

## **Reply to the “Interactive comment on “Verifications of the nonlinear numerical model and polarization relations of atmospheric acoustic-gravity waves” by N. M. Gavrilov and S. P. Kshevetskii, Anonymous Referee #2”**

**We would like to thank the Referee #2 for useful comments helping us to improve the paper. Out replies are given below with bold font.**

The paper is devoted to the comparisons of atmospheric wave parameters calculated using Direct Numerical Simulation (DNS) model with polarization relations (PR) given by analytical theory of linear acoustic-gravity waves (AGWs). Such comparisons can be used to test as the numerical models as the PR themselves. There are no such direct comparisons of analytical PRs with wave DNS models in the scientific literature. Therefore, the paper presents new and important results, which are to be useful for verifications of atmospheric wave DNS models and to improve the parameterizations of AGW effects in atmospheric dynamical models. The paper is within the scope of the GMD journal. The title and abstract reflect the contents of the paper. The overall presentation is clear and adequately structured. Therefore, the paper can be recommended for publication in the GMD after some minor revision.

Specific comments:

P7809, L7 “... of the continuity, momentum, and heat balance”.

**The revised text is corrected.**

P7809, L20-21. “... laws of the momentum, mass, and energy”.

**Corrected.**

P7809, L20-25. It would be helpful to extend the description of the numerical algorithm and give some explanations concerning the difference between the standard Lax and Wendroff scheme and suggested modifications.

**The extended description is added to the revised text.**

P7810, L2. Please explain, why you need so small vertical grid spacing (12 m) near the ground.

**Small vertical grid spacing in the boundary layer are needed because of high gradients of velocity their. We added this description into the revised text.**

P7810, L2. “... at altitudes of about 500 km...”

**Corrected.**

P7811, L6. “... sound speed,...”

**Corrected.**

P7811, two last equations (5). What denotes alpha?

**“ $\alpha = 1/(2H)$ ” is added**

P7812, equation (7). “...  $(UW^*)/2$ , where “\*” denotes the complex conjugate value.

**Corrected.**

P7812, L10. Reformulate the phrase in the middle “To make simulations matching to the linear AGW theory (see Eq.(2)), ...”

**The phrase is reformulated.**

P7813, L3. “very high altitudes”.

**Corrected.**

P7814, First sentence. “These intervals grow ...”.

**Corrected.**

P7814, L5. “The Table contains simulated SDs at each altitude averaged over n model outputs during ...”

**The phrase is modified in the revised paper.**

P7815, L15. Why you did not compare DNS model and linear PR above 100 km? If such comparisons were made, it would be helpful to give respective description.

**Above altitude 100 km we found big disagreement? Because linear AGW theory does not involve molecular dissipation. We added this description into the revised paper.**

P7815, L13-15 and P7816, L9-13. There is a possibility of AGW reflection from the dissipative region in the thermosphere – see, for instance, Yanowitch, M. Vertical oscillations in a viscous and thermally conducting isothermal atmosphere. J. Fluid Mech., 1974, 66, 273-288. A short discussion will be useful.

**We added a short description and the citation.**

P7815, Last para. “... momentum fluxes  $F_{mz}$  given by Eq. (7) and ...”

**The phrase is modified in the revised text.**

P7821. Tables 1, 2. The authors used steady-state analytical PR for comparisons during transience time intervals. Why the authors suppose validity of the steady state PR in this case?

**We do not suppose, but we checked the validity of steady state PRs during transience time intervals, because such PRs are applied to non-steady AGWs in many studies. Our comparisons show bad agreement between steady-state PRs and non-stationary numerical simulations, which show need for developments of theories of nonstationary AGWs. We added this statement to the revised text of the paper.**

English in the manuscript needs improvements.

**English in the revised text was corrected by a professional expert.**

**Yours sincerely.**

**Nikolai M. Gavrilov, Sergey P. Kshevetskii**