Geophysical Research Abstracts
Vol. 13, EGU2011-12410, 2011
EGU General Assembly 2011


# The Machaze (Mw 7, 2006, Mozambique) Earthquake: co- and post-seismic surface displacement carachterisation using multiband InSAR.

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In this study we investigate the surface deformation related to the 2006 Machaze earthquake using Synthetic Aperture Radar Interferometry (InSAR) and sub-pixel correlation of radar amplitude images. We focus on surface displacement measurement during three stages of the seismic cycle. Firstly, we investigate the co-seismic stage, using Advanced SAR (ASAR) sensor onboard the Envisat satellite. Secondly, we investigate the postseismic stage using the Phase Array L-band SAR sensor (PALSAR) onboard the ALOS satellite.Thirdly, we focus on the interseismic stage, prior to the earthquake by analysing the L-band JERS-1 SAR data. The high degree of signal decorrelation in the C-band coseismic interferogram impedes a correct positioning of the surface rupture and correct phase unwrapping. The postseismic L-band interferograms reveals a time constant surface displacement causing subsidence of the surface at ∼5cm/yr rate. This phenomenon affects the close rupture field for at least the 2 years following the earthquake and intrinsically unveils a candidate seismogenic fault trace that we use as a proxy for an inversion against an elastic dislocation model. The joint use of this rupture position estimate, the dislocation model and the co-seismic interferogram allows retrieving a more comprehensive description of the surface deformation field.

The post-seismic deformation seems to be constant with time, about 3.5 cm/year for at least the two years after the earthquake. Such a post-seismic phenomenon is unexpected in a strong lithosphere context and begs further dedicated investigation. As far as this study is concerned, we tried to discriminate broadly among different possible known source phenomena such as viscoelastic relaxation (e.g. Thatcher, 1983; Freed, 2007), poroelastic rebound (e.g. Jonsson et al., 2003), afterslip (e.g. Marone et al., 1991) and dilatancy recovery (e.g. Fielding et al., 2009). Although these phenomena might have occurred, we could reasonably rule out substantial contribution from viscoelastic relaxation and poroelastic rebound, as these phenomena would yield a post-seismic signal opposite in direction to the co-seismic signal, which was not the case here. The dilatancy recovery phenomenon was observed geodetically on the BAM strike-slip fault system in Iran (Fielding et al., 2009). Although this phenomenon in not well understood for normal faulting and certainly would deserve more attention for the Machaze case, we might argue that dilatancy recovery would affect a broad zone in the fault area, one not particularly limited by the fault plane, which is not our case. For the moment, afterslip could explain the observations and so far is the best candidate in the Machaze area, as its direction the same as that of the coseismic slip, a fact observed elsewhere (e.g. Freed, 2007). Nevertheless, we might be facing a more complex relaxation phenomenon.