Interactive comment on "First quasi-Lagrangian in-situ measurements of Antarctic Polar springtime ozone: observed ozone loss rates from the Concordiasi long-duration balloon campaign" by R. Schofield et al. by Anonymous Referee #1

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The manuscript "First quasi-Lagrangian in-situ measurements of Antarctic Polar spring-time ozone: observed ozone loss rates from the Concordiasi long-duration balloon campaign" by Schofield et al. describes Antarctic springtime ozone loss rates for 2010 as determined with the match technique from three long-duration stratospheric balloon flights. On average the obtained loss rates agree well with previously published numbers, however, there is also evidence for localized loss rates that are much higher. It was shown in the manuscript that these loss rates are caused by high PSC occurrences and large ClO abundances in specific Antarctic regions. The manuscript is very well written, and grammar and style are excellent. The description of the analysis technique and the results are in most parts clear and precise, and there is a nicely described, consistent storyline. I recommend publication after some minor changes.

We thank the referee for their valuable comments that have led to many improvements to the paper overall.

Comments:
• Page 22247, line 22-23: " important questions have remained unanswered"
– it is not clear here what questions that would be, and if they are really answered with this study. Could you specify these questions?
Here we presented a dataset that allowed us to examine the longitudinal variations in the ozone loss rates, which previous studies have been unable to disentangle. Previous studies have either been limited by studying smaller scales (i.e. targeted in-situ aircraft measurements) or larger scales i.e. ozone-sondes giving vortex averages. Satellites (which are not in-situ) potentially could provide this information, though the vertical averaging of these observations is limiting.

We have modified the text to be more specific about the unique capability of these measurements.

• Page 22248-22249: There is a very detailed description of the ClO dimer reactions and the kinetics of it. It is not clear why this has to be in the introduction in this much detail, since the dimer reactions are not mentioned later in the text again. It might be worth tightening this section, or clarifying the direct connection to the presented study (where no kinetics or new ozone destroying reactions are presented).
We agree the level of detail of this section was inappropriate – we have re-focussed on the chemistry driving polar ozone losses and significantly shortened this section.

• Page 22249-22250: In these paragraphs the ozone loss rates as determined by earlier studies are described. Loss rates in the Arctic and Antarctic. It is a bit hard sometimes to follow exactly which hemisphere is described in each sentence.

Maybe restructuring this section would help.

We have restructured this section, clarifying that only the first sentence deals with the northern hemisphere – noting this is predominantly where ozone loss rates in-situ have been made. All the numerical values are for the Antarctic, we have clarified this in several places by inserting 'Antarctic'.

• Page 22252-22253, Section 2.1: This section should get some more details in my opinion. It is not clear what exactly is a "matched pair" from this description, without reading any of the references in detail.
The following text was inserted 'At each 15 minute time interval along each lagrangian back trajectory the distance to the balloon at the corresponding time is calculated - this is termed the Match radius; other parameters such as PV and theta are also compared between the back-trajectory and the balloon location.'

• Page 22254, line 1: "disturbance of the polar vortex after September". Is there are reference for that? Or is this based on analyses that are just not shown here?
This is the Klekocuik reference – this was mentioned at the beginning of this paragraph – we insert the reference again for clarity.

• Page 22254, line 5 and line 6: "latitude" should here be "longitude", I think (according to the longitude of the end match point.")
Thank you

• Page 22254, lines 4-17: It would be helpful here to mention the actual numbers for the ozone loss rates, so that readers are not surprised in the conclusion section about the 230 ppbv per day that are mentioned there.
Good point, thank you. It was mentioned in the second to last paragraph of the Results and Discussion section, but mentioning it here as well is helpful.

•Page 22254, line 7: the phrase "maximum ozone loss rates" might not be the best choice here, because for balloon 16 the maximum ozone loss rate was observed in the dark blue sector at around day 265 (according to Figure 3). And this is not described in the paragraph on page 22254, I think.
This was altered to large ozone loss rates.

•Page 22255, line 9: Maybe add "(Figure 7, upper left corner)" after the half sentence for the day 255-265 time period," for clarity.
Done

•Page 22256, line 17-18: "vortex-average losses exclusively". But there were at least one study that did look at the loss rates of one ozonesonde station only, right?
Yes, and this is particularly true when looking at a single site only, here a vortex average is the only possible result able to be determined.