Geophysical effects caused by the fall of the Chelyabinsk bolid

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The fall of cosmic bodies to the Earth causes strong atmospheric phenomena, manifested in the heating and luminescence of air masses, the formation of a shock wave, and then an acoustic wave, etc., which are accompanied by the disturbance of geophysical fields. The instrumental observations of the caused variations of geophysical fields provide important information about the nature of the influence of cosmic bodies on the Earth's atmosphere, as well as form a quantitative basis for verifying theoretical and numerical models developed to describe the reaction of external geospheres to strong local disturbances and establish and validate the mechanisms of interaction and transformation Earth's fields.

In the present work, based on the results of complex in situ observations made at Mikhnevo Geophysical Observatory of IDG RAS, synchronous variations of the electric and magnetic fields on the Earth's surface were established when the Chelyabinsk bolide fell (2013.02.15). In so doing, the variations of the above-mentioned fields were noted for the first time not only during the passage of a cosmic body in the Earth's atmosphere (primary effect), but also during the arrival of the low-frequency acoustic signal caused by the bolide at the observation point (secondary effect), which occurred some time after the main event (time propagation of the acoustic signal from the source to the observation point).

The obtained data concerning the character and amplitude characteristics of the acoustic signal and the caused variations of the electric and magnetic fields expand the current understanding of the geophysical consequences of the fall of cosmic bodies on the Earth. At the same time, new opportunities are provided for estimating the energy of an acoustic source and developing promising approaches to identifying sources and mechanisms of electrical and magnetic field disturbances in the Earth's atmosphere based on a comparative analysis of their variations and acoustic field disturbances when meteorites fall.