Geophysical Research Abstracts
Vol. 15, EGU2013-9168, 2013
EGU General Assembly 2013

How informative are slip models for aftershock forecasting?

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Coulomb stress changes (ΔCFS) have been recognized as a major trigger mechanism for earthquakes, in particular aftershock distributions and the spatial patterns of ΔCFS are often found to be correlated. However, the Coulomb stress calculations are based on slip inversions and the receiver fault mechanisms which both contain large uncertainties. In particular, slip inversions are usually non-unique and often differ strongly for the same earthquakes. Here we want to address the information content of those inversions with respect to aftershock forecasting. Therefore we compare the slip models to randomized fractal slip models which are only constrained by fault information and moment magnitude. The uncertainty of the aftershock mechanisms is considered by using many receiver fault orientations, and by calculating ΔCFS at several depth layers. The stress change is then converted into an aftershock probability map utilizing a clock advance model.
To estimate the information content of the slip models, we use an Epidemic Type Aftershock Sequence (ETAS) model approach introduced by Bach and Hainzl (2012), where the spatial probability density of direct aftershocks is related to the ΔCFS calculations. Besides the directly triggered aftershocks, this approach also takes secondary aftershock triggering into account. We quantify our results by calculating the information gain of the randomized slip models relative to the corresponding published slip model.
As case studies, we investigate the aftershock sequences of several well-known main shocks such as 1992 Landers, 1999 Hector Mine, 2004 Parkfield, 2002 Denali. First results show a huge difference in the information content of slip models. For some of the cases up to 90% of the random slip models are found to perform better than the originally published model, for some other cases only few random models are found performing better than the published slip model.