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Estimating the atmospheric phase delay for quantifying co-seismic deformation using repeat pass Differential SAR Interferometry: Observations from 20th April 2013 Lushan (China) Earthquake

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Abstract. Atmospheric phase contribution significantly influences co-seismic surface deformation estimates from repeat pass Differential Synthetic Aperture Radar Interferometry (DInSAR). Present study investigates the contribution of the atmosphere in co-seismic deformation estimation associated with the 20 April 2013 Lushan (China) earthquake. The Lushan Earthquake occurred in the south-western segment of the Longmenshan fault zone, on the eastern margin of the Qinghai-Tibetan Plateau. Using pre- and postearthquake Radarsat-2 interferometric pair, the co-seismic deformation of the Lushan earthquake has been estimated. The tropospheric phase delay component has been estimated using tropospheric models in conjunction with surface temperature and pressure data from MODIS atmospheric products. The ionospheric phase component has been computed using the Total Electron Content (TEC) data. The net atmospheric path addition in the study area varies from 3.022 m to 4.621 m for the pre-earthquake SAR acquisition and from 2.687 m to 4.199 m for the post-event data acquisition. Comparison of the Line of Sight (LOS) displacement values computed using un-corrected and corrected interferometric data shows that the atmospheric phase component has introduced considerable contribution in the LOS displacement values. The uncorrected LOS displacement values vary from 0.902 m to −0.157 m where as those from the phase-corrected interferometric data are in the range of 0.052 m and −0.062 m. The corrected LOS displacement values show close agreement to a few GPS based co-seismic surface deformation components from published literature. Thus removal of atmospheric phase contribution is a necessary step in using repeat pass DInSAR for co-seismic surface deformation estimation.

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