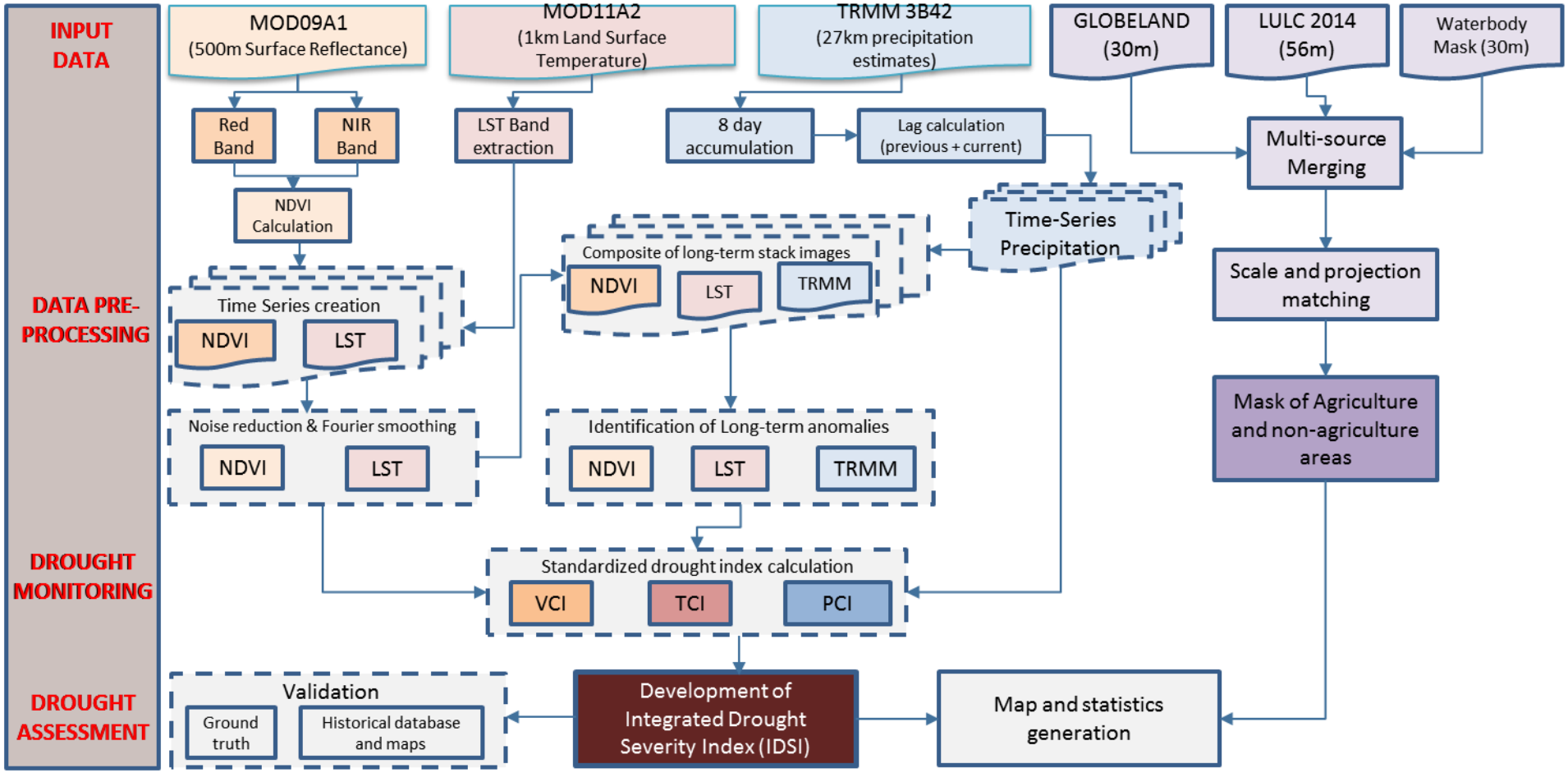
South Asia Drought Monitoring System (SADMS)

Framework, development and application

Niranga Alahacoon, Giriraj Amarnath, Dhyey Bhatpuria

SADMS FRAMEWORK



Notes: MOD09A1 – MODIS Surface Reflectance of every 8-Day product at 500m resolution; MOD11A1 – MODIS Land Surface Temperature (LST) daily product at 1,000m resolution; TRMM – Tropical Rainfall Measuring Mission; LULC NRSC – Land Use and Land Cover from National Remote Sensing Centre; Water body mask from Landsat images; NDVI – Normalized Difference Vegetation Index; VCI – Vegetation Condition Index; TCI – Temperature Condition Index (TCI); Precipitation Condition Index (PCI), IDSI – Integrated Drought Severity Index

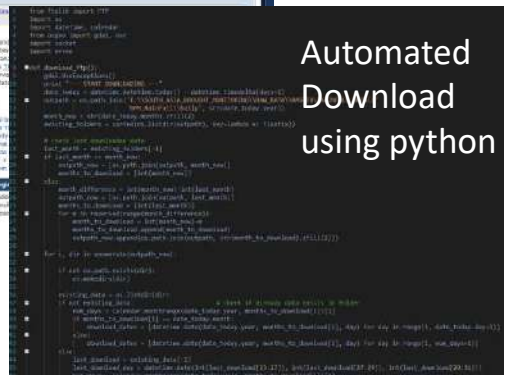
INPUT DATA

DATA DOWNLOAD & IMPORT

List of Datasets

S. No	Data	Detail	Resolution	Duration	Source	Link
1	MODIS Reflectance	MOD09A1 Surface Reflectance 8-day Composite	500m	2001-2015	NASA	http://reverb.echo.nasa.gov/reverb/
2	MODIS Surface Temperature	MOD11A2 Land Surface Temperature 8-day Composite	1km	2001-2015	NASA	http://reverb.echo.nasa.gov/reverb/
3	TRMM Rainfall	3B42 Daily precipitation estimates	0.25 Deg	1998-Mar 2015	NASA-JAXA	http://disc.sci.gsfc.nasa.gov/SSW/#keywords=TRMM_3B42_daily%207
4	GPM Rainfall	IMERG Late Run Daily Precipitation Estimates	0.1 Deg	Mar-Dec 2015	NASA-JAXA	ftp://jsimpson.pps.eosdis.nasa.gov/NRTPUB/
5	PERSIANN Rainfall	Daily Global rainfall estimates	0.25 Deg	1983-2015	CHRS, University of California	http://chrs.web.uci.edu/persiann/data.html
6	CRISP Rainfall	Daily Global rainfall estimates	0.05 Deg	1981-2015	Climate Hazard Group, USA	ftp://ftp.chg.ucsb.edu/pub/org/chg/products/CHIRPS-2.0/
7	IMD Rainfall	Daily Gridded Data	0.25 Deg	1901-2015	India Meteorological Department	CD
8	Bangladesh Rainfall	Station Data	36 Stations	1958-2015	Department of Meteorology, Bangladesh	
9	NRSC Landuse	Thematic Map for India	56m	2013-14	NRSC, India	http://bhuvan.nrsc.gov.in/gis/thematic/index.php
10	GLC 2010 Land-use	Global Thematic Map	30m	2010	National Geomatics Centre of China	http://www.globallandcover.com/
11	Hansen Water Body	Hansen GFC 2013 Datamask	30m	2013	University of Maryland	http://commondatastorage.googleapis.com/earthenginepartners-hansen/GFC2013/
12	District level Crop Yield	Crop yield for all districts of India	--	1998-2012	Directorate of Economics and Statistics, India	http://aps.dac.gov.in/APY/Public_Report1.aspx
13	District level Crop Yield	Crop yield for all districts of Pakistan	--	1998-2008	Directorate of Agriculture Crop Report Service, Punjab Lahore	Punjab Agricultural Statistics 1998-2002 & 2003-2008.

Websites

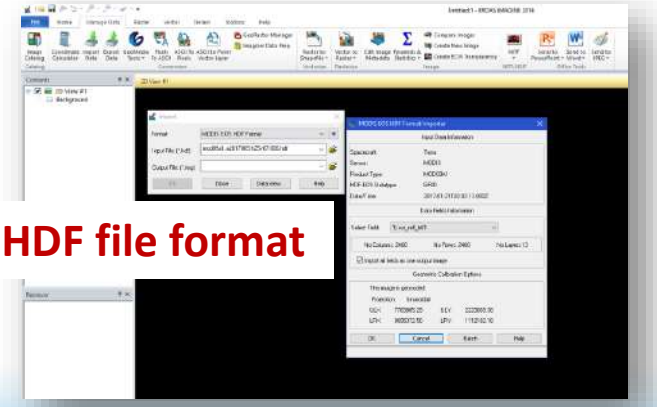


Automated Download using python

Import using ERDAS

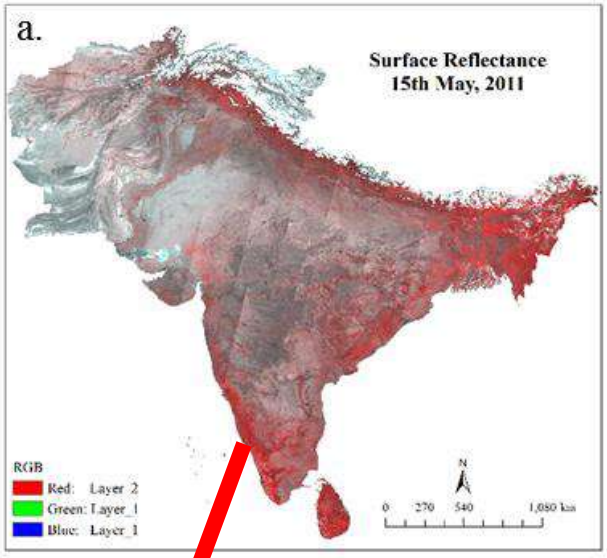
Automated scripts for import

IMG file format ← **HDF file format**

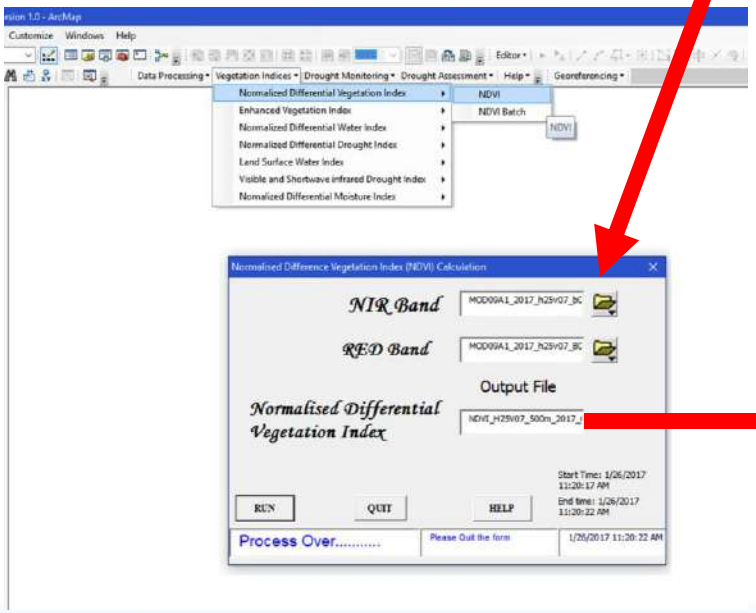


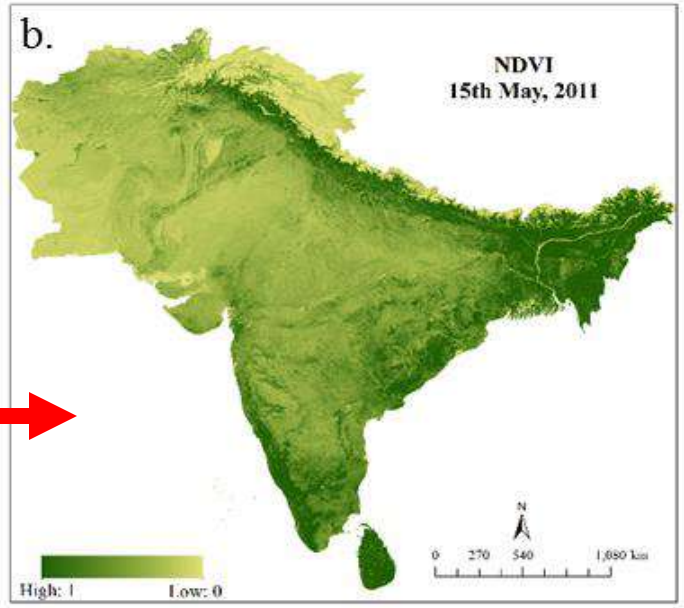
REFLECTANCE TO NDVI

False Colour Composite (FCC)



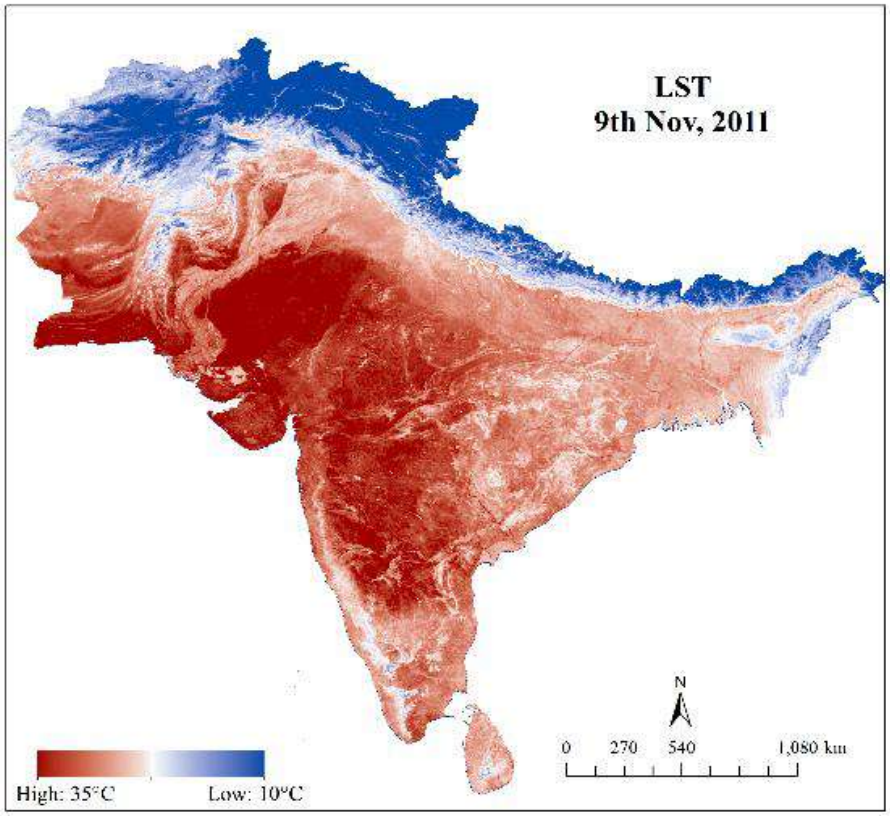
$$NDVI = \frac{NIR - Red}{NIR + Red}$$





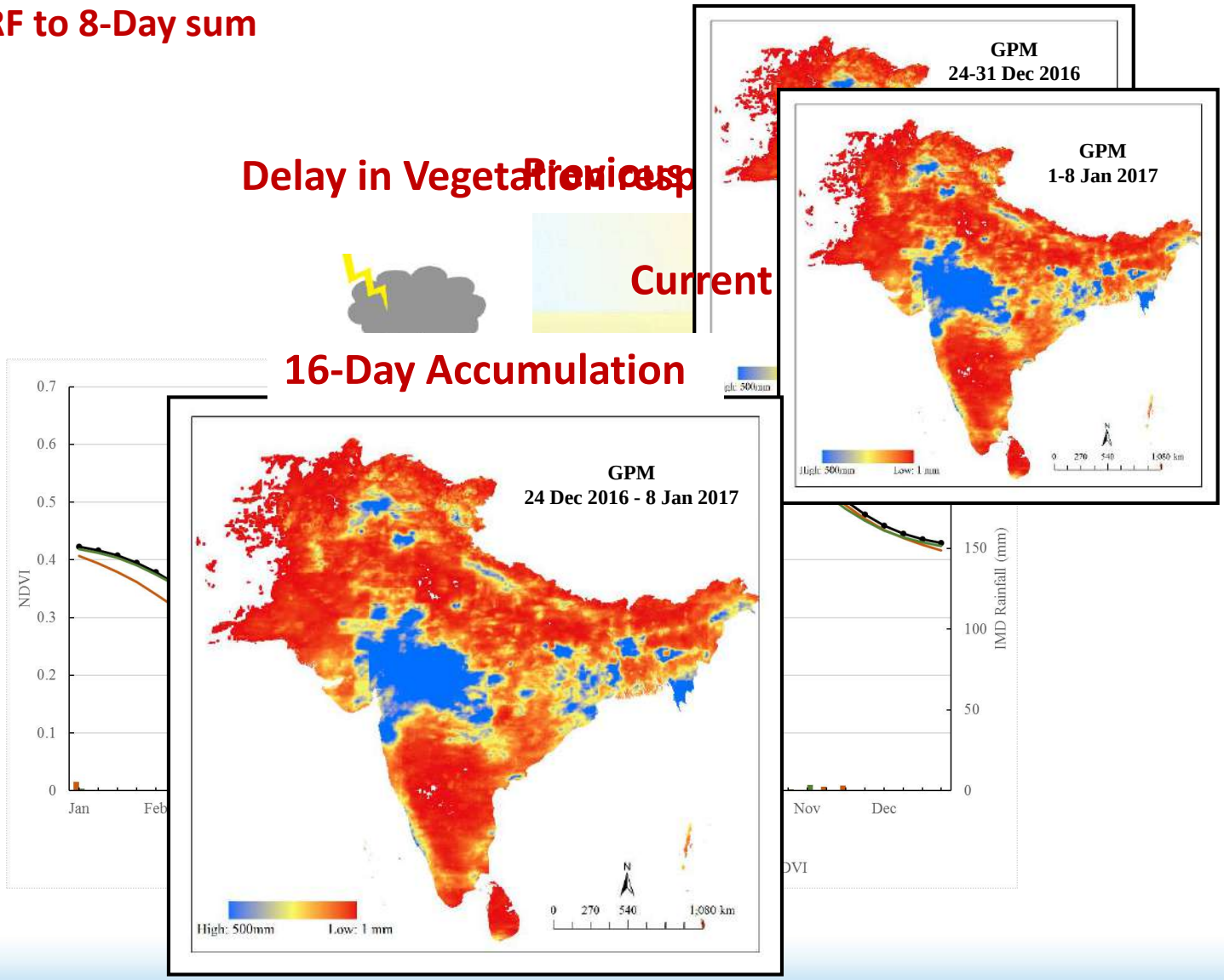
LAND SURFACE TEMPERATURE

LST is readily available from NASA Website

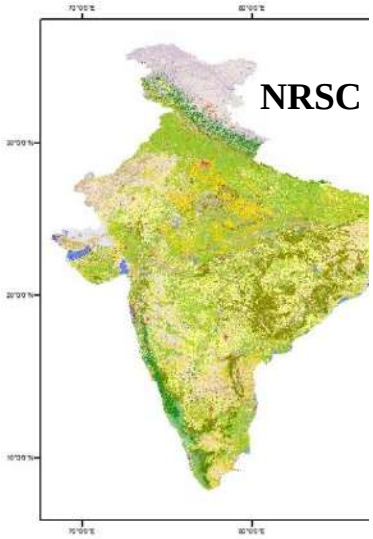


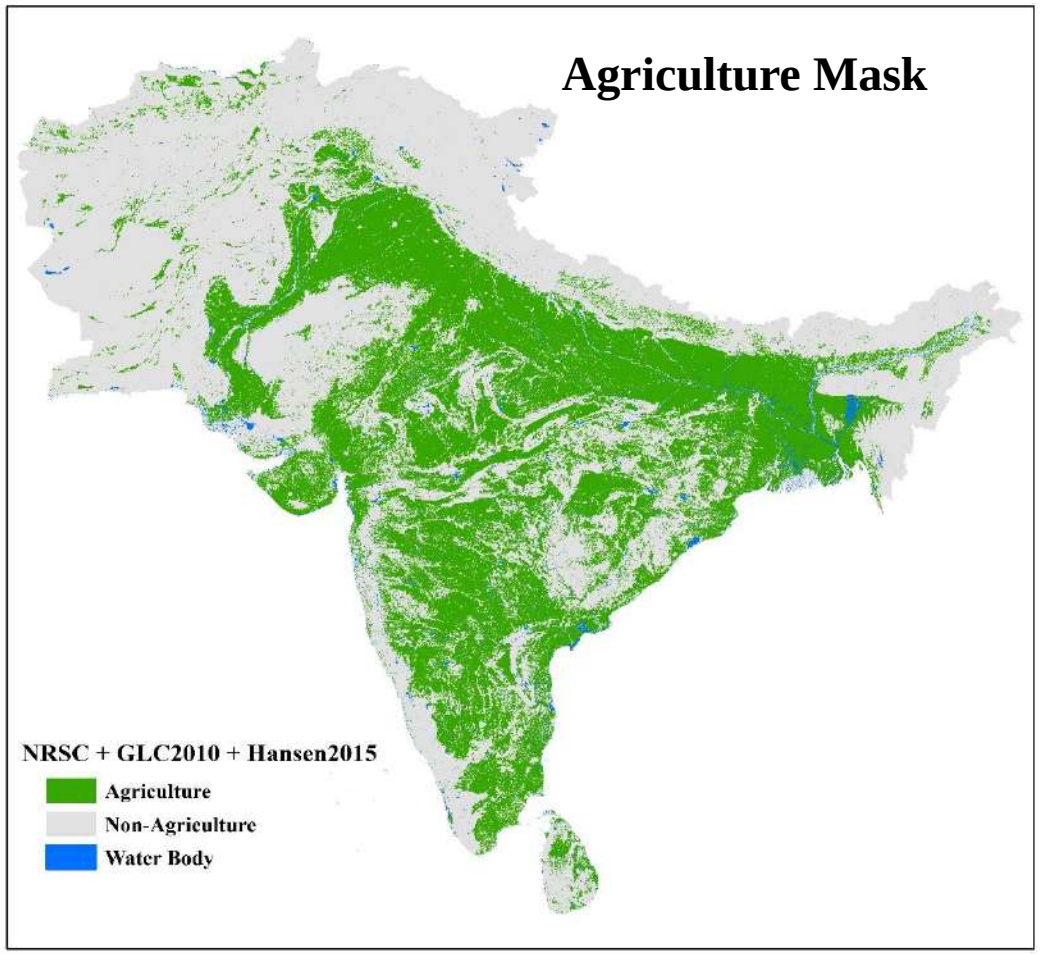
GLOBAL PRECIPITATION MEASUREMENT

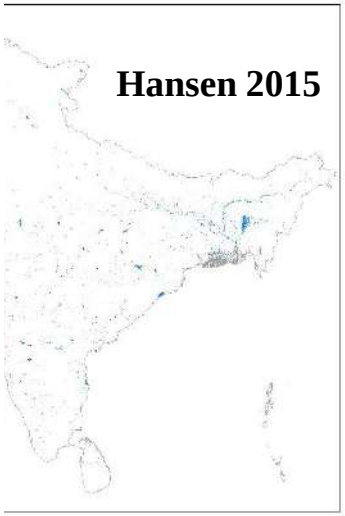
Daily RF to 8-Day sum



LAND USE

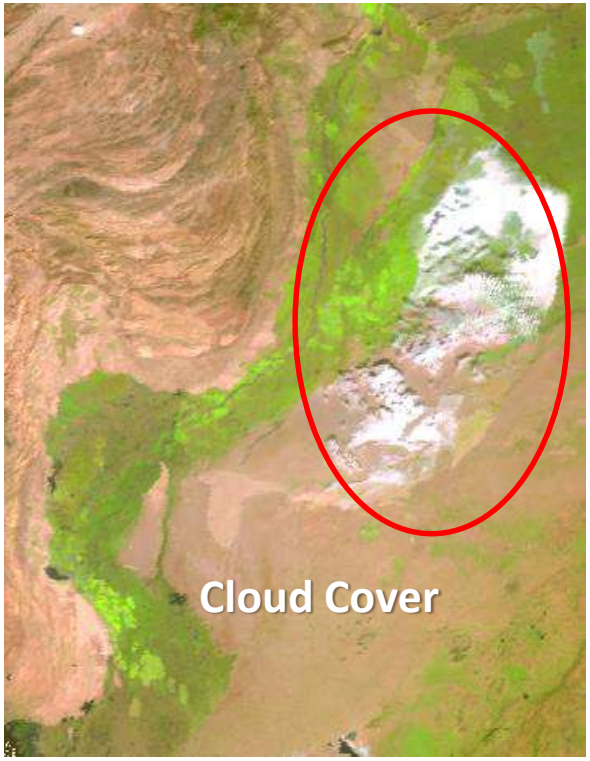

NRSC

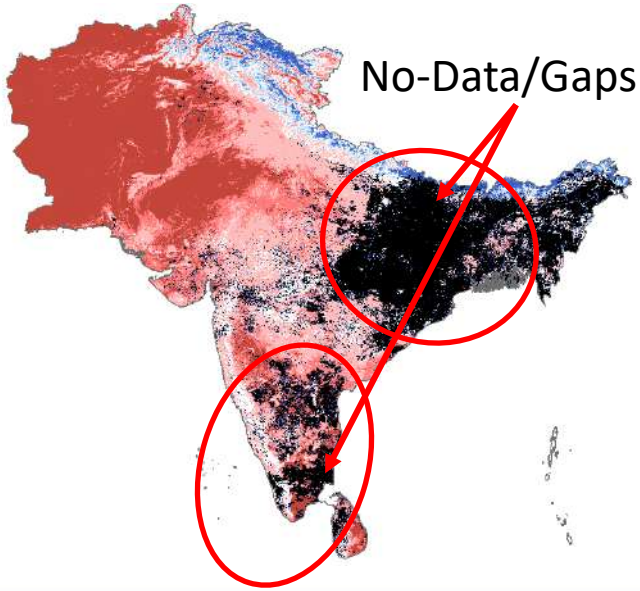

Agriculture Mask
NRSC + GLC2010 + Hansen2015
Agriculture
Non-Agriculture
Water Body


Hansen 2015

PRE-PROCESSING

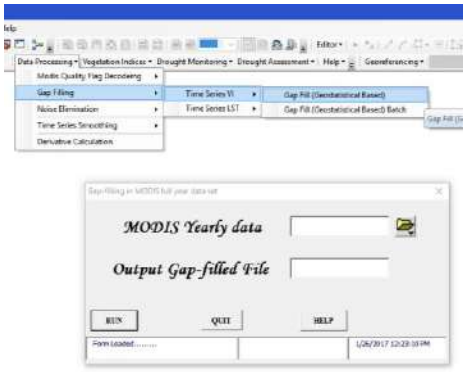
NOISE IN SATELLITE DATA SETS

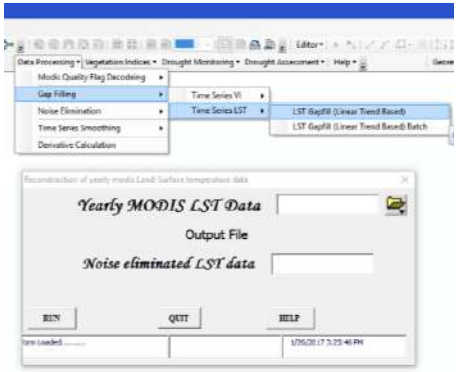


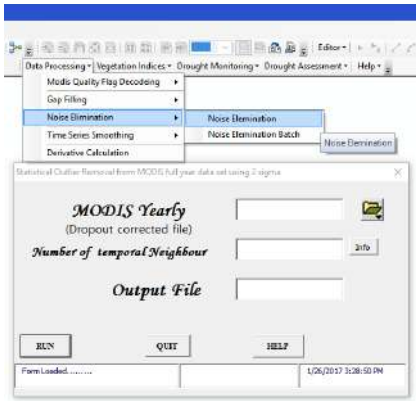


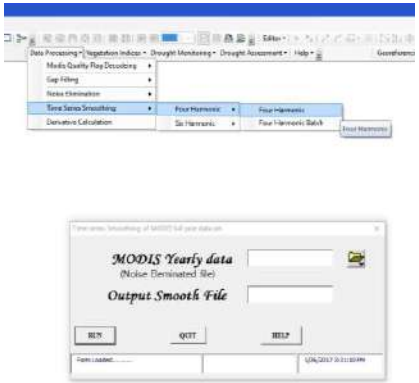
Possibility of misinterpretation using the raw satellite data full of noise

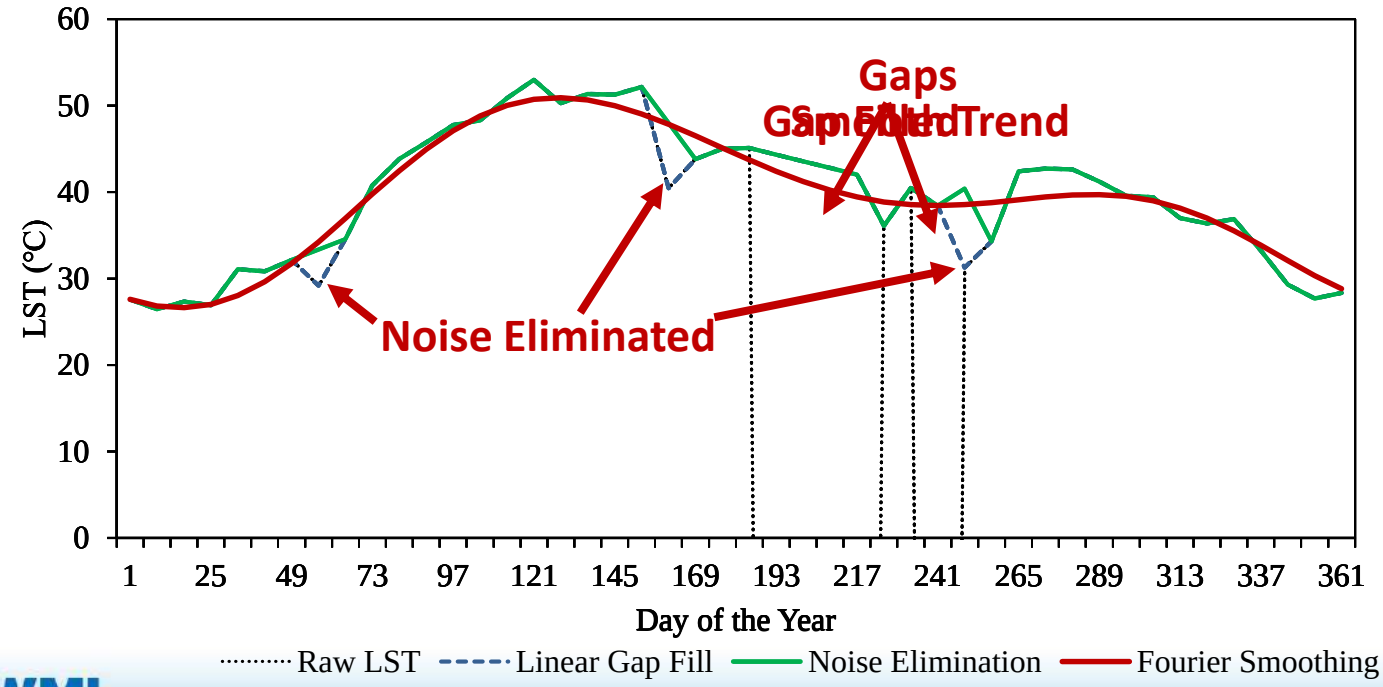
MODIS NOISE CORRECTION







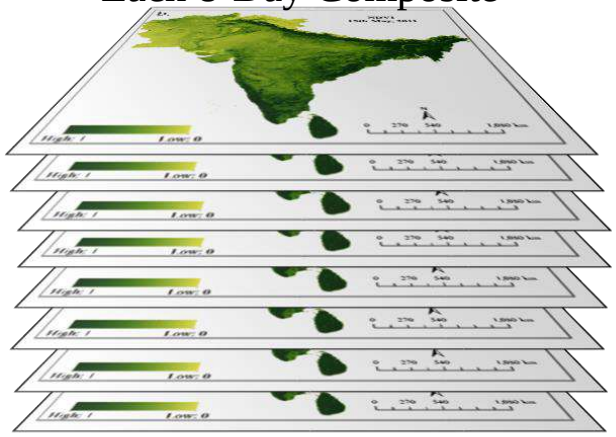




LONG-TERM EXTREME (MIN & MAX)

1. NDVI **2. LST** **3. RF**

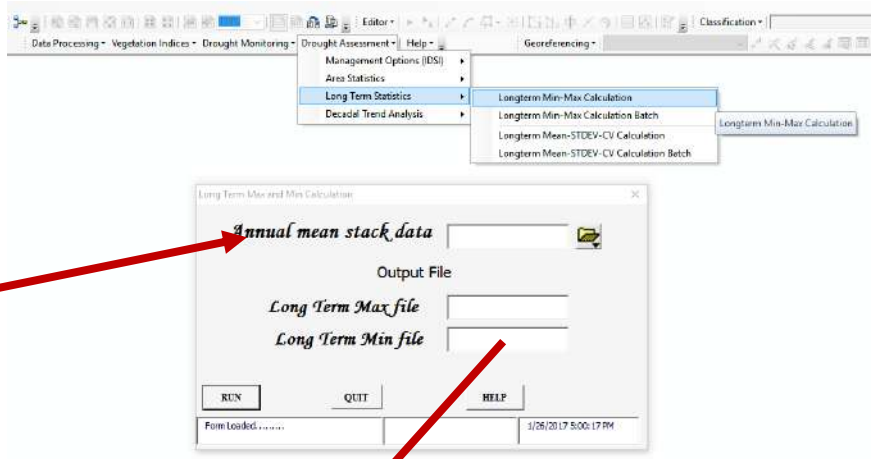
Each 8-Day Composite



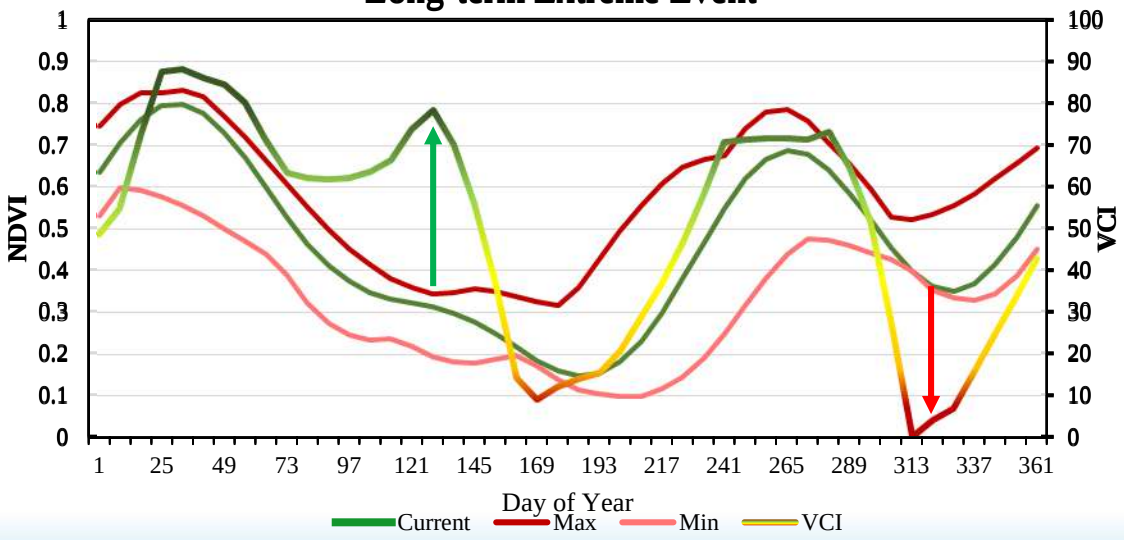
2001

Long-term stack

2015

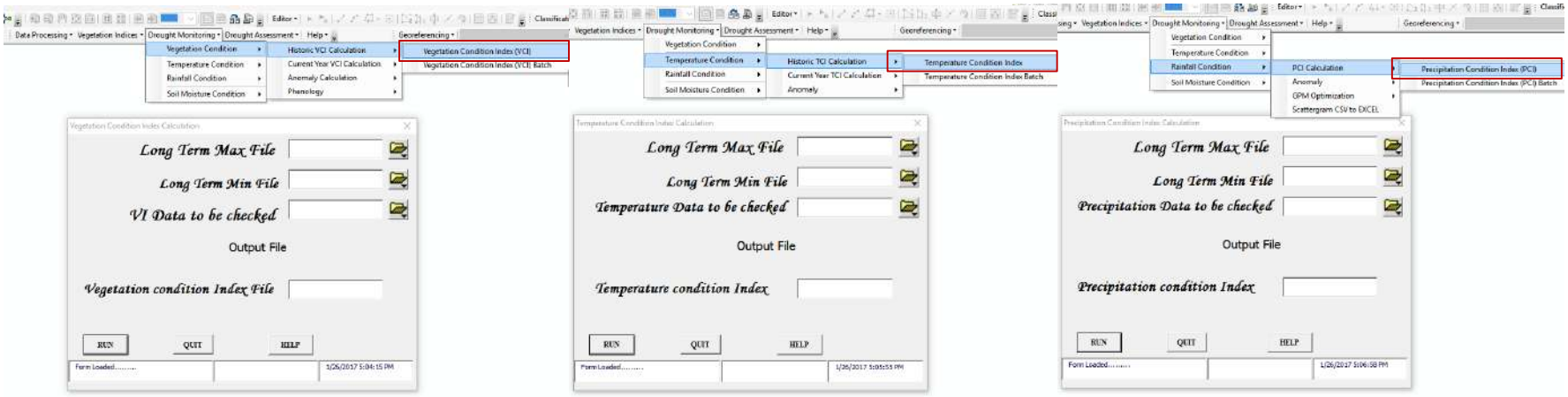


Long-term Extreme Event



CALCULATION OF DROUGHT INDICES

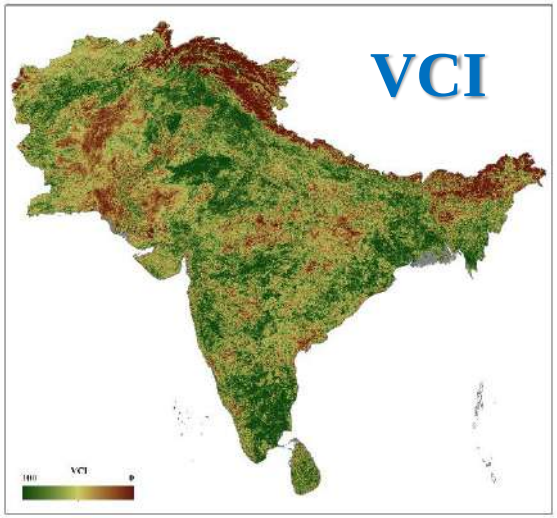
STANDARDIZED INDICES COMPUTATION

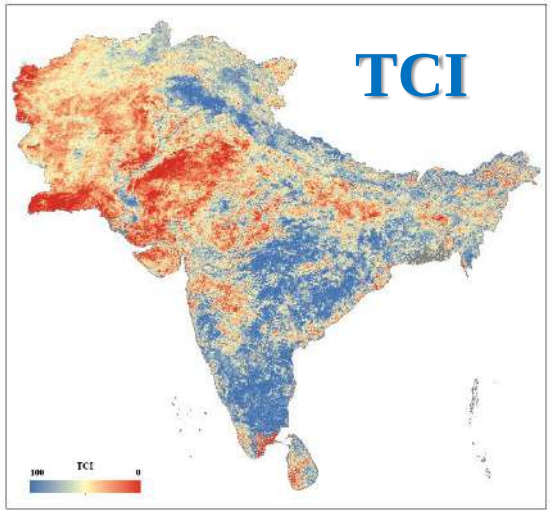


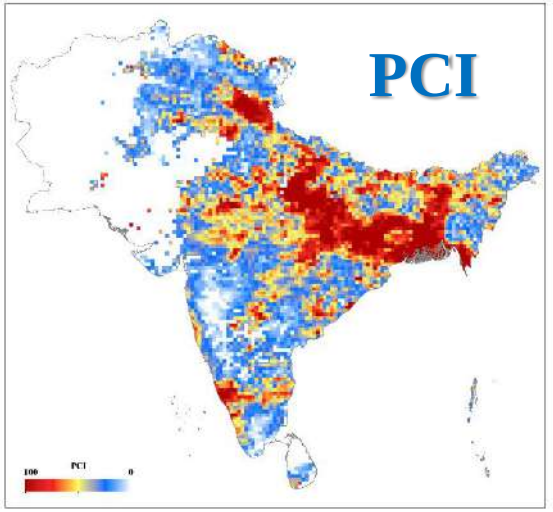
$$VCI_{ijk} = \frac{NDVI_{ijk} - NDVI_{ijn}}{NDVI_{ijx} - NDVI_{ijn}} * 100$$

$$TCI_{ijk} = \frac{LST_{ijx} - LST_{ijk}}{LST_{ijx} - LST_{ijn}} * 100$$

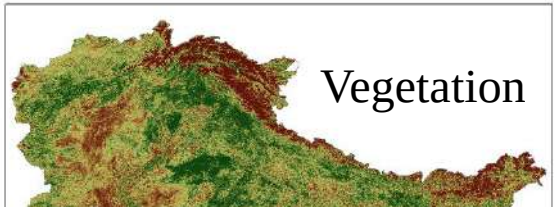
$$PCI_{ijk} = \frac{TRMM_{ijk} - TRMM_{ijn}}{TRMM_{ijx} - TRMM_{ijn}} * 100$$

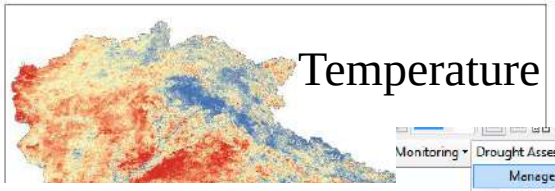


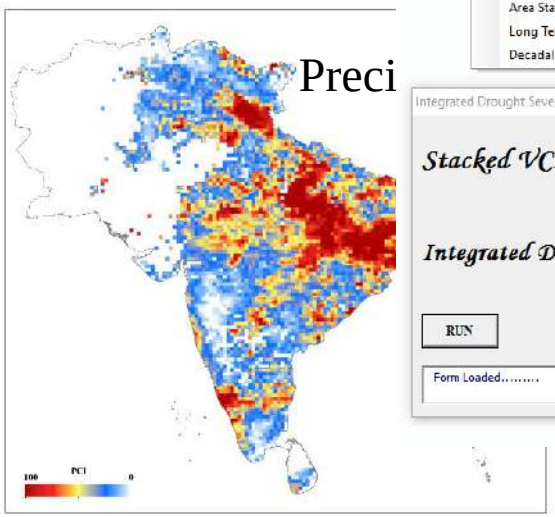


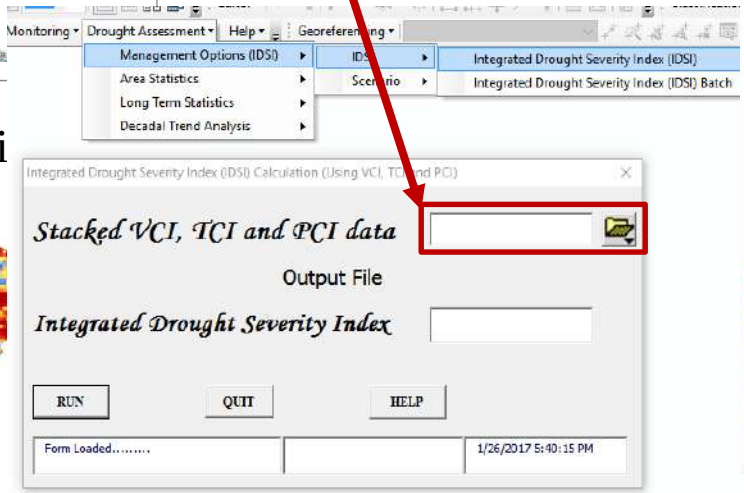


DROUGHT INDEX

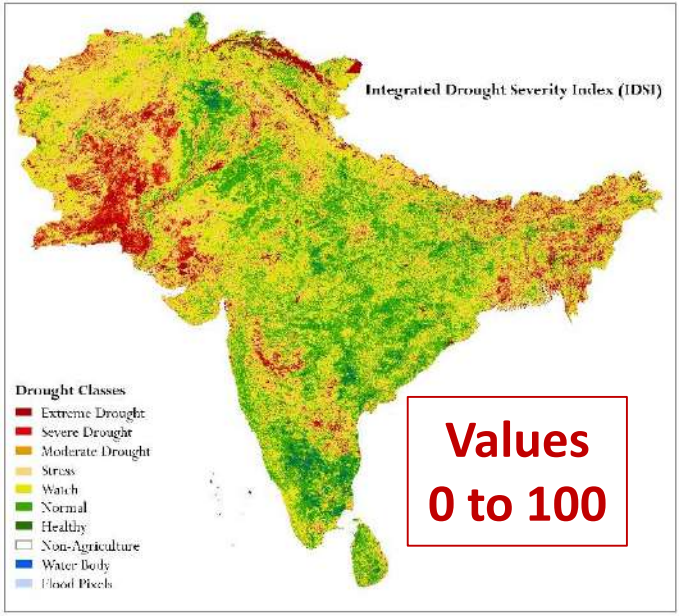








Integrated Drought Severity Index

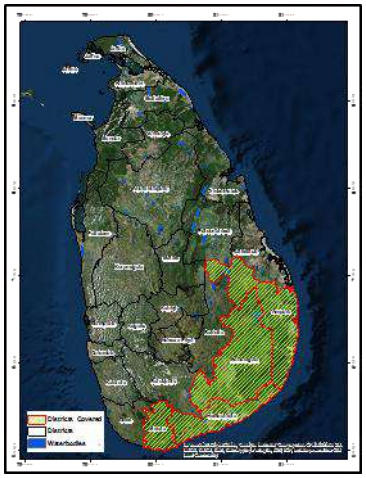


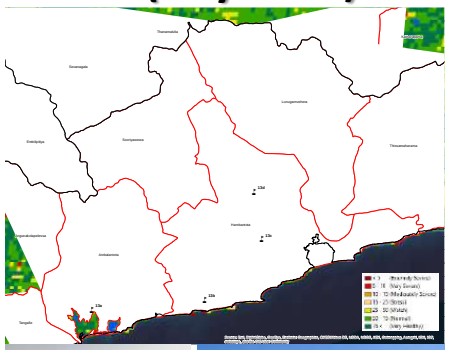
IDSI Equation

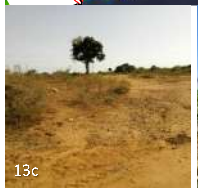
$$IDSI_{ijk} = \left[L * VCI_{ijk} * \left\{ c + \frac{1}{\left(L * (VCI_{ijk} + TCI_{ijk} + PCI_{ijk} + c\right)} * \left(TCI_{ijk} + PCI_{ijk}\right) \right\} \right]$$

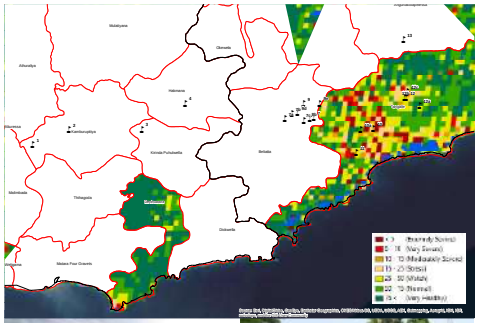
IDSI VALIDATION & CLASSIFICATION

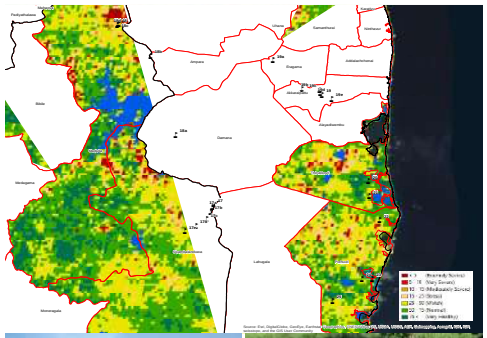
Sri Lanka field validation (July 2015)



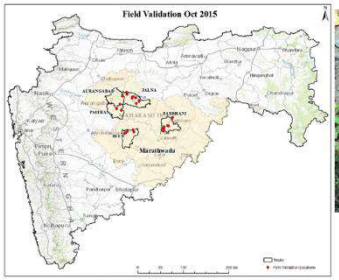








Maharashtra field validation (July 2015)



9

10

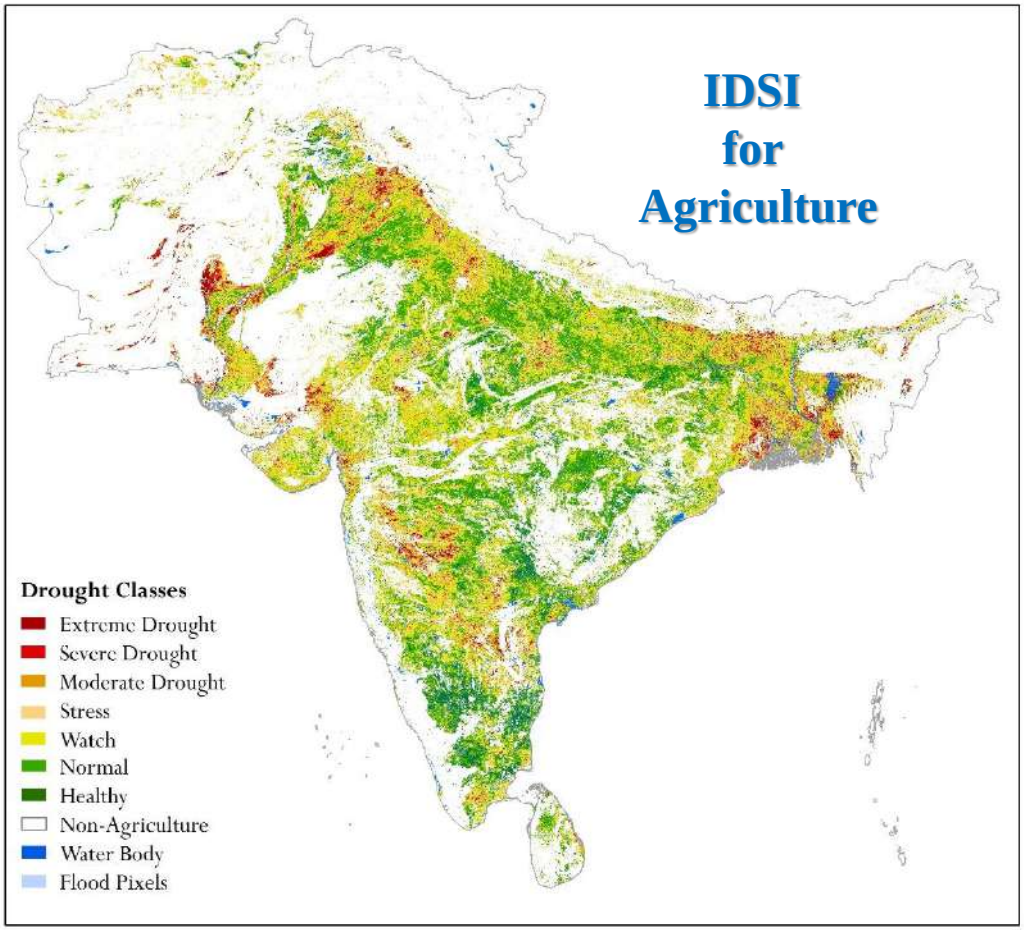
13

14

7 IDSI Classes

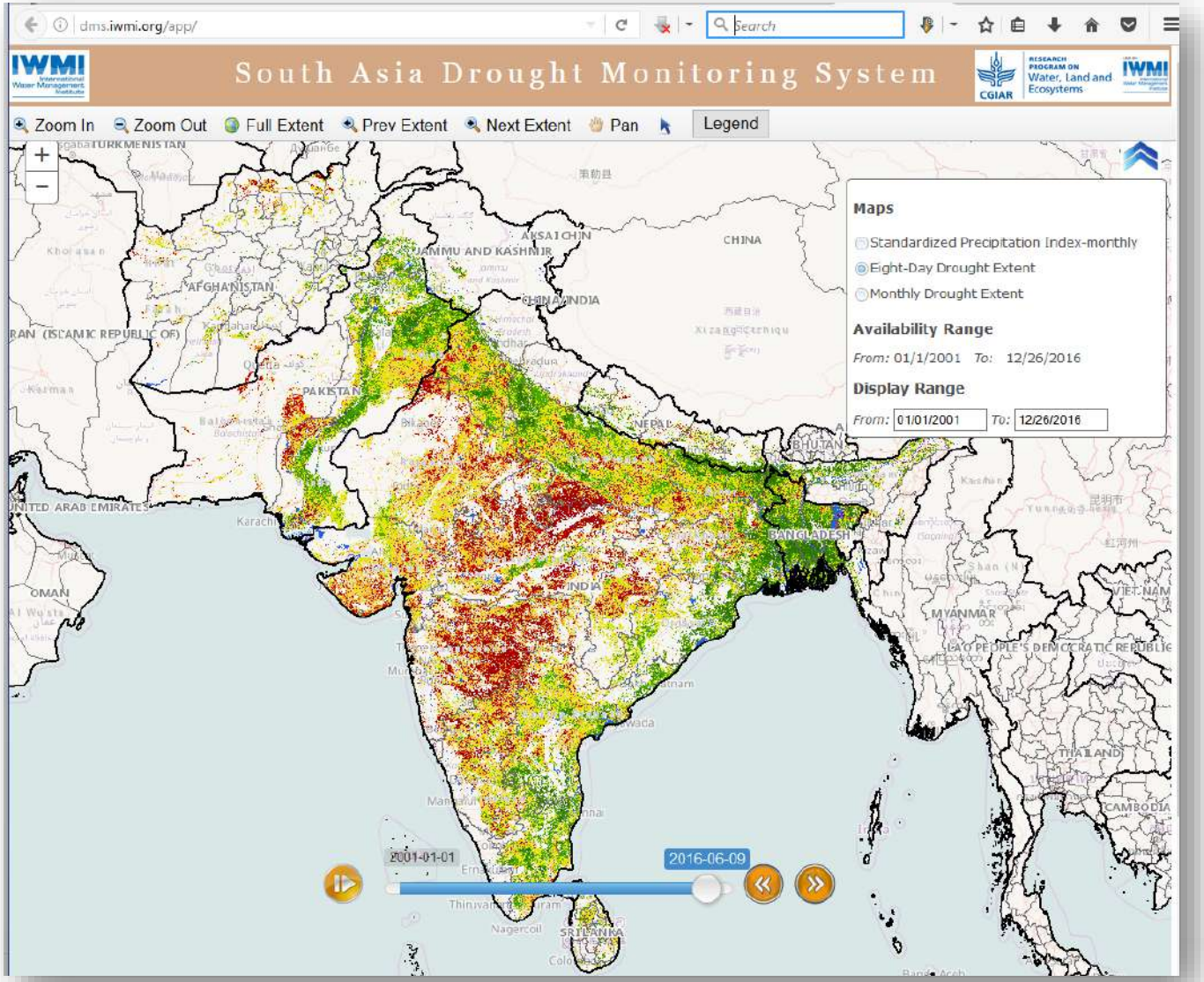
Category	Description	Possible impacts	IDSI Ranges
D4	DS Extreme	Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies	< 5 (with very low values of VCI, PCI and TCI)
D3	DS Severe	Major crop/pasture losses Widespread water shortages or restrictions	5 – 10 (with low values of VCI, PCI and TCI)
D2	DS Moderate	Crop or pasture losses likely Water shortages common Water restrictions imposed	10 – 15 (with moderate values of VCI, low PCI and TCI)
D1	Stress	Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested	15 – 20 (with moderate VCI, low PCI and moderate TCI)
D0	Watch	Going into drought: short-term dryness slowing planting, growth of crops or pastures Coming out of drought: some lingering water deficits pastures or crops not fully recovered	20 – 40 (with moderate values of VCI, PCI and TCI)
Normal	Normal		>40 (vegetation growth is normal with essential variables with a function of high VCI-TCI-PCI)
Healthy	Healthy		>60 (vigor vegetation with strong correlation on climate indicators)

IDSI IN AGRICULTURE



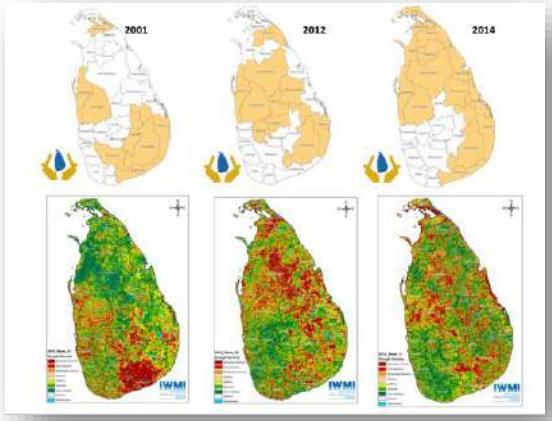
APPLICATION

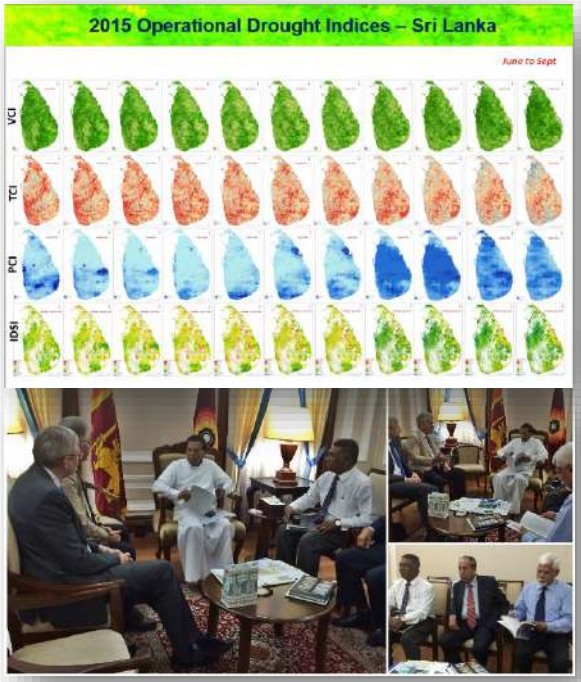
WEB-PORTAL

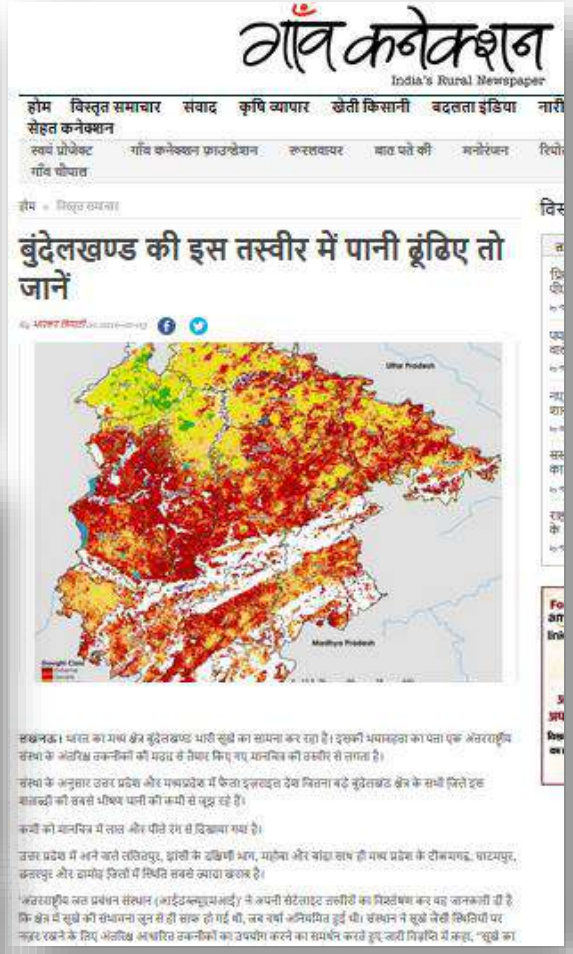


http://dms.iwmi.org/app/

USER FEEDBACK






गाँव कनेक्शन
India's Rural Newspaper
होम विस्तृत समाचार संवाद कृषि व्यापार खेती किसानी बदलता इंडिया नारी
सेहत कनेक्शन
बुंदेलखण्ड की इस तस्वीर में पानी ढूंढिए तो जानें
Uttar Pradesh
Madhya Pradesh

Web Links:

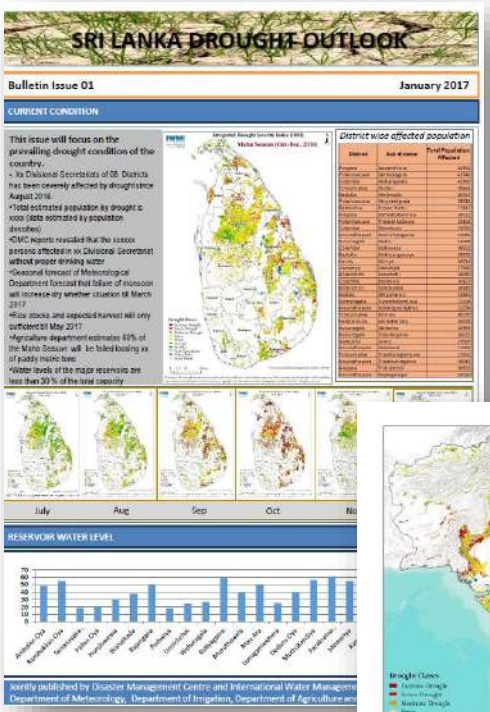
[1]http://bundelkhand.in/portal/info/current-population-of-bundlekhand

[2]http://www.currentscience.ac.in/cs/Volumes/100/09/1287.pdf

[3]http://www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-8/89/2014/isprsarchives-XL-8-89-2014.pdf

[4]http://epaper.dailynews.lk/art.asp?id=2017/01/18/pg08_0&pt=p&h=

USER FEEDBACK


SRI LANKA DROUGHT OUTLOOK

Bulletin Issue 01 January 2017

CURRENT CONDITION

This issue will focus on the prevailing drought condition of the country.

- Xx Divisional Secretariats of 08 Districts has been severely affected by drought since August 2016.
- Total estimated population by drought is xxxx (data estimated by population densities)
- DMC reports revealed that the xxxxx persons affected in xx Divisional Secretariat without proper drinking water
- Seasonal forecast of Meteorological Department forecast that failure of monsoon will increase dry weather ciuation till March 2017
- Rice stocks and expected harvest will only sufficient till May 2017
- Agriculture department estimates 69% of the Maha Season will be failed leaving xx of paddy metric tons
- Water levels of the major reservoirs are less than 30 % of the total capacity

District wise affected population

July Aug Sep Oct

RESERVOIR WATER LEVEL

Jointly published by Disaster Management Centre and International Water Management Institute

Department of Meteorology, Department of Irrigation, Department of Agriculture and

Bulletin


South Asia drought monitoring system

A collaborative program to build greater resilience to drought, and mitigate its impacts on societies and economies

Key facts on Asia's drought

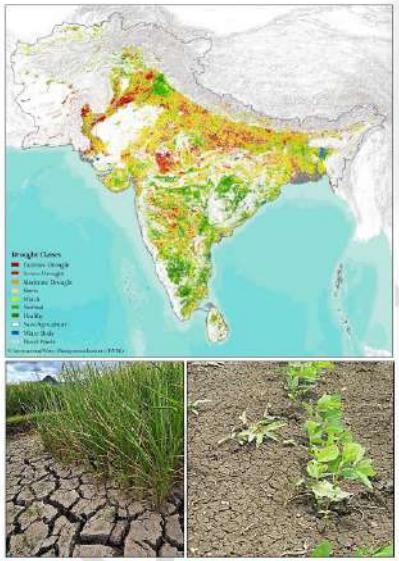
Background

Articles


14 Climate Change

A new monitoring system will help prepare South Asia for increased drought frequency caused by a changing climate. Amarnath Giriraj and James Clarke at the International Water Management Institute (IWMI) in Sri Lanka explain how the system can be used to predict drought trends in time for communities to put climate-smart water management solutions into place.

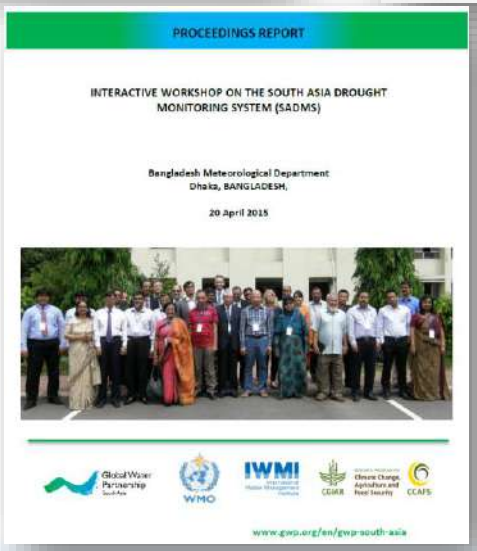
Drought monitoring system helps strengthen resiliency to climate change


Drought Monitoring and Assessment in South Asia

Focus on integration of satellite technology and the future of food security

Project Report – September 2016

NOTE: Present form of the report is in draft stage and has not yet been approved by the partners for wider circulation.


PROCEEDINGS REPORT

INTERACTIVE WORKSHOP ON THE SOUTH ASIA DROUGHT MONITORING SYSTEM (SADMS)

Bangladesh Meteorological Department
Dhaka, BANGLADESH,

20 April 2015

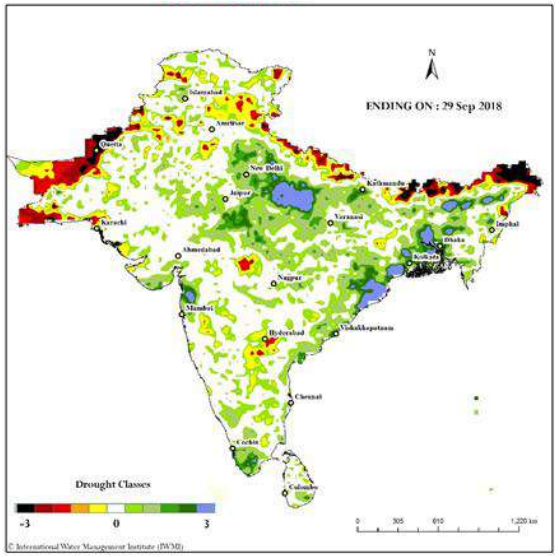
www.gwp.org/en/gwp-south-asia

Reports

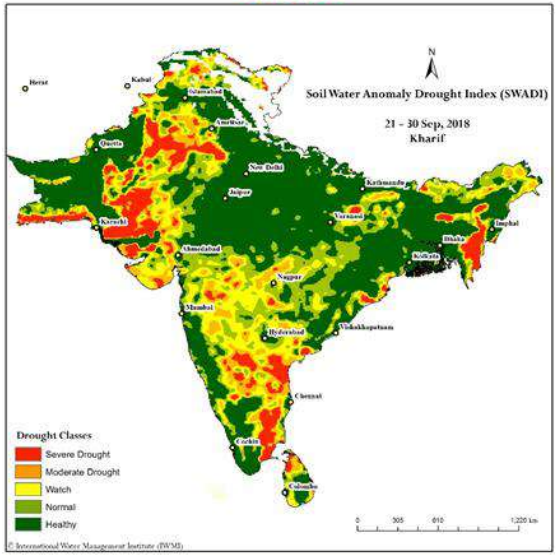
DROUGHT BULLETIN

South Asia Drought Indices – A Comparison & Assessment

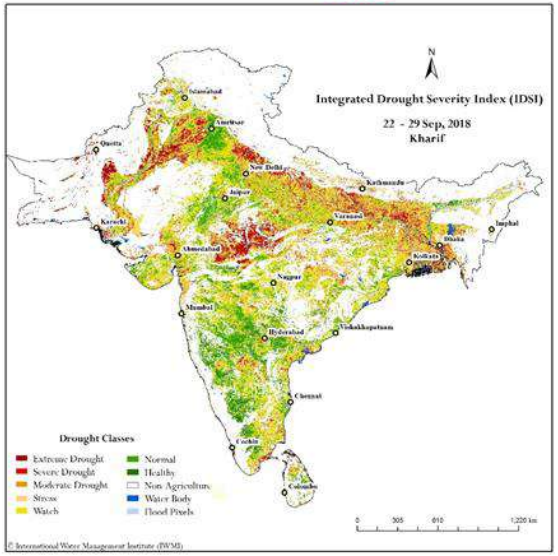
SA-DEWS



SWADI



IDSI



- South Asia-Drought Early Warning System (SA-DEWS) is an integrated approach based on satellite estimates of rainfall temperature, wind and soil type utilized in VIC model and the derived outputs namely Standardized Precipitation Index (3-Month), Standardized Soil Moisture Index (SSI) and Standardized Runoff Index (SRI).
- Soil Water Anomaly Drought Index (SWADI) is derived from satellite based decadal soil moisture product of ASCAT provided by EUMETSAT.
- Integrated Drought Severity Index (IDSI) is an integrated index that has been formulated using VCI, TCI & PCI at 500m resolution for agricultural land-use over South Asia.
- It can be observed, that during this time period, all the three indices shows a relation with each other. The peninsular India is reviving from the drought situation, including Tamil Nadu, Karnataka and AP.

HANDS ON SESSION

- SWI data for SWADI calculation
- Data source

RS data sources – https://land.copernicus.eu/global/products/swi