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Study of Propagation of Acoustic-Gravity Waves Generated by Tropospheric Heat Source

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The use of experimental data on pressure variations on the Earth's surface makes possible to study the propagation of acoustic-gravity waves from the lower to the upper atmosphere. However, a question arises: how the pressure on the Earth's surface is related to meteorological processes and how significant inaccuracy is allowed when replacing tropospheric meteorological sources instead experimentally observed pressure fluctuations on the Earth's surface.

The problem of wave propagation from a tropospheric heat source was analytically studied to resolve this issue. Based on general assumptions about the tropospheric source and its parameters, an estimate of the waves that could be generated by such source was made. The study showed that the generation of internal gravity waves by a heat source cannot occur without the generation of infrasonic waves by this source. Therefore, infrasonic waves must also be taken into account. The source of infrasonic waves was defined and it was shown that in terms of power it is approximately equal to the source of internal gravity waves. Despite this, the amplitude of the generated infrasonic waves is less than the amplitude of the gravity ones, due to the fact that the source frequency is less than the acoustic cutoff frequency.

In the numerical study of this problem, model local thermal small-sized tropospheric sources of waves operating at different frequencies were studied. Pressure fluctuations at the Earth's surface from the studied model source are recorded and then used at the boundary surface to calculate the propagation of waves upward from pressure fluctuations. Comparison results of calculations directly from a tropospheric source operating at infrasonic frequencies and from recorded pressure fluctuations on the Earth's surface showed that the wave pattern above the source, created directly by the tropospheric source, and from pressure variations recorded on the Earth's surface, practically coincide. In the case when the tropospheric source operates at the frequencies of internal gravity waves, the general coincidence of the two wave patterns also takes place. However, the quality of this match is lower. This happens due both to the typical features of the propagation of the internal gravity waves themselves, and to the fact that during the operation of such a source, infrasonic waves are additionally generated.

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