



Are aftershocks caused by the mainshock?

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Understanding the physics of aftershocks bears the question: are aftershocks caused by the stress modification induced by the mainshock or by other shocks of the seismic sequence?

This causality principle (henceforth called Hypothesis 1) constitutes the base of several aftershock models.

An alternative point of view is that both mainshock and aftershocks belong to the fracture process, both of which are related to the stress of the zone however there is no particular relationship between them (henceforth called Hypothesis 2).

The May-June 2012 Emilia-Lombardia earthquake was characterised by two major events with magnitude of 5.9 and 5.8 respectively, and other 5 shocks with magnitude greater than 5. This sequence does not allow for a precise identification of the mainshock and strongly undermines Hypothesis 1.

We can verify that the Maxwell-Boltzmann model for statistical energy distribution of independent particles agrees with the energy distribution of the shocks of the 2012 Emilia-Lombardia earthquake, as well as with other seismic sequences, randomly selected from international seismic databases. Thus suggesting that the shocks of a sequence can be considered independent events.

Our conclusions are that the distinction made between foreshock, mainshock and aftershocks for several sequences is fictitious and that Hypothesis 2 is more realistic.