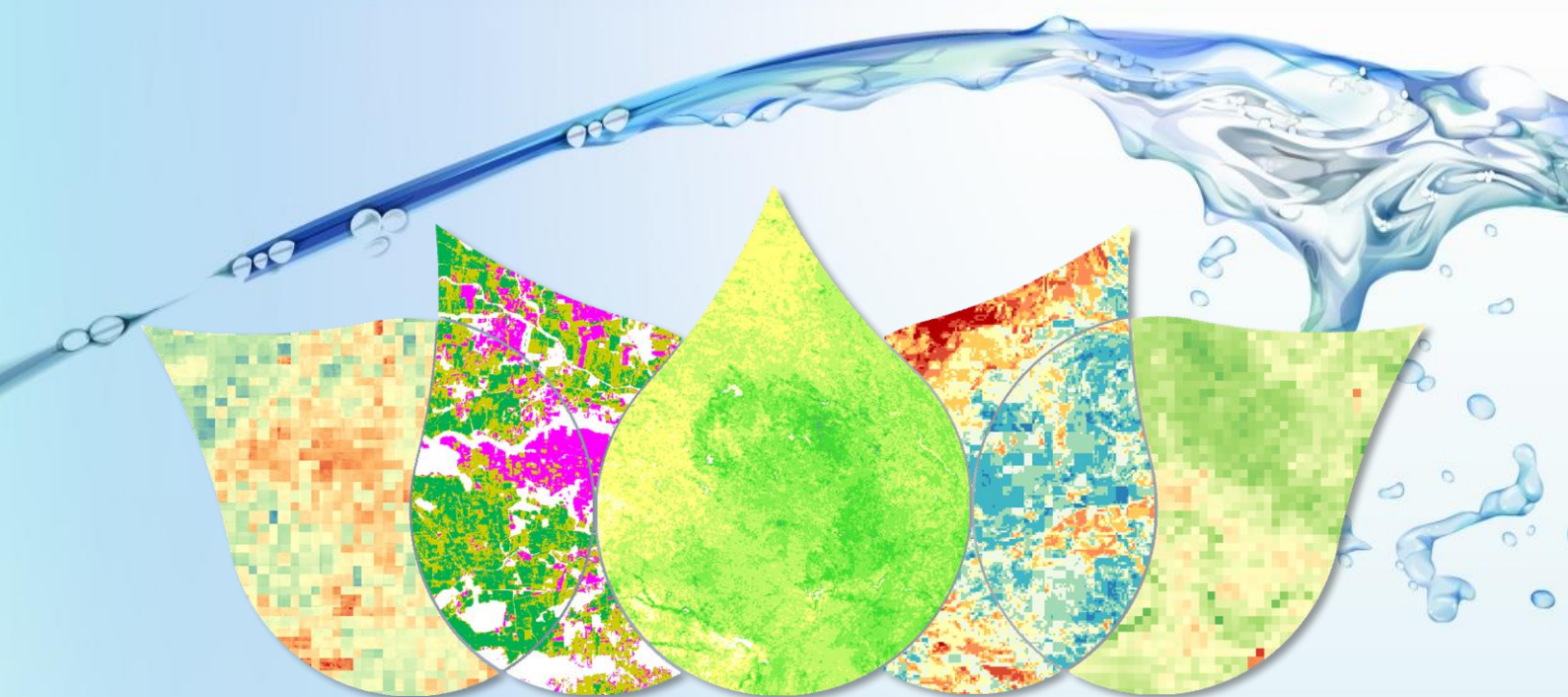


Geospatial Hydro Products and Services

National Hydrology Project



National Remote Sensing Centre
Indian Space Research Organisation
Dept. of Space, Govt. of India

December 2023

National Hydrology Project



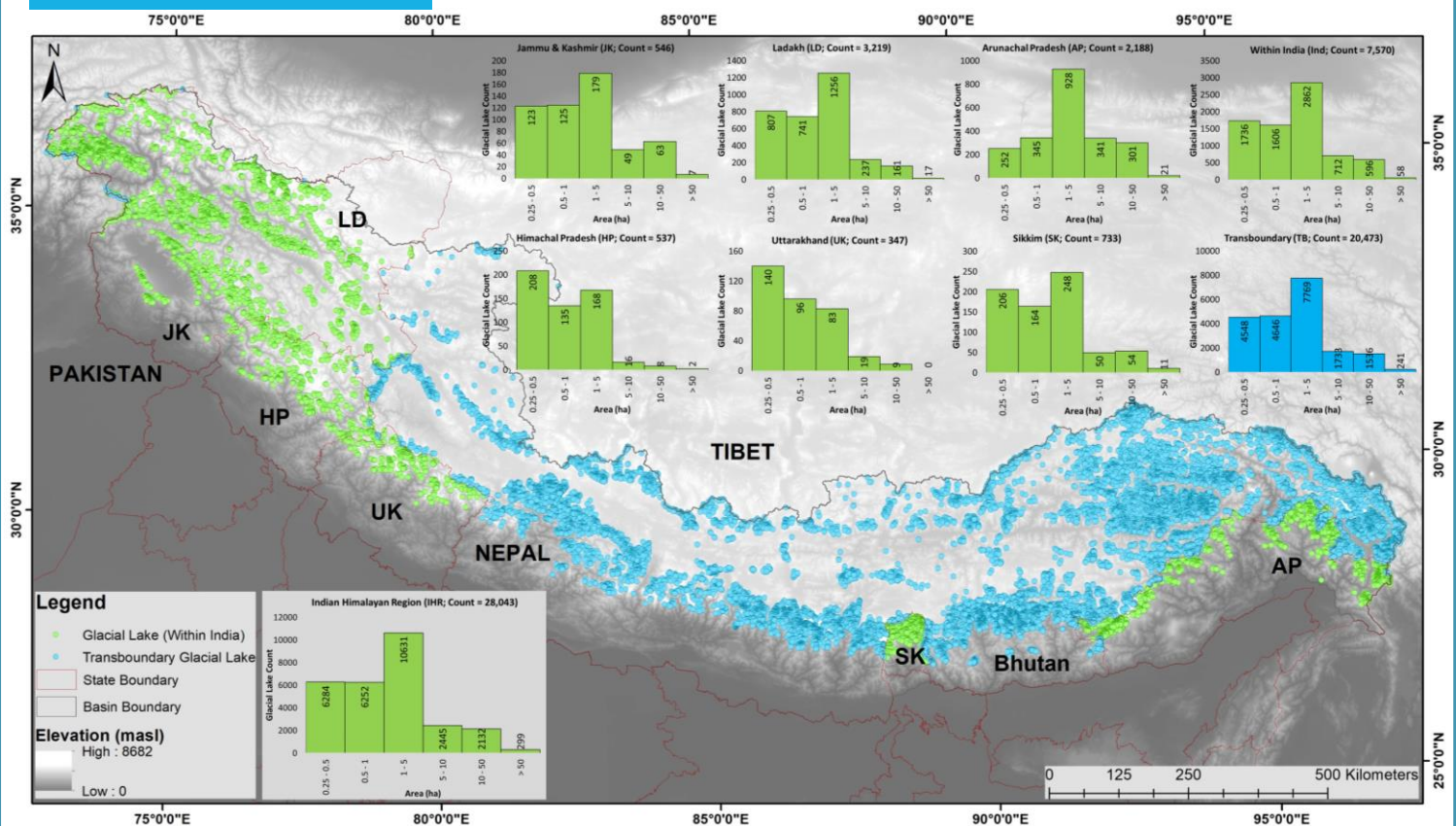
Glacial Lake Outburst Flood (GLOF) Risk Assessment of Glacial Lakes in the Indian Himalayan Region



Major Highlights

- Comprehensive inventory of glacial lakes (28,043; size ≥ 0.25 ha) along with 22 attributes
- Glacial Lake Atlases – Indus, Ganga, Brahmaputra River basins and entire Himalayas
- Ranking & Prioritization for GLOF Risk Assessment
- Glacial Lake Outburst Flood (GLOF) modeling simulations for selected glacial lakes
- GLOF risk zone maps for downstream areas of selected glacial lakes

Glacial Lake Inventory



Glacial Lake Atlases



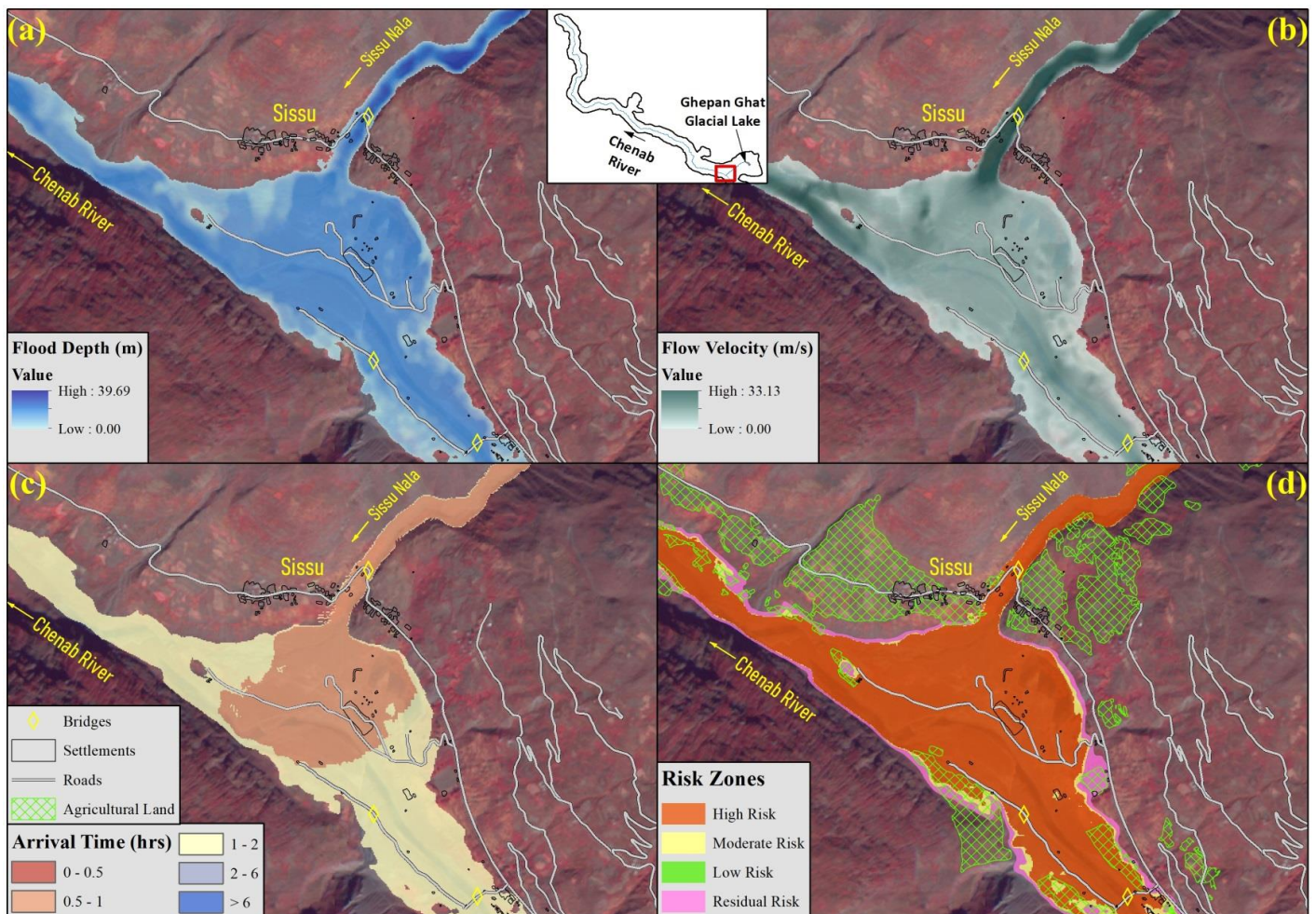
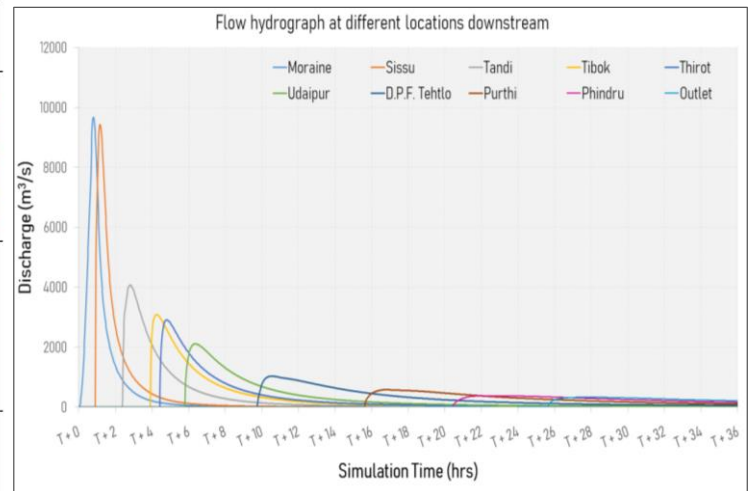
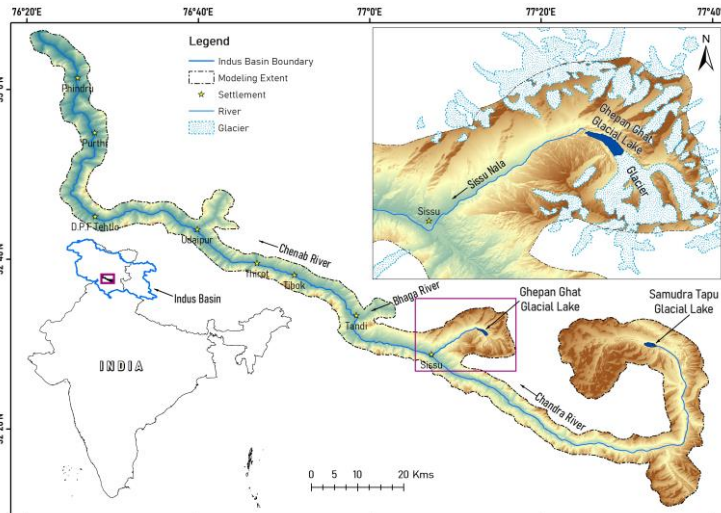
National Hydrology Project



Glacial Lake Outburst Flood (GLOF) Risk Assessment of Glacial Lakes in the Indian Himalayan Region



GLOF Modeling and GLOF Risk Assessment of Ghepan Ghat GL, Indus Basin



End Use/Utility

- ☐ Comprehensive Glacial Lake database
- ☐ Assessment of GLOF risk for prioritized critical lakes
- ☐ Glacial Lake Monitoring
- ☐ Useful for development of GLOF Early Warning Systems

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Development of Spatial Snowmelt Runoff Product in the Indian Himalayas



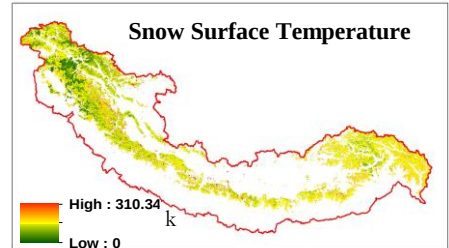
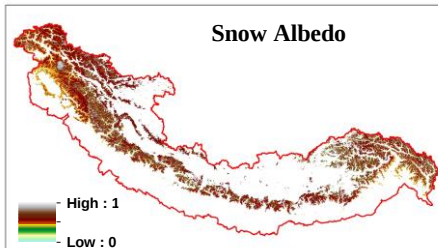
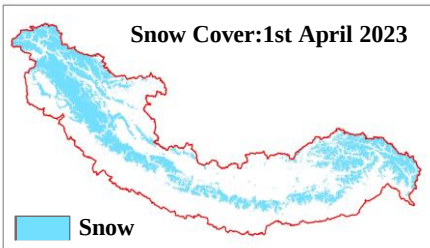
Major Achievements

- ❑ Daily generation of Snowcover for entire Himalayas at 1km spatial resolution.
- ❑ Daily spatial gridded snowmelt product during Snowmelt Season (Apr-Jun).
- ❑ Daily spatial 3-day gridded snowmelt forecast product during Snowmelt Season.
- ❑ Short term snowmelt runoff forecast at 16 Sub basin outlets during snowmelt season.

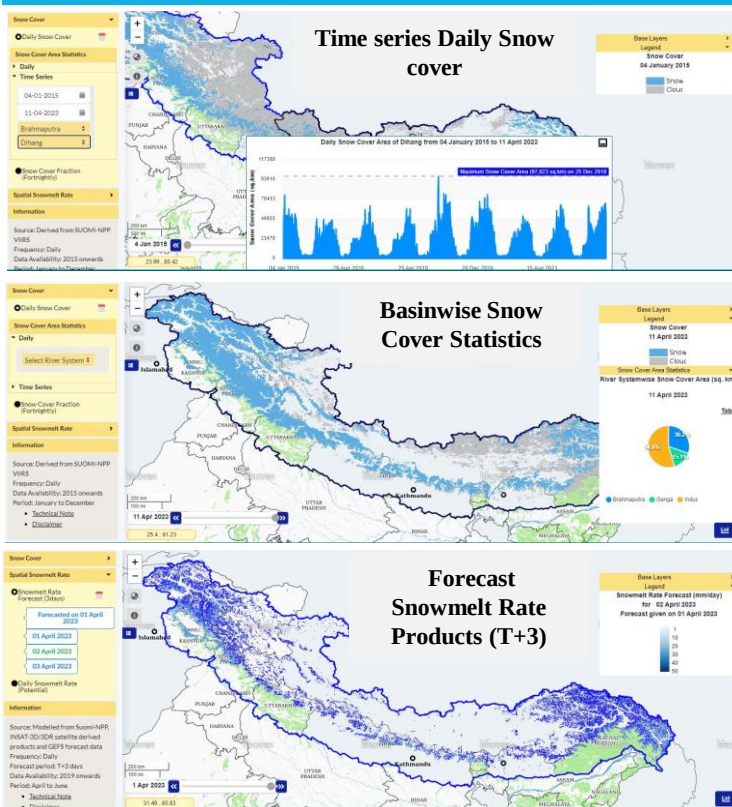
End Use

- ❑ Reservoir management
- ❑ Optimal allocation of water resources for drinking water, irrigation and hydropower generation.
- ❑ Identification of suitable locations for hydropower projects
- ❑ Climate change studies

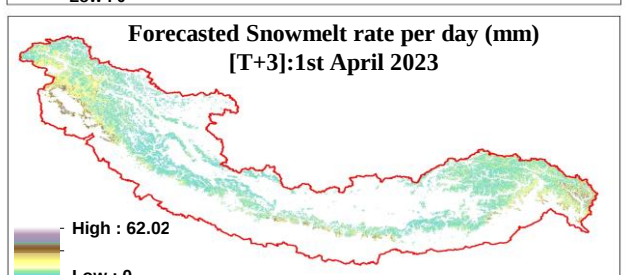
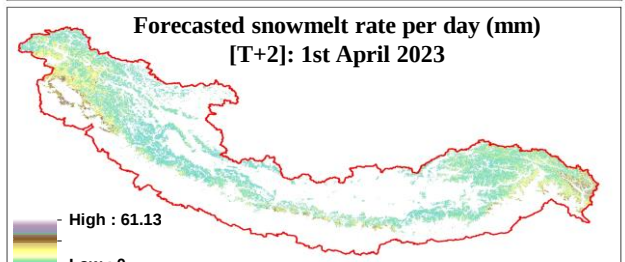
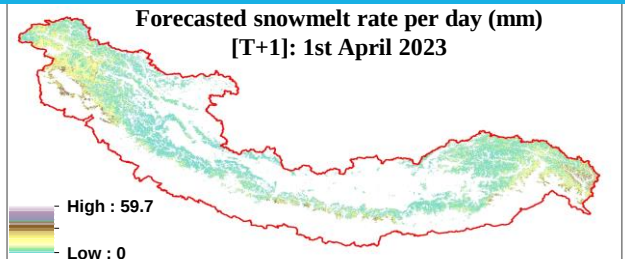
Geospatial Inputs for Snowmelt Estimation



Himalayan Snow Cover Information System Geoportal



Spatial 3-day Snowmelt Rate Forecast



National Hydrology Project



Hydrologic Unit Model for InDia - HUMID

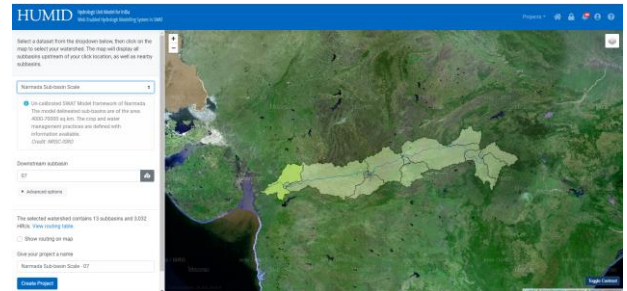
A Web Enabled Hydrologic Modelling System in SWAT



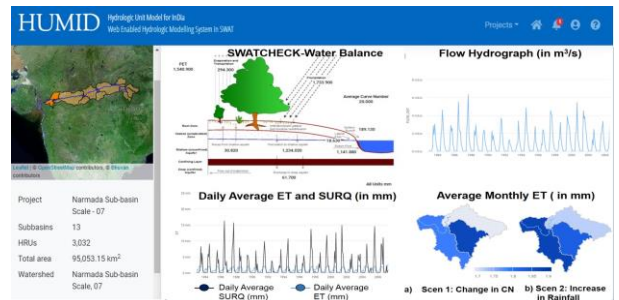
About HUMID

- ❑ Web-based interactive hydrological modelling system
- ❑ Core Modelling Engine: Soil and Water Assessment Tool (SWAT)
- ❑ System Features
 - Interactive web interfaces and maps
 - Preloaded input data
 - Online development, execution, and storage of a user's modelling projects
 - Visualisation of outputs in form of tables, charts

HUMID: Model Framework Development



HUMID: Output Visualisation



Why HUMID ?

- ❑ No Efforts required for Data Collection and Pre-processing
- ❑ Download and Installation of ArcSWAT/QSWAT not required
- ❑ Easy Customization of Model Parameters
- ❑ Faster Model Run
- ❑ Graphical Demonstration of Results
- ❑ Remote Access to Model setup and results
- ❑ Choice of Spatial Resolutions



National Hydrology Project

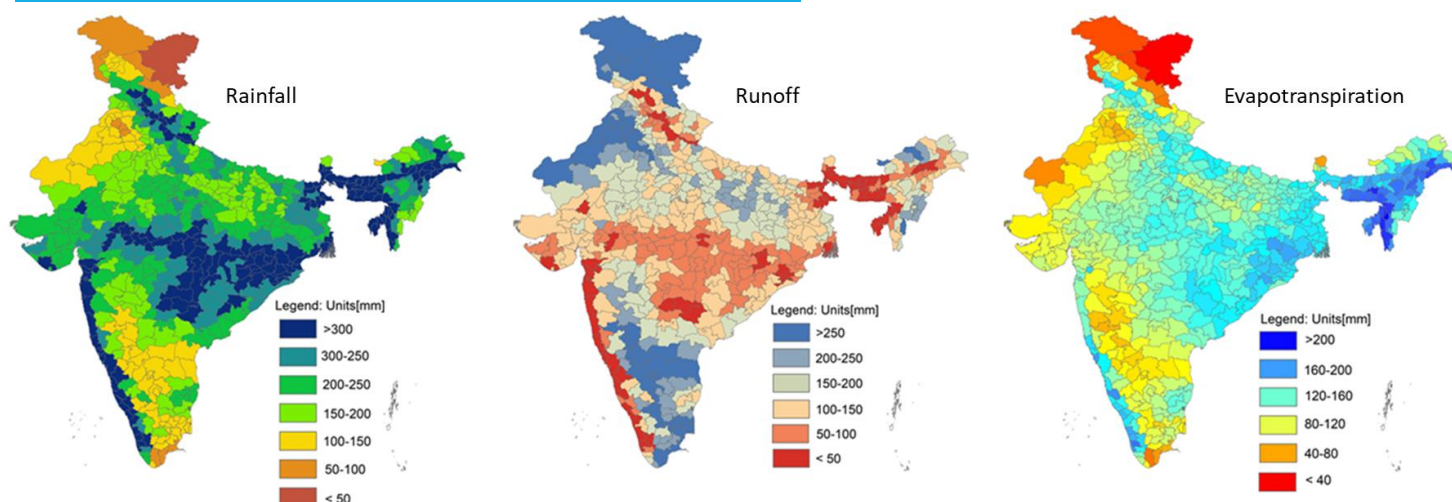
Operational National Hydrological Modeling System



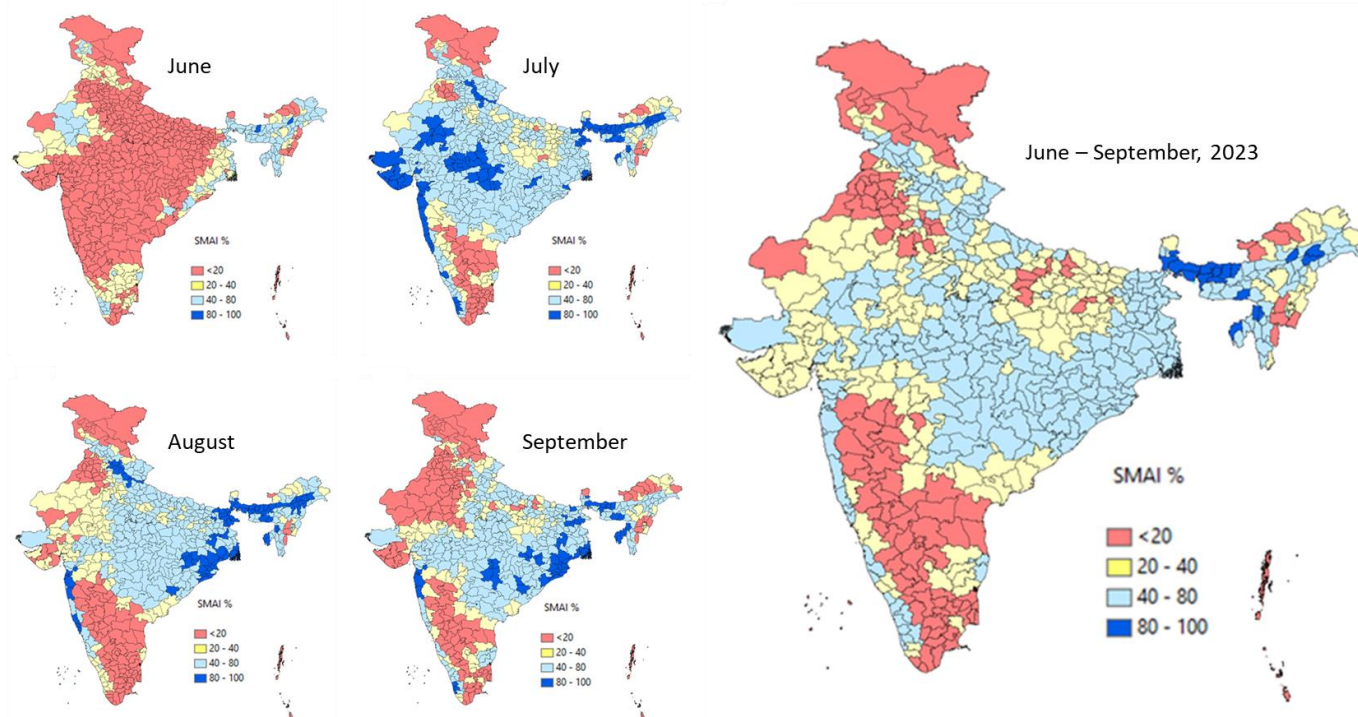
Major Highlights

- Daily estimation of water balance components
- Value added products: Inflow into major reservoirs, Soil Moisture Availability Index, Forecast surface runoff, Irrigation Requirement, forecast of river discharge
- Established 10 permanent Soil Moisture stations and 2 Cosmic-Ray Soil Moisture Observation station (COSMOS) across India for validation of Soil Moisture Product

Seasonal Water Balance Components (Y: 2023)



Soil Moisture Availability Index (SMAI)

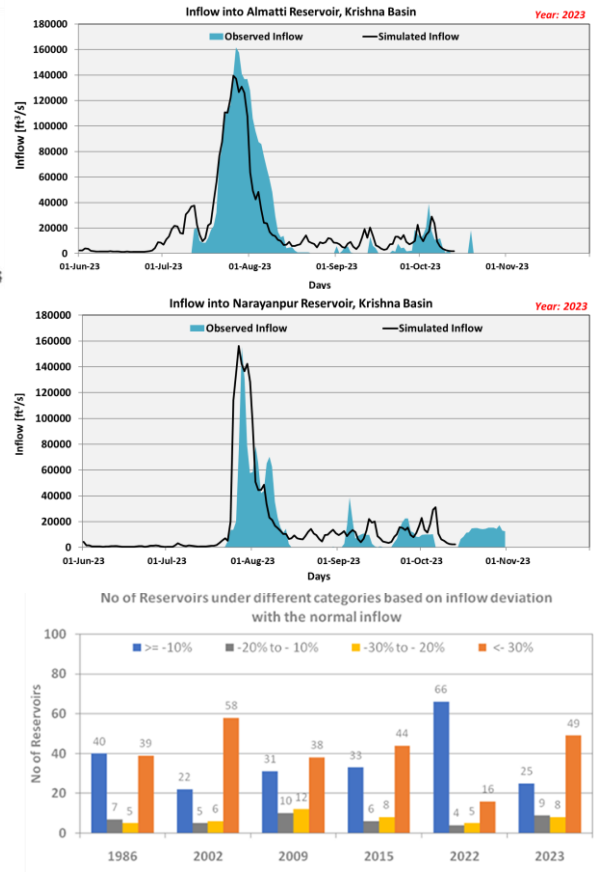
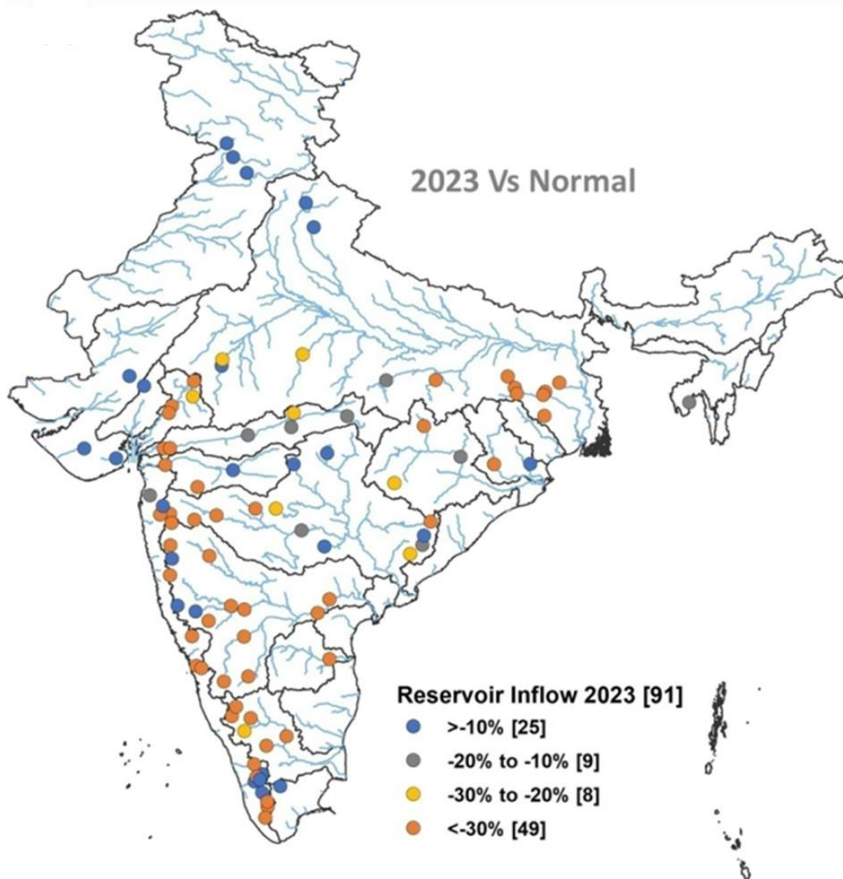


National Hydrology Project

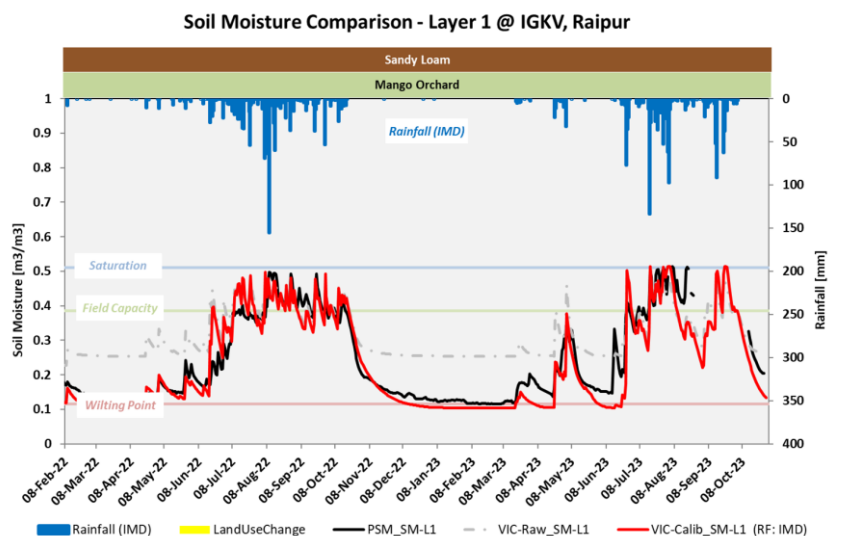
Operational National Hydrological Modeling System



Simulated Inflow into Major Reservoirs of India



Establishment of Field Instrument and Validation of Simulated Soil Moisture



End Use/Utility

- ☐ Water Availability Assessment
- ☐ Irrigation Demand Assessment
- ☐ Reservoir Management
- ☐ Hydrological Drought Assessment
- ☐ Climate Change Studies

National Hydrology Project

Satellite Based Evaporative Flux Estimation over Indian Region



Major Highlights

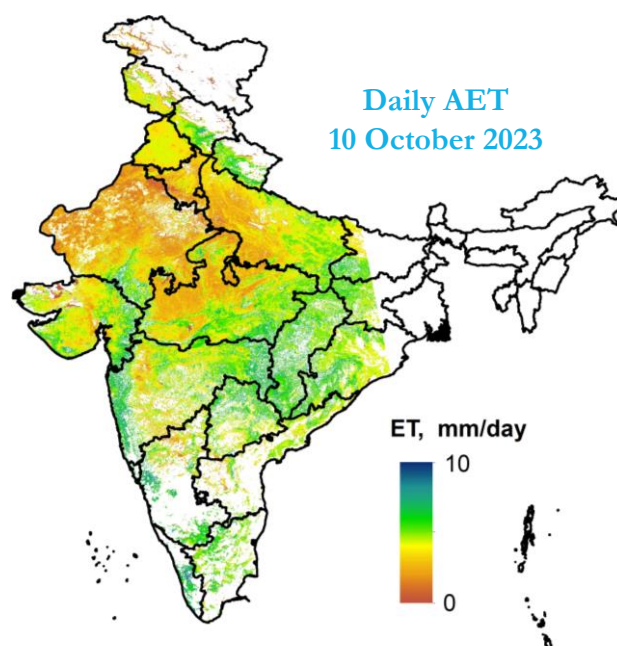
- ❑ Satellite based operational near real time daily Actual Evapotranspiration (AET) product at 5500m and 750 m
- ❑ Long term data from 2015 onwards
- ❑ Calibrated and validated using Flux Tower data
- ❑ Applications of AET products in irrigation water management and drought studies
- ❑ Products dissemination through NHP Bhuvan portal.

End use

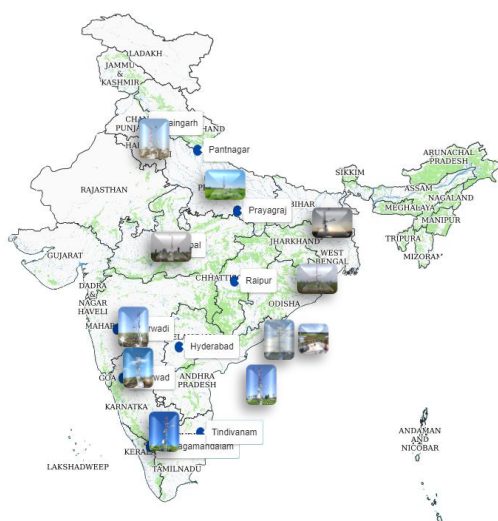
- ❑ Water Productivity / water use efficiency
- ❑ Crop water requirement
- ❑ Irrigation Scheduling
- ❑ Water availability assessment
- ❑ Drought Assessment studies
- ❑ Climate change studies

Product Specification

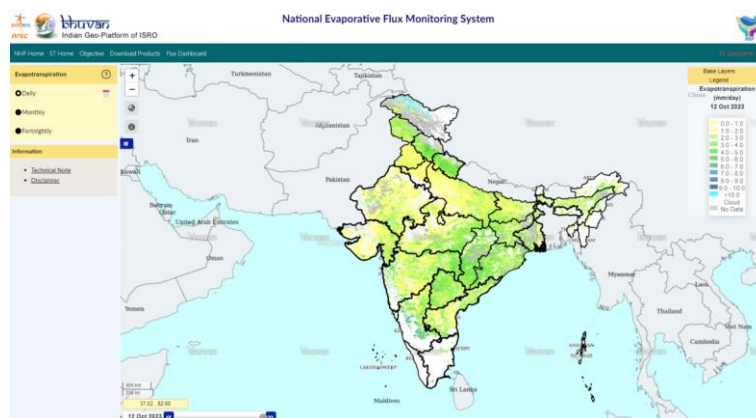
Name : Actual Evapotranspiration (AET)
Coverage : India Region
Resolution
Spatial : 750 m & 5500 m
Temporal : Daily, Fortnightly & Monthly
Latency : 3 days
Input Data : Satellite and Met. datasets



Instrumentation Network



Product Dissemination - Bhuvan Portal



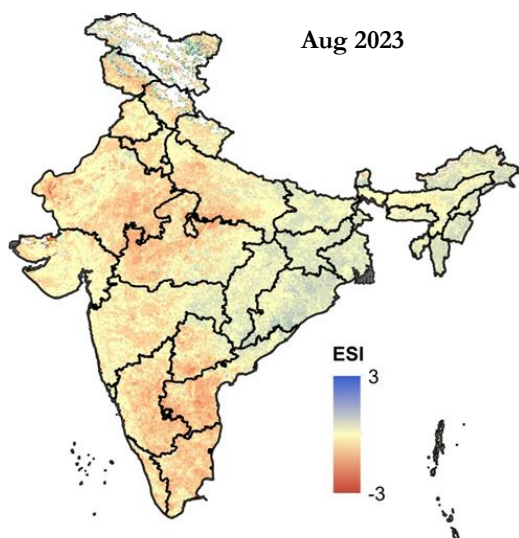
National Hydrology Project

Satellite Based Evaporative Flux Estimation over Indian Region

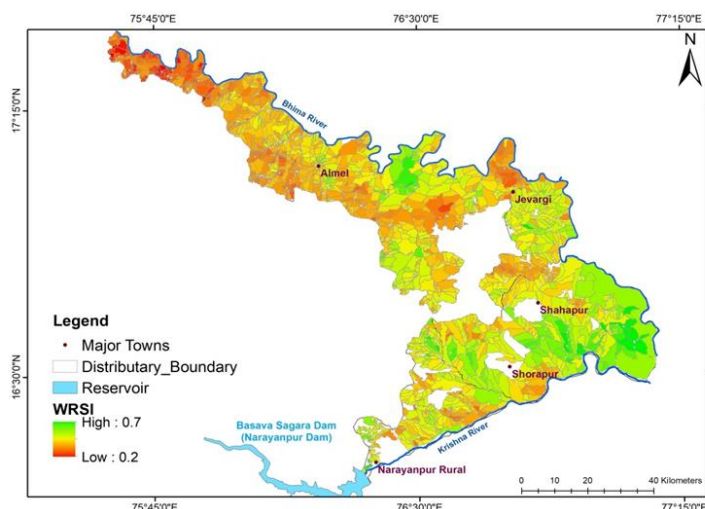


Applications of Satellite Based AET

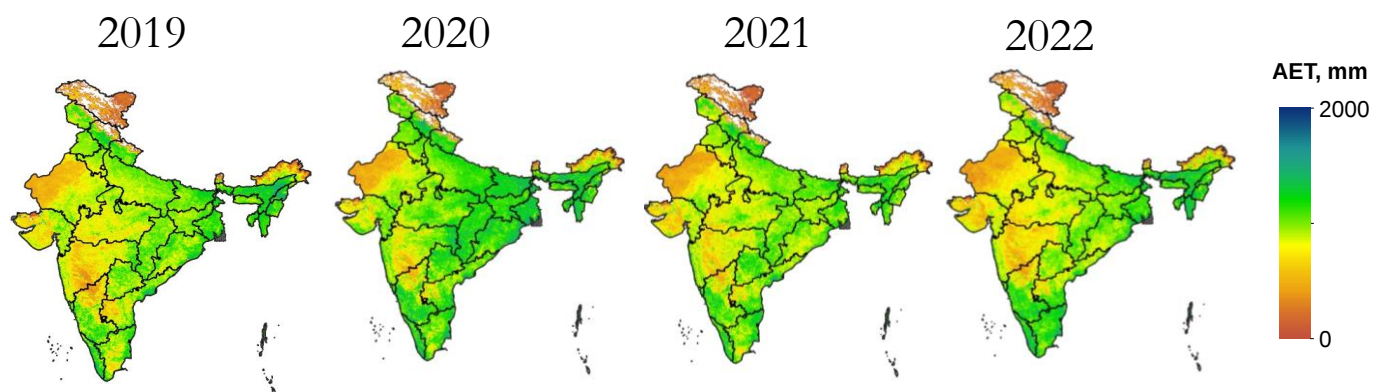
Evaporative Stress Index (ESI)



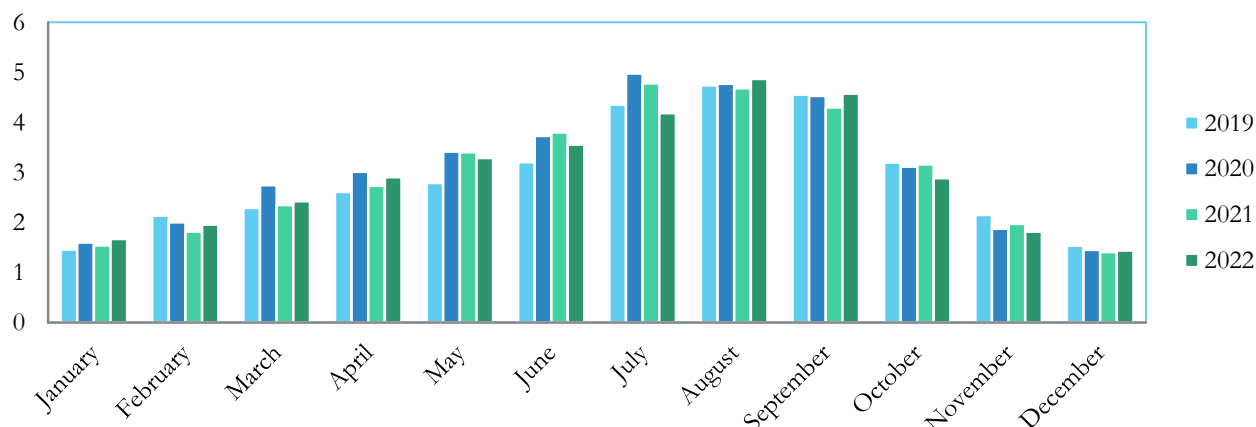
Irrigation System Performance Assessment



Yearly dynamics of annual cumulative AET over India



Monthly Average AET over agricultural area (Indian Region)



National Hydrology Project



Satellite Information Augmented Decision Support System

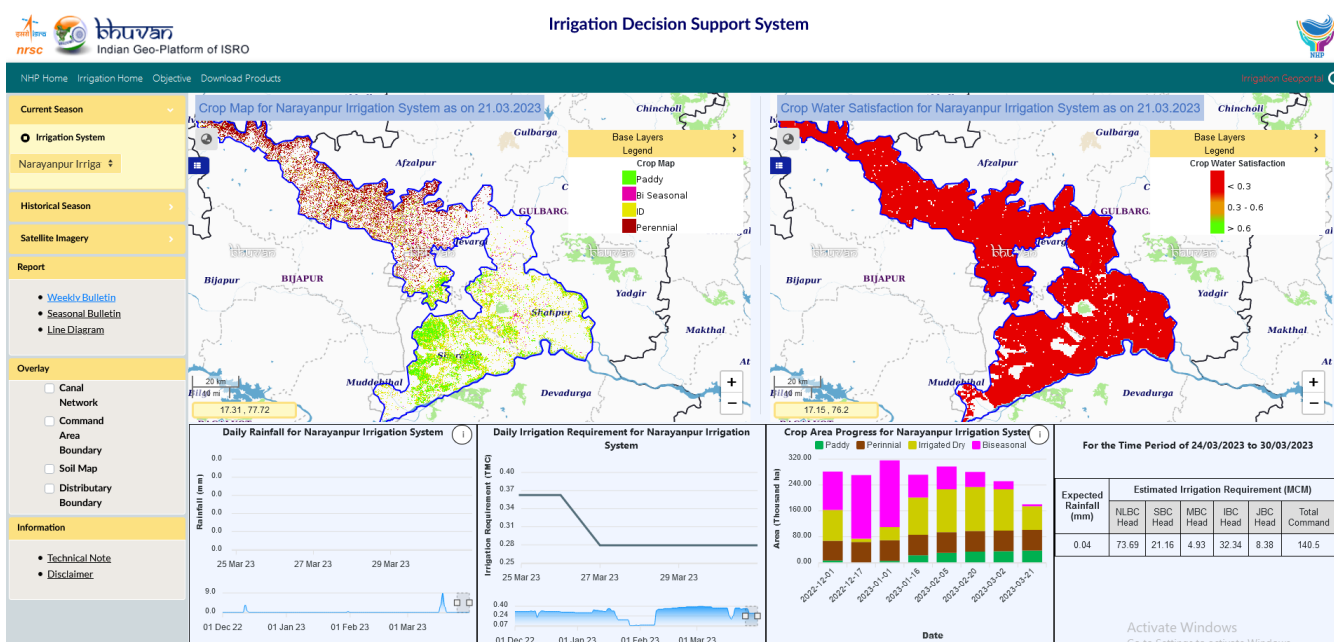


About DSS

- ❑ Satellite-based information on cropping pattern through the season
- ❑ Irrigation Requirement estimated for NRT and forecasted meteorological conditions
- ❑ Irrigation system performance assessment using satellite derived inputs

System Outputs

- ❑ Early Season Cropping Pattern (Crop Type & Area)
- ❑ Cropping Pattern Variation through Season
- ❑ Forecast Irrigation Requirement Estimates
- ❑ Crop Water Satisfaction Index Map



Output Utilities

- ❑ Pre- Harvest Decision Making
- ❑ Demand based Canal Operation Advisories
- ❑ Optimal Irrigation Releases
- ❑ Identification of Critical Distributaries/ Minors
- ❑ Yield Assessment

Potential Users

- ❑ State Irrigation Departments
- ❑ Planning and Design Departments
- ❑ Command Area Development Authority
- ❑ Water Resources Management Boards like KBJNL, NCA etc.

National Hydrology Project

Spatial Flood Early Warning Systems - Godavari and Tapi Rivers



Background

- ❑ Medium range flood early warning models are developed for Godavari and Tapi Rivers using space based inputs and DEM.
- ❑ Spatial flood inundation simulation models are developed using high resolution Digital Terrain Models.
- ❑ The models are calibrated and validated thoroughly using historical hydro-meteorological data.
- ❑ Web-enabled real-time spatial flood early warning system is developed to disseminate flood advisories to the user organization.
- ❑ Models are run in real time using real-time rainfall data and rainfall forecast data IMD WRF/GEFS obtained from India Meteorological Department.
- ❑ Results are disseminated through NDEM, & Bhuvan-NHP portal.
- ❑ Scientific assessment of flood prone areas is conducted at different return periods.

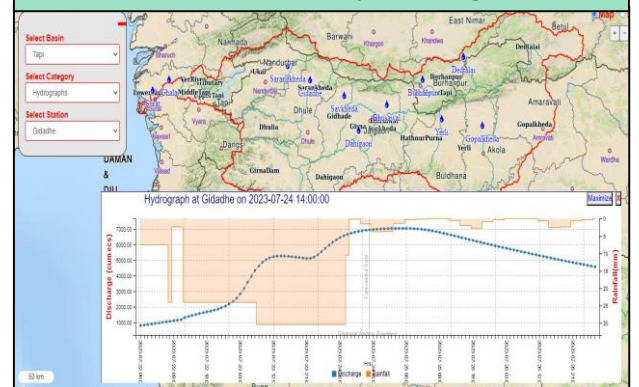
Major Highlights & End use

- ❑ Flood discharge computation accuracy is > 87 % with improved Forecast lead time (36 to 50 hours) at various locations.
- ❑ Spatial flood inundation with depth and velocity information were disseminated.
- ❑ Spatial flood advisories were given to APSDMA during Godavari floods-2020, 2021, 2022, 2023.
- ❑ Vital input for relief & rescue operations and in preparing Basin level Disaster Management plans for DRR.
- ❑ Received appreciation from State Disaster Management Authorities.

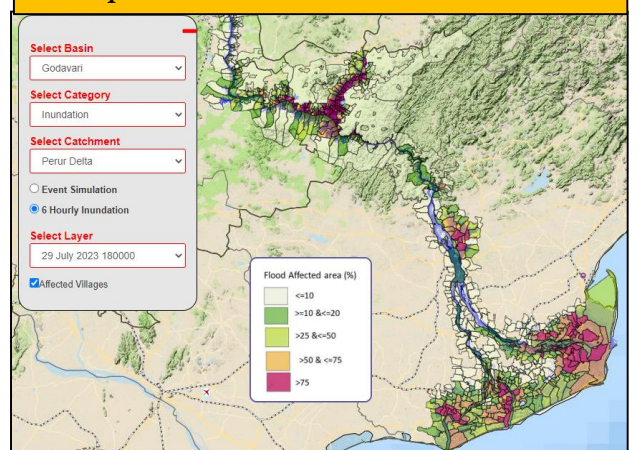
Godavari Flood Early Warning



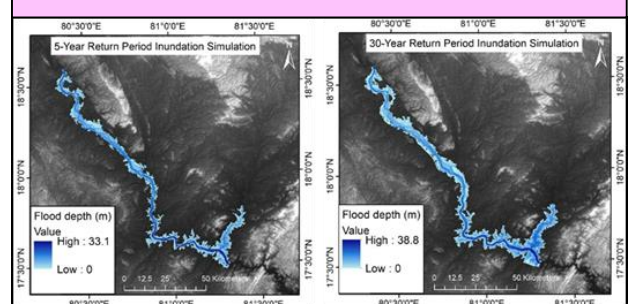
Tapi Flood Early Warning



Spatial Flood Inundation Simulation



Scientific Assessment of Flood Prone Areas



National Hydrology Project

Operational Hydrological Drought Assessment



About Hydrological Drought

Project objectives:

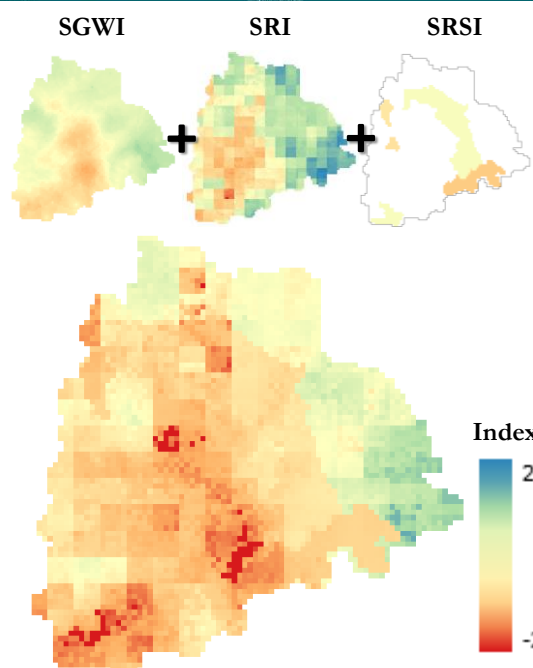
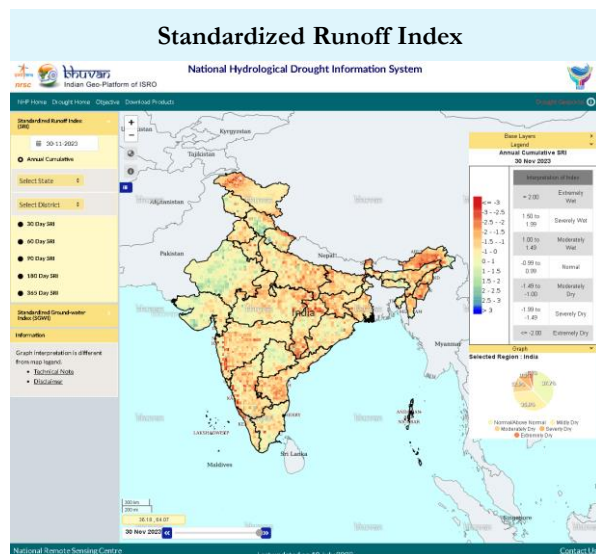
- ✓ To characterize spatio-temporal variability of hydrological drought for entire India
- ✓ To provide hydrological drought indices based on geospatial data, hydrological model outputs and observational/field data
- ✓ To provide operational hydrological drought services

As a part of National Hydrology Project, it is envisaged to develop a composite hydrological drought index using the following standardized indices.

- ✓ Standardized Runoff Index (SRI)
- ✓ Standardized Ground Water Index (SGWI)
- ✓ Standardized Reservoir Storage Index (RSRI)
- ✓ Standardized Water Spread Index (WSI)

These products can be used for/as:

- ✓ Auxiliary information for issuing drought advisories and taking preemptive actions
- ✓ Planning and management of irrigation
- ✓ Planning of targeted relief activities
- ✓ Water resource planning
- ✓ Drought vulnerability studies



Composite Hydrological Drought Index (2012 Nov)