**NASA DEVELOP National Program**

****Goddard Space Flight Center

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**Mekong Disasters**

*Utilizing NASA Earth Observations to Enhance Flood Impact Products and Mitigation in the Lower Mekong Water Basin*

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**Applied Sciences National Applications Addressed:**

Disasters

**Study Area:** Lower Mekong Water Basin, specifically Pakse, Laos, Phnom Penh, Cambodia, and the Lower Mekong Delta, Vietnam

**Study Period:** Pakse- 7/9/2009, Phnom Penh- 9/3/20006, Lower Mekong Delta- 12/9/2009

**Community Concerns**

* The Mekong flows through six countries, providing valuable drinking water and irrigation reserves.
* The Lower Mekong Basin can lose $60-70 million annually to flood damages, but can gain $8-10 billion annually in flood benefits.
* Severe flooding can cause significant loss of life, expansive crop destruction, infrastructure damage, worsened public health, and splintered social and economic continuity.
* Improved water management enhances agricultural and aquacultural productivity, drinking water quality, water-derived transportation highways, and overall quality of life, and can help alleviate poverty-stricken areas.
* Agriculture is the keystone economic activity in the Lower Mekong Basin, with the sector supporting the livelihood for 60% of its 60 million person population.
* In addition to expected monsoon rains, the region is hit by an average of 6-8 typhoons per year.
* Seasonal flows provide homes to 20,000 plant species, 1,200 bird species, 850 fish species, 800 reptile and amphibian species, and 430 mammal species in one of the most biodiverse hotspots in the world.

**80-100 Word Blurb**

Flowing through the heart of mainland Southeast Asia, the Lower Mekong Water Basin is a complex water system that houses sixty million people, as well as a thriving natural ecosystem. Booming populations and food demands have resulted in intricately crafted landscapes to promote agricultural yields and food security. Annual floods perpetrated by monsoon rains and cyclones can negatively impact these vulnerable landscapes, but they also provide numerous essential services, such as irrigation reservoir replenishment. This project aims to improve flood mapping techniques for the area, allowing policy makers and managers to alleviate negative flooding impacts while preserving the benefits.

**Abstract**

The Lower Mekong Water Basin is the largest river basin in Southeast Asia, home to more than sixty million people. The region has seen rapid population growth and socio-economic development, fueling unsustainable deforestation, agricultural expansion, and stream-flow regulation. The basin supports substantial rice farming and other agrarian activities, which heavily depends upon seasonal flooding. This project created flood impact and extent maps using three separate methodologies based on Aqua/Terra MODIS and Landsat imagery to gain a better understanding of flood prone zones in the area. They were then compared against other flood products for the area, and the MODIS Band Threshold Manipulation products will be integrated into the Committee on Earth Observing Satellites Disaster Risk Management Observation Strategy in a web-based ‘Flood Dashboard’ during the Summer 2014 term. The dashboard products were achieved using MODIS 250m products and Normalized Difference Vegetation Index (NDVI) values to derive flood maps.

**Partners/Collaborators**

My Community Our Earth (MyCOE): Minh Khoa Nguyen

Mekong River Commission (MRC): Dr. Bolten

Committee on Earth Observation Satellites (CEOS): Stu Frye

**Current Management Practices & Policies**

The main governing body over the river in the region is the Mekong River Commission (MRC); the commission oversees a variety of programs in the area to help maintain a healthy river basin. The MRC suggests that the effects of flooding can be reduced via forms of emergency planning, building controls, various land-use techniques and development of certain areas within the basin. Currently, in the Lower Mekong, the mitigation techniques that are in place to monitor floods are precipitation and water gages provided by the MRC. There have yet to be any efforts to use remotely sensed data from satellites integrated into a web dashboard from various reputable data sources to help with flood mitigation in the region.

**Benefit to End-User:**

* Using Landsat and MODIS data the team identified areas that have historically been affected by floods, and compiled a methodology to build a Southeast Asia flood dashboard website.
* The web access dashboard will provide a single, free, service that aggregates several different flood map and weather products, including near real-time maps and data.
* This tool will allow anyone to monitor the extent of floods in the region, which can aid in flood disaster relief, as well as finding patterns and vulnerable areas for flood mitigation decisions.
* Case studies provide validation of mapping methods used in flood mapping products.
* Case studies provide foundation for future CEOS projects to integrate more data and utilize satellite earth observations to help mitigate the negative effects of flood disasters across international borders.

**Decision Support Tools**

* Regional Flood Dashboard
* Case study evaluating accuracy of methods for flood mapping with Landsat and MODIS data
* Historical flood maps at medium resolution (30m) and real time at coarser spatial resolution (250m)

**Earth Observations & Parameters**

* Landsat 5 Thematic Mapper (TM) and Landsat 7 Enhanced Thematic Mapper Plus (ETM) – Multispectral data to distinguish water and other land cover
* Aqua and Terra MODIS – Multispectral data to distinguish water and other land cover
* TRMM, Precipitation Radar (PR) – Precipitation

**Future Applicable NASA Missions**

* GPM- Enhanced precipitation measurements
* SMAP- Accurate soil moisture maps

**Models Utilized**

None

**Ancillary Datasets Utilized**

NASA Global Near Real Time Flood Monitoring Methodologies

Joe Spruce’s Flood Monitoring Methodologies

**Software Utilized**

* ENVI – classification of flood extent, comparison of different flood products
* ArcGIS – Raster Manipulation/Analysis, Re-projection of raster data sets, incorporation of ancillary data, creation of maps
* Python – web design and incorporation of products into dashboard