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New method for monitoring of the atmospheric internal waves parameters

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A new analysis to identify the observed temperature or density fluctuations in the Earth atmosphere as wave-induced, assuming shear saturation of internal gravity wave (IGW), has been developed. This technique is based upon a comparison of the experimental and theoretical values of the relative amplitude threshold which is defined as the wave amplitude required for shear instability in the atmosphere. The criterion for the positive IGW identification of the observed fluctuations has been formulated and argued. In the case when the analyzed fluctuations are positively identified as wave-induced, then the intrinsic frequency and other parameters of the monochromatic gravity wave can be determined from only a single vertical temperature or density profile measurement. It is shown that the suggested method is most effective in the case of low IGW frequencies when the experimentally determined amplitude thresholds for examined fluctuations appreciably differ from unity. In order to derive internal gravity wave characteristics we have analyzed small-scale fluctuations of normalized temperature in the Earth stratosphere using radio occultation data of GPS/FORMOSAT and GPS/CHAMP missions. The results of the determination of the wave characteristics and their uncertainties are presented. For the experimental examination of the efficiency of the analysis technique proposed, the results of the simultaneous temperature and wind velocity measurements obtained in a high-resolution balloon experiment were used. By using the experimental temperature data only, we reconstructed all wave parameters. A comparison between observed and reconstructed wave parameters shows good agreement. We assume that this method can be widely applied for investigations of season and latitude variations of a wave activity in the Earth atmosphere based upon the analysis of vertical temperature or density profiles measured by other techniques.