Coupling of Sentinel-1, Sentinel-2 and ALOS-2 to assess coseismic deformation and earthquake-induced landslides following 26 June, 2016 earthquake in Kyrgyzstan

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The active deformation in Kyrgyzstan results from the collision between Indian and Asia tectonic plates at a rate of 29 ± 1 mm/yr. This collision is accommodated by deformation on prominent faults, which can be ruptured coseismically and trigger other hazards like landslides. Many earthquake and earthquake-induced landslides in Kyrgyzstan occur in mountainous areas, where limited accessibility makes ground-based measurements for the assessment of their impact a challenging task. In this context, remote sensing measurements are extraordinary useful as they improve our knowledge about coseismic rupture process and provide information on other types of hazards that are triggered during and/or after the earthquakes.

This investigation aims to use L-band ALOS/PALSAR, C-band Sentinel-1, Sentinel-2 data to evaluate fault slip model and coseismic-induced landslides related to 26 June 2016 Sary-Tash earthquake, southwest Kyrgyzstan. First we implement three methods to measure coseismic surface motion using radar data including Interferometric SAR (InSAR) analysis, SAR tracking technique and multiple aperture InSAR (MAI), followed by using Genetic Algorithm (GA) to invert the final displacement field to infer combination of orientation, location and slip on rectangular uniform slip fault plane. Slip distribution analysis is done by applying Tikhonov regularization to solve the constrained least-square method with Laplacian smoothing approach. The estimated coseismic slip model suggests a nearly W–E thrusting fault ruptured during the earthquake event in which the main rupture occurred at a depth between 11 and 14 km. Second, the local phase shifts related to landslides are inferred by detailed analysis pre-seismic, coseismic and postseismic C-band and L-band interferograms and the results are compared with the interpretations derived from Sentinel-2 data acquired before and after the earthquake.