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Post-seismic deformation related to the 2016 central Italy seismic sequence from GPS displacement time-series

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The 2016-2017 Central Italy earthquake sequence was characterized by three main events striking the central Apennines between August 2016 and October 2016 with a Mw [5.9 to 6.5], plus four earthquakes occurring in January 2017 with a Mw [5.0; 5.5]. Here we study 85 Global Positioning System (GPS) stations active during the post-seismic phase in a region within a radius of 100 km around the epicentral area, including near and far-field domains. We separate the post-seismic deformation from other, mainly seasonal, deformation signals present in ground displacement time-series via a variational Bayesian Independent Component Analysis (vbICA) technique. Excluding the postseismic transient signal, we found that all the other components are due to hydrological processes, and found no evidence of pre-seismic deformation signals with a spatial and temporal pattern that can be ascribed to a precursory deformation. We study the role played by afterslip on the main structures activated during the co-seismic phase, and we infer the activation during the post-seismic phase of the Paganica fault, which is located further south of the 2016-2017 epicenters and did not rupture during the co-seismic phase. We investigate an aseismic activation of the 2 − 3 km thick subhorizontal layer of seismicity, which bounds at depth the SW-dipping normal faults where the mainshocks nucleated, and which has been interpreted as a shear zone. Moreover we consider the possibility that the shear zone marks the brittle-ductile transition including the viscoelastic relaxation of the lower crust and upper mantle as a driving mechanism of the post-seismic displacement. However, neither afterslip nor viscoelasticity can fully explain the observations alone: the former is capable of satisfactorily explaining only the data in the epicentral area but it generally underestimates the displacement in the far-field domain; the latter cannot simultaneously explain the displacement observed in the near-field and far-field domains. Hence we infer a mixed contribution of these two mechanisms.