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# 20 years of InSAR observations on the Parkfield-Cholame section of the San Andreas Fault (California, USA): insights on the behavior of a transition zone.

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In this study we summarize the results of 18 year of multi-band, multi-platform, Synthetic Aperture Radar (SAR) interferometric observations on the Parkfield section of the San Andreas Fault (SAF, California, USA).The Parkfield section of the San Andreas Fault (SAF) is defined as a transitional portion of the fault between slip-release behavior types in the creeping section of the SAF to the northwest and the apparently locked section to the southeast. The Parkfield section is characterized by complex frictional fault behavior because it represents a transition zone from aseismic creep to stick-slip regime. At least six historic earthquakes of Mw $\sim$6 have occurred in this area in 1881, 1901, 1922, 1934, 1966, and 2004. To understand the SAF behavior in this area, it is of particular interest to measure and analyze, not only the spatial evolution of the surface displacement in this area, but also its evolution over time. Because the recurrence time of large earthquakes is often greater than the available span of space geodetic data, it has been challenging to monitor the evolution of interseismic loading in its entire duration. Here, we analyze large datasets of surface deformation at different key episodes around the Cholame, Parkfeld, and creeping segments of the San Andreas Fault. We compare the average fault slip rates before and after the 2004 Mw6 Parkfeld earthquake, in the 1986-2004 and 2006-2012 periods, respectively. Using a combination of GPS data from the Plate Boundary Observatory, the SCEC Crustal Motion Map and the Bay Area Velocity Unifcation networks and interferometric synthetic aperture radar from the ALOS, ENVISAT and ERS satellites, we show that the area of coupling at the transition between the Parkfeld and Cholame segments appears larger later in the interseismic period than it does earlier on. A possible interpretation of these results leads us to an evidence of signifcant deceleration of fault slip during the interseismic period. In a complementary analysis we couple ERS and ENVISAT data at full spatial resolution and we compare them to creepmeters measurements in the near field of the San Andreas Fault. We used the ability of InSAR technique to provide precise displacement map in line of sight to characterise the fault displacement following the 28 September 2004 (Mw 6) Parkfield earthquake between 2005 and 2010. We combine ERS and ENVISAT interferograms to increase the temporal data sampling on the Parkfield section of the San Andreas Fault at full spatial resolution. As a further result of this study, we found that Parkfield 2004 post-seismic surface displacement exhibits a particularly long duration and space extension. These InSAR analysis show that surface displacement on the Parkfield segment was active until 2009-2010. Near field surface velocity reached a peak of 7cm/year during 2005 –confirmed by creepmeters measurements. Is there depth dependence transition in the post-seismic behavior of this fault segment?