論文の内容の要旨

M8 class earthquake cycle in the southernmost part of the Kuril subduction zone

(千島海溝最南部沈み込み帯の M8 級の地震サイクル)

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The earthquake cycle consists of three periods: interseismic, coseismic, and postseismic. It is necessary to examine these three periods to understand the earthquake cycle. However, when we focus on large (M_w ~ 8) to giant (M_w ~ 9) earthquakes in a given region, the interseismic periods are often longer than the instrumental seismic observation periods, which are on the order of 100 years.

In the southernmost part of the Kuril subduction zone, six large to giant interplate earthquakes have occurred in the last 400 years. This includes the two M_w ~ 8 Tokachi-oki earthquakes that occurred in 1952 and 2003. In Hokkaido, instrumental seismic and geodetic observations began in the late 19th to early 20th centuries. Therefore, we are able to investigate more than a single *M*8 class earthquake cycle there.

In this thesis, we examine the interseismic, coseismic, and postseismic periods in the southernmost part of the Kuril subduction zone to estimate slip history and budget in the *M*8 class earthquake cycle.

First, we investigated the coseismic periods. We performed joint source inversion analyses and examined the similarities and differences between the 1952 and 2003 Tokachi-oki earthquakes. We made two datasets for the 2003 earthquake, and one is nearly the same as that of the 1952 earthquake. The results reveal that in the Tokachi-oki region, the rupture processes, slip area, and slip amounts were similar for the 1952 and 2003 earthquakes. However, there are two differences: the 1952 earthquake was initiated with an M_w 6.1 earthquake, and it extended to the Akkeshi-oki region after the main rupture in the Tokachi-oki region.

Second, we analyzed the interseismic and postseismic periods prior to and after the 2003 earthquake using recent GNSS data. We investigated the crustal deformation rate prior to the 2003 earthquake and obtained the yearly slip deficit/afterslip distribution between 25 September 2000 and 24 September 2010. We confirmed that there was no yearly scale transient phenomenon prior to the 2003 earthquake in the Tokachi-oki region. The obtained slip deficit showed that the large slip deficit regions prior to the 2003 earthquakes were consistent with the main rupture areas of the 1952 and 2003 earthquakes. Moreover, the afterslip of the 2003 earthquake did not reach the Akkeshi-oki region, where a large slip occurred during the 1952 earthquake.

Third, we investigated leveling data and repeating earthquakes during periods that were not covered by the GNSS data. We examined a survey route around Cape Erimo, which has been repeatedly measured without a route change. We also estimated the crustal deformation due to medium-sized ($M \geq 6.5$) earthquakes. We next investigated

two M5.4 repeating earthquake groups around Cape Erimo using analog seismograms. Together with the groups investigated by previous studies, we estimated the aseismic slip rate around the groups. The results of these investigations reveal that afterslip of the 1952 earthquake may have continued until around 1980. Moreover, in the Tokachi-oki region, the state of the plate interface prior to the 1952 earthquake may be similar to that prior to the 2003 earthquake. We also found that the acceleration of aseismic slip rate in the west of Cape Erimo prior to the 2003 earthquake.

Finally, we summarized the results of the above analyses and examined the slip history in the southernmost part of the Kuril subduction zone. We found that the slip budget is unbalanced in the Tokachi-oki region both in the single earthquake cycle between the 1952 and 2003 earthquakes and in the multiple cycles since 1843. We suggested four possible reasons for the unbalanced slip budget: stress transfer, temporal change of frictional properties, changes of slip deficit rate, and supercycle.