

## ***Interactive comment on “Radiative effects of ozone waves on the Northern Hemisphere polar vortex and its modulation by the QBO” by Vered Silverman et al.***

### **Anonymous Referee #2**

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Radiative effects of ozone waves on the Northern Hemisphere polar vortex and its modulation by the QBO by Silverman et al Recommendation: minor revisions

This paper discusses the interaction of ozone waves with the dynamics of the fall and winter Northern Hemisphere polar stratosphere in WACCM. Consistent with previous work, the sign of the ozone-temperature wave correlation differs between the lower and upper stratosphere. This leads to differences in wave damping and in the fall vortex. If EQBO and WQBO winters are composited separately, then differences are evident in mid-winter as well due to the differing effects of each QBO phase on wave propagation.

C1

The results are generally sound and convincing. The heat flux pulse methodology is novel and might applicable in other contexts as well. I have one potentially substantive comment about their key figure, and assuming that the relationship in this key figure is statistically significant all other changes are minor.

General Comments:

1. Much of this paper is based on differences between the top half and bottom half of figure 4. However, the authors don't appear to have explicitly calculated the statistical significance of the difference between them. The authors need to confirm that the difference between panels 4a and panels 4c, and likewise between panels 4b and 4d, is actually statistically significant.

2. I found figure 12 and its accompanying paragraph to be very confusing. What exactly is  $F_{yy}$ ? The y-derivative of the y-component of EP flux? Similar what is  $F_{zz}$ ? The z-derivative of the z-component of EP flux? Even if I assume this to be the case, I had serious trouble following the text and the accompanying figure despite multiple rereads. Either the authors need to expand their discussion and help the reader a bit, or remove this entirely as it doesn't appear to be crucial for the rest of the paper.

Technical comments: The abstract was quite long and wordy. It can almost certainly be shortened without removing key content.

P1, line 8 “in the natural configuration” can be removed. While this may have meaning to someone within the NCAR world, it has little meaning to someone on the outside

P2 line 1 chemistry climate models are also used in air pollution studies and for aerosol studies. See the AER-CHEM-MIP project (<https://wiki.met.no/aerocom/aerchemmip/start>)

P2 line 4 the majority ... do not

P2 line 29 this paragraph extends for 31 lines and is hard to digest! I suggest adding two new paragraph breaks: a first on line 4 of page 3, before “Also”, and a second on

C2

line 24 of page 3 before "To understand"

P3 line 21 nonlinear is misspelled

P4 line 24 tendency is misspelled

P4 line 26 I do not understand this sentence. Please rewrite

P4 line 28 ozone wave\*\*s\*\*

It may be helpful to add an intro sentence to section 3, rather than diving straight into the nitty gritty of the results

P8 line 22 composites is misspelled

P9 line 4 sentence is repeated

P10 line 34 "descends lower down" it is impossible to infer this from figure 13. This clause should either be removed, or reference made to a different figure.

P 11 line 2 the second half of this sentence is very unclear and needs to be rewritten

P 11 line 27 I suggest starting a new paragraph with "While"

Figure 1 units are not indicated on the colorbar on the left column

Figure 5 is missing units

Figure 8 is missing the x-label (latitude)

Figure 9 either the caption or the figure itself should state explicitly EQBO-WQBO

Figure 13: The caption should note that a thick line indicates statistical significance (assuming I infer correctly).

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