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The 2015 Lefkada earthquake: a complex fault pattern constrained by seismological observations

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The Mw6.5 Lefkada earthquake of 17 November 2015 occurred close to the southwest coastline of the Island, twelve years after an Mw6.2 main shock (August 14, 2003) that was associated with an adjacent fault segment located northward. The 2003 seismic sequence was thoroughly studied (Karakostas et al., 2004; Karakostas and Papadimitriou, 2009) using the recordings of a dense digital seismological network which was installed in the area one day after the main shock occurrence. Later on, new permanent seismological stations installed in Lefkada Island by the Geophysics Department of the Aristotle University of Thessaloniki in cooperation with the municipalities association of Lefkada Island, and are in continuous operation consisting part of the Hellenic Unified Seismological Network (HUSN). The 2015 main shock and its seismic sequence was recorded by a dense local network (five stations in epicentral distances less than 20 km). Using the recordings of ten seismological stations (five in Lefkada and five in Kefalonia Island) the aftershocks which occurred until the end of February 2016, were relocated applying the double difference technique and waveform cross correlation. The local magnitudes were corrected based on the estimated moment magnitudes of 33 aftershocks.
The aftershock zone is extended from the northern part of Lefkada to the north – northwest of Kefalonia Island. The main rupture has a length of about 17 km, is striking almost north–south and dips at 67o to the east, along the southwestern coastline of Lefkada Island. The seismicity was quickly expanded to neighboring fault segments in a manner driven by the stress regime in the area which is dominated by right lateral strike slip motion. The off fault seismic activity is located in areas with positive stress changes that are due to the coseismic slip of the main shock. To the north of the main rupture the aftershocks define rather well a structure striking at 225o, having a length of 9.5 km. It is noteworthy that the same area was also activated after the 2003 main shock. The activity to the south forms a seismicity band that although follows a general NE–SW strike, it consists of a number of small clusters with different orientations. This evidences once more the suggestion of Karakostas et al. (2014) that the Lefkada and Kefalonia fault branches of the Kefalonia Transform Fault Zone (KTFZ), which is extended from north of Lefkada to the SSW of Kefalonia Islands, are connected at this place with several small faults forming a step over zone.