Atmospheric Chemistry and Physics Discussions

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Comment on acp-2022-397

Anonymous Referee #1

Referee comment on "Effects of Arctic ozone on the stratospheric spring onset and its surface impact" by Marina Friedel et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-397-RC1, 2022

Overall, Friedel et al. present a comprehensive analysis of the influence of interactive ozone on final stratospheric warmings, a nice follow-on from a complementary paper (Friedel et al. 2022) from some of the same co-authors. Here the authors demonstrate a clear role for ozone coupling in the FSW timing, surface signatures (for high ozone cases) and the vertical evolution of the FSW. The paper is clearly written and the authors perform careful analysis to support their hypotheses. I only have a few points of clarification that I would like to see addressed before publication:

Minor Comments/Clarifications:

1. FSW threshold of 7 m/s in lower stratosphere: Can the authors elaborate on why this particular threshold was chosen? Is this a recommendation based on the cited articles to achieve FSWs each year or does this threshold specifically apply to WACCM and SOCOL? It seems that a different threshold might be appropriate for each individual model. I am curious about this in terms of the surface impacts, in particular. For the low ozone cases, are the surface impacts (SLP and TAS anomalies) sensitive to the chosen threshold?

2. Definition of ozone max/min: Based on the definition of your ozone max/min, is it possible to get overlapping years? Based on Fig. A2, the SOCOL ozone has a very clear double peak for the low ozone cases. In addition, the SOCOL low ozone seasonal cycle seems to have an unusual shapw with an extreme minimum in March and then a large recovery - makes me wonder a bit about this 5-day running mean approach. Maybe this is too short a time period over which to define the ozone max/min. Can the authors provide some information about the models differences that the reader should be aware of in order to help interpret Fig. A2.

3. Figure 3: Why do the authors choose a window up to 1 week after the FSW to examine

the impact of *preceding* ozone on the FSW date? Also figure caption says starting from March 1st, while the text (line 216) says Feb. 20th.

4. Connection to Haase and Matthes (2019): The feedbacks discussed in Section 3.3 are mainly positive. However, in the paragraph staring from line 340, the authors draw a connection between their results and the negative feedback discussed in Haase and Matthes (2019), but not explicitly. It might be useful to provide a bit more of a comparison between that study and this one and how the experimental setup differs (this could be noted in Section 2.1).

Technical Notes:

Line 4: Final Stratospheric Warming not Stratospheric Final Warming if you want to use the FSW short-hand

Line 11: lacking -> the lack of

Line 217: "...one week after the FSW in each year..."

Line 262: "Ozone thereby contributes..."

Line 290: "...wave driving across the models..."

Figure 6: y-axis labels should be: INT-3D and CLIM-3D, not INT-O3 and CLIM-O3

Line 311: also Tegtmeier et al. (2008): https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2008GL034250

Line 334: I think you are referring to Figures 7 a, b and f, g here.

Figure A4: add MERRA2 data for comparison