Aftershock distribution and source process of the Off Kushiro earthquake on November 29, 2004

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Off Kushiro earthquake, which occurred on November 29, 2004 (M7.1) and on August 12, 1961 (M7.2) have almost the same epicenter and magnitude, and are thought to be very similar events. It seems to be a very interesting events because the waveform data of both events is very similar: this means the size and location of asperity is almost same. Aftershock distribution and source process using far-field body waves and near-field strong motion data are analyzed to clarify the characteristics of this event. By comparing the waveform data of this event and former one, we verify whether the rupture area of both events is similar or not.

The aftershock distribution of this event has following features. Few aftershocks occurred around the epicenter of mainshock. Aftershocks are distributed encircled the epicenter of the mainshock. The largest aftershock occurred on December 6 located just southern end of the aftershock area. Aftershock area can be divided into 3 groups: northern, southern and western groups. Activity of the western group rapidly decreased. Before the occurrence of the largest aftershock, Northern and southern aftershock group have complementary activity. The epicenter of the former event was located a little in the south, but considering the error of the epicenter, location of 2 events are almost same. The aftershock distribution of former events is also located encircled the mainshock.

Mechanism of this event is reverse fault with NW-SE compressional axis from the analysis of first-motion data and CMT solution. Judging from the aftershock distribution, NW-dipping plane was considered to be ruptured. Analysis of source process was performed assuming NW-dipping plane is a fault plane. We used the waveform inversion method developed by Kikuchi and Kanamori (1991) for far-field body waves and Nakayama and Takeo (1997) and Ide (1996) for near-field strong motion data. The main asperity is located near the epicenter for both (far-field and near-field) analysis. Moment magnitude determined by using far-field and near-field data are 7.0 and 7.1 respectively that have almost same value. Besides the main rupture area, small slip distribution is obtained at the west of the hypocenter by near-field data analysis, but cannot be obtained by far-field data analysis. This is partly because the spatial resolution is poor for far-field data analysis. Our results shows most of the aftershock occur just the edge of the mainly ruptured area. This phenomenon is generally observed for many earthquakes, but this feature is especially remarkable about this event.

1961 Off Kushiro earthquake (M7.2) was recorded at several strong motion stations deployed by JMA. Seismograms of 2004 and 1961 Off Kushiro earthquake recorded at Obihiro, Urakawa and Sapporo are compared, because the position of the stations has not been changing since 1961. These seismograms are very similar even for the surface wave part and this suggests same asperity was ruptured for both events.