**NASA DEVELOP National Program**

**Marshall Space Flight Center**

**Fall 2014 Project Proposal**

**Andes Mountains Disasters II**

Using NASA Earth Observations to Develop a Monitoring Tool for the Copahue Volcano in the Andes Mountains

**Objective:**

The objective of this project is to outline a create monitoring tool for the Copahue Volcano where daily inputs of thermal anomalies and air quality data can be used to estimate volcanic activity for more timely evacuation warnings.

**Community Concern:**

Copahue is a composite cone volcano located along the Chile-Argentina border in the Andes Mountain Range. The Copahue Volcano peaks in Chile, with the entirety of the system extending into Argentina. Due to its remote location, Copahue is a poorly monitored volcano in the Southern Volcanic Zone. Recent eruptions have brought attention to Copahue as released volcanic ash has caused the cancellation of hundreds flights and the evacuation of thousands of people living in proximity to the volcano. These increases in volcanic activity present a higher level of risk to surrounding settlements, primarily Caviahue and Baños Copahue. There is a need to develop reliable monitoring tools for the Copahue Volcano to aid in decision making for the surrounding towns.

**End-Users/Partners/Boundary Organizations:**

NASA SERVIR (Partner/Boundary Organization, POC: Eric Anderson, Research Associate)

Smithsonian Global Volcanism Program (Partner/Boundary Organization, POC: Lee Siebert, Director)

NASA SERVIR currently acquires imagery over Copahue Volcano during every ISS pass over the region due to the summer 2013 eruptions. SERVIR will provide assistance in acquiring and processing ISERV imagery of the study area. Contact has been made to discuss important factors to consider for volcanic hazard risk mapping. Eric Anderson is an expert on landslides and has conducted research in Central America on geological disaster risk mapping.

The Smithsonian Global Volcanism Program is in need of an enhanced methodology to monitor and identify areas at risk of volcanic hazards. The proposed tool will monitor the Copahue Volcano specifically and assist in identifying volcanic activity.

**Decision Making Process:**

Currently, alerts and evacuation orders are issued based on satellite observations of volcanic ash emissions, and seismic activity measured at ground stations. The Copahue Volcanowith no use of thermal or SO2 satellite products in the monitoring process.

**Earth Observations:**

|  |  |  |
| --- | --- | --- |
| **Platform** | **Sensor** | **Geophysical Parameter** |
| **Aqua**  | MODIS | Thermal Anomalies |
| **Terra** | MODIS & ASTER | Thermal Anomalies |
| **Aura** | OMI | SO2 monitoring |
| **Landsat 8** | OLI & TIRS | Land Cover and Thermal Anomalies |

**NASA Earth Observations to be Highlighted:**

Aqua and Terra’s Moderate Resolution Imaging Spectroradiometer (MODIS) as well as Terra’s Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) will be used to identify changes in thermal activity from the Copahue Volcano. The Ozone Monitoring Instrument (OMI) onboard the Aura satellite will be used to monitor sulfur dioxide (SO2) emissions from Copahue. Lastly, Landsat 8 with its two sensors, Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS), will provide coarse temporal resolution monitoring of land cover and thermal activity.

**Software & Scripting Utilized:**

* ArcGIS – Raster Manipulation/Analysis, Model Builder interface, Python scripting interface

**Decision Support Tools & Analyses:**

|  |  |  |
| --- | --- | --- |
| **Proposed End Products** | **Decision Impacting** | **Current Partner Tool/Method** |
| Cophue Volcano Monitoring Tool | Alerts and evacuation orders for communities surrounding Copahue Volcano | Ground monitoring stations optical remote sensing |

*Copahue Volcano Monitoring Tool* – The end product will be a tool that can be imported into ArcGIS and used daily to import and analyze data from NASA Earth observations and identify any shifts in warning signs for volcanic activity. This tool will aid in more timely evacuations warnings of the area.

**Project Details:**

**National Application Area Addressed:** Disasters

**Source of Project Idea:** This project idea came from reading about the Copahue Volcano eruptions last summer in the news and by talking with Eric Anderson (SERVIR) about current issues in South America.

**Advisors:** Dr. Jeffrey Luvall (NASA, Global Hydrology and Climate Center), Eric Anderson (NASA SERVIR)

**# of Participants Requested:** 3 – 4

**Project Timeline:** 2 Terms: 2014 Summer (Start) to 2014 Fall (Completion)

**Study Location:** Copahue Volcano, Andes Mountains, Chile and Argentina

**Period being Studied:** 2012 - present

**Previous Related DEVELOP Work:**

Andes Mountains Disasters I

Utilizing NASA Earth Observations to Model Volcanic Hazard Risk Levels in Areas Surrounding the Copahue Volcano in the Andes Mountains

Summer 2014 (MSFC)

**Multi-Term Objectives:**

* **Term 1** – The goal of this term was to model locations surrounding the Copahue Volcano likely to be affected volcanic hazards in the event of an eruption. A map of hazard risks will be created to provide end-users with a method of prioritizing disaster aid. Additionally, population data of nearby settlements, building structures, and transportation routes will be used to map the level of risk and probable property damage to surrounding settlements.
* **Term 2 (Proposed Term)** – The objective of this term is to develop a method/tool for end-users to remotely monitor the Copahue Volcano using Earth observations. Increases in water temperature of volcanic crater lakes have been correlated to eruption events. Using Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). Surface temperatures of the nearby Crater Lake, Lago Caviahue, will be monitored for temperature increases. Additionally, SO2 monitoring from the OMI sensor onboard Aura will be implemented.