

# Global Data and Tools for Flood and Drought Risk Assessment in Asia and Africa

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# Where we are based:

:: LOCATIONS OF IWMI OFFICES



**IWMI is one of the Regional Support office for UNSPIDER/UNOOSA**

# Current Challenges

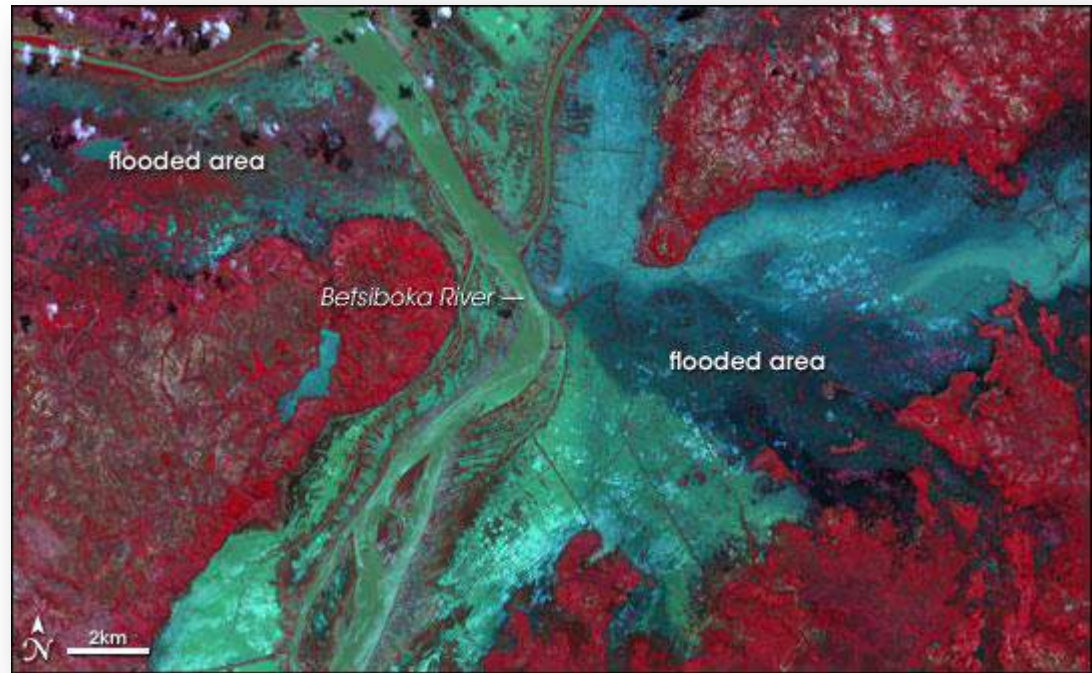
- **Changes in land cover** affect the global climate by absorbing and reflecting solar radiation, and by altering fluxes of heat, water vapour, carbon dioxide and other trace gases.
- Detailed assessments — regional, global, daily and seasonal — of floods, drought, LULC are needed to monitor the **impacts on agricultural losses, population exposure**, biodiversity loss and ecosystem dynamics and to aid in **enhancing disaster resilience, better preparedness and planning**, reducing emissions from deforestation and forest degradation.





# Outlook

- **Satellite imagery** is the best source of such data, especially over large areas. Observations need to be extensive, regular and consistent to establish baselines and trends.
- But today, most satellite observations have **limited coverage and compatibility**, because they are controlled by the diverse objectives of national space programmes. In many cases, satellite data are restricted or charged for.



Since late 2008, when Landsat earth observation images were made available to all users free of charge, nearly 40 million Landsat scenes have been downloaded through the U.S. Geological Survey portal – and the rate of downloads is still increasing.

## That's a lot of free data about the state of the planet. But what is it worth? How valuable can something free possibly be?

- The worth of many things is related to scarcity. If there are too many houses or diamonds, loads of food grain or barrels of oil for sale, the price for these items falls. A free market determines the market value of what we might hope is a \$500,000 house or a \$5,000 diamond.
- The concept of market value breaks down for goods and services that society has determined should be freely available to everyone.
- Free data for earth observation fits into this category. It is a public good -- along with public education, public roads, and public parks. While these services are not actually free (they are, of course, funded with public money), we know that the broad use of such services benefits all of society so the cost to each individual user is largely borne by all.

## Value of earth observation overall to the Global economy

- In the United States, the federal government invests about [\\$3.5 billion](#) annually in civil earth observations and data (including Landsat and other satellites, weather, GPS, etc.) across multiple agencies, while optimizing related investments that are also made by state, local and tribal governments, academia, and industry.
- Federal investments in various aspects of earth observation are conservatively estimated to add [\\$30 billion](#) to the U.S. economy each year by providing Americans with critical knowledge about natural resources, climate and weather, disaster events, land-use change, ecosystem health, ocean trends, and many other earth-related phenomena.



**Global market to Landsat data estimated over \$3 trillion**

## Other nations recognize the benefits of free and open data

More than 40 countries and geopolitical groups now have earth observing satellites, reflecting a wide range of national priorities around the world for environmental monitoring and economic growth.

Some major global initiatives in the recent times:

- Group of Earth Observation
- USGS Landsat Initiative (Landsat legacy and Landsat 8)
- ESA Copernicus (e.g. Sentinel 1, 2 +++)
- International Disaster Charter and Sentinel Asia
- CEOS

# Some Examples from IWMI's Mapping Products



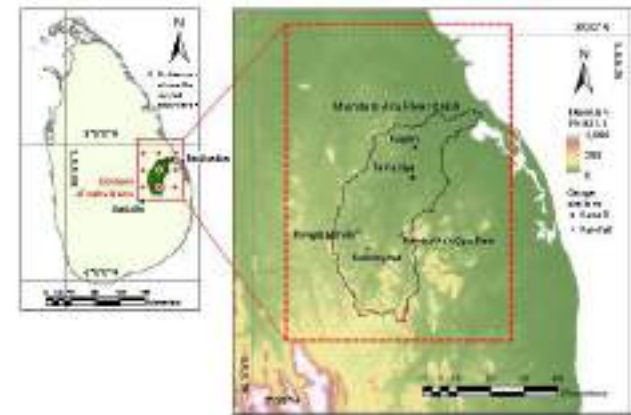
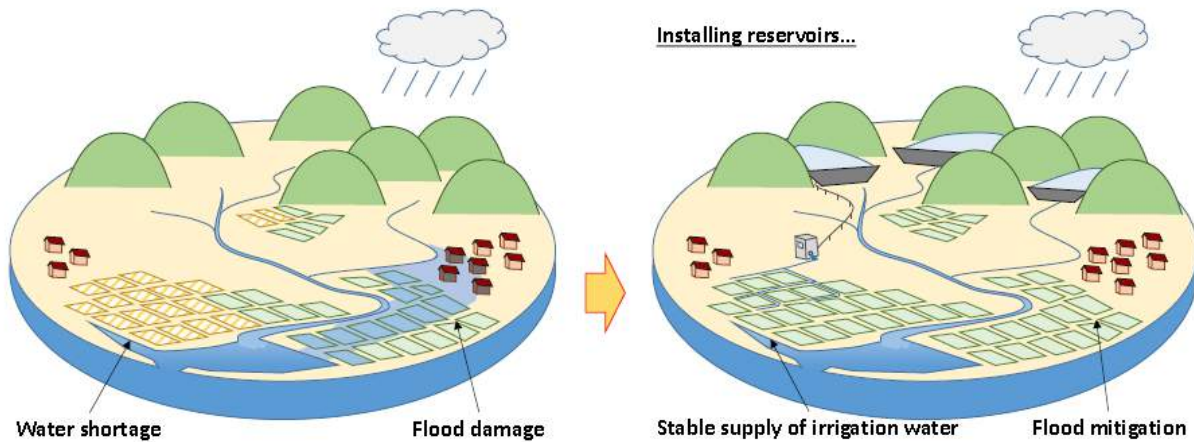
# REGIONAL FLOOD RISK MAPPING - SA and SEA



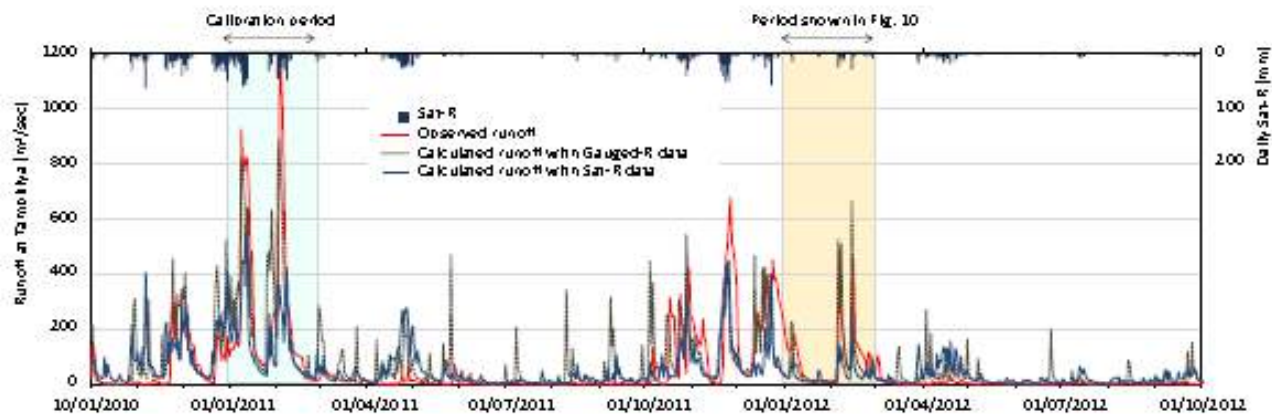
- Mapping algorithm based on MODIS data
- 8-days maps of inundation extent
- Annual maps of maximum inundation
- Inter-annual variation of regional flooding extent



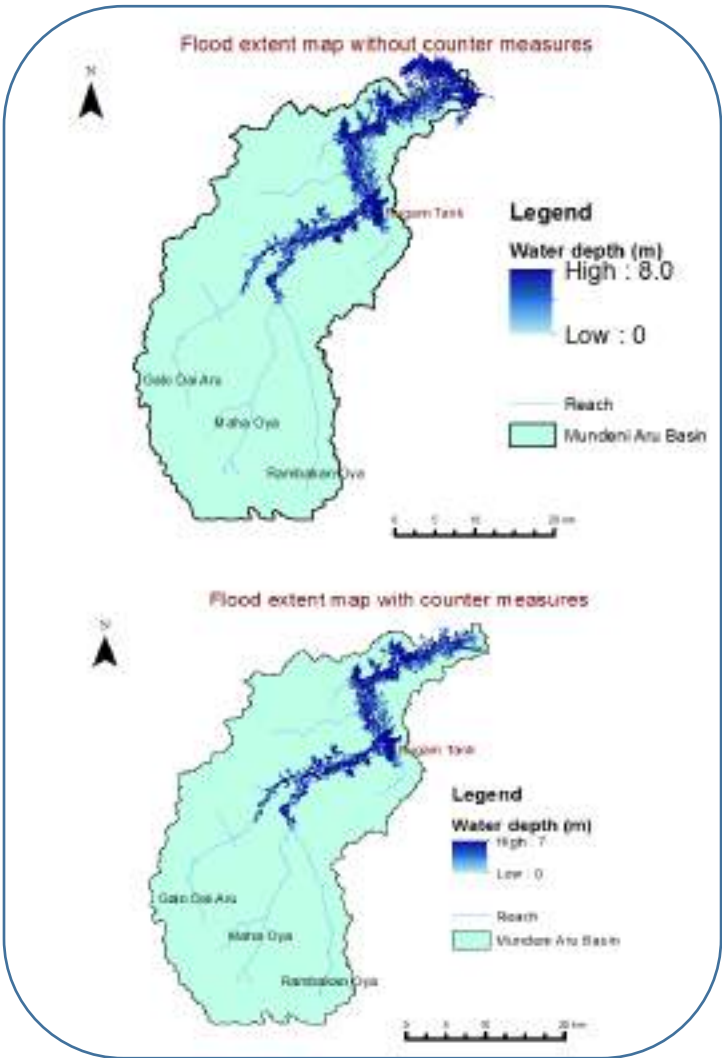
# Concept of Flood Mitigation and Irrigation Improvement



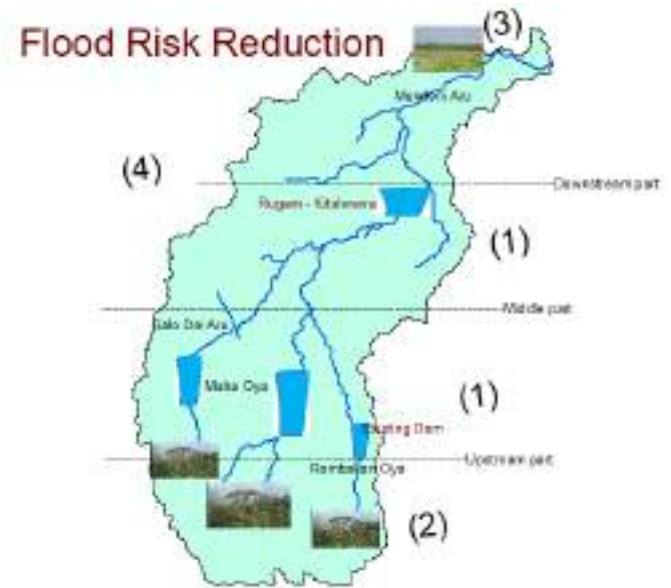
Hydrograph for observed and simulated discharge



# Flood Early Warning for Protection measures



Accepted in IAHS Red Book Series (2015)

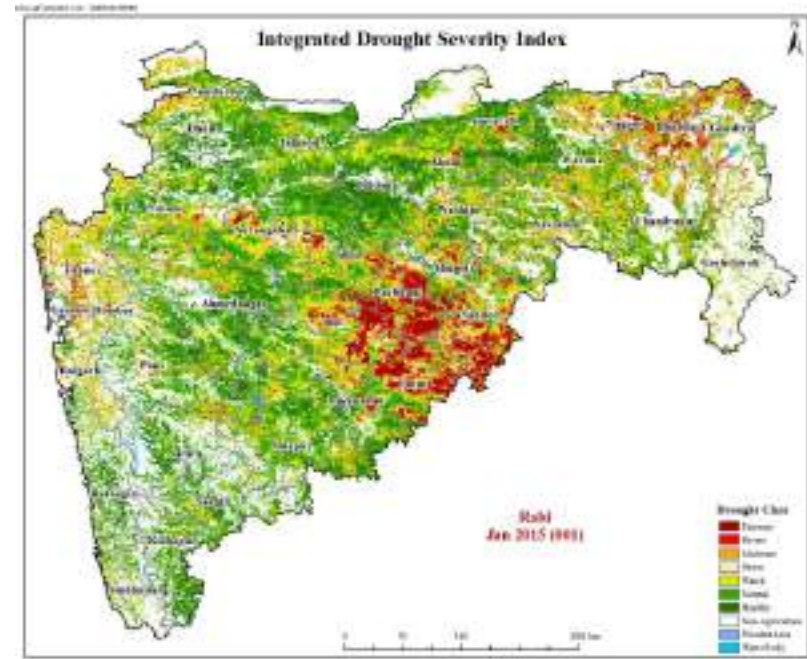
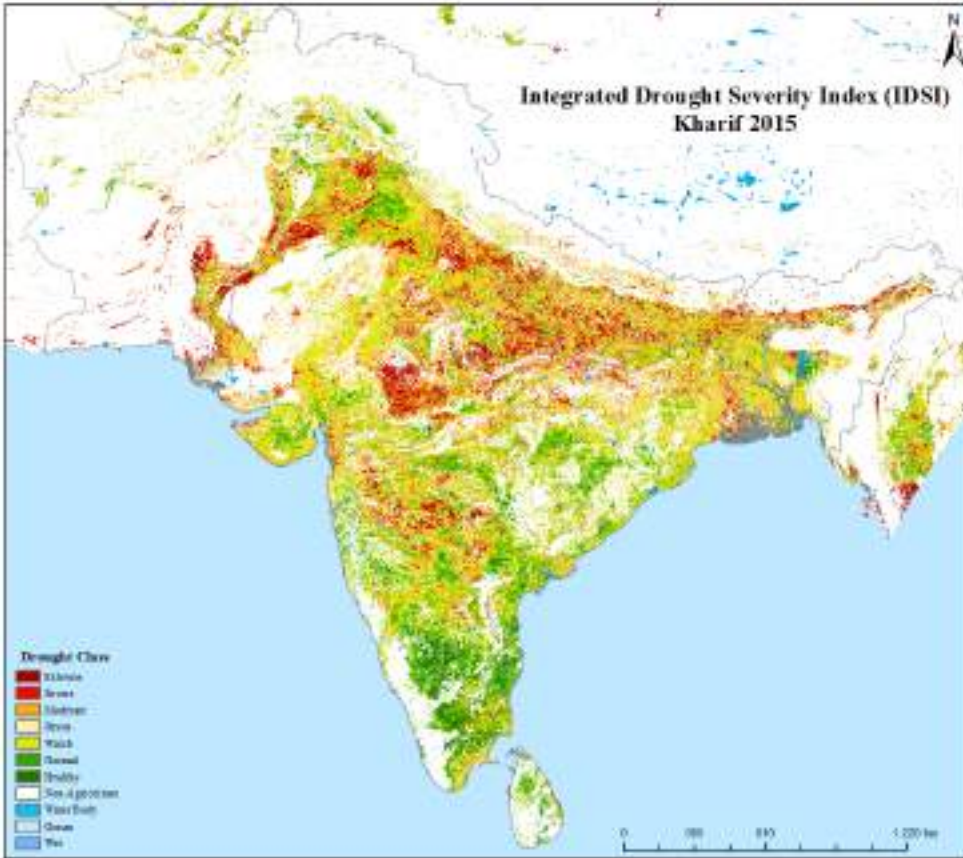


Integrated flood risk management that reduces flood risk while increasing its positive impact is needed

- Socio-economic aspects
  - Building multi-objective reservoir that reduces flood impact during wet season and used stored water for irrigation purpose during dry season
  - Proper Dam operation and application of basin scale forecasting system
- Ecosystem Management aspect
  - Re-establishing wetlands in the downstream of the basin area
  - Re-forestation in the upstream areas



# SOUTH ASIA DROUGHT MONITOR SYSTEM (SA-DMS)



- First of its kind to establish for entire South Asia using multisource remote sensing observations;
- Historical drought risk mapping and assessment covering SA countries (2000 – Current);
- IDSI allows better understanding on drought frequency, duration over the 15years;
- Products are useful tools in drought mitigation studies and in decision-making process;



2015 field observations in Jalna, Maharashtra



A water-secure world

www.iwmi.org

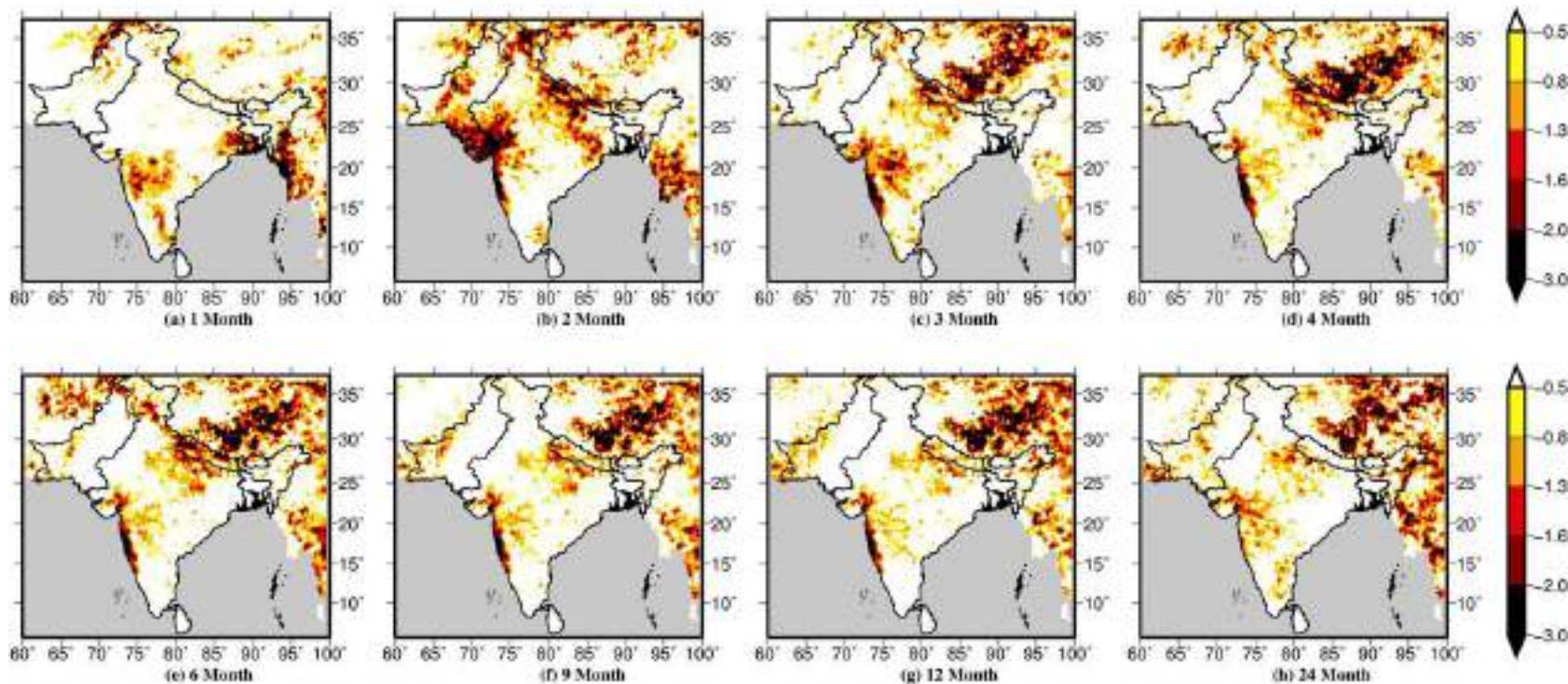


# South Asia Drought Forecast System

- To utilize real-time precipitation and air temperature data for drought monitoring in South Asia
- To evaluate the relationship between drought indices for the selected geographical regions
- Development of real-time drought monitoring and forecast system for South Asia



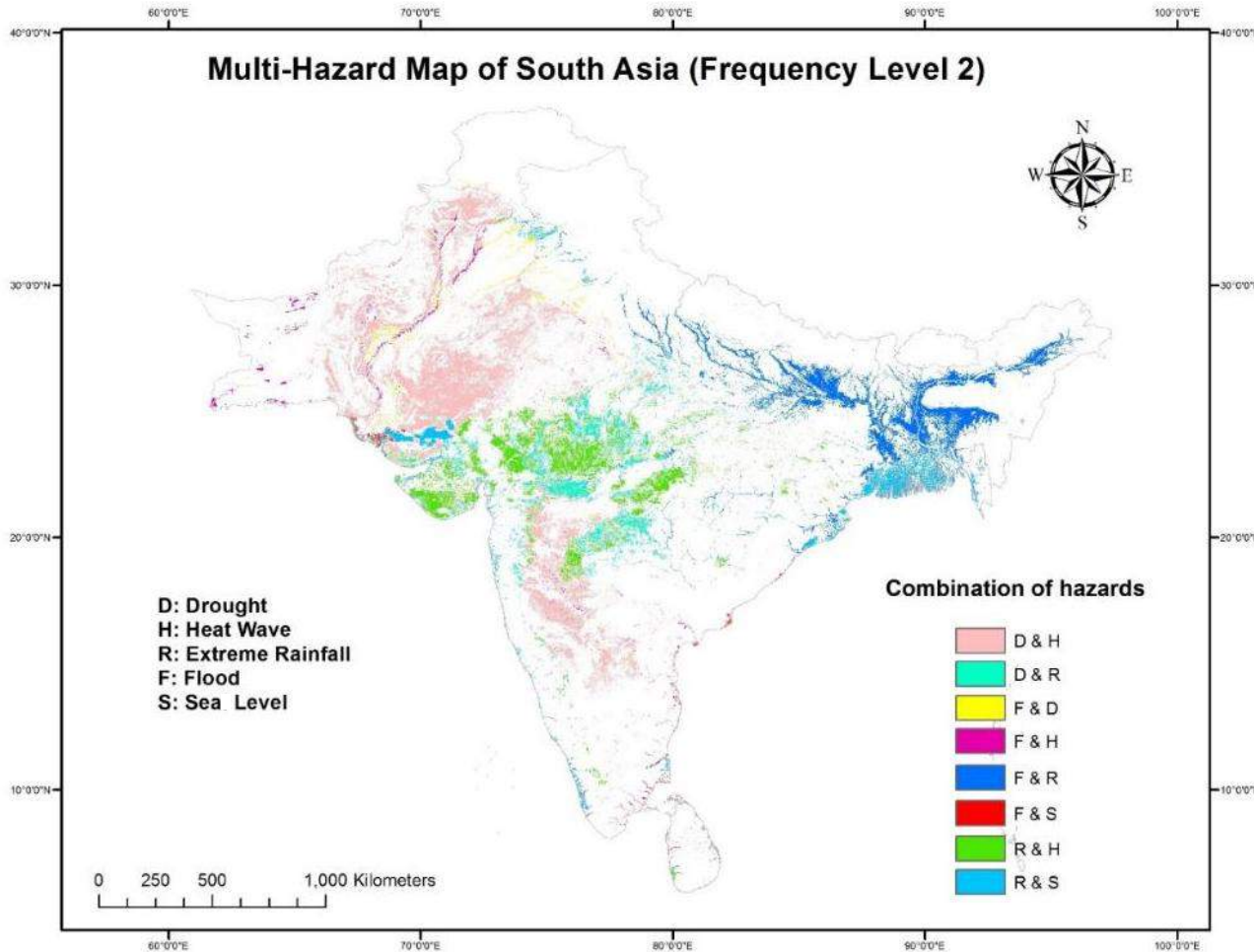
Standardized Precipitation Index



**The monitor successfully captures the meteorological drought of 2015 at the end of the monsoon (JJAS)**



# Urban planner / manager: What type and level of protection is appropriate?



Funding Donor: CCAFS



A water-secure world



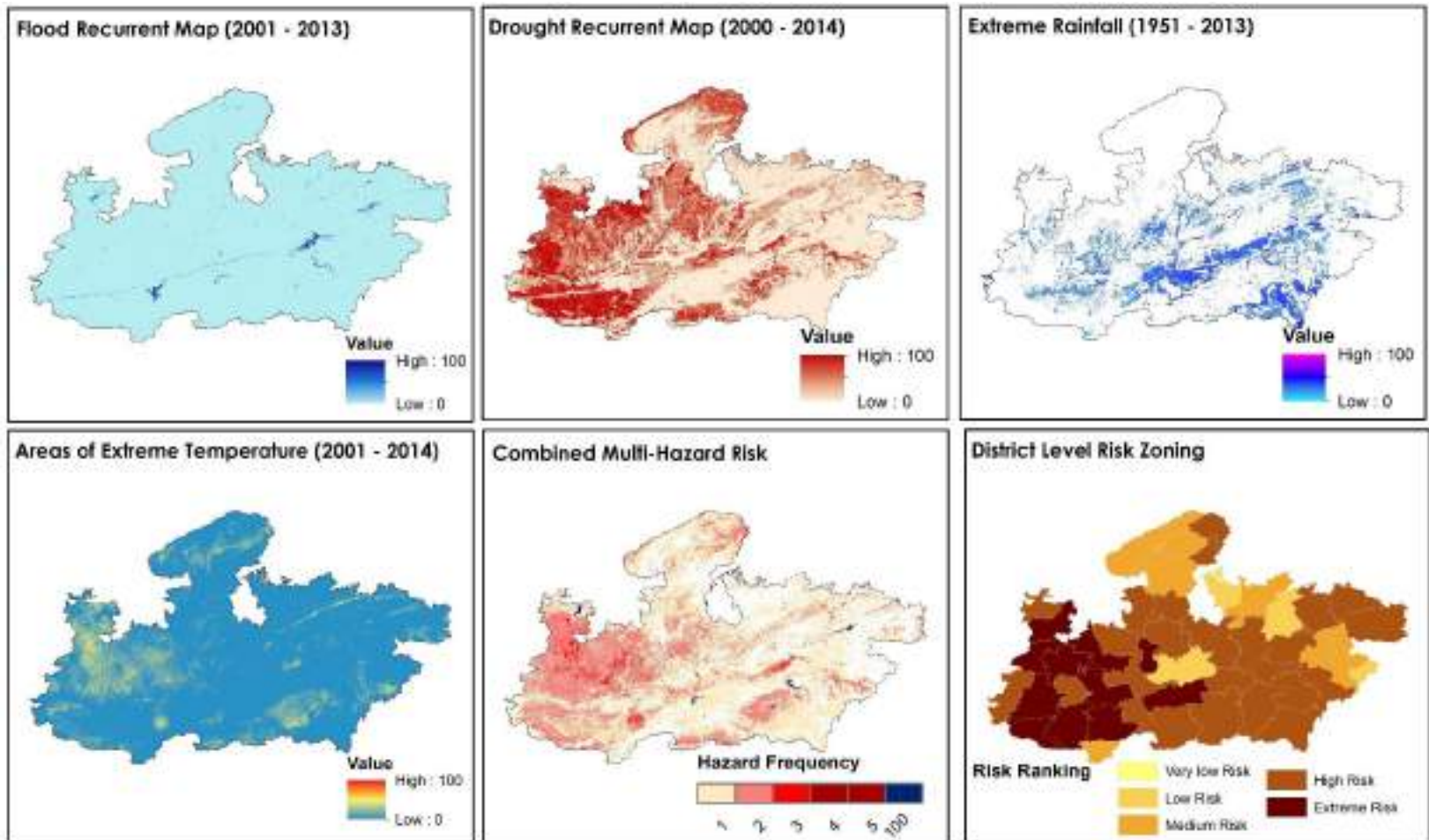
RESEARCH PROGRAM ON  
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[www.iwmi.org](http://www.iwmi.org)



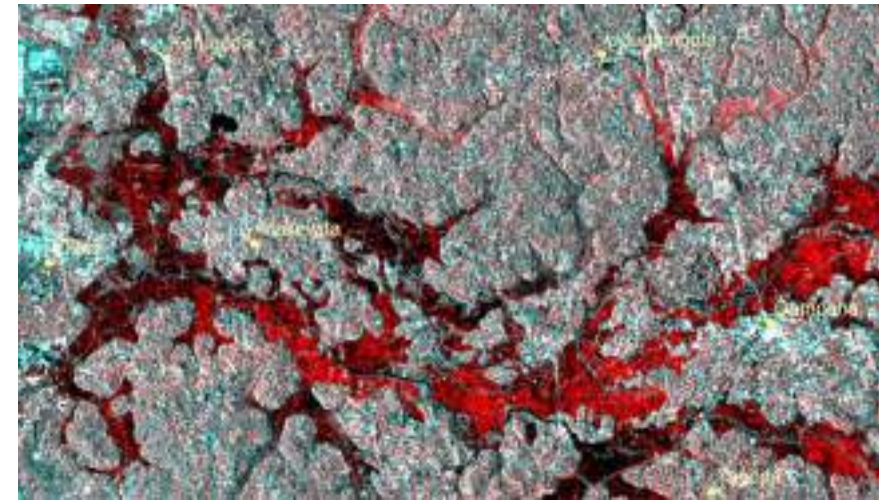
# MULTIPLE CLIMATE RISKS ASSESSMENT



High to Extreme Risk Districts:

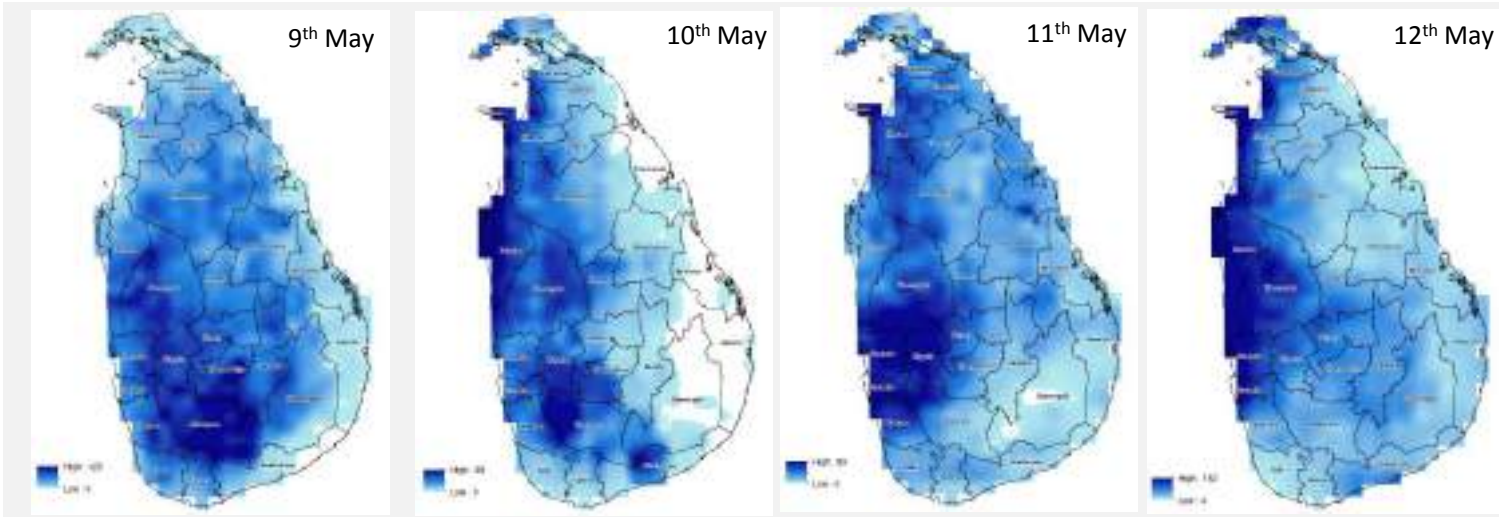
*East and West Nimar, Dhar, Barwani, Ratlam, Mandsaur, Shajapur, Bhopal, Hoshangabad*

# NEAR REAL-TIME FLOOD EMERGENCY RESPONSE MAPPING FOR SRI LANKA

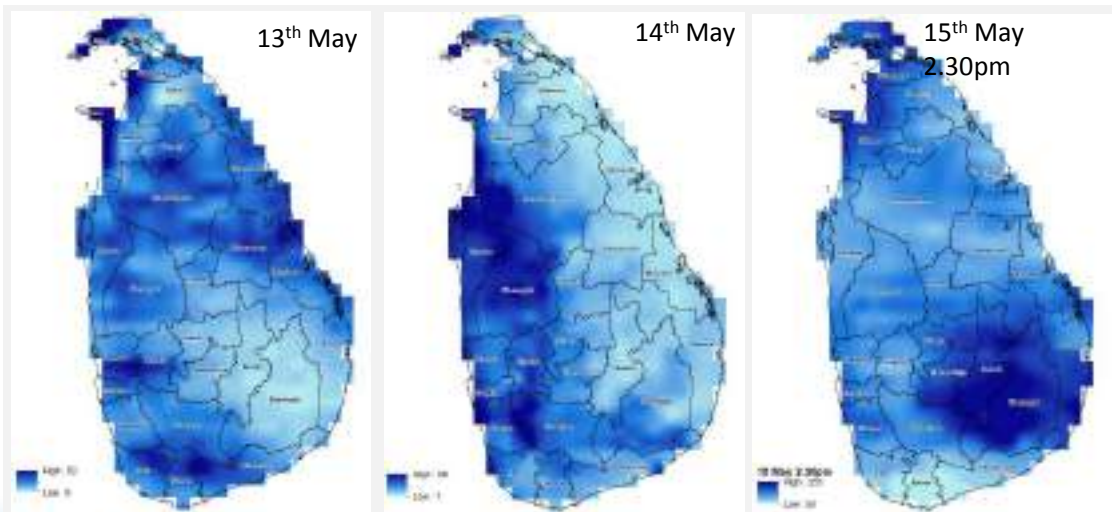




# GPM Satellite Measures Extreme Rainfall in Sri Lanka



**Accumulated Daily  
Rainfall Estimates using  
Global Precipitation  
Measurements (GPM)**



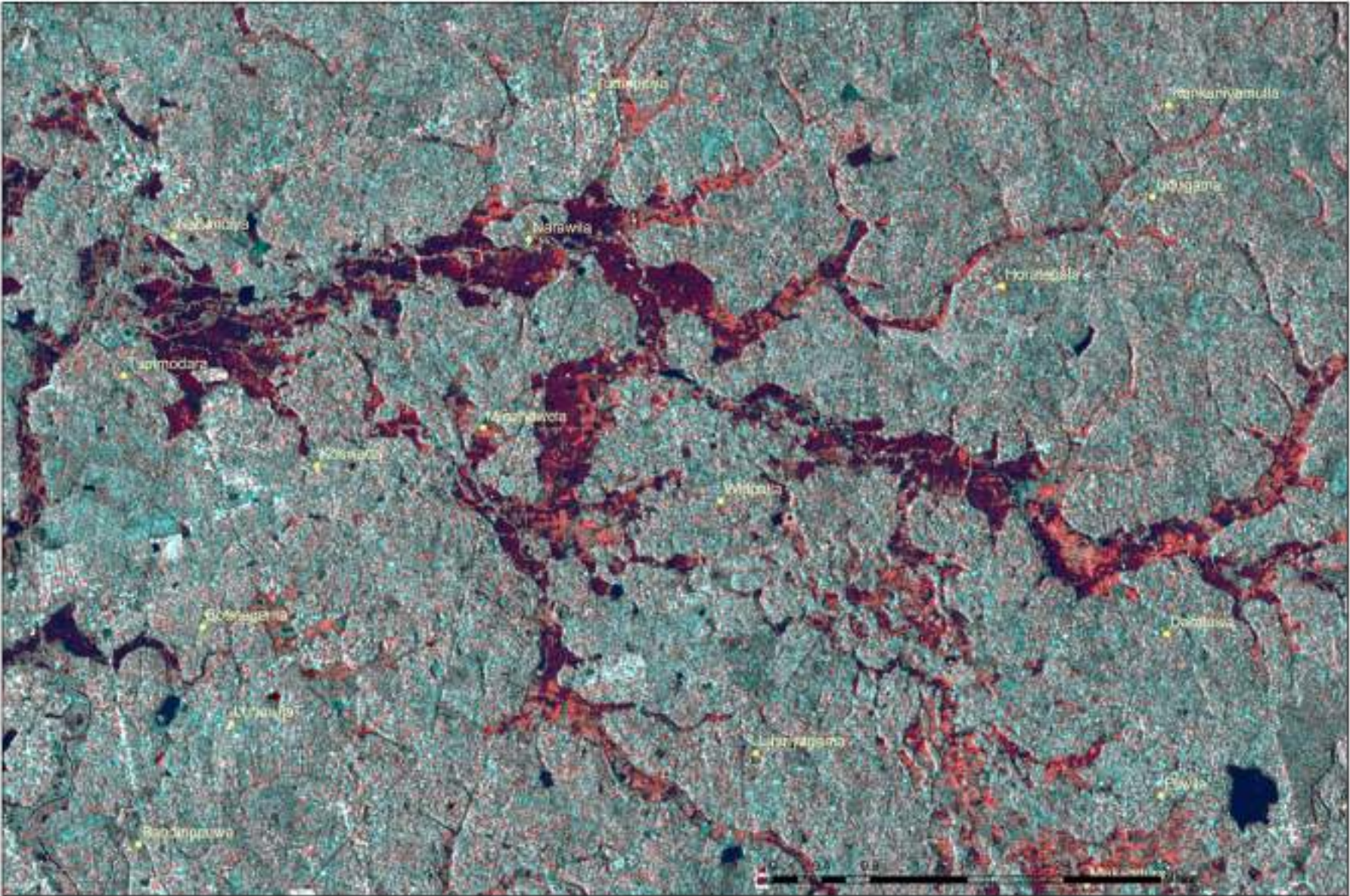
## Rainfall accumulation for the past 36 hrs.

- Districts with rainfall more than 150mm (Ampara - 161mm, Moneragala - 188mm, Badulla -160mm, Nuwara Eliya - 120mm, Kandy - 104mm, Colombo - 107mm)
- Through Wednesday, widespread rainfall of 100-200 mm (4-8 inches) of rain will fall across the region.





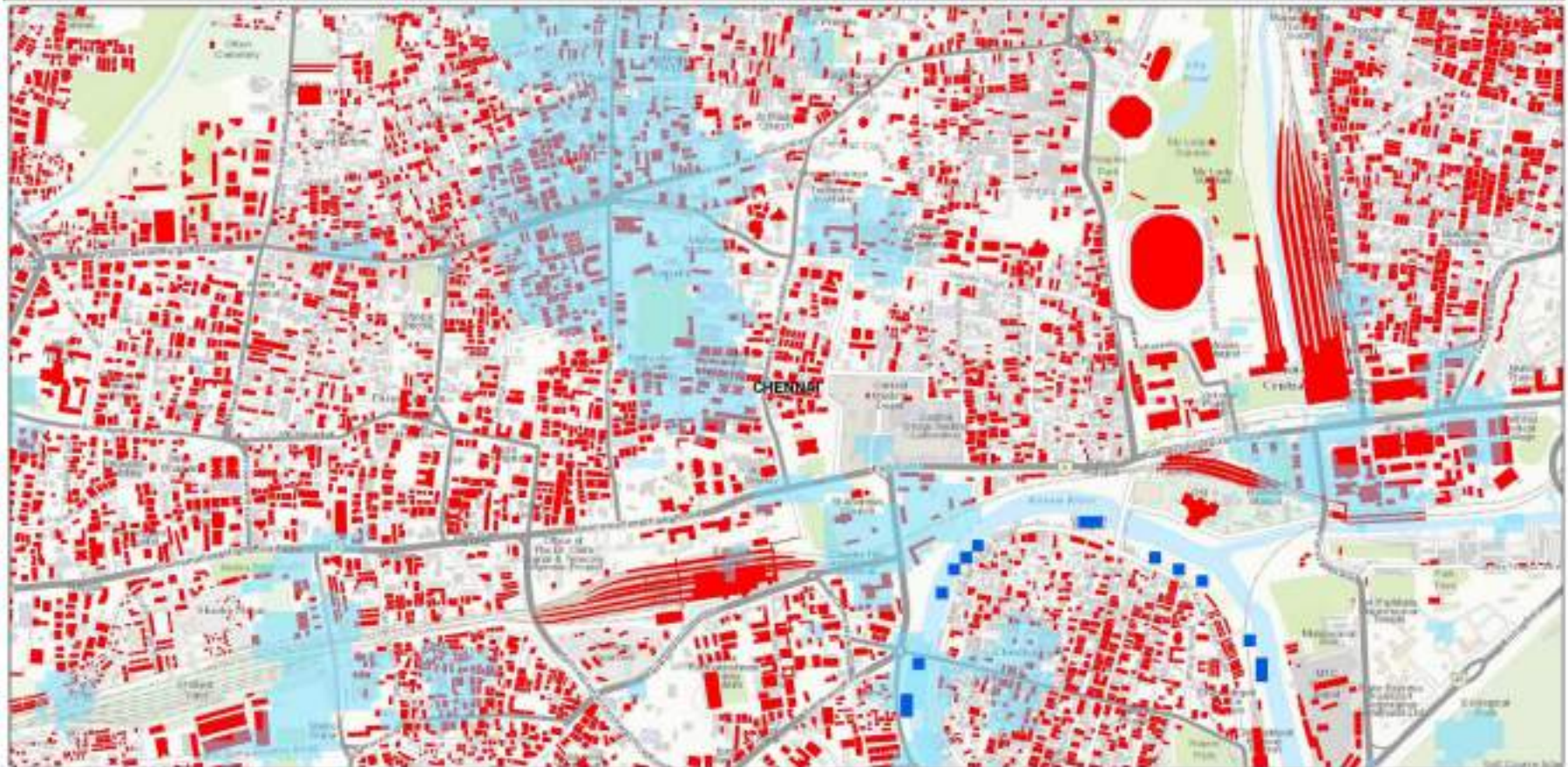
# Flood Situation maps in Sri Lanka





# Near real-time satellite data, GIS and Openstreet data....

## Second Wave of Catastrophic Flooding in Chennai (Tamil Nadu), India



# Operational Flood Management Information – Eastern Sudan

Date	Inundation 1 for non-inundated, 2 for inundated	Date	Inundation 1 for non-inundated, 2 for inundated
26-06-2013	1.00	12-09-2013	2.00
04-07-2013	1.00	16-09-2013	2.00
12-07-2013	1.00	21-09-2013	2.00
18-07-2013	1.00	24-09-2013	2.00
18-07-2013	2.00	29-09-2013	2.00
21-07-2013	2.00	31-09-2013	2.00
25-08-2013	2.00	30-09-2013	1.00
28-08-2013	2.00	17-09-2013	2.00

Daily River Flow: 24.7

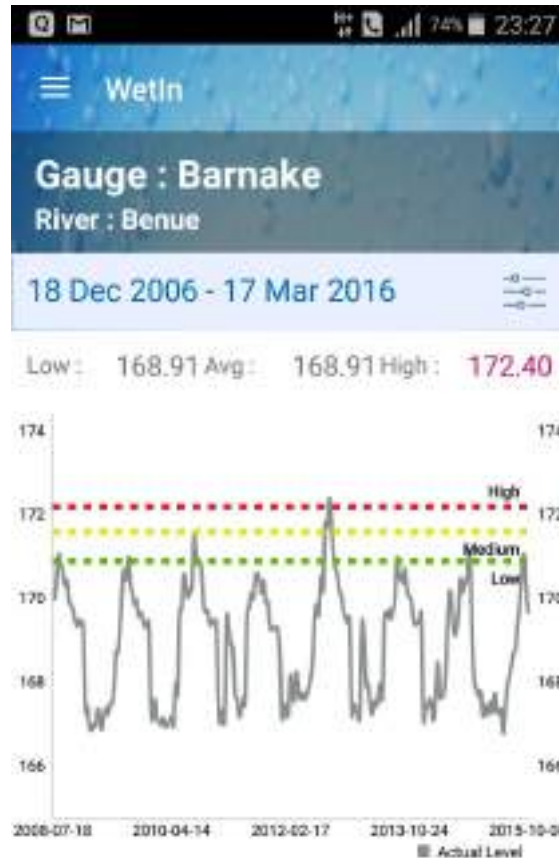
Month	Daily River Flow
Jun 13	~50
Jul 13	~100
Aug 13	~150
Sep 13	~24.7
Oct 13	~100
Nov 13	~100
Dec 13	~100





# WetIn mobile app based flood early warning

“WetIn allows users to monitor rivers and streams in the Niger-Benue river system in Nigeria using satellite altimetry”



- WetIn will be limited to the android operating system devices, for the time being.
- To provide an alternative to traditional monitoring using radar altimetry and improve model-predicted discharge in the downstream
- This mobile app aims to give added support to authorities and citizens during this rainy season in Nigeria

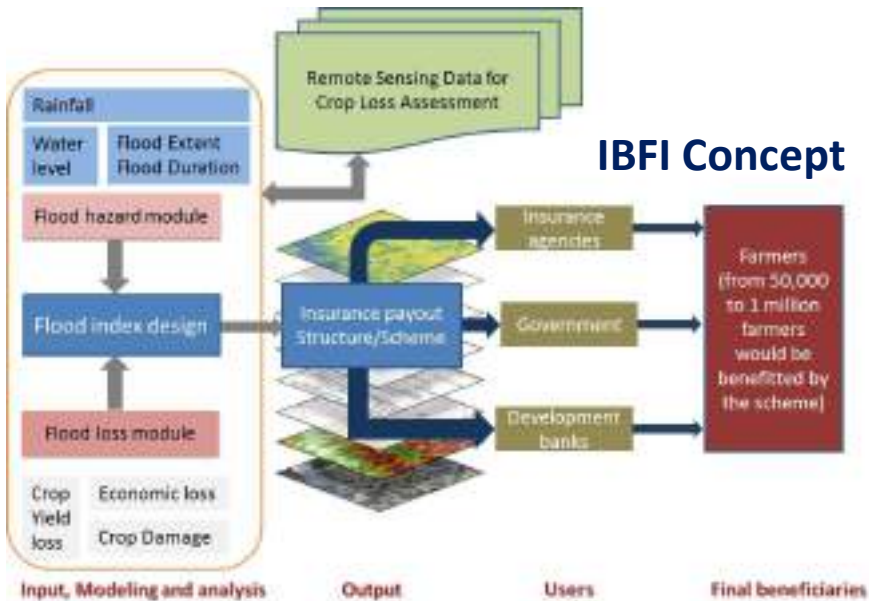
# INDEX-BASED FLOOD INSURANCE IN INDIA TO ENHANCE AGRICULTURE RESILIENCE AND FLOOD PROOFING LIVELIHOODS



RESEARCH PROGRAM ON  
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<http://ibfi.iwmi.org/>



- Setting up pilot-scale trials to demonstrate that positive verifiable impacts emerge from IBFI in terms of agriculture resilience and improving productivity, and household incomes, locally and at the broader scale
- Developing tools and strategies that support IBFI development and upscaling, integrated with existing and future flood control measures.

Project Period: 2015 - 2018  
Pilot Districts : Muzaffarpur, Darbhanga, Samastipur



Partners: International Food Policy Research Institute (IFPRI), Indian Institute of Technology (IIT)-Gandhinagar, Indian Institute of Water Management (IIWM-ICAR)\*; Agriculture Insurance Corporation of India, MoA; Bajaz Allianz, Insurer, Swiss Reinsurance



# Assessing flood damages using Drone

## Mapping flood severity using Unmanned Air Vehicle or Drone in Hanwella town along the Kelani Ganga River

- Drone with 4 cm spatial resolution deployed at 70 m above ground level at 3.30 pm to map flood damages along the Kelani Ganga river near Hanwella.
- Most damages noticed in the household than the crop damages
- Several roads has been disconnected restricted the movement of population as well as rescue operations



# Conclusions

- Freely available satellite imagery will improve science and environmental-monitoring products
- Governments and the remote-sensing community should now seize the opportunity to develop a unified strategy for DRM.
- The remote-sensing community must advocate the development and maintenance of data archives and innovative processing methods.
- Best-practice approaches and standards can be developed by the GEO, a voluntary partnership between governments and international organizations to promote global collaboration around EO, and offshoots such as the IDC.
- Finally, researchers, policy-makers, non-governmental organizations and land managers need to use and promote more widely the capacity of the satellite data for DRM.