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Rupture model of the great AD 365 Crete earthquake in the southwestern part of the Hellenic Arc

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Abstract

An M8.3 earthquake struck the southwestern part of the Hellenic Arc, near the Island of Crete, in AD 365, generating a tsunami that affected almost the entire eastern Mediterranean region. Taking into account that the time history of seismicity in this region is fairly complete for such earthquakes in the historical catalog, which can be dated as back as the 5th century B.C., there is no indication that this segment of plate boundary has been fully ruptured again. The seismic hazard associated with this part of the Hellenic Arc necessitates the evaluation of the rupture characteristics of this great event. The constraint of the faulting geometry was initially achieved by using information from seismicity, and the focal mechanisms of earthquakes that occurred during the instrumental period. A rupture model for this great earthquake is constructed by assuming an elastic medium and calculating the theoretical surface displacements for various fault models that are matched with the observed surface deformation gleaned from historical reports. The resulted fault model concerns thrust faulting with a rupture length of 160 km and a seismic moment of 5.7×10^{28} dyn·cm, an average slip of 8.9 m and a corresponding moment magnitude equal to 8.4, in excellent agreement with the macroseismic estimation. The absence of such events recurrence is an indication of the lack of complete seismic coupling that is common in subduction zones, which is in accordance with the back arc spreading of the Aegean microplate and with previous results showing low coupling for extensional strain of the upper plate.

Key words: Hellenic subduction zone, historical earthquake, slip distribution.