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Seven years of postseismic deformation in the Mw=6.8, 2003 Zemmouri (Algeria) earthquake area from PS-InSAR

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We study the postseismic deformation of the Mw 6.9, 2003 Zemmouri earthquake using both Persistent Scatterer (PS) and Small Baseline (SB) InSAR techniques. InSAR time series calculated from 31 Envisat ASAR images reveal subtle (sub cm) ground movements along the shoreline between Cap Matifou and Dellys between 2003 and 2010 where remarkable coseismic uplift was observed after the earthquake. Measurements show line of sight (LOS) ground subsidence at rates up to 4 mm/yr in the region of coseismic surface deformation. There are two lobes of subsidence in the deformation field at a maximum rate of $\sim$2.0 mm/yr in Cap Djenet and $\sim$3.5 mm/yr in Zemmouri-Boumerdes. These lobes correlate well with the regions of maximum coseismic uplift determined by InSAR and coastal uplift measurements, supporting the previous inferences that the earthquake was associated with two segments. Modeling with elastic dislocations on rectangular faults suggests that subsidence in the area of high coseismic uplift and GPS measurements can be adequately explained by afterslip on the shallow sections of the coseismic fault rupture. The impact of coseismic rupture and geologic background made of soft sedimentation allow us to characterize the ground deformation of non-tectonic origin away from the earthquake area. Indeed, ground movements also recorded in PS-InSAR time series in the Quaternary Mitidja Basin seem to result largely from seasonal water level fluctuation and water pumping for farming. Comparison of PS time series with water level changes in the eastern Mitidja Basin displays a remarkable correlation; it also indicates that the postseismic ground deformation in the western end of the 2003 earthquake rupture can be considered as negligible.