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# Assimilation of D-InSAR and sub-pixel image correlation displacement measurements for coseismic fault parameter estimation: Application to the 2005 Kashmir earthquake

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We apply both sub-pixel image correlation and differential interferometry (D-InSAR) on a series of ENVISAT images from October 2004 to June 2006 in order to map the deformation due to the Kashmir earthquake (Mw=7.6) of October 8th, 2005. The 3D surface displacement field at the Earth's surface as well as the displacement field at depth on the ruptured fault had previously been estimated based on 6 measurements from sub-pixel image correlation (Pathier et al., 2006). Here, we follow the same approach adding more measurements from sub-pixel image correlation. We also improved the D-InSAR data quality by a multi-scale frequencies analysis, which provides complementary information, less robust but more precise, in the far field, at several hundred meters from the fault trace. Firstly, the 3D displacement at the Earth's surface, with 3 components E, N, Up, is estimated by a linear inversion. The evolution of displacement value as well as associated uncertainty for each component is analyzed while adding redundant measurements from sub-pixel image correlation and D-InSAR. Three strategies of assimilation are proposed, implemented and compared.

1. For each pixel, the 3D displacement field at the Earth's surface is obtained by inversion of 4 selected measurements (displacement in range and azimuth directions for both ascending and descending tracks) whose associated uncertainty is the smallest among all of the available measurements.

2. The 3D displacement field at the Earth's surface is obtained by inversion of all measurements available for a given pixel.

3. We perform several inversions with 4 displacement measurements (displacement in range and azimuth directions for both ascending and descending tracks) each time on each pixel, and then combine the obtained 3D displacement field estimations in order to get a final estimation with reduced uncertainty.

Secondly, the fault geometry as well as mean slip, are estimated by inverting a forward model of rectangular dislocation in a homogeneous elastic half-space. The contribution of redundant measurements added, especially the measurements from D-InSAR to the improvement of the model is highlighted. Moreover, the new information provided by D-InSAR in the far field, allows us to test several configurations for the co-seismic fault geometry, such as a single ramp as previously estimated (Pathier et al., 2006) or, a ramp-décollement configuration.