

## Activity of Deep Low-Frequency Earthquakes beneath the Yake-dake Volcano, Japan, from 1993 to 2005.

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In the Hida mountain range, central Japan, we had reported two examples of swarm activity of deep low-frequency earthquakes (DLF) that occurred after a shallow swarm activity. One was observed in 1998 - 1999, whose largest shallow earthquake was Mj5.6 and the other was observed in 2004 - 2005, whose largest shallow earthquake was Mj3.2.

We examined the continuous seismogram records kept in the Kamitakara Observatory and found another example of DLF swarms followed a shallow swarm activity in 1993. In this case, shallow activity started June 1993 and terminated in January 1994. The largest shallow earthquake was Mj5.0. Tremor like DLF activities were detected in November 1993, whose waveforms were similar to those of June 1999 events. This is the third example of this trend.

The common feature of above three examples are that the largest event of the shallow swarms are larger than magnitude 3, which might have triggered the deep seismicity. Although the largest shallow event in 2004 - 2005 activity was the smallest (Mj3.2) among the three cases, DLF activity was most intense. It may indicate that the fluid activity in the deep portion would easily triggered by smaller stress change lately.

DLF activity in 2004 - 2005 probably shows the enhancement of the magma activity of the Yake-dake volcano. In this region, there were other shallow swarms in early 1990's. It is important to investigate these past shallow swarms whether deep seismic activities were accompanied in order to clarify the magma activity beneath the Yake-dake volcano. It is also important to monitor crustal movements due to the magma activity as well as monitoring seismic activity.