Acoustic-gravity waves at ionospheric heights generated by meteorological activity in the troposphere

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The study deals with observations of ionospheric effects of convective storms in the troposphere, particularly with observations of acoustic-gravity waves in the period range 1-30 min. Convective storms are a source of a broad wave spectrum. The waves propagate partly into the upper atmosphere where they contribute to changes of the structure, dynamics, and composition of the atmosphere. The results of observations in the Czech Republic were compared with the results obtained in the 1960s and 1970s in the central part of the USA. Convective storm develop in both regions under different conditions and thus may act different as far as their influence on the upper atmosphere is considered.

Acoustic gravity waves generated by severe tropospheric weather do not carry any label which would help to identify them. One of the ways to distinguish acoustic-gravity waves of tropospheric origin is to recognize waves generated by other sources. Here, a method was proposed that could help to find waves generated by fluctuations the geomagnetic field which is one of the most common sources of ionospheric waves.

Ionospheric infrasound generated by convective storms was rarely observed in the Czech Republic. Infrasonic waves of periods ~2-5 min occurred in only two cases when exceptionally strong meteorological activity occurred in the troposphere. The first event was an example of intense convective storms in summer (29 July 2005); in the second case, infrasonic waves occurred during the passage of a distinct cold front in winter (18 January 2007). Increased wave activity was also observed in the period range ~5-30 min on these two days. During the other analysed events, wave activity which could be unambiguously attributed to tropospheric meteorological processes was not found in the analysed period range. The results in the Czech Republic significantly differ from those obtained in North America. Here, occurrence of infrasound was frequently reported during convective storms.

The results may differ (1) due to different sounding frequencies used in the Czech Republic and in the USA leading to observations in different ionospheric regions, (2) in Central Europe, contrary to the central USA, suitable conditions for a strong convection develop infrequently and strong convective storms considered a source of infrasound occur rarely.