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Interactive comment on "Evanescent acoustic-gravity modes in the isothermal atmosphere: systematization, applications to the earth's and solar atmospheres" *by* Oleg K. Cheremnykh et al.

Oleg K. Cheremnykh et al.

yuraslv@gmail.com

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Reply to the report by Reviewer_1

We would like to thank the Reviewer_1 for the questions and recommendations. Below we provide the answers to the proposed questions.

Reviewer 1:

1 The correctness of the transition from equations (1), (2) to equations (5), (6) when

considering divergence-free waves (divV = 0) is in doubt. Since in an incompressible medium the speed of sound tends to infinity, the product "infinity to zero" in square brackets of equations (1), (2) becomes uncertain.

We consider a compressible atmosphere stratified in a field of gravity. In equations (1), (2), the speed of sound refers to a compressible medium and is the final value, whereas the condition divV = 0 determines the properties of the perturbations only.

2. The realization of the obtained modes was considered in the framework of a simplified model of an infinitely thin discontinuity in the altitude profile of temperature. In the atmospheres of the planets, the situation is most likely realized when the change of the parameters along the vertical occurs on scales of tens of kilometers, or even hundreds, for the Sun. Can the acceptance of the finite thickness of the transition layer significantly affect the conditions of realization of the evanescent wave modes considered in the work?

The simplest model of a thin temperature gap is considered as an example in order to show the fundamental possibility of implementing the new types of wave modes obtained in the work. To understand how the thickness of the transition layer affects the properties of the modes considered, a separate study is needed. This effect seems to be significant. Especially when the magnitude of the transition layer is commensurate with the atmosphere scale height for the upper or lower isothermal half-spaces. In our opinion, it is more expedient to investigate the implementation of the received modes within the framework of an atmospheric model with a continuous non-isothermal altitude profile of temperature.

3. In the atmosphere, different types of gravity disturbances may occur: (1) freely propagating waves, having a real and non-zero vertical component of the wave vector; (2) evanescent wave modes, propagating only horizontally. Does it mean that sources of evanescent modes and freely propagating waves are fundamentally different?

The problem of sources was not analyzed in the work, we considered free waves (on

the right side of equations (1), (2) there are zeros). It is unlikely that the sources of atmospheric acoustic-gravity waves of different types must necessarily have a different nature. In our opinion, if the sources are localized in the isothermal interval of the heights of the atmosphere, they generate a freely propagating AGW more effectively. At heights of sharp temperature gradients, evanescent wave modes are preferred, since “surfaces” arise that support the propagation of such waves. This question requires separate study.

4. It is not clear from the manuscript how complete is the list of possible evanescent modes. Are there additional requirements for disturbances that will lead to new solutions?

It is likely that equations (1), (2) admit the possibility of the existence of other types of evanescent wave modes. When imposing other additional conditions on the properties of disturbances, besides those considered in the article, other types of evanescent modes can be obtained and Table 1 can be supplemented.

The following inaccuracies:

1) The phrase “the properties of the medium" should be replaced by “the properties of the disturbances".

2) The bottom line of Table 2 (line 2, p. 20) uses the abbreviations AMp, AM, which, apparently, should be replaced by AE and AEp.

3) Mistakes are made in the names of subsections 2 and 2.1 (line 1, page 3 and line 19, page 3). Probably should be 2 Evanescent modes in the isothermal atmosphere 2.1 Non-divergent and pseudo-non-divergent modes

We have checked and corrected these inaccuracies in the text.

Sincerely, Authors

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