

We thank the reviewers and Dr. Gloria Manney for their comments and suggestions for improving the paper. Our point-by-point responses to the reviewers' comments are given below in blue text, and the revisions are shown in the version of the manuscript with track changes.

REPLIES TO Gloria Manney Comments, 31 Mar 2021

I have two general comments on this manuscript that I think raise important issues that should be addressed before publication: Inadequate citation of and discussion of relationships to previously published papers on ozone loss and meteorology in the Arctic 2019/2020 winter. There are at least about a dozen peer-reviewed papers already published on the 2019/2020 winter, including one comprehensive overview of the meteorology and its relationships to ozone loss (Lawrence et al 2020) and many that discuss and/or model chemical ozone loss in the Arctic vortex and the record low ozone values. Only two of these papers (the Manney et al, 2020 and Wohltmann et al, 2020 papers listed) are cited here. Many, but not all, of these are in the JGR/GRL special issue, [https://agupubs.onlinelibrary.wiley.com/doi/toc/10.1002/\(ISSN\)1944-8007.ARCTICSPV](https://agupubs.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1944-8007.ARCTICSPV)

In which the first papers were published online in July 2020 and all except two recent ones published in or before November 2020. All of these contain material that would be useful to cite (though a couple of the dynamical ones possibly only briefly for context) in this paper, and some of them seem critical to cite. In particular, Lawrence et al (2020) needs to be cited for the discussion of the meteorology leading to the exceptional ozone loss. The material in Figures 1 and 2 of the current manuscript are, as far as I can tell, completely covered by Lawrence et al (2020), Wohltmann et al (2020), and Dameris et al (2021, ACP, <https://doi.org/10.5194/acp-21-617-2021>), so if they are to be included in the final paper, the authors need to highlight something that is new in their presentation of the material. (In that discussion it would also be worth citing DeLand et al. (2020) for actual PSC observations.) All of the following papers include discussion of anomalous column ozone and its implications, and should be cited in addition to Wohltmann et al. (2020): Rao and Garfinkel (2020), Inness et al. (2020), Bernhard et al. (2020), Dameris et al (2021, ACP), Feng et al (2021), Weber et al (2021).

Several of these papers (as well as Manney et al, 2020 and Wohltmann et al, 2020) include estimates from data and/or modeling of amounts of chemical ozone loss in 2019/2020 in relation to previous years (including especially 2010/2011), and the results in this paper should be discussed in the context of those in these papers, and what is new in this paper clearly highlighted.

Thanks for the comments. We are really sorry for having not cited enough papers published in the JGR/GRL special issue because our original manuscript was first submitted last June and was delayed after we have tried other journals. Therefore, we cited then available two published papers, Manney et al., and Wohltmann et al. These papers came after we submitted the paper to other journals and some were still not published. There it was not deliberate that we left out some.

We have included the latest studies on this winter and cited them wherever is appropriate. We have not cited any discussion papers, but only peer-reviewed. Please find the cited ones in **lines 70, 71, 154, 168, 174, 175, 187, 270, 315-316, 402-403, and 467**. The citation details can be found in the reference section.

Inadvisably casual use of the term "ozone hole" for the Arctic:

There are many reasons (first discussed extensively in relation to the 2010/2011 winter, e.g., see Solomon et al, 2014, <https://doi.org/10.1073/pnas.1319307111>) why one should be very careful and precise about applying the term "ozone hole" to the Arctic. There is some discussion of this in Wohltmann et al (2020), and I do not want to go through all of the detailed arguments again, so I strongly urge the authors of this manuscript to read the reviews of (especially the one by Dr. Wohltmann) and the SC by Grooß & Manney in the discussion of Dameris et al (2021,

ACP) for a comprehensive discussion of this point, and use these cautions to consider and revise the presentation of the results in this paper accordingly.

Thanks for the suggestion. We agree that it will be confusion to term Arctic ozone hole since this is not happening every year in the Arctic. Therefore, we have revised the discussion accordingly. Please find it in **Title, Section 3.8** and elsewhere in the text and replies to other two referee comments. Thank you.

Thank you for your critical comments that helped to improve the content of this article.

V09/JK/07072021