Geophysical Research Abstracts
Vol. 16, EGU2014-6407-1, 2014
EGU General Assembly 2014

Joint interpretation of infrasound, acoustic, and seismic waves from meteorites: Chelyabinsk bolide and other events

Ivan Kitov (1), Mikhail Rozhkov (2), Dmitry Bobrov (2), and Vladimir Ovtchinnikov (1)
(1) Institute of Geosphere Dynamics, Russian Academy of Sciences, (2) CTBTO, Austria (mikhail.rozhkov@ctbto.org)

Meteorites are always the events that testing the capability of the International Monitoring System to measure and the International Data Centre to analyze sources similar to nuclear explosions. Monitoring of the Comprehensive Nuclear-Test-Ban Treaty suggests the possibility to detect infrasound (acoustic) and seismic signals from atmospheric and underground events and to locate their sources. Chelyabinsk meteor was one of the best exemplar in a row of other atmospheric events exposing the ability of IDC and IMS to handle the atmospheric explosions. The uniqueness of this event is that the generated seismic, acousto-seismic and infrasound wave fields were recorded by considerable number of IMS stations of different technologies at wide distance range. The shock waves from the Chelyabinsk meteor generated an I-phase recorded by IMS infrasound stations and a series of seismic phases. The Pn-waves were observed by five near-regional seismic stations together with Sn- and Lg-waves. They are most likely associated with the impact of the meteor debris and the location associated with their source differs by tens of kilometers from that obtained by Rayleigh and Love waves. The latter were generated by acoustic (low-amplitude shock) waves hitting the ground beneath the trajectory of the meteor. Surprisingly, these surface waves associated with the meteor and observed at least at distances of 45º were not associated with the event in the Reviewed Event Bulletin. This implies a conceptual gap in the IDC processing and fusion of acoustic and seismic waves. The trajectory of the meteorite built with the epicenters of seismic, acousto-seismic and infrasound events is in good compliance with the trajectories built by different scientific institutions including NASA. We present an approximate distribution of energy release along the trajectory and thus the amplitude of the generated shock wave. It allows interpreting the period and amplitude dependence of the LR and LQ waves on the trajectory altitude. Corresponding relationships were obtained from the set of historical atmospheric nuclear tests. We also compare the Chelyabinsk meteor with seismic observations from the 1984 Chulym River (Western Siberia) bolide, which fell approximately 1000 km east of the studied event, and with the so called Vitim Bolide of 2002 (Eastern Siberia). We estimate the energy of these bodies and its distribution between various acoustic/seismic waves in order to interpret their respective sources and to discuss possible mechanisms of wave generation and conversion.