A Sensitivity Study of the Operational NSSL WRF using Unique NASA Assets

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Objectives

- *Demonstrate utility of NASA contributions to WRF*
  - Goddard Space Flight Center (GSFC) physics
  - GSFC Land Information System (LIS) initialization of land surface variables
  - SPoRT 2-km Moderate Resolution Imaging Spectroradiometer (MODIS) sea surface temperature (SST) composites for water point initialization
- *Enhance collaboration between SPoRT and NSSL*
  - Spring Experiment participation
  - NSSL WRF case studies for important operational events
  - Possible enhanced NSSL WRF based on results

NASA Contributions to WRF

- *SPoRT 2-km MODIS SST composites (example, below left)*
- *LIS land surface initialization on WRF grid (below right)*
- *Goddard 3-ice cloud microphysics (graupel or hail)*
- *Modified Goddard shortwave radiation physics (Chou and Suarez 1999; Matsui et al. 2007)*
- *Goddard longwave radiation physics (Chou et al. 2001)*
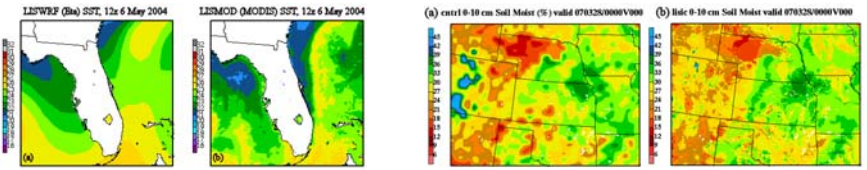
Summary of Results Shown Below

- *OVERALL:* Improved surface heating and reduction of low clouds by using new GSFC SW radiation scheme. Adding LIS initialization and GSFC LW radiation further improved predicted convection over TX, OK, and KS.
- GSFC SW Radiation scheme → produced fewest BL clouds
  - Higher 2-m temps (closer to observed, see abstract)
  - Significantly higher CAPE at 21z 28 MAR
  - More intense convection by 00z 29 MAR from TX to W. NE
- LIS initialization + GSFC SW + LW → slightly fewer BL clouds
  - Produces most intense supercell in TX Panhandle at 00z
  - Less anomalous convection over western OK
  - Less convection in W. NE than GSFC SW, but still better than Control run
- LIS + GSFC SW + LW + GSFC MP (hail) → most BL clouds
  - Even colder at surface with less CAPE than Control
  - Sparse convection by 00z, farther west due to weaker dryline

Selected Case Study

- 28–29 MAR 2007 tornado outbreak
- 80 tornado reports; 198 large hail
- NSSL WRF Control run had difficulty in eroding low clouds
  - Surface temps and CAPE too low
  - Delayed / missed convective initiation, esp. in TX Panhandle and W. Nebraska

Forecast Variables ↓

Sensitivity Run →

| 21z 28 MAR (21-h forecast) Total Condensate |
| 21z 28 MAR CAPE |
| 00z 29 MAR Reflectivity |

GSFC SW

LIS + GSFC SW + GSFC LW + WSM6

LIS + GSFC SW + GSFC LW + GSFC 3-ice hail

SPC Storm Reports for 03/28/07

LNX
GLD
DDC
AMA