

Using High-Resolution Sea Surface Temperature Data and a NASA Land Information System to Initialize a Local Weather Forecast Model



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Introduction

The Houston/Galveston National Weather Service office, through a partnership with NASA SPoRT (Short-term Prediction Research and Transition Center), began utilizing the high resolution MODIS SST (Sea Surface Temperature) dataset to initialize a local WRF EMS model in early 2009. In December 2009, the office added a control run to aid with assessing the value of this SPoRT dataset. In the spring of 2011, the NASA SPoRT LIS dataset was also incorporated at initialization, with the goal of further improvement of the local WRF EMS. What follows are several examples highlighting differences between the control and SPoRT initialized WRF EMS runs for different forecast challenges. In most cases, our assessment is that the high resolution SPoRT datasets improve the WRF model forecast output.

NWS Houston/Galveston WRF EMS Configuration

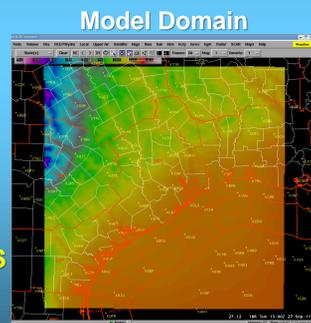
Workstation Cluster: Two Dell Precision 690 Workstations
Intel Quad Xeon Processor with four 2.33 GHz CPUs (8 CPUs)
RAM: 4 GB OS: RHEL 5.4

Winter 2010 Model: WRF EMS v.3.0.1 beta2 > Summer 2011 Changes
WRF EMS v.3.1.1.5.1

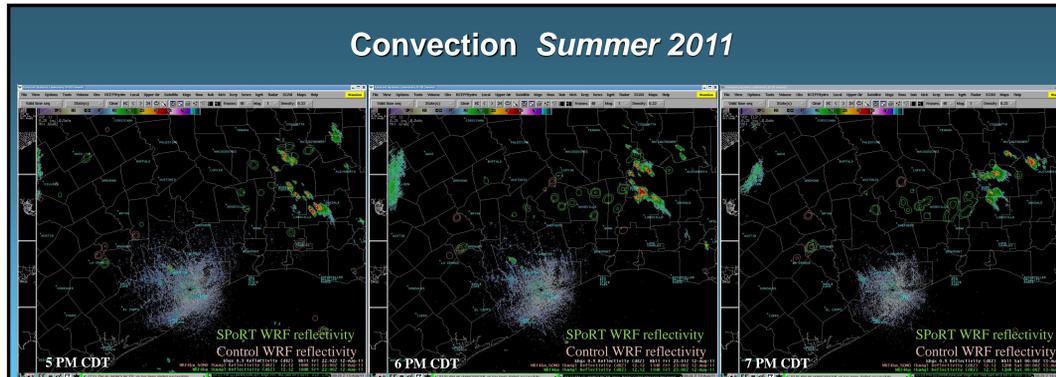
Core: ARW
Dimension: 129 X 129 > 150 X 150
Spacing: 4 KM
Levels: 35
Length: 30 HR > 36 HR
Time step: 24 seconds
Boundary conditions: NAM 12 KM

2 runs @ 00, 06, 12, 18 UTC > @ 00,12 UTC
1st run (SPoRT): SPoRT SST > SPoRT SST & LIS
2nd run (Control): RTG SST HR & NAM PTILE

Microphysics: Lin et al.
Planetary Boundary Layer: Yonsei University Scheme



Convection Summer 2011



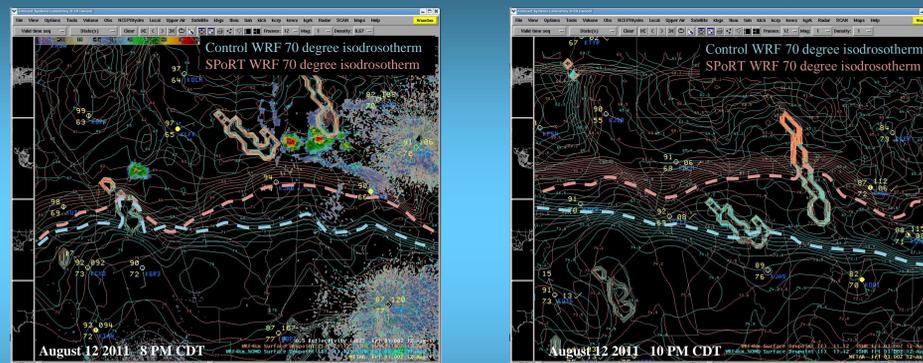
August 12 2011



August 14 2011

- In general, both versions of the WRF tended to over-develop convection especially on non-active days across west/southwest areas of southeast Texas, that were often capped.
- Both versions had some timing issues, but in general, provided useful guidance to forecasters, particularly on the possible degree of convective coverage.
- The SPoRT WRF reflectivity forecast was often better during convectively active afternoon/evenings when compared to the control forecast.

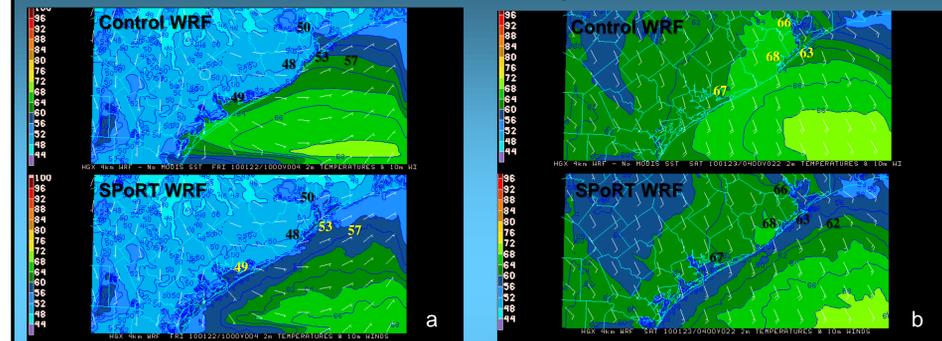
Seabreeze Boundary Summer 2011



- Orientation/timing similar across coastal zones.
- The SPoRT WRF was at times slightly faster moving the boundary well inland, and appeared to be more accurate in these cases.
- The further inland location affected convection developing in the vicinity of the seabreeze.

Onshore Flow/Warm Air Advection Winter 2010

WRF Forecast: Winds/Temperatures



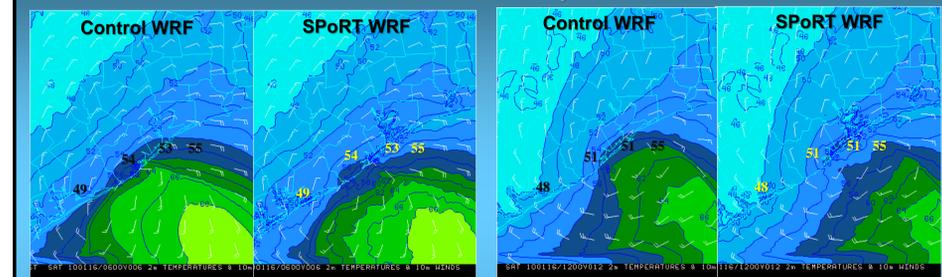
January 22 2011 10 UTC F4 HR

January 23 2011 4 UTC F22 HR

- Actual surface air temperatures are shown in black and yellow, with yellow indicative of the more accurate WRF temperature forecast.
- Over the near-shore waters, during a light onshore or along-shore flow, the SPoRT WRF temperatures were usually more accurate. (a)
- WRF (both runs) inland temperatures were too cool, and generally cooler with the SPoRT WRF as compared to the control WRF, once a moderate or strong warm air advection pattern was on place. (b)

Near-Shore Cyclogenesis Winter 2010

WRF Forecast: Winds/Temperatures

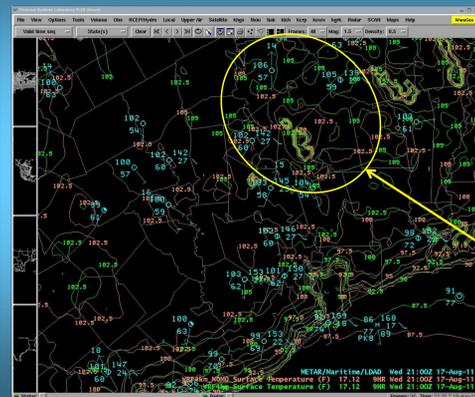


January 16 2010 6 UTC F6 HR

January 16 2010 12 UTC F12 HR

- Actual surface air temperatures are shown in black and yellow, with yellow indicative of the more accurate WRF temperature forecast.
- The SPoRT WRF temperatures in most cases were more accurate across the near-shore waters, and at coastal stations when comparing them to the control WRF.

Maximum Temperatures Summer 2011



Southeast Texas experienced the warmest summer on record with maximum temperatures reaching or exceeding 100 degrees at Houston's Bush Airport on 46 days!

The SPoRT WRF was warmer and closer to actual temperatures, especially across northern areas on days with near record, or record breaking maximum temperatures.

Future Work

Objectively verify with the MET (Model Evaluation Tools) package.
Experiment with different initialization methods (RUC, LAPS, etc.)

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