SPoRT Seminar Series Presents:

Assimilation of Satellite Precipitation and Soil Moisture Data into the WRF-Noah Model

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Date: Tuesday, April 25, 2017
Time: 2:00 P.M.

Location: SPoRT VCL (NSSTC 3027)

Abstract:

Among a wide variety of satellite earth observations, precipitation and soil moisture are the two most important and complementary variables for hydrological applications. To better understand the usefulness of satellite observations on the forecasts of precipitation, soil moisture, and near-surface energy balance; the paper presents a framework that enables assimilating both satellite precipitation and soil moisture observations into the coupled Weather Research and Forecasting (WRF) and Noah land-surface model through variational approaches. We examine the framework by assimilating precipitation data from the Tropical Rainfall Measuring Mission (TRMM) and soil moisture data from the Soil Moisture Ocean Salinity (SMOS) satellite. The results show that both assimilation of TRMM and SMOS data can effectively improve the forecast skills of precipitation, top 10-cm soil moisture, and 2-m temperature and specific humidity. The validation of forecasts of up to two days shows that the impacts of precipitation data assimilation on precipitation forecasts quality beyond the six-hour assimilation window remains nearly time invariant, while the impacts of soil moisture data assimilation increase with lead times. The effects of soil moisture and precipitation assimilation on the improvement of 2-m temperature and specific humidity forecasts are in the same order. It is demonstrated that the forecast skills are further improved when the TRMM and SMOS data are assimilated simultaneously. The results show that joint data assimilation reduces the prediction errors of precipitation (57%, 6%), surface soil moisture (73%, 27%), 2-m temperature (17%, 9%), and 2-m specific humidity (33%, 11%) measured in the bias and the root-mean-squared error, respectively.