**NASA DEVELOP National Program**

**** NOAA National Centers for Environmental Information

*Summer 2017*

**Short Title: Philippines Disasters II**

**Subtitle:** Utilizing NASA and NOAA Earth Observations to Enhance the United Nation’s Office for the Coordination of Humanitarian Affairs Storm Preparation and Disaster Relief Planning Methods

**VPS Title:** A Step Ahead: Analyzing Cyclone Vulnerability to Coordinate Disaster Relief Efforts in the Philippines

**Project Team**

**Project Team:**

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**Advisors & Mentors:**

Dr. Carl Schrek (Cooperative Institute for Climate and Satellites, NOAA National Centers for Environmental Information)

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**Past or Other Contributors:**

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**Project Overview**

**80-100 Word Objectives Overview:**

The Philippines are impacted by 19 tropical cyclones on average each year, which frequently bring flooding rains, strong winds, and crippling storm surge to areas that home at-risk communities. This project aims to use NOAA and NASA satellite-derived datasets to quantify tropical cyclone intensity and shape parameters of past storms with demographic data to compute a municipality level risk assessment. The final risk assessment will allow our partners at UN-OCHA to determine the locations of the most vulnerable populations and proactively distribute resources.

**Abstract:**

The Philippine islands, located within the northwest Pacific Ocean basin, are frequently affected by tropical cyclones. During and after tropical cyclones, the number of gender-based violence (GBV) crimes increase. To assist the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), a cyclone vulnerability assessment for each municipality within the Philippines was created and streamlined with demographic data to identify at risk communities. For this effort, hurricane satellite (HURSAT-B1) data were downloaded for each tropical cyclone that affected the Philippines from 1985 to 2009. To include the recent record, data were gathered for tropical cyclones affecting the study area from 2010 to 2015 from the Cooperative Institute for Research in the Atmosphere’s (CIRA) Multiplatform Tropical Cyclone Surface Wind Analysis (MTCSWA). The HURSAT and CIRA products were used to derive estimates of the 18 m/s, 26m/s, and 33 m/s wind radii for each of the four quadrants (i.e. northwest, northeast, southeast, southwest) of each tropical cyclone at a 6-hour temporal resolution. The wind radii estimates were provided by the National Oceanic and Atmospheric Administration’s National Environmental Satellite, Data, and Information Service (NESDIS). The wind speed data were used to estimate the Integrated Kinetic Energy (IKE) of each tropical cyclone in the study period. IKE values were then accumulated over the entire study period for the Philippines and used to generate a climatology of cyclone intensity for each municipality. Additionally, areas susceptible to rainfall-triggered landslides were mapped using slope data from Shuttle Radar Topography Mission.

**Keywords:**

IBTrACS, HURSAT, cyclones, Philippines, disaster relief planning, remote sensing

**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  Joseph Addawe, General Advisor | End User | Yes |
| United Nations Institute for Training and Research, Operational Satellite Applications Programme (UNOSAT) | Luca Delloro, Programme Specialist | Collaborator | No |
| Netherlands Red Cross | Maarten van der Veen, Initiator | Collaborator | No |
| NOAA, National Environmental Satellite, Data, and Information Service (NESDIS) | Dr. John Knaff, Regional and Mesoscale Meteorology Branch (RMMB) Tropical/Satellite Meteorologist | Collaborator | No |

**Community Concerns:**

* About 19 tropical cyclones enter the Philippine Sea each year, and an average of six to nine make landfall in the Philippines.
* Cyclones are common natural hazards in the Philippines, causing extensive societal consequences, such as population displacement, which can lead to serious health, social, and economic consequences.
* Due to the high risk of traumatic impacts, people of the Philippines seek to improve their ability to prepare for and recover from land-falling tropical cyclones.
* The category five tropical cyclone Typhoon Haiyan/Yolanda (November 2013) proved to be the deadliest storm to ever hit the Philippines, killing over 6,000 people.
* Women and children are uniquely vulnerable to tropical cyclones, experiencing increased rates of gender-based violence and long-term damages on childhood development.

**Current Decision Making Practices & Policies**:

Currently, our partners use hazard information (e.g., threat maps) generated by the Nationwide Operational Assessment of Hazards (NOAH), an organization launched in 2012 by the Filipino Department of Science and Technology in response to President Aquino’s goal to implement a disaster prevention and mitigation program. Since its launch, the NOAH project has installed over 500 pieces of weather equipment, such as automated weather stations (AWS) and automated rain gauges (ARG). Despite these efforts, hazard management is not reaching all vulnerable populations. To address this issue, we are working with OCHA to use additional datasets including tropical cyclone tracks, satellite derived precipitation estimates and various population statistics to focus on gender vulnerability.

**Decision Support Tools & Benefits:**

|  |  |  |  |
| --- | --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Partner Benefit & Use** | **Software**  **Release** |
| Landslide Hazards and Vulnerabilities Map | SRTM | A landslide vulnerability map will be used to aid decision makers in determining the allocation of emergency management and resources after potentially devastating rainfall events. | N/A |
| Philippines Cyclone Climatology Maps & Figures | IBTrACS archived tropical cyclone data/tracks | Climatology maps & figures will be used by OCHA to better understand typical cyclone tracks, intensity, and impacts that will aid mitigation planning across the Philippines. | N/A |

**Project Benefit to End-User**:

The deliverables provided by this project will allow OCHA to more appropriately tailor their hazard management techniques to address vulnerable populations in disaster affected municipalities. Using tropical cyclone tracks and satellite derived data in concert with the previous term’s demographic data, government organizations will be able to plan their response to tropical cyclones and take proactive action.

**Project Details**

**Applied Sciences National Application Addressed:** Disasters

**Study Area:** The Philippines

**Study Period:** January 1985 – December 2015

**Earth Observations & Parameters:**

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| Shuttle Radar Topography Mission (SRTM) | Digital Elevation Model (DEM) | The DEM was used to assess areas that are vulnerable to flooding and landslides based on elevation and slope. |
| International Best Track Archive for Climate Stewardship (ITBrACS) | Tropical cyclone tracks, wind speed | ITBracks data were used to create a cyclone climatology for the Philippines. |
| HURSAT-B1 | Infrared imagery of tropical cyclones | HURSAT-B1 provided raw satellite observations to estimate the wind field of tropical cyclones. |

**Ancillary Datasets Utilized:**

* Humanitarian Data Exchange – Literacy rates and additional demographic variables
* OCHA Philippines Population Demographic DataPhilGIS – Philippine-based shapefiles including municipalities and county boundaries
* Socioeconomic Data and Applications Center (SEDAC) – socioeconomic data

**Software Utilized:**

* Esri ArcGIS – used for mapping and data processing
* Fortran – used for data processing
* Python – used fort data processing
* R – used for data processing

**Project Handoff Package**

**Transition Plan:**

We plan to handoff our deliverables via teleconference to Joseph Addawe (OCHA) during week 9. During the teleconference we will ensure that our partner understands the methodologies and conclusions of our work. We will also explain how our methods can be replicated for future tropical cyclone occurrences.

**Team POC:** Michael Marston, mlm92@vt.edu

**Partner POC**: Joseph Addawe, addawe@un.org

**Handoff Package:**

* ArcMap .mxd file containing the final risk assessment
* Copies of our final deliverables