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A modified SqueeSAR approach for urban displacement monitoring with Sentinel-1 data

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For displacement monitoring in an urban environment using a stack of synthetic aperture radar (SAR) data, it is desired to use an effective technique capable of mapping detailed infrastructure, not only from Persistent Scatterer (PS) points but also from Distributed Scatterers (DS). SqueeSAR is an approach to extract the signal from DS, which first applies a spatiotemporal filter on images and optimizes DS, then incorporates information from both optimized DS and PS points into Interferometric SAR (InSAR) time-series analysis. In this study, we evaluate and propose the use of two-sample T-test to identify effectively the neighbouring pixels with similar behaviour for DS analysis. PS points together with the optimized DS points are then fed into Stanford Method for Persistent Scatterers (StaMPS) for the rest of processing to derive the displacement map. We apply the technique on 50 images of Sentinel-1 acquired over Trondheim city in Norway to demonstrate the efficiency of the proposed approach. A cross check of the number of the identified neighbouring pixels using the Kolmogorov-Smirnov (KS) test, which is employed in standard SqueeSAR and our proposed T-test shows that using high number of images (50) their results are strongly correlated. However, in comparison to KS-test, the T-test is faster and less computationally intensive. Moreover, applying the tests under different SAR stack sizes from 40 to 10 shows that T-test is less sensitive to the number of images.