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Evaluation of Different Methods for Ionospheric Phase Correction of PALSAR-2 ScanSAR InSAR observations

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Abstract – The phase delay caused by ionosphere is a major source of error in L-band Interferometric Synthetic Aperture Radar (InSAR) measurements. Several methods have already been proposed for ionospheric delay correction in InSAR data, each of them has its own advantages and disadvantages. Corrections using Multiple Aperture Interferometry (MAI) and Amplitude Tracking (AT) have been applied in the past, aim at generating shift along azimuth direction. The ionospheric phase can then be evaluated by estimating the approximate linear relationship between the azimuth shift and ionospheric phase streak. The use of MAI for wide-swath ScanSAR data from ALOS-2 that have been focused with the "full-aperture" approach of JAXA. It is problematic as it results in to significant azimuth depending loss of coherence due to doppler spectrum changing in azimuth direction of ScanSAR data. Amplitude tracking method can be applied, but will also be problematic if there is obvious surface displacement in the study area. We evaluate the use of existing ionosphere product from Center for Orbit Determination in Europe (CODE) for ionospheric phase correction of ALOS-2 ScanSAR interferograms. CODE provides global ionospheric map (GIM) using data from 200 GPS/GLONASS stations of the IGS and other institutes. This product contains global covered vertical total electron content (VTEC) map with a resolution of 5 degree by longitude and 2.5 degree by latitude. To down-scale this product to a resolution sufficient for InSAR observations we use spherical harmonics expansion and calculate ionospheric phase delay for a grid appropriate for InSAR observation data. The performance of the corrections baseon on this down-scaled CODE product is evaluated against other correction methods for pairs of L-band ScanSAR interferograms covering preseismic, coseismic and postseismic deformation of the 2016 Mw 7.8 earthquake in Ecuador.