**NASA DEVELOP National Program**

Marshall Space Flight Center

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**Alabama Water Resources**

*Incorporating NASA Earth Observations in Spatial and Temporal Water Quality Monitoring of Alabama’s Inland Waters*

**Project Team:**

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**Partner Organizations**

Alabama Water Watch (AWW), End-User, POC: Eric Reutebuch

Alabama Department of Environmental Management (ADEM), End-User, POC: Chris Johnson

**Applied Sciences National Applications Addressed:**

Water Resources

**Study Area:** Alabama-Cahaba, Coosa-Tallapoosa Water Basins in Central Alabama, United States

**Study Period:** January 2001 - December 2014

**Earth Observations & Parameters**:

Suomi NPP, VIIRS - Water Quality Parameters

Landsat 5, TM - Water Quality Parameters

Landsat 7, ETM+ - Water Quality Parameters

Landsat 8, OLI and TIRS - Water Quality Parameters

**Objectives Overview**

Alabama water resources are currently monitored using point-based water sampling; this is not only costly and time consuming, but results in very spatially-limited data. Empirical formulas were derived using in situ data provided by Alabama Water Watch and Alabama Department of Environmental Management. This allowed for the development of water quality products from satellite imagery for water quality monitoring in Alabama. By using methods created through the use of remote sensing, a more temporally- and spatially- thorough assessment of water quality in Alabama provided a way to conserve limited time and resources.

**Abstract**

According to the Alabama Department of Environmental Management (ADEM), 65% of the water in Alabama community water systems comes from lakes, rivers, and streams. The water from these sources is treated by disinfection, sedimentation and filtration. Current methods of inland water quality monitoring in Alabama require data from field sampling, which can be inconsistent, expensive, and can provide insufficient information about water bodies as a whole. The Alabama Water Watch (AWW) is a volunteer driven organization that trains community members to test and monitor water quality in the state. AWW has received over 79,000 water quality data forms from volunteers on 825 water bodies in Alabama. NASA Earth observations Landsat and Suomi NPP present innovative and *cost-effective*techniques for monitoring water quality parameters such as turbidity, suspended sediments, chlorophyll-a, and surface water temperature. These observations can be easily integrated into hydrologic watershed models, using the images to predict the index of a water quality parameter and apply in situ measurements to validate the results. The purpose of this project was to demonstrate how freely available NASA EO imagery can be used to remotely predict the water quality parameters of rivers, streams, and lakes in Alabama.

**Community Concerns**

* Due to limited funds and the high cost of water monitoring, Alabama has cut back on programs to monitor its inland waters. This limits the amount of available information on the quality of water that the community consumes.
* The water quality parameters that are sampled (e.g. turbidity, suspended sediment, surface water temperature) via water quality stations and field samplings are spatially limited. There are roughly 77,272 miles of rivers and streams and over 490,000 acres of lakes in Alabama making it difficult to fully assess the water quality trends of Alabama’s inland waters.

**Current Management Practices & Policies**

Alabama Water Watch (AWW) is a community-driven volunteer program that encourages residents of Alabama to participate in water quality monitoring. AWW educates citizens on water quality issues by offering workshops to train individuals on how to obtain water quality samples and identify issues that need to be mitigated. The Alabama Department of Environmental Management (ADEM) is an organization that follows Federal regulations and policies to improve and preserve Alabama’s environment and natural resources. Both of these organizations take water quality samples manually. The use of remote sensing is not currently implemented at either AWW or ADEM.

**Decision Support Tools**

* Alabama Turbidity Model
* Alabama Chlorophyll-a Model
* Alabama Surface Water Temperature Model
* Methodology for calculating Turbidity
* Methodology for calculating Chlorophyll-a
* Methodology for calculating Surface Water Temperature

**Benefit to End-User:**

* Save time and money used for taking point-based water samples
* Maintain a temporally- and spatially-accurate overview of inland water quality
* Have a model to continue to use GIS and remote sensing technology to monitor Alabama water quality efficiently

**Ancillary Datasets Utilized**

* Alabama Water Watch - in situ water quality data
* Alabama Department of Environmental Management - in situ water quality data
* USGS National Hydrography Dataset – water quality

**Software Utilized**

ArcGIS 10.2.1 - Raster Manipulation/Analysis, Model Builder Interface, Python Scripting Interface, AWW and ADEM in situ data manipulation