Geophysical Research Abstracts, Vol. 7, 05563, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05563

Empirical scaling relations for seismic faults

Álvaro González (1), Javier B. Gómez (1) and Amalio F. Pacheco (2)

(1) Departamento de Ciencias de la Tierra. Universidad de Zaragoza.
Pedro Cerbuna, 12. 50009 Zaragoza (Spain). (Alvaro.Gonzalez@unizar.es)

(2) Departamento de Física Teórica and BIFI. Universidad de Zaragoza.
Pedro Cerbuna, 12. 50009 Zaragoza (Spain).

A new database of active-fault parameters is used here, both for reviewing scaling relations previously proposed in the literature, and for proposing a new one. The latter may be useful for estimating the earthquake recurrence interval from only two parameters of a given fault: its length and slip rate.

The database contains parameters of more than 600 faults or fault segments from all over the world, the majority from continental regions. These parameters are mainly: fault length (L), slip rate (S), mean recurrence interval of large earthquakes in the fault (T), and mean coseismic displacement in large earthquakes (D). We have chosen only those data which are independent (i. e., not estimated one from another).

Longer faults tend to slip faster and produce large earthquakes more frequently. However, a simple scaling between L and S or between L and T has not been found, considering both the whole (composite) dataset or regional datasets.

Other authors quote that faster faults tend to produce large earthquakes more frequently, with $T \propto S^{-\alpha}$. Our data suggest that $\alpha \simeq 0.7$.

For those faults for which D, T, and S are available, the frequently-used approximation $T \simeq D/S$ (from Wallace's classical formula, assuming that the creep rate is zero) is good, although, as expected, generally underestimates T.

Finally, we have noted that the following scaling relation holds for the whole dataset:

$$S \propto \frac{L}{T} \tag{1}$$

Interestingly, this relation is dimensionally homogeneous (both sides of the relation are measured in units of velocity) and less scattered than the relation between T and S commented on before. As L and S are among the easiest parameters to determine for a given fault, this relation could be used for an easy, first-order approximation of T.