

Shockwave phenomena related meteorite fall: Infrasound and seismic records of the Chelyabinsk meteorite fall

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Bolides or meteoroids passing through the atmosphere with high velocities generate strong shockwaves with conical wave front, and when the terminal burst of the meteoroid is occurred, additional shockwave with spherical wave front is also generated. These two types of shockwave propagate as atmospheric pressure wave (main component is infrasound band) and sometimes detected by infrasound sensors. Pressure induced ground motions (resulting air-to-ground coupling) are also detected by seismic sensors. Shockwave records by infrasound/seismic sensors are useful for estimating trajectory and size of meteoroid.

A huge bolide was appeared in the skies over the Ural district, Russia around 03:20 UTC, Feb. 15, 2013 and a few minutes after, strong shockwave struck at Chelyabinsk city (55.1544444 °N, 61.4297222 °E). The shockwave destroyed lots of window glasses of buildings and injured more than 1,000 residents. The shockwave related infrasound signals were clearly recorded by worldwide CTBT-IMS infrasound monitoring arrayed stations. In addition, strong surface wave generated air-to-ground coupling of terminal burst shockwave is also detected by global broadband seismic network beyond 3000 km in range. It is no doubt that this is the largest bolide event since 1908, when the Tunguska event [e.g., Ben-Menahem, 1975; Trayner, 1997; Foschini, 1999] occurred.

In this presentation, we introduce CTBT-IMS infrasound monitoring network and infrasound and seismic records of the Chelyabinsk event. And then we compare those records with smaller events (natural bolide [e.g., Ishihara et al., 2004] and the Hayabusa reentry [Ishihara et al., 2012]).

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