# The NASA Short-term Prediction Research and Transition (SPoRT) Center: Opportunities for Collaboration in the Great Lakes Region

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SPoRT

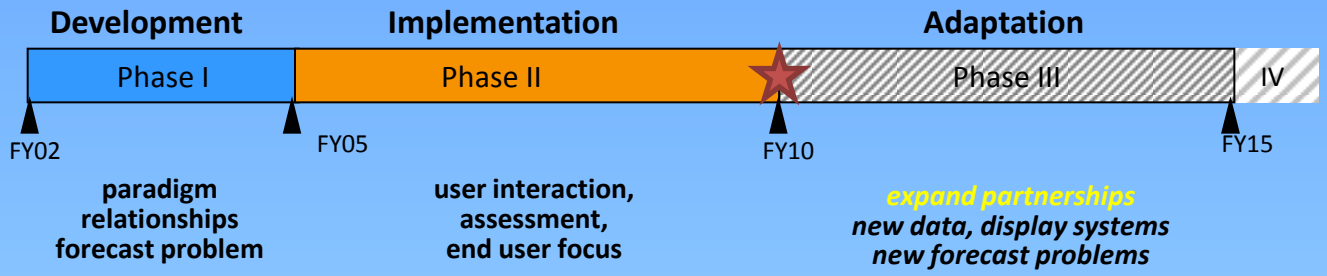
transitioning unique NASA data and research technologies to operations

NASA

# The SPoRT Center

- SPoRT is a NASA project to transition unique observations and research capabilities to the operational weather community, to improve short-term forecasts on a regional scale.
- Located at NASA Marshall Space Flight Center
  - Huntsville, Alabama
  - Within the MSFC Earth Science Office
  - Collocated with the NWS WFO in Huntsville, AL, the University of Alabama in Huntsville (UAH).
  - Combination of NASA scientists, UAH employees, contractors, graduate students and staff.

# History and Future of SPoRT




**Phase I: Development**

- Partnership with WFO Huntsville to identify local forecast problems, relevance of NASA data, and best means of integrating within forecast operations.

**Phase II: Implementation**

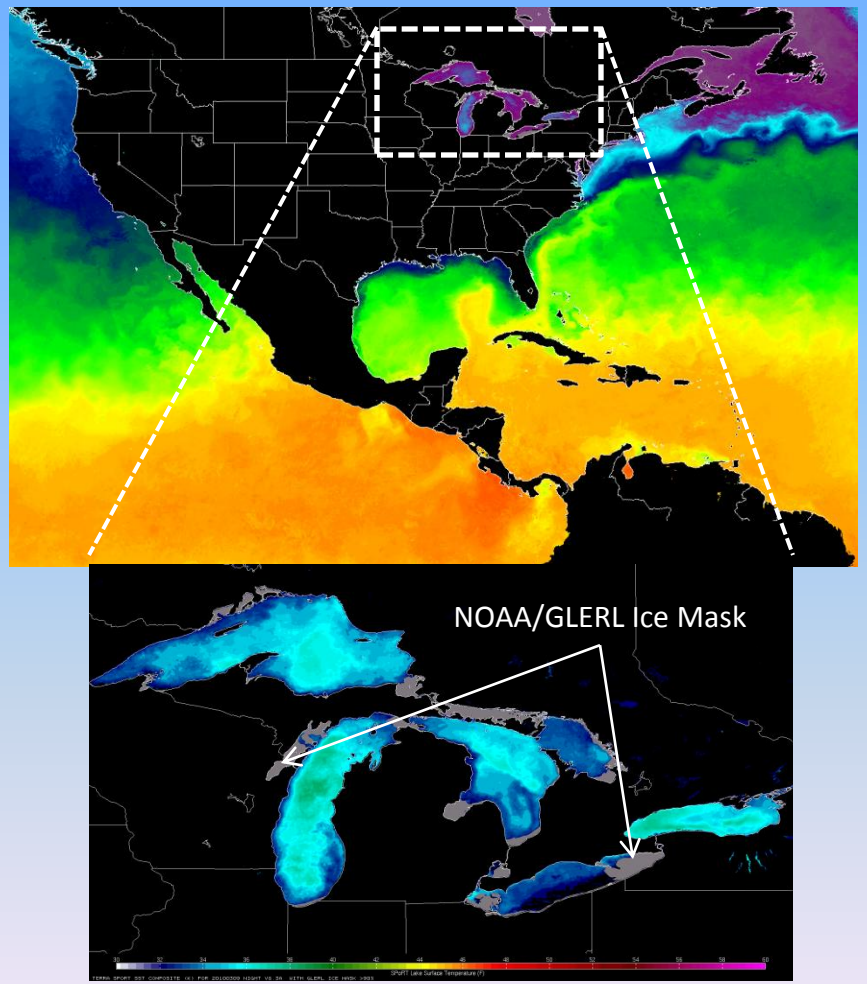
- Expansion within Southern Region, integration of NASA data within local forecast models, extensive development of product training and assessments.

**Phase III: Adaptation**

- Currently, SPoRT is expanding beyond NWS Southern Region, seeking new collaborations with operational forecasters where NASA data can provide value.
- Met with SSD regional chiefs and hosted a WFO workshop for Southern Region.
- SPoRT is currently exploring opportunities in the Great Lakes region.

# Great Lakes Applications

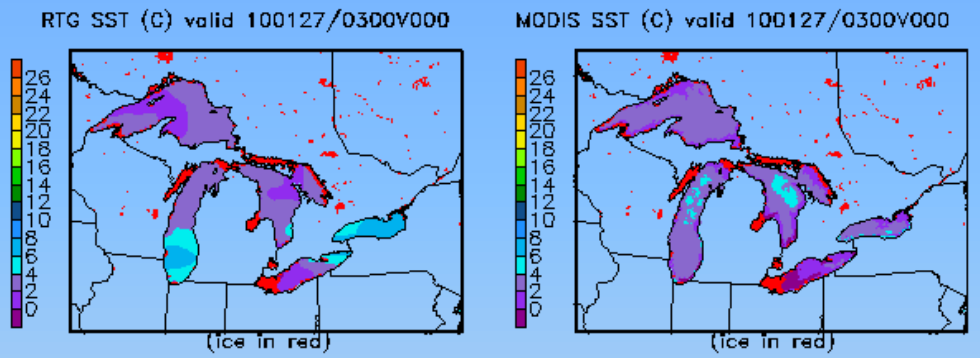
- SPoRT currently produces a Great Lakes surface temperature composite.
  - Incorporates MODIS, AMSR-E and other thermal infrared imagery as available.
  - Resolution of 1 km.
  - Latency varies with cloudiness but typically less than 7 days.
- The SPoRT SST product is the ***current default*** within the latest WRF-EMS release.
- Download the WRF-EMS, install, and run.
  - Data provided online via the SPoRT FTP.
- SPoRT has contributed code changes to allow for the inclusion of the Great Lakes product.
  - Includes the NOAA/GLERL ice mask for a complete physical representation of Great Lakes surface characteristics.



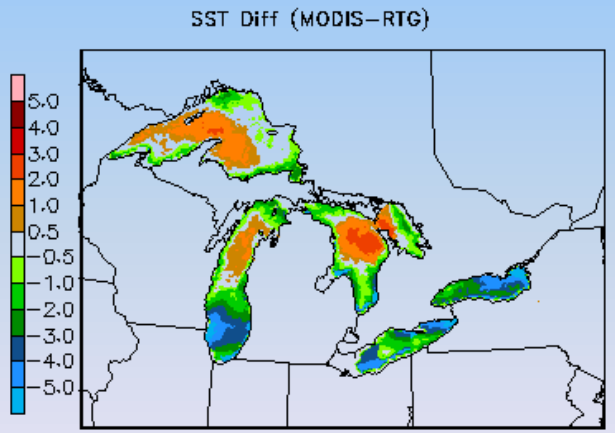
# Great Lakes Forecasting Issues

- The SPoRT paradigm:
  - Forecasters identify their local challenges.
  - SPoRT researchers pursue NASA data relevant to their needs.
- Forecast challenge:
  - Lake effect precipitation
- SPoRT Solution:
  - Incorporate high resolution lake temperature and ice fields within the WRF-EMS.

**January 27-28, 2010: "Lake Effect Storm Echinacea"**
**WFO Buffalo, NY**

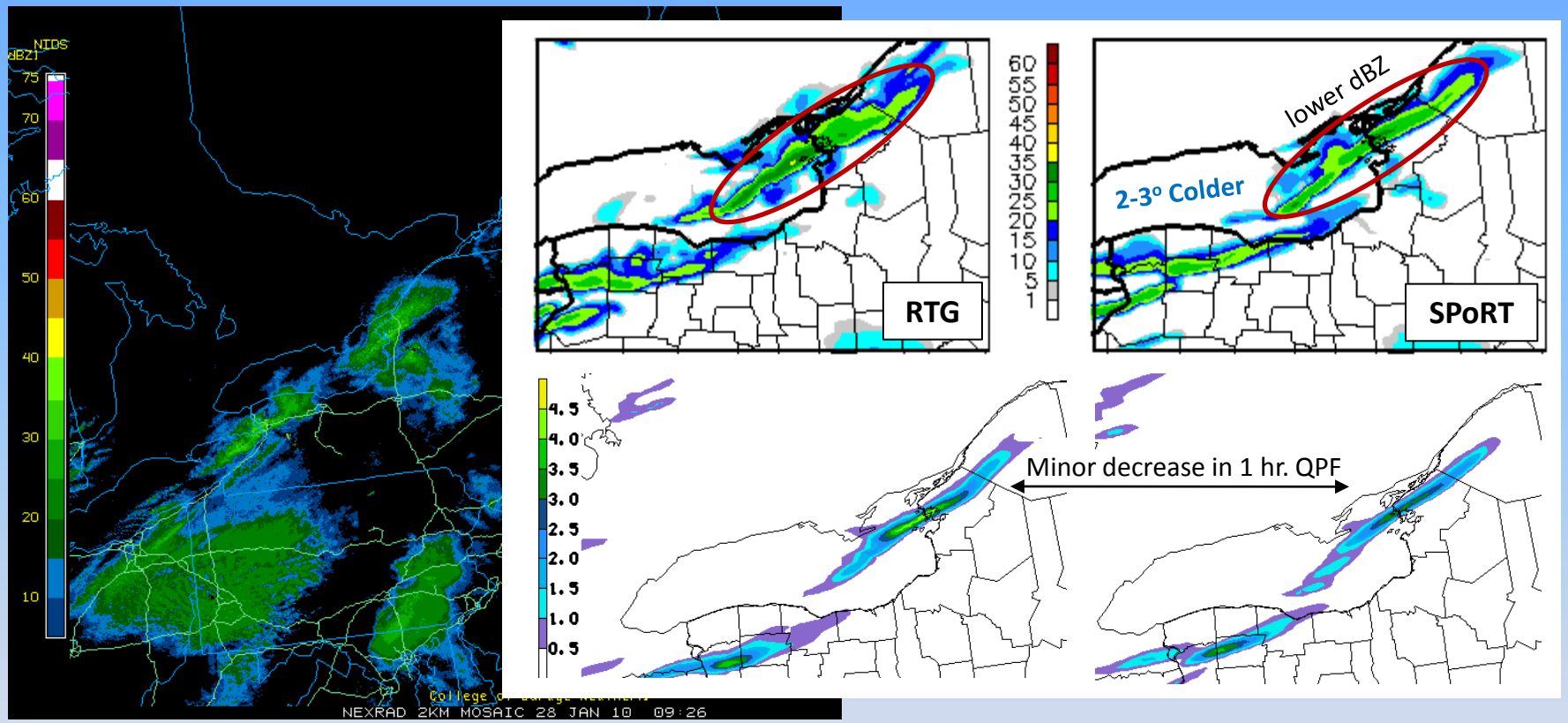



**PREVIOUS DEFAULT** **SPoRT COMPOSITE**




**SPoRT -- DEFAULT**

# Applications to the WRF-EMS

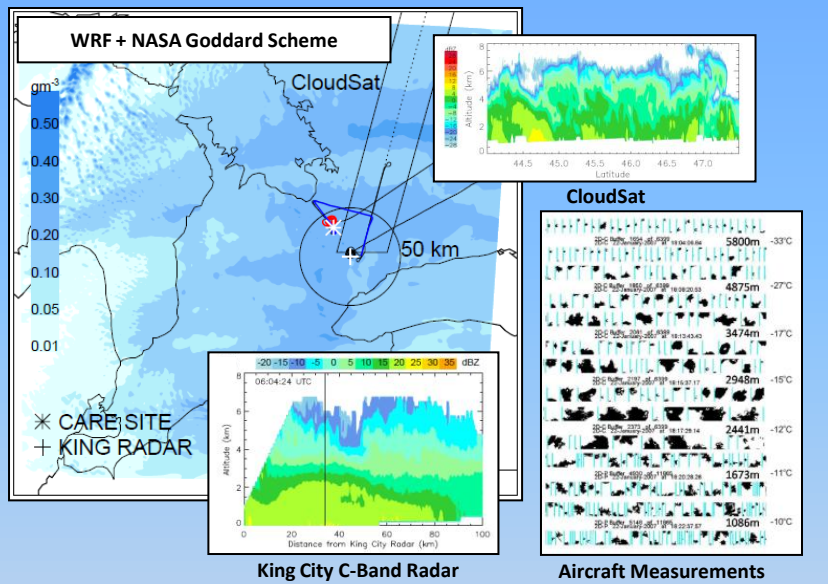


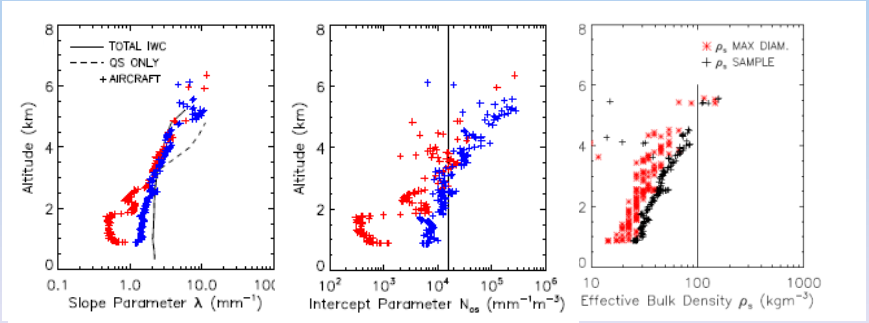

**January 28, 2010: "Lake Effect Storm Echinacea"**
**1/28 NEXRAD at 0930 UTC vs. 6-Hr. WRF Forecast**

**Application of NASA Data:**
Implement MODIS temperatures within high resolution WRF forecasts.

# Precipitation Science

- SPoRT has also leveraged NASA participation in field campaigns to explore the assumptions of cloud microphysics schemes.
- Canadian CloudSat/CALIPSO Validation Project (C3VP)
  - Obtained aircraft observations of snow crystals and sizes
  - Determine capabilities of NWP in representing ice water content, size distribution
  - Evaluation via radar remote sensing and other instruments
  - Observations from synoptic and lake effect cases

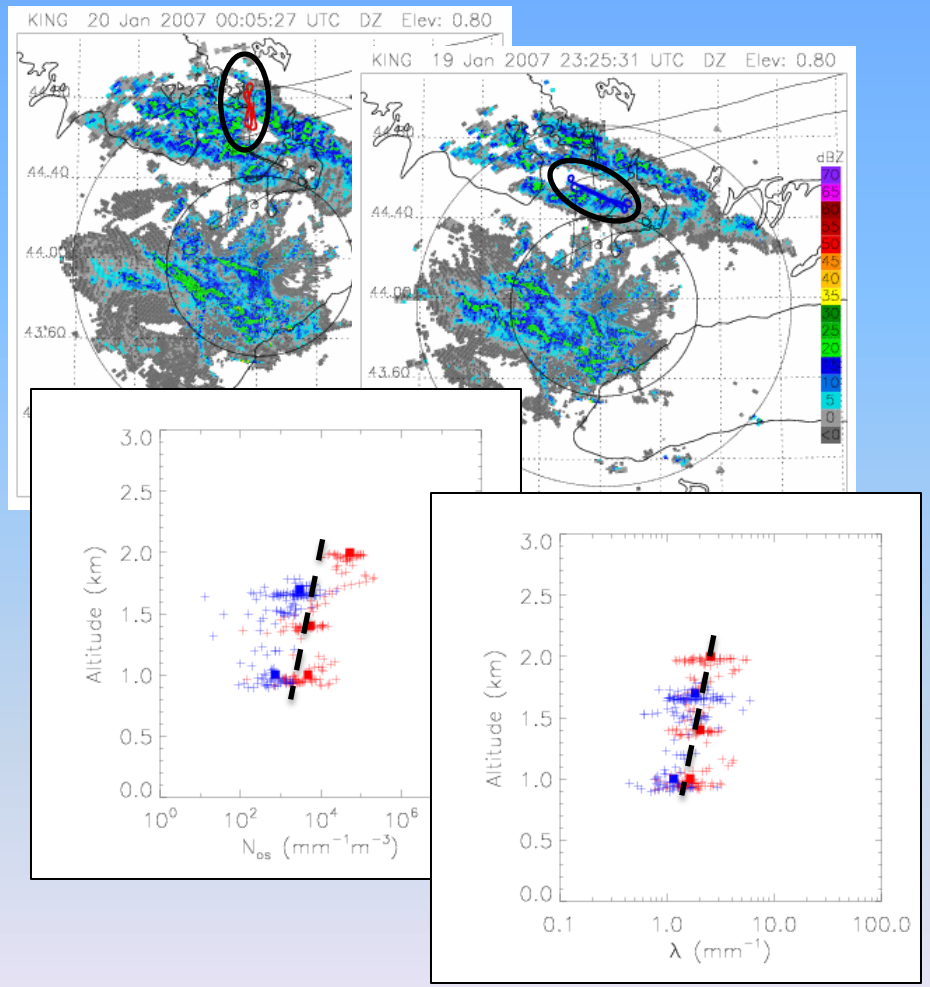



Snow Crystal Size Distributions and Bulk Density vs. Assumptions

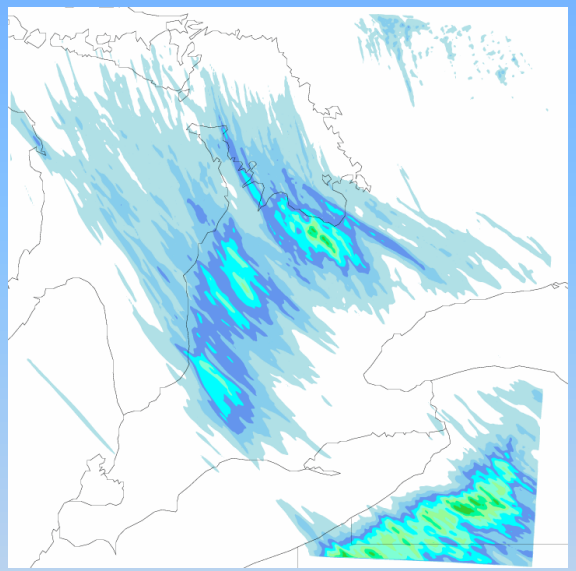
# Lake Effect Precipitation

- C3VP data are also available for lake effect snowfall cases.
- Challenge:
  - Significant variability within and along the sampled bands.
  - Less likelihood of an along-track sampling by CloudSat.
- Field campaign data can be leveraged to:
  - Guide selection of a representative scheme.
  - Modify schemes based on new data when appropriate.

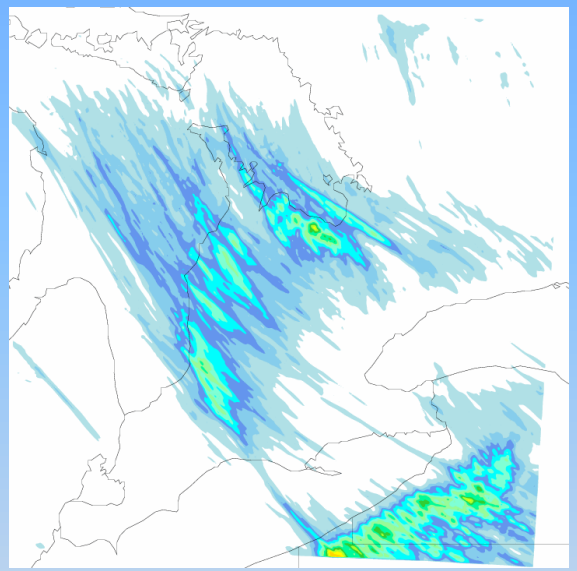


# Sensitivity to Microphysics

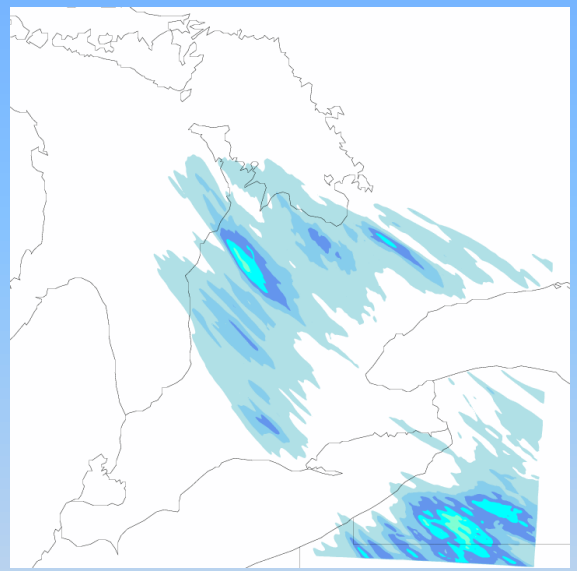
Storm total precipitation (mm) for a 36-hr. simulation of the C3VP Lake Effect event.



NASA Goddard Scheme



WRF Scheme (WSM6)



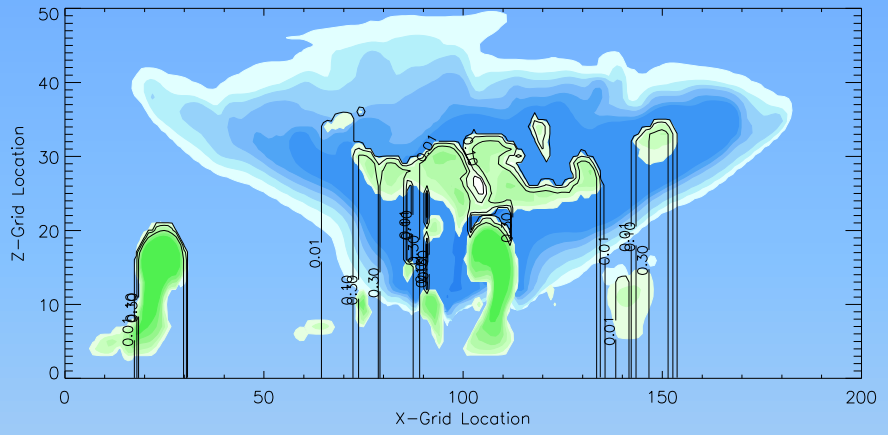
Thompson Scheme

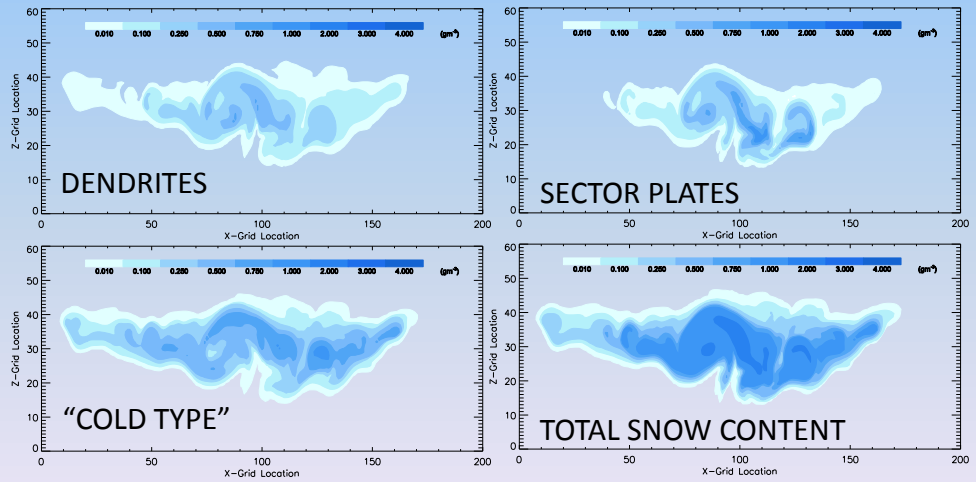
Pending research questions:

- Which scheme(s) best represent particle size distributions, fall speeds, and QPE?
- How does the length of individual bands or inland penetration vary with LST?

# Exploring New Schemes

- SPoRT seeks to evaluate additional schemes within the community.
- SUNY Stony Brook
  - Lin and Colle 2009
  - Incorporates riming effects where snow and cloud water are present.
- University of Washington
  - Woods et al. 2008 and McCormick 2009
  - Habit prediction (up to 7) and special handling of riming for contributions to snow or graupel.



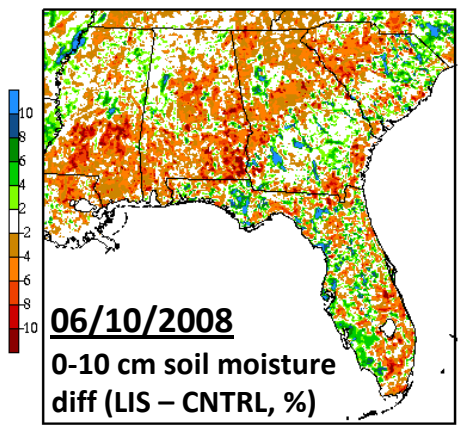



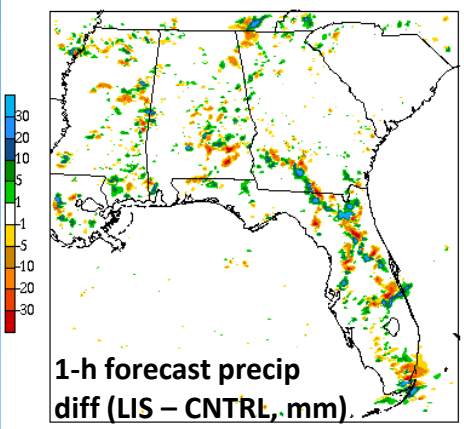
# Opportunities for Collaboration

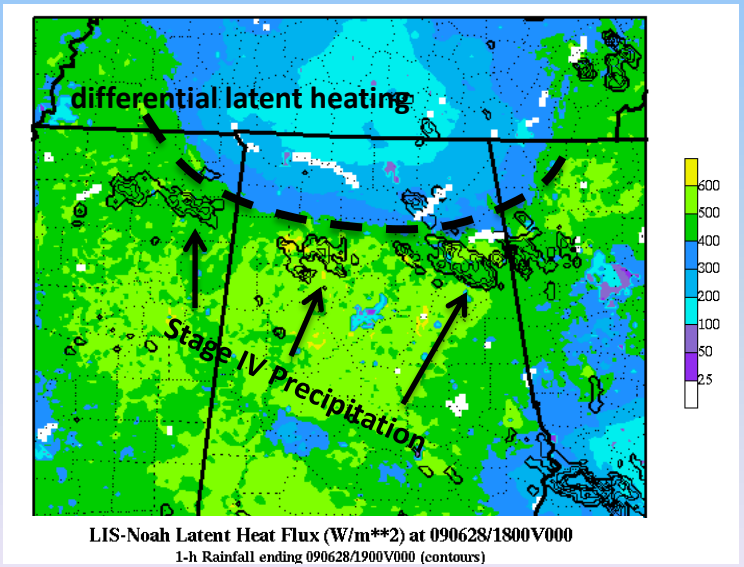
- SPoRT develops partnerships with WFOs and research groups.
  - Identify a forecast challenge, then applicable NASA data.
  - Develop a method to assess the product impact on the forecast or process.
  - Iterate to improve upon the utilization of NASA data.
  - Share results with the community via presentations or publications.
- Potential collaborations:
  - Utilization of Great Lakes temperatures in local NWP or regional ensemble efforts
  - Investigate sensitivities of QPF to model microphysics
  - Explore impact of lake temperatures on simulated lake breezes, convergence, and convective initiation.
  - Transition of additional NASA data to partner WFOs through AWIPS

# SPoRT Research and Development

- NASA Land Information System (LIS)
  - Provides high resolution depiction of soil moisture and vegetation characteristics.
  - Incorporates observed precipitation (Stage IV) or model QPF to improve land surface depiction for NWP applications.
  - Output fields available within AWIPS for diagnostic display.
  - Future plans to incorporate a MODIS vegetation composite.

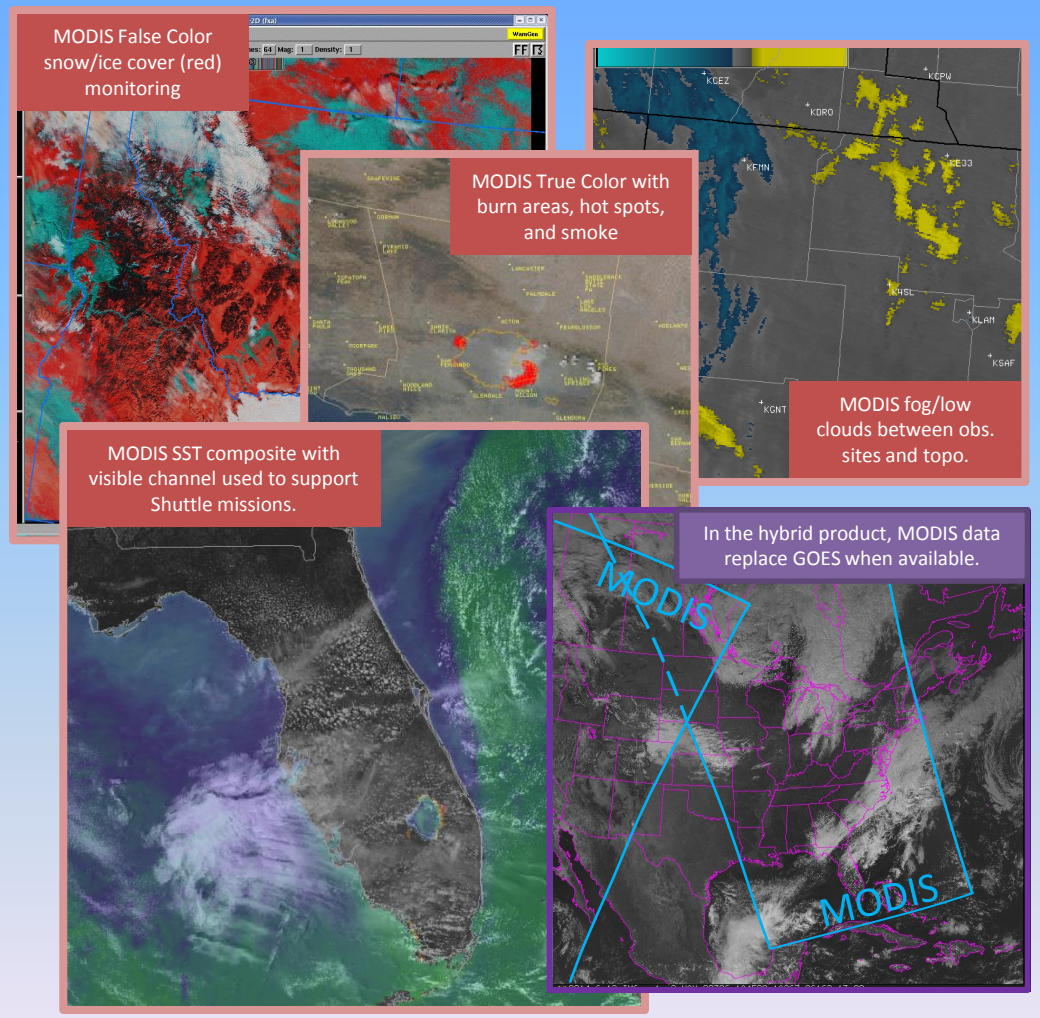


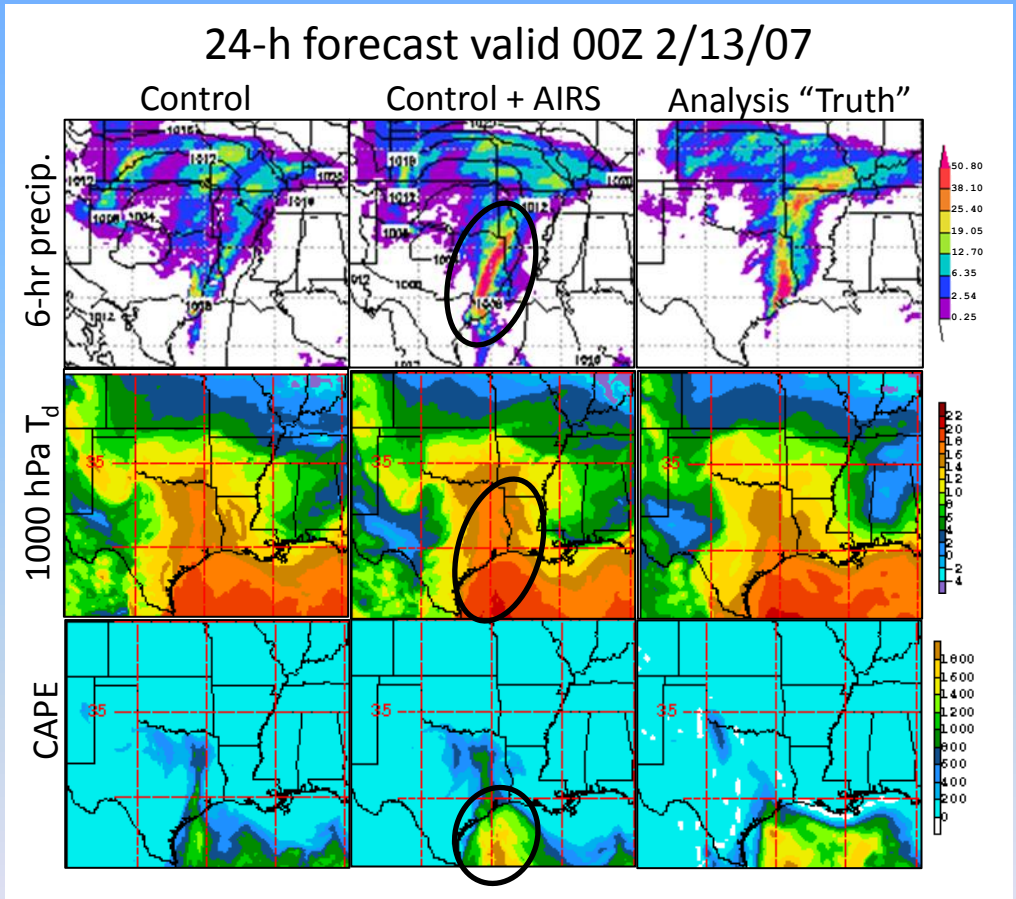
# SPoRT Research and Development

- SPoRT provides several MODIS products to WFOs.
- Identifying ways for partner WFOs to utilize polar orbiting data.
  - High spatial resolution
  - Low temporal resolution
- Incorporating within AWIPS for use with other data.
- Hybrid product replaces GOES with MODIS when available.



# SPoRT Research and Development

- Atmospheric profiles of temperature and moisture from hyperspectral sounders such as AIRS, IASI.
- These instruments can provide a three dimensional analysis
  - Estimate conditions between balloon soundings
  - Use to initialize forecast models
- In this case, AIRS improves the simulation of moisture return in TX/LA, resulting in an improved simulation of convection.



# Summary

- The mission of SPoRT is to transition unique NASA data and research technologies to the operational forecasting community.
- Paradigm:
  - Data is not just “thrown over the fence”, we collaborate with partner WFOs to identify focused research projects where NASA data provides value.
- Several ongoing projects are relevant to the Great Lakes region and other regional forecast problems.

# Questions?

- Contact information:
  - andrew.molthan@nasa.gov
- SPoRT web page:
  - http://weather.msfc.nasa.gov/sport
- “The Wide World of SPoRT” collaborator blog:
  - http://www.nsstc.uah.edu/sportblog