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A Hybrid Change Detection Approach for Damage Detection and Recovery Monitoring

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Following a disaster, change detection via pre- and post-event very high resolution remote sensing images is an essential technique for damage assessment and recovery monitoring over large areas in complex urban environments. Most assessments to date focus on detection, destruction and recovery of man-made objects that facilitate shelter and accessibility, such as buildings, roads, bridges, etc., as indicators for assessment and better decision making. Moreover, many current change-detection mechanisms do not use all the data and knowledge which are often available for the pre-disaster state. Recognizing the continuous rather than dichotomous character of the data-rich/data-poor distinction permits the incorporation of ancillary data and existing knowledge into the processing flow. Such incorporation could improve the reliability of the results and thereby enhance the usability of robust methods for disaster management.

This study proposes an application-specific and robust change detection method from multi-temporal very high resolution multi-spectral satellite images. This hybrid indicator-specific method uses readily available pre-disaster GIS data and integrates existing knowledge into the processing flow to optimize the change detection while offering the possibility to target specific types of changes to man-made objects. The indicator-specific information of the GIS objects is used as a series of masks to treat the GIS objects with similar characteristics similarly for better accuracy. The proposed approach is based on a fusion of a multi-index change detection method based on gradient, texture and edge similarity filters. The change detection index is flexible for disaster cases in which the pre-disaster and post-disaster images are not of the same resolution. The proposed automated method is evaluated with QuickBird and Ikonos datasets for abrupt changes soon after disaster. The method could also be extended in a semi-automated way for monitoring progressive changes months following earth quakes and landslides.