**NASA DEVELOP National Program**

**Spring 2016 Project Proposal**

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

**Wise County Disasters**

Utilizing NASA Earth Observations to Identify and Predict the Extent of Flooding and to Mitigate its Risks in Wise County, Virginia

**Project Overview**

***Objective:*** To identify the past extent and probable future extent of flooding throughout Wise County, Virginia, in order to better prepare those areas most likely to be effected and to decrease the amount of personal injuries and economic harm done to the county.

***Community Concern:*** Flooding is a major concern for the residents of Wise County, VA. In the Wise County Emergency Operations Plan, flooding is the top threat. In February of 2015, the Virginia Army National Guard was deployed in response to the massive flooding in the area. It contributed to at least $8 million worth of damages in Wise County alone. In addition to the 2015 flooding, there has been annual flooding from 2009-2013 with records of flooding as far back as 1977. Many of these factors that potentially contribute to high flooding in this area include the high volume of strip mining which increases flooding due to hardened soil, low capacity thresholds of the many stream networks, and the intensity of rainfall with powerful storms that drop a large quantity of water within a relatively short period of time.

***National Application Area Addressed:*** Disasters

***Study Location:*** Southwest Virginia

***Study Period:*** 2000 – 2015: Months that reported having flooding during those years

***Advisors:*** Dr. Kenton Ross (NASA DEVELOP), Dr. DeWayne Cecil (Global Science Technology Inc.), Bob VanGundy (University of Virginia’s College at Wise)

***Source of Project Idea:*** A Wise Countylocal and DEVELOP Alumni, Jordan Bates, suggested this idea. After discussing the idea with a member from the Wise County Board of Supervisors, it was seen that the project could be of use to the county.

**Partner Overview**

***Partner Organization(s):***

Wise County Board of Supervisors (End-user, Boundary Organization; POC: Bob Adkins, Director of Emergency Management)

***End-User Current Decision Making Process:***

As per the Wise County Emergency Operations Plan (EOP), in regards to a disaster, the Wise County Board of Supervisors Members are (1) responsible for protecting the lives and property of citizens, (2) understanding and implementing laws and regulations that support emergency management and response, (3) establishing the local emergency management program, (4) appointing the local Emergency Management Coordinator, and (5) adopting and promulgating the Emergency Operations Plan. Currently, they are in constant contact with the National Weather Service, and they also continuously monitor the Integrated Flood Observing and Warning Systems (IFLOWS) program for possibility of floods. The IFLOWS program is also installed in all the dispatch units, so that they get alerts whenever there is a flood.

***NASA Earth Observations Capacity:***

Wise County Board of Supervisors – Currently, the end-user does not use NASA Earth observations for their emergency management activities. Wise County has had an official emergency operations plan in place for many years, and currently, is using *in situ* measurements and FEMA data.

***Collaborator & Boundary Organization Support:***

Wise County Board of Supervisors – This project will make use of the historical flood data and the WebGIS data provided by Wise County. Being the county’s primary emergency management contact, the Emergency Management Coordinator is in the best position to disseminate project results and methodologies to necessary people and organizations.

***Communication Plan & Transition Approach:***

Since the location of the end-user is the same as that of the project team, there will be direct meetings between them every two weeks, during which the team will explain to the end-user the status of the project. At the end of the term, the team will do an in-person presentation to the partners and explain the results and methodologies derived from the project.

***End-User Benefit:***

Currently, Wise County relies on *in situ* measurements and FEMA data for their flood planning. Using NASA Earth observations will save them substantial time and money and will help them take preventive measures before a flood happens. To quote Jessica Swinney, the Geographic Information Officer of Wise County GIS Department, “This type of innovative research and partnership will provide important new findings that will help to support faster recovery, quicker response, and better organization and outreach for flood mitigation and damage assessment”.

**Letters of Support:** Geographic Information Services, Wise County GIS, Jessica R. Swinney, Geographic Information Officer.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform** | **Sensor** | **Geophysical Parameter** |
| **Landsat 5** | TM | Surface Reflectance |
| **Landsat 8** | OLI | Surface Reflectance |
| **Terra** | ASTER | Digital Elevation Model |
| **SRTM** | SIR-C/X-SAR | Digital Elevation Model |
| **Aqua/Terra** | MODIS | Surface reflectance |

***NASA Earth Observations Use:***

Landsat 8 (OLI) / Landsat 5 (TM) – Landsat imagery will allow visual identification of the flooded regions. A supervised classification map can help to identify flood affected areas.

Terra (ASTER)–Can Provide elevation data on the terrain that can be used to detect flood prone areas.

SRTM (SIR-C/X-SAR) – Can Provide elevation data on the terrain that can be used to detect flood prone areas.

Aqua/Terra(MODIS) – Can provide surface reflectance that can be used to identify the extent of past floods.

***Ancillary Datasets:***

NASA NRT Global Flood Mapping; FEMA Flood Map Service Center; Wise County, VA WebGIS; *In situ* data collection from participants during the next flooding event

***Models:***

Coupled Routing and Excess Storage (CREST) model - POC: Xianwu Xue, Developer of the FORTRAN version of the model.

Hazus-MH Flood Model – POC: FEMA.

**Decision Support Tool & End-Product Overview**

|  |  |  |
| --- | --- | --- |
| **Proposed End Products** | **Decision to be Impacted** | **Current Partner Tool/Method** |
| Flood Extent Maps | Helping locate usual flood areas, planning evacuation routes, insurance coverage and urban planning | *In situ* observation and FEMA mapping resources |
| Probable Flood Areas Map Derived from DEM | Helping to locate probable flood areas, planning evacuation routes, insurance coverage and urban planning | *In situ* observation and FEMA mapping resources |

Flood Extent Maps – These are maps showing the extent of flooding in past events. These maps are produced by analyzing Landsat and MODIS imagery along with *in situ* flood data. Maps of this nature can be used to enhance flood risk preparedness, communication, warning, response, and mitigation.

Probable Flood Areas Map Derived from DEM – Terrain maps delineating areas prone to flooding will be produced. These maps will be derived based on data from the ASTER and SIR-C/X-SAR sensors that provide elevation information.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1Term: 2016 Spring

***Previous Related DEVELOP Work:***

2015 Summer (WC) – Peru Disasters II: Identifying and Mapping Flood Prone Regions in the La Libertad Region of Peru Using NASA's Earth Observations

**Project Needs/Requests**

***Participants Requested:*** 3-4

***Software & Scripting:***

ArcGIS - Image enhancement, raster manipulation, and map creation of various data collected from satellites listed above