**NASA DEVELOP National Program**

Goddard Space Flight Center

**Summer 2015**

**Thailand Disasters**

Monitoring Risk and Extent of Drought for Enhanced Decision Making and Resource Allocation in the Kingdom of Thailand

**VPS Title:** The Trifecta of Drought: Monitoring Meteorological, Hydrological and Agricultural Drought in the Kingdom of Thailand

**Project Team & Partners**

**Project Team:**

Sean McCartney (Project Lead), sean.mccartney@nasa.gov

Nobphadon Suksangpanya

Chisaphat Supunyachotsakul

Srisunee Wuthiwongyothin

Sahakait Benyasut

Thanapat Vichienlux

**Advisors & Mentors:**

Dr. John Bolten (NASA GSFC)

Colin Doyle (NASA GSFC)

**Partner Organizations**

Royal Thai Embassy, Collaborator/Boundary Organization, POC: Bunyakiat Raksaphaeng

Asian Disaster Preparedness Center/SERVIR Mekong, Collaborator/Boundary Organization,

POC: Pete Cutter

Thai Department of Disaster Prevention and Mitigation, End-User, POC: TBD

National Safety Council of Thailand, End-User, POC: TBD

**Project Details**

**Applied Sciences National Applications Addressed:**

Disasters

**Study Area:** Kingdom of Thailand

**Study Period:** January 1998 - June 2015

**Earth Observations & Parameters**

### TRMM, Microwave Imager (TMI) - Precipitation measurements

GPM, Microwave Imager (GMI) - Precipitation measurements

Terra/Aqua, MODIS - Evapotranspiration, Land Surface Temperature, Vegetation Indices

SMOS, MIRAS - Soil moisture

**Ancillary Datasets Utilized**

* Royal Irrigation Department - In situ stream-flow measurements

**Models Utilized**

* None (so far)

**Software Utilized**

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Aqua/Terra MODIS, TRMM TMI, GPM GMI

TerrSet - Image processing of Aqua/Terra MODIS, TRMM PR, GPM GMI and SMOS MIRAS

MatLab - Data acquisition of TRMM PR and GPM GMI

Python - Scripting of drought monitoring tool and incorporation of tool into web service

**Project Overview**

As the biggest exporter of rice in the world, Thailand depends on monsoon rains to provide precipitation for on-season and off-season rice. Water stored in reservoirs during the monsoon rains provides needed irrigation during the off-season when precipitation is limited. When unfavorable meteorological conditions lead to drought, this affects the economy and social livelihoods of Thai citizens. The drought of 2015 is the worst drought to impact Thailand in over 15 years. This study monitors three type of drought: meteorological, hydrological and agricultural within the Kingdom of Thailand. Using data derived from Earth Observing (EO) satellites and *in situ* stations, tools are created that will aid in mitigating risk and improve resource allocation in the country.

**Abstract**

Drought is a natural disaster impacting agricultural, environmental and economic livelihoods. The Kingdom of Thailand is impacted by drought due to the variability of monsoon rains as well as other unfavorable meteorological conditions. As the biggest exporter of rice in the world, drought has the ability to impact the economy of Thailand in a big way. The available drought monitoring system in Thailand looks at only agricultural drought. This is insufficient for analyzing accurate risk management and decision-making. Using data from various Earth Observing (EO) satellites and *in situ* stations, this study utilizes three indices to analyze and monitor the current state of meteorological, hydrological and agricultural drought across Thailand. The Standardized Precipitation Index (SPI) is used in monitoring meteorological drought, the Stream-Flow Drought Index (SDI) is used in monitoring hydrological drought and the Drought Severity Index (DSI) is used in monitoring agricultural drought. All indices are based on a monthly temporal resolution for monitoring drought. The study demonstrates how a combination of various indices can offer better understanding of drought conditions, with data derived from EO satellites offering the ability to monitor drought across the entire country, and in near-real time.

**Community Concerns**

* Drought diminishes crop yields with effects to the economy and livelihoods of citizens
* The Office of Agricultural Economics (OAE) of Thailand estimated the 2015 drought will reduce Thailand’s off-season crops export by higher than 30%
* Government policies must be enacted to conserve water and provide for the welfare of the people
* Government expenditures increase to install water pumps and provide mobile water tanks in the most drought affected areas

**Current Management Practices & Policies**

In 2015, the Royal Thai Government established a four-part integrated plan for drought management. The first strategy focuses on drought prediction and developing a reliable warning system for drought-prone areas. The second strategy focuses on drought preparation. The third and fourth strategies focus on emergency management and post-disaster management. Currently, the drought monitoring system is provided by the Geo-Informatics and Space Technology Development Agency (GISTDA). This system contributes NDVI and NDWI products derived from MODIS data from the platforms of Terra and Aqua to monitor drought. This information is published on a near-real-time web-based service (7 days) at<http://drought.gistda.or.th/>. Vegetation indices are characteristic of agricultural drought which is of considerable concern for such a large rice-exporting country.

**Decision Support Tools & Benefits**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Meteorological Drought Index (Time Series) | TRMM - TMIGPM - GMI | Index allows Thai government agencies and NGOs the ability to identify the timing and severity of meteorological drought from 1998 - present. |
| Hydrological Drought Index (Time Series) | None | Index allows Thai government agencies and NGOs the ability to identify the timing and severity of hydrological drought from 1998 - present. |
| Agricultural Drought Index (Time Series) | Terra/Aqua - MODISTRMM - TMIGPM - GMI | Index allows Thai government agencies and NGOs the ability to identify the timing and severity of agricultural drought from 1998 - present. |
| Agricultural Drought Near-Real Time Monitoring Tool | Terra/Aqua - MODIS | Tool allows Thai government agencies and NGOs the ability to monitor agricultural drought in near-real time (monthly).  |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)