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InSAR analysis of the 21 May 2003 Zemmouri earthquake (Mw 6.8, Northern Algeria): Rupture constraint of an offshore hidden fault.

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We study the 21 May, 2003 (Mw=6.8) Zemmouri (Algeria) earthquake, the strongest seismic event felt in the region since 1716. The focal mechanisms solutions of the mainshock indicate reverse faulting with a rupture trending ∼N60E and dipping ∼45° SE. The earthquake has an epicenter located offshore Zemmouri and caused a coastal uplift of an average of 50 cm along ∼50 km of shoreline. We mapped the coseismic surface displacement field caused by the earthquake using the ENVISAT ASAR (IS2) and RADARSAT standard beam (ST5) data. We were able to obtain coseismic interferograms from both the ascending and one descending orbits of ENVISAT satellite. The RADARSAT data proved useful only in the descending mode. While the two RADARSAT interferograms cover the entire area of coastal uplift, ENVISAT data cover only the western half of the epicentral zone. Although the InSAR coherence in the area around the epicenter is poor, deformation fringes are observed along the coast in different patches. Located in the Boumerdes area, the maximum deformation is indicated by presence of high gradient of fringes seen in all the interferograms. To constrain the rupture parameters of the earthquake, we model the interferograms and the uplift measurements using elastic dislocations on both rectangular and triangular fault patches in an elastic and homogeneous half space. We first invert the rectangular fault parameters using a Monte Carlo simulation technique. The best fitting model indicates a fault striking ∼N65°E and dipping 24° SE with two lobes of high slip (up to 3.5 m) located southwest and northeast of the epicentral area. The low angle of the fault rupture deduced is however inconsistent with the focal mechanism solutions and the aftershocks distribution, and is largely due to the simple planar geometry of the modeled fault. In the next stage of modeling, we invert the coseismic slip on a

more realistic curving surface constructed from triangular elements using Poly3Dinv program that uses a damped least square minimization. The slip distribution obtained is similar to that on rectangular fault surface, but the fault dips about 45˚ SW with a smooth change in strike north of Boumerdes from N45˚E in east to N70˚W in the west.