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Seismic and aseismic activity associated with the 2008 Mw 6.3 Damxung earthquake, Tibet

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We investigate the 2008 Mw 6.3 Damxung earthquake on the Tibetan Plateau. The main objectives of this study are (i) to derive a coseismic slip model in a layered elastic Earth; (ii) to test whether afterslip is spatially and temporally correlated with aftershocks; (iii) to constrain the lower bound of mid-crustal viscosity. The fault parameters and coseismic slip model are derived by joint inversion of Envisat data. We developed a new Monte Carlo nonlinear inversion scheme with a layered crust. Compared to the slip distribution obtained with a homogeneous crustal model, the maximum slip is smaller and deeper, while the moment release calculated from both models are similar.

Postseismic deformation time series constructed from 17 interferograms covering 665 days after the main shock reveals localised deformation at the southern part of the fault. Afterslip inversions indicate three localised slip patches, and the cumulative afterslip moment after 615 days is at least $\sim$11% of the coseismic moment.

We obtained aftershock data from the China Earthquake Data Centre, which provides phase information, magnitude and location as recorded by a local network until the end of 2008, for Ml > 1 aftershocks. We apply the Joint Hypocentral Determination method to relocate Ml > 3 aftershocks, most of which occurred within 20 days after the mainshock, before the first postseismic SAR acquisition. Using the centre of the InSAR-derived slip distribution as a fixed location, we test the spatial relationship between coseismic slip, afterslip and relocated aftershocks. We find that the aftershock distribution matches the coseismic slip distribution well, in contrast to the overlapping relationship found by D'Agostino et al. (2012) for the 2009 L'Aquila earthquake. The observed relationship for the Damxung case implies that the afterslip and aftershocks do not obey certain space-time relationships inferred in other studies of different earthquakes. We note, however, that since our InSAR postseismic time series starts 20 days after the Damxung earthquake, there is a possibility that the very early afterslip pattern looked different.

We also carry out modeling of viscoelastic relaxation in a Maxwell half-space to constrain the lower bound of mid-crustal viscosity. By calculating the RMS misfit of the residual between observed and modelled postseismic displacements using a range of viscosities, we infer a lower bound of 1×10^{18} Pa s. This is consistent with viscosity estimates in other studies of postseismic deformation across the Tibetan Plateau.

1. D'Agostino, N., Cheloni, D., Fornaro, G., Giuliani, R., & Reale, D. (2012). Space-time distribution of afterslip following the 2009 L'Aquila earthquake. Journal of Geophysical Research, 117(B2), B02402.