**NASA DEVELOP National Program**

**Fall 2015 Project Proposal**

**Wise County Clerk of Court’s Office**

**Virginia Water Resources II**

Monitoring Chlorophyll and Harmful Algal Blooms through NASA Earth Observations in the Lower Chesapeake for Improved Water Management

**Objective:**

To apply NASA Earth observations to monitor chlorophyll and harmful algal blooms in Virginia’s the Lower Chesapeake Bay and some of its estuaries including the lower James River and lower York River. Earth observation based products are desired to provide additional tools for earlier detection and greater spatial detail in mapping sources and hotspots of algae in the area.

**Community Concern:**

Harmful algal blooms are a major concern for coastal managers, local governments, and the Governor’s Office. Harmful algal blooms have a negative impact on the health of fish and other species which has economic impacts on fisheries. There are also potential impacts on human health with economic consequences for tourism. Chlorophyll estimation is useful for finding algal blooms whether harmful or otherwise and is also an important parameter in monitoring estuary nutrient levels.

**Partner Organizations:**

Virginia HAB Task Force (End-User, POC: XXX)

Virginia Department of Environmental Quality (VDH) (End-User, POC: Anne Schlegel)

Virginia Institute of Marine Science (VIMS) (Collaborator, POC: Kim Reece, Professor of Marine Science)

Old Dominion University (ODU) (Collaborator, POC: Todd Edgerton, Professor)

Hampton Roads Sanitation District (HRSD) (Collaborator, POC: Will Hunley, Environmental Scientist)

Virginia Secretary of Technology (Collaborator, POC: Sec. Karen Jackson)

Meetings have taken place at VA DEQ, VIMS, and all project partners through the course of the first term of the project carried out in Summer 2015 at the DEVELOP Richmond node.

**Decision Making Process:**

Currently the VDH hosts an algal bloom surveillance map which is based on a network of water quality sampling stations and reports called in to a HAB Hotline. This is a product of Virginia’s Harmful Algal Bloom Response Plan and the Virginia HAB Task Force, who has a 24-7 response capability.

**Earth Observations:**

|  |  |  |
| --- | --- | --- |
| **Platform** | **Sensor** | **Geophysical Parameter** |
| **Landsat 8** | OLI, TIRS | Turbidity, Chlorophyll-a, Water Color, Water Surface Temperature |
| **Landsat 7** | ETM+\* | Turbidity, Chlorophyll-a, Water Color, Water Surface Temperature |
| **Aqua, Terra** | MODIS | Turbidity, Chlorophyll-a, Water Color, Water Surface Temperature |
| **Suomi NPP** | VIIRS\* | Turbidity, Chlorophyll-a, Water Color, Water Surface Temperature |
| \*Use of ETM+ and VIIRS are included as a contingencies in case MODIS and Landsat 8 sensors cannot sufficiently address partner requirements | | |

**NASA Earth Observations Highlighted:**

Chlorophyll, sediment and water surface temperature parameters are currently estimated for the lower Chesapeake based on more precise spectral observations from MODIS and VIIRS sensors; however, the spatial resolution of these measurements limit the number of useful data points in sub-estuaries such as the lower James and York Rivers. To address the need for moderate resolution estimates of chlorophyll, sediment and water surface temperature parameters will be cross-calibrated from MODIS sensors from Aqua and Terra to Landsat 8 sensors including both OLI and TIRS. The source of the

**Ancillary Datasets:**

Aerial imagery and in situ water quality datasets

HABs reports

**Decision Support Tools & Analyses:**

|  |  |  |
| --- | --- | --- |
| **Proposed End Products** | **Decision to be Impacted** | **Current Partner Tool/Method** |
| Moderate resolution chlorophyll estimates | These indices display early, spatially explicit detection of chlorophyll sources and hot spots | Coarse resolution remote sensing, in situ sampling at fixed stations, and in situ “flow-through” sampling on periodic or intermittent cruises |
| Moderate resolution sediment or turbidity estimates | This measurement gives spatial understanding to a significant contributor to conditions that affect algae development | Coarse resolution remote sensing, in situ sampling at fixed stations, and in situ “flow-through” sampling on periodic or intermittent cruises |
| Moderate resolution water surface temperature estimates | This measurement gives spatial understanding to a significant contributor to conditions that affect algae development | Coarse resolution remote sensing, in situ sampling at fixed stations, and in situ “flow-through” sampling on periodic or intermittent cruises |

**Project Details:**

**National Application Areas Addressed:** Water Resources

**Study Location:** lower Chesapeake and sub-estuaries including the lower James and York Rivers in southeastern Virginia

**Period being Studied:** 2010 - present

**Advisor:** Dr. Kenton Ross (NASA DEVELOP)

**Previous Related DEVELOP Work:**

New England Water Resources (LaRC Summer 2014) – Historical Tracking of Harmful Algal Blooms Utilizing Landsat Missions from 1999 – 2013

Lake Erie Water Resources (Ames Spring 2015) – Methodology Validation for Quantitative Analysis to Model Indicators of Harmful Algal Blooms in the Maumee River Watershed of Lake Eerie

New England Water Resources (LaRC 2013) – Multispectral Monitoring of New England Freshwater Resources to Assess Turbidity, Algal Blooms, and Water Quality for Enhanced Natural Resource Management

**Software & Scripting Requested:**

* ArcGIS – raster manipulation/analysis, image enhancement & map creation
* R – statistical modeling
* SeaDAS – water quality analysis (SeaDAS is potentially needed, but not anticipated in the work as proposed)