

## ***Interactive comment on “Impact of local gravity wave forcing in the lower stratosphere on the polar vortex stability: Effect of longitudinal displacement” by Nadja Samtleben et al.***

### **Anonymous Referee #1**

Received and published: 25 September 2019

The paper "Impact of local gravity wave forcing in the lower stratosphere on the polar vortex stability: Effect of longitudinal displacement" by Samtleben et al. investigates the sensitivity of the northern hemisphere stratospheric polar winter jet to perturbations imposed by localized gravity wave forcing. This topic is of interest because localized forcing may be relevant for the jet evolution prior to sudden stratospheric warmings. In the fixed latitude range 37.5 to 62.5 deg N the locations of forcing are shifted in steps of 45deg longitude. It is found that forcing near the Rocky Mountains increases the stationary planetary wave 1 (vortex weakening), whereas forcing near the Caucasus, the Himalayas or the Scandinavian region decrease the wave 1 (vortex less weakened). Particularly, for forcing near the Himalayas it is found that local instabilities in the lower

mesosphere can generate additional stationary planetary waves that propagate into the mesosphere.

Overall, the paper is well written and publication of the paper in Annales Geophysicae is recommended with only minor comments.

Main comment:

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.

Specific comments:

general comment: west wind -> westerly wind / east wind -> easterly wind

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

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

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"?

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

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

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

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

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

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

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

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

p.9, l.12 remove linebreak

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

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

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

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

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

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

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