Atmospheric Chemistry and Physics Discussions

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Comment on acp-2021-824

Anonymous Referee #1

Referee comment on "Decay times of atmospheric acoustic–gravity waves after deactivation of wave forcing" by Nikolai M. Gavrilov et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-824-RC1, 2021

This paper presents a series of numerical simulations with a high-resolution two-dimensional wave model addressing responses of acoustic-gravity waves to transient sources. The latter were gradually activated and deactivated at the lower boundary using two characteristic time scale scenarios. While modelers are quite familiar with the "growing" phase, the behavior of the wave field after sources are turned off was least studied. The paper deserves publication, however the presentation has to be improved. Some general points are listed below.

1. Some discussion is required on what mechanisms (beside the numerical viscosity) cause wave dissipation in the lower and middle atmosphere. It seems that molecular diffusion in the thermosphere is the major mechanism that eliminates waves in the modeling domain.

2. The results are essentially summarized in two tables. How numerical viscosity affects these numbers? Are they representative, or just depend on the particular model?

3. Is there any significance of your results for waves in 3-dimensional case? The decay would apparently be much faster in 3D due to dispersion and localized sources.

4. Are there implications for the real atmosphere? My impression after reading the manuscript is that the atmosphere is full of run-away packets and individual spectral harmonics.

More specific comments
- The terms "quasi-standing", "residual" and "secondary" waves are used, but their

meaning is not defined and is not clear (e.g., l. 210).

- l. 180 "This may reflect disappearing of fast traveling AGW modes". - It probably is quite opposite. Deactivating the forcing below introduces a spectrum of harmonics, including those traveling fast.

- l. 240. "Theoretical time delay t_e..." - Was it introduced/calculated somewhere?