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Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-279

Anonymous Referee #1

Referee comment on "Possible influence of sudden stratospheric warmings on the atmospheric environment in the Beijing–Tianjin–Hebei region" by Qian Lu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-279-RC1, 2022

(1) General comments:

The manuscript by Lu et al., submitted to ACP, presents observationally-based evidence of Sudden Stratospheric Warmings (SSWs) influence on air quality (AQ) over the Beijing-Tianjin-Hebei (BTH) region. The authors use reanalyses and observations fields over the 1980-2021 period to analyse stratosphere-troposphere coupling during 17 SSWs events, distinguishing between displacement (8) and split (9) type events. Responses of surface AQ over the BTH region, albeit substantially limited by the number of SSWs and (likely) large natural variability, show consistent changes with regard to current stratosphere-troposphere coupling understanding. This work extends and supports previous studies findings by including a number of SSW events, and finds stronger AQ responses over the BTH region associated with split SSW events.

The present study is of interest to the atmospheric chemistry and physics community. However, the language of the manuscript could be substantially improved, which would help to achieve a clear logic flow. The aim of the paper is clearly defined and technical concepts are usually presented. The methodology is sensible; however, it lacks a more detailed description to clearly understand the significance of the findings and their implications (see below). Results are well presented and support the conclusions. However, the analysis can greatly benefit from an additional discussion about the robustness of the results, e.g., limitations due to a relatively small number of SSW events and how this could be addressed in future work. I would recommend the present study for publication after the comments below are addressed.

(2) Specific comments:

- The manuscript would greatly benefit from a substantial language revision (i.e.,

technical). The manuscript in its current form makes difficult the reading and understanding of the analysis. For example, please avoid using parenthesis to highlight the opposite (i.e., it takes at least two readings of the sentence to understand the meaning).

- The statistical test (i.e., t-test) used to define the significance of the results needs to be more clearly described. This involves the assumptions made, such as the distribution of the samples (e.g., normal or Student's t), and the variance of the samples (e.g., equal?), as well as the test used (i.e., one-sided or two-sided). All these details will greatly influence the statistical significance of the findings (e.g., Krzywinski & Altman, 2013; doi:10.0.4.14/nmeth.2698).
- The authors often describe their results without addressing whether the signals are significant or not (i.e., yet significance is provided in their analysis). It is important to focus on relevant features (i.e., statistically significant) to understand the implications of the results.
- The manuscript lacks a discussion about the robustness and limitations of the results, e.g., taking into account that only 8-9 events for displacements and split types are accounted, respectively; what else can be done in future work to gain confidence?

(3) Technical corrections:

L30. References only refer to AQ health impacts. Please, include/expand references that support haze pollution impacts on the ecological environment, transportation, and so forth.

L35-40. What is the Arctic Oscillation? Please describe (e.g., one sentence).

L63-64. Since this is a key feature of SSWs events, the authors may want to move the sentence at an earlier stage of the paragraph, i.e., "SSW event is a typical phenomenon of two-way coupling between stratosphere and troposphere (Hu et al., 2014)".

L104-106. Observations provided by the China Meteorological Information Center need reference and/or link.

L137-141. Please clarify the meaning of the dates provided, e.g., onset of the SSWs events?

L148 and L152-154. Only for the split SSWs cases, right? With the analysis being not statistically significant below ~200hPa.

L166. Warmest anomalies for SSWs displacement events appear on day 5? Do you mean

day -5?

L169-171. Such statement needs reference.

L188-189. It is not clear what the sentence is referring to. Please clarify.

L194-196. "... might have a downward influence on the tropospheric circulation. ..." This is a bit confusing given the statement in L199-200 ("... the stratosphere-troposphere coupling in the extratropics, which is followed by discernable tropospheric circulation anomalies...").

L200-201. I do not understand this sentence here. Are the authors not focusing on describing stratospheric circulation anomalies?

L233. PNA has not been introduced.

L250. "The enhanced wavenumber 2 can also propagate upward into the stratosphere and split the polar vortex" needs a reference.

L257. "are shown Fig. 4" -> "are shown in Fig. 4"

L284-287. The SSWs stratosphere-troposphere coupling needs reference.

Figure 7. The authors may want to include confidence intervals of the environmental metrics shown in the figure.

L423. "... is more significant..." -> "... stronger..."?

L440. "Compared with the some previous..." -> "Compared to previous..."