Geophysical Research Abstracts
Vol. 20, EGU2018-14601, 2018
EGU General Assembly 2018

Coulomb stress controls on the initiation and progression of the 2016-2017 seismic sequence: the importance of fault geometry and historical seismicity

Zoe Mildon (1,2), Gerald Roberts (3), Joanna Faure Walker (2), and Francesco Iezzi (3)

(1) Centre for Research in Earth Sciences, School of Geography, Earth, and Environmental Sciences, Plymouth University, PL4 8AA, UK (zoe.mildon@plymouth.ac.uk), (2) Institute for Risk and Disaster Reduction, University College London, WC1E 6BT, UK, (3) Department of Earth and Planetary Sciences, Birkbeck, University of London, London, WC1E 7HX, UK

The 2016-2017 central Italy seismic sequence has been used to investigate the importance of including strike-variable geometry and historical earthquakes in calculations of Coulomb stress transfer. We demonstrate that, only by considering; 1.) the Coulomb stress changes from 31 historical earthquakes (1349 - 2009 A.D.), 2.) the interseismic stress loading from underlying shear zones and 3.) resolving the Coulomb stresses onto non-planar faults, this sequence can be explained with Coulomb stress transfer. It is shown that along-strike variations in the fault geometry (which is mapped in the field) affect the Coulomb stress transferred to receiver faults from earthquakes on nearby source faults by magnitudes of up to $\pm$1 bar (i.e. above the hypothesised earthquake triggering threshold of 0.1 bar). By including the fault geometry, heterogeneous stress patterns are generated; these would not be resolved using the typical approach of modelling planar faults. This approach of modelling non-planar faults is utilised to model coseismic Coulomb stress transfer from 34 earthquakes from 1349 to the present day in central Italy. Interseismic loading from underlying shear zones (that slip at the Holocene slip rate measured from surface scarps) is also included to calculate the build-up of Coulomb stress on all faults in the central Apennines since 1349. The cumulative (interseismic and coseismic) Coulomb stress transfer is calculated prior to, during and after the 2016 central Italian earthquake sequence. We also take account the 1316–4155 yr elapsed time on the Mt. Vettore fault implied by palaeoseismology. The stress on the faults that ruptured in this sequence was heterogeneous prior to the sequence beginning due to the location of historical earthquakes, the fault geometries and the elapsed time since the last earthquake that occurred on the faults. These stress heterogeneities, in particular regions of highly negative stress, correspond to the locations and extent of the three mainshocks in the sequence, and we suggest that the "pre-stress" controlled the extent and therefore the magnitude of these three mainshocks.