1. Introduction

- National Water Center implemented operational National Water Model (NWM) to improve hydrological prediction (Figure 1)

- NWM is instantiation of Weather Research and Forecasting model hydrological extension package (WRF-Hydro) [Gochis et al., 2013] coupled with Noah Land Surface Model with Multi-Parameterization options (Noah-MP) [Niu et al., 2011]

- Noah-MP includes vegetation parameterizations which use monthly climatological tables to define leaf area index (LAI) and green vegetation fraction (GVF) within the model

- However, LAI and GVF can deviate greatly from climatology as result of anomalous meteorological conditions or changes in land use/land cover due to agriculture, forest fires, etc.

- Changes in vegetation influence soil moisture and surface runoff, which are intrinsically linked to streamflow

- This study investigates the impact of replacing climatological vegetation in Noah-MP with real-time vegetation

2. 2015 December North Alabama Flood

- Warmer than average temperatures leading up to event

- LAI higher than climatological values (Figure 2)

- Heavy rainfall over multiple days in excess of 100 mm (4 in.) across much of northern Alabama and over 250 mm (10 in.) in some locations (Figure 3)

- Moderate to major flooding along several rivers in North Alabama, including Flint River and Paint Rock River (Figure 5)

- Case study of 2015 December North Alabama Flood

3. Methodology

- Coupled WRF-Hydro (version 3.0) with Noah-MP

- Real-time Suomi National Polar-orbiting Partnership (5-NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) Green Vegetation Fraction (GVF) and SPoRT Land Information System (LIS) LAI replace climatological vegetation in Noah-MP

- Case study of 2015 December North Alabama Flood

- 2-year model spin-up, manual calibration

4. Preliminary Results

- Model hydrographs follow observations trend, but magnitude is lower than observed

- Replacing climatological vegetation with real-time vegetation in Noah-MP noticeably changes WRF-Hydro streamflow

- 10-40 cm volumetric soil moisture is relatively unchanged when using real-time vegetation

5. Conclusions and Future Work

- Accurate depiction of vegetation is needed for hydrological modeling applications

- Further calibration of WRF-Hydro against stream gauge observations using PEST parameter estimation tool (http://www.pesthomepage.org/)

- Investigate impacts of assimilating other NASA satellite datasets (e.g., SMAP, SWOT) into WRF-Hydro on simulated streamflow

References

