Reexamination of space-time pattern of great interplate earthquakes along the south Kurile trench (2)

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Along the northern Japan to southern Kurile trenches, great interplate earthquakes have recurred with the spatial and temporal regularities. The source regions are divided into six segments, A to F. The most recent activity of great interplate events started in 1952 and ended in 1973. However, some large interplate earthquakes occurred in this region after 1973 as well. Concerning D, E, and F regions Harada and Ishibashi (2001) compared mainshock-aftershock distribution of such large interplate events with those of great interplate events and revised space-time pattern of interplate earthqukake occurrence in these regions.

In this paper we discuss A, C, and D regions. We reexamined the mainshock-aftershock distributions of the following great/large interplate events; the 1968 Tokachi-Oki (Mw8.2, A), 1989 Sanriku-Haruka-Oki (Mw7.4, A), 1992 Sanriku-Haruka-Oki (Mw6.9, A), 1994 Sanriku-Haruka-Oki (Mw7.6, A), 1973 Nemuro-Hanto-Oki (Mw7.8, C), 1964 Shikotan (Ms7.2, D), 1968 Shikotan (Ms7.1, D), 1969 Hokkaido-Toho-Oki (Mw8.2, D), 1980 Shikotan (Mw7.1, D), and 1984 Etorofu (Mw7.1, D) earthquakes, and those of great/large slab events; the 1994 Hokkaido-Toho-Oki (Mw 8.3, D) and 2000 Nemuro-Hanto-Oki (Mw6.8, C) earthquakes.

We relocated these hypocenters by using Double-Difference method (Waldhauser and Ellsworth, 2000). In order to remove errors due to unmodeled velocity structure, difference of station distribution of each event, and reading errors of arrival times at each station, this method minimizes residuals between observed and theoretical travel-time difference (or Double-difference) for pairs of earthquakes at each stations. Thus, we can expect that the Double-Difference method provide accurate relative locations in the subduction zone where the complex velocity structure exists between events and stations. We extracted main shocks and 3-day aftershocks from relocated events and examined distributions of them.

The results are as follow:

C and D regions: (1) Aftershock areas of the 1969 Hokkaido-Toho-Oki and the 1973 Nemuro-Hanto-Oki earthquakes abut each other. (2) The largest aftershock (Mw7.5) of the 1973 event is located near the boundary of the 1966 and 1973 aftershock areas. (3) The 1968 Shikotan and 1980 Shikotan earthquakes occurred near southwestern end of D region, and their aftershock areas overlapped a part of the 1969 aftershock area. The 1984 Etorofu earthquake occurred near the northeastern end of D region, and its aftershock area also overlapped a part of the 1969 aftershock area. Especially, the 1968 and 1980 main shocks are close each other and their aftershock areas completely overlap each other. The depth distribution and mechanisms of the 1968, 1980, and 1984 events indicate that they were all interplate earthquakes. (4) Judging from the shallow drpth of the main shock, the 1964 Shikotan earthquake was probably a large interplate event. (5) Since the 1964 events occurred near the 1968 and 1980 main shocks, large interplate events recurred in the southwestern part of the 1969 aftershock area. (6) the 2000 Nemuro-Hanto-Oki earthquake was large slab event which occurred southwestern end of the aftershock area of the 1994 Hokkaido-Toho-Oki earthquake. This event, however, did not occurred on the actual fault plane of the 1994 event but at the trench-ward region of aftershock area.

A region: The aftershock areas of the 1989, 1992, and 1994 Sanriku-Haruka-Oki earthquakes completely occupy the southern part of that of the 1968 Tokachi-Oki earthquake.