Comparison of Texas A&M WRF convection-allowing forecasts with other high-resolution models

ATMOSPHERIC SCIENCES
TEXAS A&M UNIVERSITY

Armani Cassel, Jamison McCarthy and Dr. Chris Nowotarski

Introduction


TAMU Eos supercomputer

Established during the summer 2015 Student-Operational ADRAD Project (SOAP), the Weather Research and Forecast (WRF) model running at Texas A&M University operates with 3-kilometer grid spacing as WRF version 3.7 on an IBM iDataplex Cluster supercomputer at TAMU. Closer examinations of two situations are made to determine where TAMU-WRF stands in its performance against other high-resolution models. Qualitative analyses will be performed for two weather scenarios: a convective squall line and a landfalling tropical storm. The results of these examinations are to be displayed in two and three-dimensional data visualizations.

Model Characteristics

Model	TAMU-WRF	NSSLWRF	HWRF
Version	3.7	3.4.1	3.6.1
Boundary Conditions	12 km NAM	40 km NAM	GFS
Microphysics	WSM6	WSM6	Ferrier-Aligo
Land Surface Model	NOAH LSM	NOAH LSM	NOAH LSM
Radiation Parameterization	RRTM	RRTM	RRTM-G
Grid Spacing	3 km	4 km	2 km

All models have the same radiation parameterization and land surface model.

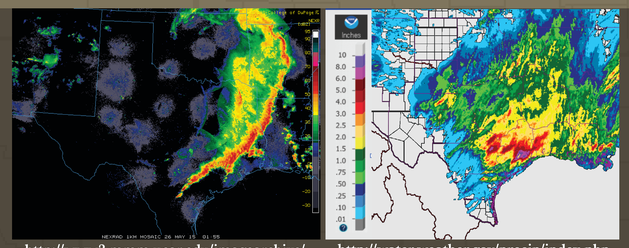
Contact Us

Armani Cassel: ac.07.93@gmail.com
Jamison McCarthy: jman4@tamu.edu
Dr. Chris Nowotarski: cjnowotarski@tamu.edu

Case #1: May 25, 2015

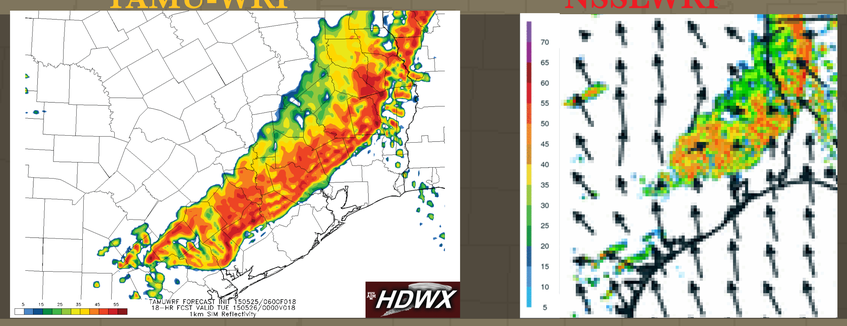
Impacts/Observations:

10+ inches of rain for SW Houston neighborhoods in less than 12 hours

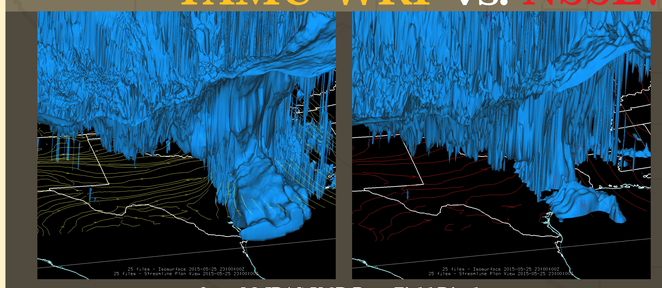

http://www2.mmm.ucar.edu/imagearchive/ http://water.weather.gov/precip/index.php

Simulated Reflectivity:

TAMU-WRF NSSLWRF



Low-level Wind Comparison: TAMU-WRF vs. NSSLWRF


from McIDAS-V 3D Data Field Display

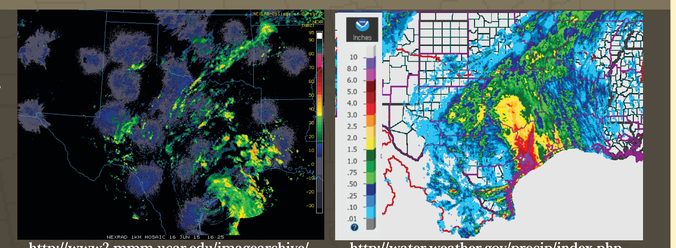
In this diagram, the blue-shaded isosurface represents a magnitude of 30 knots with streamlines at 850 hPa flowing eastward across west Texas and NNW-ward into SE Texas.

The blue isosurface over SE Texas surrounds a feature known as a low-level jet. Both computer models picked up on an LLJ with TAMU-WRF forecasting a more vigorous LLJ than the NSSLWRF. The presence of the LLJ likely played a significant role in enhancing and reinforcing moisture ahead of the thunderstorms over Houston.

Case #2: (T.S. Bill) June 15-17, 2015

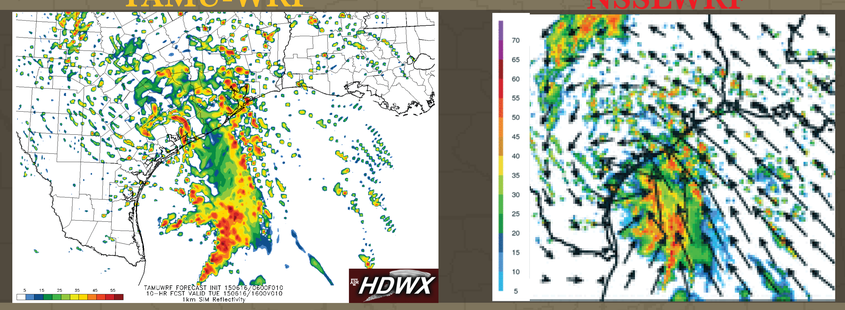
Impacts/Observations:

8+in. of rain for the Central Texas coastline

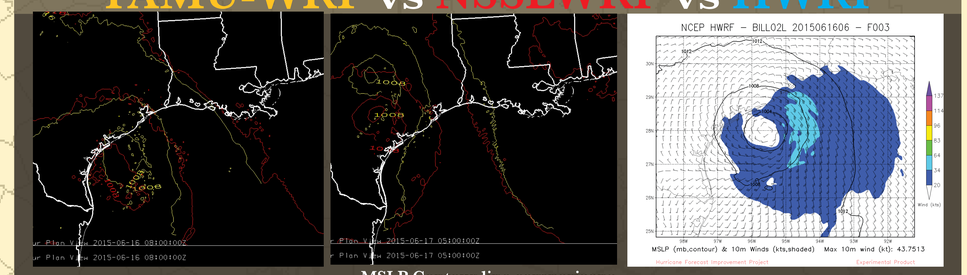

http://www2.mmm.ucar.edu/imagearchive/ http://water.weather.gov/precip/index.php

Simulated Reflectivity:

TAMU-WRF NSSLWRF



Model Comparison: TAMU-WRF vs NSSLWRF vs HWRF



MSLP Contour line comparisons

All of the computer model output on display are from initializations at 06z except for the NSSLWRF. Before Tropical Storm Bill's forecasted landfall, TAMU-WRF predicted the weakest of the three landfall intensities while NSSLWRF gave the stronger and slower forecast track and intensity. Model forecasts after landfall gave similar intensities with NSSLWRF remaining the slowest in track speed. Both TAMU-WRF and NSSLWRF have Tropical Storm Bill out of Texas by June 18th.

Conclusion

TAMU-WRF depicted a more vigorous low-level jet for Case #1, reinforcing moisture for thunderstorms over southeast Texas, possibly resulting in improved simulated reflectivity.

In Case #2, TAMU-WRF performs similarly to HWRF, with similar track and intensity forecasts that are an improvement in comparison to NSSLWRF.

Overall, TAMU-WRF tends to outperform NSSLWRF for these cases.

Acknowledgements

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McIDAS-V QR Code

Future Work

-Visualizing TAMUWRF data in Virtual Reality with WebVR
-Completing further quantitative analyses between TAMUWRF, NSSLWRF and HWRF as well as experimental HRRR data sets

WORKS WITH Google Cardboard