Comment on acp-2021-436

Anonymous Referee #1

Referee comment on "Comparison of the influence of two types of cold surge on haze dispersion in eastern China" by Shiyue Zhang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-436-RC1, 2021

General comments

This manuscript addresses interesting questions that are within the scope of ACP – how do different types of cold surge contribute to the dissipation of haze in Eastern China during the northern hemisphere winter, and are there trends in these contributions? The findings contain information on varying trends in different types of cold surge which has implications for understanding how air pollution levels in this region will change in future.

On the whole the methodology, the results and the interpretation appear largely sound. However, the methods need to be more fully and carefully explained, including more information on how this work builds upon the methodological approaches of past research. I also make suggestions below that should help to structure material within the manuscript and to clarify various details of the results and interpretation.

The fluency and precision of the language used could be improved and would certainly benefit from further work. Included in the specific and technical comments below are suggestions for changes which would help to clarify meaning.

Also throughout the Figure labelling is with a font size that is smaller than ideal – it would be helpful to increase the font size significantly for a later version of this manuscript. Figures 2, 4, 7, 8 in the current layout were especially hard to read.

Specific comments

Line 26 – add a sentence summarising new implications from this work; any indication of trend being due to changing climate, or how the identified trend contributes to an overall literature-based view on haze events in future; given past work, is this work in agreement overall?

29 – it would be useful to explain briefly that "haze" is used in referring to a specific type of pollution event in China. The term "haze" can refer to slightly different types of pollution in different regions.

67 – "it is necessary to consider the influence of classified CSs on haze" – this statement can be elaborated on, especially whether classification has been used in previous studies on cold surges and haze, and if so, how are the CS types referred to on line 68 (and 73) linked to the literature?

89 – it will be helpful to explain more fully how the other parameters (dust, sandstorm etc.) are defined and then used to filter out some days

94 – in Figure S1b clarify how are the number of haze days in a month calculated when presumably not all locations in EC meet the criteria on the same day?

106 – good to clarify the identified CS are those that might affect a haze day, i.e. "a total of 187 CSs that might affect a haze day in EC were identified"

133-145 – I suggest this text on CS type classification will be more appropriately moved to the preceding section on Data and Methods. It would also be helpful if the procedure could be explained a more fully, for example more clearly on how the approach and the definition of the two CS types follows from previous work, and including an explanation which data is used in the classification.

150-152 – to support this text it would be helpful to indicate the movement of air (e.g. lower level wind vectors) within Figure 3

161 – here it would be good to add a quantification of "relatively large value". Perhaps the fraction of locations categorised as haze within the EC box? This fraction could be displayed for each panel in Figure 4.

168-173 – for this passage I suggest moving the information on the datasets to Section 2, and explaining there more fully why you use the visibility for the main analysis rather than PM2.5 – presumably the length of dataset? Within this explanation it would also be appropriate to discuss briefly how these two types of pollution indicator (visibility and PM2.5) have been used and compared in previous studies on this problem.

Here you can then just mention the consistent result of this supplemental analysis. And within Figure S2, please better explain in the caption the PM2.5 data values – presumably this is a difference in concentration from some reference quantity? The range seems small though (+/- 0.2 µg/m3)?

177 – please explain the test of significance to indicate haze here.

185 – the variations in Rhum do look similar, but it will be helpful to explain how was the difference was tested?

191-194 – finishing with "… transporting pollution to the east" would be clearer. However, I think overall these lines do not add much new information. Suggest rephrasing to link to next paragraph: a closer investigation of additional meteorological parameters is required for further understanding of the differences between the two types of CS.

225 – in the passage "the cold front will lead the TIP to control EC" it will be helpful to explain how the cold front is identified (the edge of the positive anomaly?) and within this paragraph, "TIP" is just the parameter, would "large positive TIP values" be more precise?

251 – with the current presentation the contours in Figure 8 indicating SAT anomalies need rather close scrutiny to interpret, so I would encourage authors to consider a clearer way of presenting these, and certainly include some indication of the size of the anomalies is needed.

260 – for the ratio shown in Figure 9b, is there an issue with this calculation when there are zero occurrences of one type of CS in a particular year? For example, in 1982, there are 7 wave train CS and 0 blocking CS, which is plotted as a ratio of 0 in 9b – will this not have the opposite effect on your moving average than it should? Overall I am not sure you need this ratio analysis to make the final statement on line 261-262, which already follows from 9a. However, to support this statement further it would be interesting to

assess the trend in total number of cold surges (of both types) which so far is not discussed explicitly.

I also think the descriptions of Figure 9b are given the wrong way around – should it not be the ratio of wave-train to blocking CS? (for example, in 1980, the ratio plotted in 9b is 3 wave train to 1 blocking)

263-264 – the explanation of the partial correlation coefficient procedure could be clearer to understand exactly what was done. Would "of the two types of CS" rather than "of blocking CSs (wave-train CSs)" and "the other" rather than "another" describe the procedure correctly?
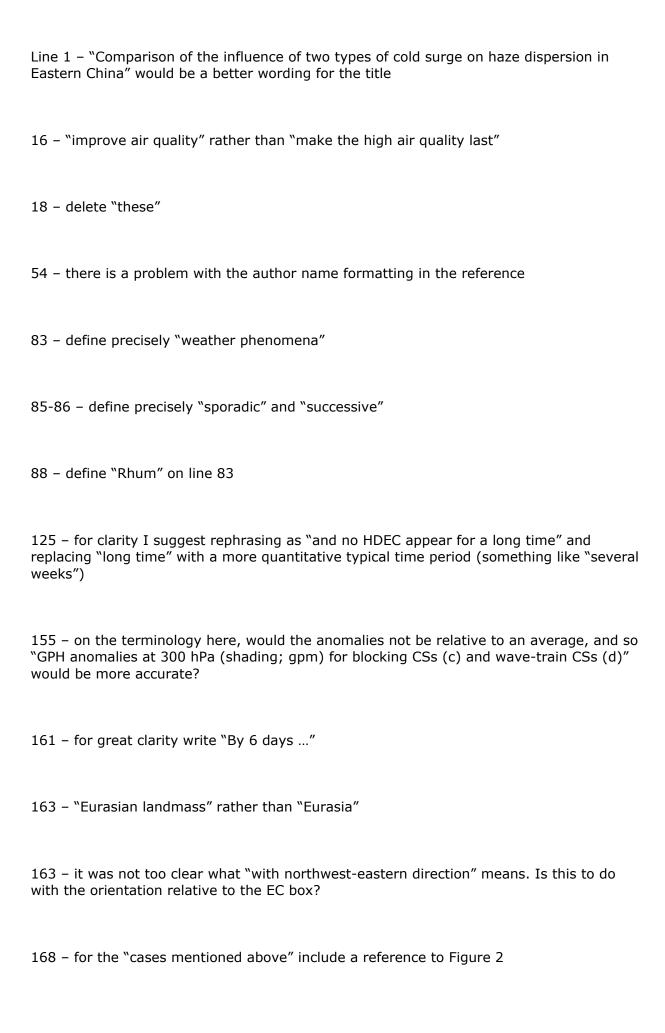
272 – rather than an increase in blocking CS, I think your results show the major reason for the ability of CS to dissipate haze in future would be the reduction in wave-train CS. It would be important to assess existing literature that relates to this finding that you can include in the discussion here.

281 – given the proceeding Results section already contains some reasonable discussion of the results, I suggest moving the few discussion points currently in this Section 4 to the relevant part of Section 3. The label for section 3 could then be "Results and Discussion", and the label for this Section 4 could be "Conclusions".

296 – given your results, I think in this sentence on "the future" there should be more emphasis on the strong trend for a reduction in wave-train CS

298-305 – linking to the comment on line 281, I suggest integrating this text with your discussion of relevant results. In doing so it will be helpful to expand on the limitations and draw upon insights from the literature. For example, "the lack of meteorological station information" is too vague.

Technical corrections

Line 1 – "Comparison of the influence of two types of cold surge on haze dispersion in Eastern China" would be a better wording for the title

16 – "improve air quality" rather than "make the high air quality last"

18 – delete "these"

54 – there is a problem with the author name formatting in the reference

83 – define precisely "weather phenomena"

85-86 – define precisely "sporadic" and "successive"

88 – define "Rhum" on line 83

125 – for clarity I suggest rephrasing as "and no HDEC appear for a long time" and replacing "long time" with a more quantitative typical time period (something like "several weeks")

155 – on the terminology here, would the anomalies not be relative to an average, and so "GPH anomalies at 300 hPa (shading; gpm) for blocking CSs (c) and wave-train CSs (d)" would be more accurate?

161 – for great clarity write "By 6 days …"

163 – "Eurasian landmass" rather than "Eurasia"

163 – it was not too clear what "with northwest-eastern direction" means. Is this to do with the orientation relative to the EC box?

168 – for the "cases mentioned above" include a reference to Figure 2

204 – does the Figure not show 4 days before and 9 days afterward?

205 – delete "respectively", I don't think it applies here

206-207 – suggest rephrasing this sentence for clarity: "The variation of meteorological elements during wave-train CSs is larger than during blocking CSs"

210 – explain more fully why "This is in line …" by referring briefly to main mechanism and/or literature

213 – for greater clarity suggest rewriting as: " … Park et al. (2014) who identified CSs in a different region which included the northern part of Northeast Asia."

219 – the caption does not accurately reflect the timescale or the colour scheme in this Figure. For consistency and clarity, it would be better to keep the same colour scheme as in Figure 5.

222 – "invading" rather than "invades"

228 – "control region" in EC, or within the plotted domain? Please clarify.

232 – not sure if "abnormally" is the correct word here, just delete?

236 – Given it is referred to in the text it would be useful in Figure 7 to mark the EC area. Same comment for Figure 8.

267 – explain relative to what

268 – suggest start a new paragraph for the sentence beginning on this line

276 – why are there inset maps in the lower right of Figures 9c and d? Are they needed?

277 – clarify in the caption that in the text on the trend 10a means, I assume, per decade?

291 – "of blocking" rather than "to block"

292 – is this referring to when there is a wave-train CS?