RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security

CGIAR CCAFS

Mapping the spatial and temporal extent of floods in South Asia

Photo credit: UN Photo

Floods affect many regions around the world year after year- leaving a trail of death and destruction. Over half a billion people every year worldwide are affected by floods and it is expected that by 2050 nearly two billion people globally will be threatened by floods. A high proportion of these people live in Asia. In recent years, most South Asian countries including Bangladesh, India, Nepal, Pakistan, and Sri Lanka have experienced the devastation of massive floods. The recent report from the Intergovernmental Panel on Climate Change (IPCC) and other studies suggest an increase in monsoon related flood events in South Asia due to climate change.

Considering their large impact on human lives, it is important to understand the spatial and temporal distribution, frequency and intensity of floods. In order to evaluate and improve flood prediction models and to develop adaptation strategies, it is vital to develop comprehensive, standardised and detailed flood information about historic flood events including their frequency, intensity, severity and societal impacts. Advances in satellite remote sensing technology have made it feasible to monitor global flooding and its impacts even in remote areas and developing regions.

A research project by CCAFS and the International Water Management Institute (IWMI) focuses on a moderate-resolution mapping of monsoon flood risk areas in South Asia using satellite remote-sensing datasets. In the past, many studies were carried out in South Asia to investigate the hydrologic behaviour of the floods and post-flood event mapping using remote-sensing data. However, large-scale systematic monitoring of floods both spatially and temporally covering the whole of South Asia has been very limited.

Objectives

- To create a methodology that can be used to detect spatio-temporal changes in the extent of flood inundation.
- To develop an inundation algorithm to quantify the extent of the temporal South Asian floods.
- To map monsoon flood affected areas at a fine resolution in South Asia for the period 2000 to 2011.

Partners

International Water Management Institute (IWMI)

Approach

- The MODIS 8-day composite time-series data of Land Surface Water Index (LSWI), Enhanced Vegetation Index (EVI), Normalized Difference Vegetation Index (NDVI) and Normalized Difference Snow Index (NDSI) were obtained.
- An algorithm for flood inundation mapping to understand seasonal and annual changes in the flood extent and in the context of emergency response was determined for the study.
- The proposed algorithm was applied for MODIS data to produce time-series inundation maps for the ten annual flood season between 2000 to 2011. The flood product has three classes as flood, mixed and long-term water bodies.
- The MODIS flood products were validated via comparison with ALOS AVINIR / PALSAR and Landsat TM using the flood fraction comparison method.
- The spatial characteristics of the estimated early, peak and late and duration of inundation cycle were also determined between 2000 to 2011.

Initial Results

- A methodology was developed in order to detect spatial extents and temporal changes of flood inundation of South Asia from the time-series MODIS data.
- The inundation products are in good agreement with the water-surface area derived from ALOS AVINIR/PALSAR and Landsat images at a 10-km grid level in terms of temporal changes and spatial distribution.
- A database of fine-resolution flood inundated areas in South Asia at 500-m spatial resolution has been developed for the period 2000 to 2011.
- The inundation products derived from MODIS 500m imagery gives the ability to study flood dynamics.

ABOUT CCAFS

The CGIAR Research programme on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT).

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