**NASA DEVELOP National Program**

****Wise County and City of Norton Clerk of Court’s Office

**Fall 2015**

**Short Title: African Great Lakes Weather**

**Subtitle:** Utilizing NASA Earth Observations to identify Indicators to Help Predict Deadly Storms over African Great Lakes

**VPS Title:**

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (Lead Scientist, NASA DEVELOP National Program)

Kristopher Bedka (NASA Langley Research Center – Climate Science Branch)

Dr. Dwayne Cecil (Global Science Technology, Inc.)

Professor Robert VanGundy (UVA- Wise)

**Partner Organizations:**

Kenya Meteorological Department (type), POC: Name; Boundary Organization

**Project Details**

**Applied Sciences National Applications Addressed:** Weather, Disasters, Ecological Forecasting

**Study Area:** East African Great Lakes Region

**Study Period:** 2005 - 2013

**Earth Observations & Parameters:**

TRMM, PR – rainfall measurements

Terra, MODIS - aerosol optical depth

EUMETSAT, SEVIRI – infrared monitor

**Ancillary Datasets Utilized:**

* NASA Langley Research Center - Hazardous Storm Event Database

**Models Utilized:**

Agency & Model Name (*examples below, please bulletize*)

* USGS National Invasive Species Forecasting System (ISFS)
* NASA Regional Ocean Model System (ROMS)
* NOAA Sea, Lake and Overland Surges from Hurricanes (SLOSH) model

**Software Utilized:**

MATLAB R2015a – processing of data within Hazardous Storm Event Database

ArcMap 10.1 – NetCDF data import and image visualization

**Project Overview**

**80-100 Word Objectives Overview:**

This project assisted work being done at the NASA Langley Research Center Climate Science Branch in regards to storm origination and development over the East African Great Lakes, esp. Lake Victoria. From a database of pixels that represented detection of the ‘overshooting tops’ convective phenomenon certain storm events were chosen as temporal study areas. Using these events, measurements of certain environmental aspects were studied preceding an event through its duration and relationships between events were assessed.

**Abstract:**

The African Great Lakes lie along East Africa’s rift valleys and play an important role in the economy and culture of the millions of people in the region. The lakes’ governance of regional climate and weather, while less understood, is as profound. Intense storms occur around the lakes with little warning and can create life threatening hazards to unsuspecting fisherman; leaving their fishing vessels capsized or wrecked. Finding correlations between climatic indicators that precede the onset of these storm events will aid the Kenya Meteorological Department in their ability to improve the forecasting efforts of local and regional authorities. Using the detection of ‘overshooting tops’ (OT) as an indicator of severe storm occurrence, certain days were identified in which the pixel count of the aforementioned criteria from MSG SEVIRI IRW geostationary images was heightened significantly.

**Community Concerns:**

* The storms along the African Great Lakes can bring torrential rainfall, lightning, hail, and/or high winds, producing hazards which pose a major threat to the population and infrastructure of the surrounding countries.
* The areas affected by these storms have the highest population density in all of Africa due to the fact that the lakes provide vital economic opportunities in the fields of fishing, tourism, and agriculture for millions of people.
* Families in nearby countries depend on the African Great Lakes as a major food source. The fish caught can account for up to 70% of the protein consumed by families in some areas.
* Approximately 5,000 people are killed every year by storms on Lake Victoria alone. Most of the victims are fishermen who depend on the lakes for their livelihood.
* No early warning system is in place to inform the public of storm events. This prevents fisherman and others from being able to adequately prepare for the dangers associated with the storms.

**Current Management Practices & Policies**:

Atmospheric monitoring practices in the East Africa Great Lakes are a collaboration between meteorological agencies from Kenya, Uganda, and Tanzania. Most of their work revolves around the forecasting of weather patterns from a series of ground-based meteorological observation sites. Recording temperature, pressure, relative humidity, and precipitation amounts, these sites forward information (at 15min to 1 hour intervals) to central forecasting offices in near real-time so that surface conditions can be assessed and mapped. From this information the prospects of severe thunderstorms are included in both 24 hour and 4-day forecasts. Daily forecasts are also obtained from regional meso-scale models adapted from more global forecasting systems. These models do not take in aforementioned surface data and are often uniform over large areas.

Forecast information is often circulated over a patchwork system of television reports, radio, and through print media. A mobile text message alert system pilot program established in 2011 provided daily forecasts and other hazard information, but at that time did not cover the whole extent of the lake.

**Decision Support Tools & Benefits:**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| End-Product 1 (ex. Risk map, habitat loss map, land cover change detection, etc.) | Ex. Landsat 8 OLI (use acronyms) What EO data were used to derive your product? | Brief description of how the end-product has/will/can improve a specific decision making process or be used by the partner |
| End-Product 2 |  |  |
| End-Product 3 |  |  |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Software Release Requirements**

What category do the tools your project is creating fall within? [Category I to V]

If your decision support tools fall within Category IV, fill out this section:

**Software Title:** Insert here (ex. DEVELOP National Program Python Package)

**Software Abbreviation:** Insert here (ex. dnppy)

**Technical Point of Contact:** Insert full name, permanent email, and node here. Also include whether employed through SSAI or Wise County. (Team member who knows the most about the software.)

**Brief Description of the Software:** Insert here (ex. The dnppy package will be used to functionalize common programming tasks in the geospatial community, specifically for working with NASA data products. It will include functions for processing satellite data and assist in structuring analysis to reduce the startup time for DEVELOP teams to learn programming and create tools for end users.)

**Type of Code:** *Executable Code* and/or *Source Code* (Select one or both)

**Will the software include any embedded computer databases?** *Yes* or *No* (Select one)

**Does the software use or call any open software or libraries?** *Open Source* and/or *Proprietary/Commercial* (Select one or both)

**List the software or libraries used, under what license they were obtained, and the URL for the license in the table below:**

|  |  |  |
| --- | --- | --- |
| **Name** | **License** | **License URL** |
| Ex. Arcpy module | Ex. group license through ArcGIS | http://www.esri.com/software/arcgis |
| Ex. Python | Ex. Open source license | http://opensource.org/licenses/Python-2.0 |
|  |  |  |

**Full Software Description and Plan**

**Introduction/Objective:**

What motivated the creation of this software, what problem does it address?

**Applications and Scope:**

Where and how will this software be used to influence decisions?

**Capabilities:**

What can it do better than what was previously available?

**Interfaces:**

How is one expected to use the software? For example, command line, GUI, script execution, etc.

**Assumptions, limitations, & Errors:**

What areas that the software could be improved upon in the future? This is where limitations of the theory, model, science, etc should be briefly documented. If the tools only work for a specific scenario, say so.

**Testing:**

What validation techniques and testing strategy will be used to build confidence in the software?