **Figures:**

Figure 3:

suggest to use larger font sizes for the tickmark labels on the map and the color bar

please add the unit of “m/s” to the wind arrow scale bar

remove the contour labels in panels e) and f)

insert missing blank in axis label in e) and f): “Pressure (hPa)”

mark Beijing with black dot as in Figure 1

Figure 7:

contains a typo in the graphics: “Unfaovrable for vertical diffusion” should be “Unfavorable for vertical diffusion”. The red letter “H” is hard to see because it is partly hidden

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behind the large red arrow.

### **References:**

Many of the references in line 362ff are missing their Digital Object Identifier (DOI), e.g. the papers in Nature Climate Change, Journal of Geophysical Research, Quarterly Journal of the Royal Meteorological Society, Atmospheric Environment, etc.

The citation style is not consistent: sometimes the volume is separated from the pages by “:”, sometimes by “;”. Sometimes the page range is given with a short dash “-”, sometimes with a long dash “—”. Sometimes the issue number is given, sometimes it is omitted.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-757>, 2017.