

## Seismo-acoustic effects of the Lipetsk bolide 21.06.2018

---

**Rybnov Y., Varypaev A., Volosov S., Nesterkina M., Konstantinovskaya N., Kharlamov V.**

Institute of geosphere dynamics RAS, Moscow, Russia

e-mail: avalex89@gmail.com

The meteoroid fall, bright trail of which was visible at a long distance, was being observed in the district of Lipetsk region at around 01:16 21.06.2018 UTC. The motion of such meteoroids produces strong acoustic disturbances in the atmosphere, which can cause seismic vibrations in the earth medium. Acoustic and seismic vibrations associated with this event were recorded by the seismo-acoustic complex IDG RAS (GFO «Mikhnevo»).

An analysis of complex field observations showed that simultaneous seismic and acoustic vibrations are observed. The time of their registration is about 01:30:46 UTC. It was found that seismic vibrations were excited by an infrasonic wave from a bolide that propagated in a stratospheric waveguide.

In this paper, based on the results of acoustic observations, the source coordinates were estimated ( $N \approx 52,40$ ,  $E \approx 37,80$ ). There is a good agreement with the data on the coordinates presented by NASA, where using the maximum brightness of the glow the estimation was performed ( $N \approx 52.80$ ,  $E \approx 38.10$ ). The estimation error does not exceed  $\approx 40$  km.

The calculated value of the azimuth to the source according to seismic observations was  $\approx 174$  degrees, according to acoustic observations  $\approx 178$  degrees. The error doesn't exceed  $\approx 4$  degrees. Using source coordinates that are given by NASA the similar estimated value is equal to 174 degrees which coincides with the results obtained by records of «Mikhnevo» seismic array.

According to the data of infrasound observations and the methodology developed at IDG RAS, the energy of the bolide was estimated to be equal to  $\approx (1,2 \div 1,3) \times 10^{13}$  J.

The results of the studies concerning the amplitude-frequency characteristics of seismo-acoustic signals and their sources, allow us to expand our understanding of the mechanisms of generation of these disturbances and their manifestations in various geophysical fields.