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Polarimetric Optimization of Small Baselines and Persistent Scatterer SAR Interferometry approaches in Urban and Agricultural Regions

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In this paper, we investigate the use of polarimetric optimization method for Interferometric Synthetic Aperture Radar (InSAR) time-series analysis of SAR images that are acquired in co-polar channels (HH and VV). The goal functions are to minimize the Amplitude Dispersion Index (ADI) and Amplitude Difference Dispersion index (ADD) to increase the number of candidates for the stable pixels in both Persistent Scatterer Interferometry (PSI) and Small BAseline Subset (SBAS) approaches. For this purpose, the appropriate scattering mechanism basis of each pixel is first derived by applying Simulated Annealing optimization method. Temporal coherency criterion is then used for identifying the final stable pixels. Finally, Stanford Method for Persistent Scatterer and Multi-temporal InSAR (Stamps/MTI) is used to estimate the time-series and rate of deformation.
We apply our method on a dataset including 17 TerraSAR-X dual polarimetric SAR images over Tehran plain in Iran. The main phenomena in the study area is high rate of subsidence which has been advanced to both urban and agricultural regions. Therefore, it possible to evaluate the performance of the above methods for both urban and non-urban areas.
By applying polarimetric optimization on SB method, the density of candidate pixels is increased by about 2.5 times in comparison with the results obtained from HH or VV polarization dataset. The number of [U+FB01]nal pixels increases by about 1.5 times in comparison with single-channel SAR data. In the case of optimization of PSI, number of PS candidates increased by about three times, with respect to single channel dataset, and the [U+FB01]nal PS density improved by about 50 percent. Comparison of SB and PSI results shows that with regards to the number of pixels with optimum scattering mechanism, the SBAS method detects 10 percent more pixels than PS in agricultural regions. On the contrary, the PS method identifies nearly 8 percent more stable pixels than SB method in urban regions.