Weather Research and Forecasting Model Sensitivity Comparisons for Warm Season Convective Initiation

Leela R. Watson ENSCO, Inc/Applied Meteorology Unit, **Brian Hoeth** Spaceflight Meteorology Group, Houston, TX **Peter F. Blottman,** NWS Melbourne, FL

Mesoscale weather conditions can significantly affect the space launch and landing operations at Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS). During the summer months, land-sea interactions that occur across KSC and CCAFS lead to the formation of a sea breeze, which can then spawn deep convection. These convective processes often last 60 minutes or less and pose a significant challenge to the forecasters at the National Weather Service (NWS) Spaceflight Meteorology Group (SMG). The main challenge is that a "GO" forecast for thunderstorms and precipitation is required at the 90 minute deorbit decision for End Of Mission (EOM) and at the 30 minute Return To Launch Site (RTLS) decision at the Shuttle Landing Facility. Convective initiation, timing, and mode also present a forecast challenge for the NWS in Melbourne, FL (MLB). The NWS MLB issues such tactical forecast information as Terminal Aerodrome Forecasts (TAFs), Spot Forecasts for fire weather and hazardous materials incident support, and severe/hazardous weather Watches, Warnings, and Advisories. Lastly, these forecasting challenges can also affect the 45th Weather Squadron (45 WS), which provides comprehensive weather forecasts for shuttle launch, as well as ground operations, at KSC and CCAFS. The need for accurate mesoscale model forecasts to aid in their decision making is crucial.

Both the SMG and the MLB are currently implementing the Weather Research and Forecasting Environmental Modeling System (WRF EMS) software into their operations. The WRF EMS software allows users to employ both dynamical cores – the Advanced Research WRF (ARW) and the Non-hydrostatic Mesoscale Model (NMM). There are also data assimilation analysis packages available for the initialization of the WRF model – the Local Analysis and Prediction System (LAPS) and the Advanced Regional Prediction System (ARPS) Data Analysis System (ADAS). Having a series of initialization options and WRF cores, as well as many options within each core, provides SMG and NWS MLB with a lot of flexibility. It also creates challenges, such as determining which configuration options are best to address specific forecast concerns. The goal of this project is to assess the different configurations available and to determine which configuration will best predict warm season convective initiation in East-Central Florida.

Four different combinations of WRF initializations will be run (ADAS-ARW, ADAS-NMM, LAPS-ARW, and LAPS-NMM) at a 4-km resolution over the Florida peninsula and adjacent coastal waters. Five candidate convective initiation days using three different flow regimes over East-Central Florida will be examined, as well as two null cases (non-convection days). Each model run will be integrated 12 hours with three runs per day, at 0900, 1200, and 1500 UTC. ADAS analyses will be generated every 30 minutes using Level II Weather Surveillance Radar-1988 Doppler (WSR-88D) data from all Florida radars to verify the convection forecast. These analyses will be run on the same domain as the four model configurations. To quantify model performance, model output will be subjectively compared to the ADAS analyses of convection to determine forecast accuracy. In addition, a subjective comparison of the performance of the ARW using a high-resolution local grid with 2-way nesting, 1-way nesting, and no nesting will be made for select convective initiation cases. The inner grid will cover the East-Central Florida region at a resolution of 1.33 km. The authors will summarize the relative skill of the various WRF configurations and how each configuration behaves relative to the others, as well as determine the best model configuration for predicting warm season convective initiation over East-Central Florida.