1 Author's Response

Dear referee,

We would like to thank you for the in-depth review of our work. In the following sections, we will respond to the individual points raised in the review. The comments from the review will be highlighted in bold, followed by our responses. After the end of the discussion period, we will post a revised version of our manuscript which takes into account the recommended suggestions for improvement.
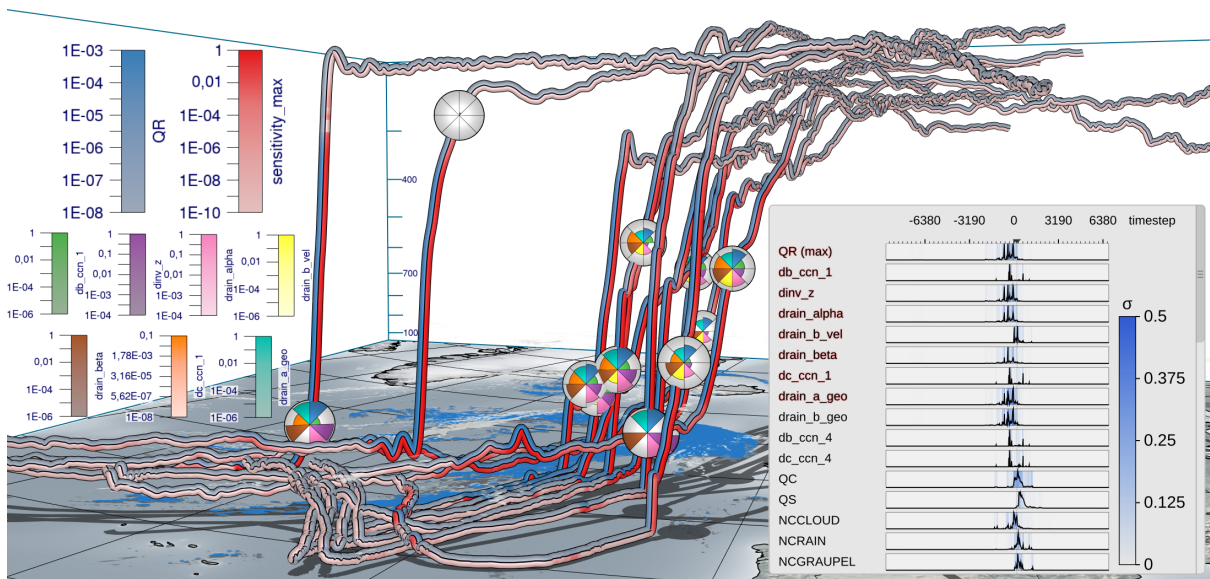
Best regards,
The authors

Figure 1: Updated version of Fig. 1 in the manuscript with the new visual mapping.
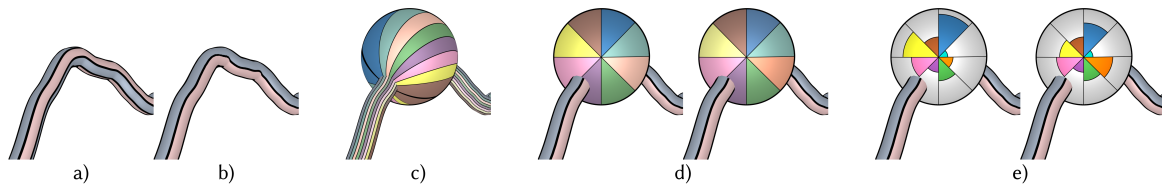

Figure 2: Target variable (bluish colormap) and maximum sensitivity (reddish colormap) are mapped to the trajectory surface via a) object space bands and b) view-aligned color bands. c) When multiple variables are mapped to view-aligned bands running across an enlarged focus sphere, the band's distortions and alignment with the trajectory's tangent prohibit an effective visual analysis and comparison between different trajectories. d) The use of consistently view-aligned polar color charts improves readability of multiple variables and enables an effective comparison between different trajectories. While in d) values are encoded by saturation, in e) a polar chart using the radius instead of the saturation for encoding the individual values is used.

1.1 Pie charts

I find the term "pie charts" quite confusing, as I first expected the slices to have different sizes to illustrate relative sizes of data. Furthermore, I find it rather difficult to capture the values in the pie charts based on the colour saturation, could you make the difference between low and high values larger?

- The criticism regarding the term *pie charts* has been raised by both reviewers. We agree with the reviewers that the term pie chart is closely entangled with using the pie angle for the visual mapping. Consequentially, we have considered this suggestion and renamed the type of visual mapping to *polar chart*.

- As suggested by reviewer 1, we have added an improved visual mapping to our system that we call *polar area chart*, which we compare to the saturation-based encoding (cf. Fig. 2). In this new encoding, differences in value are more strongly perceivable, as quantities are mapped to the radius.

It is difficult to understand Fig. 1 at this point in the paper, without watching the supplementary videos and before reading sections 2 and 3. Please add further details in the
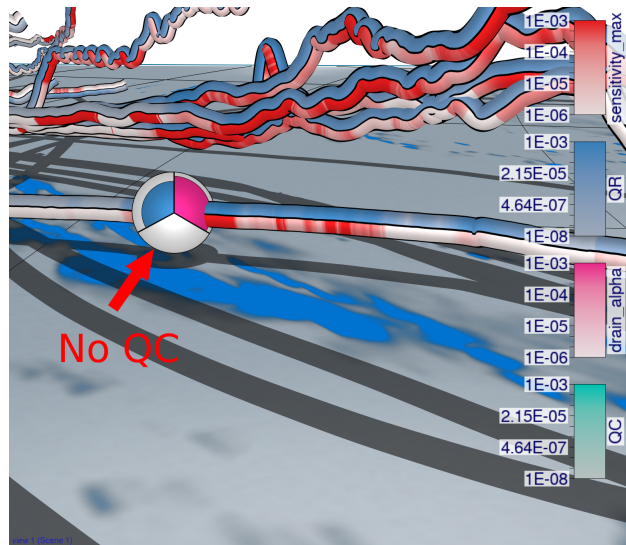
Figure 3: Updated version of Fig. 10 of the manuscript with an arrow pointing out the lack of cloud droplets (QC).

caption: What is the starting time of the WCB trajectories? What is QR (it has not yet been defined when Fig. 1 is mentioned) and what are the units of QR? What is sensitivity_max and what are the units of the sensitivities? What is shown in the curve plots, i.e., what is shown on the x and y axes, what are the black lines and the blue shading? What do the colours in the pie charts show? Please add colour bars to the figure. Even with the added information, you might consider moving the plot to the data and method section (where you nicely explain the different fields) to make it easier understandable, or to mention that the details will be explained in the data and method section.

- The updated version of Fig. 1 of the manuscript with color bars and the new visual mapping can be seen in Fig. 1. We have added color maps as requested by the reviewer. We will revise the figure description in the new manuscript accordingly, to make clear the start time of the trajectories, the units of QR, the units of the sensitivities, and what is shown in the curve plots and pie charts. We decided not to move the figure to the data and methods section, as we hope it can act as a teaser figure showing the reader the major contributions of the manuscript.

Abstract and conclusions: Please also include some key findings about your case study. In the conclusion it would be nice if you could come back to the questions posed in the introduction and summarise the results.

- We added some key findings in the abstract and a paragraph in the conclusion that refer to the different questions raised.

Data, first paragraph: Over which time interval are the WCB trajectories calculated (and shown in the figures)?

- The trajectories are calculated from 20 September 2016 at midnight until 24 Sep 2016 at 16:00 hours. Different trajectories are started every two hours until 22 Sep 2016 at 16:00 hours. The starting time for the trajectories from Section 5 covers the same range. The other trajectories showcasing different visual analysis methods start on 20 September 2016 at 00:30 hours and are calculated until 22 September 2016 at 08:00 hours. We added the information in the first paragraph of the data section.

3

Line 321: "Sensitivities to CCN parameters and to k_r are ranked higher in the southern group." I see the symbol dk_r in Fig. 9a, but where are the sensitivities to the CNN parameters? I don't see any of the CCN parameter names from Table C2 in Fig. 9a.

- Thank you for pointing this out. We inadvertently set the cut-off for the figures too high. This has been fixed by showing more rows.

Fig. 9: From the text in the figure caption, one might infer that precipitation from above is more important for the southern than for the northern group, but according to the text it is the other way around.

- Indeed, there has been a mistake in the caption. The large peaks of rain mass density stem from the formation of rain droplets which is also indicated by the peak of the collision parameter dk_r. We corrected the caption accordingly.

Fig. 10: I find it confusing that you refer to the absence of something in turquoise in the caption. Should the turquoise cloud droplets (or their absence) be found in the pie or in the underlying map? If it should be in the pie, maybe you could highlight the outer border of this (grey) segment with turquoise lines. Otherwise, the reader does not know to which variable the grey part of the pie belongs.

- We agree that the absence of color is confusing. The cloud droplets refer to the grey segment in the pie. We added an arrow and some text in Fig. 3 to highlight the lack of cloud droplets. However, highlighting the outer border of this segment works only for a single or a few pie charts. If we zoom out and compare multiple trajectories, e.g., in Fig. 1, it is easier to distinguish trajectories with and without certain sensitivities without colored borders.

You mention Fig. 12 before Fig. 11, could you exchange them?

- Thank you for pointing that out. We exchanged both figures (now Fig. 12 and Fig. 13).

Line 355: "... convective trajectories in the foreground and slantwise trajectories in the background" – Do you mean group 1 and 2, respectively?

- These are all trajectories from group 2. Both groups contain slantwise and convective trajectories, but their fastest ascent is located at similar places within each group. We added the group affiliation to the text.

Figs. 10, 11, 12, 13, 14 (and in other places in the paper): It would make the text easier understandable if you could be more specific with the wording and more often write "sensitivities of QR to xxx" (in the figure caption and in the text).

- At the beginning of Section 5, we clarified that the prefix "d" in the names of parameters refers to the sensitivity of QR to the parameter. We made the caption in those figures clearer and added the phrase "sensitivity of QR to" throughout the text.

Typos and wording
- **Appendix Table C2, description of inv_z: parenthesis sign ")" after "sedimentation" not needed.**
- **Line 175: "Figure 3a,d shows ...": Do you mean Figure 3c,f?**
- **Line 296: "different group": different groups**
- **Line 326: "..., we compare the maximum sensitivity of QR to any parameter in Fig. 8." I find this phrase difficult to understand. Maybe better something like "..., we investigate where along the trajectories any of the parameters is associated with the maximum sensitivity (Fig. 8)."**

- Line 332: Parenthesis should include "Video 2".
- Line 345: "more sensitive . . . along convective trajectories . . . " – Maybe add: "than along slantwise trajectories".
- Lines 368-370: Part of the phrase is repeated.

- We have addressed the individual comments in the revised manuscript.