Integration of NASA Global Precipitation Measurement Mission Data into the SERVIR Flood Decision Support System for Mesoamerica

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Goals

To test and validate next generation Global Precipitation Measurement Mission (GPM) data to 1) enhance the current satellite-based inputs into SERVIR, 2) replace AMSR-E data used for SERVIR's flood Decision Support System (DSS) for floods and 3) calibrate flood extent information generated from AMSR-E data with gauging data in Central America

Project Overview

SERVIR is an important decision support tool for Central America. Supported by NASA, SERVIR provides scientific information on issues of disasters, ecosystems, biodiversity, weather, water, climate, oceans, health, agriculture and energy for the region. SERVIR provides flood information generated from NASA's Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E) satellite sensor. NASA's next generation Global Precipitation Measurement (GPM) satellite system will provide information that could improve the current suite of flood products SERVIR offers. Our goal is to test simulated GPM data and assess its ability to replicate or improve the flood products currently generated using AMSR-E data.

Approach

The Dartmouth Flood Observatory (DFO) has developed a method for generating flood extent mapping using AMSR-E data for discharge estimation (Figure 1). AMSR-E is a multichannel passive microwave instrument which monitors ground surface water changes in watersheds. As land surface becomes saturated and then inundated with runoff, the areal extent can be mapped. Flooding or inundation map products are integrated into the SERVIR DSS and delivered to the public.

The proposed GPM mission offers significant improvements on rainfall estimation. GPM will be capable of measuring rain rates as small as a hundredth of an inch per hour to as large as 4 inches an hour. GPM will seek to achieve these measurements with a 3-hour average revisit time over 80% of the globe, and the data will be available to users within 3 hours of observation time. AMSR-E data and future GPM data are significantly different in character. The closest analogy for the product GPM will produce is Tropical Rainfall Measuring Mission (TRMM) data. Tennessee Technological University will convert TRMM data into simulated future GPM data. Then Dartmouth will generate their flood products using the GPM data. The University of Mississippi is guiding this project and will evaluate and quantitatively compare of flood products for simulated GPM and ASMR-E data.

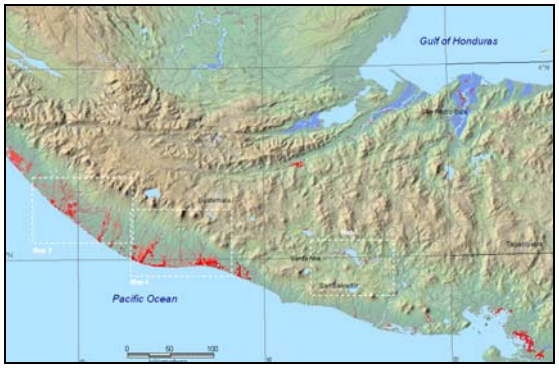

Figure 1: Flood map from Dartmouth Flood Observatory using AMSR-E data

For our product assessment, we will compare flood products associated with Hurricane Stan. Hurricane Stan (October 2005) was a relatively weak storm embedded in a larger non-tropical system that delivered torrential rains to Guatemala, El Salvador and southern Mexico. Storm related flooding and mudslides lead to between 1600 and 2000 deaths with damage of approximately $1 billion U.S. dollars. Figure 2 shows rainfall accumulations of up to 500 mm (200 inches) over parts of Central America. Figure 2 shows the rainfall accumulation associated with Hurricane Stan.

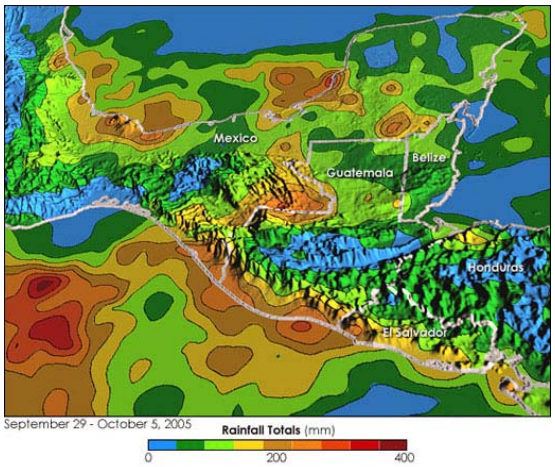

Figure 2: NASA generated Rainfall accumulation map for Hurricane Stan

Using ground data from weather stations and river gauging stations as well as available AMSR-E data (Figure 3) and GPM data simulated from TRMM imagery (Figure 4), Dartmouth will generate ground surface water changes. We will compare the GPM products against the AMSR-E products to determine if they meet or exceed the current level of accuracy expected. We will also compare the TRMM rainfall estimates for discharge and simulated GPM estimates for discharge against discharge measurements by the Dartmouth Flood Observatory.

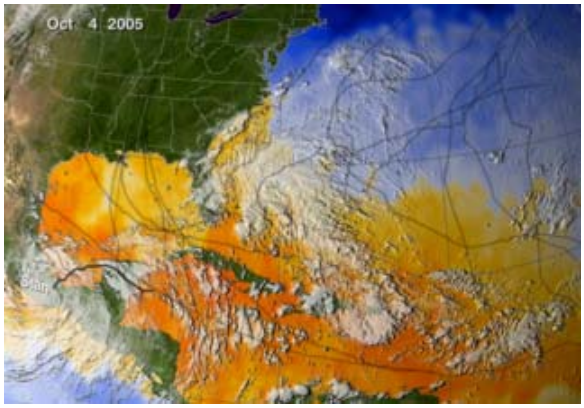

Figure 3: AMSR-E data for Hurricane Stan from NASA

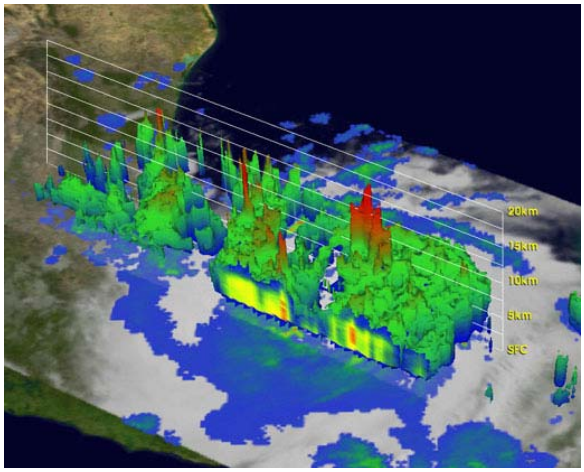

Figure 4: TRMM data for Hurricane Stan from NASA

IMPACTS

The development of this methodology will allow for rapid streamlining of new GPM-generated flood products into an important regional decision support system, SERVIR. GPM rainfall products are expected to be more accurate and more timely than current products from either TRMM or AMSR-E. GPM will continue to provide the information needed for Dartmouth to generated flood inundation maps long after the AMSR-E satellite fails. Dartmouth's discharge measurements are crucial for calibrating models for discharge of rainfall from select watersheds. The integration of rainfall into the decision support system represents an important first step in the shift from monitoring discharge to anticipating discharge and thereby forecasting flooding events. GPM integration into SERVIR will allow for disaster anticipation, rapid flood response and appropriate allocation of resources. The goal is to mitigate injury and death due to flooding should another heavy rainfall event like Hurricane Stan occur in the future.

Collaborators

Dartmouth Flood Observatory
Science Systems and Applications Inc. at Stennis Space Center
Tennessee Technological University
Water Center for Humid Tropics of Latin America and the Caribbean (CATHALAC)

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