Research objectives and summary of results:

In order to clarify the generating process of intraplate earthquakes, and to verify and sophisticate the asperity model, we studied an M~5 repeating earthquake sequence off Kamaishi, northeastern Honshu, Japan.

Recent studies including ours indicate that there are seismic patches called 'asperities' (interplate regions that connect the two plates firmly and can generate seismic waves when they rupture) on plate boundaries, and aseismic slip regions surround the asperities. This hypothesis corresponds to a slight modification of the asperity model that was originally proposed by Kanamori's group in 1980's.

The off-Kamaishi repeating earthquake sequence is one of the seismic activities that contributed to the improvement of the asperity model. In the sequence, M~5 earthquakes have repeatedly occurred with a recurrence interval of around five and a half years. After the 2001 event, we predicted that the next event with M~5 would occur within the period from September 2006 to January 2008 with 68 % probability (i.e., within +/- 1σ range, where σ is the standard deviation of the recurrence interval) and the period from August 2005 to February 2009 with 99 % probability (i.e., within +/- 2.57σ range). The size of the event was expected to be Mj4.7-4.9 (where Mj denotes the JMA magnitude) [Matsuzawa et al., 2002]. The expected event of Mj4.7 occurred on January 11, 2008.

We investigated the source processes of the 1995, 2001 and 2008 events and found that all the events rupture the same region whose diameter is around 1 km. This result indicates that the off-Kamaishi sequence is caused by repeated ruptures of an asperity. Detailed analyses of the seismic wave data show that the slip distributions and rupture processes of the recent two events are slightly different causing the difference in the high-frequency components of waveforms. The difference in the slip distribution between the two events is inferred to be caused by the difference in the smaller event activities just before the occurrences of the M~5 earthquakes.

These results show the correctness of the asperity model providing a basis for long-term forecasts of earthquakes.

Publications:

Journals:


**Contribution to books:**


2. Matsuzawa, T., Recent progress in the earthquake prediction research at Tohoku University, in "Forty Years of the Coordinating Committee for Earthquake Prediction", 2009 in press.

**Symposium Participations:**


3. Uchida, N., M. Mishina, and T. Matsuzawa, Afterslip of the 2008 off Ibaraki (M7.0) and off Fukushima (M6.9) earthquakes estimated from small repeating earthquakes, The 7th General Assembly of Asisan Seismological Commission, Tsukuba, Tsukuba international congress center, November, 2008.
15. Ariyoshi, K., T. Matsuzawa, T. Hori, R. Hino, Y. Kaneda, and A. Hasegawa, Estimation of frictional properties by comparing propagation speed of post seismic slip with numerical simulation results, PGU


