**NASA DEVELOP National Program**

Wise County Clerk of Court’s Office

**Spring 2015**

**Peru Water Resources and Disasters**

*Utilizing NASA Earth Observations to Develop the Tools for a Water Budget and Flood Risk Mitigation for the Asunción District and Gran Chimú Province of Peru.*

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**Partner Organizations**

Water for People, End-User, POC: Mark Duey, Head of Program Quality, and Francisco Soto, Director of Peru

Instituto Nacional de Defensa Civil del Peru (INDECI), End-Users, POC will be added as soon as it is available. Contacts will be initiated through Mr. Mark Duey when Water For People receives their final products as they are a boundary organization.

**Applied Sciences National Applications Addressed:**

Water resources, Disasters

**Study Area:** Asunción district in Cajmarca province, Cajamarca Peru and the Ochape Sub-basin in Gran Chimú province, La Libertad, Peru

**Study Period:** Water Resources, 2011-2014; Disasters, 2007-2014

**Earth Observations & Parameters**

Landsat 8, OLI/TIRS - Evapotranspiration, Land Cover

Terra, ASTER - Evapotranspiration, Land Cover

GEOS-5 and TRMM - Climatology Resources

Terra/Aqua, MODIS - Digital Elevation Model data

**80-100 Word Objectives Overview**

Many developing countries, like Peru, struggle with providing water security and sanitation services to rural communities. Inadequate flood risk management plans further convolute efforts to provide water resource management systems. Water for People, a non-profit organization dedicated to providing clean water in developing countries, is currently working with the Peruvian government to develop a water budget and assist in flood risk mitigation. In this project, the NASA DEVELOP team at Wise utilized NASA Earth observations to improve datasets necessary for a water budget and provide preliminary flood risk analysis.

**Abstract**

In rural regions of Peru, access to adequate water and sanitation systems is limited, and large percentages of the population remain below the poverty line. In addition, major flooding in 2008, 2013, and 2014 devastated the region. In a partnership with Water For People, a non-profit organization, this project aimed to create datasets and tools necessary for water resource management projects in the Gran Chimú province and Asunción district of Peru. An additional partnership with the Instituto Nacional de Defensa Civil del Peru (INDECI) will aim to support flood mitigation. NASA Earth observations were used in this project to provide alternative datasets for Water For People’s projects in Peru. Earth observations systems such as Landsat 8’s Operational Land Imager (OLI) data, Digital Elevation Model (DEM) data from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), and land use data from the Moderate-resolution Imaging Spectroradiometer (MODIS) were used in this project. The Soil and Water Assessment Tool (SWAT) was used to build a model that will enable the end-user to study the hydrological processes and to develop a water resources inventory for the study area. Necessary models and data to estimate the flood risk assessment were also identified. The final maps, models, datasets and tutorials developed in this project will enable Water For People and the Peruvian government to improve water management programs.

**Community Concerns**

* In rural areas of Peru only about 65% of residents have access to satisfactory water resources and only 37% of residents have access to satisfactory sanitation facilities.
* Major floods in Peru have affected over 45,012 people and contributed to major agriculture economic loss; similar flooding occurred again in 2013 and 2014.

**Current Management Practices & Policies**

Peru’s 2009 Water Law enhanced the National Water Resources Systems, prioritized water usage, and defined water usage rights. However, it left control of the water regulations to the federal government, a centralized structure which can often have negative implications for local governments. Currently, Water For People is partnering with local governments to develop water resources management plans. However, because of the lack of in-situ data, Water For People wishes to incorporate remotely sensed data from NASA Earth observations to help augment currently available in-situ data. In addition to underdeveloped water resource management plans, current flood disaster management plans are incomplete and there are not enough proactive plans to prevent widespread disaster. This project would assist local policy makers to develop stronger and research-backed efforts to manage floods, improve water conservation and storage, increase the supply of irrigation water and ameliorate drinking water supply systems.

**Decision Support Tools**

* Elements of water budget - The SWAT Model and tutorials created will help add to our partner’s development of a water budget
* Flood Inundation Map - Shows the extent of flooding expected spatially over a given area
* Flood Risk Map - Depicts flood risk data for a flood risk project area and can be used to illustrate an overall picture of flood risk for the area

**Benefit to End-User:**

* Identifying the elements of a water budget will help the end-users conduct a more thorough water resources inventory and plan water distribution systems accordingly.
* Flood inundation maps will help the show the extent of flooding expected spatially and can be used to improve flood risk preparedness, communication, warning, response and mitigation.
* Flood risk maps take into account socio-economic parameters as well as geographic parameters and can provide detailed product highlighting the risk associated with specific areas.

**Models Utilized**

* Agency? Soil and Assessment Tool (SWAT)
* Agency? Integrated Flood Analysis System (IFAS)

**Ancillary Datasets Utilized**

* Modern Era Retrospective-Analysis for Research and Applications (MERRA)
* Temperature data from Giovanni Database
* Weather data from National Centers for Environmental Prediction (NCEP)
* Rain gauge data from local weather stations

**Software Utilized**

ERDAS IMAGINE - Land classification of Landsat imagery

ArcGIS - Raster Manipulation/Analysis, ArcSWAT, flood inundation map creation

Python - Processing of bulk data