**NASA DEVELOP National Program**

****NASA Langley Research Center

*Spring 2017*

**Short Title: Chesapeake Bay Water Resources**

**Subtitle:** Assessing Water Clarity to Identify Potential Areas of Submerged Aquatic Vegetation (SAV) in the Chesapeake Bay

**VPS Title:** Satellites and SAV: Assessing Water Clarity in the Chesapeake Bay

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (NASA Langley Research Center)

**Partner Organizations:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| Virginia Department of Environmental Quality | Tish Robertson, Water Quality Assessment Coordinator | End-User | No |
| US Geological Survey, Water Science Center | Peter Tango, Chesapeake Bay Monitoring Coordinator | Collaborator | No |

**Project Details**

**Applied Sciences National Application Addressed:** Water Resources

**Study Area:** Chesapeake Bay, VA

**Study Period:** March 2003 – November 2016

**Earth Observations & Parameters:**

Landsat 5 Thematic Mapper (TM) – surface reflectance

Landsat 8 Operational Land Imager (OLI) – surface reflectance

**Ancillary Datasets Utilized:**

* Virginia Institute of Marine Science (VIMS) Virginia Estuarine and Coastal Observing System (VECOS) – Shallow Water Monitoring Program, Continuous Monitoring

**Software Utilized:**

* Google Earth Engine API – Landsat analysis
* ESRI ArcGIS – map creation
* Python

**Project Overview**

**80-100 Word Objectives Overview:**

Measurements of water quality help determine the health of a body of water and include dissolved oxygen, pH, salinity, clarity, and turbidity. The size of the Chesapeake Bay makes it difficult to provide Bay-wide water quality and Submerged Aquatic Vegetation (SAV) measurements. This project correlated NASA’s Landsat data with *in situ* water quality data collected by the Virginia Institute of Marine Science (VIMS). The results of this project determined the feasibility of using Landsat data to measure turbidity in the Chesapeake Bay and determine the likelihood of SAV growth.

**Abstract:**

Submerged Aquatic Vegetation (SAV) is vitally important to the Chesapeake Bay, serving as one of the primary food sources for the organisms that inhabit the Bay. This project evaluated the efficacy of remote sensing applications as a tool to monitor water quality parameters, specifically turbidity, to indicate areas that can potentially support healthy seagrass populations in the Chesapeake Bay. The resources and methods included visual analysis of the Bay utilizing Landsat 5 Thematic Mapper (TM) and Landsat 8 Operational Land Imager (OLI). By correlating the Landsat-derived Normalized Difference Turbidity Index (NDTI) to the Virginia Institute of Marine Sciences’ (VIMS) *in situ* monitoring data, a model was created that can be used to provide an estimate of water clarity throughout the entire bay. This model focuses on providing an additional resource for the Virginia Department of Environmental Quality (DEQ) for use in monitoring changes in water turbidity in the Chesapeake Bay and aid in monitoring efforts of SAV growth locations and Total Maximum Daily Load (TMDL) calculations of the Bay.

**Keywords:**

Submerged Aquatic Vegetation (SAV), Landsat, water quality, water clarity, aquatic health, Normalized Difference Turbidity Index (NDTI), turbidity

**Community Concerns:**

* SAV stabilizes near-shore sediments to prevent erosion.
* SAV provides habitat and food resources for aquatic wildlife.
* The blue crab is an important species that lives in the SAV within the Bay. It is an invaluable species to the fishing industry and serves as a major predator.
* Sedimentation lessens the amount of light through the water column, affecting the growth and resiliency of SAV. Because the SAV are sensitive to their environment, changes in light attenuation can be catastrophic for the beds of vegetation throughout the bay.

**Current Management Practices & Policies**:

The Virginia Department of Environmental Quality (DEQ) works alongside the Environmental Protection Agency’s (EPA) Chesapeake Bay Program to evaluate the health of the Chesapeake Bay and its tributaries. The EPA developed the *Regional Criteria Guidance* in accordance with the 1972 Clean Water Act to provide the water quality standards by which local governments must comply. On December 29, 2010, the EPA established the Chesapeake Bay Total Maximum Daily Load (TMDL) that serves as a calculation for the maximum amount of pollutants that can occur in the Bay. In effort to meet these regulations, the DEQ currently utilizes two methods of collecting water quality data. The first is Dataflow that generates a surface map of water quality from a small boat. A pump on the transom of the boat feeds the surface water into an instrument where the water temperature, salinity, pH, chlorophyll, turbidity, and dissolved oxygen measurements record every 3-4 seconds. The measurements and location of the collection site obtained via GPS is then stored in an onboard computer. Secondly, the Virginia DEQ collects continuous data at monitoring stations located throughout the Bay and its tributaries. These stations collect data approximately every fifteen minutes at a depth of about one meter. The continuous data monitoring stations collect data on various parameters including depth, water temperature, dissolved oxygen, chlorophyll, salinity, and turbidity, and provide a long-term water quality measurement.

**Decision Support Tools & Benefits:**

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| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** | **Software**  **Release** |
| Annual Water Clarity Maps for the Chesapeake Bay and Tributaries in Virginia | Landsat 5 TM & Landsat 8 OLI | Used to determine water clarity across the entire Bay | I |