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Finite fault modeling of the 2015, Mw 6.5, Lefkada, Greece, earthquake by using near source high-rate GPS, strong motion data and InSAR

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The 2015 November 17 Lefkada earthquake occurred with a right-lateral strike slip mechanism in agreement with the tectonic regime existing in the area dominated by the Cephalonia Transform Fault (CTF), which accommodates the difference of deformation (with shear velocity of 20 mm/yr) existing between the Apulia-Eurasia collision zone on the north and the Hellenic arc subduction zone on the south. This event was observed by a few stations in near source: five strong motion (SM) stations belonging to the ITSAK accelerographic network and three continuous high-rate sampling (1-5Hz) GPS (HRGPS) stations belonging to the NOANET continuous GPS network. The area was also imaged by two SAR images' pairs acquired by the Sentinel1-A satellite in TOPSAR mode for the ascending pass and the descending orbit. To model the causative finite fault of the 2015 Lefkada event, we used a two-steps procedure. In the first step, we determined the fault geometry with uniform slip by using only static deformation (InSAR, HRGPS- and SM-derived static offsets). For this step, the best-fitting model was characterized by a 70° E-SE dipping and 13°N striking fault plane, with a strike slip mechanism (rake ∼170°) and a slip of 1.3 m. In a second step, starting from the previously determined fault geometry and assuming a rupture starting point at the hypocenter released by NOA, we adopted a nonlinear inversion technique for a joint inversion of both waveforms (SM and HRGPS) and static deformation (GPS, strong motion and InSAR offsets) to determine the slip distribution and the rupture process. Our best-fit model shows the activation of three main patches of slip, characterized by rise time and peak slip velocity in the ranges 2.5-3.5 sec and 1.4-2.4 m/s, respectively, corresponding to 1.0-1.7 m of slip. The inferred slip distribution and the resulting seismic moment (M0 = 5.95 × 1018 Nm) agree with a Mw 6.45. We will finally discuss the relationships between the 2015 Lefkada event and the historical strongest earthquakes occurred in the area.