

Detailed Business Specific Requirements	
Theme	Event Analysis (theme renamed as "Existing IT system for internal agencies of MoJS")
Application	Flood Analysis (application renamed as "WIMS expansion-WRIS")
Use Case	Estimated Spatial Flood Extent / Flood Inundation Mapping based on RISAT-1A data (use case renamed as "Flood Inundation Mapping")
Use Case ID	FA-UC-02
Other linked Use cases	Flood prone area assessment (FPA) (FA-UC-03) & Flood Plain zoning (FA-UC-05) & other purposes like post damage assessment.
Description	Remote sensing data already plays a significant role in water resources management, but further advancements in the technology promise to support sustainable water resource management and development in more comprehensive and holistic manner. Earth Observation Satellite (EOS)-04 or RISAT-1 A is follow-on to RISAT-1 and launched in February 2022 based on the recommendation from Planning Committee of Space Application Management System (PC-SAMS), subsequent to evaluation of its need aspects by various Ministries/Dept. The EOS-04 is first of its kind mission that went through a series of deliberations with the Planning Committee of Space Applications Management Systems (PC-SAMS) mechanism, wherein its intended utilization plan was endorsed by the user Ministries, and funding support was also provided by them, including launch cost. Ministry of Jal Shakti (MoJS) is one of such agency. The images acquired from RISA-1A at regular intervals are being used for various applications in water resources.
Used by	Planners, Decision makers, administrators, academicians, SDMA and NDMA, Insurers, general public.
Priority	<b>High Priority:</b> This use case is important for post disaster management, assessment, deployment of disaster response teams, planning of mitigation measures and as an input to calibrate and validate models on flood inundation forecasting.
Phase	<b>Phase 2:</b> DSS Development of WARIMS
Business Problem	RISAT-1A acquires large spatial datasets at regular interval for PAN India for which high computational resources for continuous fetching of satellite data, archiving and processing for intended purpose. This further requires a visualization platform for GIS query based decision support system (DSS) for utilization among all stakeholders.
Output	Estimated Spatial Flood Extent Near real-time flood inundation maps along with reports
Outcome	Post-disaster management, assessment, deployment of disaster response teams, planning of mitigation measures and as an input to calibrate and validate models on flood inundation forecasting.
Visualization	<b>1. Map of inundated areas corresponding to each flood event with date</b> <ul style="list-style-type: none"> <li>• Political boundary <ul style="list-style-type: none"> <li>o State,</li> <li>o District</li> <li>o Town/ village/ Panchayat boundary</li> <li>o Boundaries of Assembly and Parliamentary constituencies</li> </ul> </li> <li>• Hydrological Boundary <ul style="list-style-type: none"> <li>o Basin,</li> <li>o Sub-Basin</li> </ul> </li> </ul>

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	o River			
	• Base Layers			
	<ul style="list-style-type: none"><li>o All types of base layers as available should be displayed such as</li><li>o Infrastructure</li><li>o Water Projects</li><li>o Population</li><li>o Places</li><li>o Crop Area</li><li>o LULC</li><li>o Embankments</li><li>o Built-up area</li></ul>			
	User Selection: The default screen will appear as a terrain map of India. By zooming, the required state, district, river, or inundated area can be searched. There will be a "Search" button also to facilitate searching for a particular district or river by name. When user clicks on an inundated area, the table mentioned below will pop up on screen with the following information:			
	1. Name of river basin			
	2. Name of river			
	3. Name of State/District			
	4. No. of villages/towns affected			
	5. Population affected			
	6. Length of road/railway line affected			
	7. No. and type of houses and other infrastructure affected			
	8. No. and type of critical structures (hospitals, fire stations, power plants and sub-stations, water supply and sewerage treatment plants, structures of historical and strategic importance etc.) affected, if any			
	9. Crop area damaged and estimated value of loss in Rs Lakhs			
	10. Dates of flooding with time series of images (historical spatial estimated flood extent)			
	11. Estimated Damage			
Up-dating Frequency	As soon as RISAT-1A data is acquired (near real time)			
Measures of Success (KPIs)	Based on feedback of stakeholders			
Input				
Data Required	Data	Unit	Type	Source
	SAR data		Satellite imagery	ISRO/RISAT-1A / NWIC
	Population density map with village/ town as unit	Number	decimal	Census / NWIC

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LULC map with special reference to area under crops		Map	NRSC/ Satellite Image / NWIC
Map layer showing railway network		Map	NRSC/ Satellite Image /NWIC
Map layer showing road network		Map	NRSC/ Satellite Image /NWIC
Map layer showing important structures like hospitals, fire stations, power plants and sub-stations for power supply, water supply and sewerage treatment plants, police stations, structures of historical and strategic importance, nearest flood shelter etc		Map	Sol/ NRSC/ High resolution Satellite Images / NWIC
Length of road/railway line affected	km	Decimal number	Transportation network layer prepared in-house / NWIC

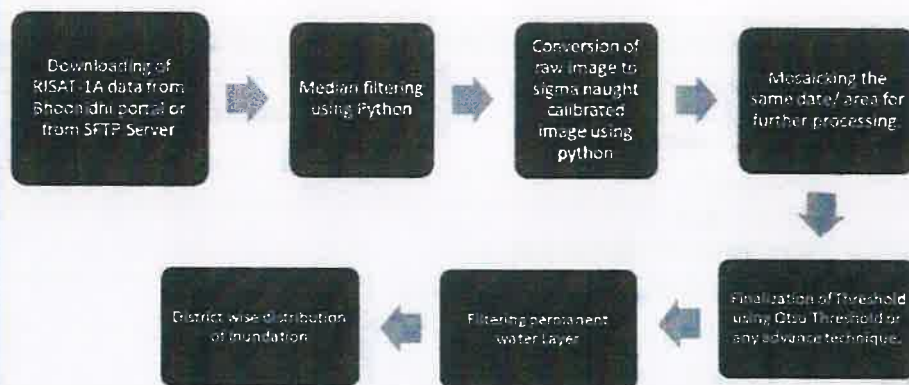
#### Process

Algorithm/Tool **Step 1: Fetch all base layers as listed above.**

(Process flow **Step 2: Fetch recently available RISAT-1A satellite data**

along with the **Step 3: Processing the SAR data (RISAT-1A) preparation of water masks from satellite data. The steps are as follows:**

#### Steps for processing the RISAT -1A Data



**Step 4: Superimpose the water masks on the natural waterbodies prepared in Step-1 and derive the flood-inundated areas.**

**Step-5: Superimpose the flood inundated maps on available village/town/city maps, transportation network, population density map, crop area map and other infrastructure maps and find out no. of village/towns affected, number of people affected, length of road/railway line affected, crop affected, no. of other important/ critical infrastructure affected etc.**

**Step 6: Estimate the damages for the chosen administrative unit as applicable.**

**Step 7: Outputs displayed on a GIS platform.**

**Step 8: Chart of estimated flood extent at selected location pixels.**

**Step 9: Provide data download option in multiple formats i.e. .pdf., .csv, .xls, .png**

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Software Requirement (specific if any)	Python3 and open-source GIS platform or any other
Dependencies & Risks	Data availability, permission to fetch data, inability to detect flood depths and distinguishing between different types of flood etc.
User Acceptance Testing (UAT) By	CWC, NRSC, SDMA and NDMA
Development Responsibility	HARSAC
Reference material	<ol style="list-style-type: none"> <li>1. <a href="https://ndem.nrsc.gov.in/login.php">https://ndem.nrsc.gov.in/login.php</a></li> <li>2. <a href="https://bhuvan-app1.nrsc.gov.in/disaster/disaster.php?id=flood">https://bhuvan-app1.nrsc.gov.in/disaster/disaster.php?id=flood</a></li> <li>3. <a href="https://bhoonidhi.nrsc.gov.in/bhoonidhi/home.html">https://bhoonidhi.nrsc.gov.in/bhoonidhi/home.html</a></li> </ol>

**For any communication/clarification on the BSR, the following officers may be contacted.**

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This is to certify that the above BSR has been vetted and found satisfactory.

**Details of Domain Organization SPOC and SME for Verification and Approval of above BSR**

 <b>(Signature of SPOC)</b> <b>SPOC Name:</b> <b>SPOC Designation:</b> <b>Organization:</b>	 <b>(Signature of SME)</b> <b>SME Name:</b> Ritesh Khattar <b>SME Designation:</b> Director <b>Organization:</b> Flood Control Application-II Directorate, Central Water Commission
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