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Remote earthquake triggering: the case of the strong earthquakes along the Hellenic arc and trench during 2008

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From 6 January 2008 up to 15 July 2008 an impressive sequence of four strong) large mainshocks, with magnitudes ranging from 6.2 to 6.8, ruptured the Hellenic Arc and Trench (HA-T) system where the Mediterranean lithosphere moves on a counter-clockwise mode and subducts beneath the Aegean lithosphere. The earthquakes were independent by the means that they were not members of a single foreshock-mainshock-aftershock sequence, the epicentral distances between them ranging from 200 km to 600 km. Although it is well-known that HA-T is seismotectonically one of the most active in the entire western Eurasia, the space and time cluster of four independent earthquakes within a time interval of less than 6.5 months is still quite unusual. In addition, the earthquakes were of different types in their focal mechanisms but also in their focal depths. Shallow but also intermediate-depth earthquakes were involved in the process. More than one possible triggering mechanisms may account for the generation of those sequential strong earthquakes beyond chance. The first incorporates rapid stress increase in the source of an earthquake which is under preparation due to viscoelastic response of the asthenosphere and the effect of the lithosphere-asthenosphere coupling on stress redistribution after previous strong earthquake(s). The second predicts upward migration of stresses along the descending lithospheric plate after strong intermediate-depth shock which may account for the accelerated generation of shallow or interplate earthquake in the trench. The last mechanisms is the shear-stress increase in the eastern segment of HA-T due to previous generation of strong earthquakes in the western segment of HA-T. We show that such mechanisms are effective in areas where high seismic potential is stored and that the identification of such areas could be an important parameter for time-dependent hazard assessment.