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Effects of baseline urban texture on SAR image: applications to earthquake damage detection

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The detection of urban damages due to earthquakes is a key point, particularly in remote areas or where the infrastructures are not well developed to ensure the necessary communication exchanges or where their operability has strongly decreased as a consequence of the event. Synthetic Aperture Radar (SAR) sensor is widely used in environmental studies due to its characteristics which allow a fairly synoptic view in almost completely weather and time independent conditions.

The interaction of the SAR signal with the urban structures has been studied in papers available in the literature. These highlight that the radar return from urban settlements is determined mainly by the double bounce mechanism. However, diffraction effects from the structure edges as well as trihedral reflections also contribute to the radar echo. Further developments are needed in the field of the analysis of SAR images in urban areas to completely define the characteristics of the electromagnetic response of buildings and the influence of urban settlements characteristics on the backscattered signal. In particular, a better evaluation of the influence of scatterers (i.e. buildings) dimension and their distribution in the resolution cell is needed to understand and explain the role of the SAR acquisition geometry on InSAR phase coherence changes.

InSAR phase coherence and intensity correlation of multilook images collected before and after the earthquake have been used in previous works to detect changes in built-up area. SAR images series of Rome have been used to analyze these characteristics, in order to evaluate the potential and the limitation of InSAR techniques to detect urban changes for different values of baselines, both spatial and temporal. The effect of the baselines has been evaluated experimentally from the available ERS1/ERS2 im-

ages dataset. The drop-off of the InSAR phase coherence with the spatial baseline has been shown dependent on different urban texture which has been deduced by optical images. For this purpose the so called “dissimilarity” texture parameter has been evaluated. Supporting experimental observations, a theoretical study of the InSAR phase coherence in an urban environment is also proposed.