



PROBABILISTIC DISCRIMINATION ASSESSMENT FOR THE 2012 EMILIA ROMAGNA EARTHQUAKES: A CASE OF SEISMICITY TRIGGERED BY OIL RECOVERY?

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On May 20th and 29th 2012 two damaging earthquakes with magnitudes Mw 6.0 and Mw 5.8 struck the Emilia-Romagna region in the sedimentary Po Plain, Northern Italy. The shallow hypocentral depth (6-10 km) led to severe damage and substantial impact to the local economy, and 24 fatalities were reported. The foredeep basin in Northern Italy is bordered by two active thrust and fold belts, the Apennines and Southern Alps, and convergence between them is accommodated by buried outer thrust fronts in the Po Plain. The Emilia 2012 earthquakes, which occurred on one of these buried faults, were therefore considered to be caused by tectonic processes (e.g. Cesca et al., 2013).

In the closer area to the Emilia events, at least two oil/gas fields were exploited since 1980 and 2005, respectively. From the former one approximately 3 Mt of oil and 70 Mm³ of gas have been produced. Besides, small amounts of wastewater are reinjected by one of the boreholes. This raised recently concerns whether the Mw 5.8 and Mw 6.0 earthquakes could have been influenced by reservoir depletion from former exploitation.

We apply a novel probabilistic discrimination method (Dahm et al., 2013, Passarelli et al., 2013) to assess the probability that the earthquakes were human triggered or possibly induced. The depletion-induced stress perturbation is modeled by means of boundary element method adapted for the nuclei of strain approach. Human- and tectonic-induced stress rates are compared using a rate and state frictional nucleation model to assess relative earthquake probabilities. The method has previously been tested with depletion-triggered earthquakes in the North Sea and the Northern German basin. In comparison to these studies, the oil production in the Emilia-Romagna region is relatively low. We find the induced scenario is very unlikely for the Emilia events, differently from the cases of the previously tested events in Northern Europe.

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