

Interactive comment on “Conditions for the occurrence of seismic sequences in a fault system” by Michele Dragoni and Emanuele Lorenzano

Anonymous Referee #2

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Reviewer's comments

“Conditions for the occurrence of seismic sequences in a fault system” by Michele Dragoni and Emanuele Lorenzano submitted to Nonlin. Processes in Geophysics (2016)

Summary: Dragoni and Lorenzano present textbook-style arguments favouring conditions under which a pre-existing fault system could generate a seismic sequence. Seismic sequences, as observed in 1997 Umbria-Marche sequence and 2012 Emilia sequence, have been subjects of detailed studies. In this regard, the use of the elastic model for seismic sequencing and the changes in the differences between Coulomb stresses and different stress drops of the events resulting in alteration of the initial

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permutation order during sequencing are important points. Furthermore, for seismic sequences similar to the Emilia 2012 sequence, the authors claim that the state of stress at any time during the sequence can be retrieved.

The model used by the authors makes a few assumptions. With the exception of the external perturbation not influencing the system of n coplanar faults, the remaining assumptions are acceptable. Clearly, the authors exercise caution about the non-use of external perturbation in making long-term predictions.

General:

(1) The arguments in favour of the permutation order of the sequence are clear. However, they are uniquely based on static Coulomb stress field changes. These are in contrast to the arguments presented by Convertito, Catalli, and Emolo (Scientific Reports, 2013, DOI: 10.1038/srep03114). Their main conclusion is that static stress distribution alone does not explain the location of the subsequent events in the seismic sequence. Furthermore, their argument favouring dynamic triggering to influence the seismic sequence would have to be looked at carefully.

(2) Dragoni and Lorenzano argue that the pore-fluid effects are one order of magnitude smaller than the Coulomb stress changes. This is in contrast to the argument by Convertito, Catalli, and Emolo (2013) on the variation in permeability and pore-pressure effects due to a massive presence of fluids in the Po Plain basin to play a triggering role in the seismic sequence.

(3) Source mechanism of major events in observed seismic sequences in northern Italy or central Italy falls either into a reverse-fault or normal fault mechanisms. The seismic sequence studied in the 2012 Emilia region satisfies the conditions proposed for similar fault systems. Castro et al. (Geophysical Journal International, 2013) suggest that the reverse faulting events of the Emilia 2012 sequence generated low stress drops but relatively large amounts of low frequency effects. This is an important point to be considered.

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(4) The Umbria-Marche sequence and the Amatrice-Composto-L'Aquila sequences reveal locations in the vicinity of original fault systems in central Italy. This suggests that the present static model might require revisiting for forecasting purposes.

Specific:

(1) References: The list of references is adequate but a brief review of the findings of other authors on the 2012 Emilia sequence is missing in the text. (2) Table: References should be included citing where the data information came from. (3) Figures: Adequate for the purpose of showing how the static model works for the sequence.

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