Physical implication of instrumental seismic intensity (2)

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Modeling a variety of seismic waves on a PC, we investigated the frequency dependence of instrumental seismic intensity (ISI) to understand its physical implication.

(1) S-phase: Various S-phases are successfully simulated by a bundle of line-spectra with random phases within a restricted range. The range of phase is critical to create a clear wave-packet for a given frequency band-width. A narrow phase-range shows a sharp pulse, whereas a wide phase-range, a ground motion similar to microseisms. S-phases of seismic waves are generally characterized by a phase-range from -90 to 90 deg.

(2) Frequency dependence of ISI: Thus simulated acceleration waves are filtered and large-amplitude pulses are excluded from the vector amplitude according to the established method. We call its peak value 0.3s-lebel. The frequency dependency of 0.3s-level is represented as y = c f^k, where y is the 0.3s-level. The exponent, k, is a function of phase-range. A wide range shows a small k as small as -0.5, and a narrow range, a big k. The range from -90 to 90 deg, that is typical to general seismic waves, shows k=-1, which implies the frequency dependence of 0.3s-level is similar to that of ground velocity. It implies that the ISI indicates the peak intensity of ground velocity, but not of acceleration.

(3) Cause of damage: The model of structure is the elastic column, in which plane seismic waves propagate and reflect. The destruction supposed to occur when a strain exceeds a critical level. Then it will be shown that the maximum strain in the column is proportional to the peak ground velocity for a shorter wave-length than the height of column, H, and proportional to the peak ground acceleration for longer wave-length. The critical wave-length may be H/4.