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Nonlinear radiation of hypocenter and prevision of earthquakes

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Hypocenter vibrations have been analyzed using the analysis method based on time reversal. The dynamic model of the hypocenter vibrations based on the results was advocated. In addition, the effectiveness of the dynamic model was confirmed. The activity regions in the hypocenter are presumed using the dynamic model here.

First, the outline of the dynamic model is described. The time-reversal process was executed to the P wave signals received at the observation stations for the earthquake that occurred in the central part of Suruga Bay in August, 2009, and the pulses formed at the position of the hypocenter, that is, time reversal pulse (TRP) was obtained. The TRP corresponds to an equivalent source to which the hypocenter emits. The obtained TRP provided clear orientation dependency. To clarify the origin of the azimuthal dependence, the frequency spectrum of the TRP to azimuth was obtained. The frequency spectrum was greatly changed by the azimuth. Then, the distribution of the maximum amplitude frequency to azimuth was obtained. As a result, the maximum amplitude frequency rises greatly as azimuth moves from west to east and it has descended afterwards. This frequency rise shows the local movement of sources by high speed. The moving direction converged in the direction of Nishiizunishi, Kawazu, and Ito.

The P waves received at these observation stations exhibited a unique behavior. The head part of the wave received in Nishiizunishi was expanded. However, there was no expansion in the head part in the waves received in Ito and Kawazu near Nishiizunishi.

The head's growing in this manner occurs when the progression rate of cracks in an active fault becomes near the velocity of propagation. The pressure that occurs due to the crack is added cumulatively by moving by high speed. That is, the parametric effect occurs in the active fault. Nishiizunishi is a specific point that reflects the feature of this earthquake.

As for the waveform of the aftershock that received at the specific observation station, the head part of the P waves expanded more than that of main shock. Similarly, the expansion of the head part was observed for the precursor earthquake that occurred before the main shock. The dynamic model of hypocenter vibrations has advocated from these results. The point where the narrow beam emitted from an active fault reaches the surface of the earth is called a parametric spot. The head of the pulse to which the head expands is called a parametric head. This model was verified about four earthquakes larger than M5 that occurred from 2012 to 2009 near Mt. Fuji. The effectiveness of the dynamic model was confirmed.

The dynamic model is consistently approved for precursors, a main shock, and aftershocks. Therefore, the dynamic model may be used for the prevision of earthquake.

The precursor earthquakes of the earthquake that occurred in the central part of Suruga Bay in August, 2009 are examined. The receiving waves that accompanied the parametric head in that were observed seven times. These represent evidence that the progress of the crack began to become a high speed in the active fault. Therefore, observing the seismic waves of a slight earthquake at the peculiar parametric spot and examining the change, may foresee a big earthquake afterwards.

Keywords: hypocenter vibrations, dynamic model, time reversal, prevision of earthquakes