

Interactive comment on “Roles of Climate Variability on the Rapid Increase of Winter Haze Pollution in North China after 2010” by Yijia Zhang et al.

Anonymous Referee #2

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The authors proposed a very interesting question that haze pollution in early winter in North China experienced a rapid increase from 2010 after a two-decade decrease. This notion is supported by long-term haze days defined by visibility and relative humidity. By using model simulation and statistical analysis, they argued that climate variability is the dominant driver for rapid increase after 2010. They further analyzed the possible external climate forcings to support their conclusions. Overall, the topic of this study fits this journal well. The authors conducted modeling and statistical efforts to defend their conclusions. I think it is publishable before some concerns in the following are addressed.

C1

1. I am most concerned about the rapid increase trend after 2010, because it looks like the trend is mainly driven by an extreme anomaly in 2010. As for visibility-based haze days, year 2010 doesn't change the increasing trend. But, I think the increasing trend will not hold for observed PM_{2.5} and simulated haze days if year 2010 is removed. If this is the case, that means the authors should take caution stating that there is rapid increase of haze pollution after 2010. It is better to focus on the long-term trend than only highlight the rapid increase after 2010. Other PM_{2.5}-related measurements (e.g., satellite AOD) might be helpful.

2. It is surprised that the simulations with fixed anthropogenic emissions can produce the observed reversal frequency of haze days very well. You also cite Dang and Liao (2019) to support this argument. I take a look at this reference, but I think their results didn't show an increasing trend after 2010. I am very curious about if the role of anthropogenic emissions is very limited after 2010.

Specific comments:

Title: The authors focused on “early winter” in this study, but you failed to define what's “early winter”, December and January? Please clarify this in the title and also in the main text. Also, I am not sure if the conclusions support the “rapid increase” after 2010.

Line19: You mentioned “human emissions” started to decline in mid-2000s. How did they jointly lead to rapid increase in haze days?

Line91: MLR should spell out.

Line 102: The trend should be given with its statistical significance. Please check throughout the text.

Lines 109-110: Only PM_{2.5} data in Beijing used from the national measurement network? Or PM_{2.5} over North China? This should be also clarified in the caption of Figure 1.

Lines 136-137: I think they also show results with varying meteorology?

C2

Figure 1a: missing legend for green dash line. I don't think it is reasonable to show the red dash line. The sum of these pollutant emissions doesn't make sense.

Figure 1b: You should give observed trends of haze days along with the simulated trends.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-505>, 2020.