

Observed Later Phases for the Aftershocks of the Tokachi-oki Earthquake, 2003: 2. sP Depth Phase

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We investigated the local characteristics of sP depth phases for the aftershocks of the 2003 Tokachi-oki earthquake. Waveform data observed by the dense seismic network named Hi-net were used in the present study. Many clear later phases between the direct P- and S- wave arrivals with similar to or slightly lower apparent velocities than the direct P waves of the each event were observed at the many stations in the southeast part of Hokkaido, however these phases seemed to be unclear at the stations in the northern part and western part of Hokkaido, because seismic waves passing through the volcanic front in Hokkaido and the Hidaka collision zone were scattered and attenuated by the strong inhomogeneity in these region. The most prominent later phase was observed for the aftershocks occurred in the central part of the mainshock fault of the 2003 Tokachi-oki earthquake. We assumed that the phase is an sP depth phase, an upgoing S wave from the hypocenter which is then reflected and converted to a P wave at the Earth's surface, diving into the earth again, and then estimated the focal depths of the aftershocks, in which seismograms we can easily pick the arrivals. The estimated focal depths of the aftershocks in the central part of the mainshock fault are about 20 to 30 km, which is consistent with the depth distribution of the plate boundary between the Chishima arc and the Pacific plate estimated by previous studies. We considered that one of the reasons, why such prominent arrivals were observed for the aftershock, is that the take-off angles of the sP phases from the hypocenters are about 140 to 150 degrees, and the angles agree with the typical direction with large S-wave energy-radiation from the thrust-type earthquakes in this region. We could not see clear later phases corresponding to the sP depth phase for the aftershocks which occurred in the land-side of the mainshock fault and near the trench axis. We infer that such a local variation in the detectability of the sP depth phases probably depend on take-off angles of the phases, source mechanisms of the earthquakes, and amplitudes of other phases related to the Earth's surfaces and the subducting slab.