Daily MPAS Convection-Allowing Forecasts at NSSL

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Introduction

- NSSL initiated three daily runs of the MPAS in early 2023 to assess its suitability as the dycore for the Warn-on-Forecast System
- Test impact of initial/lateral boundary condition and microphysics differences
- Subjective evaluations completed during the 2023 HWT-Spring Forecasting Experiment (see Clark et al. Session 10 presentation)
- Preliminary objective verification completed in real-time using the Model Analysis Tools Suite (MATS) developed by the GSL

Configuration

- 3-km horizontal mesh, CONUS domain
- 0000 UTC daily initialization out to 48 (HRRR-based) or 60 (RRFS-based) hours

Parameterization Schemes	MPAS-HT	MPAS-HN	MPAS-RT
Convection	Grell-Freitas		
Boundary Layer	MYNN		
Surface Layer			
SW and LW Radiation	RRTMG		
IC/BC	HRRR	HRRR	RRFS
Microphysics	Thompson	NSSL 2-M	Thompson
LSM	RUC		

Visualization

- MPAS-NSSL forecasts can be viewed at https://cams.nssl.noaa.gov

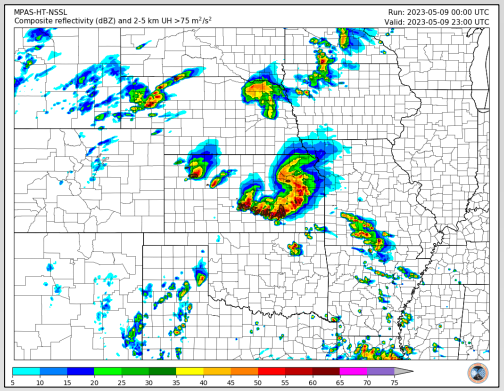

Figure 1. Composite reflectivity (dBZ; see label bar) and 2-5 km AGL updraft helicity (UH; shaded) > 75 m²/s²

Subjective Verification

0000 UTC 9 May 2023 24-h Forecast

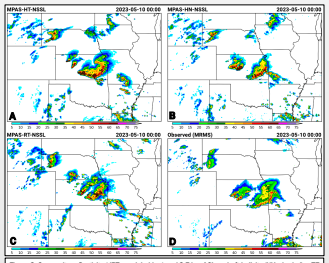

Figure 2. Composite reflectivity (dBZ; see label bar) and 2-5 km AGL updraft helicity (UH; shaded) > 75 m²/s² for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed Multi-Radar-Multi-Sensor composite reflectivity (dBZ; see label bar).

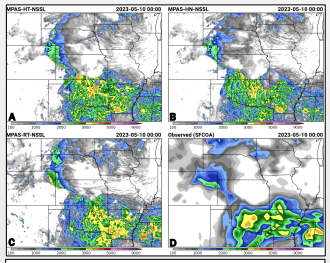

Figure 3. Surface-based Convective Available Potential Energy (J kg⁻¹; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Surface-based Convective Available Potential Energy (J kg⁻¹; see label bar) from the Storm Prediction Center's Surface Objective Analysis.

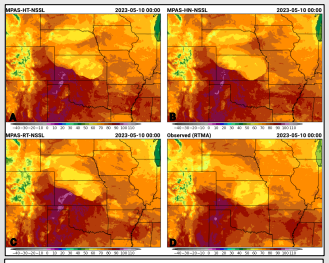

Figure 4. 2-m AGL temperature (°F; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed 2-m temperature (°F; see label bar) from the Real-Time Mesoscale Analysis.

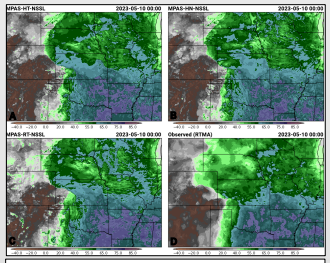

Figure 5. 2-m AGL dewpoint temperature (°F; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed 2-m dewpoint temperature (°F; see label bar) from the Real-Time Mesoscale Analysis.

0000 UTC 11 May 2023 24-h Forecast

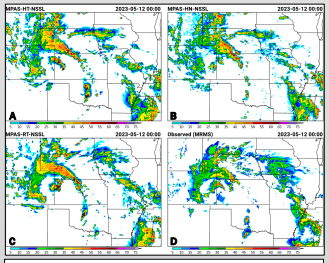

Figure 6. Composite reflectivity (dBZ; see label bar) and 2-5 km AGL updraft helicity (UH; shaded) > 75 m²/s² for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed Multi-Radar-Multi-Sensor composite reflectivity (dBZ; see label bar).

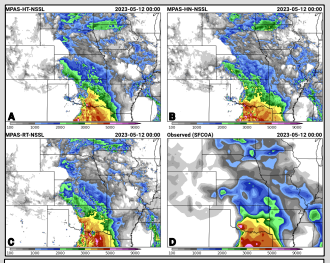

Figure 7. Surface-based Convective Available Potential Energy (J kg⁻¹; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Surface-based Convective Available Potential Energy (J kg⁻¹; see label bar) from the Storm Prediction Center's Surface Objective Analysis.

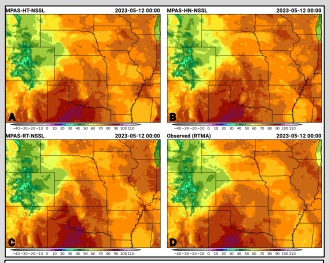

Figure 8. 2-m AGL temperature (°F; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed 2-m temperature (°F; see label bar) from the Real-Time Mesoscale Analysis.

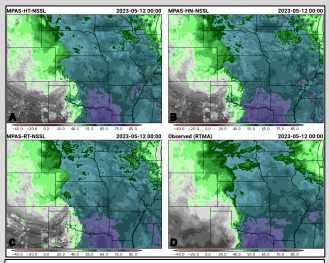

Figure 9. 2-m AGL dewpoint temperature (°F; see label bar) for A) the MPAS-HT run, B) the MPAS-HN run, and C) the MPAS-RT run. D) Observed 2-m dewpoint temperature (°F; see label bar) from the Real-Time Mesoscale Analysis.

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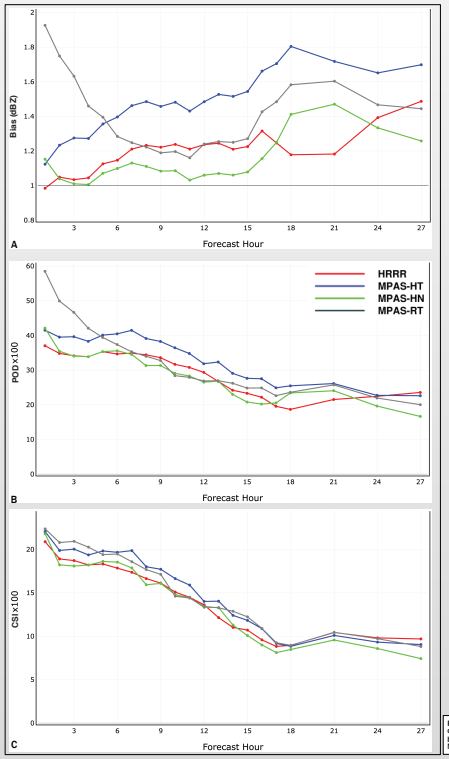
Objective Verification

- Computed over the eastern half of CONUS, 4 May – 8 June 2023

30-dBZ Reflectivity Threshold



Bias

Probability of Detection (POD)

Critical Success Index (CSI)

Figure 10. 30-dBZ reflectivity threshold A) bias, B) probability of detection, and C) critical success index values computed between the various models (see legend) and Multi-Radar-Multi-Sensor reflectivity observations.

2-m Temperature

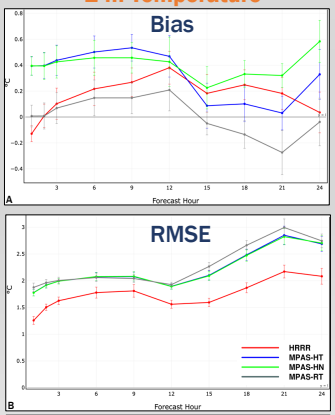


Figure 11. 2-m temperature A) bias and B) root-mean-squared error (RMSE) values computed between the various models (see legend) and observed 2-m temperature observations.

2-m Dewpoint Temperature

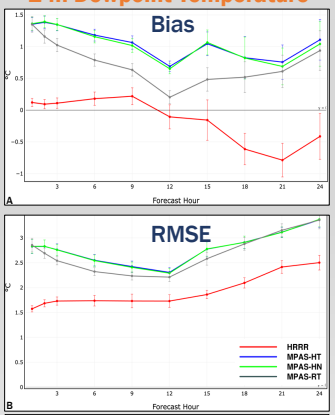


Figure 12. 2-m dewpoint temperature A) bias and B) root-mean-squared error (RMSE) values computed between the various models (see legend) and observed 2-m dewpoint temperature observations.