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Urban damage Analysis and Surface Deformation Monitoring for 2003 Bam Earthquake Using SAR Interferometry

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The Mw 6.6, 26 December 2003 Bam (Iran) earthquake was the deadliest earthquake in 2003. An estimated 30000 people were killed and 85% of the buildings in the area were damaged or destroyed. This Earthquake was one of the first earthquakes for which Envisat advanced synthetic aperture radar (ASAR) data were available.
In this paper we used DInSAR technique for mapping surface deformation at an unprecedented spatial resolution and demonstrated that interferometric observations of the Bam earthquake can not only map surface displacements and constrain fault models, but can also be used for damage mapping using the coherence and correlation magnitude.
Our aim is to monitor the deformation due to earthquake and analyse the capability of SAR remote sensing techniques for damage detection in urban areas.
In the first step we performed DInSAR process onto SAR images to retrieve displacement fringes. in this regards, we used three-pass interferometry approach , which in it 3 radar images of the same area was combined to form two interferograms and then the interferometric phase field due to topography is removed from the observed phase.
In the second step we calculated pre and post- seismic coherence and correlation values from the related phase and amplitude data, respectively. We define a number of indexes based on the pre and co seismic coherence and correlation changes to map damage level. These indexes were calculated as relation between the pre and co-seismic coherence and correlation values.
The case study of this research is on the 2003 Bam earthquake with using co-seismic and pre-seismic pairs of Envisat radar images in ascending and descending orbits. The images processed with Doris Software in Linux systems. Finally urban damage analysis was accomplished with ArcGIS software in Windows.The deformation field derived in this study has compared with other publications. We validated the damage maps using imagery acquired by ETM satellite before and after the earthquake. We found a close agreement between our damage maps and those derived from optical images after the earthquake. This suggests that coherence-based damage maps might be used for rapid damage mapping where interferometric data can be made available shortly after a damaging earthquake.