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The Mw6.5 earthquake of 17 November 2015 in Lefkada Island and the seismotectonics in the Cephalonia Transform Fault (Ionian Sea, Greece)

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On 17 November 2015 a Mw6.5 earthquake ruptured offshore Lefkada Isl. in Ionian Sea, Greece, causing two victims, damage and ground failures particularly in the SW part of the island, which is consistent with the ground deformation pattern shown by InSAR analysis. Fault plane solutions released by CMT, NOA and other institutes are consistent indicating strike-slip right-lateral faulting, which is typical for the area, e.g. 2003 earthquake in the same fault zone. The analysis of 30-s daily observations of the permanent GPS stations operated by NOA showed displacement vectors with a motion pattern which is in agreement with the right-lateral kinematics of the rupture. The seismic plane was striking/dipping about N24E/W75.The seismic sequence for the period from 17 Nov. to 8 Dec. 2015 was relocated, with and without the use of time residuals, applying the NNLoc algorithm on a slightly modified 9-layer seismic velocity model (Haslinger et al., 1999) and by using only phases at stations closer than 120 km from the mainshock in order to avoid the use of Pn phases. The relocation procedure obtained without the use of residuals was repeated with the HypoDD algorithm. All relocations showed that the aftershock cloud follows the fault plane strike and consists of one north and one south clusters distributed in the seismogenic layer of 4-12 km. The south cluster started to develop a few hours after the mainshock, while it presents different statistical properties as compared to the north one. These results indicate that the south cluster was likely the result of triggering effect. Digital broadband P-wave teleseismic records, selected from GDSN stations to achieve the best possible azimuthal coverage, were used to invert for the mainshock rupture history. The teleseismic waveforms were corrected for instrument response, integrated to displacement, band–pass filtered from 0.01 to 1 Hz using a Butterworth filter and finally re-sampled to 0.2 samples/s. The finite fault inversion method, which is capable of estimating the distributions of both the spatial slip and rise time on the ruptured fault, was applied using the Harvard CMT focal mechanism solution. The above velocity model was used to create the subfault synthetics. It was found that the earthquake had a not very complex source time function with nearly 78 cm maximum slip with source duration of $\sim$13 s. Most of the slip is concentrated on a 14 km x 7 km fault rupture. The rupture propagated from the mainshock focal depth of 12 km upwards and southwards. Taking into account together the Cephalonia Jan.-Febr. 2014 seismic sequence and the Lefkada 2015 sequence, the overall seismotectonic picture is that the northern (Lefkada) branch of the Cephalonia Transform Fault (CTF) continues towards SW intersecting western Cephalonia. Also, it is likely that the 2015 earthquake fits the characteristic earthquake model suggested for the area after the 2003 Lefkada earthquake by considering also the historical seismicity of the area. This research is a contribution to the EU-FP7 ITN research project ZIP (Zooming In between Plates, grant agreement no: 604713, 2013.