P036-007 Room: C401 Time: May 27 14:42-14:54

Temporal Change of the Meteoroid Size along the Fall Path

Yoshiaki Ishihara[1], Yoshihiro Hiramatsu[2], Muneyoshi Furumoto[3]

[1] Natural Sci. and Tech., Kanazawa Univ., [2] Natural Sci., Kanazawa Univ., [3] Dept. Earth Sci., Kanazawa Univ.

Fireballs are caused by high-velocity passages of meteoroids through the atmosphere, generating shock waves. Shock waves are recorded on seismograms from high sensitivity seismographs. Seismological records provide two kinds of information, the shock wave arrival time and the amplitude of the shock wave at each seismic station. Shock wave arrival time data enable to determine the trajectories of fireballs. Ishihara et al. (2001) read arrival times of shock waves manually on seismograms and determined the trajectories of the 1998 Miyako fireballs and the 1999 Kobe meteorite.

The amplitude of the shock wave depends on the energy release rate or the reduction rates of the mass and velocity of the fireball. The information on the amplitude history along the trajectory is important to study the ablation process of the meteoroid in the atmosphere. Seismic amplitude data is, therefore, useful to estimate the history of the shock wave generation along the trajectory, while the amplitude data have been never analyzed before. In this study, we investigate temporal changes of the energy release of fireballs, the above two and the 1996 Tsukuba meteorite, using the data of amplitudes of shock waves. The observed amplitudes of shock waves are affected by the exciting efficiency of shock waves in the atmosphere, which depends on the atmospheric pressure, the attenuation along the traveling path and the incident angle at the surface. The parameters of the trajectories of the fireball and the meteorites enable to determine the generation point of the shock wave recorded at an arbitrary station. Correcting the difference of the exciting efficiency, the attenuation and the incident angle, we estimate the relative amplitude of shock waves along the trajectory.

We find the systematic change of amplitudes along the trajectory. If the fall velocity is nearly constant, these changes of amplitudes suggest the decrement of the size of meteoroids along the trajectories. The amplitude of the shock waves on the Tsukuba meteorite is one order of magnitude larger than that of the Kobe meteorite at a given altitude. The difference of the amplitudes means that the size of the Tsukuba meteorite is ten times larger than that of the Kobe meteorite, since fall velocities of these meteorites are nearly constant (18 ~ 20 km/sec). This estimate is very concordant with the ratio of the recovered masses of the Tsukuba and the Kobe meteorites, 0.8 and 0.1 kg, respectively.