**NASA DEVELOP National Program**

**Summer 2016 Project Proposal**

**NASA Marshall Space Flight Center**

**Mekong River Basin Agriculture**

Utilizing NASA Earth Observations to Enhance Drought Management Decisions within the Mekong River Basin’s Agricultural Fields

**Project Overview**

***Objective:*** To build capacity in NASA Earth observations and improve decisions regarding food security and drought management within the lower Mekong River Basin.

***Community Concern:*** The Mekong River Basin experiences annual flooding and frequent periods of drought. This region is known for its rain fed rice crops which benefit the local economy and work force. Drastic changes in climatic conditions have the potential to drastically impact the rice yields which would result in a major economic loss throughout the region.

***National Application Areas Addressed:*** Agriculture, Disasters

***Study Location:*** Thailand, Myanmar, Laos, Vietnam, Cambodia

***Study Period:*** Jan 2000 to May 2016

***Advisors:*** Dr. Jeffrey Luvall (NASA at NSSTC), Dr. Robert Griffin (University of Alabama in Huntsville), Eric Anderson (NASA SERVIR)

***Source of Project Idea:*** Interest for this project came about after both the SERVIR Mekong Hub and officials at the Royal Thai Embassy highlighted this as a priority topic during multiple meetings with DEVELOP.

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Asian Disaster Preparedness Center (ADPC)/SERVIR Mekong Hub | Peter Cutter, SERVIR-Mekong Science & Data Co-Lead (SIG)  Rishiraj Dutta, Technical Specialist in Climate Risk Management (ADPC)  Eric Anderson, NASA/SERVIR-Mekong Science Coordination Lead | End-User | Yes |
| Royal Thai Embassy | Bunyakiat Raksaphaeng, Project Consultant and Policy Analyst | Collaborator | Yes |

***End-User Overview***

***End-User’s Current Decision Making Process:***

Currently, ADPC/SERVIR Mekong Hub uses scientific knowledge to understand, identify, and quantify agricultural drought to institutionalize or strengthen systems to address the risk. They also aim to reduce local, national, and regional risk throughout the Asia-Pacific by deploying drought monitoring information systems. Once these systems are in place, ADPC/SERVIR Mekong Hub end users are enabled to integrate such information into food security and development planning processes.

***End-User’s NASA Earth Observations Capacity:***

ADPC – ADPC currently uses NASA Earth observations and science based information to understand drought, as well as to focus on hazard assessments, vulnerability field surveys, and damage estimation of hypothetical event scenarios. They respond to end user needs for Earth observations and information dissemination/management systems by increasing their capacity to access and use such tools.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

Royal Thai Embassy – The Royal Thai Embassy is interested in assessing which areas are prone to drought. They will assist the project by giving knowledge and advice on the Mekong River Basin.

***Boundary Organization Dissemination:***

Royal Thai Embassy – Officials at the Royal Thai Embassy will serve as the liaison to local organizations and decision makers throughout Thailand. The Royal Thai Embassy will provide these local parties with the derived end-products and results that will improve disaster management practices and the allocation of resources.

ADPC/SERVIR-Mekong will also serve as a liaison to regional organizations throughout the Lower Mekong. It is envisioned that final products be hosted on the SERVIR-Mekong geoportal and capacity be built at ADPC to continue creating the drought monitoring products in house.

***Project Communication & Transition Overview***

***In-Term Communication Plan:***

Joint communication with the Royal Thai Embassy and ADPC will be initiated through the National Program Office. The team will initiate a telecon or in-person meeting with the SERVIR Mekong Hub during the first week of the term. This will allow the team to introduce themselves and present the project’s objectives and proposed end-products. During the term, the DEVELOP team will update ADPC/SERVIR-Mekong and NASA/SERVIR SCO with progress on a bi-weekly basis via Skype (as part of the SERVIR-Mekong bi-weekly science meetings). The team may also invite the Royal Thai Embassy to these calls; in the event they are unable to join, they summarize and send bi-weekly project updates to all partners via email.

***Transition Approach:***

The end-products will be handed off via e-mail to Peter Cutter and Rishiraj Dutta from the SERVIR Mekong Hub and Bunyakiat Raksaphaeng from the Royal Thai Embassy due to their locations away from MSFC. The end-products will also be handed off to Eric Anderson from SERVIR in person. Presentations will be given to both project partners to explain how the end-products were created and how they can be used. The end-products will be hosted on the SERVIR-Mekong geoportal (forthcoming, currently <http://servir.adpc.net>).

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **SMOS MIRAS** | Soil Moisture | SMOS MIRAS data will be used for soil moisture data to identify areas prone to droughts. |
| **GPM GMI** | Precipitation | GPM GMI IMERG product will provide precipitation data that will aid in identifying areas prone to droughts. |
| **Aqua/Terra MODIS** | Surface reflectance, Temperature | Aqua/Terra MODIS will be used to create the Normalized Difference Vegetation Index (NDVI) as an input for analyzing drought. Aqua/Terra MODIS will also be used to derive land surface temperature for analyzing drought. |
| **TRMM PR** | Precipitation | TRMM PR 3B43 monthly precipitation rate and 3A12 monthly precipitation will provide precipitation data that will aid in identifying areas prone to droughts. |

***Ancillary Datasets:***

Climate Hazards Group – CHIRPS – Ground measurement rainfall

**Decision Support Tool & End-Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Scaled Drought Condition Index Time Series | Allows project partners the ability to identify the timing and severity of agricultural drought. This allows for better allocation of resources to target the most affects areas. | Using Aqua/Terra MODIS to calculate land surface temperature and NDVI, TRMM PR and GPM GMI for precipitation data, and SMOS MIRAS for soil moisture data to calculate which areas are being affected by agricultural drought. Metadata following SERVIR guidelines will be included (see attached). | N/A |
| Near Real-Time Scaled Drought Condition Index Monitoring Tool | Allows project partners to monitor agricultural drought in near real-time. | Using Aqua/Terra MODIS to calculate land surface temperature and NDVI, TRMM PR and GPM GMI for precipitation data, and SMOS MIRAS for soil moisture data to calculate which areas are being affected by agricultural drought in near real-time. Metadata following SERVIR guidelines will be included (see attached). | 3 |

***End-User Benefit:***

These end-products will benefit the end-user by improving their decision making process when allocating resources, such as water, to rice paddies. They will also allow for a more strategic placement of water reservoirs that benefit crop productivity during flooding and drought conditions. Lastly, the project partner will also be able to determine which locations throughout the Mekong River Basin are suitable for new rain-gauges.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 Terms: 2015 Summer (Start) to 2016 Summer (Completion)

***Multi-Term Objectives:***

* **Term 1:** 2015 Summer (GSFC/Wise) – Thailand Disasters
  + The Thailand Disasters team created a Meteorological Drought Index Time Series, a Hydrological Drought Index Time Series, an Agricultural Drought Index Time Series, and an Agricultural Drought Near Real-Time Monitoring Tool throughout Thailand. The end-products were presented to project partners at the Royal Thai Embassy.
* **Term 2 (Proposed Term):** 2016 Summer (MSFC) – Mekong River Basin Disasters
  + The objectives for the second term of this project are to create a Scaled Drought Condition Index Time Series and a Near Real-Time Scaled Drought Condition Index Tool throughout the lower Mekong River Basin. The project partners will be updated on a bi-weekly basis. The end-products will be handed off to the project partners both by email and in person.

***Previous Related Terms:***

2015 Summer (GSFC/Wise) – Thailand Disasters

***Related DEVELOP Work:***

2015 Summer (MSFC/Wise) - Thailand Agriculture: Monitoring Food Crop Health and Stress Due to Changing Climate for Enriched Agricultural Land Management

**Project Needs/Requests**

***Participants Requested:*** 4

***Software & Scripting:***

ArcMap 10.3 – Raster Manipulation/Analysis, Image Enhancement, and Map Creation of GPM GMI, TRMM PR, Aqua/Terra MODIS, and SMOS MIRAS

ENVI Classic – Raster Manipulation/Analysis and Image Enhancement of Aqua/Terra MODIS and SMOS MIRAS

Python 2.7 – Scripting of drought monitoring tool