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Interferometric Mapping of Earthquake Damage

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Rapid damage assessment following natural disasters like damaging earthquakes is crucial for an efficient and effective response. However, damage maps are typically obtained using high resolution optical imagery obtained from airborne or spaceborne sensors, which can only be acquired under suitable weather conditions. In cloudy conditions damage maps based on synthetic aperture radar (SAR) may therefor be superior. Unfortunately, civilian spaceborne SAR sensors to date have not provided sufficient resolution to support meaningful damage mapping in urban areas.

Here we demonstrate how interferometric coherence can be used to quantify earthquake damage in the city of Bam, Iran following the devastating earthquake on December 26, 2003.

A coherence change index based on coherence images before and spanning the earthquake is used to classify damage in Bam. The resulting damage map is highly correlated with independent damage assessments derived from optical imagery. Comparing the results for three different coherence images that span the time of the earthquake we find that the results are relatively robust for differences in the perpendicular baseline, although effects of temporal decorrelation become apparent for longer time periods spanned.

Using existing synthetic aperture radar (SAR) satellites coherence-based damage assessments can be obtained within days after a catastrophic event, provided the necessary reference images are prepared ahead of time. Also, the higher resolution provided by the recently launched TerraSAR-X satellite will enable interferometric damage maps at substantially higher detail than what was feasible previously.