



Rupture process of the Oklahoma Mw5.7 Pawnee earthquake from Sentinel-1 InSAR and seismological data

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Since 2009, Oklahoma has experienced a surge in induced seismicity, a side effect of extensive saltwater injection into subsurface sedimentary rocks. The seismic hazard entailed by regional- scale injection operations is however difficult to assess. The September 3, 2016, Mw5.7 Pawnee earthquake is the largest since the increase of seismic activity. Using Sentinel-1 spaceborne interferometric synthetic aperture radar, we unambiguously show that the earthquake produced vertical displacement of 2-3 cm at the surface. Kinematic inversion of geodetic and seismological data shows that the main seismic rupture occurred between 4 and 9km depth, over a length of 8km, with slip reaching at least 40cm. The causative fault is entirely buried within the Precambrian basement, i.e. well beneath the Paleozoic sedimentary pile where injection is taking place. Potentially seismogenic faults in the basement of Oklahoma being poorly known, the risk of $M_w \geq 6$ events triggered by fluid injection remains an open question.