Relationship between the asperities and centroids of short-period wave radiation energy from the seismic intensity inversion

Katsuhisa Kanda[1]; Masayuki Takemura[1]

[1] Kobori Res. Comp., Kajima Corp.

The inversion method using seismic intensity in JMA scale has been developed to evaluate energy distribution regarding short-period seismic waves. It can analyze the source mechanism of not only recent but also historical earthquakes. Therefore, This method is quite useful and effective to analyze major earthquakes along the oceanic plate boundaries, because they occurred repeatedly at regular interval in the long history.

In this study, we identified short-period radiation zone and their energy centroids from evaluated energy distribution, and compared them with slip distributions from waveform inversion. We investigated the geographical relationship between the energy centroid and slip asperity of major interplate events of the Off-Tokachi, Off-Miyagi-ken, Great Kanto, Tokai, Tonankai and Nankai earthquakes.

Since the short-period radiation zone and its centroid of the 2003 Off-Tokachi earthquake were quite similar to those of the 1952 event, it might be suggested that the same type of earthquake recurred. The energy centroid of both earthquakes was located at the north edge of asperities. The energy centroid of the 1936 Off-Miyagi-ken earthquake was located at the south edge of its asperity, and that of the 1978 event was located at the west edge of its asperity. There were two asperities during the 1923 Great Kanto earthquake according to the waveform inversion. The obtained short-period radiation zone was divided into two areas and their energy centroids were located at the east edge of the asperities. It is obvious that all the energy centroids are located near the end of rupture propagation.

As for the 1944 Showa Tonankai earthquakes, there were four short-period radiation zones surrounding asperities area near the Shima Peninsula. Two energy centroids of them were considered to be located near the forward edge of fault rupture. The 1946 Showa Nankai earthquake consisted of three short period radiation zones whose centroids were located near the edge of the corresponding asperities.

It is indicated that most of the centroids of short-period wave energy of major plate boundary earthquakes were located at the edge of corresponding asperities in the forward direction of fault rupture. The short-period seismic waves were radiated from near the terminal slip points in asperities. It may be explained from the rupture front focusing phenomenon that fault rupture is finally focused on rupture-terminated areas where slip velocity increases rapidly and short-period seismic wave radiates strongly. It may be suggested that the relationship between slip asperities and short-period radiation zones can reveal the rupture process of historical earthquakes without waveform data as well.

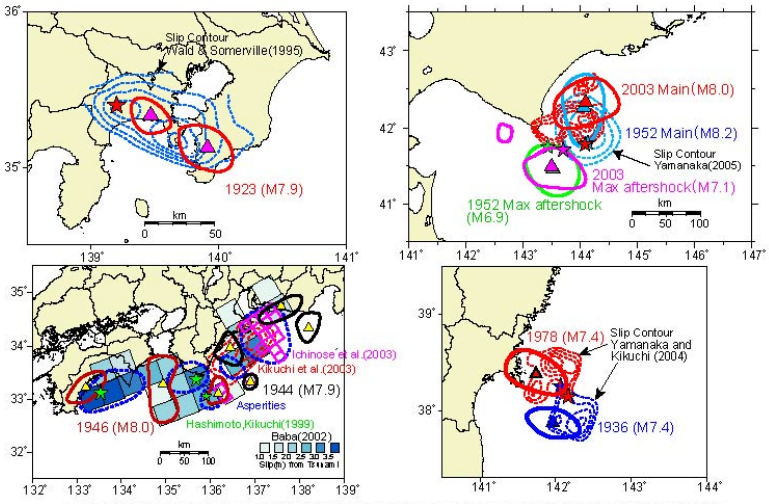

Figure : Comparison between centroids of short-period wave radiation energy and asperities of major plate boundary earthquakes.
Solid line: short-period wave radiation zone; Star: epicenter; Triangle: centroid of short-period wave radiation energy.