Influences of PBL Parameterizations on Warm-Season Convection-Permitting Regional Climate Simulations

Stan Trier (NCAR/MMM)
Andreas Prein (NCAR/ASP) and Changhai Liu (NCAR/RAL)

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Results from 13-Yr WRF-CONUS Current Climate Simulation (Oct 2000 – Sep 2013)


Figures courtesy of Kyoko Ikeda (NCAR/RAL)
1 May – 1 September 2001 WRF CONUS PBL Sensitivity Simulations

- **Model Setup** (following Liu et al. 2016, Clim. Dyn.)
  - Single domain (1360 x 1016 x 51) with model top at 50 hPa
  - $\Delta x, y = 4$ km, coupled with Noah-MP LSM (Niu et al. 2011, JGR)
  - 4-month continuously running with LBCs from 6-hourly 0.7° ERA-Interim reanalyses
  - Spectral nudging ($\lambda \geq 2000$ km) of $\phi, T, u, v$ above PBL

- **PBL Parameterizations**
  - Yonsei University (YSU) (Hong et al. 2006, Mon. Wea. Rev.)

- **Other Parameterizations**
Area-Averaged (1000 x 1000 km) Time Series from 1 May – 31 Aug 2001

Accumulated Precipitation

Daily Mean 2-m Temperature

Simulation Day (starting 1 May)

PRISM (Observations)  
WRF (YSU)  
WRF (MYNN2)

Precipitation (mm)

Temperature (deg C)

Daily Precipitation

Simulation Day (starting 1 May)
Dominant pattern prior to 15 June 2001 (precipitation widespread with lulls of several days between major events)

Dominant pattern after 15 June 2001 (precipitation occurs almost nightly in narrow 2-3 degree latitudinal corridors)

July 2001 Mean Conditions
July 2001 Conditions

July 2001 2-m Temperature Bias at 0000 UTC

WRF (YSU) – ERA Reanalysis

WRF (YSU) – WRF (MYNN2)
July 2001 2-m Water Vapor Mixing Ratio Bias at 0000 UTC

WRF (YSU) – ERA Reanalysis

WRF (YSU) – WRF (MYNN2)
July 2001 Most Unstable CAPE (MUCAPE) Bias at 0000 UTC

WRF (YSU) – ERA Reanalysis

WRF (YSU) – WRF (MYNN2)
Summary

• Four-month CONUS simulations during the 2001 warm-season (MJJA) have been completed and are currently being analyzed

• Significant near surface warm-dry model bias develops in late Spring, becoming large in mid-late summer over central U.S.

• Choice of PBL parameterization influences precipitation amounts and surface conditions but does not explain biases

• Significant position error in July heavy precipitation corridor associated with position error in simulated near-surface frontal zone. Intensity errors associated with diminished CAPE

• Anomalously low soil simulated moisture develops over central U.S. by July possibly contributing further to model warm bias