

## ***Interactive comment on “Small-scale variability of stratospheric ozone during the SSW 2018/2019 observed at Ny-Ålesund, Svalbard” by Franziska Schranz et al.***

### **Anonymous Referee #1**

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This manuscript presents an analysis of the effects of the sudden stratospheric warming (SSW) of January 2019 on the evolution of stratospheric ozone observed from the Arctic research base at Ny-Alesund, Svalbard. The authors also analyze in detail the influence of wave activity of very long waves on ozone gradients. To do so, different types of data are used: observations from two ground-based microwave radiometers, atmospheric reanalysis (MERRA-2) and the output of specified-dynamics simulations of WACCM for the winter 2018-19. The results show that the SSW did have an effect on the stratospheric ozone distribution at Ny-Alesund. Although poleward transport is enhanced during the SSW and so, an ozone increase would be expected at high latitudes, the authors show that the ozone mixing ratio is highly dependent on the stratospheric

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circulation, i.e. location of the Aleutian high and the polar vortex. Moreover, the authors find a link between an enhancement of wavenumber- 1 and 2 wave activity and a reduction in ozone gradients close to Ny-Alesund during the 2018/19 winter.

I find the analysis interesting, in particular, the study of the evolution of the ozone gradient in relation with the wave activity. However, I have some concerns that the authors should address before its publication. First of all, I would really encourage the authors to highlight more strongly the novel results of the study. In this sense, I think that the analysis of the small spatial scale variability of the ozone should have a more prominent place in the manuscript to make a stronger difference from the previous paper by Schranz et al. (2019). Secondly, the authors often refer to results that do not appear in the manuscript. In some cases, you can just say “(not shown)”, but in other cases, I think it would be great to show the results. For instance, in P7L1, it is indicated that vortex started to shift notably around 20 December, but the vortex structure is only shown from 25 December. I think it would be great to show its structure before 20 December to appreciate the shift.

Other comments (line by line): P4 L18: Please specify that the grey horizontal lines are in Figures 2a and 3a. P6 L23-25: I guess you mean that “between 60° and 90°N” refers to the reversal of the latitudinal temperature gradient at 10hPa but not to the reversal of the zonal mean zonal wind. Typically, it is the reversal of the zonal wind at 60°N what defines the occurrence of a major SSW, as it is indicated some lines above in the same page. P6 L25: Please remove one “as” P6L30-31: Please describe more in detail the criterion for the identification of the polar vortex edge. P7 L23-24: I am confused. I am not sure which level the authors are referring to, because in the stratosphere and most of the mesosphere, the winds remain westward the whole December except for some days in mid-December. Please rewrite this sentence. P7 L29-30: Please add not shown. P8 L12: Figure 7 only shows the water vapor from 1st October. However, since the effective descent rate of H<sub>2</sub>O is measured for the period of 15 September-1 November, I would start the figure on 15 September too. P11 L14:

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Northern Hemisphere P11 L15: Figure 12 shows only the plots for a specific day of October, December and March but not the monthly field. I recommend the authors computing the monthly means of the fields if they want to show the monthly state. P11 L21-22: I guess the authors are comparing figure 10 and 11, so please indicate it. P11 L24-27: The wave activity is already low in January and the ozone gradient is then increasing by that time. However, by the end of January and the first fortnight of February the ozone gradient decreases and the wave activity is still low. How do you explain that? P11 L33: Background wind → zonal mean wind. P12 L 4: I think the wind is mainly southward in October. P12 L9-10: so, no specific effects of the SSW? Figure 1: I cannot see the red square indicating the location of Ny-Alesund.

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