Using the SPoRT MET Scripts to Assess the WRF EMS for a Southeast Texas Heavy Rainfall Event

Patrick Blood and Lance Wood

NWS Houston/Galveston
SPoRT Model Simulation Matrix

Cold Season Heavy Rainfall - WFO Houston Case Study

November 8-9, 2011

Andrew Molthan
We learned that selecting the appropriate PBL and Microphysics is important for accurate storm total precipitation predictions.
18 April 2009 Synoptic Overview

- Upper divergence apparent at 300 mb level with SE Texas between two diverging jet streaks.
- 500 mb low moving over the southern plains with a shortwave trough moving across SE Texas.
- Deep layer moisture in the lower levels noticed at the 850 and 700 mb levels (PWATS : ~1.55” (25th percentile)).
- Pre-existing surface trough over the Houston area with a dry line and cold front approaching from the west.
18 April 2009 Synoptic Overview

courtesy of http://www.spc.noaa.gov/obswx/maps/

12 UTC 18 April 2009
00 UTC 19 April 2009

500 mb

NWS Houston/Galveston
18 April 2009 Synoptic Overview
courtesy of http://www.spc.noaa.gov/obswx/maps/

12 UTC 18 April 2009

00 UTC 19 April 2009

850 mb

NWS Houston/Galveston
The April 18th 2009 Extreme Rain Event

18Z Surface Analysis

Inland trough provided the convergence / ample inflow (1014.3 mb at IAH)
Meso-Low forms and enhances inflow

1829Z

1902Z

1930Z

1956Z
24 Hour Precipitation Estimate from KHGX

Houston/Galveston, TX (HGX): 4/19/2009 1-Day Observed Precipitation
Valid at 4/19/2009 1200 UTC - Created 4/21/09 10:33 UTC

NWS Houston/Galveston
The 18 April event had 9.9 of its 11 inch max of rainfall fall in 6 hours with 6.9 inches in one hour.
The April 18th 2009 Extreme Rain Event

Friendswood

Image Courtesy: Galveston Daily News

The Strand

Image Courtesy: Galveston Daily News
Forecaster Patrick Blood has utilized 3 different model initialization datasets, 6 PBLs, and 8 microphysical schemes to produce 144 model runs to analyze - using v3.4 of the WRF EMS.

Using the SPoRT MET scripts v4.1 and the new grib2 capability (courtesy of Brad Zavodsky) to objectively assess the precipitation forecasts.

This work is part of Mr. Blood’s MS Thesis work at the University of Houston. He is in the early stages of data analysis.
Re-Analysis Initialization:
C : CFSR

PBL Schemes:
1: Yonsei
4: QNSE

Microphysical Schemes:
02: Lin
06: WSM 6 Class
08: Thompson
09: Milbrandt-Yau
10: Morrison
13: Stony Brook University
14: WDM 5-Class
16: WDM 6-Class
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Stage III Precipitation
Example of 6 consecutive 1 hour precip. totals from a WRF-EMS run
During the critical afternoon period

PBL: BouLac
Microphysics: WDM 5-class

18-19 Z
19-20 Z
20-21 Z
21-22 Z
22-23 Z
23-24 Z

> 3 inches

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

mm
CSI
6 Hr (1800-2400) / 50 mm / 24 km x 24 km

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Early Observations

The strongest performers across the three PBLs/spatial-temporal schemes were the Lin, Thompson, WRF Single Moment (WSM) 6 class, and both WRF Double Moment (WDM) 5 and 6 classes.

There was a trend to over-forecast 1 inch rainfall amounts (Frequency Bias) in the last couple of hours (Yonsei, QNSE) and under-forecast during the early-mid afternoon heavy rainfall period.

The BouLac-WDM 5 class simulation performed well. It placed a 2 to 3 inch bulls-eye over central and southern Galveston County (22 - 24Z) a couple of hours behind where 2 to 3 inches were sensed by the radar (20 – 22Z).

Acknowledgements: Brad Zavodsky, Jon Case, Jayanthi Srikishen