Shallow creep along the 1999 Izmit earthquake's rupture (Turkey) from high temporal resolution interferometric synthetic-aperture radar data (2011-2017)

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Abstract

Characterizing the spatiotemporal evolution of creep is essential to constrain fault's slip budget and understand creep mechanism. Studies based on Interferometric Synthetic-Aperture Radar (InSAR) and Global Positioning System (GPS) satellite observations until 2012 have shown that the central segment of the August 17, 1999 Mw 7.4 Izmit earthquake on the North Anatolian Fault began slipping aseismically following the event. In the present study, we compute InSAR time series based on TerraSAR-X and Sentinel 1A/B radar images acquired over the period 2011-2017. The mean velocity fields reveal that creep on the central segment of the 1999 Izmit fault rupture continues to decay but is still taking place, more than 18 years after the earthquake, in overall agreement with models of postseismic afterslip decaying logarithmically with time for a long period of time. The creep extends along the fault section that experienced supershear velocity rupture during the Izmit earthquake with a rate up to _˜6 mm/year. A significant transient accelerating creep is detected in mid-November 2016 on the Sentinel-1 time series, near the maximum creep rate location, associated with a total surface slip of 10 mm released in one month only. Additional analyses of the vertical velocity fields show a persistent subsidence on the hanging wall block of the Golcuk normal fault that also ruptured during the Izmit earthquake. These results demonstrate that afterslip processes along the North Anatolian Fault in east-southeast of Istanbul are more complex than previously proposed as they vary spatiotemporally along the fault.

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