



## **Mapping Damage Buildings Using VHR Optical Data: the 2003 Bam Earthquake Case Study**

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In this work, the December 26<sup>th</sup>, 2003, Bam (Iran) earthquake has been investigated. The epicentre of the seism was nearby the ancient urban area of Bam and caused strong damage. Pre- and post-earthquake Quickbird panchromatic images, with 60 cm geometric resolution, have been used to show the capability of this data to map damage at building scale by means of segmentation approach. QuickBird captured a clear images of Bam on January 3, 2004, eight days after the event and on September 30, 2003, about three months before.

The use of QuickBird panchromatic images lead to detect very small details while on the other hand buildings become rather complex structures. Furthermore they may be surrounded by scattering objects making less evident the contrast between the roofs and the ground thus increasing the difficulties in the segmentation process. False alarm signals affecting the change detection process can be caused by the shadows and their variations due to seasonal sun illumination of the scenes. This implies that a single band is not enough to classify such complex environment, therefore the extraction of other information such as the shape of objects within a panchromatic image can be very useful. Morphological profiles from the original panchromatic images acquired before and after the earthquake have been carried out in order to classify buildings within the urban area to the aim of reducing false alarms caused by shadow or other

temporary objects like cars or recovery tents. For this purpose, the open and close morphological operators have been applied and the derived profiles have been used as input to a classifier in order to extract the entire map of building before and after the earthquake. Comparing the pixel belonging to each building before and after the earthquake a damage level at single building scale (ratio between the number of pixels after and before forming the single object) has been extracted.

A validation process has been performed by comparing the map of damage levels at single building scale with a detailed ground-based damage map provided by in situ survey.