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Shallow deformation of the M_w 4.9 Khonj earthquake (6 January 2017) in the Zagros Simply Folded Belt, Iran

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On 6 January 2017, an M_w 4.9 earthquake occurred c. 40 km northeast of the city of Khonj, in the Simply Folded Belt (SFB) of the Zagros, southwestern Iran. Using the JAXA ALOS-2 PALSAR as well as the Copernicus Sentinel-1 SAR images, we applied two-pass Interferometric Synthetic Aperture Radar (InSAR) to acquire the corresponding surface deformation of the Khonj earthquake. The fault plane solutions confirm the thrust mechanism for the earthquake that has a shallow depth of 5 km resulting in a subtle, permanent surface deformation visible through InSAR displacement maps. Concentric fringes on the interferograms in both ascending and descending geometries indicate the rupture has not reached the surface; nonetheless, they indicate shallow seismic deformation within the Zagros SFB. The Khonj earthquake is one of the smallest events with a discernible InSAR deformation field of c. 5–10 cm in the satellite line-of-sight (LOS). The epicenter of the earthquake is located in a plain between the northwestern and southeastern hinges of the Qul Qul and Nahreh anticlines. The source modeling from the InSAR data quantifies an NW-SE-striking fault either dipping to the northeast or the southwest. This shallow event is aligned with a zone in which the only documented surface ruptures in the Zagros—i.e., the Furg and Qir-Karzin earthquakes—are located.