Post-seismic deformation after the 2016 Norcia earthquake (Italy) revealed by InSAR times series

Lea Pousse-Beltran*[1], Anne Socquet[2], Lucilla Benedetti[1], Marie-Pierre Doin[2,3], Magali Rizza[4], and Nicola D'agostino[5]

[1]Centre européen de recherche et dénseignement de géosciences de lénvironnement – Centre National de la Recherche Scientifique : UMR7330, Institut de Recherche pour le Développement : UMR$_D$161, $AixMarseilleUniversité : UM34, CollègedeFrance$: $UMR7330, InstitutNationaldelaRechercheAgronomique, Institutnationaldessciencesdel\acute{U}nivers, Institutnationaldes$ $-EuropôleMéditerranéendel\acute{A}rbois - AvenueLouisPhilibert - BP80 - 13545Aix - en - Provencecedex4, France$

[2]Institut des Sciences de la Terre – Université Joseph Fourier - Grenoble 1, Institut français des sciences et technologies des transports, de l'aménagement et des réseaux, Institut national des sciences de lÚnivers, Institut de recherche pour le développement [IRD] : UR219, PRES Université de Grenoble, Université Savoie Mont Blanc, Centre National de la Recherche Scientifique : UMR5275, Université Grenoble Alpes, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers – BP 53 - 38041 Grenoble cedex 9, France

[3]Laboratoire de Géologie, CNRS, ENS, Paris – CNRS : UMR8538 – France

[4]Centre européen de recherche et d'enseignement de géosciences de l'environnement (CEREGE) – Aix Marseille Université, Institut de recherche pour le développement [IRD], CNRS : UMR7330 – Europôle Méditerranéen de l'Arbois - Avenue Louis Philibert - BP 80 - 13545 Aix-en-Provence cedex 4, France

[5]Istituto Nazionale di Geofisica e Vulcanologia – Roma, Italy

Abstract

Strain accumulated on active fault systems can be released either through seismic events that trigger sudden slippage along a fault plane or through aseismic slow slip during the inter-seismic and post-seismic periods. The quantification of aseismic deformation is also a cornerstone in the estimation of slip deficit or loading on faults. During the 2016-2017 Italian seismic sequence, four MW $>$ 5 events occurred. The main shock, on October 30th 2016 MW 6.6 (the so called "Norcia earthquake") broke the ground surface and produced up to two meters of slip displacement (Emergeo et al. 2016; Civico et al. 2018). How much of the accumulated strain was released aseismically during or after the seismic sequence is still an open question. To detect potential aseismic slip, we produced time-series using 6 days repeat cycles of Sentinel-1A/1B SAR images from November 1st 2016 to February 11th 2017. Results of our time-series reveal a post Norcia earthquake deformation which lasted mainly 2 weeks. The deformation distributed on 14 km2 features centimetre-scale subsidence (_˜0.4 mm/days in LOS direction) located in the south extremity of the rupture near Arquata del Tronto. This zone corresponds to an aquifer which dried up after the Norcia event (Petitta et al. 2018). This aquifer is located in limestone layers (Maiolica unit) folded

*Speaker

above an ancient basal OAS thrust (Olevano-Antrodoco-Sibillini thrust) corresponding to an impermeable limit, that has likely been reactivated as a shallow angle normal fault by the earthquakes (Cheloni et al. 2017; Scognamiglio et al. 2018). We invert our data by pattern tracking and observe a temporal decay consistent with post-seismic relaxation. We infer that this subsidence might be due to an afterslip along the OAS thrust coeval with the water discharge along the unsealed thrust. Poro-elastic effects seem inconsistent with the localized subsidence of the aquifer and the total dry up of the spring, but still could participate in the phenomenon.