BUILDING EXTRACTION FOR TSUNAMI EARLY DAMAGE ESTIMATION

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Commission VIII, WG VIII/1

KEY WORDS: Feature extraction, High-resolution satellite image, Tsunami, Object-based analysis, Damage estimation.

EXTENDED ABSTRACT:

Advanced remote sensing technologies have expanded the employment of satellite images in various other disciplines. Especially, less-than-one-meter spatial resolution satellite images such as QuickBird and IKONOS have been favourably used in disaster management. High-resolution satellite images can provide synoptic and detailed information for both modelling and damage detection. In the case of tsunami disaster, the integration between numerical modelling and remote sensing technologies would enable the damage estimation at an early stage after a tsunami attack.

This research developed an automated extraction tool to delineate the building footprints from high-resolution satellite images. Based on a scale-space analysis, the algorithm combines morphological, shape, size and texture information in the process. The extracted objects will contribute as the resistance (roughness factor) in numerical modelling. Particularly, the size and distribution density of building structures are of the requirement. The developed tool is deployed in processing an IKONOS image acquired on 24 June, 2002 over Ban Nam Ken village, Khao Lak. The 2004 Indian Ocean tsunami had devastating consequences on the fisher communities of Ban Nam Ken. The communities have not been fully recovered today. The extracted building structures will present as the status before the 2004 tsunami attack and be inserted in tsunami numerical modelling for early damage estimation.

Manually detected building footprints are used as reference data for accuracy assessment. The manual time-consuming work confirmed the extremely difficult situation in interpretation of small, dense houses in this study areas using IKONOS image. Visually, most of houses were successfully extracted with quite small omission and commission errors. The automated detection achieved over 70% for both correctness and completeness measurement. Nice shape of buildings, i.e. straight edges, is not strictly required in further tsunami numerical modelling. In terms of density distribution, similar results can be found from reference and automated extraction data. Quantitatively, their difference value distributes in a tall and narrow curve inferring an acceptable standard deviation value.

Since response time is critical at the early stage after a catastrophe, the implementation of building extraction tool here should be optimized for speed. At the current stage of development, the algorithm is implemented to run on a multi-core PC as dual-core or even quad-core PC is easily affordable nowadays. The implementation on IDL (Interactive Data Language) is taking advantage of multi-thread capability. The test were performed on a dual-core 2.13 GHz CPU with 3GB RAM. Time processing of this module depends on many factors such as image quality, complexity of the scenes, etc. Totally, building extraction took approximately less than 1 hour for a test image of 450x500 pixels^2. It seems to be acceptable for early damage estimation. However, there are lots of room for improvement of coding to achieve better computation time. It should be further improved in code implementation for parallel processing. On one hand, it is recommended to deploy the developed tool for various data sets to improve the current codes. On another hand, it would be much improved if the developed algorithms can be implemented using Grid Message Passing Interface (GridMPI) on grid-computing platform.

ACKNOWLEDGEMENT

This research is a part of an internationally collaborative research project supported by Industrial Technology Research Grant Program from New Energy and Industrial Technology Development Organization (NEDO), Japan.