Surface creep along the 1999 Izmit earthquake's rupture (Turkey) from high temporal resolution InSAR data

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Résumé

The determination of the slip budget is essential to estimate seismic potential of faults. Studies based on InSAR and GPS observations until 2012 have shown that the central segment of the August 17, 1999 Izmit earthquake on the North Anatolian Fault (NAF) began slipping aseismically following the event. To monitor this long-lasting afterslip and characterize its spatio-temporal behaviour, we compute InSAR time series by using 32 TerraSAR-X radar images acquired between 2011 and 2015 and 275 ascending and descending Sentinel 1a/b images acquired on three tracks, spanning the period from October 2014 to July 2017. Results over the period 2011-2017 show that afterslip on the central segment of 1999 Izmit fault rupture is still taking place since this earthquake at an average rate of about 6 mm/year, becoming the longest recorded afterslip. Modelling of the data reveals that the creep rate fluctuates in space and time, along the different segments of the Izmit rupture and is maximum along the segment that showed supershear rupture. The present data are in agreement with previous studies that have shown that creep might have initiated as postseismic deformation after the 1999 Izmit earthquake and decays logarithmically with time since. In addition to the stable steady state creep, results reveal a transient creep event (creep burst) in December 2016. Vertical velocity fields obtained with decomposition of velocity fields on ascending and descending tracks show the persistent subsidence on the hanging wall block of the Golcuk normal fault. These results demonstrate that high-resolution temporal InSAR data allow detecting deformation signals that were not seen previously and that active continental deformations East and South of Istanbul area are more complex than what was previously measured as they vary along the North Anatolian Fault both in space and in time.

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