

Kerala Floods 2017: A Mapthon Study

Abstract:

With regard to the theme selected in Mapthon 2020 to produce a flood map for the chosen study area, a flood map for the proposed study area of Kottayam is prepared and water bodies and flooded areas are extracted using NDWI method. The area of the total waterbodies extracted is noted as 35.08 Sq. Km

Introduction:

Kerala floods are one of the disastrous flood event in the history of India. With that goal, the study area is chosen in the State of Kerala, to produce flood inundation map. Kumarakom is a village situated on back waters of Kerala, of Vembanad lake in the district of Kottayam. It is having elevation range of 1-2 m from the MSL which makes it more prone to flooding during monsoon season. This study showed the inundated area in the village in the month of December, 2017 where there is minute flooding because of heavy rain fall.

Description data used and Study area:

The data chosen for this study is from ISROs Resourcesat2, LISS-III sensor which acquire data in four spectral bands of Green, Red, NIR and SWIR. The resolution of the sensor is 23.5m in visible, NIR bands and 70.5m in SWIR band. The data is downloaded from Bhuvan open data archive (<https://bhuvan-app3.nrsc.gov.in/data/download/index.php>) which covers two districts of Alappuzha and Kottayam in the state of Kerala. The selected data tile from Bhuvan is shown in Figure1. And the data specifications are tabulated in Table1.

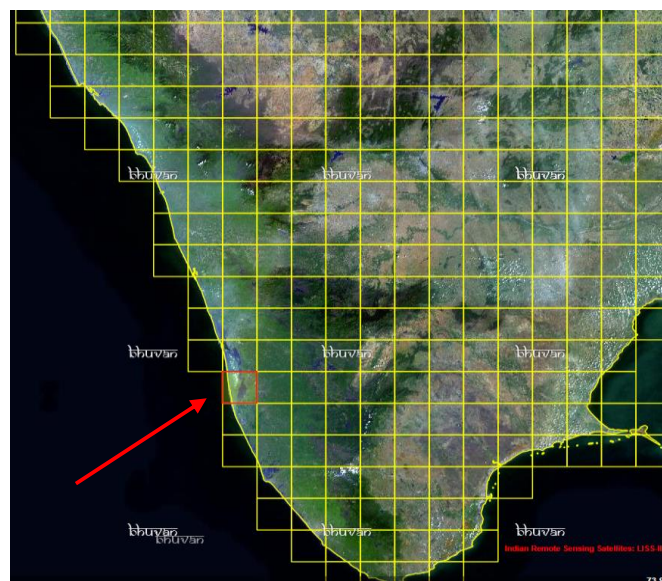


Figure 1. Selected tile for the study

Satellite/Sensor	Resoursesat-2 ,LISS-III	
Spectral bands Used	Green	0.52-0.59 μm
	NIR	0.77-086 μm
Date of Acquisition	30 th April, 2017	Pre monsoon
	19 th Dec, 2017	Post monsoon

Table1. Data Specifications

Methodology:

For the study, two data sets are chosen, one in pre monsoon season and other in post monsoon, in the months of April and December respectively. In the first step, all bands in each of two data sets are stacked to visually see the water changes on the land surface. To delineate the flooded regions, post flood data is subtracted from pre monsoon season to even out the permanent water bodies. Normalized Difference Water Index (NDWI) is calculated from equation 1. to extract the water bodies. Then a threshold is applied to extract flooded regions and to produce a binary map. The number of flooded pixels are calculated from the histogram and multiplied with the spatial resolution of the bands (23.5m) to give the flooded area.

$$NDWI = \frac{X_{green} - X_{nir}}{X_{green} + X_{nir}} \quad \dots\dots\dots (1)$$

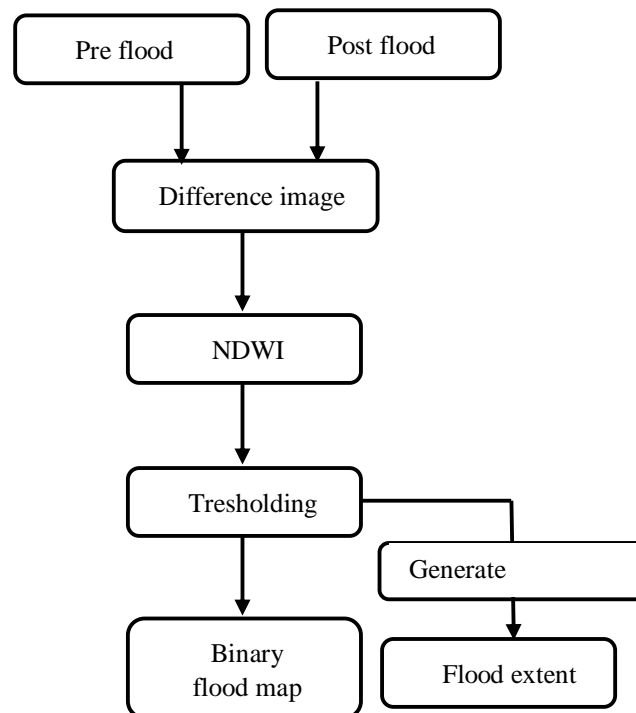


Figure 2. Methodology

Results and Discussion:

The village level boundaries for the state of Kerala, are downloaded and all bands in the LISS-III dataset are clipped for the chosen study area. The elevation values of the area are taken from google maps and found to be 1-2m which suggests the area is low lying. The total area of the village is found out to be 54.77 Sq.Km. The flooded areas are visually interpreted and the stacked images are shown in Figure 3. The inundated area is calculated as explained in methodology and the extent of the total water bodies is found to be 35.085 Sq.km. The threshold value chosen for the delineation is 0.1 and all the values above 0.1 are classified as flood water. The 3D view of the area is shown in the Figure 4. However, this study finds out flood on both land surface including the lake extent.

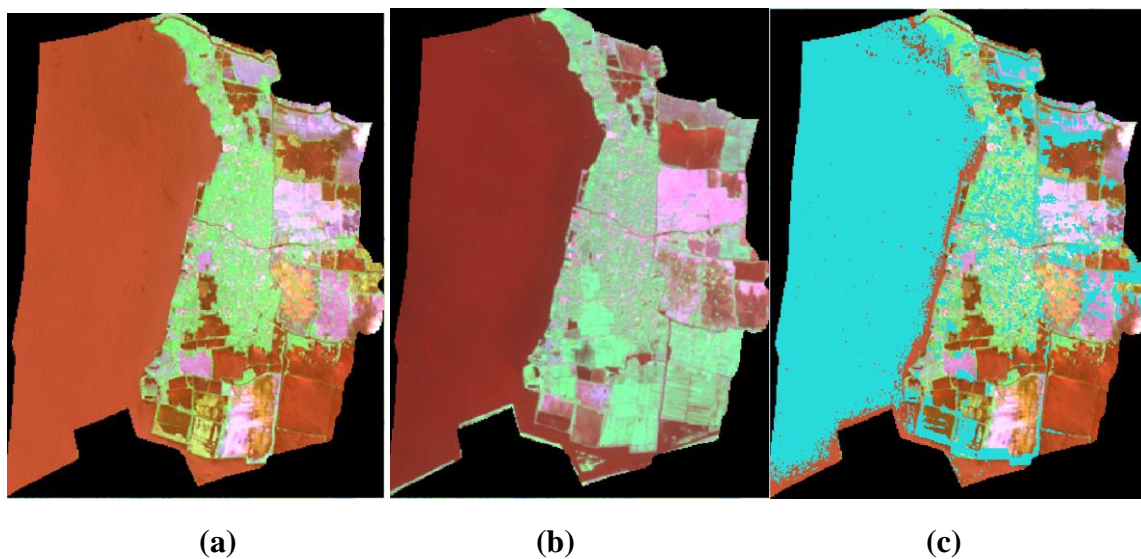


Figure 3. (a) Stacked image(B2,B3,B5) on 19th Dec (b) Stacked image(B2,B3,B5) on 30th April (c) Stacked image(B2,B3,B5) on 19th Dec with overlay of flood layer.

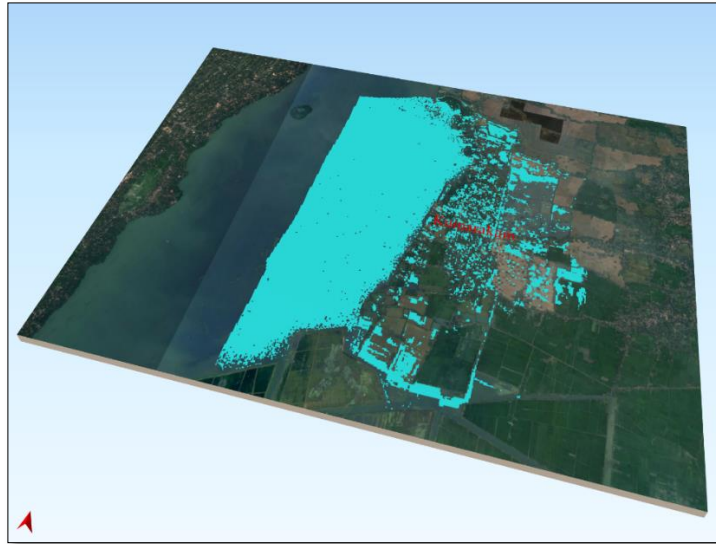


Figure 4. 3D image of flooded map showing on google earth

Map showing flooded area of kumarakkam village

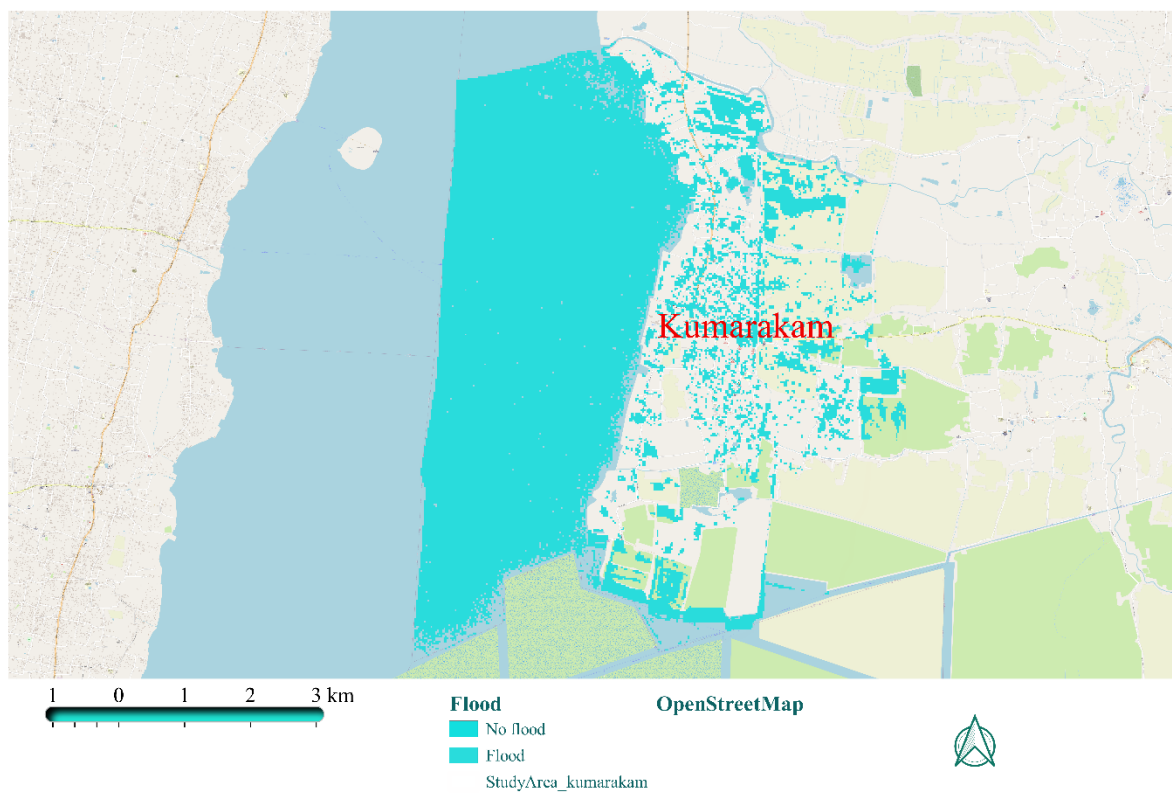


Figure 5. Flood inundation extent for Kumarakom village

Challenges faced:

With the chosen theme, few complexities are encountered by the team for the successful production of the map.

1. Unavailability of microwave data- Studies suggested the usage of microwave data for flood mapping because its day and night/all weather imaging capabilities. Due to unavailability of data, team has opted for optical data.
2. Extensive cloud coverage – Data sets have lot of clouds on selected dates which made practically impossible to work with the data.
3. Unavailability of data – Encountered few problems because of mismatch of date of occurrence of floods and date of availability.
4. Missing values- Few data sets that are downloaded have missing band information.

References:

G. Amarnath, “An algorithm for rapid flood inundation mapping from optical data using a reflectance differencing technique” *Journal of Flood Risk Management*, <https://doi.org/10.1111/jfr3.12045>

Team details:

Sl.no	Name of the member
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