

Can Chi-Chi earthquake be modeled based on measured frictional and transport properties of Chelungpu fault zone?

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The title question has been shared by most scientists involved with Chi-Chi earthquake and with Chelungpu drilling projects. In particular, nearly everybody wondered what caused the contrasting behaviors between the northern and southern parts of Chelungpu fault during the earthquake. Recently, H. Noda and N. Lapusta of Caltech have modeled the generation of Chi-Chi earthquake (presented at JPGU meeting last May) based on measured frictional and transport properties of Chelungpu fault zone (Tanikawa and Shimamoto, 2008, JGR). Work is in progress and there are rooms for improvements, but they have reproduced essential features of Chi-Chi earthquake. This work brings about renewed interest in Chi-Chi earthquake and Chelungpu fault.

Northern part of Chelungpu fault zone is characterized by velocity strengthening, and thus the fault is supposed to be aseismic in conventional view of fault mechanics. But in reality, the northern part moved more than the southern part during the Chi-Chi earthquake. A key to understand such a behavior seems to be high velocity frictional property; that is, the northern part exhibits more dramatic slip weakening than the southern part owing to the differences in fault-zone permeability. Southern part of fault zone shows velocity weakening behavior and it is natural that rupture started from the south. But whether the rupture grows large or not seems to be controlled by high velocity frictional properties of fault zone. Modeling predicted characteristic recurrence behaviors of seismicity which should be tested by trench survey. Modeling also provides a renewed view of subduction-zone earthquakes.

The modeling encourages more detailed studies integrating fault mechanics and modeling earthquake generation. Although this is the last year in my career at Hiroshima University, I cannot help revisiting fault outcrops and existing cores (TCDP cores, DPRI shallow cores and cores from several drill holes of Geological Survey of Taiwan). I hope that you will revive your interests in this problem too.