**NASA DEVELOP National Program**

**** International Research Institute for Climate and Society (IRI)

**Spring 2015**

**Malawi Disasters**

*Comparing Techniques of Inundation Detection for the January 2015 Malawi Floods Using NASA Earth Observations*

**Project Team:**

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**Partner Organizations**

Red Cross/Red Crescent Climate Centre (RCRCCC), Boundary Organization, POC: Erin Coughlan, Senior Climate Specialist

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**Applied Sciences National Applications Addressed:**

Disaster

**Study Area:**

Malawi

**Study Period:**

January 1, 2015 to January 31, 2015

**Earth Observations & Parameters**

Aqua and Terra, MODIS - Water body delineation (DFO flood product)

Aqua and Terra, LANCE MODIS - Flood detection (NRT-GFM flood product)

TerraSAR-X, Synthetic Aperture Radar (SAR) - Flood detection

RADARSAT, Synthetic Aperture Radar (SAR) - Flood detection

RADARSAT-2, Synthetic Aperture Radar (SAR) - Flood detection

TRMM, Precipitation Radar (PR) - Rainfall

TRMM, TRMM Microwave Imager (TMI) - Rainfall

TRMM, Visible and Infrared Scanner (VIRS) - Rainfall

Aqua, Advanced Microwave Scanning Radiometer Earth Observing System (AMSR-E) - Rainfall

Defense Meteorological Satellite Program (DMSP) satellites, Special Sensor Microwave Imager (SSM-I) – Meteorology data

Aqua, Microwave precipitation Estimates (AMSU-A) - Rainfall

**80-100 Word Objectives Overview**

During extreme climate disasters, humanitarian organizations rely on Earth observation (EO) data to evaluate impact and design response programs. For flood events, inundation maps and flood models were produced from EO in real and near-real time to analyze the spatial and temporal characteristics of the disaster. This project used recent flood events in Malawi as a case study. It then compared various inundation detection products derived from remotely-sensed data with the location of shelters based on Red Cross and UKAID information.

**Abstract**

Malawi is prone to floods especially during its rainy season from October to April. In January 2015, Malawi experienced a series of flooding which resulted in 79 deaths, 153 missing, and over 175,000 people displaced. From a partnership with the Malawi Red Cross and supported by a review of media reports, it was shown that relief efforts were not reaching the affected population in a timely manner. The difference between the spatial coverage and accuracy among flood maps generated regarding to the January 2015 flood events in Malawi may have contributed to the delay or lack of relief efforts in certain areas. Due to the limitations of flood detecting products (e.g. especially flash flood), affected communities could have been overlooked by disaster responders. A comparative analysis using shelter locations to verify the spatial coverage of the January 2015 Malawi floods was conducted using Dartmouth Flood Observatory (DFO) flood map, NASA Goddard Space Flight Center Moderate Resolution Imaging Spectroradiometer Near Real-Time Global Flood Mapping Project (NRT-GFM), TerraSAR-X (German satellite) inundation map, RADARSAT (Canadian satellite) inundation map, RADARSAT-2 (Canadian satellite) inundation map, the University of Maryland Global Flood Monitoring System Flood Detection (GFMS-FD) product and GFMS Inundation 1KM (GFMS-I) product. It is expected that the results of this study will increase the ability to monitor flood events, which will benefit organizations involved with disaster relief efforts in Malawi; allowing for quicker response and more appropriate allocation of emergency flood relief efforts.

**Community Concerns**

* January, 2015 floods in Malawi resulted in 79 deaths, 153 people missing, and over 175,000 people displaced. The affected population is in urgent need of nutritional supplies, shelter, and drinkable water.
* Due to the spatial and temporal characteristics of flash floods, flood detection products are rarely able to identify them. Communities affected by the flash floods may be overlooked by disaster responders and or delay the delivery relief aid.
* Potential to improve flash flood detection and prediction using satellite products is not only vital for local preparation, but also for enhancing the efficiency of relief aid delivery.

**Current Management Practices & Policies**

Remote regions in Africa often have sparse meteorological and ecological satellite and ground data. Project partners in this region rely heavily on remotely sensed data as it increases the temporal and geospatial scales of projects. Data from NASA satellites and sensors (e.g. MODIS onboard Aqua and Terra and TRMM) enable project partners working in these regions to better evaluate the impact extent and develop response programs.

**Decision Support Tools**

* Flood product comparison - Through comparing different flood products at the height of the January 2015 Malawi floods, Malawi Red Cross and other decision makers will be better equipped to develop more effective response programing.
* Validation maps – The project used a map of displacement sites to compare the various flood products.

**Benefit to End-User:**

* Identification of a set of flood detection products that accurately depict flood events in Malawi to enable end-users to better monitor spatial extent of floods and improve response programs.

**Models Utilized**

* University of Maryland/University of Washington Dominant river tracing-Routing Integrated with VIC Environment (DRIVE) model

**Software Utilized**

QGIS – Raster manipulation/analysis, map creation of Dartmouth Flood Observatory, NASA NRT-GFM Flood Mapping Products, TerraSAR-X, RADARSAT, RADARSAT-2