

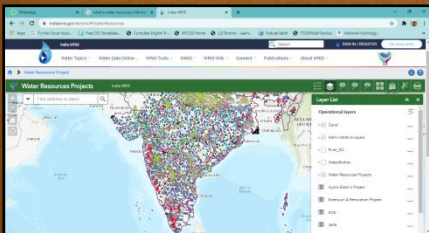
Water Resources Information Systems



K Abdul Hakeem

Head

Water Resources Informatics Division
National Remote Sensing Centre, ISRO



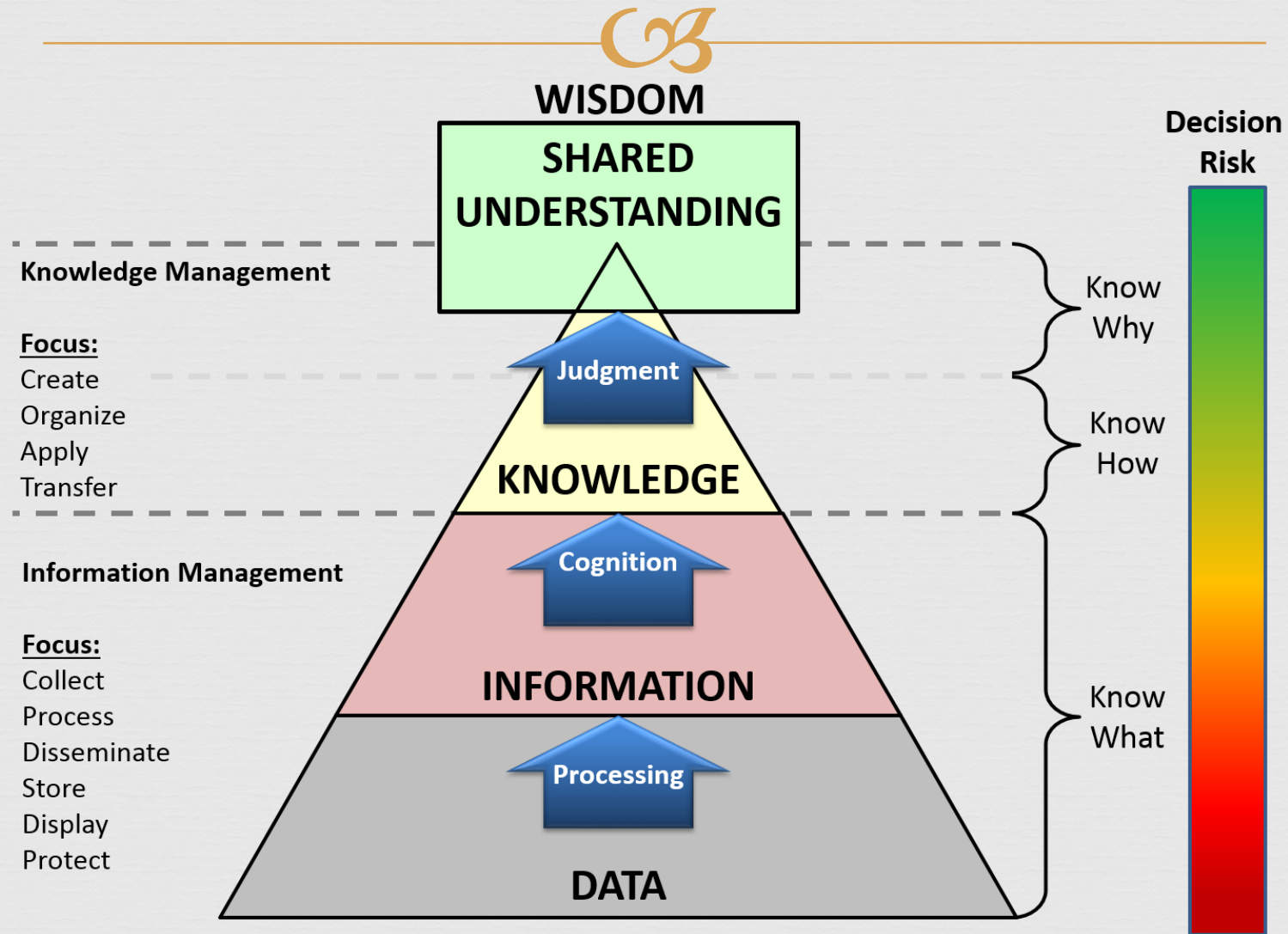
Data, Information, Knowledge, and Wisdom



1. **Data:** symbols that represent properties of objects, events and their environments
2. **Information:** data that are processed to be useful; provides answers to "who", "what", "where", and "when" questions
3. **Knowledge:** application of data and information; answers "how" questions
4. **Understanding:** appreciation of "why"
5. **Wisdom:** evaluated understanding

Source: Ackoff, Russell L. 1989. "From Data to Wisdom." *Journal of Applied Systems Analysis* 16: 3-9.

Knowledge Management Cognitive Pyramid



Source: By Matthew.viel - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=49310779>

Different purposes for water data & information



Water data and information management are particularly needed for

Sectorial water management

- Industry fishing etc.
- Drinking water supply
- Irrigation
- Energy
- Health
- Transportation

Integrated Water sector planning

- Local level
- Basin level
- National level
- Transboundary basins

Climate change adaptation

Disaster risk reduction

- Flood
- Shortage
- Drought

Reporting

- Global (ex SDG)
- Regional (ex EU)
- National statistics
- Specific conventions

Specific decision taking

- Operational management
- Territory management
- Emergency situation

Other water sector activities

- Regulatory aspects
- Partners/ Public Information

efficient water resource management cannot exist without efficient access to and management of the necessary data and information

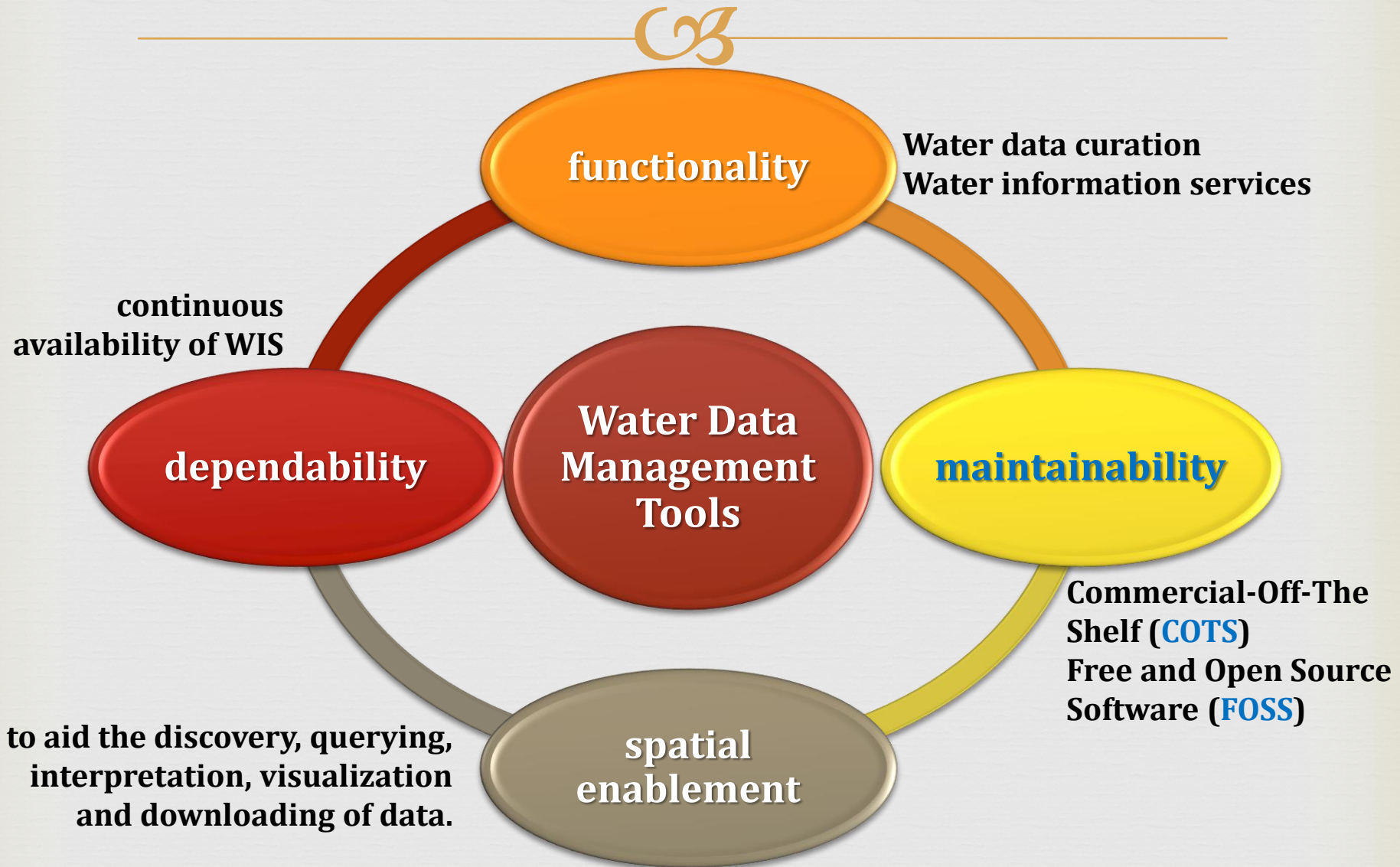
Source: The Handbook on Water Information Systems Administration, Processing and Exploitation of Water-related Data www.unesco.org/water/

Why is organizing access to water-related data so complex?



- ❧ **Multiple data producers on many topics**
- ❧ **The data is usually incomplete and dispersed**
- ❧ **Lack of homogeneity and comparability**
- ❧ **Lack of traceability of existing datasets and difficulties to identify what exists**
- ❧ **Lack of legislative and institutional frameworks organizing access and dissemination of water-related information**
- ❧ **Data produced with public funds are not always freely accessible, and datasets are considered confidential**
- ❧ **Lack of financial and human resources**

Selecting the right water data management tools



Water data production



produced through various **data collection processes**, managed by numerous **institutions**, and generally organized through

- ❧ **Monitoring programmes established at national, basin and local/organization levels;**
- ❧ **Self-monitoring processes (e.g. by individual industries relating to discharges);**
- ❧ **Surveys / inventories / inspections carried out by statistical services or administrative services involved in the management of water resources (basin organisations, municipal services, etc.);**
- ❧ **Studies and simulations (impact studies, technical study of works, etc.).**

Sources of water data



❧ In-situ monitoring

- ❧ Meteorological networks
- ❧ Hydrological monitoring networks
- ❧ Water quality monitoring networks
- ❧ Groundwater & quality monitoring

❧ Remote sensing

- ❧ Precipitation, Evapotranspiration
- ❧ Streamflow, Water levels
- ❧ Soil moisture, Snow and Ice
- ❧ Groundwater, Water Quality

❧ Crowd sourcing



Data processing, information production and visualization

Water data processing and analysis

to transform raw data into understandable information that corresponds to requirements and to the target public

Transforming datasets into useful and understandable information: dashboards, indicators, maps, graphs, etc.

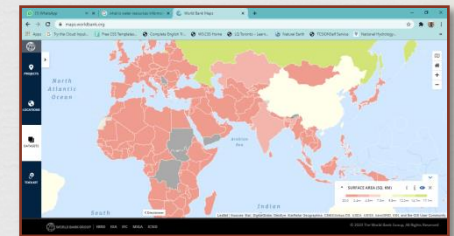
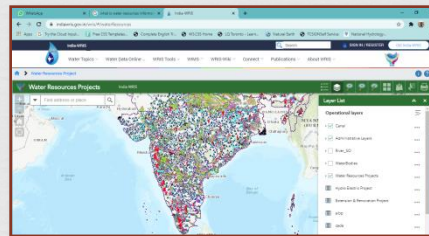
Tools and methods for disseminating information

Web portal / Website

Smartphone Apps

E-book

Social networks



Main domains of application



- ❧ **Integrated Water Information Systems for IWRM and planning at basin and national levels**
- ❧ **Water information systems for climate change adaptation**
- ❧ **Early warning systems for flood and drought period management**
- ❧ **Water information systems for aquatic ecosystem protection**
- ❧ **Sectorial and thematic water information systems (drinking water and sanitation, irrigation, hydroelectricity, groundwater, etc.)**
- ❧ **Water information systems for reporting (SDG, WFD, Flood Directive, etc.)**
- ❧ **Water information systems for transboundary basins**

Australian Water Resources Information System (AWRIS)



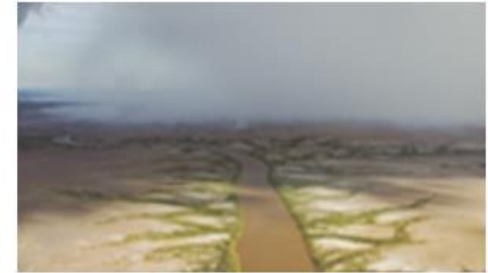
Water data

- Climate Resilient Water Sources
- Design Rainfalls
- Geofabric
- Groundwater Information
- Hydrologic Reference Stations
- Water Market Information
- Water Data Online



Water status

- Water Assessments
- Landscape Water Balance
- National Water Account
- Urban National Performance Report
- Urban Water Information
- Water Restrictions
- Water Storage
- Water Focus Reports
- Water Reporting Summaries
MDB Catchments

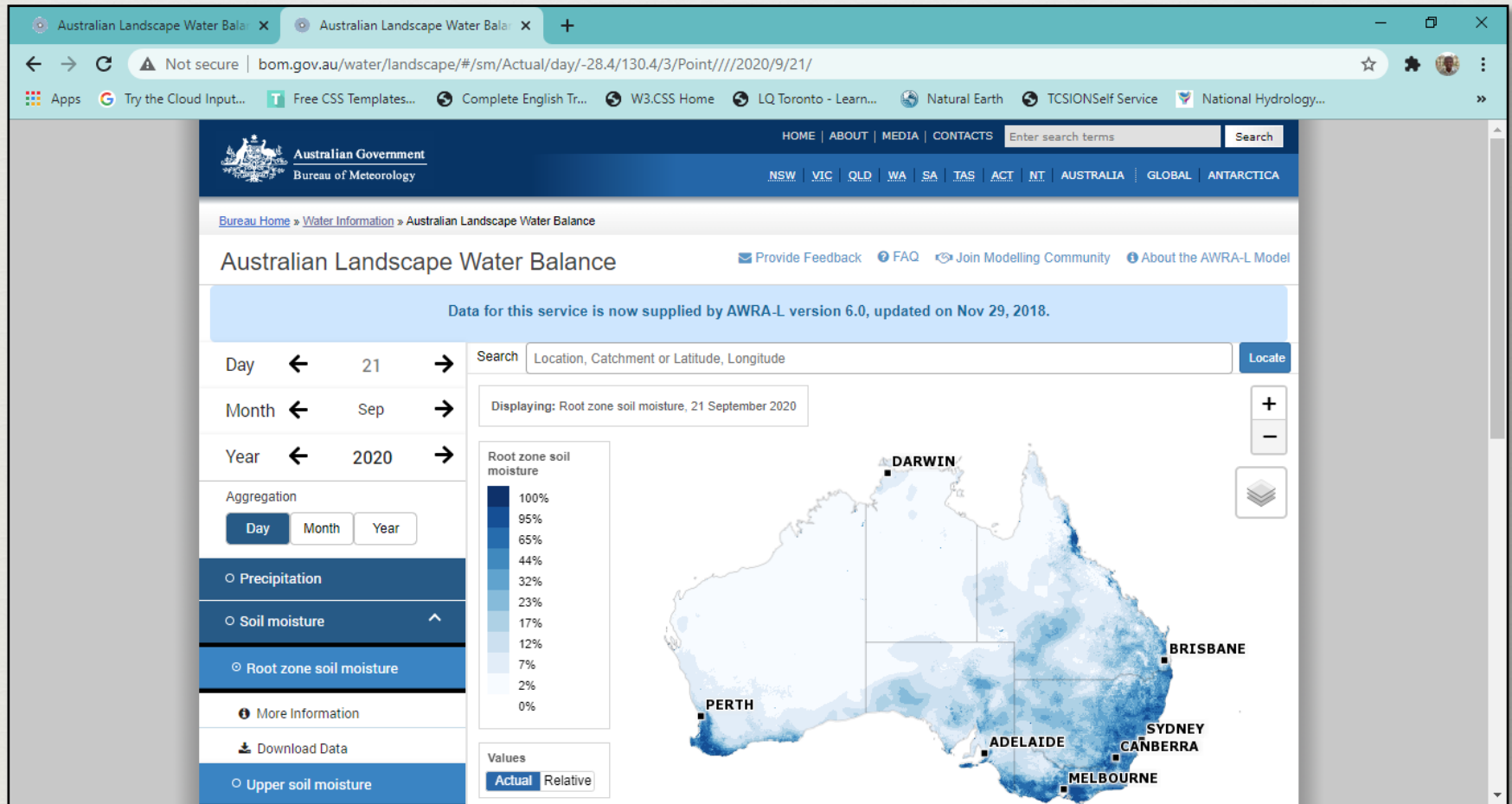


Water forecasts

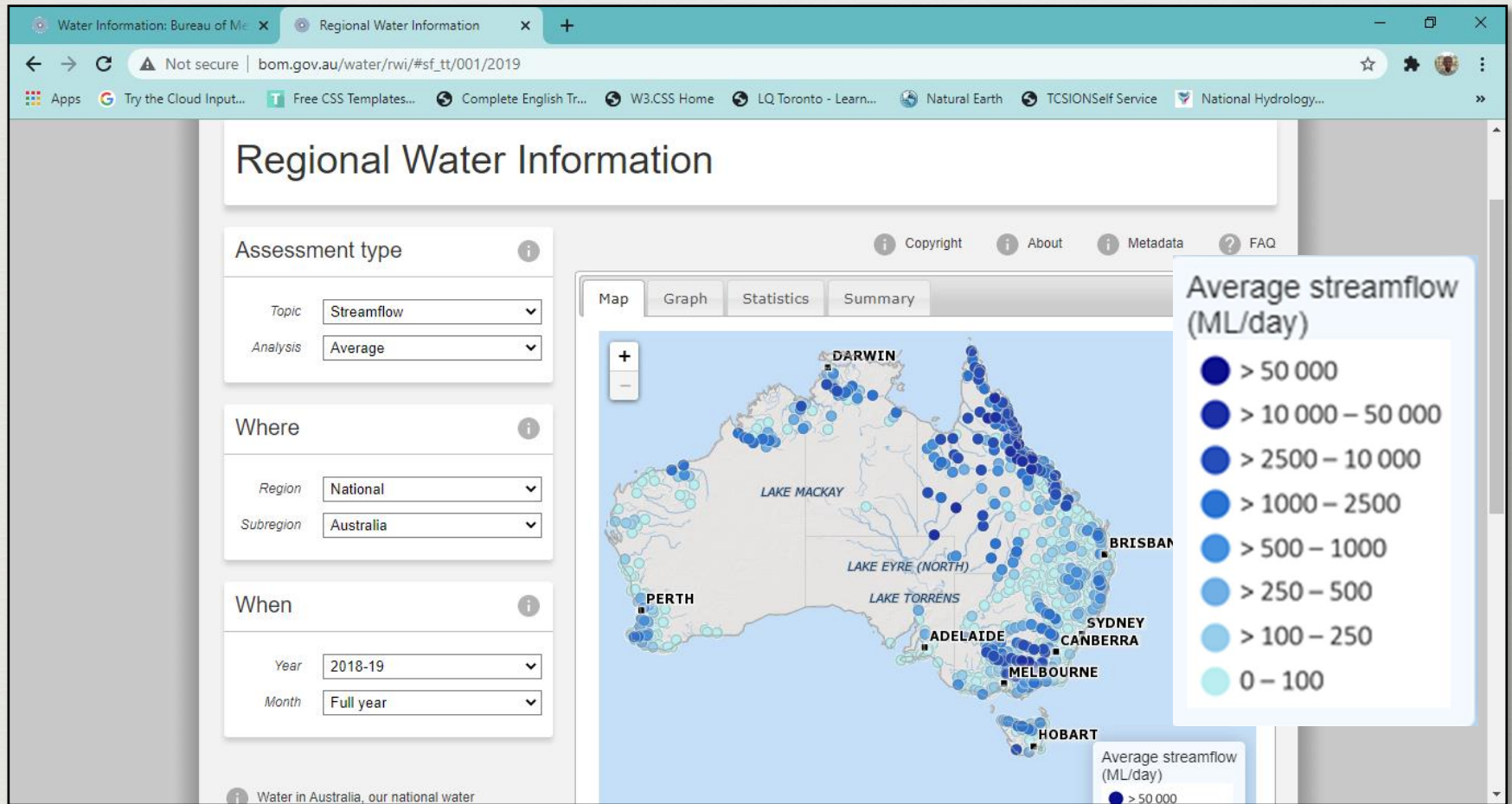
- Floods
- 7-day Streamflow Forecasts
- Seasonal Streamflow Forecasts

<http://www.bom.gov.au/water/index.shtml>

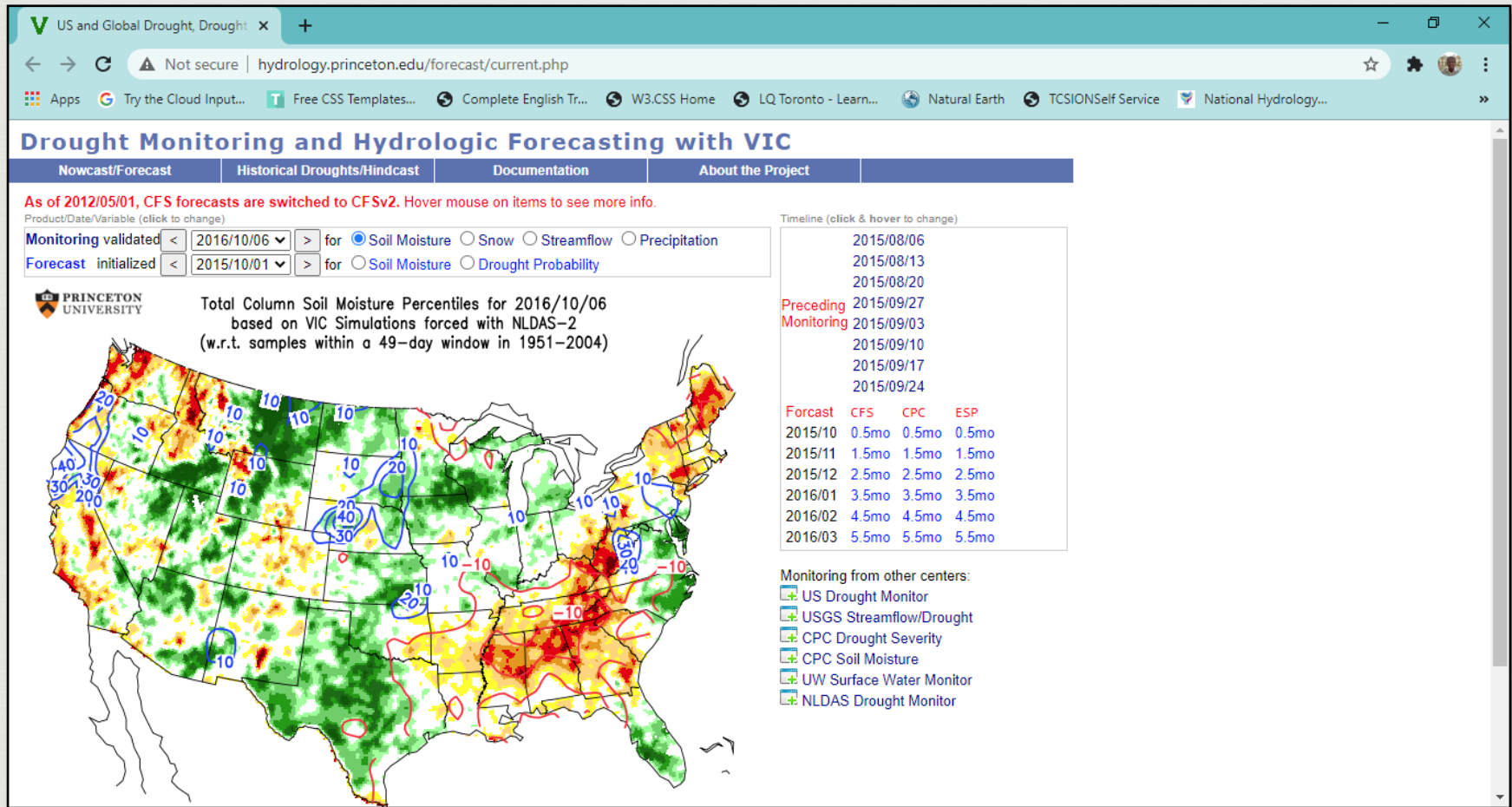
Australian Landscape Water Balance



Regional Water Information

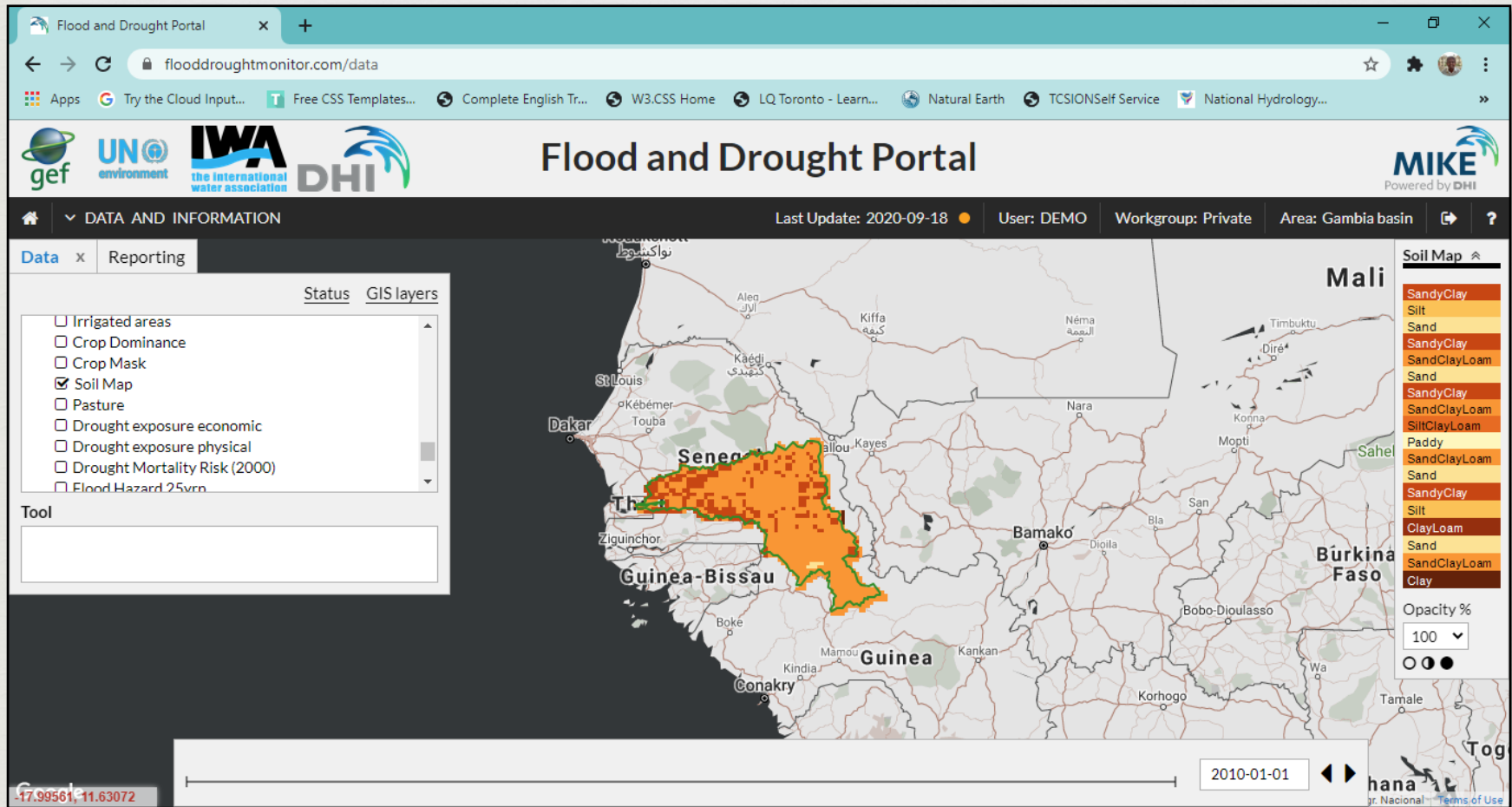


Drought Monitoring and Hydrologic Forecasting with VIC



<http://hydrology.princeton.edu/forecast/current.php>

Flood and Drought Portal



<https://www.floordroughtmonitor.com/data>

National Hydrology Project (NHP)

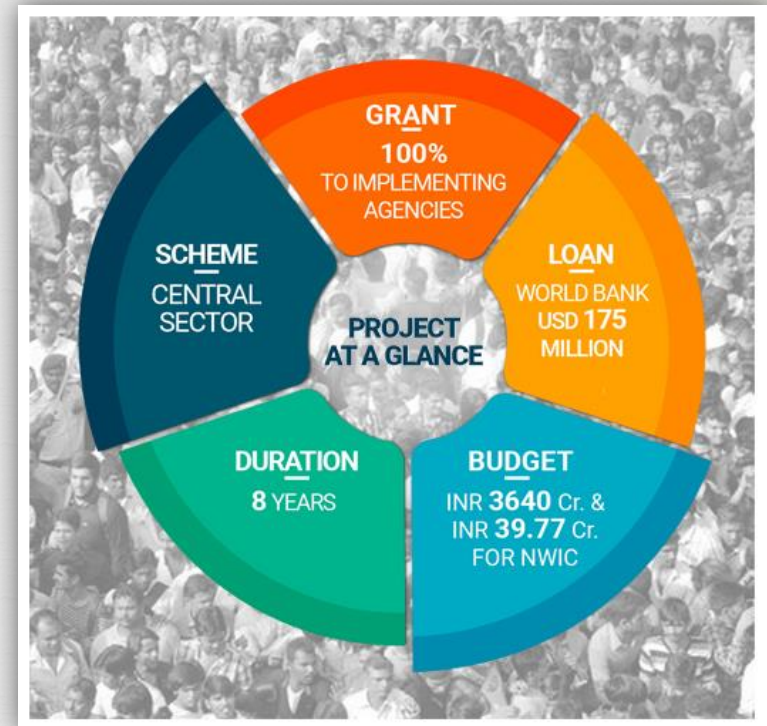


Objective

to improve the extent, quality and accessibility of **water resources information**, and to **strengthen the capacity** of water resources management institutions in India.

Four components of NHP

- A. Water Resources Monitoring System
- B. Water Resource Information System**
- C. Water Resources Operation And Planning System
- D. Water Resources Institutions Capacity Enhancement

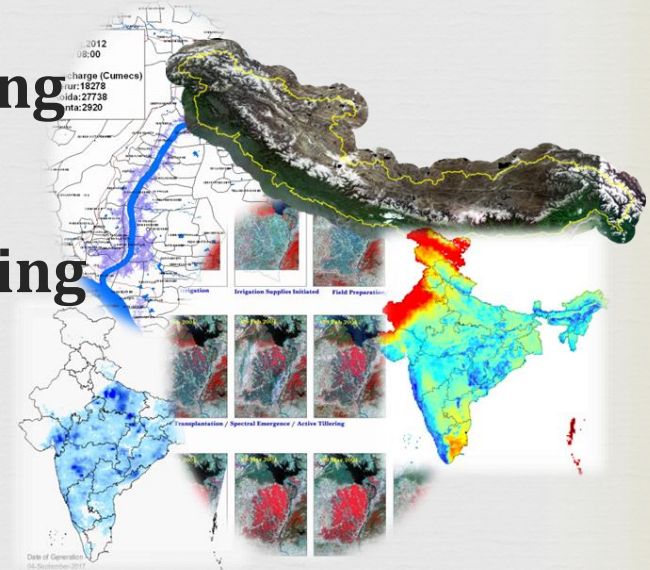


Source: <http://nhp.mowr.gov.in/>

NRSC @ NHP



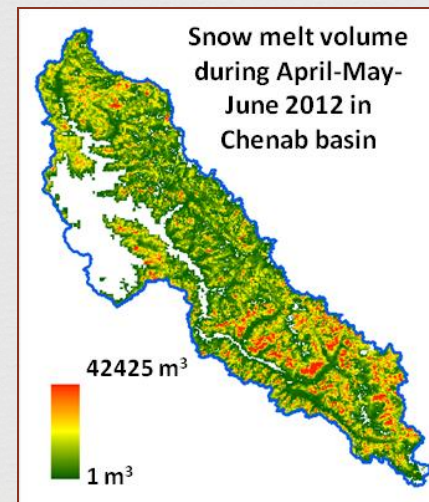
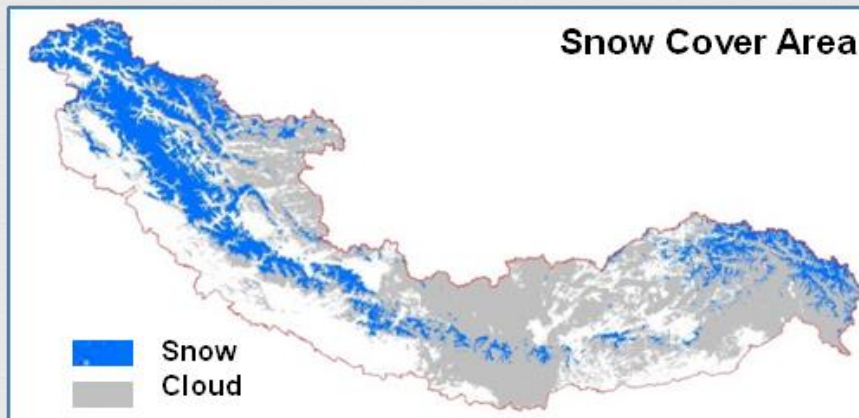
- ❧ Spatial Snowmelt Runoff
- ❧ GLOF Risk Assessment of Glacial Lakes
- ❧ National Hydrological Modelling System
- ❧ Regional Evaporative Flux Monitoring System
- ❧ Spatial Flood Early Warning System
- ❧ Spatial Inputs for Irrigation Scheduling
- ❧ Hydrological Drought Services
- ❧ RS & GIS Training and Capacity Building



Spatial Snowmelt Runoff



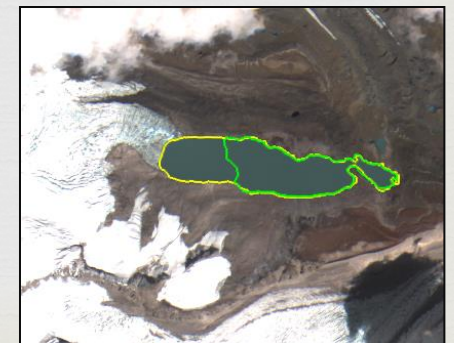
- Daily snow cover map **at 1 km resolution** from year 2017 onwards.
- 3-day **(at daily time-step)** spatial snowmelt runoff forecast product during snow melt season.
- Short term **(3-day)** and seasonal **(3 months)** snowmelt runoff forecast at selected basin outlets during snow melt season.



GLOF Risk Assessment of Glacial Lakes



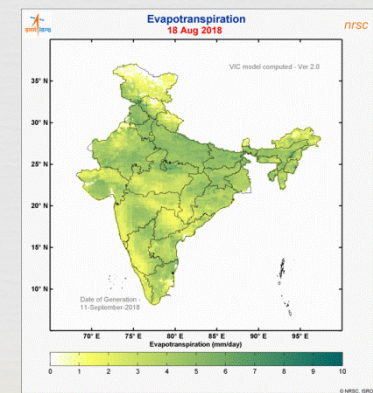
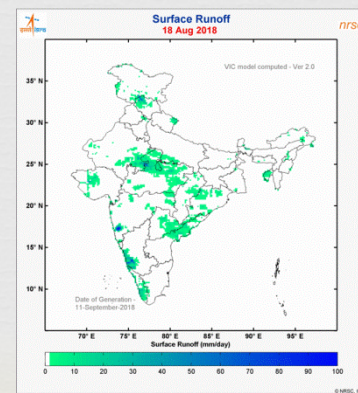
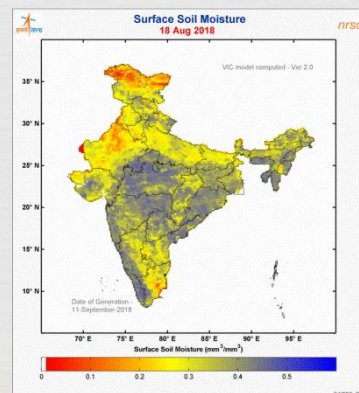
- Inventory of glacial lakes (> 0.25 ha) Himalayan region of Indian River basins using 2016-17 data
- Prioritization and critical GLOF risk lakes
- High resolution DEM for d/s of critical GLOF risk lakes
- Simulated flood inundation maps under different scenarios for the critical lakes
- GLOF risk visualisation system



National Hydrological Modelling System



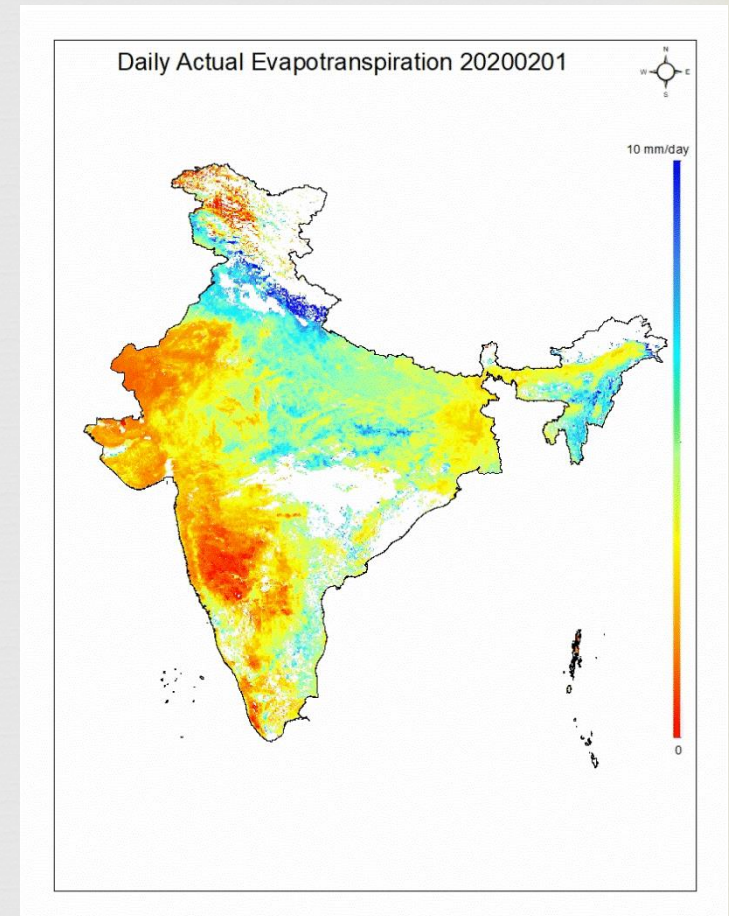
- Model derived daily Soil Moisture, Surface Runoff, Evapotranspiration at 5.5 km resolution in near real time (2017-18 onwards)
- Regional (watershed/sub-basin/basin) and temporal (daily, fortnightly, monthly and annual) estimates
- 3-day inflow forecast (selected major reservoirs) and surface runoff forecast (selected river reaches)
- Long term (1951 onwards) database on water balance components



Regional Evaporative Flux Monitoring System



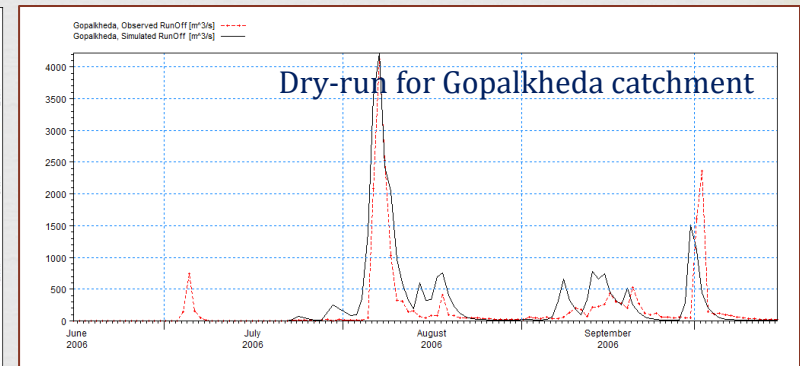
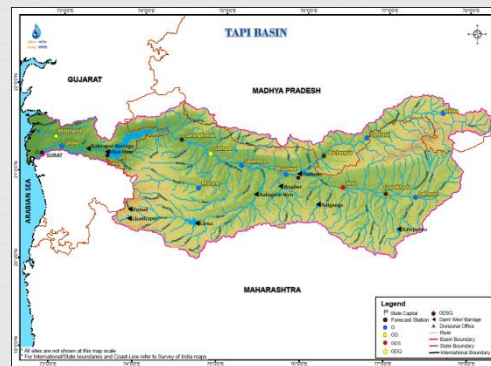
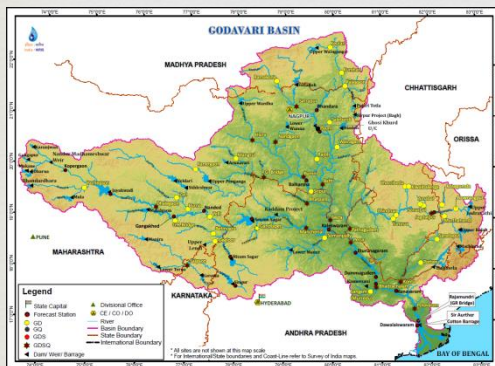
- Daily actual evapotranspiration (mm/day) estimate **at 5.5 km spatial resolution** in near real time.
- Long term (**from 2004 onwards**) ET database
- Regional ET estimates at spatial scales of **watershed/sub-basin/basin** and at temporal scales of **daily, fortnightly, monthly and annually**



Spatial Flood Early Warning System



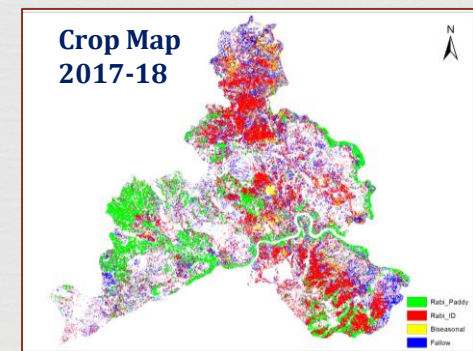
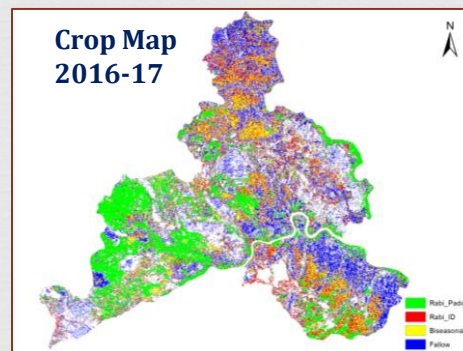
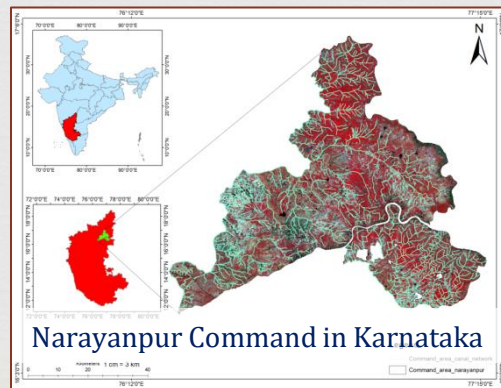
- Flood forecast models for Godavari (by Sep 2019) and Tapi (by Sep 2020)
- Spatial flood early warning models for Godavari (by Dec 2020) and Tapi basin (by Dec 2021)
- Web based flood inundation maps and mobile based flood alerts with improved lead time for Godavari (by March 2021) and Tapi (by Dec 2021)



Spatial Inputs for Irrigation Scheduling



- Forecast of weekly/fortnightly canal irrigation schedule (up to tertiary canal level) - Progressively during the season - Rabi 2019 onwards
- Seasonal cropping pattern and crop condition - Rabi 2019 onwards
- Command Area Performance assessment
- Development of decision support system for improved irrigation water management

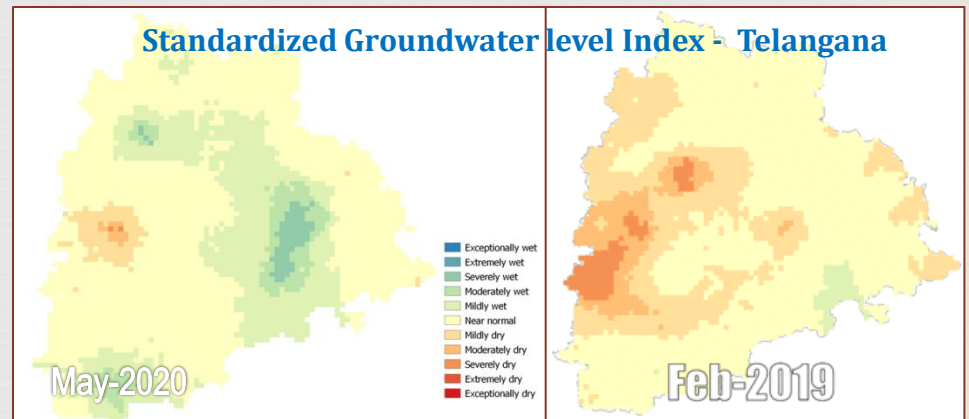
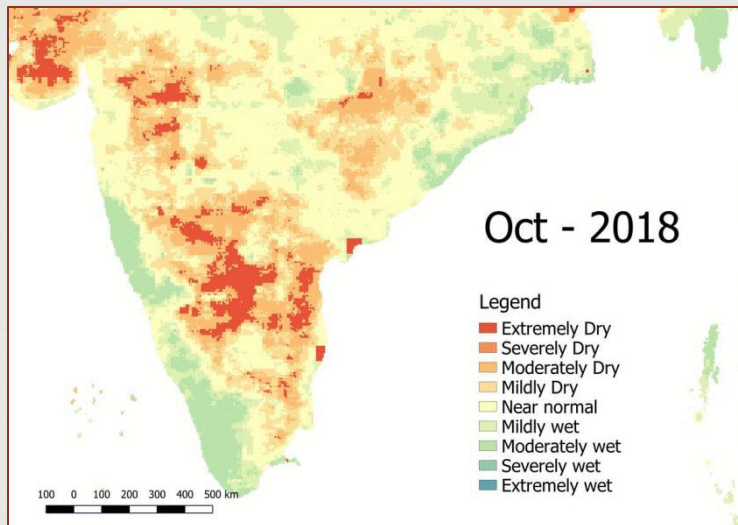


Hydrological Drought Services



- Providing near real time hydrological drought status at fortnightly/monthly interval at administrative/ hydrological unit level
- Development of indicators like SRI (Runoff), SGWI (Groundwater), SRSI (Reservoir), SWSI (Water spread area)
- Historic hydrological drought status (2000 onward)

Standardized Runoff Index: Hydrological drought propagation
(Chennai water crisis and Kerala flooding captured Jul18-Feb19)

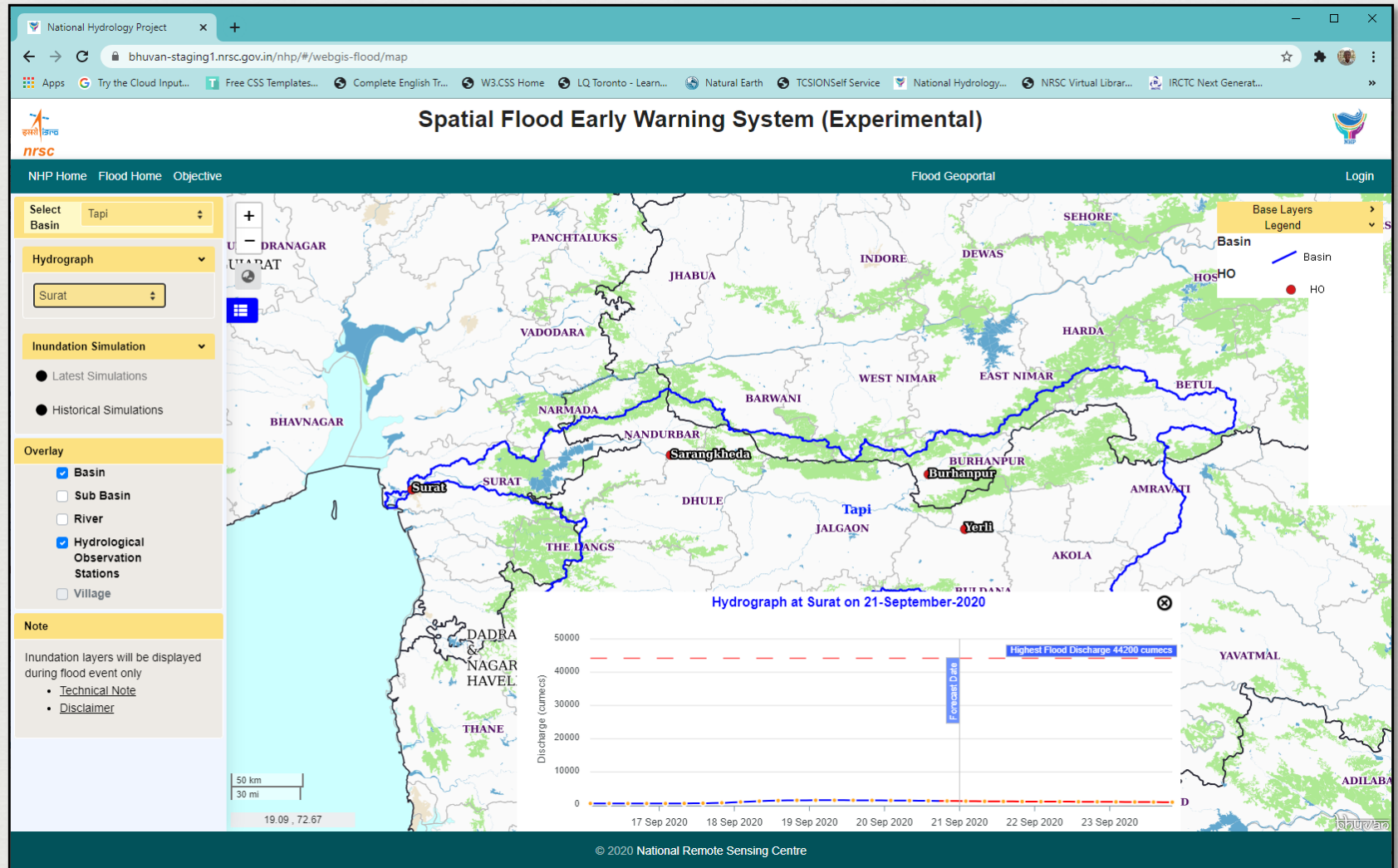


NRSC NHP Portal



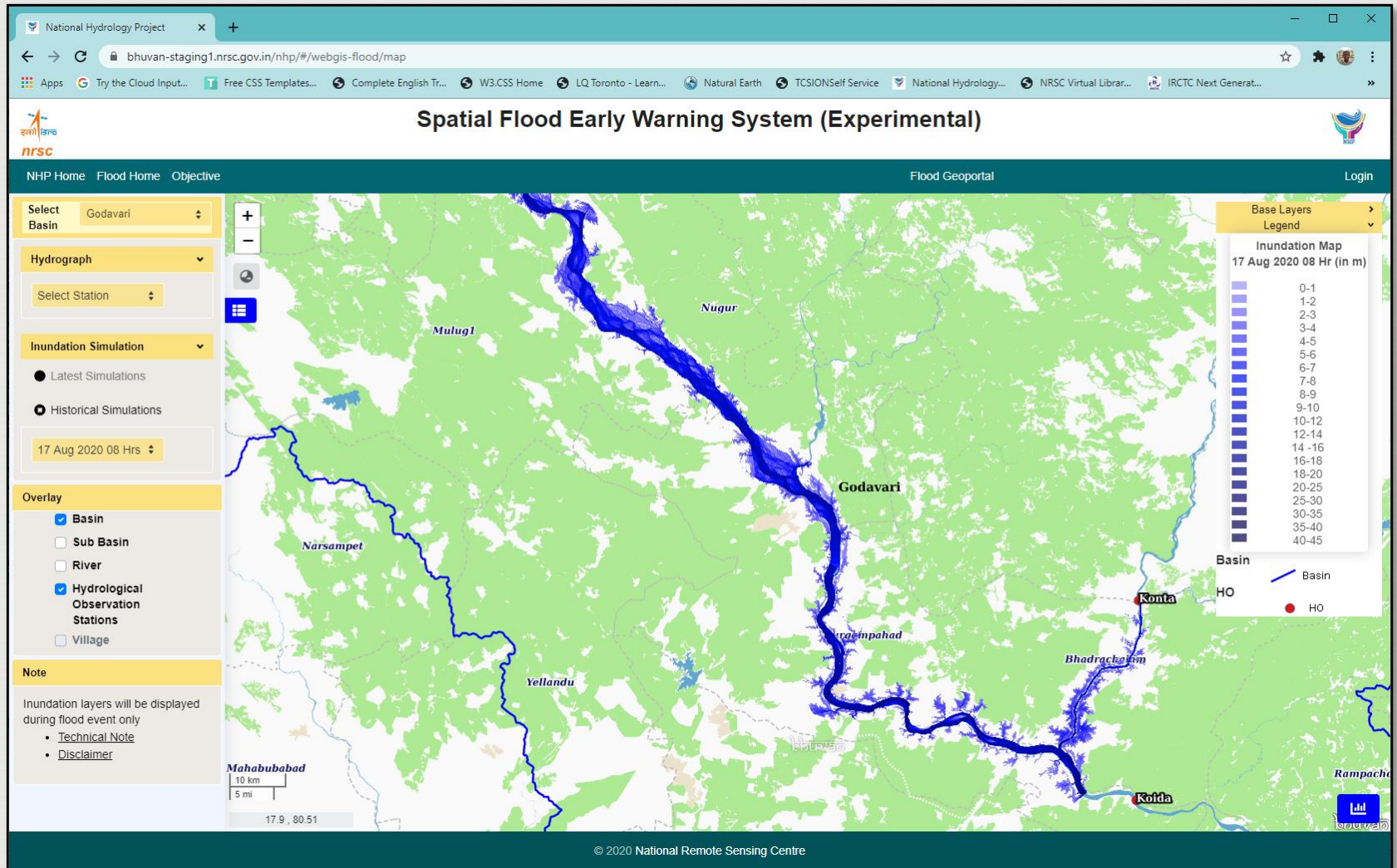
The screenshot shows the NRSC NHP Portal website. The browser address bar displays "bhuvan-staging1.nrsc.gov.in/nhp/#/". The page header includes the NRSC logo, the title "National Hydrology Project", and the subtitle "National Remote Sensing Centre". A navigation menu contains "Home", "About", "Project Teams", and "Projects". On the right, there are "Login" and "Register" links. The main content area features a large satellite image of a river valley. Below it is a grid of eight project categories, each with a representative image and a title: "Flood Early Warning", "Evapotranspiration", "Glacial Lakes", "Snowmelt Runoff", "Hydrological Modelling", "Irrigation Management", "Hydrological Drought", and "Capacity Building". The footer contains the copyright notice "© 2020 National Remote Sensing Centre".

Spatial Flood Early Warning System

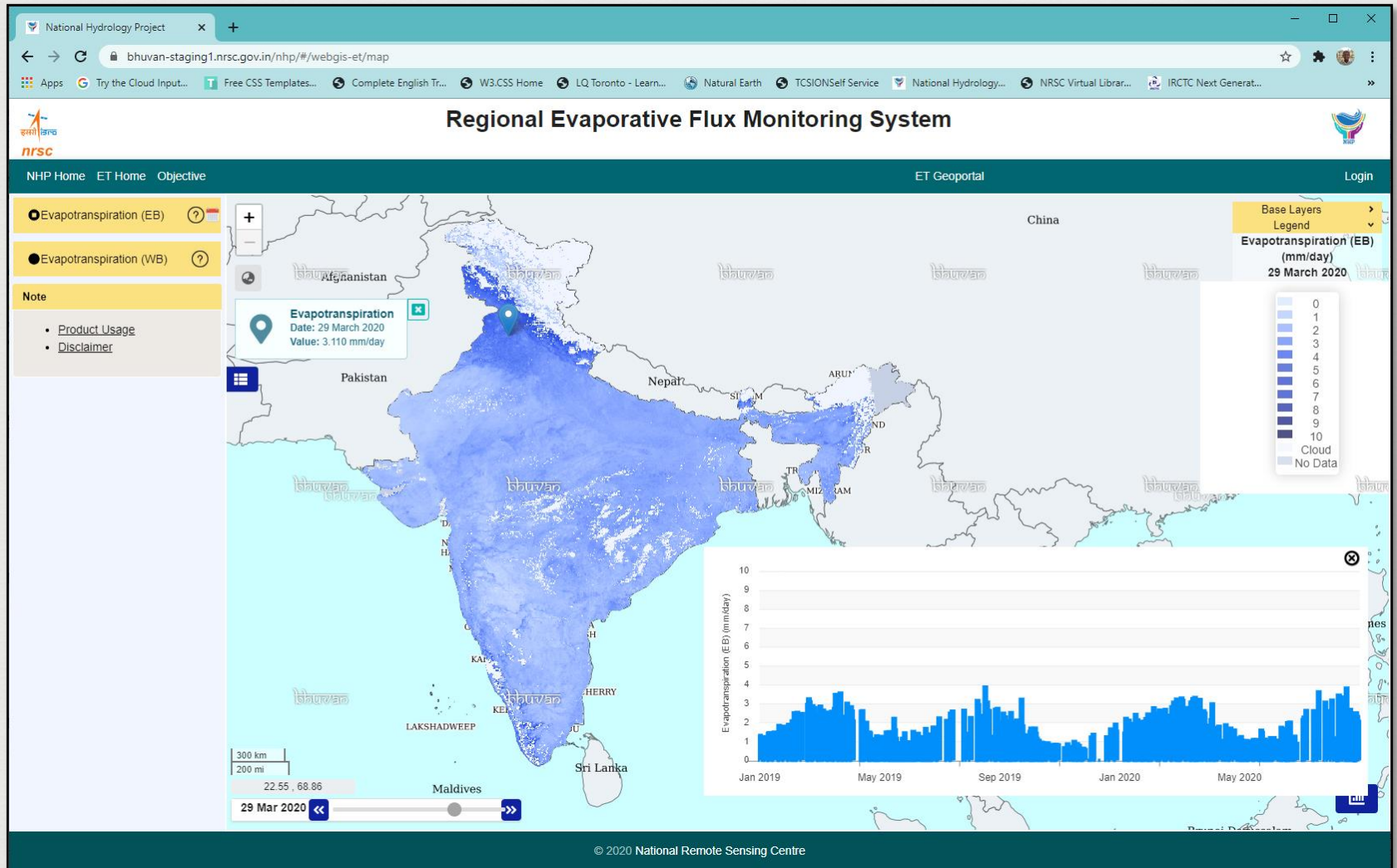


© 2020 National Remote Sensing Centre

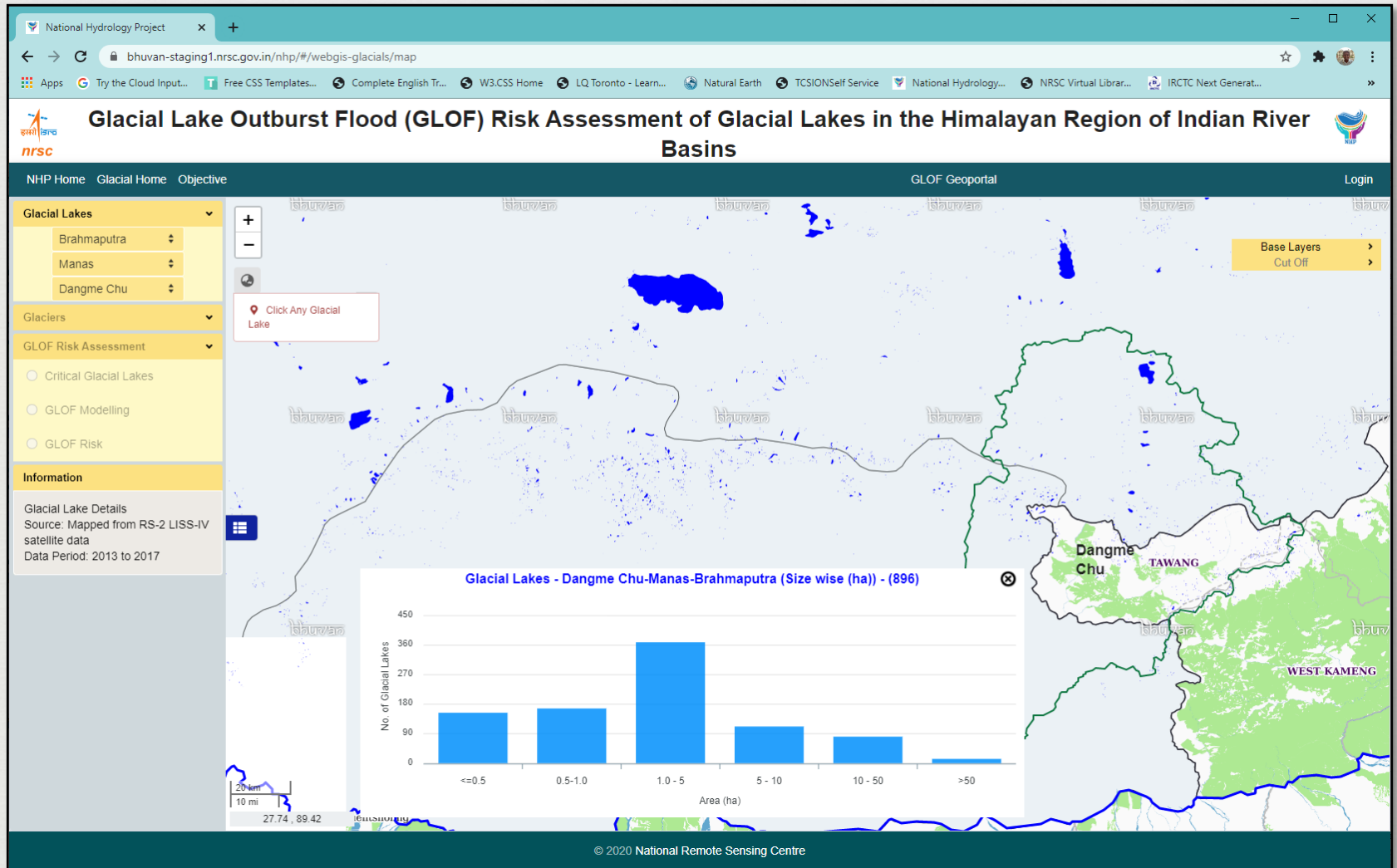
Spatial Flood Early Warning System



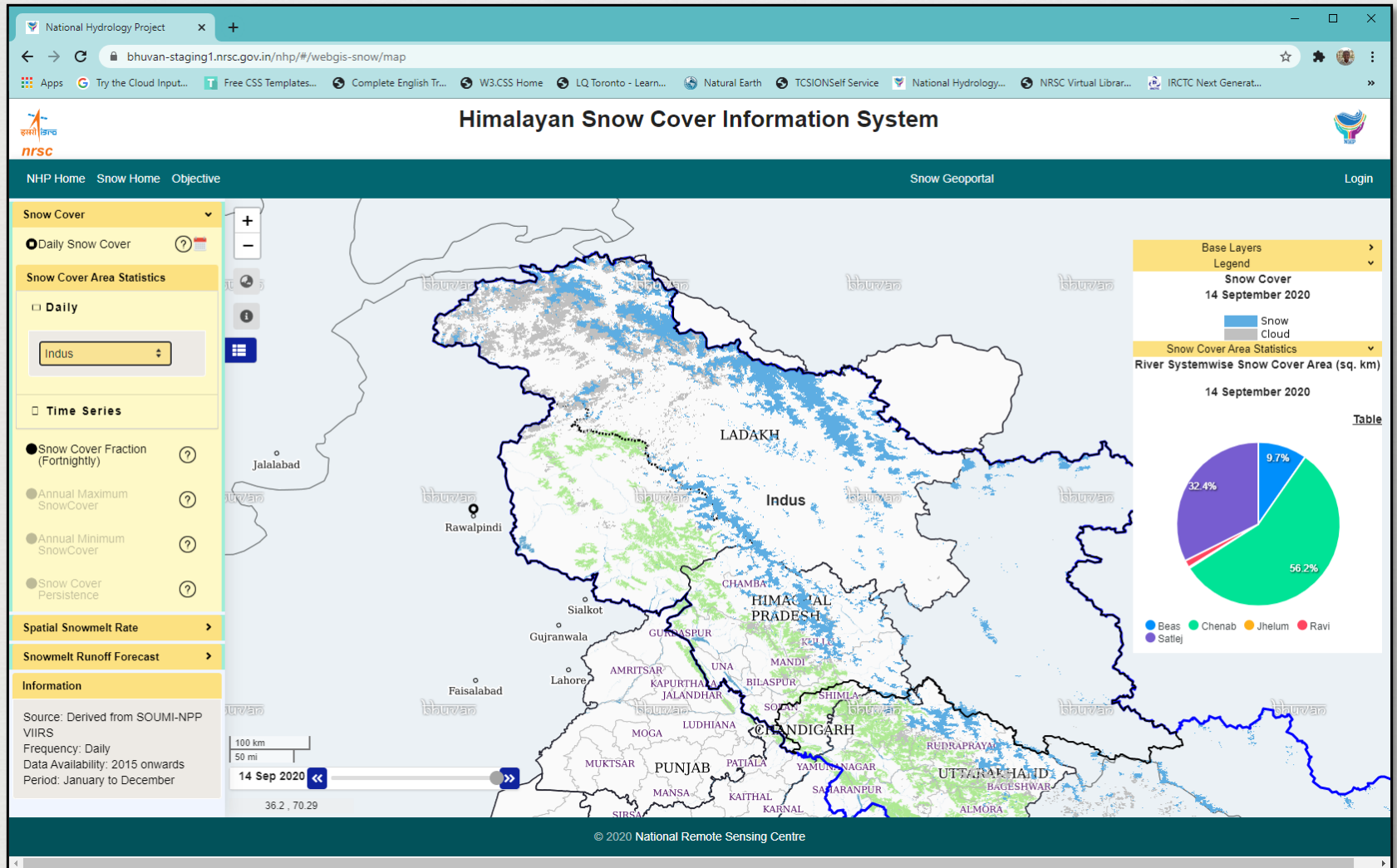
Regional Evaporative Flux Monitoring System



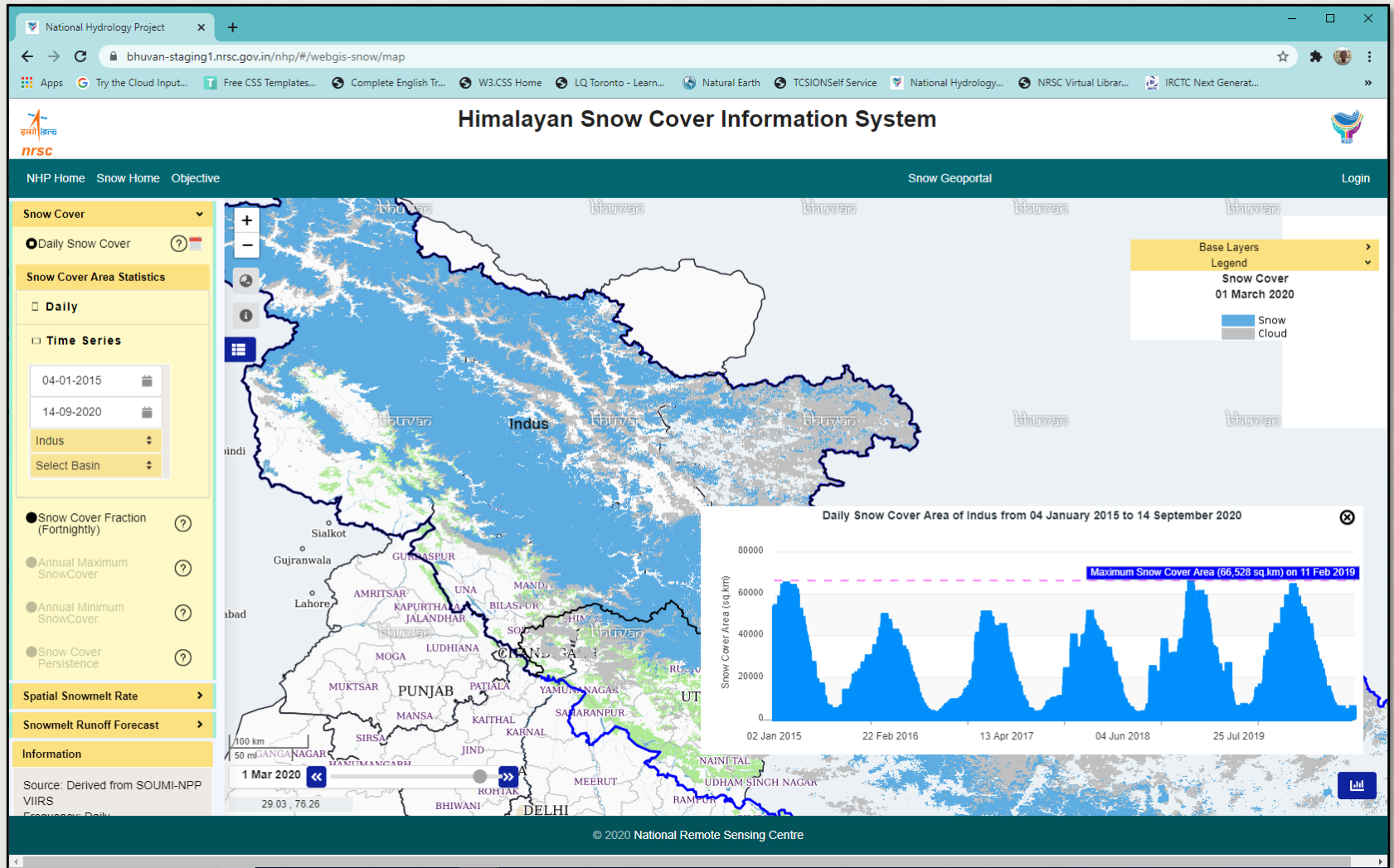
Glacial Lake Outburst Flood (GLOF) Risk Assessment



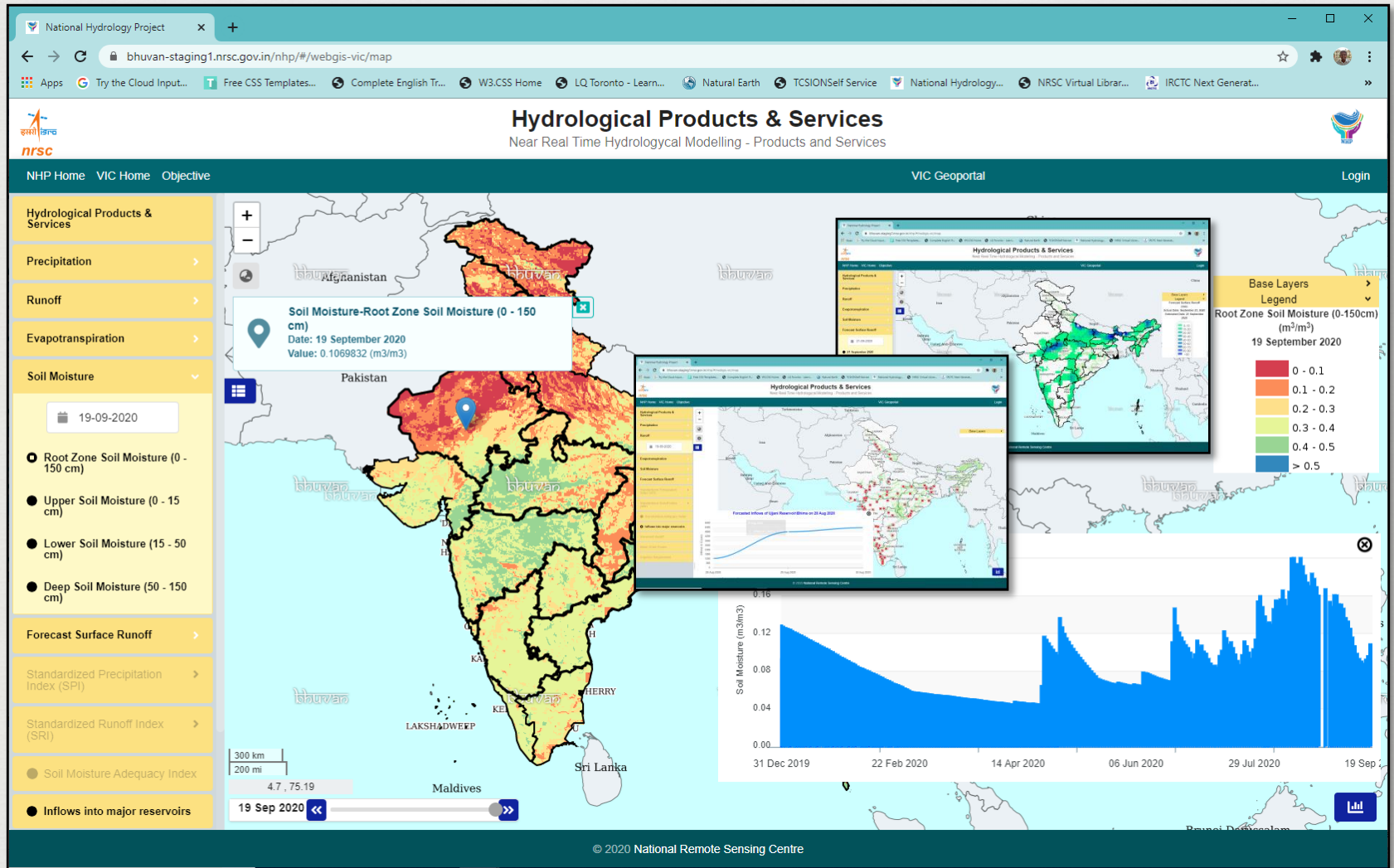
Himalayan Snow Cover Information System



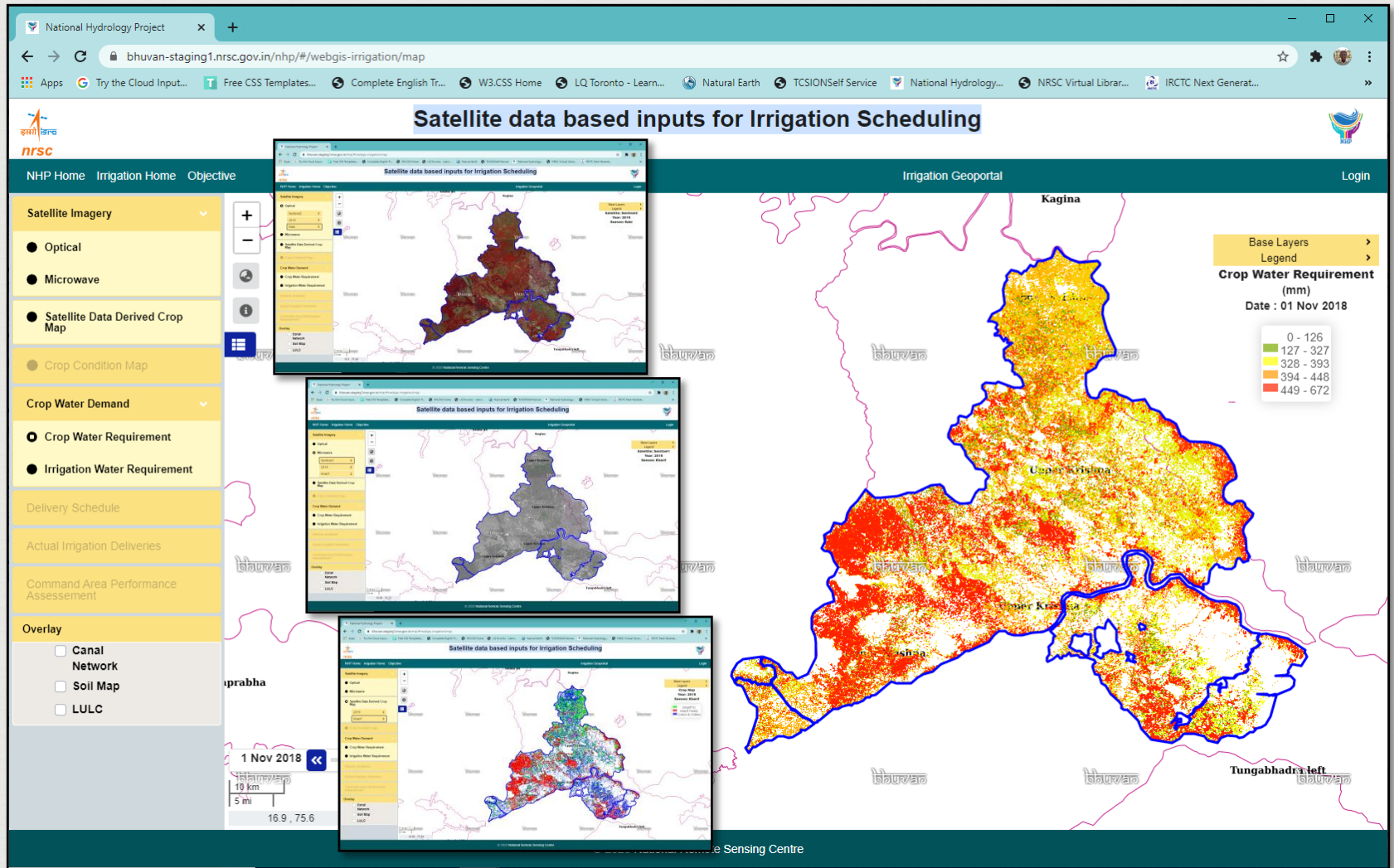
Himalayan Snow Cover Information System



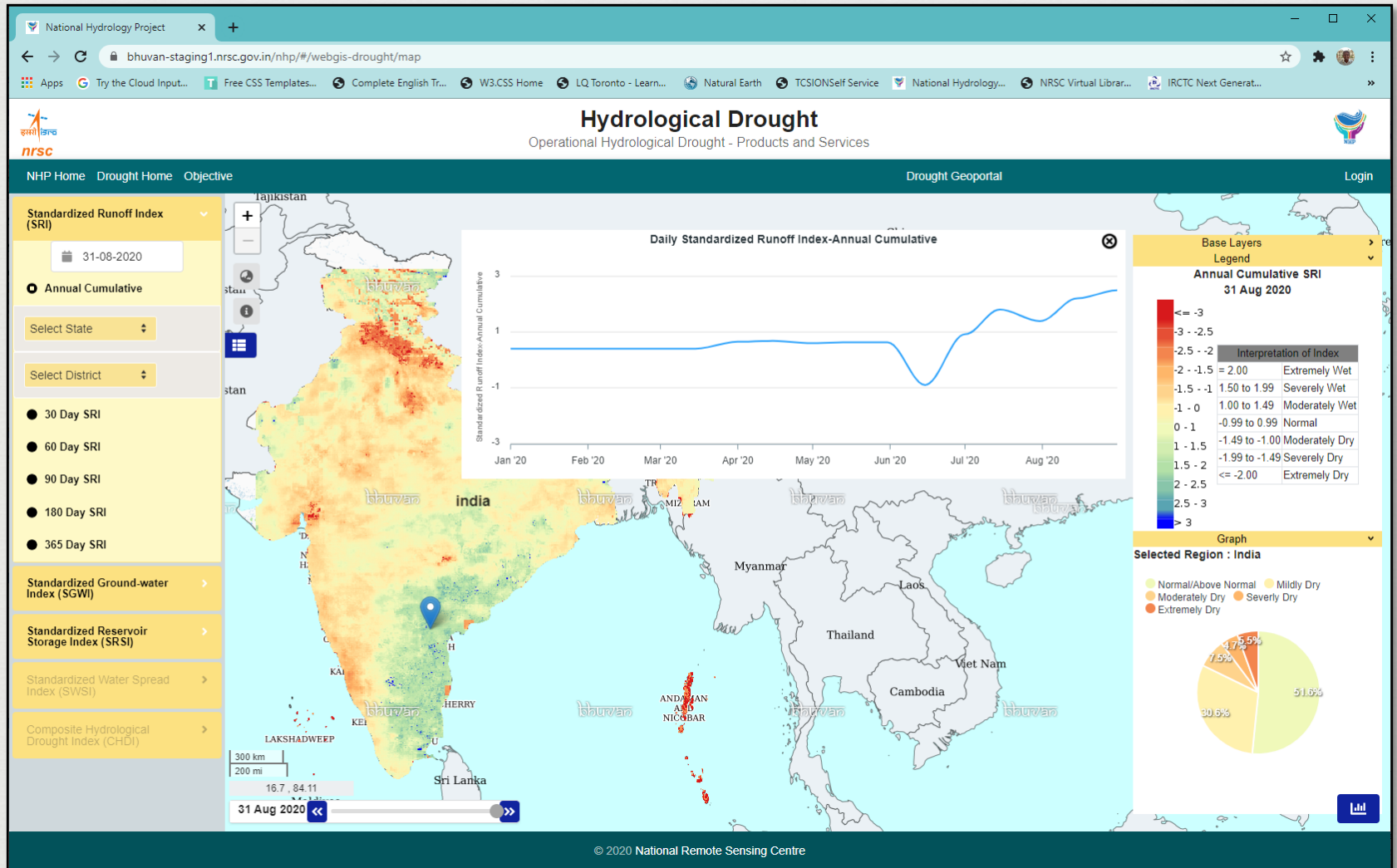
Hydrological Products & Services



Satellite data based inputs for Irrigation Scheduling



Hydrological Drought



Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ



Telanga Water Resources Inform x +

bhuvan-app1.nrsc.gov.in/twr/twr.php#

Apps Try the Cloud Input... Free CSS Templates... Complete English Tr... W3.CSS Home LQ Toronto - Learn... Natural E

**Irrigation Department, Govt. of
Telangana has entered in to MoU with
NRSC, ISRO on 6th August, 2016 to
develop a geoportal
“Telangana Water Resources
Information System (TWRIS)”**

Telanga Water Resources Inform x TWRIS Dashboard

bhuvan-app1.nrsc.gov.in/twr/twr.php

ISRO Indian Geo-Platform of ISRO

Telanga Water Resources Information System
తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Welcome User Logout

Enter City or Loc (Auto-complete on) []

Show Telangana Only

Base Map

- Administrative
 - District Boundary
 - Mandal Boundary
 - Village Boundary
 - Mandal HQ
 - Habitations Information
 - Cadastrel Boundary
 - Terrain
 - Infrastructure
- Water Resources Projects
- Hydrological Data
- Cropping Patterns
- Natural Resources
- Compendium
- Map/Business
- Field Data Viewer
- Project Search

Activate Swipe

Download Field Data Collection App for Android

Mobile App Info Document

**Telangana Water Resources
Information System**

A Complete Geoportal & Dashboard for TWRIS

TWRIS GEOPORTAL **TWRIS DASHBOARD**

<https://bhuvan-app1.nrsc.gov.in/twr/twr.php>

Geospatial Layers Generated

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Welcome User [Login](#)



Major & Medium Irrigation Projects

- Salient features, canal network, distributary command boundary, WUA boundary, crop statistics, irrigation potential statistics

Major Projects: **23** (Completed - 9 & On-going - 14)

Medium Projects: **42** (Completed - 32 & On-going - 10)

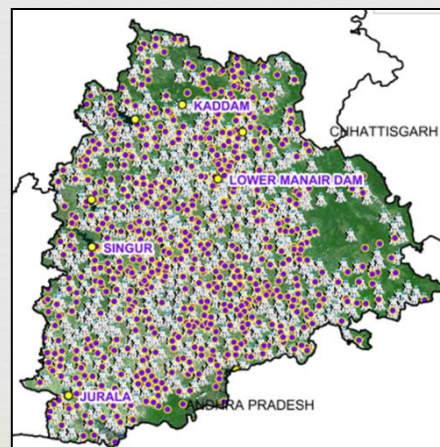
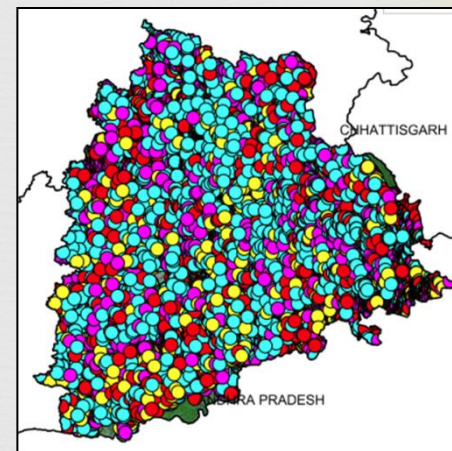
Minor Irrigation Projects

- Geoid, Tank Name, Tank Type, Village, Mandal, District, Sub Division, Division, Circle, Minor Basin, Major Basin, Mission Kakatiya Phase

Total tanks geotagged: **45,082**

Hydromet Data

- Daily AWS data - **863**
- Daily reservoir level data - **72**
- Monthly groundwater level data - **750**



Detailed canal attributes

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Welcome User [Login](#)



Enter City or Lat, Lon(ex:chennai or 13

Tools | Link | Home

Show Telangana Only

Base Map [New](#)

Water Resource Projects [New](#)

Administrative

Major & Medium Irrigation Projects

Select Project **Kaddam Nar** ▾

[See all projects details](#)

[Salient Features](#)

[Cropping Statistics](#)

[IPC Statistics](#)

Administrative

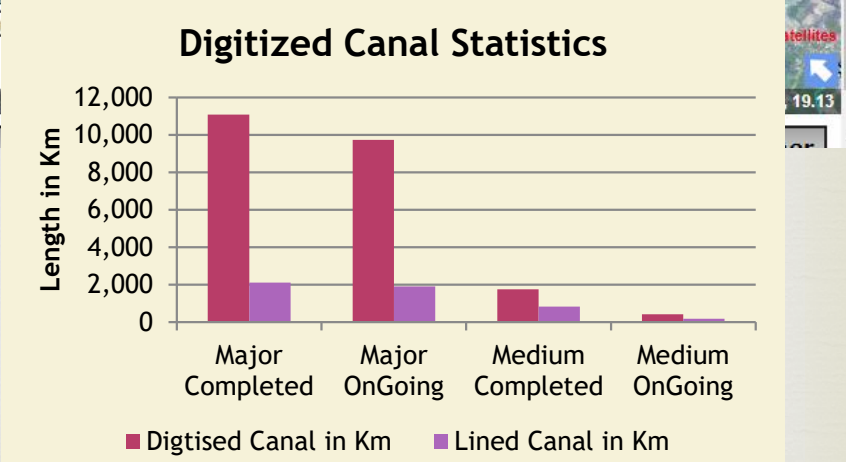
Hydrological

Hydromet

Cropping Pattern (Kharif - 2016)

Canal Information	
Name	D12
Parent Canal Name	Left Flank Main Canal
Type	Distributory
Off Take Chainage (km)	26.212
Length (km)	3.810
Carrying Capacity (cumecs)	0.821
CBWM	1.372
CTWM	4.804
CLINING	LINED
TYPE LINING	CC LINING
IPCHA	250.506
KHARIF CROPS	Paddy,Cotton
RABI CROPS	Paddy,Maize,Pulses
IRSECOFF	Jannaram
IRSDOFF	Sub Division No-01, KNR Project,Kaddam Division No-04, KNR Project, Kaddam G.V.C -1, S.R.S. Project, Pochampad KNR46 Kaddam Narayana Paddy Project Com

Map | ▾ | **Satellite** | Hybrid | Terrain | More



Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

The screenshot shows the TWIRIS web application interface. At the top, there is a navigation bar with the title "Telangana Water Resources Information System" and the Telugu equivalent "తెలంగాణ జలవనరుల సమాచార వ్యవస్థ". Below the title, there is a search bar and a sidebar with various filters. The main map area displays a satellite view of Telangana with various water resource projects overlaid, including the Krishna Dam, Nizam Sagar Project, and others. The sidebar contains the following sections:

- Administrative**
 - Major & Medium Irrigation Projects
 - Minor Irrigation Projects
 - All Projects
- TS Irrigation Profile Map**
 - Pump Houses
 - New Reservoirs
 - All Canals
 - Additional Canals
 - District Boundary
 - River
 - Major Irrigation Projects
 - Medium Irrigation Projects
 - New Ongoing Projects
 - Completed Command Area
- Hydromet Data**
- Cropping Pattern**
- Natural Resources**
- Groundwater New**
- Miscellaneous**
- Field Data Viewer**
- Project Search**

At the bottom of the sidebar, there is a button to "Download Field Data Collection App for Android". The main map area includes a search bar, a scale bar (20 km), and a legend. The map shows various water resource projects, including the Krishna Dam, Nizam Sagar Project, and others. The interface is in Telugu and English.

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

The screenshot displays the Telangana Water Resources Information System (TWIS) web application. The main interface features a map of Telangana with various data layers. A pop-up window displays the following data:

Latest AWS Rainfall Data		
Station ID	11195	
District	Hyderabad	
Mandal	Ammerpet	
Location	Srinagarcolony	
Entry Date	September 23, 2020 11:09 AM	
Humidity	Min	75.2
	Max	92.6
Temperature	Min	23.5
	Max	31.5
Rain		0.0
Latitude		17.430462
Longitude		78.44195

Summary Report of all stations

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Telangana Water Resources Information System
తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Welcome User [Login](#)

Enter City or Lat_Lon(ex:chennai or 13:

Tools | [Link](#) | [Home](#)

Show Telangana Only

Base Map

Water Resource Projects

Administrative

Major & Medium Irrigation Projects

Select Project: **PP Rao Proj**
[See all projects details](#)

Salient Features

- [Seasonal Cropping Statistics](#)
- [Annual Cropping Statistics](#)
- [IPC Statistics](#)

Administrative

Hydrological

Hydromet

Cropping Pattern

- Kharif - 2016 [statistics](#)
- Rabi - 2017 [statistics](#)
- Kharif - 2017 [statistics](#)
- Rabi - 2018 [statistics](#)
- Kharif - 2018 [statistics](#)
- Rabi - 2019 [statistics](#)

Canal Network

- Distributary Boundary
- [Canal Statistics](#)
- [Index Map](#)
- [Avacut Map](#)

Minor Irrigation Projects

All Projects

TS Irrigation Profile Map

- Pump Houses
- New Reservoirs
- All Canals
- Additional Canals

Statistics

PP Rao Project (Yerravagu) : CCA - 11150 acre(s)
Season-wise Crop Area Statistics (in acres)

Year	Season	Paddy	Non Paddy	Total
2016	Kharif	5170	4624	9794
2017	Rabi	1719	1006	2725
2017	Kharif	6158	4194	10352
2018	Rabi	2211	320	2531
2018	Kharif	6067	1596	7663
2019	Rabi	3703	229	3932

Kharif - 2016

- Paddy: 53%
- Non-paddy: 47%

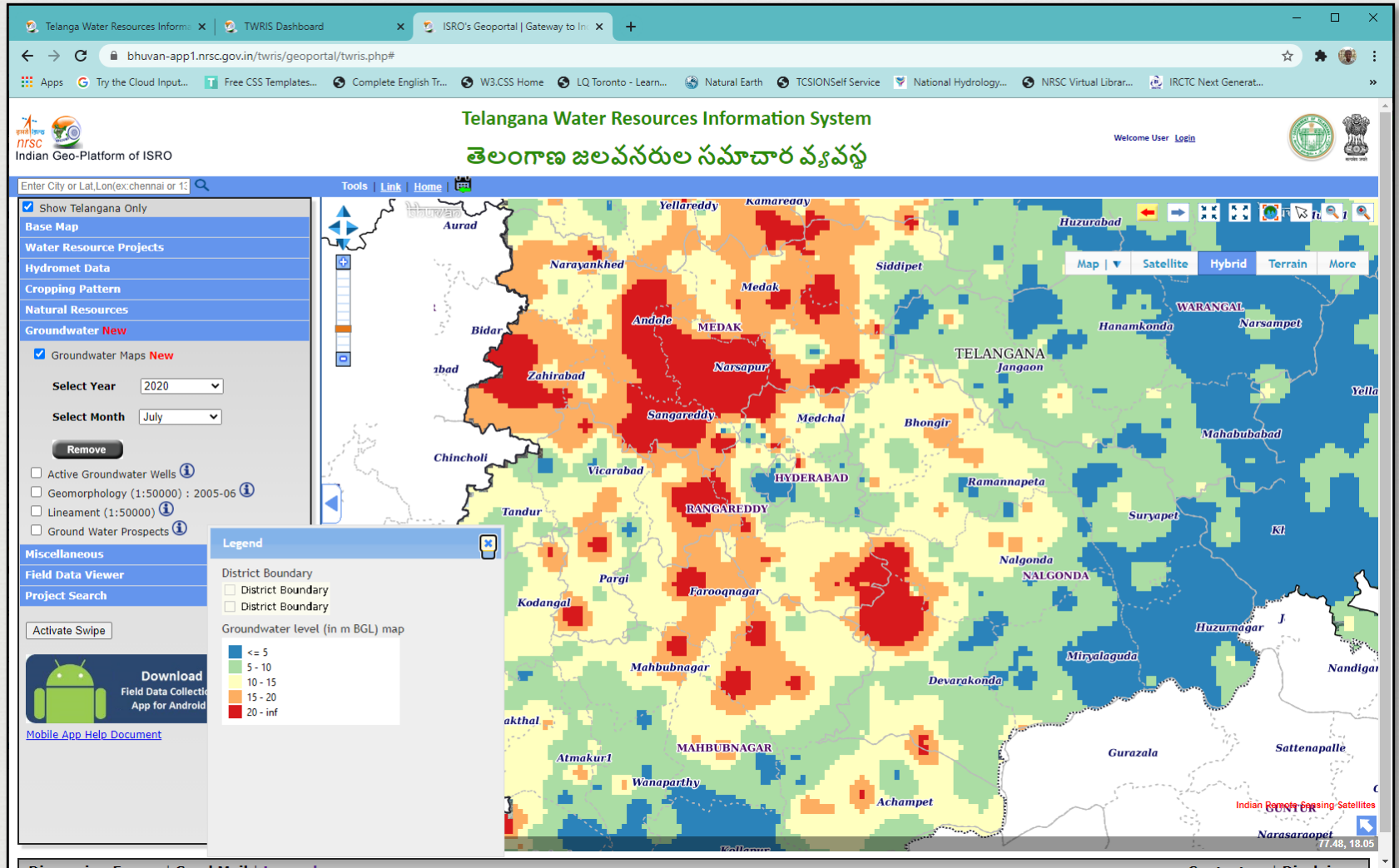
Rabi - 2017

- Paddy: 37%
- Non-paddy: 63%

79.72, 19.47

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ



Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

Telangana Water Resources Information System Dashboard

Navigation: Home | Projects Overview | Canal Network | Cropping Pattern | Rainfall Status | Reservoir Status | Groundwater Status

Projects Overview		Canal Network		Cropping Pattern (Rabi 2019)	
Projects	65	Projects	55	Projects	56
CCA(acres)	68,07,396	Canal length (km)	22,958	CCA (acres)	48,71,758
		Lined Canals (km)	5,101	IPU-Satellite	22,89,047
				Gap in %	53.01

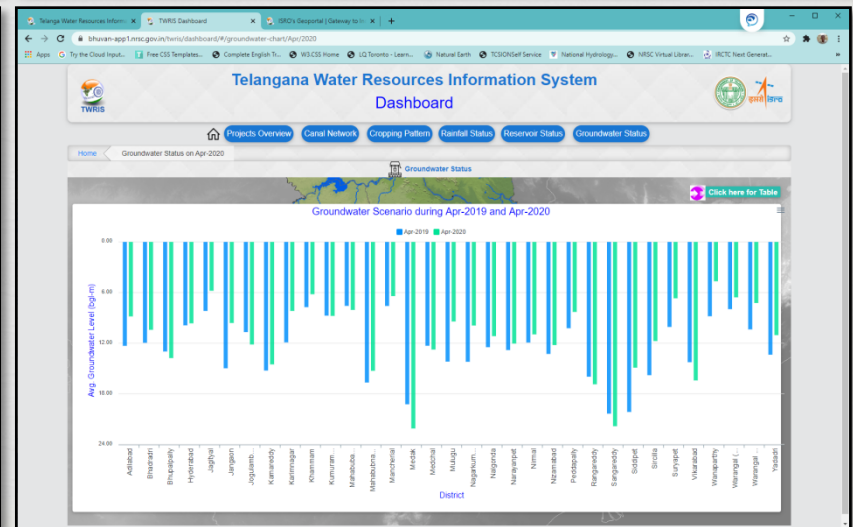
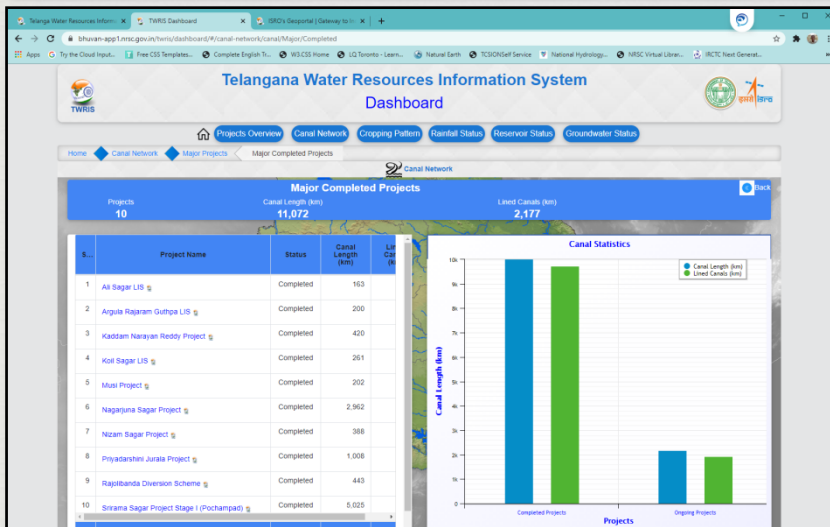
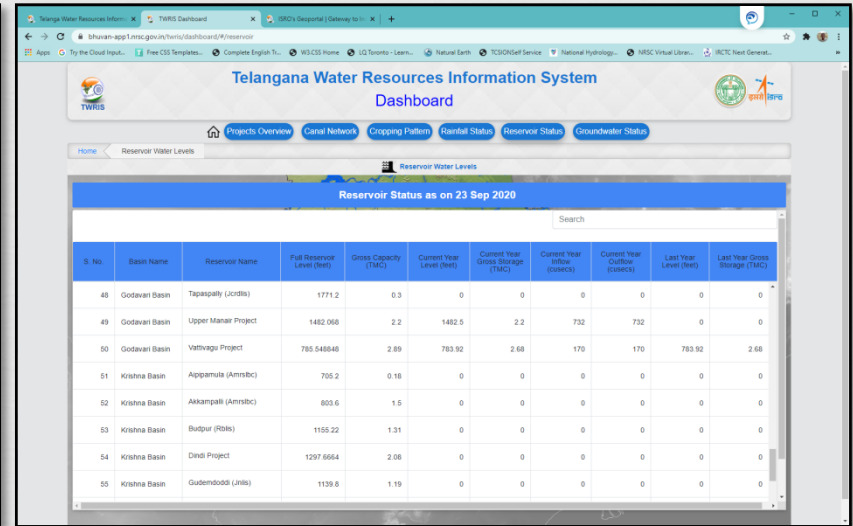
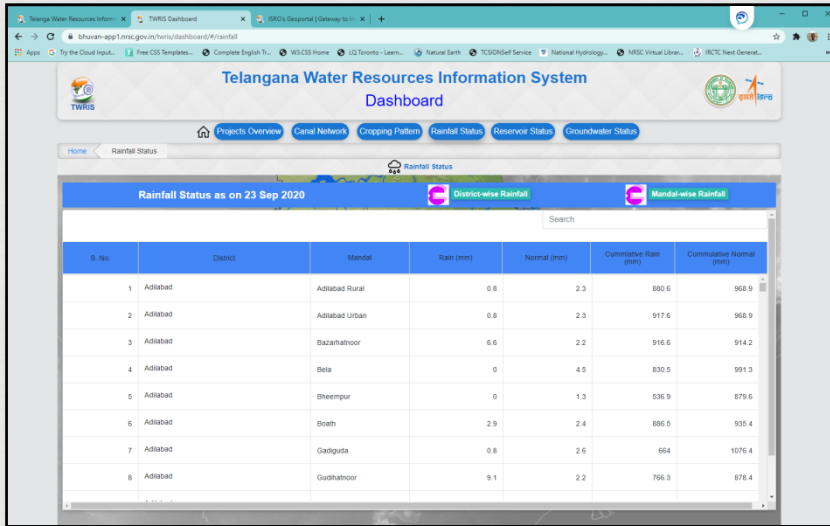
Rainfall Status (23-Sep-2020)		Reservoir Status (23-Sep-2020)		Groundwater Status (Apr - 2020)	
Actual Rainfall (mm)	6.5	Total (T M C)	8487.92	Raise (+)/Fall (-) (m)	-2.43
Normal Rainfall (mm)	4.5	Major (T M C)	478.65	Apr-2020 (m)	7.92
Deviation (%)	44.4	Medium (T M C)	8009.27	Apr-2019 (m)	10.35

Disclaimer: Last Updated on : 23-Sep-2020

* Best viewed in resolution 1680 x 1050

Telangana Water Resources Information System

తెలంగాణ జలవనరుల సమాచార వ్యవస్థ

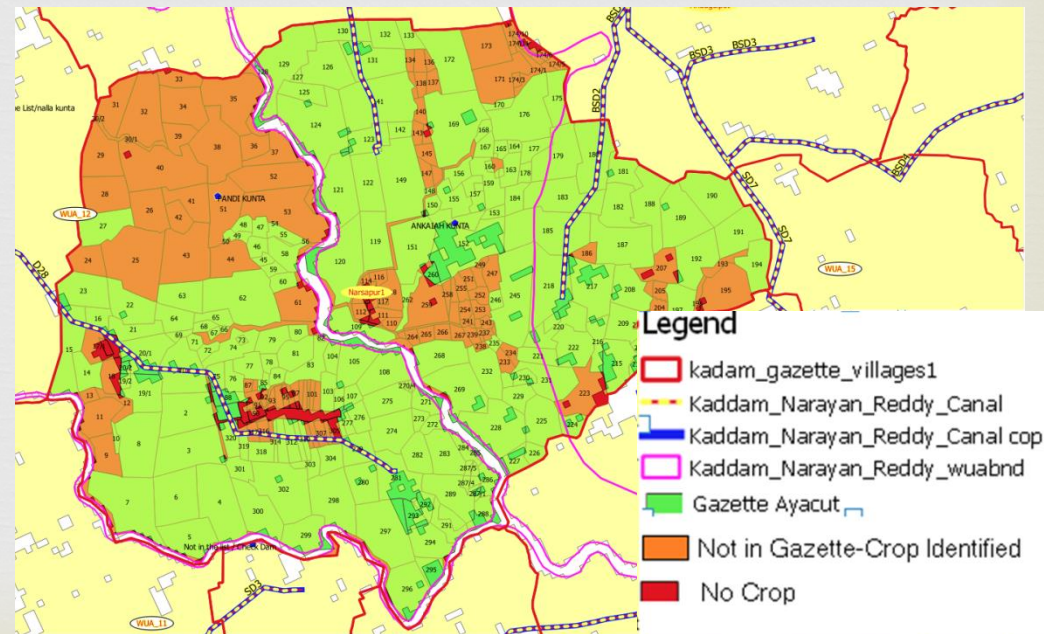


Kaddam Command Area Relocalisation

The gazette published localizing the Kaddam command area is as old as 1953 and needs re-localization due to :

- Overlap between Ralivagu and Kaddam.
- Submergence due to SYP project
- Overlap between Sadarmat barrage and Kaddam.
- R & R colonies
- Urbanization
- Irrigation outside localized area due to Land development and other reasons

Source	Crop Area (acres)
Satellite based	89,345
As per Gazette RFC Ayacut	67,000
Total	68,100
As per cadastral maps	58,000



ISRO's Geoportals | Gateways | APWRIMS

Water Resources Information | Water Resources Management | Geo Portal

Andhra Pradesh Water Resources Information & Management System
Water Resources Department, Govt. of Andhra Pradesh

Sri Nara Chandrababu Naidu, Hon'ble Chief Minister

Water Available Across State
903.21 T.M.C

Sri Devineni Uma Maheswara Rao, Hon'ble Minister (WRD)

Reservoirs	MI Tanks	WC Structures
No. of Reservoirs: 86	No. of MI Tanks: 37,502	No. of Structures: 1,211
Storage: 378.36 T.M.C (39.35 %)	Storage: 48.28 T.M.C (23.66 %)	Storage: 5.75 T.M.C (0.63 %)

Rainfall	Soil Moisture	Ground Water
Total from June 1st : 1,211.41 T.M.C	ASM Storage: 476.58 T.M.C	Change Since June 1st : 1,211.41 T.M.C

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National Remote Sensing Indian Space Research Organisation



Water Resources Department, Govt. of Andhra Pradesh & NRSC signed MoU on 17th March, 2017 to provide geospatial support and to develop geoportal “Andhra Pradesh Water Resources Information & Management System (APWRIMS)”

<http://apwrims.ap.gov.in/>

Andhra Pradesh Water Resources Information & Management System



APWRIMS
Not secure | apwrims.ap.gov.in

APWRIMS
 Andhra Pradesh Water Resources Information & Management System

 Water Available Across State : **1,776.26 T.M.C**

Rainfall

Total from June 1st 2020
3,722.71 T.M.C

% Deviation from Normal

Rainfall : 648.54 mm
Deviation : 26%

Reservoirs

Storage
834.47 T.M.C

% Storage

84.95%

No. of Reservoirs : 108
SCADA

Minor Irrigation Tanks

Storage
80.37 T.M.C

% Storage

39.59%

No. of Minor Irrigation Tanks : 37,256
(Geo-Tagged)

Groundwater

Change since June 1st
174.51 T.M.C

Rise/Fall from June 1st,2020

Groundwater Level as on
23 Sep 2020 : 12.86 m

Soil Moisture

Available Soil Moisture
659.21 T.M.C

Soil Moisture at 100cms depth

Available Soil Moisture till
30 cms depth : 91.05%
100 cms depth : 89.20%

Water Conservation Structures

Storage
27.70 T.M.C

% Storage

71.07%

No. of Water Conservation Structures : 1,399,237

Polavaram project construction activities

Sri Y.S. Jagan Mohan Reddy,
Hon'ble Chief Minister

NEW! Features

- Evapotranspiration
- New Geoportal
- MIMIC GIS View
- MIMIC SCADA View
- LI Schemes

The state of Andhra Pradesh is blessed with about 40 major and medium rivers...
[Read More](#)

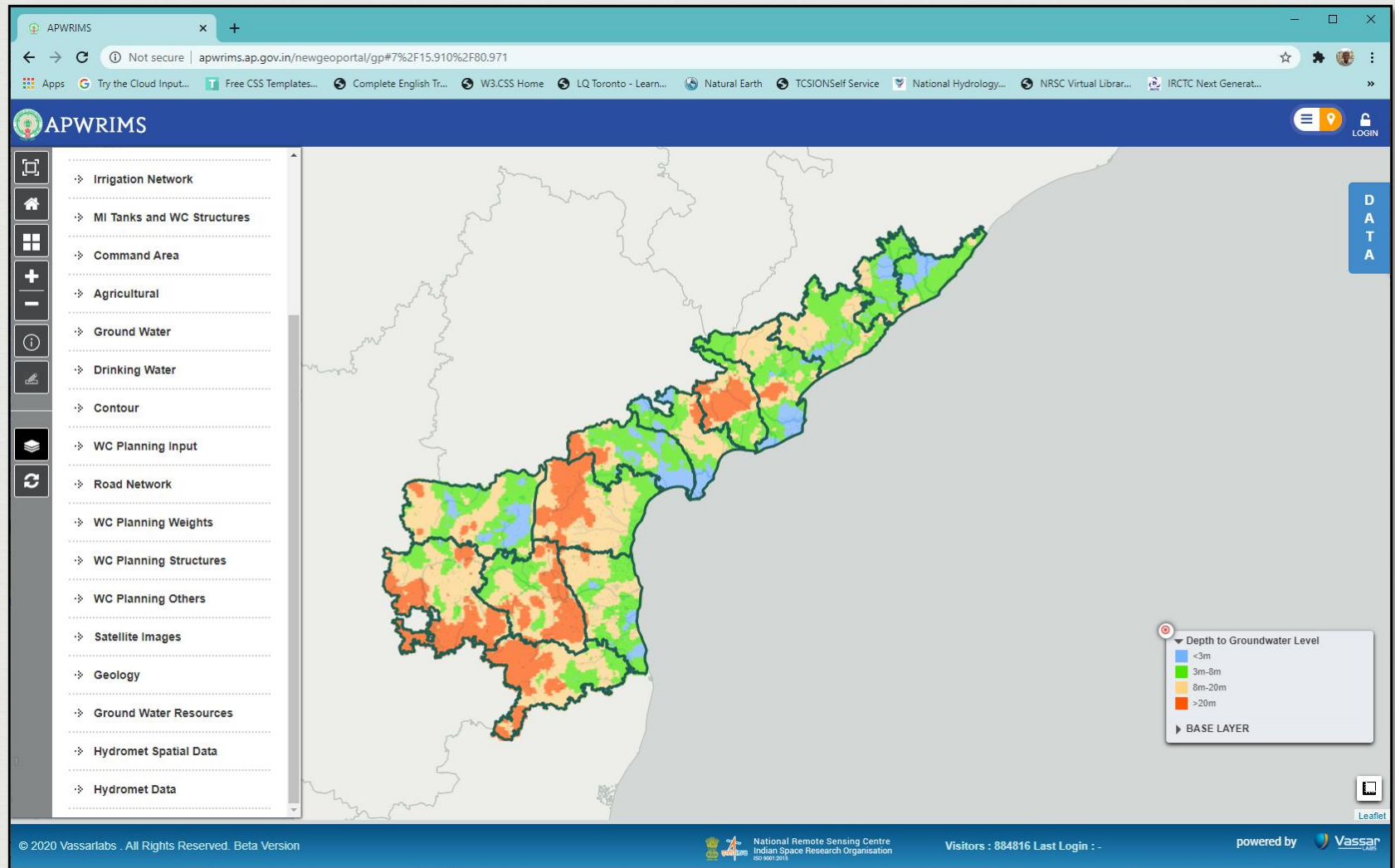
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National Remote Sensing Centre
 Indian Space Research Organisation

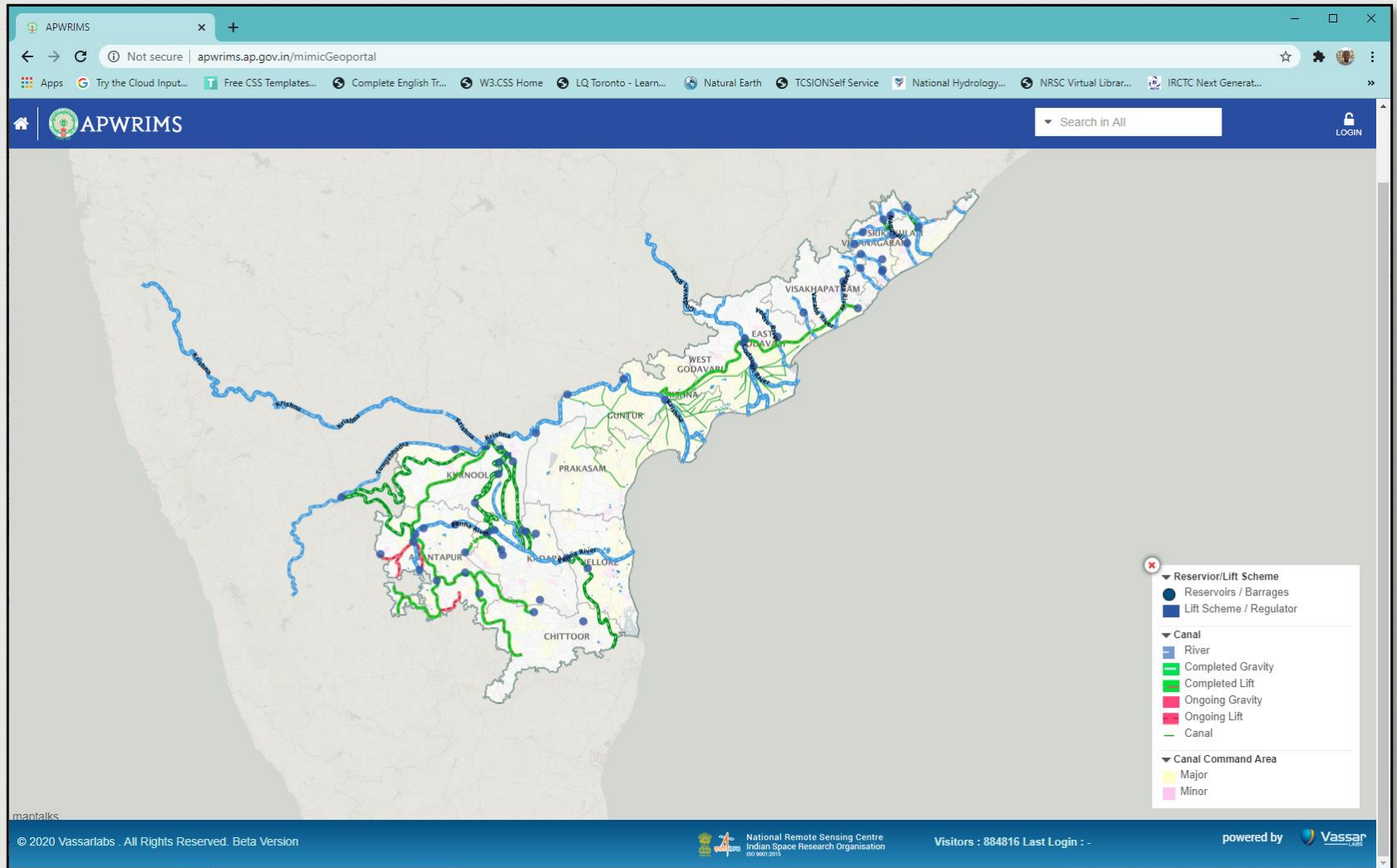
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Andhra Pradesh Water Resources Information & Management System



Andhra Pradesh Water Resources Information & Management System



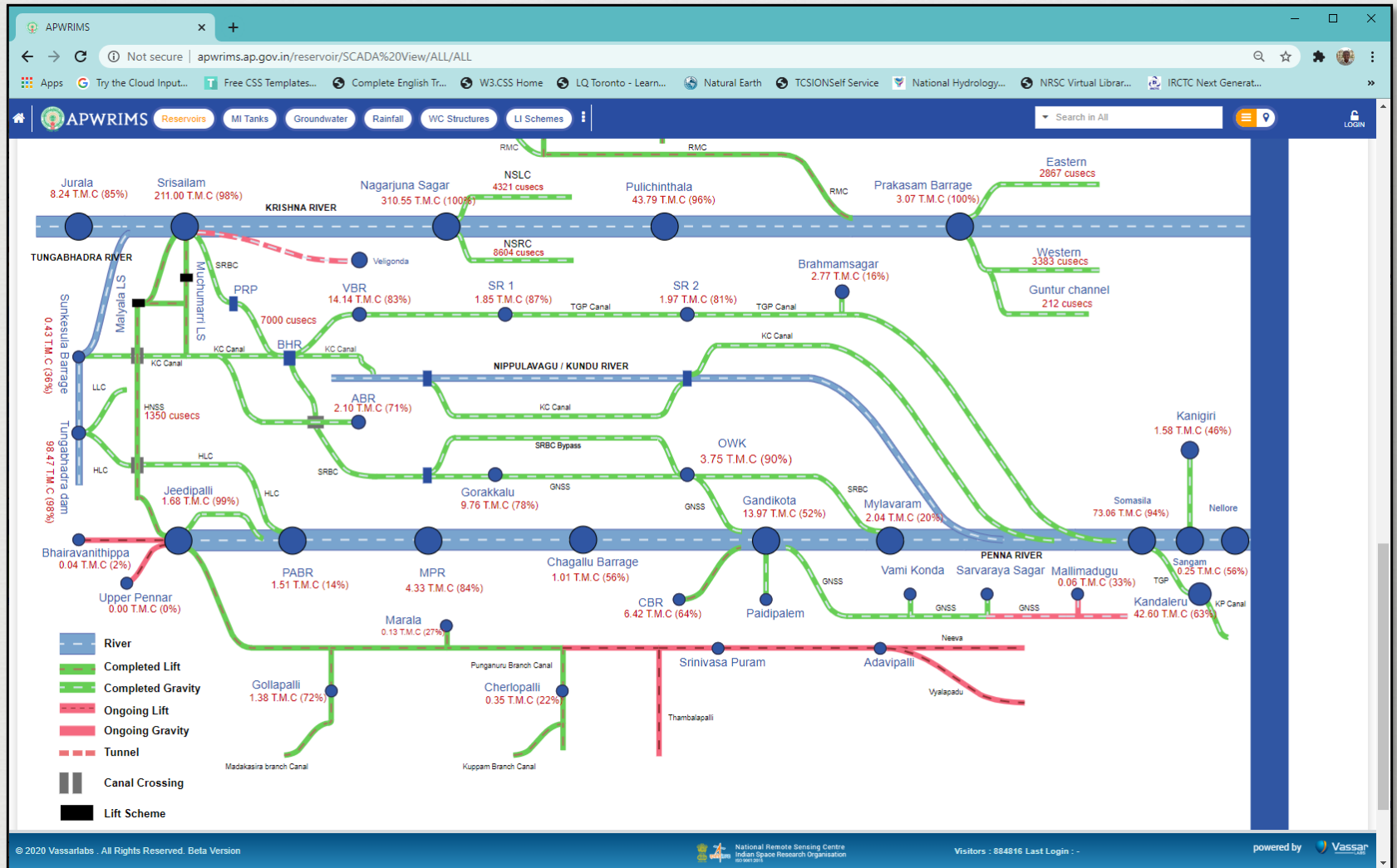
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Andhra Pradesh Water Resources Information & Management System



Andhra Pradesh Water Resources Information & Management System



APWRIMS

Not secure | apwrims.ap.gov.in/waterbalance/sensor%3Fsource=mitankPage.child&component=MI Tanks&type=summary&state=ANDHRA%20PRADESH&district=Srikakulam&mandal=AMADALVALASA&village=...

Reservoirs MI Tanks Groundwater Rainfall WC Structures LI Schemes

State : Andhra Pradesh » District : Srikakulam » Mandal : Amadalavalasa » Village : Marrikothavalasa » Tank Name : Konkinatank

Memoirs of Konkinatank

MI023892

Srikakulam

Buja

Marrikothavalasa

Latitude : 18.46

Longitude : 83.87

Total Capacity : 0.6

Current Storage : 0.1

Registered Area : 12.0

Current Transplantation Acreage (acres) : 0.0

Tank FTL (m)

Tank MWL (m)

TBL (m)

Catchment Area (Sq. km)

Yield as per Strange's table (mctf)

Tank Spread area at FTL (Sq. km)

No. of sluices (Nos)

Sill level of the deepest sluice (m)

No. of surplus weir (Nos)

Length of 1st weir (m)

Location Map

Gallery

29-Aug-2017

08-Jul-2017

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Indian Space Research Organisation

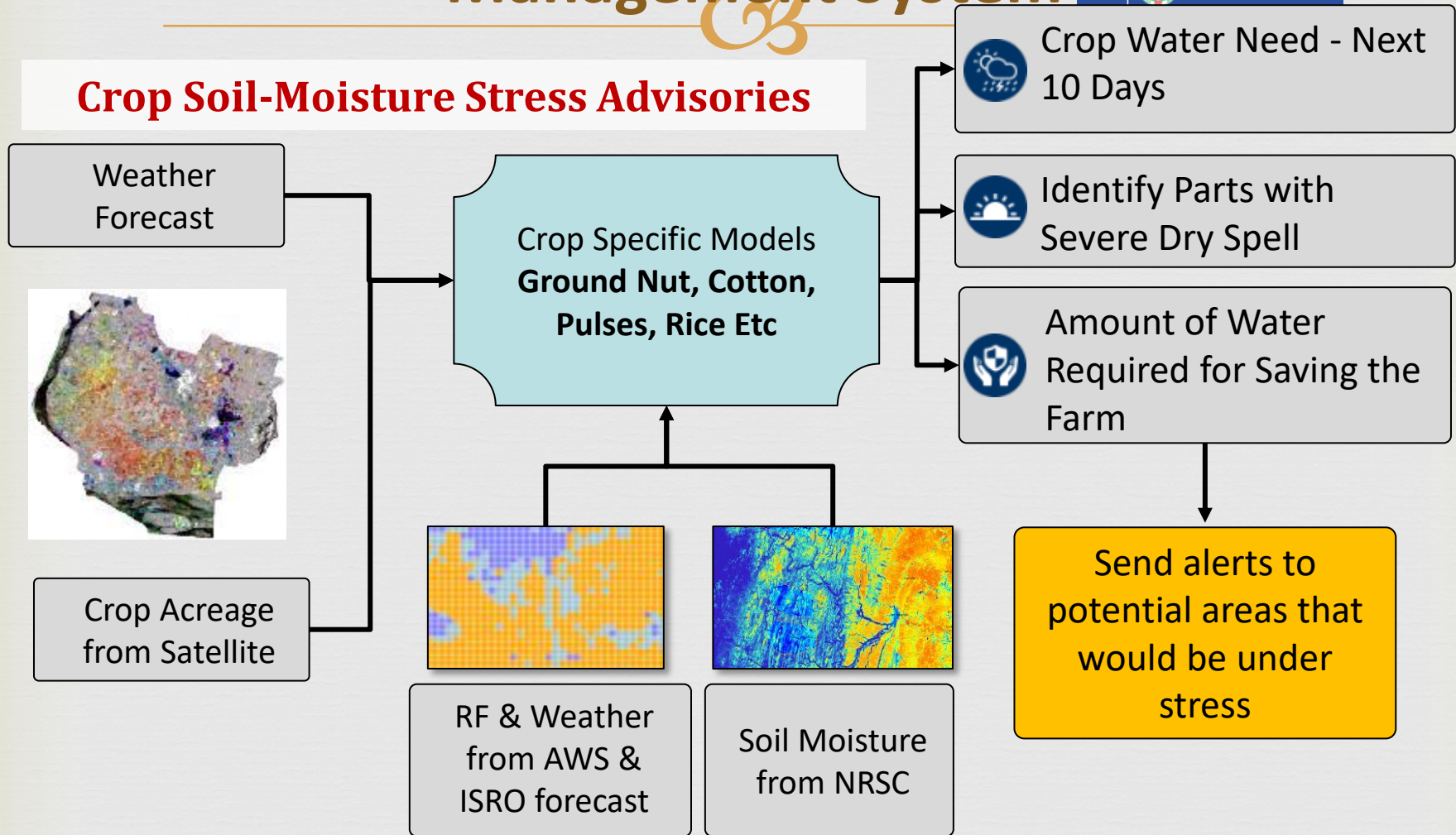
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Andhra Pradesh Water Resources Information & Management System



Crop Soil-Moisture Stress Advisories



Area of around 38,000 ha were alerted and the State had intervened for 29,000 ha

SAVE WATER with the 3 Rs



abduhakeem_k@nrsc.gov.in