Geophysical Research Abstracts
Vol. 20, EGU2018-13051-1, 2018
EGU General Assembly 2018

Development and application of HI-Flood software for flood plain mapping using high resolution optical and ESA Sentinel-1 Synthetic Aperture Radar (SAR) imagery

Dongkyun Kim (1), Waqas Ahmad (2), and Minkwan Oh (2)

(1) Hongik University, Department of Civil Engineering, Seoul, Republic Of Korea (kim.dongkyun@hongik.ac.kr), (2) Hongik University, Department of Civil Engineering, Seoul, Republic Of Korea

Terrestrial flooding due to excessive seasonal rainfall and hurricanes is a frequently occurring natural hazard. Timely and accurate flood mapping is extremely necessary for early damage assessment and economically efficient relief operations. The availability of new geomatics data sets with highest ever temporal resolution has a great potential to efficiently map the flood plains across the world in near real time. The operation of optical satellite sensors in near infra-red band is the most accurate and widely used tool in identifying flooded areas. However, the presence of floating debris and most importantly partial or complete cloud cover during the flooding event usually obscure the field of view of optical sensor hence limiting its applicability to the full spatial scale of the image or at that time. The Synthetic Aperture Radar (SAR) which has the capability of day and night and all weather monitoring can overcome this limitation. This research demonstrates the applicability of a purpose built flood analysis tool called the HI-Flood satellite data analysis system for detection of flooded area. The software can accept optical and SAR images from a wide range of satellites and integrate them to generate highly accurate flood map. For this purpose we selected the Planet mission and the ESA Sentinel-1 for the optical and SAR imageries, respectively. The analysis consists of three stages: (i) optical image that is partially obscured by clouds during the flood event is classified using cluster analysis technique and the most appropriate classes representing water are combined to generate a preliminary flood plain map of the cloud free areas only; (ii) the SAR image of during the flood event is analyzed in comparison with the preliminary map and a threshold SAR reflection value is selected such that the pixel values below the threshold SAR reflection corresponds to water or flooded area and vice versa; the thresholding technique helps in identifying large water inundations during the flooding; (iii) the before and during the flood event images are first divided in to sub patches and each patch is further analyzed using the histogram equalization technique to enhance the contrast of the two images for clear identification of flooded pixels, then the histogram matching is employed to make the histograms of both the images exactly similar. Finally the before flood event image is subtracted from during the flood event image to generate a differential map of the flood area, the differential technique helps in identifying very fine inundation points of the flood plain. Lastly, the flood plain maps generated by thresholding and differential analysis of SAR images are merged together and a final flood inundation map is produced which also includes the areas obscured by clouds in the optical image. The recent summer flooding of 2017 in Kalutara, Sri Lanka and wide spread flooding in Houston, Texas due to hurricane Harvey provided feasible test ground to evaluate the applicability of this software. The results of these two test sites are in close comparison with the optical images.

Acknowledgement
This research was supported by a grant [MOIS-DP-2015-05] through the Disaster and Safety Management Institute funded by Ministry of the Interior and Safety of the Korean government.