

Distinctiveness of the aftershock activity of the 2004 Mid-Niigata Prefecture earthquake

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The 2004 Mid-Niigata Prefecture earthquake (M6.8) was accompanied by many large aftershocks. The 1943 Tottori earthquake (M7.2) and the 1945 Mikawa earthquake (M6.8) are well-known examples for which aftershock activity were very active. However, large aftershocks with a magnitude equal to or larger than M6 were two for the Tottori earthquake and only one for the Mikawa earthquake. On the other hand, the 2004 Mid-Niigata Prefecture earthquake accompanied four aftershocks larger than M6 and 25 aftershocks larger than M5. Therefore, we can say definitely that the 2004 Mid-Niigata Prefecture earthquake was exceptionally active when large aftershocks are taken up.

Actually a true anomalous feature is not that one that so many large aftershocks as not observed at any inland earthquakes of that magnitude in the past occurred after the Mid-Niigata Prefecture earthquake. A more notable feature is that the main shock is plotted to the left side of the extension of the line representing the Gutenberg-Richter relation in the magnitude-frequency diagram. There exists no such earthquake of the mainshock-aftershock type with a magnitude of 6.5 or larger which shows that feature since 1926 when the nation-wide seismograph network has been deployed in the Japanese islands. Even in the cases of the 1943 Tottori earthquake and the 1945 Mikawa earthquake, the main shock is plotted to the right side of the extension of the line representing the Gutenberg-Richter law.

A type of seismic activity which exhibits the feature that the largest shock in a group of earthquakes is located near the extension of the Gutenberg-Richter law in the magnitude-frequency diagram is a swarm activity such as the Matsushiro swarm earthquake and the 2000 swarm activity near Miyake, Kozu and Niijima Islands. If then, can we classify the 2000 Mid-Niigata Prefecture earthquake into the swarm-type activity? The answer is rather not, because the decay of the aftershock activity was well represented by the Omori-Utsu law. That is a feature which a mainshock-aftershock type activity not a swarm activity shows. An example of such types that the activity decayed according to the Omori-Utsu law as a whole but showed a kind of feature of the mainshock-aftershock type in the magnitude-frequency distribution is the 1996 Onikobe earthquake, though the magnitude was a little bit smaller. We may categorize the 2000 Mid-Niigata Prefecture earthquake and the 1996 Onikobe earthquake as the third type activity, neither the typical mainshock-aftershock type nor swarm activity.