Impact of MODIS High-Resolution Sea-Surface Temperatures on WRF Forecasts at NWS Miami, FL

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Over the past few years, studies at the Short-term Prediction Research and Transition (SPoRT) Center have suggested that the use of Moderate Resolution Imaging Spectroradiometer (MODIS) composite sea-surface temperature (SST) products in regional weather forecast models can have a significant positive impact on short-term numerical weather prediction in coastal regions. The recent paper by LaCasse *et al.* (2007, *Monthly Weather Review*) highlights lower atmospheric differences in regional numerical simulations over the Florida offshore waters using 2-km SST composites derived from the MODIS instrument aboard the polar-orbiting Aqua and Terra Earth Observing System satellites. To help quantify the value of this impact on NWS Weather Forecast Offices (WFOs), the SPoRT Center and the NWS WFO at Miami, FL (MIA) are collaborating on a project to investigate the impact of using the high-resolution MODIS SST fields within the Weather Research and Forecasting (WRF) prediction system. The scientific hypothesis being tested is: More accurate specification of the lower-boundary forcing within WRF will result in improved land/sea fluxes and hence, more accurate evolution of coastal mesoscale circulations and the associated sensible weather elements.

The NWS MIA is currently running the WRF system in real-time to support daily forecast operations, using the National Centers for Environmental Prediction Nonhydrostatic Mesoscale Model dynamical core within the NWS Science and Training Resource Center's Environmental Modeling System (EMS) software. The EMS is a stand-alone modeling system capable of downloading the necessary daily datasets, and initializing, running and displaying WRF forecasts in the NWS Advanced Weather Interactive Processing System (AWIPS) with little intervention required by forecasters. Twenty-seven hour forecasts are run daily with start times of 0300, 0900, 1500, and 2100 UTC on a domain with 4-km grid spacing covering the southern half of Florida and the far western portions of the Bahamas, the Florida keys, the Florida straights, and adjacent waters of the Gulf of Mexico and Atlantic Ocean. Each model run is initialized using the Local Analysis and Prediction System (LAPS) analyses available in AWIPS, invoking the diabatic "hot-start" capability. In this WRF model "hot-start", the LAPS-analyzed cloud and precipitation features are converted into model microphysics fields with enhanced vertical velocity profiles, effectively reducing the model spin-up time required to predict precipitation systems. The SSTs are initialized with the NCEP Real-Time Global (RTG) analyses at 1/12° resolution (~9 km); however, the RTG product does not exhibit fine-scale details consistent with its grid resolution.

SPoRT is conducting parallel WRF EMS runs identical to the operational runs at NWS MIA in every respect except for the use of MODIS SST composites in place of the RTG product as the initial and boundary conditions over water. The MODIS SST composites for initializing the SPoRT WRF runs are generated on a 2-km grid four times daily at 0400, 0700, 1600, and 1900 UTC, based on the times of the overhead passes of the Aqua and Terra satellites. The incorporation of the MODIS SST composites into the SPoRT WRF runs is staggered such that the 0400 UTC composite initializes the 0900 UTC WRF, the 0700 UTC composite initializes the 1500 UTC WRF, the 1600 UTC composite initializes the 2100 UTC WRF, and the 1900 UTC composite initializes the 0300 UTC WRF.

A comparison of the SPoRT and Miami forecasts is underway in 2007, and includes quantitative verification of near-surface temperature, dewpoint, and wind forecasts at surface observation locations. In addition, particular days of interest are being analyzed to determine the impact of the MODIS SST data on the development and evolution of predicted sea-/land-breeze circulations, clouds, and precipitation. This paper will present verification results comparing the NWS MIA forecasts to the SPoRT experimental WRF forecasts, and highlight any substantial differences noted in the predicted mesoscale phenomena.