

## **Aggregated Flood Inundated Area Based On Historical Satellite Observations (AFIHSO) 2003-20**

### **INTRODUCTION**

India is one of the worst flood affected countries in the globe and damage caused by floods is very high compared to any other disasters. Nearly 75 to 80 % of the total annual rainfall is concentrated over a short monsoon season of four months (June-September) in India. As a result, the rivers witness a heavy discharge during these months, leading to widespread floods. Cyclones are other major water disasters in India. The recurring floods cause loss of life, destruction and damages to existing infrastructure, including roads, bridges, embankments and agricultural land stresses the need for identification of flood prone areas in the country. Identification of flood prone areas is one of the most important non-structural measures for mitigation of floods

With limited information available during 1970, Rashtriya Barh Aayog assessed the flood prone area of India to be about 40 mha. Various Expert Groups for Flood Management have expressed strong need for adopting scientific approach for arriving at reliable flood affected area in the country.

NRSC has initiated a study to scientifically assess the flood prone area. As a first step, available historical satellite datasets acquire during the flood season from Indian Remote Sensing Satellites (IRS) and foreign satellites have been analysed for generating the aggregated extent of flood inundated area. Only those datasets corresponding to either high flood situation or unprecedented floods were used in this study.

The study aims to address the assessment of areas flooded in states which are conventionally not affected by floods on an annual basis.

The aggregate flood maps are prepared for 7 states namely - Arunachal Pradesh, Gujarat, Jammu & Kashmir\*, Karnataka, Kerala, Maharashtra and Tamil Nadu.

### **METHODOLOGY**

Generation of the Flood hazard zones was done based on the analysis of multi-temporal satellite data acquired during the floods of 2003-2020. Following are the major steps involved in preparation of flood hazard zonation maps.

- **Satellite data Planning and Acquisition:** Satellite data from Indian Remote Sensing Satellites (IRS) and other foreign satellites was acquired during the floods. The water levels observed at different gauge stations were closely monitored during floods and attempts were made to program the satellite data during peak/near peak situations. Satellite data was also programmed and procured during progression and recession of the flood wave for studying the impact of the flood.
- **Rectification:** The acquired satellite datasets were geo-rectified to Lambert Conformal Conic projection system with Modified Everest Datum for achieving positional accuracy.

- Flood inundation layer: Using image processing classification algorithms water layer was extracted from the satellite data and integrated with the pre-flood river and water bodies layer to derive flood inundation layer. Fig 1 shows the methodology for extraction of flood inundation layer from satellite data.
- Annual Flood Layer: The flood inundation layers generated for different flood waves in a calendar year were integrated to generate the maximum flood inundation extent observed in that year.
- Aggregated Flood Inundated Extent Layer: The flood inundation layers corresponding to various years (2003-2020) were integrated to generate aggregated extent of flood inundated area.

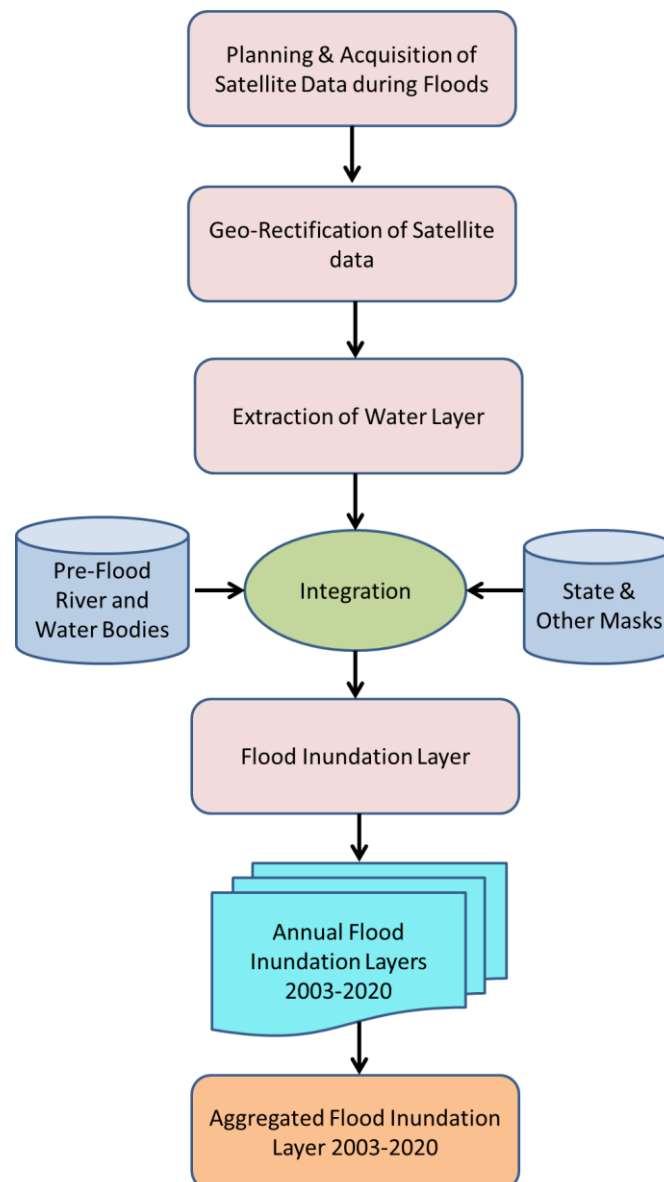


Fig1: Methodology for creation of aggregate flood Inundation layer

## DATASETS

Multi-mission, Multi-sensor and Multi-temporal satellite datasets comprising of IRS Resourcesat 1, IRS Resourcesat 2, IRS Resourcesat 2A, IRS RISAT, Radarsat 1-2, Sentinel 1-2 and MODIS spanning a 18-year period acquired during 2003-2020 are used to map floods .

## SUGGESTED USE

The Aggregated Flood Inundated Extent Layer should be used at broad level for the following purposes:

- Regulate land use in the flood plain areas.
- Sustainable Development.
- Preparation of District Disaster Management plan.

## DISCLAIMER

- The satellite datasets acquired during the calendar years of 2003-2020 are available with DSC, NRSC.
- Most of the flood inundation layers were derived from microwave data. Since optical data was found to be cloudy during flood season. However, partially cloud-free datasets were considered for analysis.
- The satellite coverage may not correspond to the peak flooding in all cases
- Observed flood inundation includes flooding due to embankment breaches and also due to rainwater accumulation in low lying areas
- Due to rapidity of flash floods the same may not have been captured by the satellites.

## USER RESTRICTION

- I. Database could be used up to 1:250,000 scale.
- II. User of this data/information will consult NRSC to commercially exploit/ use the intellectual property generated in the Projects.

## CONTRIBUTORS

S.NO	NRSC-PROJECT MANAGEMENT	PERSONNEL
1	DSC-Project Team	K.H.V. Durga Rao, SVSP Sharma, Asiya Begum, Abhinav Shukla, Aakash Mohan, Aravind RS & Shaikh Rafik Ramjan.

## CONTACT INFORMATION

Group Head, Disaster Management Support Group  
 National Remote Sensing Centre,  
 ISRO, Department of Space, Balanagar, Hyderabad-500 037  
 Telephone: +91 40 2388 4541  
Email: [flood@nrsc.gov.in](mailto:flood@nrsc.gov.in)

**CITATION**

*NRSC (2021), "Aggregated Flood Inundated area based on Historical Satellite Observations (AFIHSO)2003-20", DSC-Flood Project, Disaster Management Support Programme, RSAA, National Remote Sensing Centre, ISRO, Hyderabad, India*

**ACKNOWLEDGEMENT**

Use of data in any form is to be duly acknowledged as shown below:

*I/We have used the flood hazard zonation information for my/our research work from DSC-Flood Project, Disaster Management Support Programme, RSAA, National Remote Sensing Centre, ISRO, Hyderabad, India*

**REFERENCES**

Jain S.K., Singh R.D., Jain M.K. and Lohani A.K. (2005) Delineation of Flood Prone Areas Using Remote Sensing Techniques. *Journal of Water Resource Management*, 19, (4), 333-347. DOI: 10.1007/s11269-005-3281-5 1.

Manual on Flood Inundation Mapping - Service under Disaster Management Support Programme, Manual (July 2007) NRSC.

Annual Flood Reports of DMSG