Dear reviewer #1,

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.

One of the main results is that the position of the additional gravity wave forcing relative to the phase of the stationary wave 1 is of relevance, and the role of forcing at different locations is discussed. The effect of the different locations, however, strongly depends on the phase of the stationary wave 1 in the model. Therefore, it should be discussed whether the phase of the simulated stationary wave 1 in the model is realistic.

Thank you, this is a good and important point we did not consider in our discussion. The phases of the stationary planetary waves (SPWs) with wavenumber 1-3 are extracted from the 2000-2010 mean January mean ERA reanalysis temperature and geopotential data. Thus, the distribution of the SPW phases, which is included at the lower boundary of the model, is based on observations. To see if the model correctly reproduces the SPW 1 phases in the middle atmosphere, we compared them to SPW 1 phases extracted from SABER temperature measurements performed between 2002 and 2007 (mostly corresponds to our decadal mean) [Mukhtarov et al., 2010]. However, Mukhtarov et al. [2010] only provided a height-latitude cross section of the SPW 1 phase for December, while our simulations are based on January conditions. To see if we can still compare the datasets, we first had a look at the height-time cross section in Fig. 1 (a) showing the monthly averaged SPW 1 phase for the whole period (2002-2007) at 50°N [Mukhtarov et al., 2010]. We can see that the SPW 1 phase does not essentially change during December and January, so that they are more or less comparable (considering temporal averages of 6 years - might be different if the phases are presented separately for each year).

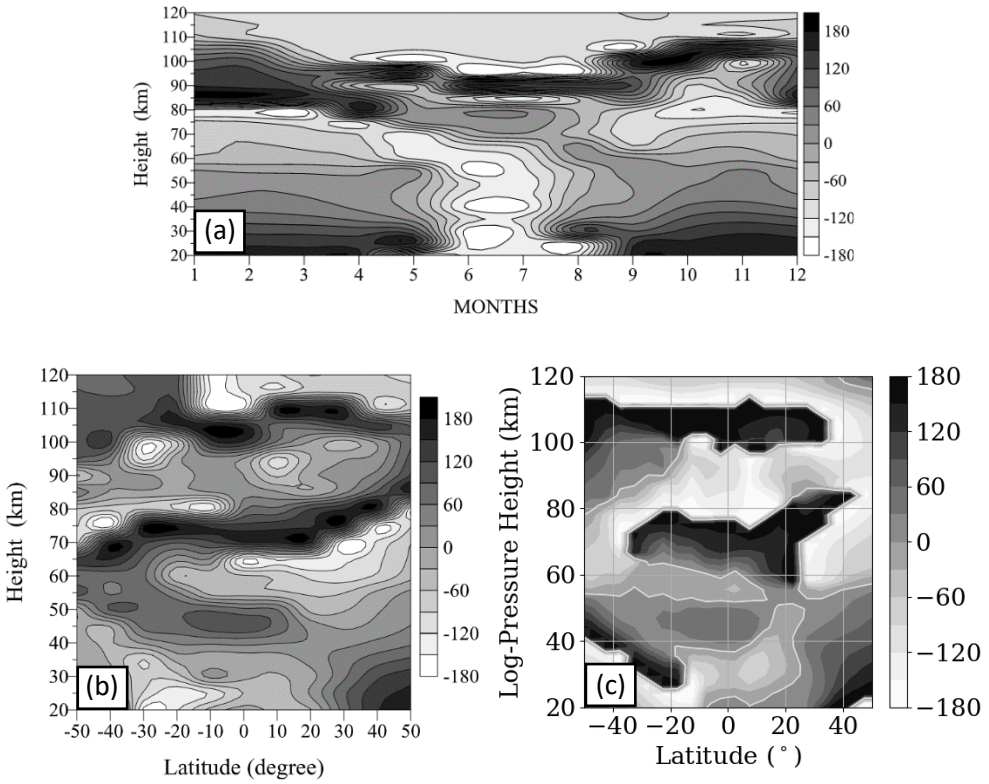

Figure 1: (a) Average (2002–2007) altitude-time cross section of the SPW1 phase at 50°N and average altitude-latitude cross sections of the SPW1 phase for (b) SABER (2002–2007) [Mukhtarov et al., 2010] and (c) MUAM (2000-2010).

By comparing the height-latitude distribution of the SPW 1 phases based on the SABER (b) and the MUAM (c) data in Fig. 1, it can be seen that the MUAM SPW 1 phases mostly correspond to the SABER SPW 1 phases. There are only small differences, which are possibly induced due to (i) the two different

time frames (2002-2007 for SABER and 2000-2010 for MUAM), and (ii) the different months (December for SABER and January for MUAM). Despite the small deviations, the SPW 1 phase seems to be quite realistic and creates a good basis for the analysis of the interference between the artificial gravity wave (GW) hotspots and the modeled SPW 1.

Reference:
Mukhtarov, P., D. Pancheva and B. Andonov, 2010: Climatology of the stationary planetary waves seen in the SABER/TIMED temperatures (2002-2007), J. Geophys. Res., 115, A06315, doi:10.1029/2009JA015156.

west wind -> westerly wind / east wind -> easterly wind

We will replace the words as suggested.

often the word "whereby" is used where it does not fit

Thank you for this remark. We will rephrase these paragraphs.

p.2, l.16: persistant -> persistent

We will correct this.

p.2, l.24: Here you state "which are limited in time," This statement is unclear. Did you want to say: "which occur only sporadically"?

We agree that it is a bit confusing. Yes, we meant sporadic or intermittent occurrence of breaking GWs in the lower stratosphere. We will change the sentence as suggested.

p.4, caption of Fig.1: Please mention that only the Northern Hemisphere is displayed

We will include your suggestion.

p.5, l.7: please explain why GWDv is set negative

Depending on the GW source and the background conditions, the GW drag can be separated into a zonal and meridional component. Compared to the meridional component, the zonal component is more pronounced. While it is already possible to derive the zonal GW drag from satellite measurements (still including large biases), the observation of the meridional GW drag is strongly constrained. So, the question was then how to estimate the local GW forcing of the observed breaking GW hotspot (in the East Asian/North Pacific region – H3 in the paper) and how to represent it within the model MUAM.
To get first an idea of the zonal and meridional GW drag direction, Šácha et al. [2015] analyzed the prevailing horizontal winds in the region of the observed breaking GW hotspot. Because the GW drag is acting against the zonal mean flow, the zonal and meridional GW drag were chosen according to the wind fields under the assumption that the GWs are orographically induced. As a result, both forcings were set to be negative.
The intensity of the zonal and meridional GW drag was examined in a previous sensitivity study, in which different kind of negative GW drag values were chosen [Šácha et al., 2016]. The setting with $GWD_u = -10 ms^{-1}day^{-1}$, $GWD_v = -0.1 ms^{-1}day^{-1}$ and $GWD_T = 0.05 Kday^{-1}$ was a quite moderate GW forcing, which did not lead to total breakdown of the polar vortex. They also found that the strongest impact on the middle atmospheric circulation is caused by the zonal GW drag component, so that the meridional GW drag is more or less negligible (also the direction).

References:
Šácha, P., A. Kuchar, Ch. Jacobi, and P. Pišoft, 2015: Enhanced internal gravity wave activity and breaking over the Northeastern Pacific/Eastern Asian region, Atmos. Chem. Phys., 15, 13097-13112, doi:10.5194/acp-15-13097-2015.
Šácha, P., F. Lilienthal, Ch. Jacobi, and P. Pišoft, 2016: Influence of the spatial distribution of gravity wave activity on the middle atmospheric circulation and transport, Atmos. Chem. Phys., 16, 15755-15775, doi:10.5194/acp-16-15755-2016.

p.5, l.14: distribution of the Ref (left) and the H3 (right) -> distribution of the Ref (Fig.2a) and the H3 (Fig.2b)

We will correct this.

p.5, l.15: is shown in Fig. 2(a) -> is shown in Fig. 2

We will correct this.

p.6, l.10: decreasing west wind, -> weakening westerly wind,

We will change this sentence as suggested.

p.6, l.13, l.15: increasing west wind -> strengthening westerly wind

We will change this sentence as suggested.

p.8, l.30: of increased zonal mean zonal wind -> of strengthened zonal mean westerly wind ???

Yes, that's right. We will change this sentence as suggested.

p.8, l.31/32: please check: which decelerates the mesospheric jet. -> and thus the zonal wind is less decelerated. ???

Thank you for this comment. The sentence is also a bit confusing. We will rephrase it as follows:
Due to the absent SPWs 1, less SPWs 1 are breaking, which leads to a reduced transfer of momentum and energy, and thus, to a less decelerated zonal wind.

p.9, l.12 remove line break

We will remove it.

p.10, l.4: please check: "WH" -> NH ??

Thank you for this remark. We forgot to introduce this abbreviation. WH stands for winter hemisphere, which is on our case the Northern hemisphere. We will include that in the revised paper.

p.11, l.5: 360deg -> 360deg East

We will correct this.

p.11, l.5: interference -> superposition

We will replace the word as suggested.

p.11, l.23: (east wind or strong west wind) -> (easterly wind or strong westerly wind)

We will correct this as suggested.

p.13, l.16: concentrate on -> focus on

We will replace the word as suggested.

p.15, l.1: stabel -> stable

We will correct this.