EGU21-16576
https://doi.org/10.5194/egusphere-egu21-16576
EGU General Assembly 2021

Ground deformation related to slip and afterslip of the 29 December 2020 Mw 6.4 Petrijna earthquake (Croatia) imaged by InSAR

Athanassios Ganas[1], Sotiris Valkaniotis[2], Panagiotis Elias[3], Varvara Tsironi[1,4], Ilektra Karasante[1], Pierre Briole[5], Eugenio Sansosti[6], and Vincenzo De Novellis[6]

[1]National Observatory of Athens, Institute of Geodynamics, Lofos Nymfon, Thission, 11810 Athens, Greece (aganas@noa.gr)
[2]Koronidos Str., 42131, Trikala, Greece
[3]National Observatory of Athens, Institute of Astronomy, Astrophysics, Space Applications and Remote Sensing, Vas. Pavlou & I. Metaxa, GR-15 236 Penteli, Greece
[4]Department of Geology, University of Patras, 26504 Rio, Greece
[5]École Normale Supérieure de Paris, PSL Research University, Laboratoire de Géologie - UMR CNRS 8538, 24 rue Lhomond, 75005 Paris – France
[6]National Research Council of Italy (CNR), Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA) via Diocleziano 328, 80124 Naples, Italy

On December 29, 2020, at 11:19 UTC, a strong (M6.4), shallow earthquake occurred in the central region of Croatia. The epicentre was located near the town of Petrinja, about 40 km to the south of the capital, Zagreb. Here we present a preliminary analysis of the geodetic data (differential InSAR & GNSS) and preliminary estimates of the slip that occurred on the fault during the earthquake and subsequent aftershocks. We picked InSAR data to invert for the seismic fault assuming linear rheology and Okada-type dislocation (rectangular) source with non-uniform slip. The interferograms show an asymmetric, four□lobed pattern, centered on a NW□SE oriented discontinuity that is in agreement with the right-lateral plane of the moment tensor solutions for the mainshock. We found that the Petrijna earthquake ruptured a segment of a strike-slip fault zone that is shorter (8 km) than average and with larger slip (~ 3 m). All parameters of the seismic fault are well constrained by InSAR modeling due to the full azimuthal coverage with both ascending and descending data of good quality. The fit to the fringes is better with a steep dip angle (76°) than with a purely vertical fault. The upper edge of the modeled fault is at a depth of ~1 km, this means that the slip drop from 3 to 0 m in the uppermost kilometer and our geodetic analysis cannot assess whether the fault reached the surface in some sections of the fault, however should this be the case, we expect ruptures at the surface in the range of 0.1 to 0 m for consistency with our model and the structure of the fringes pattern. In particular, preliminary modelling results with distributed fault-slip show that the slip reached a peak of more than 2.5 m at a depth of about 2 km. We also found that, differently from what reported in the European database of seismogenic sources (EDSF), the seismic fault dips westward instead of eastward. Additionally, the 2020 rupture and the InSAR mapped trace do not match the EDSF composite seismogenic fault surface trace. Kinematic analysis of GNSS waveforms at station BJEL (about

70-km east of the epicentre) revealed that horizontal ground motion reached 7-cm (peak-to-peak). The InSAR data revealed a 7 km of right-lateral afterslip on the NW-edge of the rupture, and 5 km to the south of the main fault rupture. In particular, the afterslip data on the NW edge of the rupture document the curved shape of the post-seismic deformation, that highlights the non-planarity of faults in nature and possibly indicating the existence of a ramp structure connecting to the neighboring segment towards north.