

Index Based Drought Monitoring in CLMV countries

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Effective use of space applications for drought monitoring in Central Asia
18-19 March 2019, UNCC, Bangkok, Thailand



Drought Impacts in CLMV Countries El Nino Impacts (2015-2016)

- **Cambodia:** Considered the worst drought in about 50 years; Banteay Meanchey, Battambang, Pursat, and Kampong Speu provinces are the worst affected, with around 2.5 million people severely affected (National Committee for Disaster Management).
- **Lao People's Democratic Republic:** Estimated that around 188,000 households in Lao PDR are at risk of food insecurity caused by drought;
- Rice yield has reduced from 10% to 50% in the central parts of the country.

Reference: <https://reliefweb.int/disaster/dr-2015-000180-vnm>



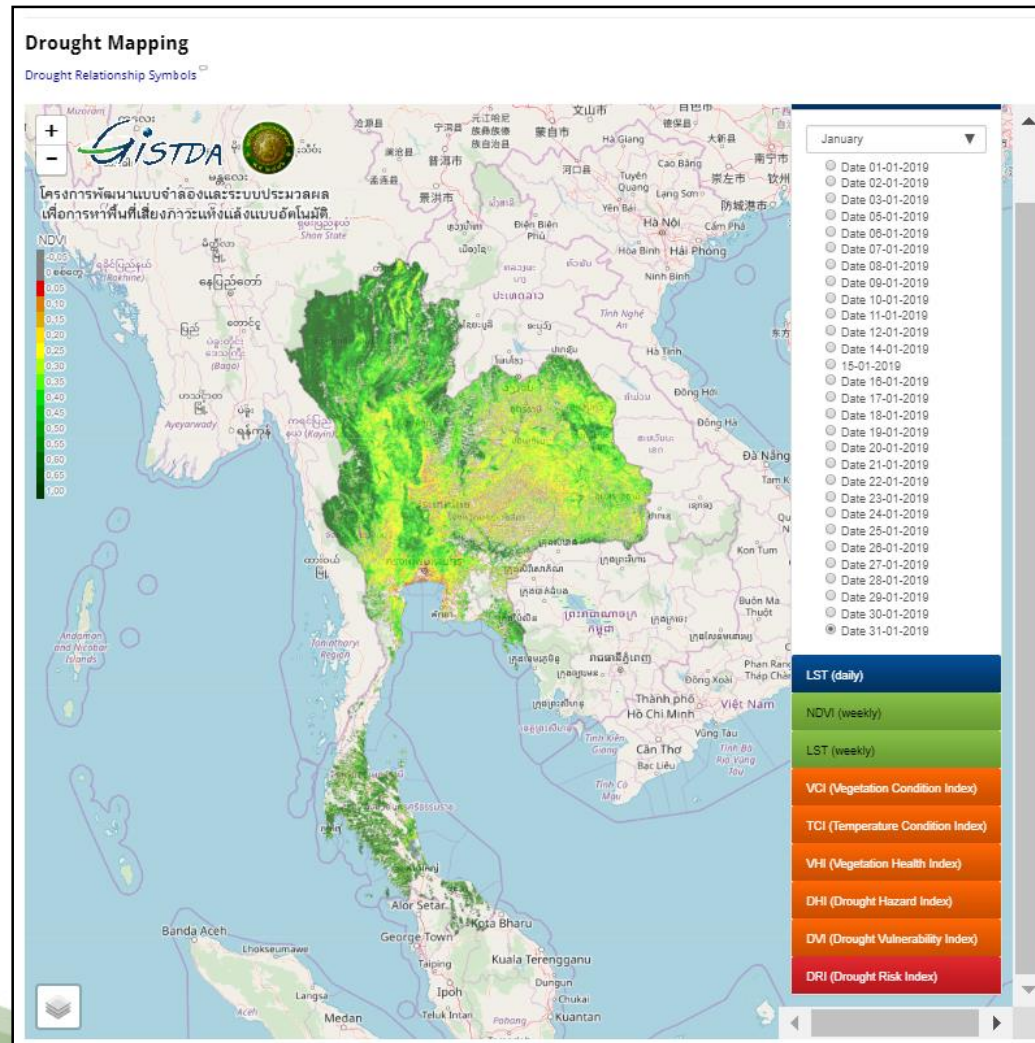
- **Myanmar:** In Myanmar, drought years were observed as 1972, 1979, 1982, 1983, 1986 and 1987 and 2016;
- Severe impact of El Niño in 2016 (leading to extreme temperatures, unusual rainfall patterns, dry soil, high risk of fires and acute water shortages.
- **Vietnam:** Experienced worst drought in 90 years due to El Niño, affecting 52 out of 63 provinces;
- Affected 18 provinces with 2 million people.

Reference: <https://reliefweb.int/disaster/dr-2015-000180-vnm>

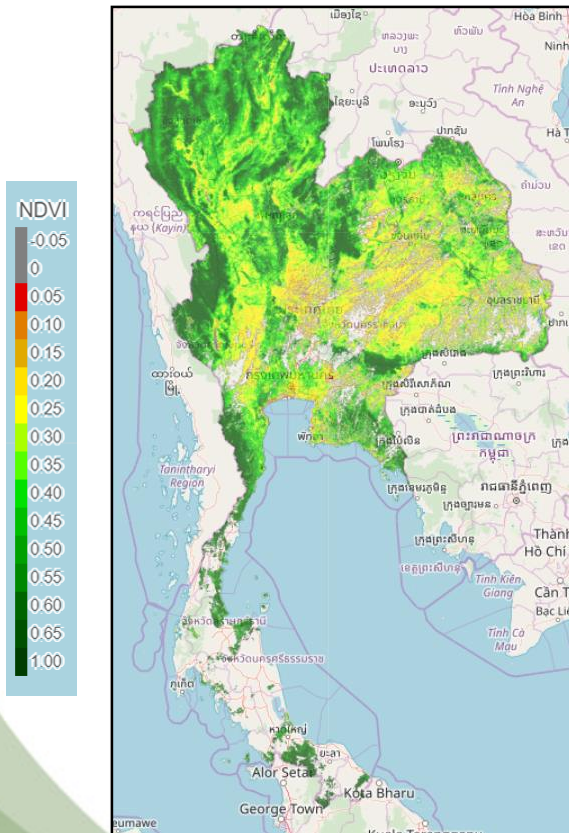
- Of the total 2 million people affected, some 500,000 live in the drought-affected South Central and Central Highlands Regions, and 1.5 million live in the Mekong Delta.

Index Based Drought Monitoring (Lower Mekong Basin)

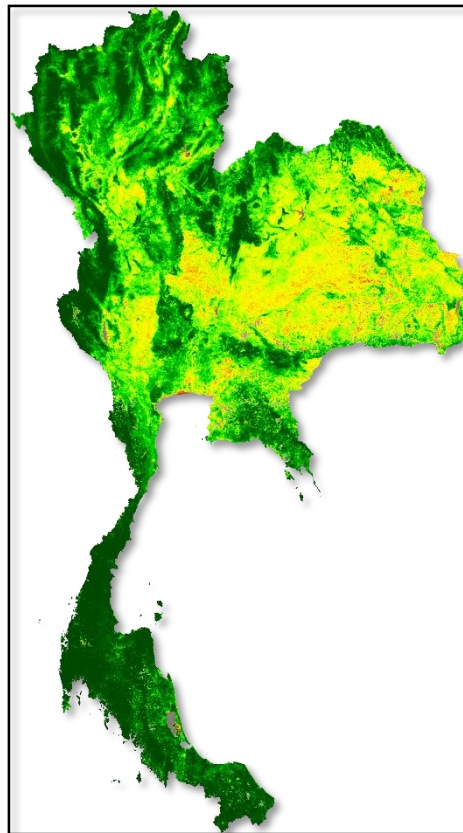
Automatic Drought Monitoring: NPP-Suomi Mission



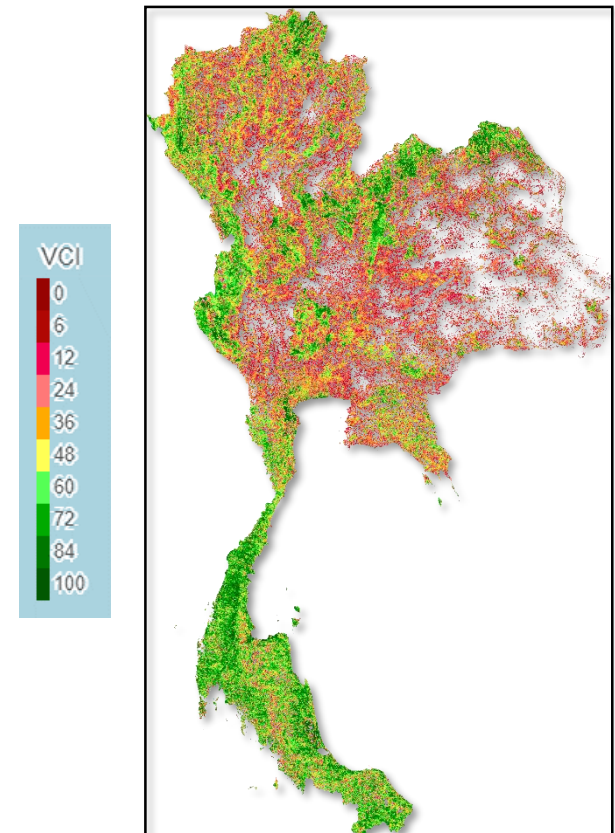
MODIS Based Drought Products



Daily NDVI
05-Mar-2019

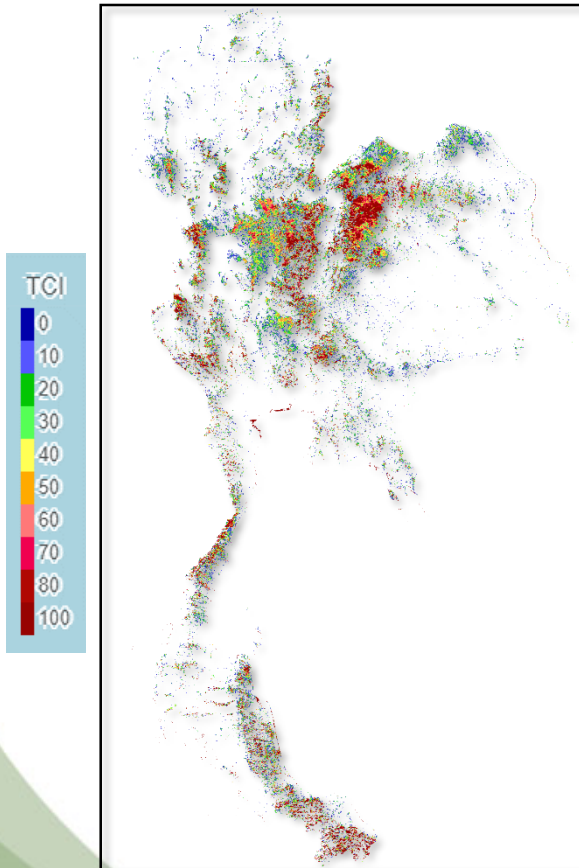


Weekly NDVI
Week 8, Year 2019

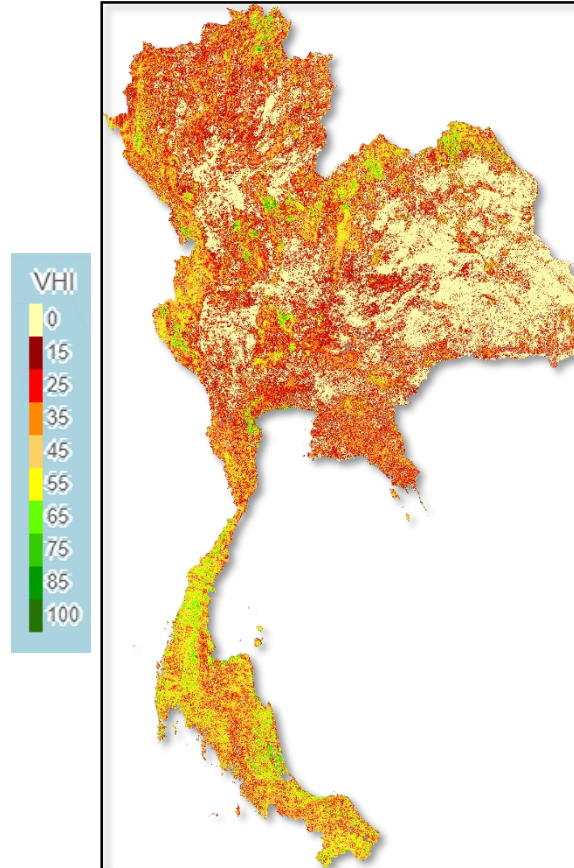


Weekly VCI
Week 8, Year 2019

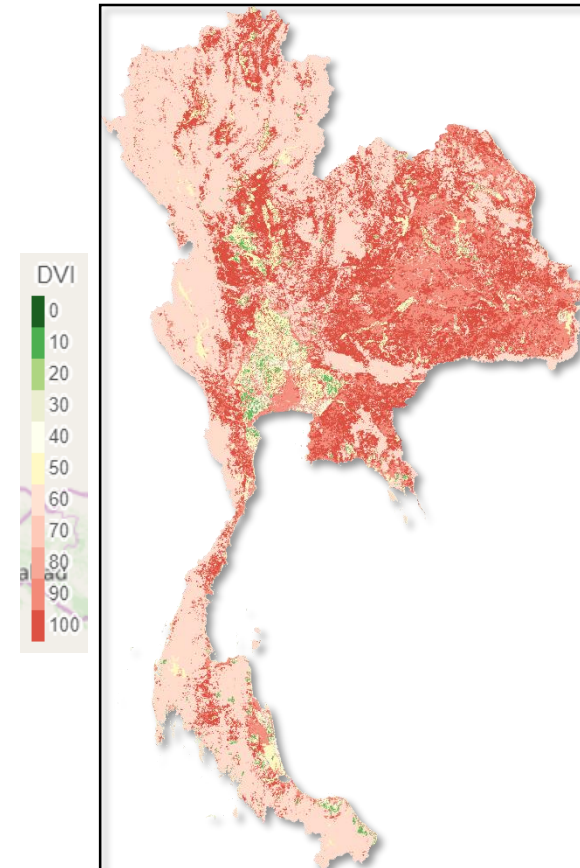
MODIS Based Drought Products



Weekly TCI
Week 7, Year 2019



Weekly VHI
Week 8, Year 2019



Weekly DVI
Week 8, Year 2019

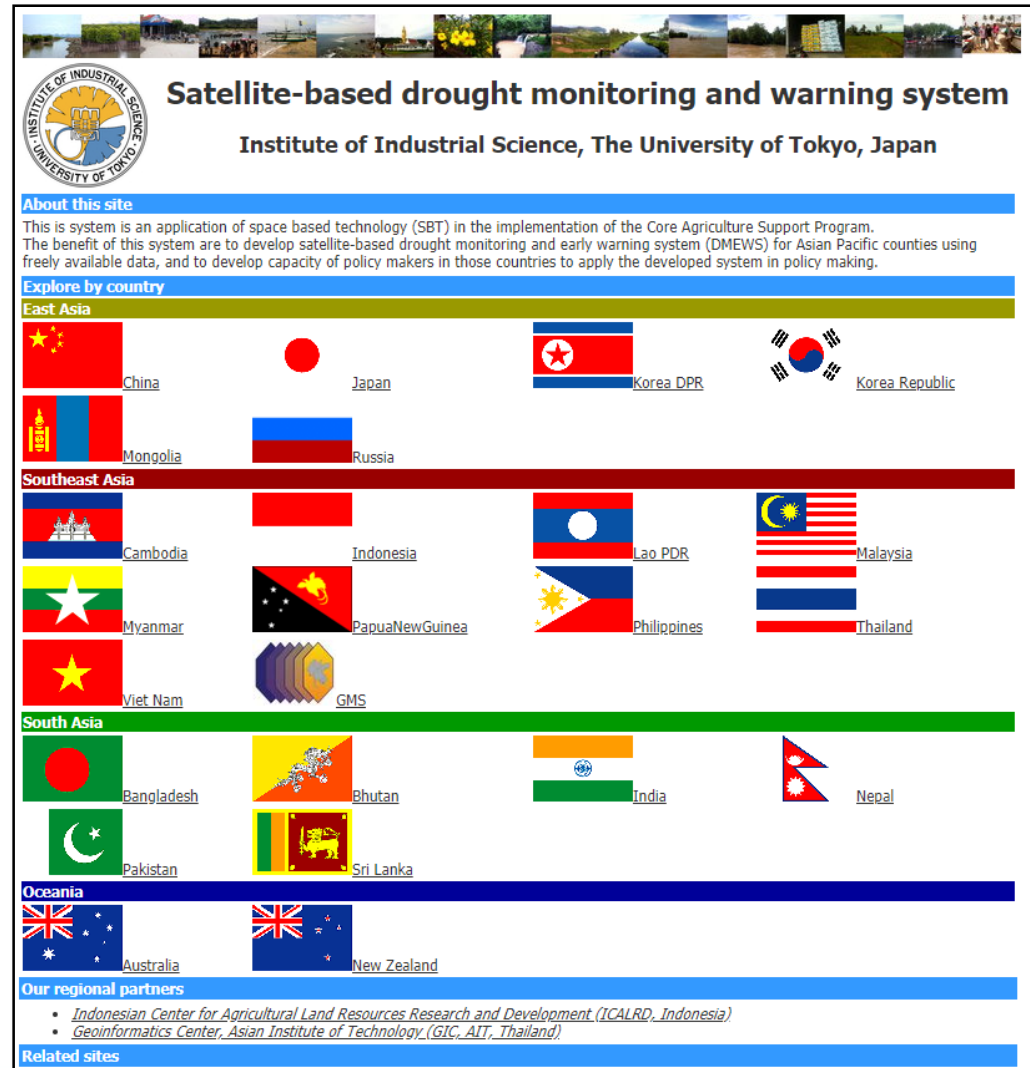
Satellite-based Drought Monitoring and Warning system

The system uses freely available satellite data with the aim to improve decision making process

This system is an application of space based technology to implement the Core Agriculture Support Program of the University of Tokyo, Japan

Regional Partners includes:

- Indonesian Center for Agricultural Land Resources Research and Development (ICALRD, Indonesia)
- Geoinformatics Center, Asian Institute of Technology (GIC, AIT, Thailand)



Satellite-based drought monitoring and warning system
Institute of Industrial Science, The University of Tokyo, Japan

About this site
This system is an application of space based technology (SBT) in the implementation of the Core Agriculture Support Program. The benefit of this system are to develop satellite-based drought monitoring and early warning system (DMEWS) for Asian Pacific counties using freely available data, and to develop capacity of policy makers in those countries to apply the developed system in policy making.

Explore by country

East Asia

- China
- Japan
- Korea DPR
- Korea Republic
- Mongolia
- Russia

Southeast Asia

- Cambodia
- Indonesia
- Laos PDR
- Malaysia
- Myanmar
- PapuaNewGuinea
- Philippines
- Thailand
- Viet Nam
- GMS

South Asia

- Bangladesh
- Bhutan
- India
- Nepal
- Pakistan
- Sri Lanka

Oceania

- Australia
- New Zealand

Our regional partners

- Indonesian Center for Agricultural Land Resources Research and Development (ICALRD, Indonesia)
- Geoinformatics Center, Asian Institute of Technology (GIC, AIT, Thailand)

Related sites

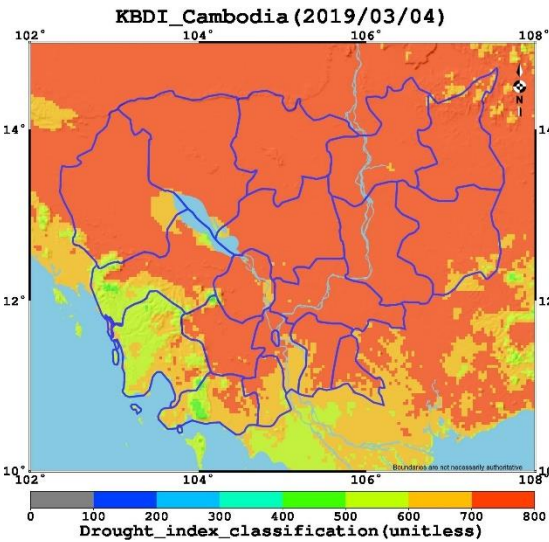
Methodology

- S-DMEWS used Keetch-Byram Drought Index (KBDI) which is a balance between precipitation and evapotranspiration;
- KBDI measures Meteorological Drought;
- Precipitation measured by Global Satellite Mapping of Precipitation (GSMaP) available freely with JAXA;

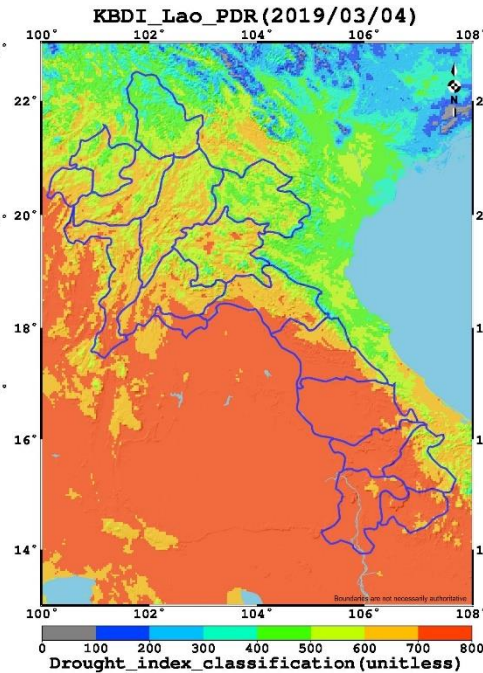
Methodology (contd....)

- Evapotranspiration measured by Land Surface Temperature from Japanese Meteorological Satellite (MTSAT).

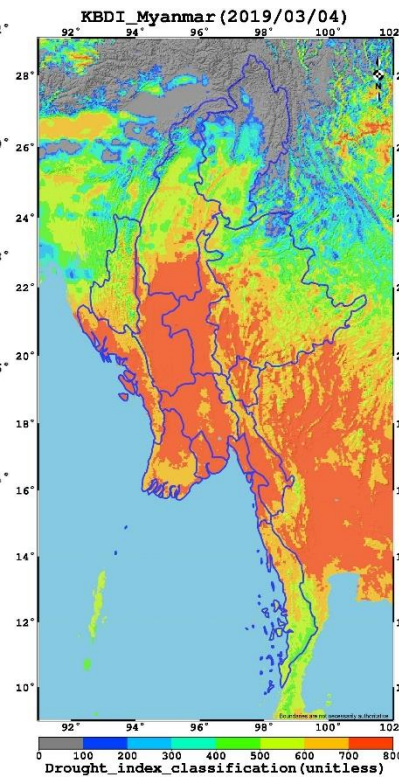
Drought Index Maps



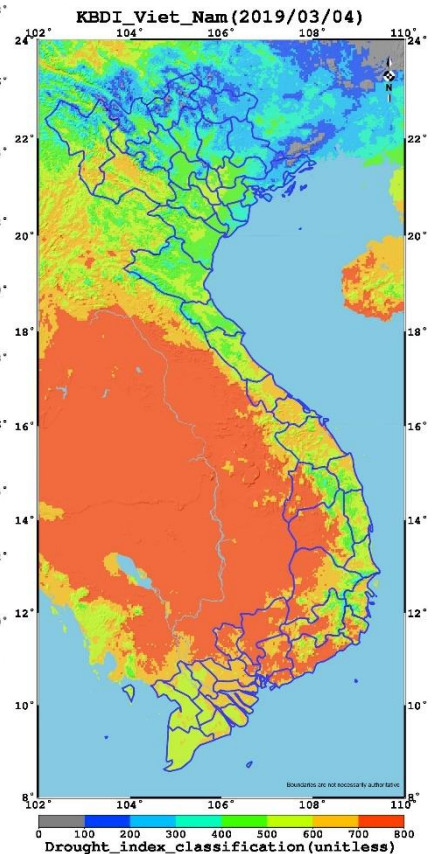
Cambodia



Lao PDR



Myanmar

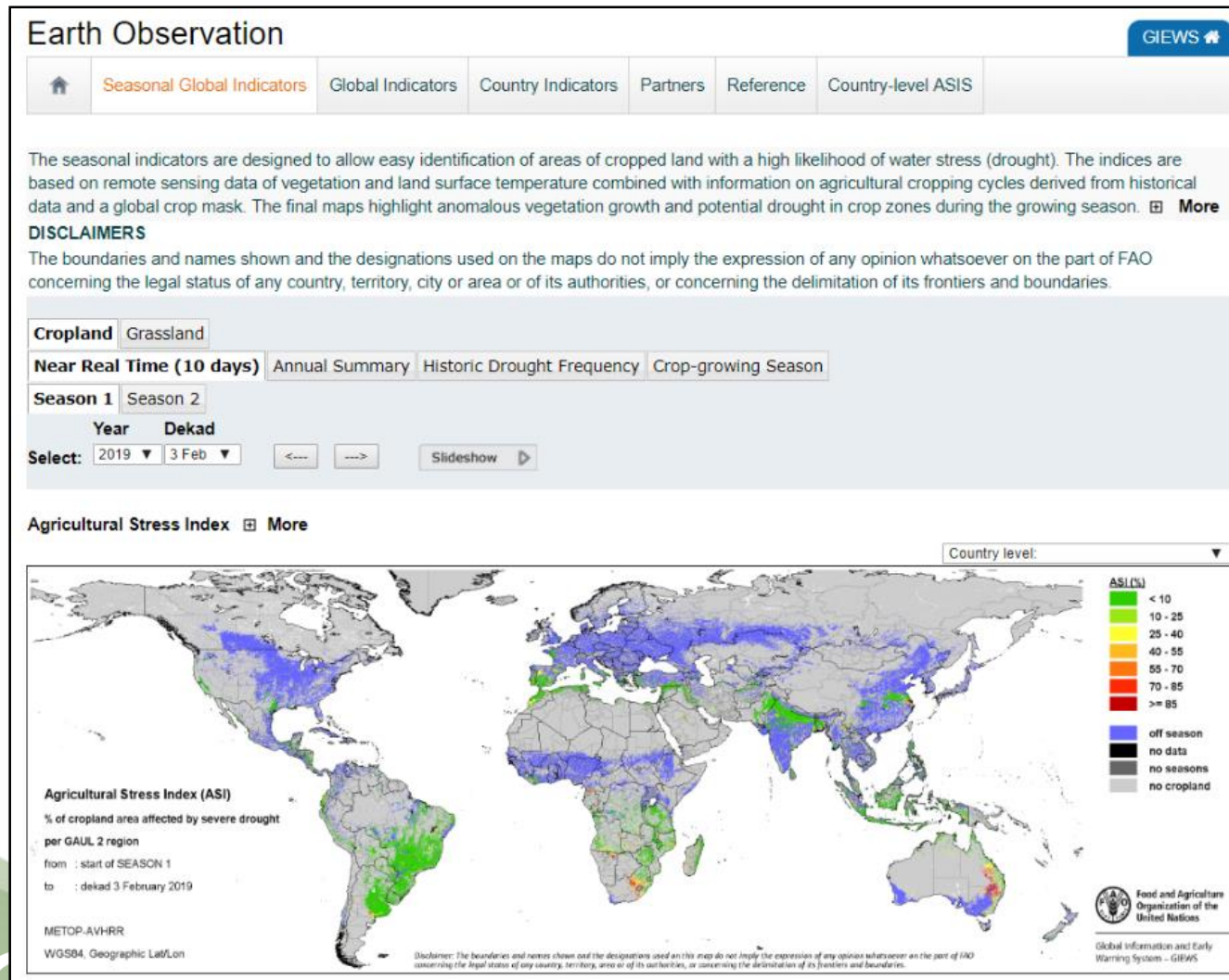


Viet Nam

Available Near Real-Time Drought Information

- Daily, monthly and annual drought index maps for every 10 km x 10 km grid;
- Daily updated drought trend graph for every 10 km x 10 km grid;
- Daily updated drought warning and its maps [province name and affected areas (km²)].

Agricultural Stress Index System (ASIS) of GIEWS - Global Information and Early Warning System (FAO)



Country-Level ASIS Tool

- Developed to help countries monitor agricultural drought and manage its risks, using satellite data to detect cropped land that could be affected by drought;
- The country-specific version of the Tool uses general methodological principles of the global ASIS that FAO uses to support the Global Information and Early Warning System on Food and Agriculture (GIEWS).

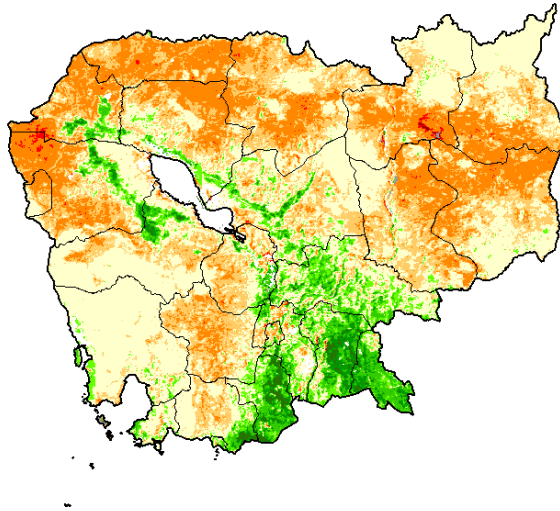
Country Indicators

- The country level maps and graphs depict the latest 36-month period of the seasonal, vegetation and precipitation indicators;
- The data is presented by dekad and month;
- All three vegetation indicators are based on 10-day (dekadal) vegetation data from the METOP-AVHRR sensor at 1 km resolution (2007 and after);
- Data at 1 km resolution for the period 1984-2006 are derived from the NOAA-AVHRR dataset at 16 km resolution.

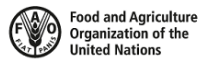
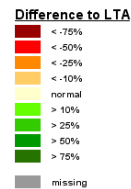
NDVI Anomaly

Cambodia

Cambodia



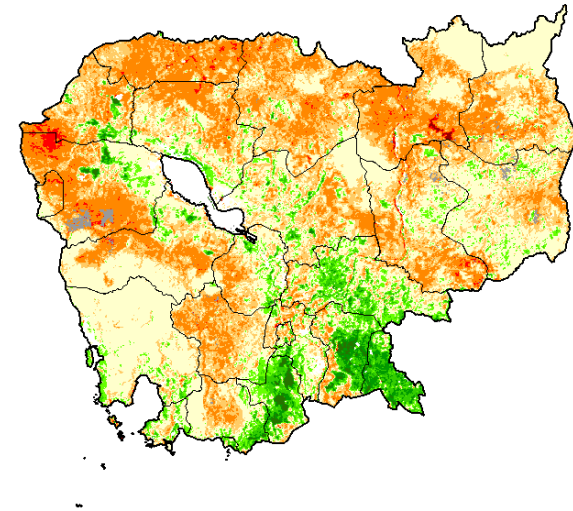
NDVI anomaly
Relative difference to Long Term Average
January 2019
METOP-AVHRR
WGS84, Geographic Lat/Lon



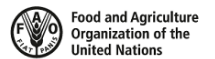
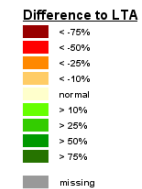
Global Information and Early
Warning System – GIEWS

Disclaimer: The boundaries and names shown, and the designations used on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, area or of its authorities, or concerning the delimitation of its frontiers and boundaries.

Cambodia



NDVI anomaly
Relative difference to Long Term Average
February 2019
METOP-AVHRR
WGS84, Geographic Lat/Lon



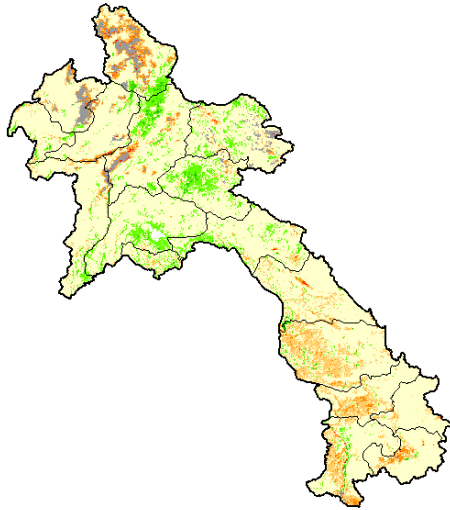
Global Information and Early
Warning System – GIEWS

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NDVI Anomaly

Lao PDR

Lao People's Democratic Republic



NDVI anomaly

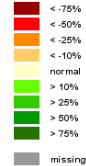
Relative difference to Long Term Average

January 2019

METOP-AVHRR

WGS84, Geographic Lat/Lon

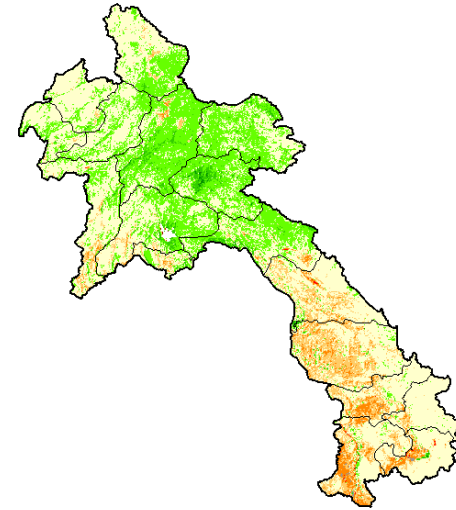
Difference to LTA



Food and Agriculture
Organization of the
United Nations

Global Information and Early
Warning System – GIEWS

Lao People's Democratic Republic



NDVI anomaly

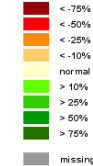
Relative difference to Long Term Average

February 2019

METOP-AVHRR

WGS84, Geographic Lat/Lon

Difference to LTA



Food and Agriculture
Organization of the
United Nations

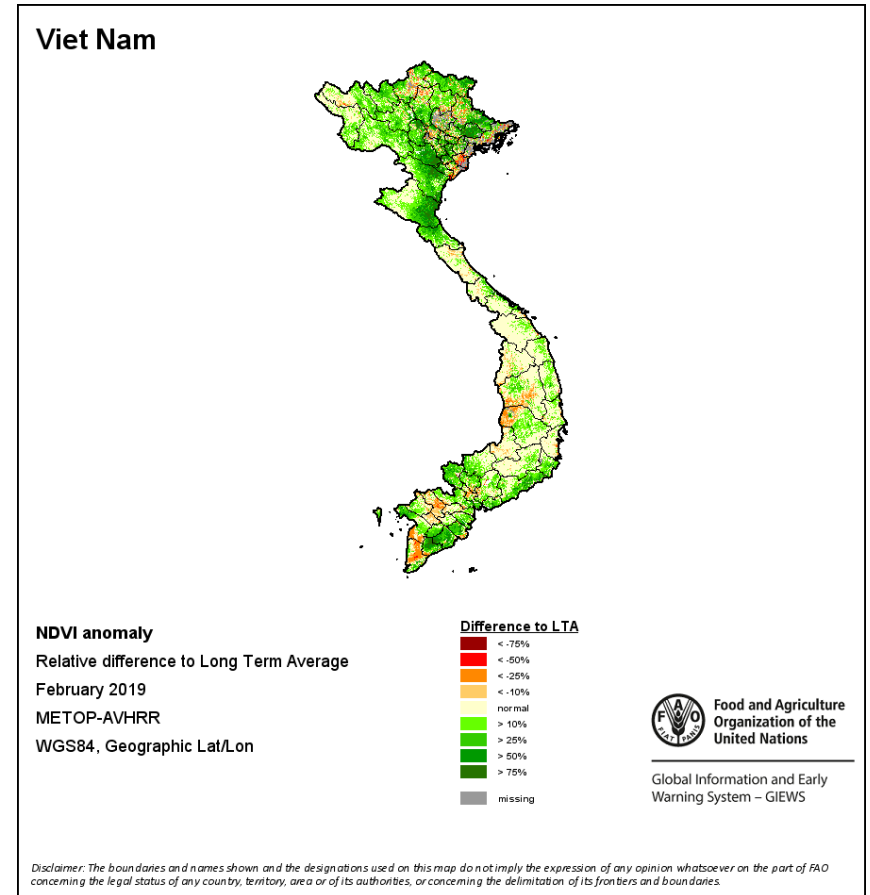
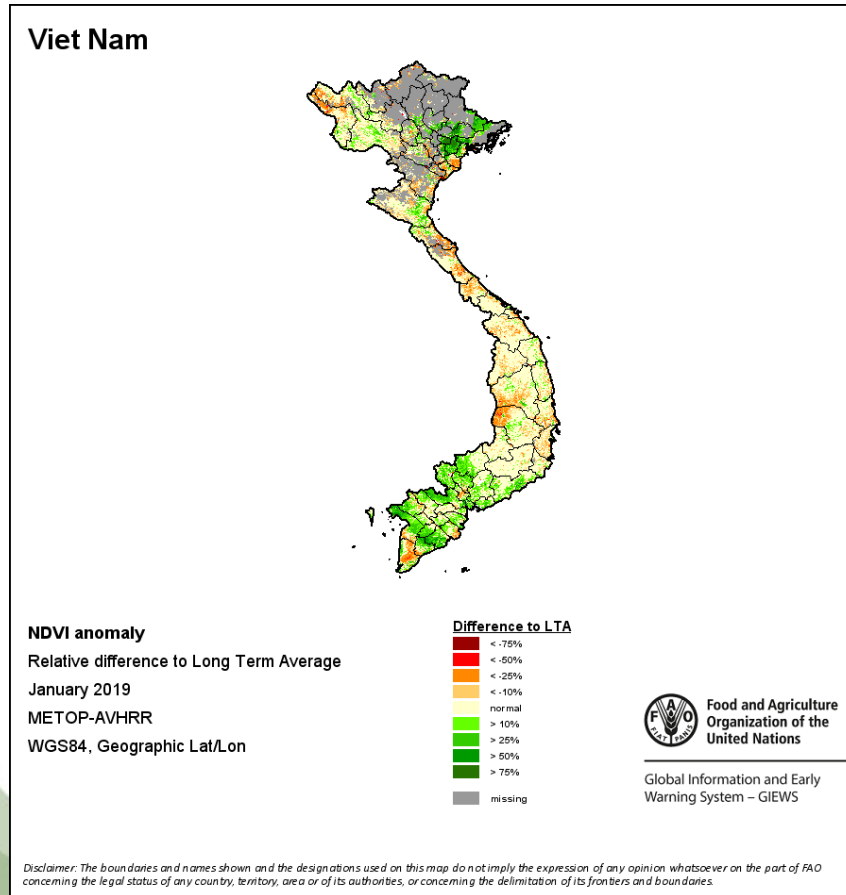
Global Information and Early
Warning System – GIEWS

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NDVI Anomaly

Viet Nam

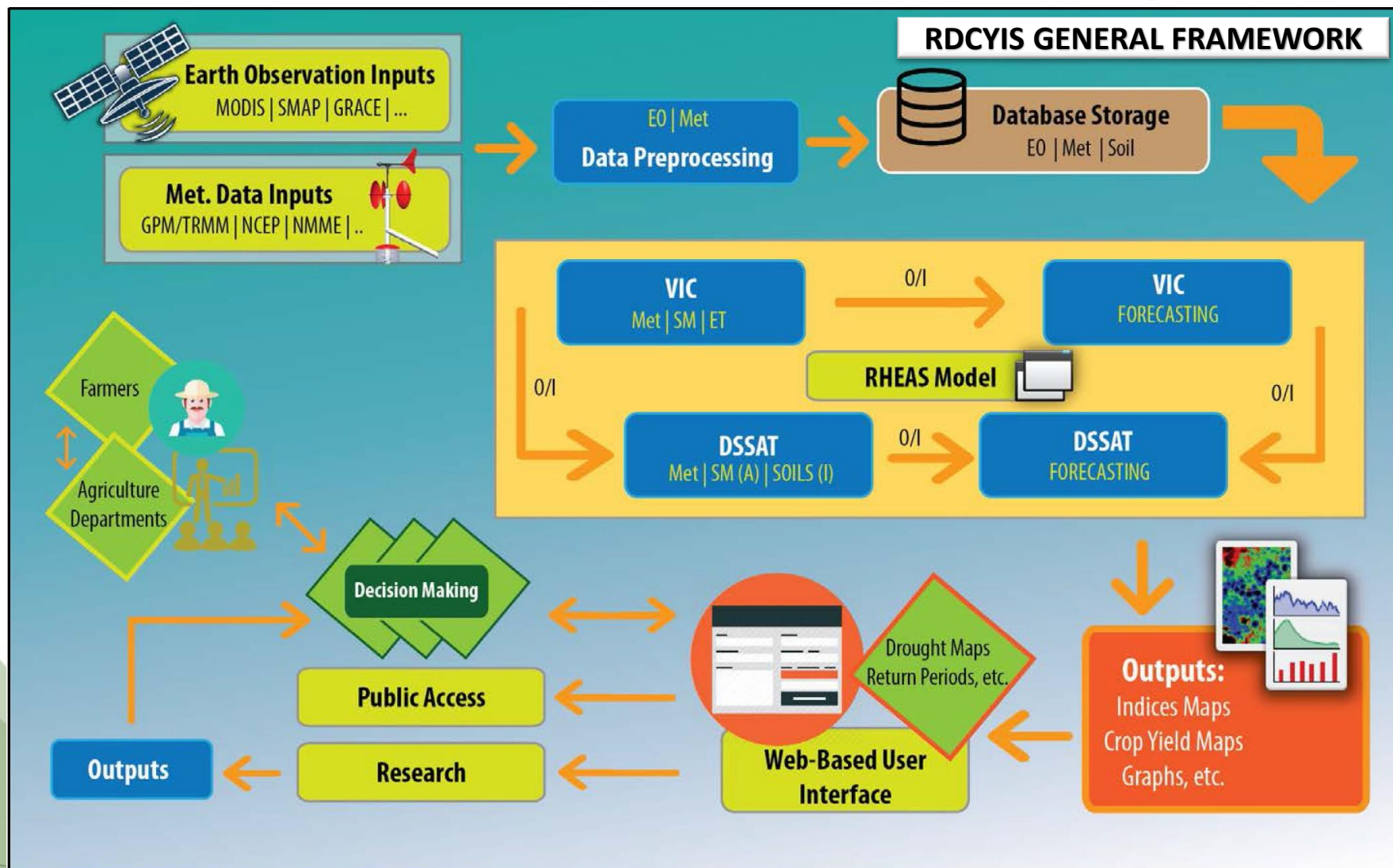


Regional Drought and Crop Yield Information System (RDCYIS)

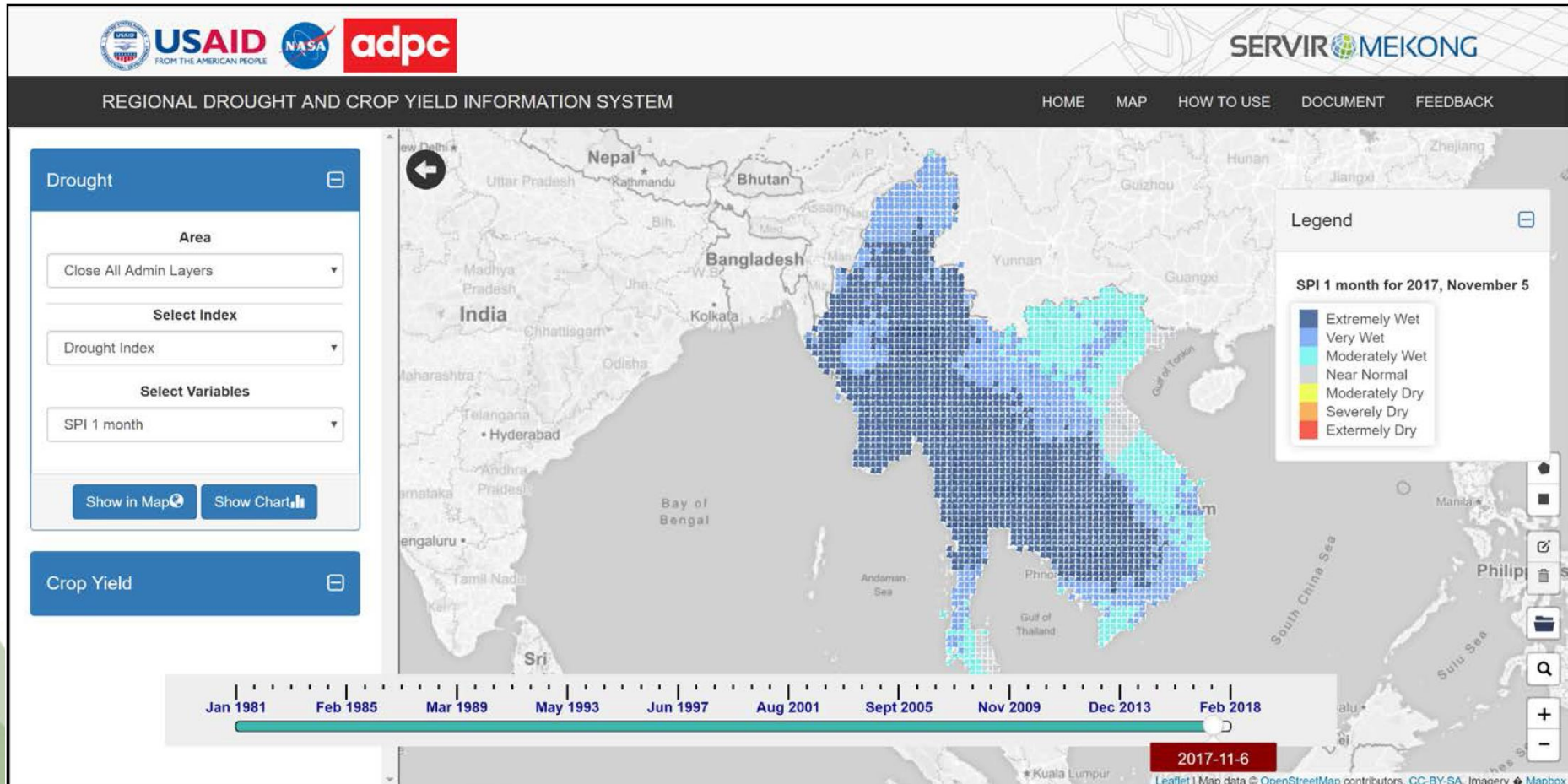
- Regional tool that integrates drought monitoring and forecasting information as well as crop yield information to allow decision-makers in planning and preparedness during drought situations;
- The system is developed under NASA-SERVIR program (SERVIR-Mekong) for Lower Mekong.

RDCYIS Framework

SERVIR  MEKONG



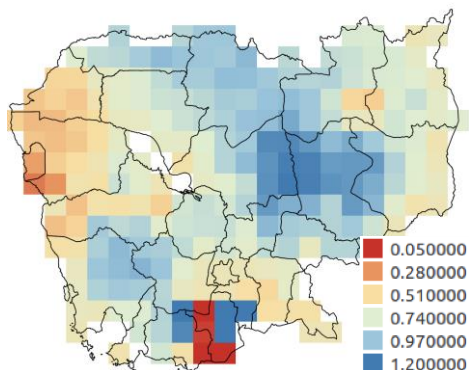
RDCYIS Interface and Drought Information



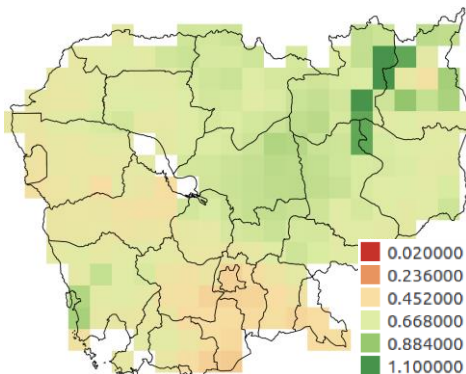
<https://rdcyis-servir.adpc.net>

Monitoring & Forecasting Drought and Crop Yield in Lower Mekong Basin

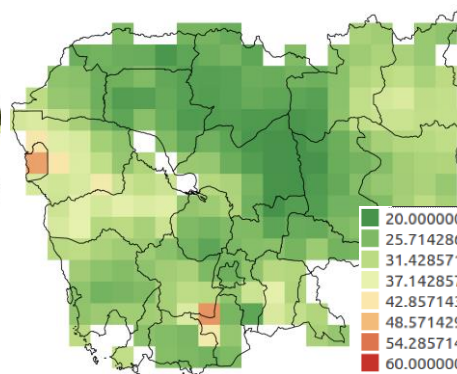
GS SMDI: 2016



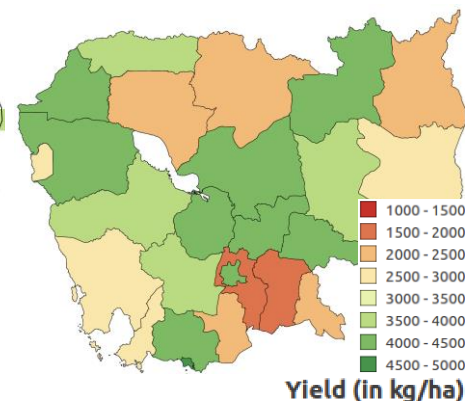
GS SPI3: 2016



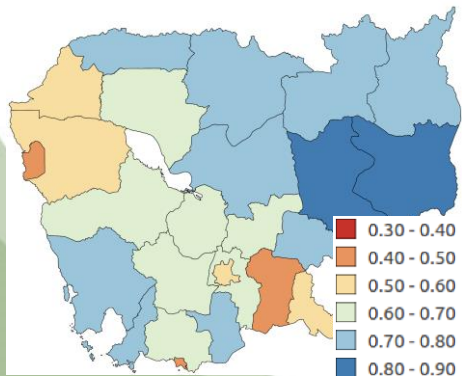
GS SEVERITY: 2016



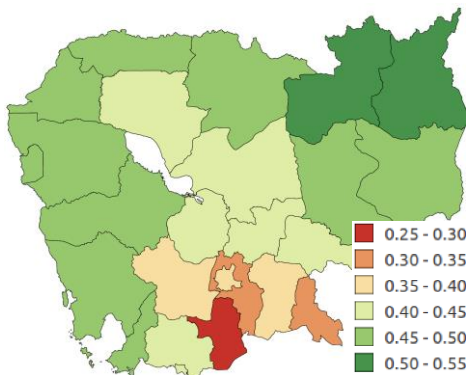
RICE YIELD: 2016



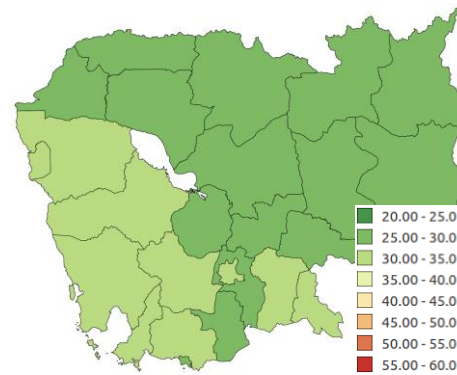
SMDI: 2000 - 2016



SPI3: 2000 - 2016



SEVERITY: 2000 - 2016



The study highlight clear climatic patterns and its influence on rice yield.

GS: Growing Season (April – October)

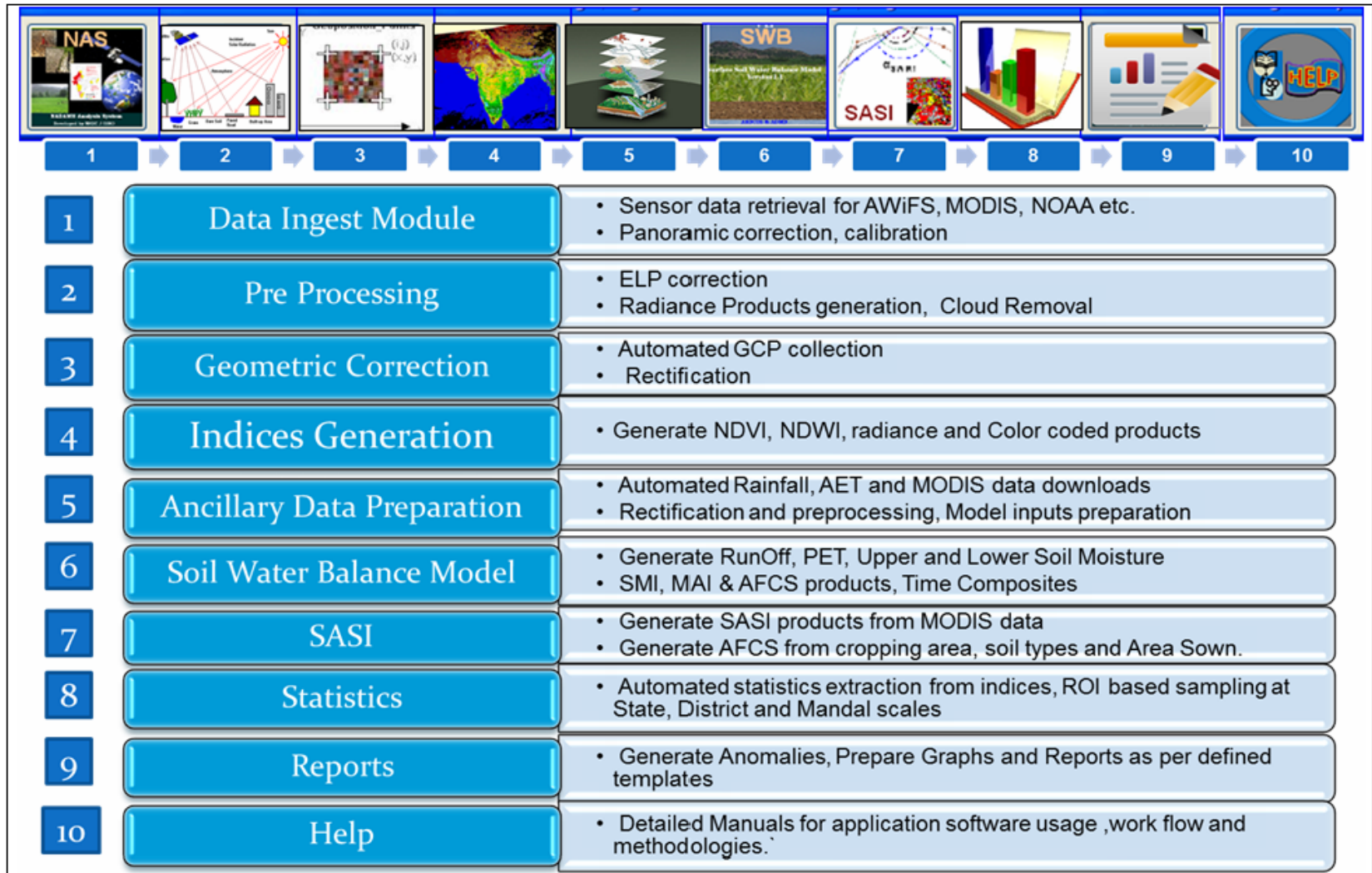
Source: NASA-JPL/SERVIR-Mekong

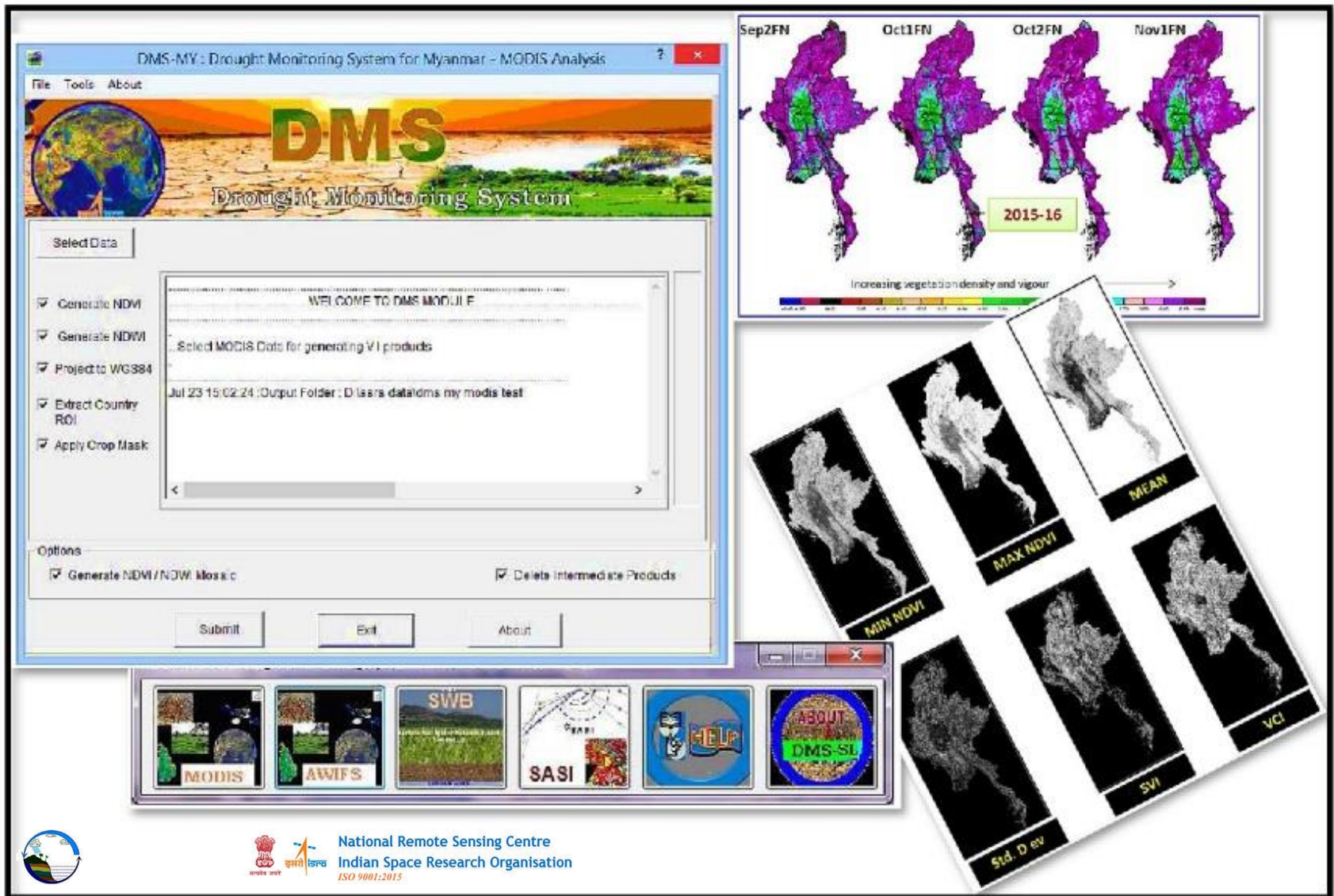
Drought Monitoring System (DMS) in Myanmar

- Department of Meteorology and Hydrology, Government of Myanmar has been using the DMS in the Dry Zone to produce 5- 15 days outlooks on drought conditions;
- The system developed by National Remote Sensing Center of India has been customized and calibrated to Myanmar conditions.

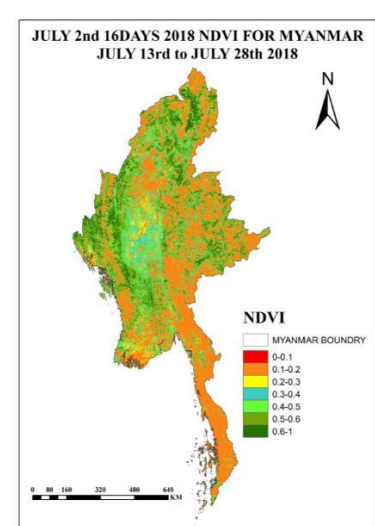
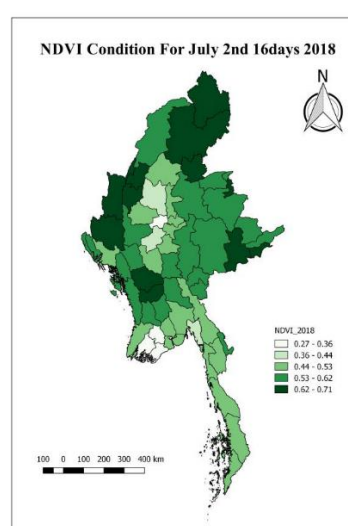
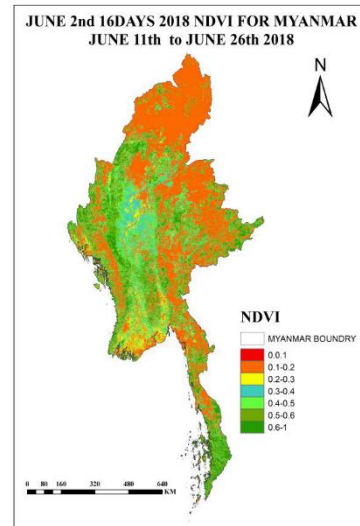
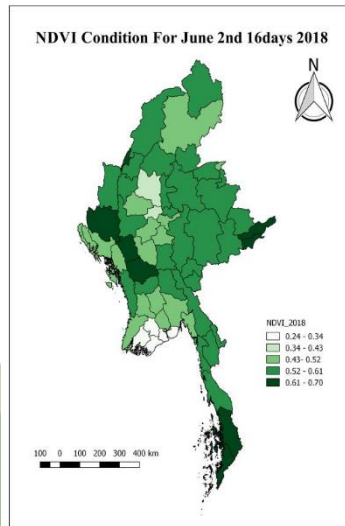
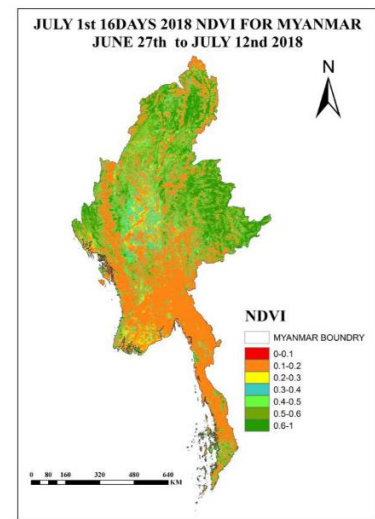
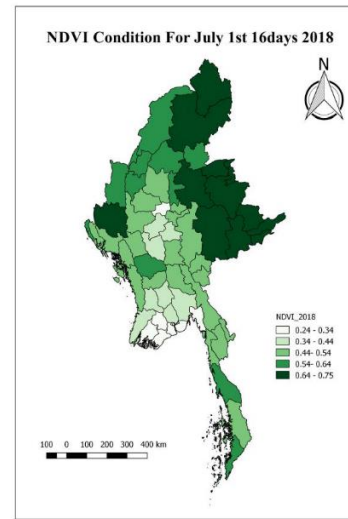
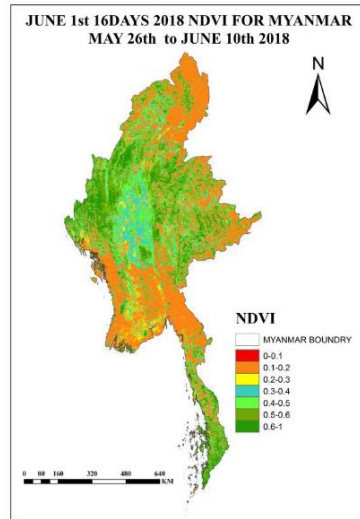
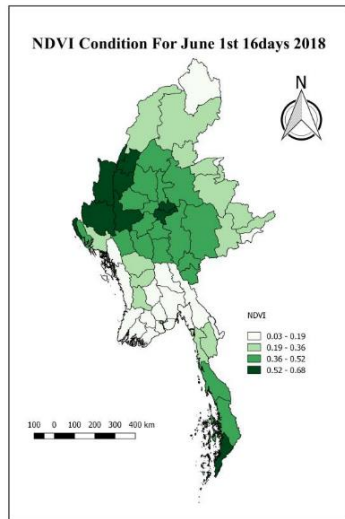
ESCAP's Regional Drought Mechanism

Workflow of DMS Software





NDVI for Drought Monitoring



Lessons Learned

- Many tools for drought monitoring are available at global, regional and national levels;
- Most tools can be customized and calibrated depending on country needs;
- Availability of real time satellite data also enhances the effective monitoring of drought conditions;
- Space-based data is a vital complement to ground-based information in combating drought;

Lessons Learned

- Critical for the Asia-Pacific region to place a stronger emphasis on preparedness by applying innovative space technologies for effective drought monitoring and early warning;
- Availability of timely and free access to space-based data/products and services;
- Space technology can help the agricultural community to make evidence-based decisions on how and when to prepare for drought.

Data Availability

Variable	Dataset	Tim. Cov.	Temp. Res	Spat. Res	Spatial Coverage
Precipitation	CHIRPS	1981-	Daily	5km	Global
Precipitation	TRMM	1998-	Daily	0.25 °	Global
Precipitation	RFE2	2001-	Daily	0.10 °	Africa
Precipitation	CMORPH	1998-	Daily	0.25 °	Global
Precipitation	GPM	2014-	Daily	0.10 °	Global
Temp/Wind	NCEP	1981-	Daily	1.875 °	Global
Temp/Wind	PRISM	1981-	Daily	4km	CONUS
Soil moisture	AMSR-E	2002-2011	Daily	0.25 °	Global
Soil moisture	SMOS	2009-	Daily	~40km	Global
Soil moisture	SMAP	2015-	Daily	3/9km	Global
Evapotranspiration	MOD16	2000-	8 days	1km	Global
Water storage	GRACE	2002-	Monthly	1.0 °	Global
Snow cover	MOD10	2001-	Daily	1km	Global
Snow cover	MODSCAG	2001-	Daily	1km	Global
Leaf Area Index	MCD15	2002-	8 days	1km	Global
Meteorology	IRI	2000-	Monthly	2.5 °	Global
Meteorology	NMME	2000-	Daily	0.5 °	Global
Precipitation	CHIRPS	1981-	Daily	5km	Global
Temp/Wind	NCEP	1981-	Daily	1.875 °	Global
Soil moisture	SMOS/SMAP	2009-	Daily	~40km	Global
Meteorology	NMME	2000-	Daily	0.5 °	Global

How can I access drought monitoring information?

- Famine Early Warning Systems (FEWS NET);
- Agricultural Stress Index System (ASIS, FAO);
- Crop monitoring (GEOGLAM);
- Global Agricultural Drought Monitoring and Forecasting System (GADMFS - CSISS);
- Global Drought Information System (NIDIS);
- Drought Monitoring (EOSDIS Worldview - NASA).

Thank You!!

