Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS39-P16 Room:Convention Hall Time:May 25 13:45-15:15

Envelope broadening of S-waves from earthquakes near the hypocenter of the Tohoku-Oki earthquake.

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We investgated envelope broadening and delays of peak arrivals of S waves that radiate from the aftershocks of the 2011 Tohoku-Oki earthquake on an onshore seismic network. The onshore seismograms of earthquakes occurring in the forearc of the northeastern Japan show clear difference in their S-wave envelope shapes according to difference in those focal depths (Gamage et al, 2009; Koga 2010). The seismograms of interplate earthquakes tend to have broader S-wave envelopes than those of intraplate earthquakes. Focal mechanism of earthquakes in the focal area of the 2011 Tohoku-Oki earthquake indicate that thrust faulting earthquakes, dominant earthquakes before the occurrence of the M9 mainshock, have been almost extinct around the hypocenter (Asano et al., 2011). This remarkable difference of focal mechanisms suggests that focal depth distribution of those events is largely different before and after the Tohoku-Oki earthquake. Consequently, it will be expected that characteristics of S wave seismograms of the those earthquakes in the focal area of the M9 earthquake should have also changed.

We analyzed 1Hz seismograms recorded at the seismic stations in the forearc side of the NE Japan. Root means square (rms) envelopes of velocity seismograms of horizontal components are calculated in four frequency bands 2-4, 4-8, 8-16, and 16-32Hz. As a result, most of the S-waves of the earthquakes occurring before the M9 mainshock show delays of peak arrivals and envelope broadning, originating from the characteristics of interplate earthquakes. Among the records of the aftershocks of the M9 mainshock, the envelopes of S-waves show clear onset and narrower envelopes, indicating that those earthquakes could occur within the Pacific plate. We also identify several seismograms with broad S-wave envelopes. Since no thrust type earthquakes were identified in the region, these earthquakes could occur in the hanging wall side plate of the NE Japan.

Keywords: the Tohoku-Oki earthquake, interplate earthquake, intraplate earthquake, S coda wave