



The debate on the prognostic value of earthquake foreshocks: A meta-analysis

Arnaud Mignan

ETH Zurich, Swiss Seismological Service, NO H66, Zurich, Switzerland (arnaud.mignan@sed.ethz.ch)

The hypothesis that earthquake foreshocks have a prognostic value is challenged by simulations of the normal behaviour of seismicity, where no distinction between foreshocks, mainshocks and aftershocks can be made. In the former view, foreshocks are passive tracers of a tectonic preparatory process that yields the mainshock (i.e. loading by aseismic slip), while in the latter, a foreshock is any earthquake that triggers a larger one. Although both processes can coexist, earthquake prediction is plausible in the first case while virtually impossible in the second. Here I present a meta-analysis of 37 foreshock studies published between 1982 and 2013 to show that the justification of one hypothesis or the other depends on the selected magnitude interval between minimum foreshock magnitude m_{min} and mainshock magnitude M . From this literature survey, anomalous foreshocks are found to emerge when $m_{min} < M - 3.0$. These results suggest that (i) a deviation from the normal behaviour of seismicity may be observed only when microseismicity is considered, and (ii) claims that foreshocks have no predictive power might be a result of under-sampling. These observations should encourage new research in earthquake predictability with focus on the potential role of microseismicity.