Rapid Prototyping Capability

Integration of Global Precipitation Measurement Data Product with the
USM-MRCSSC-2152007-55T
Prime Award No: NNS06AA98B
Sub Award No: NNS07AA55T

Project Overview

The UM uses the simulated gridded precipitation data derived from proxy Global Precipitation Measurement (GPM) data products. These data will be simulated at a variety of spatial and temporal scales. The simulated gridded precipitation data will then be used as an input to the United States Army Corps of Engineer (USACE) Hydrologic Engineering Center- Hydrologic Modeling System (HEC-HMS). The proposed RPC experiment will focus on assessing the use of prototype GPM precipitation data for creating precipitation hyetographs within the HEC-HMS model and the resulting hydrographs.

This proposed RPC experiment is limited to the HEC-HMS output to the Hazards U.S. Multi-Hazard (HAZUS-MH) DSS. The majority of the error and data suitability analysis will center on the quality of transaction files being produced for the DSS. However, the results of this proposed RPC experiment may be used in other DSSs requiring similar input parameters.

Statement of Problem

The goal of this RPC experiment is to test the effectiveness of GPM simulated rainfall data in capturing the flood dynamics by comparing to the flood simulations obtained from ground-based rainfall networks/systems. By using the TRMM Multi-Satellite Precipitation Analysis Real-Time (TMPA-RT) data products with the assumption that future GPM system will gradually evolve from the TMPA system, we can test such an RPC concept based on our current progress in satellite rainfall estimation at higher resolutions (sub-daily and sub-degree scales).

As evident from Figure 1, there are about 5 coarse (25x25 km) NASA TMPA rainfall pixels over the example stream basin. This coarse satellite rainfall data will need to be spatially downscaled and then investigated for its effectiveness in streamflow simulation using HEC-HMS.

Figure 1 – Downscaling of simulated rainfall data from GPM proxy data.
Methods

About 100 Monte Carlo (MC) sets of downscaled rainfall data of the 3B41 and 3B42 data product for the 2002 rainfall event at scales 12.5 km, 6.25 km and 3.125 km. The downscaling scheme can disaggregate data only at successively halve scales.

Each of the MC downscaled realizations will then be propagated in HEC-HMS for all 4 spatial scales and the output in streamflow will be saved (MC realizations again). For the 25 km scale, Tennessee Tech team members will provide MC realizations from an error model that has developed called SREM2D.

Answers sought in RPC

The following four questions are very pertinent RPC questions to seek answers for GPM:

1) Which is the better option for satellite rainfall based flood simulation when rainfall data is available at coarse scale:
   a) an error propagation based ensemble streamflow scheme at the coarse (native) resolution or
   b) a probabilistically downscaled based ensemble streamflow scheme?

2) How much downscaling of the coarse NASA satellite data is needed for observing a beneficial effect on the flood simulation?

3) Which specific NASA satellite rainfall product is more beneficial to downsampling for flood simulation?
   a) 3B41 (based on Infrared data calibrated to Microwave estimates)
   b) 3B42 (based on Microwave estimates filled with Infrared data)
   c) a combination of these products may eventually morph to the GPM era in 2013 onwards.

4) What are the implications of downscaling of NASA satellite rainfall product on decision making for flood management?

Contact information:

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