STRUCTURE OF THE UPPER CRUST BENEATH CENTRAL TAIWAN AS ILLUMINATED BY 35,000 SMALL EARTHQUAKES

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The structure of the upper crust beneath central Taiwan is illuminated not only by major earthquakes, but also by tens of thousands of small events (mostly M=1 to 4). We used both aftershock swarms and background seismicity, totaling over 35,000 events, including 11,000 aftershocks from the 1999 Chi-Chi earthquake. These earthquakes allow us to image major active faults, including the basal detachement of the mountain belt.

We constrained fault geometries by combining earthquake hypocenter locations and focal mechanisms with surface geology, seismic profiles, and well data. We then used Gocad to generate fault surfaces from these data. A clustering algorithm applied to the hypocenter locations is helpful to obtain tighter 3D definition of faults from the scattered clouds of seismicity surrounding them.

Our work shows the presence of a major decollement, spanning almost the entire width of the island, at a depth of about 10 km. Near the eastern coast of Taiwan, this decollement suddenly dives down steeply to depths that reach 70 km at the northern end of the studied area, but only 50 km at the southern end. Thus, when the decollement surface is unfolded, its eastern edge is subparallel to the present continental margin.

Several steep active faults exist in the footwall of this structure. The hanging wall contains many low-angle thrust faults that ramp up either directly from the main decollement, or from higher-level decollements, and pile up to form the mountain belt. Several major events, like the M 7.8 Chi-Chi and M 6.2 Rueyli earthquakes, occurred on these thrust faults, with initial slip at the base of the thrust ramps.