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Precise Measurement of Coseismic Deformation by Multi-temporal Radar Interferometry

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Conventional Differential InSAR derived coseismic measurements are often perturbed by topography residuals, long wavelength orbital ramps，potential phase unwrapping errors and atmospheric artifacts. These nuisance components degrade the precision of the inverted fault slips. We outline here a multi-temporal InSAR (MT-InSAR) model to obtain precise coseismic deformation, with application to 6 October 2008 Dangxiong earthquake (Mw 6.3). By analyzing a set of pre-seismic SAR images and at least one post-seismic image our model can jointly estimate the coseismic deformation together with DEM and orbital errors, as well as pre-seismic (and post-seismic) deformation rate. The parameterization of orbital errors in our model is based primarily on its spatially smooth and temporally random characteristics. The joint model makes the separation of long wavelength orbital error, DEM residuals and seismic deformation possible. Furthermore, our method performs linear parameter estimation directly on the wrapped differential phases at arcs (coherent point pairs) implying no phase unwrapping procedure is needed, neither is a solution space searching needed. The slip due to Dangxiong earthquake inverted respectively based on MT-InSAR and DInSAR derived coseismic deformation shows up to 34cm differences indicating the topography error and distortions introduced by application of a best fitting orbital phase plane to the coseismic interferogram can bias the fault slip inversion.

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