Dear reviewer #2,

thank you for the comments and suggestions to improve the manuscript. Below we give some reply of the raised points, and we will carefully consider all of them in the revised manuscript.

p3, l20-33: Reading the description of the MUAM, I was wondering whether this is a somewhat simplified model (e.g., pretty coarse vertical resolution) and whether this possibly affects the results presented here?

Yes, it is true that the model is simplified. We intentionally used it since the purpose of the study was not to make detailed comparisons with observations, but to analyze the general response of the atmosphere to GW forcing. Using MUAM, we do not need to consider interaction of GW-PW processes with other dynamical features. It would not dramatically change our results if we would increase the resolution, because the scale of the considered processes is much larger. Model runs with refined resolution have shown an only small weakening of the polar vortex, so that our results would not be affected significantly.

p4, l9-15: Does the reference simulation agree well to reality? I assume it has been evaluated already in earlier studies, but it would be good if this would be stated here explicitly.

In the previous publication we compared parameters such as the zonal and meridional wind, temperature, stationary and planetary wave activity to climatologies and satellite observations. As a result, the model well reproduces the dynamics and processes in the middle atmosphere, and is therefore useful for the analyses of local breaking gravity wave hotspots. For the sake of completeness, we will shortly summarize the results from the previous paper and will include them in the revised manuscript.

p14, l28-31: Although SSWs were not simulated in this study, I was wondering if you could say something about the timing between the gravity wave events and the following changes in the general circulation. How long did it take the circulation changes to manifest themselves?

To identify the time interval, in which the atmosphere stabilizes after the gravity wave drag enhancement, in Fig. 1 the zonal mean zonal wind is shown in a latitude-time plot at an altitude of about 24km, so within the region of the forcing, where the effects should be strongest. As in the paper, we are now only concentrating on the H2 (a) and H6 (b) gravity wave hotspot. When we include the local gravity wave forcing after model day 270 and let the model run for another 120 days, we observe a shift of the polar vortex border from middle to lower latitudes. According to the results in the paper, the shift is more pronounced for the H6 GW hotspot.

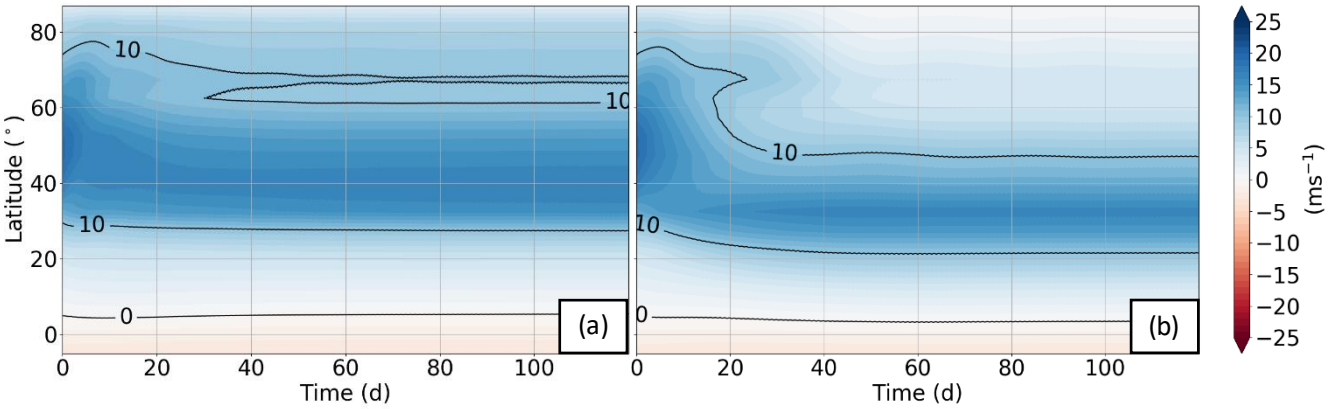

Figure 1: Hovmöller diagram of the zonal mean zonal wind at 24 km for the H2 (a) and H6 (b) gravity wave hotspot.

The response to the additional GW forcing takes about 10-20 days, then the zonal mean zonal wind distribution nearly remains the same until model day 120. Because the temporal effect of such an artificial GW hotspot was already shown in the sensitivity study of Šácha et al. [2016, Fig. 3(c)], we will not include these figures in our revised paper, but we will shortly summarize the timing of the enhancement and the resulting circulation changes.

Reference:

Šácha, P., Lilienthal, F., Jacobi, C., and Pišoft, P.: Influence of the spatial distribution of gravity wave activity on the middle atmospheric dynamics, Atmos. Chem. Phys., 16, 15755–15775, https://doi.org/10.5194/acp-16-15755-2016, 2016.