**NASA DEVELOP National Program**

**2017 Summer Project Proposal**

**NOAA National Centers for Environmental Information**

**Philippines Disasters II**

*Utilizing NASA and NOAA Earth Observations to Enhance Cyclone Movement and Intensity Measurements to Improve Disaster Relief Planning in the Philippines*

**Project Overview**

***Project Synopsis*:** This project will partner with the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) to utilize NOAA Hurricane Satellite (HURSAT) data, in conjunction with NASA datasets like cloud characteristics data from Aqua and CALIPSO, as well as the joint NASA and NOAA mission Suomi-National Polar-orbiting Partnership (NPP). These datasets will be used to derive storm size and shape measurements using remotely sensed data. The team will combine these tropical cyclone measurements with cyclone vulnerability maps created in the previous term to further assess gender-specific vulnerabilities in the Philippines. The combined results of both project terms will help inform decision makers about the most vulnerable populations and how to tailor disaster relief efforts to specific demographics.

***Community Concern:*** In the Philippines, cyclones are common natural hazards with extensive societal consequences. Following such events, communities typically experience population displacement leading to serious health, social, and economic consequences. In November of 2013, the Philippines was hit by the category five Tropical Cyclone Haiyan. Killing at least 6,000 people, the storm was the deadliest Philippine typhoon on record and the deadliest event of 2013 within the Asia-Pacific (“Typhoon Haiyan – Nov 2013”). Approximately 19 tropical cyclones enter the area surrounding the Philippines with an average of six to nine cyclones making landfall in the Philippines each year (Shoemaker 1991). Affected by multiple cyclones every year, the Philippines seek to improve their ability to prepare for and recover from such traumatic events. In recent years there have been great advances in the ability to track and predict tropical cyclones as a result of satellite remote sensing advances. However, many advances still remain to be seen outside the range of American hurricane-chasing aircrafts, which are limited to patrolling the Atlantic and northeastern Pacific Oceans (LePage 2014).

***Source of Project Idea:*** In September of 2016, Lauren Childs-Gleason and Georgina Crepps met the Gender Advisor for OCHA in the Philippines, Rowena Dacsig, at a Gender and GIS for Disaster Resilience meeting in Bangkok, Thailand. Rowena mentioned an interest in research looking at the nuanced impacts of disasters on women and girls in the Philippines. Soon after, Lauren and Georgina connected node leadership at NCEI with Rowena to establish OCHA as a project end-user. The first term of this project utilized a multivariate weighted approach to derive a municipality-level threat map incorporating Accumulated Cyclone Energy, building material strength, slope, and gender-based vulnerability census data. The second term of this project builds upon the methodology of the first project.

***National Application Areas Addressed:*** Disasters, Weather

***Study Location:*** Philippines

***Study Period:*** September 2014 – May 2017

***Advisors:*** Dr. Carl Schreck (Cooperative Institute for Climate and Satellites-North Carolina, NOAA NCEI), Dr. Ken Knapp, (Center for Weather and Climate, NOAA NCEI), Dr. L. DeWayne Cecil (Global Science & Technology, NOAA NCEI)

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| United Nations Office for the Coordination of Humanitarian Affairs (OCHA) | Rowena Dacsig, Gender Advisor | End-User | Yes |
| The Netherlands Red Cross | Maarten van der Veen | Collaborator | No |

***End-User Overview***

***End-User’s Current Decision-Making Process:***In the Philippines, OCHA has several resources in times of disaster such as the United Nations Disaster Assessment and Coordination System. They currently work with governmental technical image-processing groups that utilize satellite images to respond to disasters.

***End-User’s Capacity to Use NASA Earth Observations:***

*United Nations Office for the Coordination of Humanitarian Affairs (OCHA) –* Our partner at OCHA works closely with governmental mapping groups and United Nations satellite groups (i.e. UNOSAT) who utilize NASA Earth observations. However, OCHA has not yet utilized NASA Earth observations or NOAA data to assess gender-specific vulnerabilities (e.g., vulnerability of child-lead households, access to disaster relief training, etc.) to cyclones.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The team will communicate via teleconference weekly, or bi-weekly as needed, with advisors and project partners. The team lead of this project will be the primary point of contact for the partner organizations with assistance from UNOSAT for regional end-user communication.

***Transition Plan*:** The project team will hand off results from the second term of this project to the end-users, OCHA, via a video conference at the end of the term. The team will also demonstrate potential applications of the methodology during this meeting. If an operational tool is finished by the end of the term, a software release will be required before the team can hand it off to end-users at OCHA. OCHA will utilize project results in conjunction with the Philippines cyclone climatology and vulnerability maps created in the first term of the project to enhance their cyclone disaster management strategies.

***Letters of Support*:** Einar Bjorgo, Manager, UNOSAT

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **CALIPSO CALIOP** | LiDAR-distribution of aerosols and clouds | LiDAR data will be used to assess vertical structure of Tropical Cyclone Eyewall Cloud Top (ECT) for storm intensity measurements. |
| **Aqua MODIS** | Temperature (sea-surface, cloud top temp, etc.) | Temperature and reflectance data will help determine cloud characteristics and intensity of the storm. |
| **Suomi-NPP VIIRS** | Cloud Top Parameters (CTP) | CTP data will help determine cloud characteristics and intensity of the storm. |
| **International Space Station CATS** | CATS LiDAR distribution of aerosol and cloud | LiDAR data will be used to calculate recent storm intensity and cyclone eye cloud wall characteristics. |

***Ancillary Datasets:***

HURSAT-B1 (GOES-1 to 13, SMS-2, Meteosat-2) – IR imagery of tropical cyclones – determine size and shape of cyclone storms.

NOAA NCEI International Best Track Archive for Climate Stewardship (IBTrACS) – creation of tropical climatology for the Philippines

OCHA – Philippines Population Demographic Data – cyclone hazards risk map creation

NCEI - Global Historical Climatology Network – validation of satellite precipitation estimates

OCHA – Philippines Floodplain Risk Data – cyclone hazards risk map creation

SEDAC – Socioeconomic data – augment Philippines Census Data

Humanitarian Data Exchange- Literacy rates and additional demographic variables – Gender-based vulnerability map creation

***Software & Scripting:***

Esri ArcGIS – raster manipulation and analysis, map creation

R – statistical analysis

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| **Tropical Cyclone Potential Impacts Tool** | Tool will be used by OCHA in conjunction with cyclone vulnerability maps and cyclone climatology from the first term to predict impacts and the most vulnerable regions based on cyclone characteristics | HURSAT IR imagery and demographic threat mapping from the first term | III |

***End-User Benefit*:** End-users will be able to incorporate these end-products into current storm intensity monitoring methodology and cyclone vulnerability management, as seen in the quote from our collaborators at UNOSAT below:

“We believe that the proposed NASA DEVELOP project will complement our current cyclone monitoring and early warning efforts…” – Einar Bjorgo – Manager, UNOSAT

The Tropical Cyclone Estimated Impacts Tool will aid OCHA in allocating resources for long-term pre-disaster preparation and post-disaster relief efforts that will consider which municipalities have the greatest gender-based vulnerability.

**Project Timeline & Previous Related Work**

***Project Timeline:*** Two Terms: 2017 Spring (Start) to 2017 Summer (Completion)

***Multi-Term Objectives:***

* **Term 1:** 2017 Spring (NCEI) – Philippines Disasters I
  + The first term created a tropical cyclone climatology of the Philippines using archived cyclone data from January 1982 to December 2016. The team used population demographic data (number of poor households with single mothers, disabled females, elderly females, and female child-headed households) and the cyclone climatology to create an overall threat score. The climatology and cyclone vulnerability maps and figures serve as a reference and planning guide for natural disaster mitigation groups in the Philippines.
* **Term 2 (Proposed Term):** 2017 Summer (NCEI) – Philippines Disasters II
  + A second term will utilize hurricane satellite data to incorporate storm size and shape variables into the cyclone threat variable weighting. This project will utilize a finer-scale, raster-based analysis that will be aggregated to the municipality level.

***Previous Terms:***

2017 Spring (NOAA National Centers for Environmental Information) – Philippines Disasters I

***Related DEVELOP Work:***

Fall 2015 (Wise County Clerk of Circuit Court’s Office) – African Great Lakes Weather I: Utilizing NASA Earth Observations to Identify Indicators to Help Predict Deadly Storms over the African Great Lakes

Spring 2016 (Wise County Clerk of Circuit Court’s Office) – African Great Lakes Weather II: Utilizing NASA Earth Observations to Identify Indicators to Help Predict Deadly Storms over the African Great Lakes

**Notes & References:**

***References:***

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