Reply to Referee_2

We would like to thank the Referee_2 for the recommendations that have helped us to improve our manuscript. Below we provide answers for your questions.

Referee 2:

The title: Perhaps, the authors should modify the title of the paper, as it addresses also the case of a vertically non-isothermal atmosphere.

In the first part of the work, we considered.separate types of modes in an unlimited isothermal atmosphere. In the second part, we studied the possibility of realizing the modes at a temperature discontinuity, but for each half-space within the isothermal model. Therefore, we are of the opinion that the term "isotermic atmosphere" in the title is appropriate.

p. 1, l. 23 "consisting of acoustic and gravity regions" - are those regions on the dispersion plane or in different parts of the atmosphere?

We changed the sentence to «consisting of acoustic and gravity regions on the dispersion plane».

p. 2, l. 30: the authors claim that the possibility of the existence of a new type of evanescent acoustic-gravity modes is proved in the paper. Could the authors explain why this mode has been missing from the vast amount of previous studies of this problem? In other words, which novel element (assumption or method) allowed the authors to identify this previously unknown mode.

We assumed that wave disturbances may exist in a stratified compressible atmosphere that satisfy the new additional conditions. Under the assumption of perturbation incompressibility (divV = 0), the known ND mode was obtained, and under the assumption of perturbation inelasticity ($\mathrm{div}(\rho_0 V) = 0$) a new AE mode was obtained. In the text of the article indicated, under which assumption each of these modes is obtained.

p. 3, l. 8: Please mention that the sound speed is determined by the temperature.

We added in the text the definition of the atmospheric scale height in the form H = kT / mg, clearly indicating the dependence on temperature.

Eq. (11): the RHS of the equation may be confusing: it is not clear that it actually consists of two different lines corresponding to different signs on the LHS. Please modify the equation, by, e.g., adding a comma after k_x in the top raw, and a full stop after k_x in the bottom raw.

Equation (11) was written in one line.

It would be instructive to link the term "anelastic" with the terms "compressive" or "incompressive", which are commonly used in the solar atmospheric research.

According to the physical meaning, ND mode is "incompressible" (divV = 0), the other considered modes, that is, NDp, AE, AEp modes, are "compressible" (divV ≠ 0). We use the term "anelastic" for disturbances with $\mathrm{div}(\rho_0 V) = 0$.

The term "an unlimited atmosphere" would perhaps sound better as "an unbounded atmosphere".

Replaced.

p. 10, l. 8: Please give the physical meaning of this boundary condition. In other words, the continuity of which physical quantity or quantities should be kept across the interface?

Obviously, if the atmosphere is barometric, then the equilibrium pressure p_0 should be continuous across the interface, and hence the value of ρc^2 also. In addition, for the perturbed values, we require continuity of the vertical velocity component V_z (kinematic condition) and perturbed pressure (dynamic condition). Under these assumptions, we obtained equations (29), (30). For more details see, for example, Tolstoy (1963), Rosental and Gough (1994), Cheremnykh et al. (2018a).

Throughout the paper: please use "equation" instead of "equality".

Corrected.

p. 11, l. 1: It is not clear how the 8th order polynomial in Eq. (31) is obtained from Eq.(30) which has a 4th order polynomial in the numerator.

To get rid of the radicals in expressions (28), (29), which determine the values of a1 and a2, these expressions were squared several times when a polynomial was obtained. The procedure for obtaining a polynomial from boundary conditions (30) is described in Miles and Roberts (1992). Note that expression (31) is only part of the full polynomial expression obtained in Miles and Roberts (1992). Moreover, in (31) two non-physical roots are omitted.

p. 15, l. 4: "the f-mode observed on the Sun should not be compared with the nondivergent ND mode, but with non-divergent pseudo–mode NDp." First of all, I think that the word "associated" would be better than "compared" in this context. Anyway, please explain the physical implications of this association (or comparison).

We agree that "associated" better reflects the meaning of the statement. ND mode and pseudo – mode NDp have the same variance. Therefore, when observing ω (kx), these modes are indistinguishable. The modes differ in the sign of polarization (in one mode, the Vx oscillations are ahead of Vz by 90 °, and in the other mode they are 90 ° behind) and the pattern of amplitude variation with height. Physically, ND mode is "incompressible" (divV = 0), and NDp mode is "compressive" (divV ≠ 0). In the framework of the considered model, only the NDp mode can satisfy the condition of energy reduction in both sides of the interface if the temperature in the upper half-space is higher than in the lower half-space.

Table 2 and 3: Please remind the abbreviations used in the tables (i.e., "L", "Lp", "BV", "BVp", etc.) in the captions. It would allow using those tables in review papers and presentations.

We gave the full names of the modes in the headings of Tables 2 and 3.

Sincerely,
On behalf of the authors of the manuscript,

Yuriy Selivanov, PhD