

A Syncro Floodwater Index for Flood Risk Mapping using Multiple Satellite Data: A Case Study of 2015 Bangladesh Flood

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In January 2015, the Government of Japan addressed the new space policy, "Basic Plan for Space Policy," which emphasizes the development and utilization of outer space in recognition of increasing demands for safety and security including recovery from the Great East Japan Earthquake. In this context, remote sensing technology is expected to play a central role in more effective and accurate disaster risk reduction and restoration.

The purpose of this study was to provide a rapid and accurate flood mapping of temporal changes in the extent of annual flooding for a transboundary river basin. We proposed the Syncro Floodwater Index (SfWI) to detect widespread inundation extent in a transboundary river basin using the different sensors obtained by NASA's Moderate Resolution Imaging Spectrometer (MODIS MOD09A1), JAXA's new L-band SAR satellite ALOS-2 (PALSAR-2), and JMA's Multi-functional Transport Satellite series (HIMAWARI-8). After removing clouds using the White-object Index (WOI), the SfWI coupled with land surface temperature (LST: MOD11A1) data and in-situ water level data was applied to the 2015 Bangladesh flood for near-real-time nationwide rapid flood monitoring.

The preliminary results showed that the estimated maximum inundation area from MODIS-derived SfWI was smaller than the area from the solo use of modified land surface water index (MLSWI) that was 32% (29,900 km²) of the total area of Bangladesh. We also addressed that the new hybrid approach based on SfWI has showed the possibility of a major contributor in international flood monitoring by means of the integration of multiple satellite data, despite different time and spatial resolutions. The SfWI was particularly designed to enhance advantages of SAR data to overcome disadvantages of the multiple optical satellite images by the hybrid image fusion for integration of SAR and optical satellite.

With recent advances in satellite data, this scheme for a rapid flood mapping will help provide stakeholders with important information to support not only the development of a national policy but also the implementation of international cooperation for disaster risk management. At the same time, these results are important to evaluate for validation of hydrological model simulation output such as flood inundation area in the national-level flood risk.

Keywords: flood mapping, Syncro-floodwater index, MODIS, ALOS-2, Himawari-8