



SPC Operational Focus and Collaboration Needs

Dr. Russell S. Schneider

Steven J. Weiss

Dr. Joseph T. Schaefer

DOC/NOAA/NWS/NCEP Storm Prediction Center

DTC-HWT Workshop - September 2009

"Where America's Weather and Climate Services Begin"



Storm Prediction Center

Hazardous Phenomena

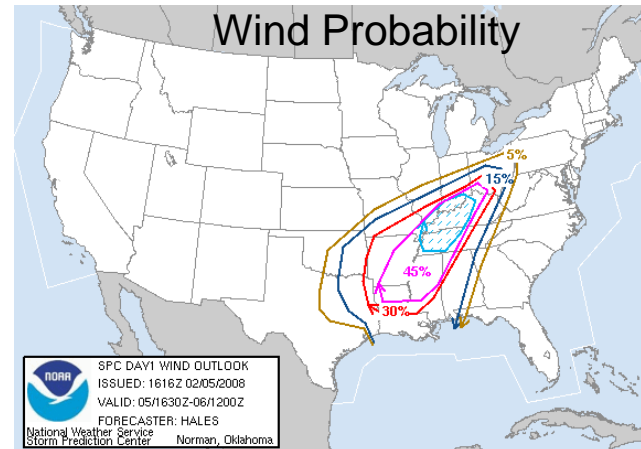
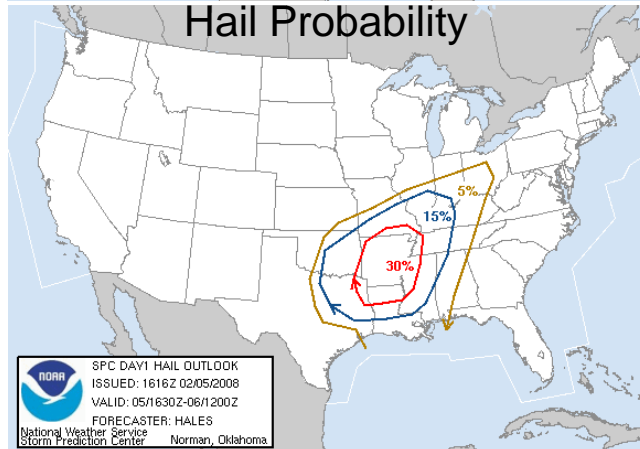
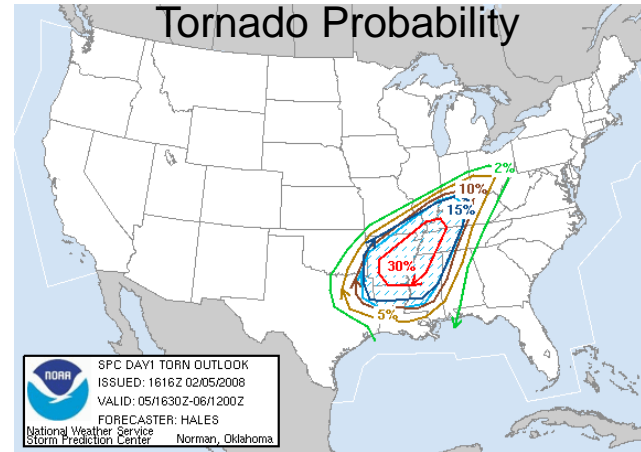
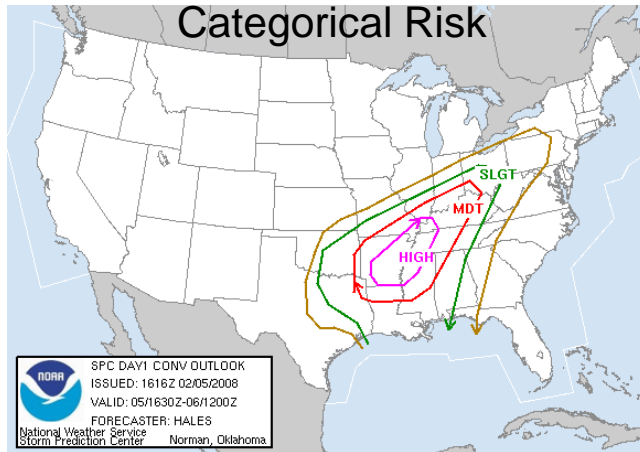
- **Tornadoes, Hail & Wind (Day 1-8)**
- **Fire weather (Day 1- 8)**
- Winter weather
- Excessive rainfall



Day 1 Convective Outlook

Operational since 1955 (categorical) & 2000 (probabilistic)

Probability of individual hazards within 25 miles of a point
Hatched Areas --- 10% or greater chance of an extreme event
(EF2 or greater tornado, 2" or larger hail, 65 kt or faster gust)



Issued at 0600 UTC; updated at 1300, 1630, 2000, 0100 UTC
Valid for period ending at 1200 UTC



Watch Hazard Probabilities

All watches are not created equal



Tornadoes

Probability of 2 or more tornadoes	High (70%)
Probability of 1 or more strong (F2-F5) tornadoes	Mod (50%)

Wind

Probability of 10 or more severe wind events	High (80%)
Probability of 1 or more wind events > 65 knots	Mod (50%)

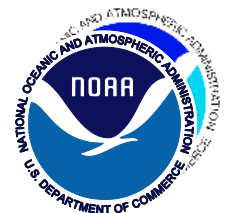
Hail

Probability of 10 or more severe hail events	High (>95%)
Probability of 1 or more hailstones > 2 inches	Mod (60%)

Combined Severe Hail/Wind

Probability of 6 or more combined severe hail/wind events	High (>95%)
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Use the probabilities to refine the specific threat within the watch and gauge forecaster confidence in the specific convective hazards

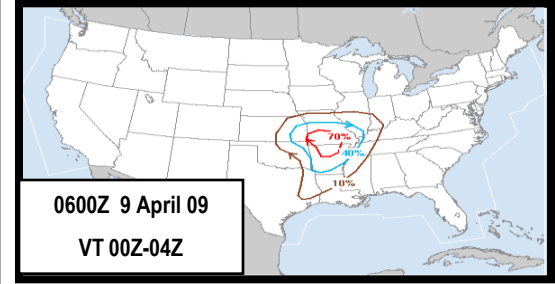
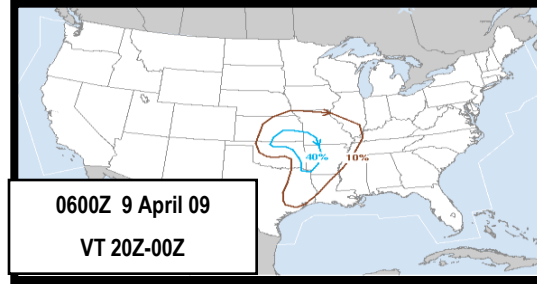
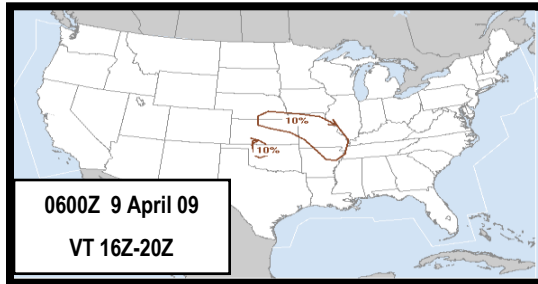


Operational since 2006

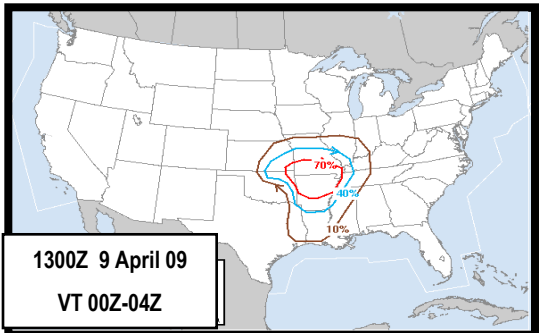
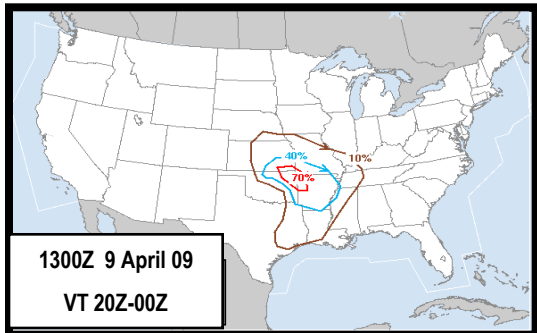
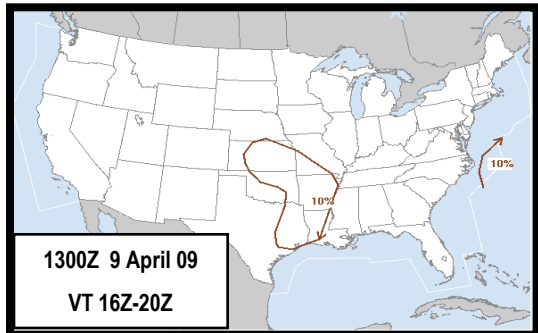


Thunderstorm Outlooks to Support Aviation

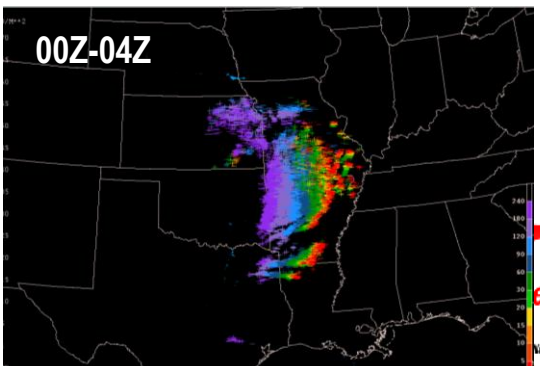
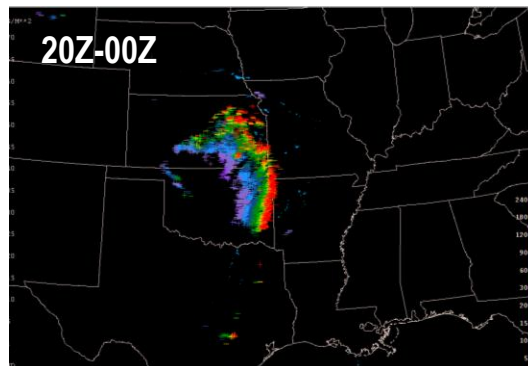
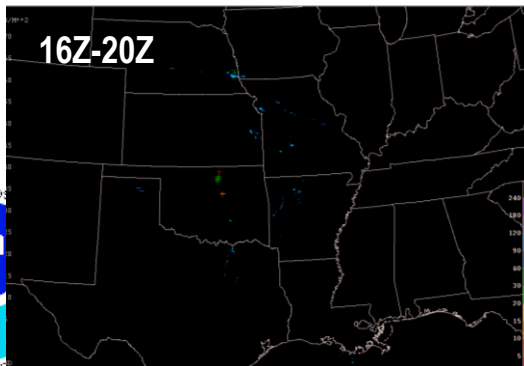
0600UTC 9 April 2009



1300UTC 9 April 2009



Observed Cloud-to-Ground Lightning



SPC Personnel Distribution

(32 Government, 4 Contract, 2 Students)

• Operations Branch

- 1 Branch Chief
- 5 Lead Forecasters
- 10 Mesoscale/Outlook
- 5 Assistant Mesoscale

■ Administration

- 1 Director
- 1 WCM (outreach)
- 1 Administrative Officer
- 1 Contract Admin. Coord.

■ Science Support Branch

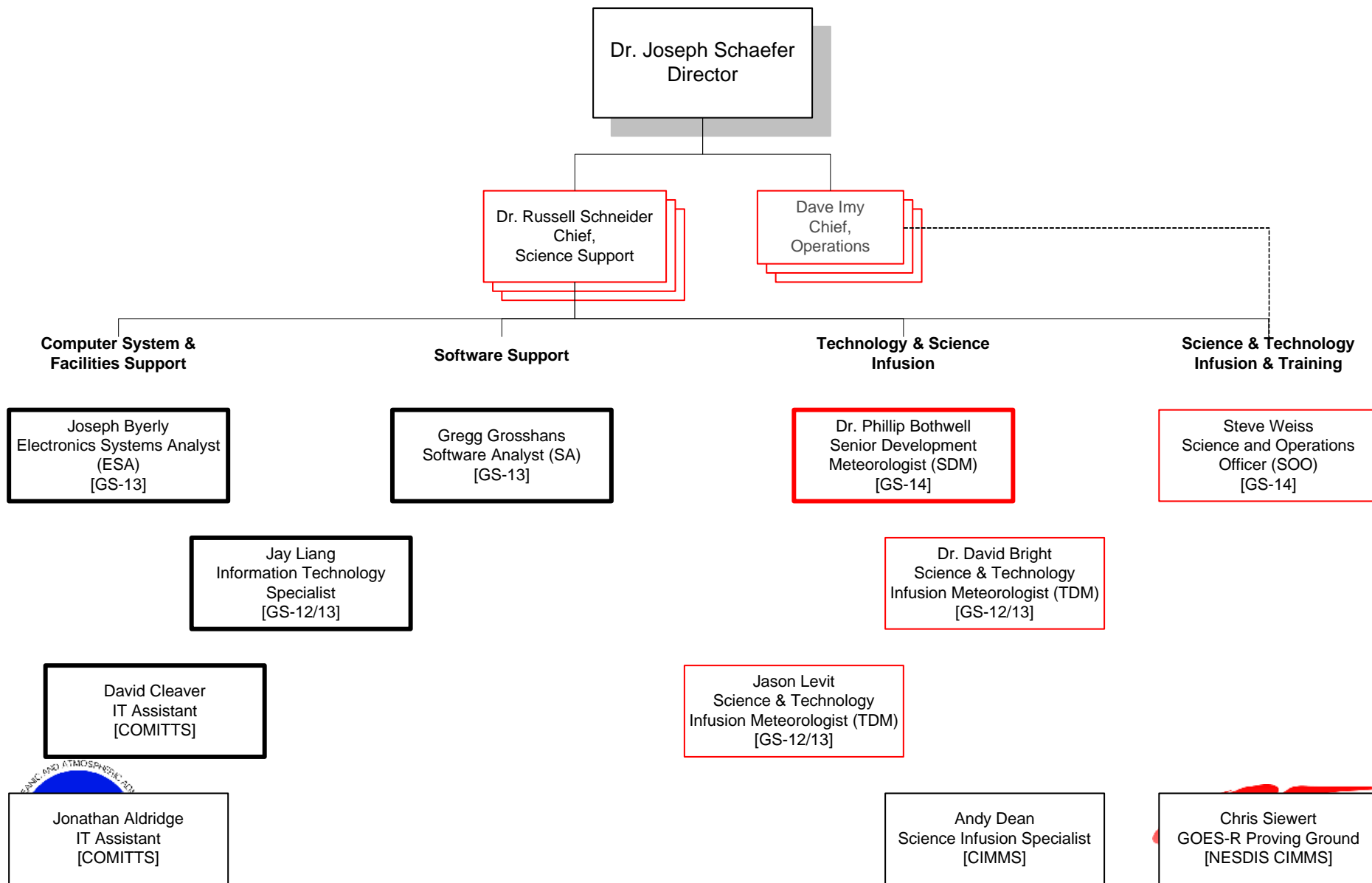
- 1 Branch Chief
- 1 Science & Operations (SOO)
- 3 Science & Tech. Infusion
- 1 Contract Science Specialist
- 1 Software Analyst
- 1 IT Specialist
- 1 ESA
- 2 Contract Computer Support
- 2 SCEP

Organic Science Infusion Capability



Storm Prediction Center - Science Support Branch

July 2009



SPC Scientific Approach

- Engage the Community (SSB & Forecasters)
 - Professional Meetings and Conferences
 - Collaborative Research Projects
 - Hazardous Weather Testbed
- Sift & Winnow
 - Eye toward specialized mission specific data & tools
 - Hazardous Weather Testbed (key intermediate step)
 - Early integration of ensemble forecast systems
 - Storm-resolving WRF NWP
 - Storm-scale Ensemble Forecast System
- SSB focus on Science Enabling “Structure”
 - Flexible. Adapt to specific trends as path becomes clear
 - Multiple dimensions for success and synergy



SPC Science Support Branch Foci

- Collaborative Research

- HWT Spring Experiments
- NSSL, OU, EMC, NCAR, GSD, U. of Albany, Pacific NW Fire Lab
- **Steve Weiss, David Bright, Phillip Bothwell, Jason Levit, Chris Siewert**

- Forecast Tools & Guidance

- Regional Scale NWP Information Extraction (e.g. SREF guidance)
- Storm Scale NWP Information Extraction (e.g. storm scale ensemble)
- Interactive Forecast Tools (e.g. NSHARP)
- **David Bright, Phillip Bothwell, Jason Levit & Steve Weiss**

- Forecast Product & Storm Environment Database

- SPC Administrative & Context Based Verification
- Understanding Storms & Supporting Forecast Tools
- **Andy Dean, Phillip Bothwell, Greg Carbin**

additional support: Gregg Grosshans, Jay Liang, Joe Byerly



Examples of Science Infusion Activities



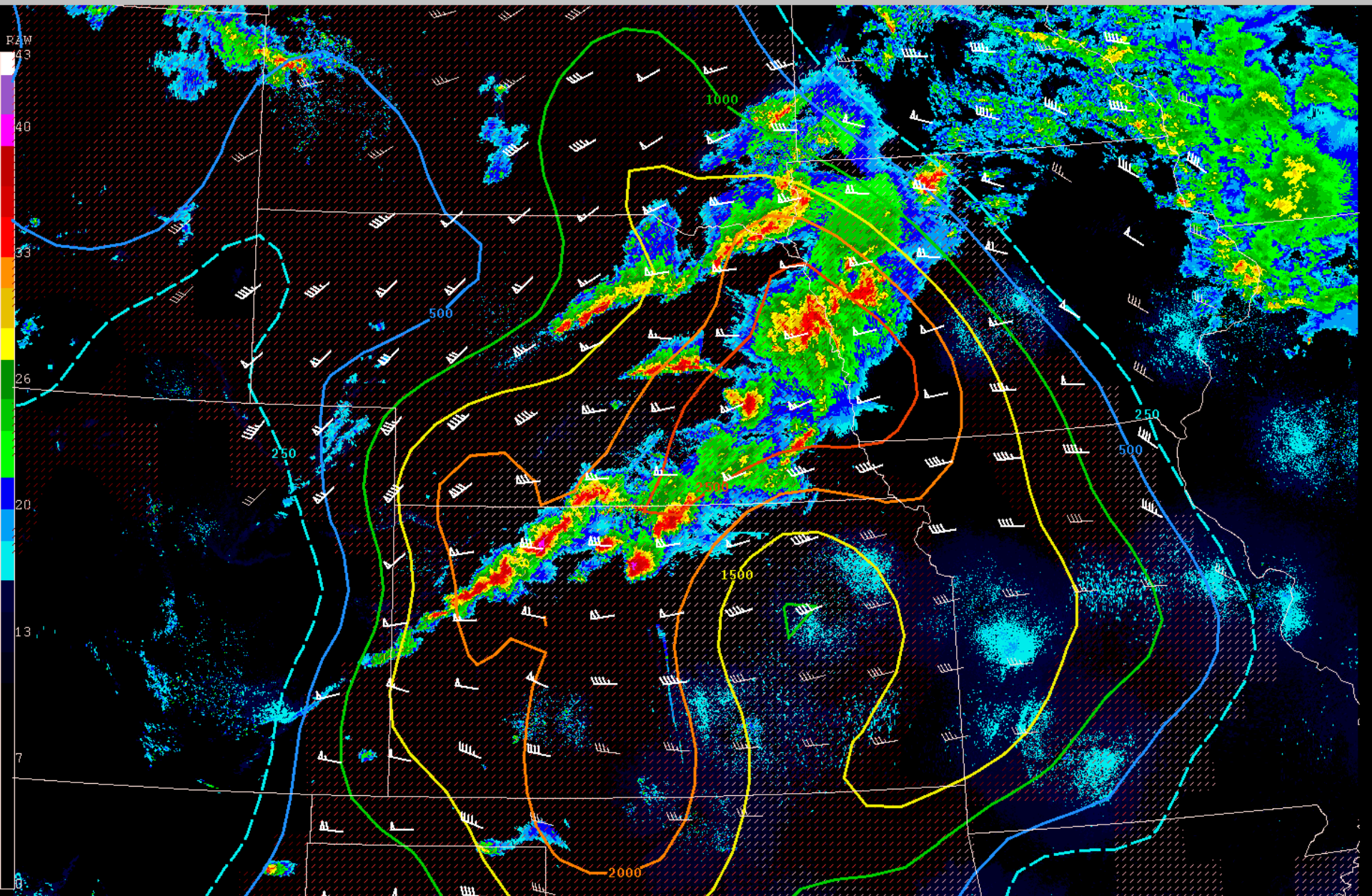
SPC Hourly Mesoscale Analysis

- SPC Hourly Mesoscale Analysis (*Bothwell et al. 2002*)
 - Blends hourly surface data with RUC “free atmosphere” analysis (or 1-hr forecast) to create “best” **timely** 3-D estimate of environment
 - **Each grid point profile processed by N-SHARP** sounding analysis program to compute hundreds of parameters
 - Parameter fields displayed in N-AWIPS and distributed on SPC web page (www.spc.noaa.gov/exper/mesoanalysis/)
- **Leverage Rapid Refresh** hourly updates and advanced data assimilation methods
 - Integrates numerous observational datasets using 3DVAR



Support Branch Developed & 24x7 Maintained

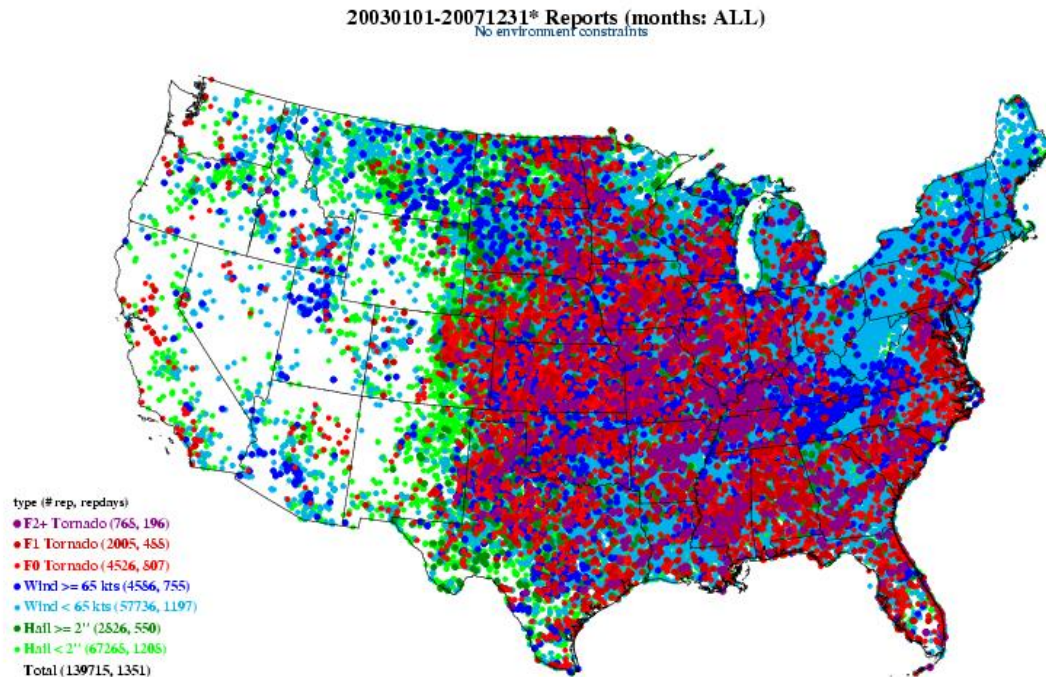




SFCOA 080530/0100 100MB MLCAPE and MLCIN/EFFECTIVE BULK SHEAR(LPL-50% EL in kts)
 080530/0100 RADAR NOR

Severe Storm Environment Relational Database

- All “final” severe weather reports since 1950
- Environmental estimates from SPC - RUC analysis (2003 - present)
- All historic SPC forecast products
- Lightning & radar derived data



* Report data from 20070101 to 20071231 is preliminary

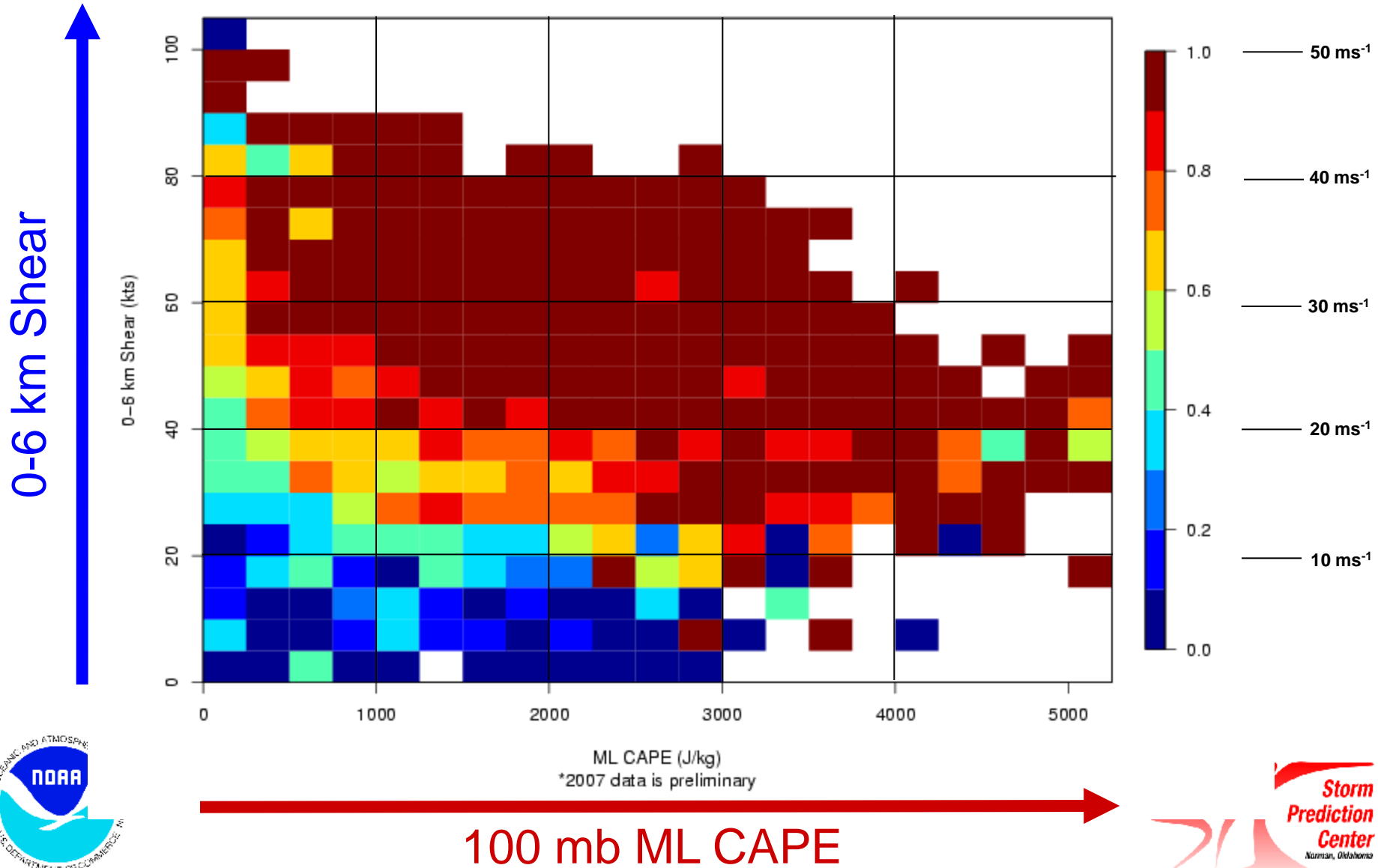
139,715 reports & 7396 tornadoes



Context Based Verification: Watch Tornado POD

Tornado POD (In ANY), 2003–2007*

Overall POD: 0.69; F2+: 0.94

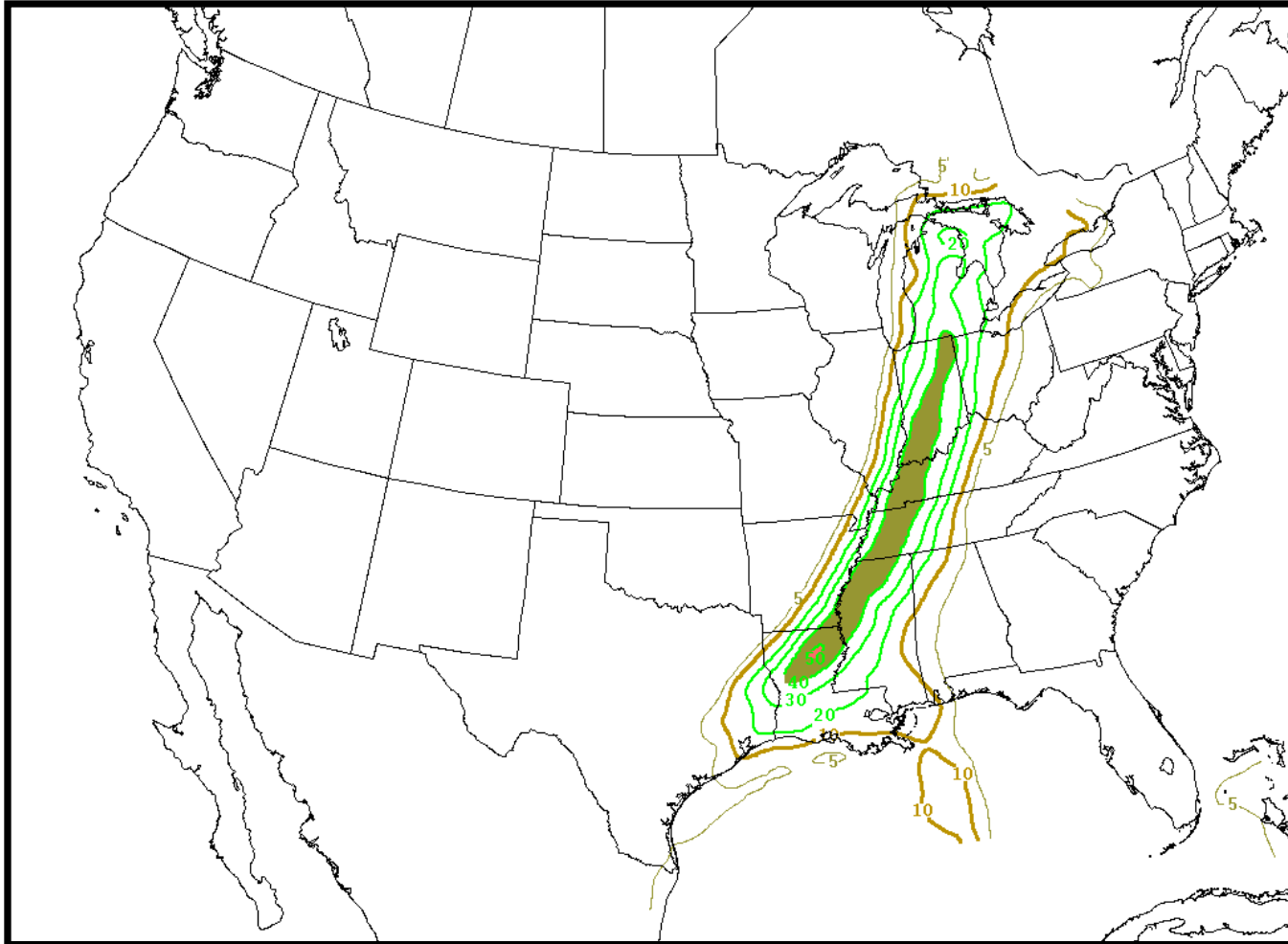


Examples of Strongly Collaborative Science Infusion Activities



Example of 39 Hour SREF Calibrated Thunderstorm Forecast

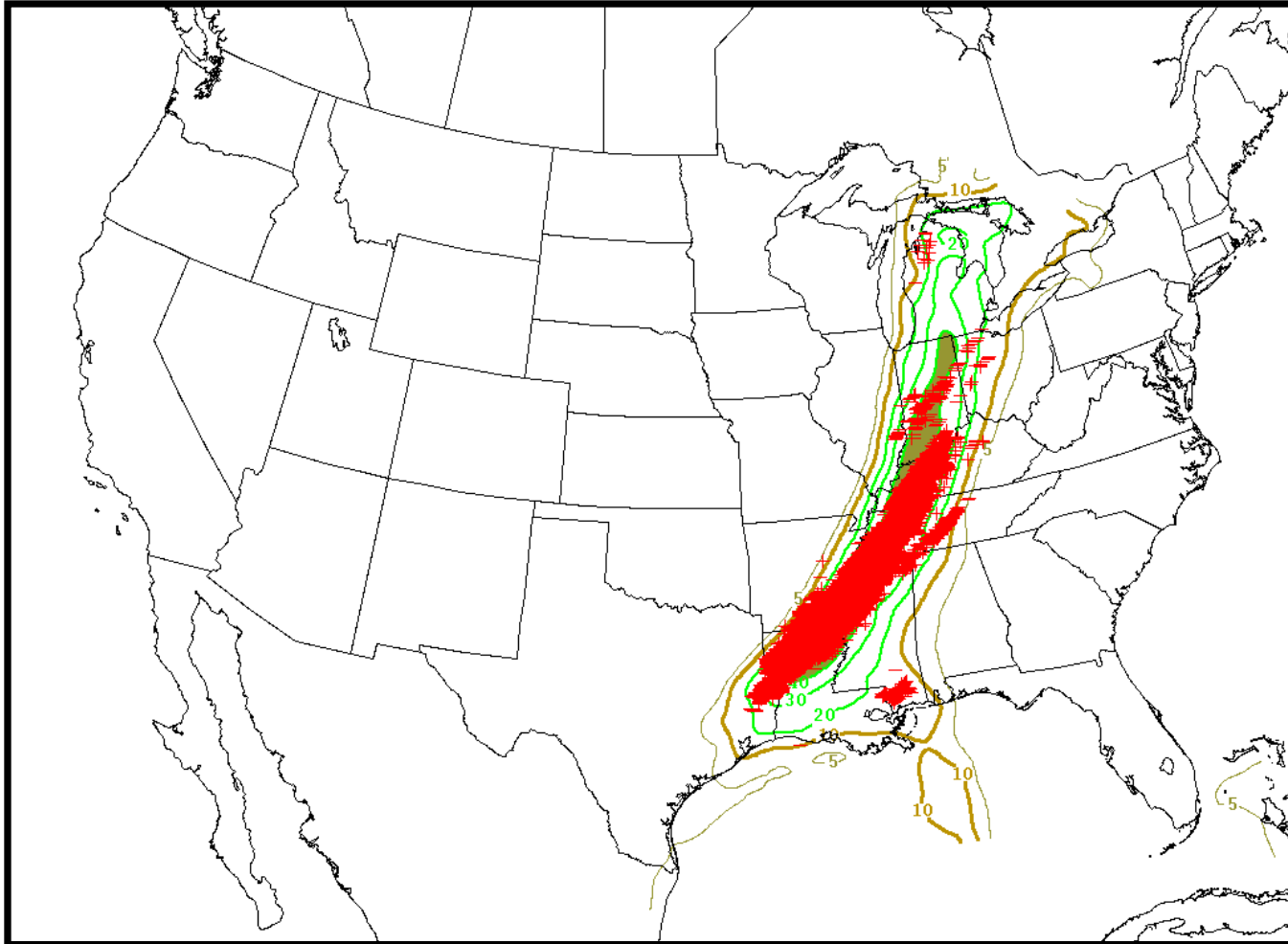
Valid: 03-06 UTC 03 May 2008



Bright et al. 2005

Example of 39 Hour SREF Calibrated Thunderstorm Forecast

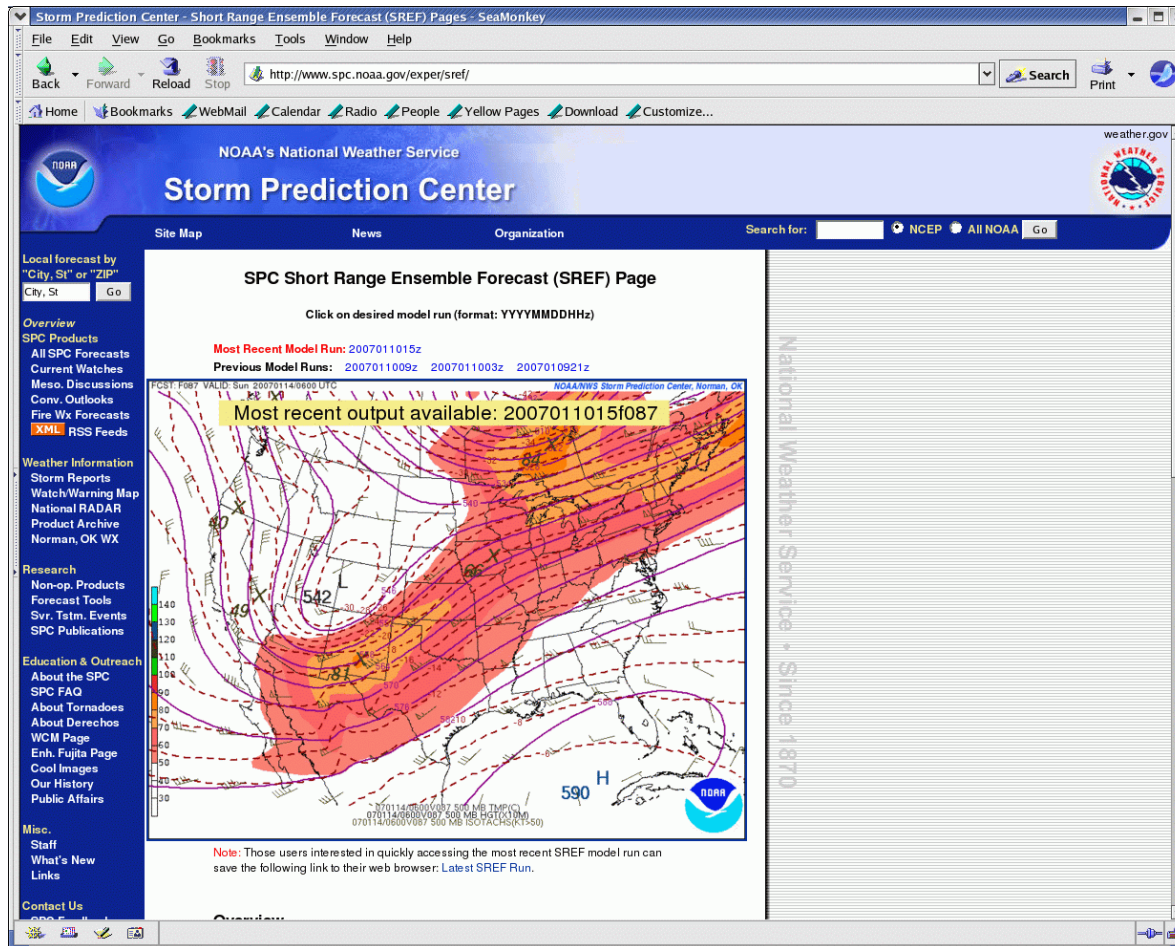
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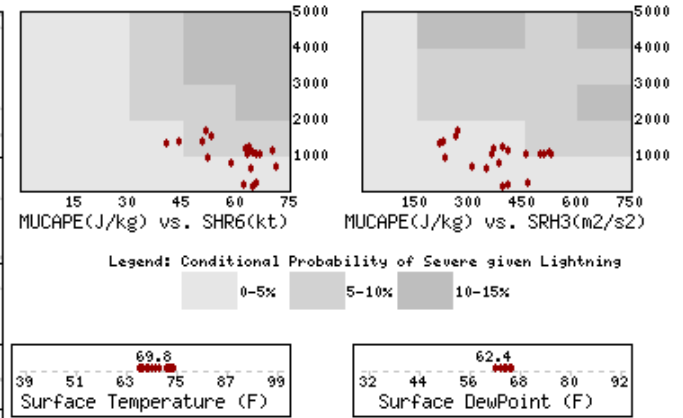
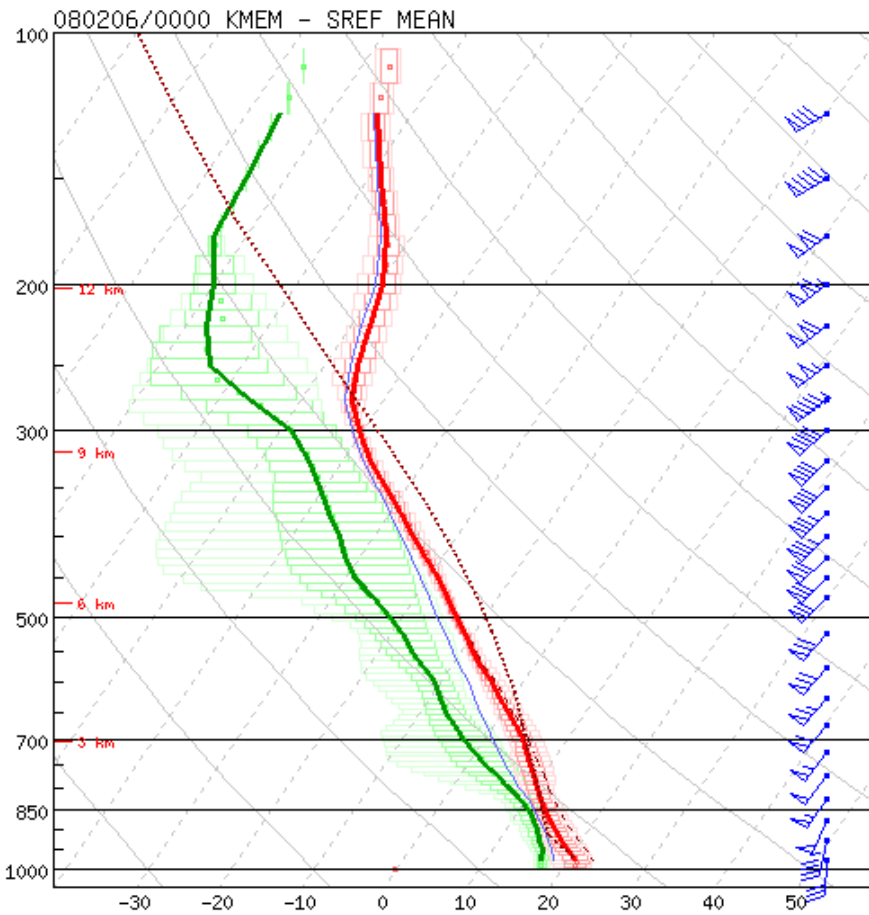
Bright et al. 2005

Wide range of high impact SREF guidance are available at the SPC website

<http://www.spc.noaa.gov/exper/sref/>



Ensemble Vertical Profiles



	MUCAPE (J/kg)	75LR (C/KM)	100MMR (G/KG)	500T (C)	PWAT (IN)
SREF MEAN	931	6.7	11.6	-12.8	1.31
ETA-KF CONTROL	1024	7.6	12.6	-13.9	1.39
ETA-KF N2	1083	7.6	12.8	-13.9	1.39
ETA-KF-DET N4	1011	7.1	12.3	-13.1	1.36
ETA-KF P2	1009	7.5	12.3	-13.9	1.44
ETA-KF-DET P4	1032	7.3	12.3	-13.9	1.40
ETA-BMJ CONTROL	612	6.4	11.6	-13.1	1.28
ETA-BMJ N1	760	6.3	11.9	-12.9	1.34
ETA-BMJ-SAT N3	1161	6.8	12.6	-13.5	1.40
ETA-BMJ P1	694	6.4	11.6	-13.3	1.31
ETA-BMJ-SAT P3	1016	6.9	12.4	-13.9	1.35
WRF-NMM CONTROL	166	6.5	11.2	-13.4	1.35
WRF-NMM N1	209	6.2	11.1	-13.0	1.27
WRF-NMM P1	150	6.6	11.1	-13.5	1.41
RSM-SAS CONTROL	1351	6.9	12.5	-13.1	1.50
RSM-SAS N1	1363	7.0	12.3	-13.4	1.46
RSM-RAS N2	1522	7.4	12.7	-14.0	1.49
RSM-SAS P1	1340	6.9	12.6	-13.1	1.53
RSM-RAS P2	1653	7.4	13.0	-13.7	1.54
WRF-ARW CONTROL	1245	7.6	12.5	-13.0	1.19
WRF-ARW N1	1148	7.7	12.3	-13.1	1.19



NOAA Hazardous Weather Testbed



Experimental
Forecast
Program

*Prediction of hazardous weather events from **a few hours to a week in advance***



EFP

EWP

GOES-R PG

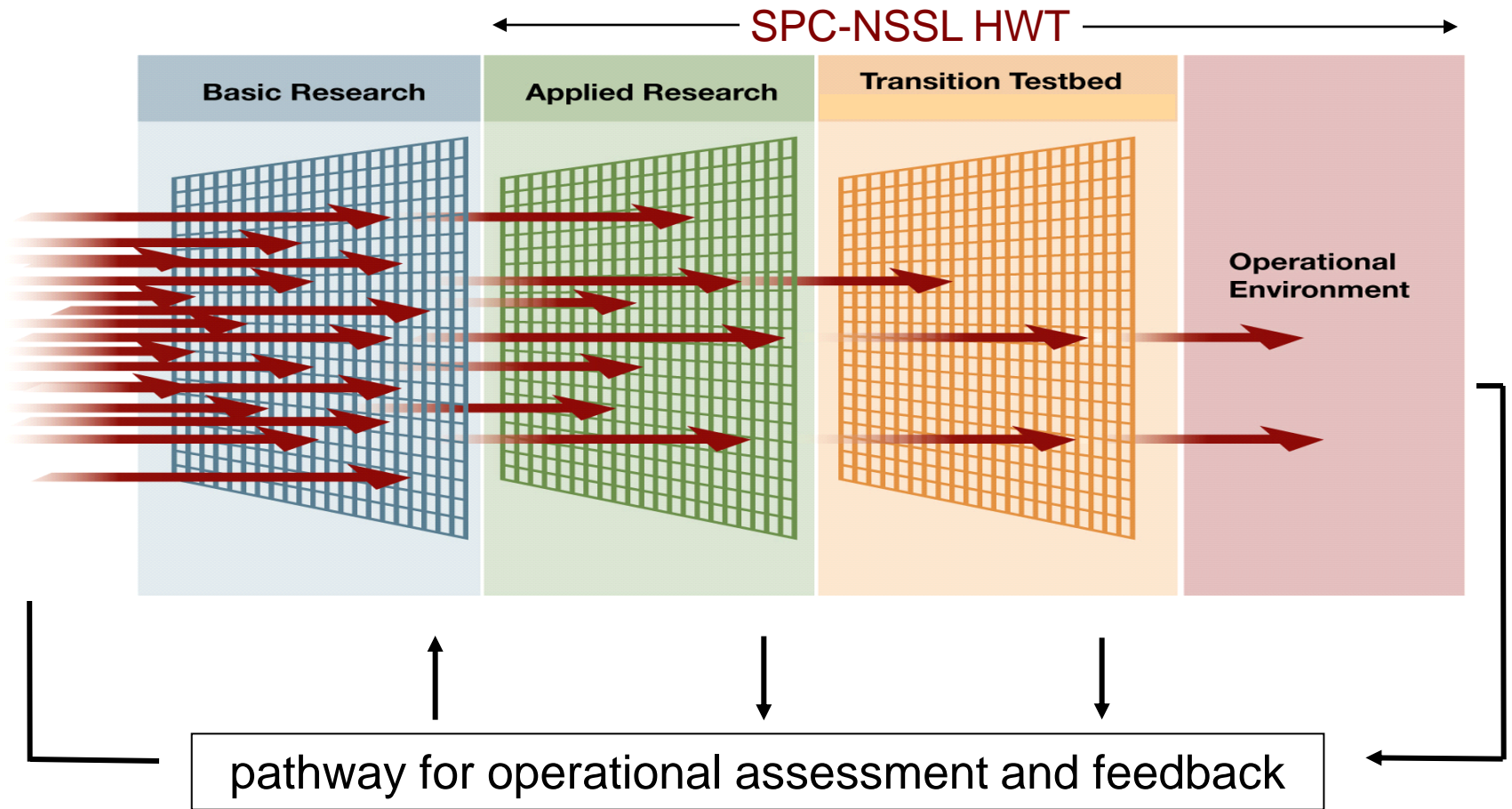


Experimental
Warning
Program

*Detection and prediction of hazardous weather events **up to several hours in advance***



Testbed R20 Process



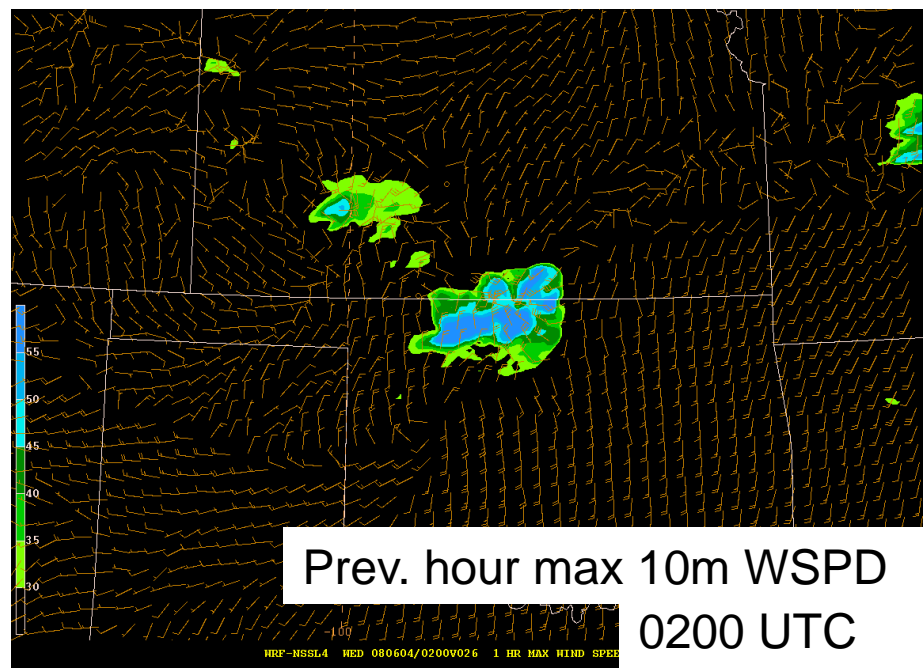
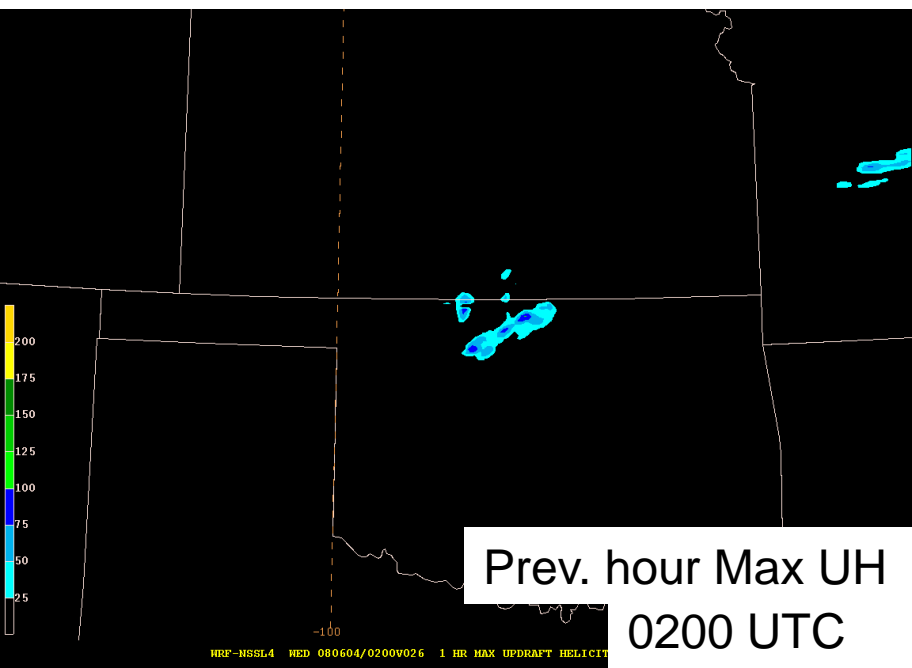
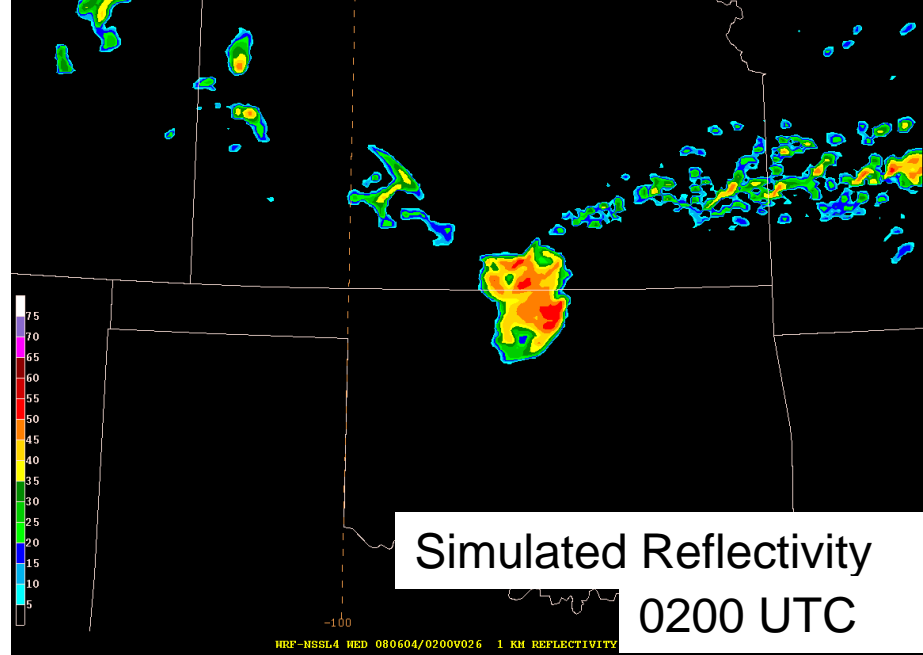
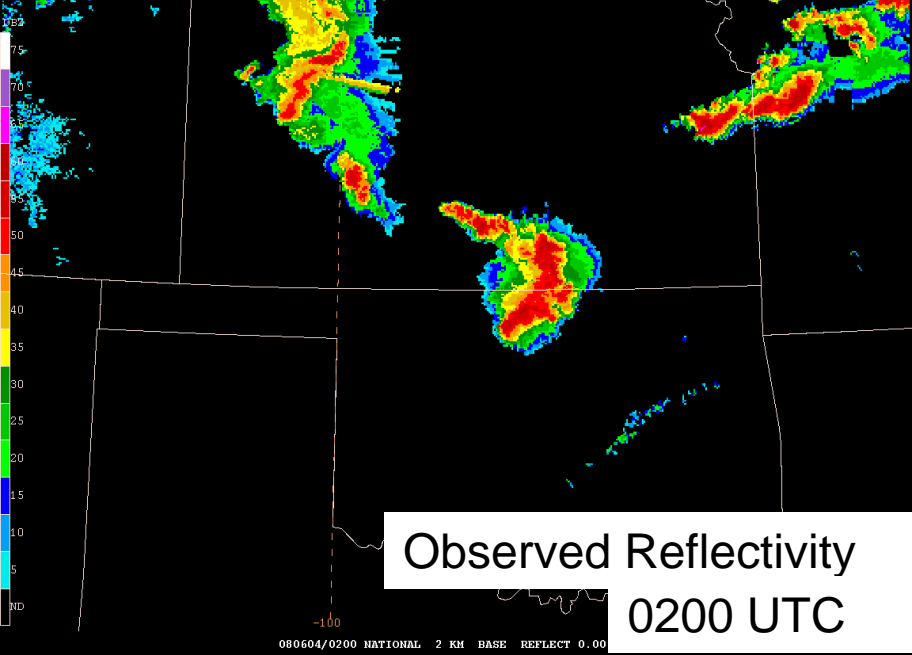
HWT strategy is to engage wider range of community



Key HWT Contributions to Advances in SPC Operations

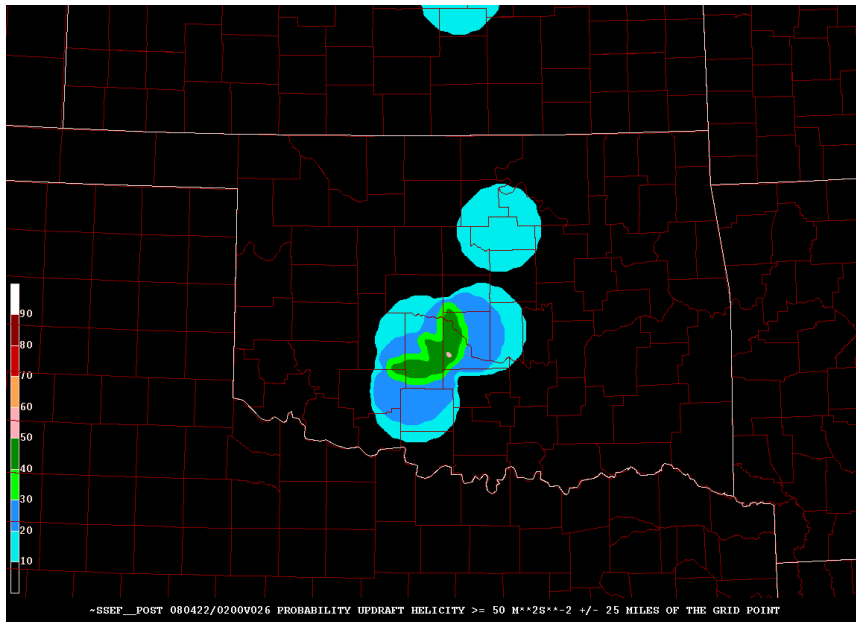
- **Short Range Ensemble Forecast System (SREF)**
 - SREF Workshop (NCEP 1994)
 - Collaboration on SREF with EMC & NSSL (1999-2002)
 - SPC focused SREF guidance in Operations (2003)
 - Developing additional calibrated high impact wx. guidance
- **Global Ensemble Forecast System (GEFS)**
 - SPC Focused GEFS Guidance in Operations (2005)
 - Working toward NAEFS tools (2010)
- **Convection Allowing High Resolution NWP**
 - Experimental WRF data in Operations (2004)
 - Operational WRF data in Operations (2008)





Probability Updraft Helicity $\geq 50 \text{ m}^2/\text{s}^2$

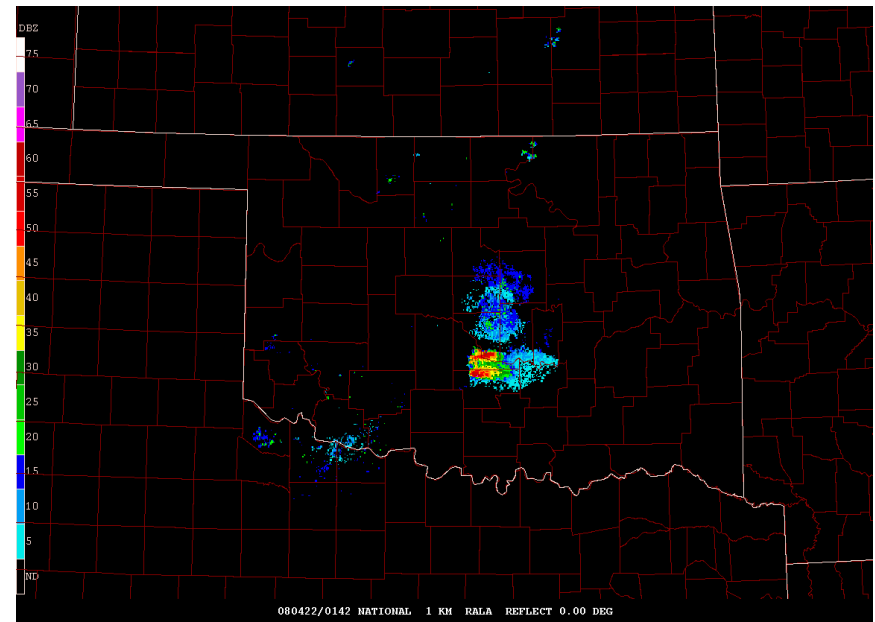
Supercell Forecast (26 hour)



F026: Valid 02 UTC 22 Apr 2008

Updraft Helicity $> 50 \text{ m}^2/\text{s}^2$ within 25 miles

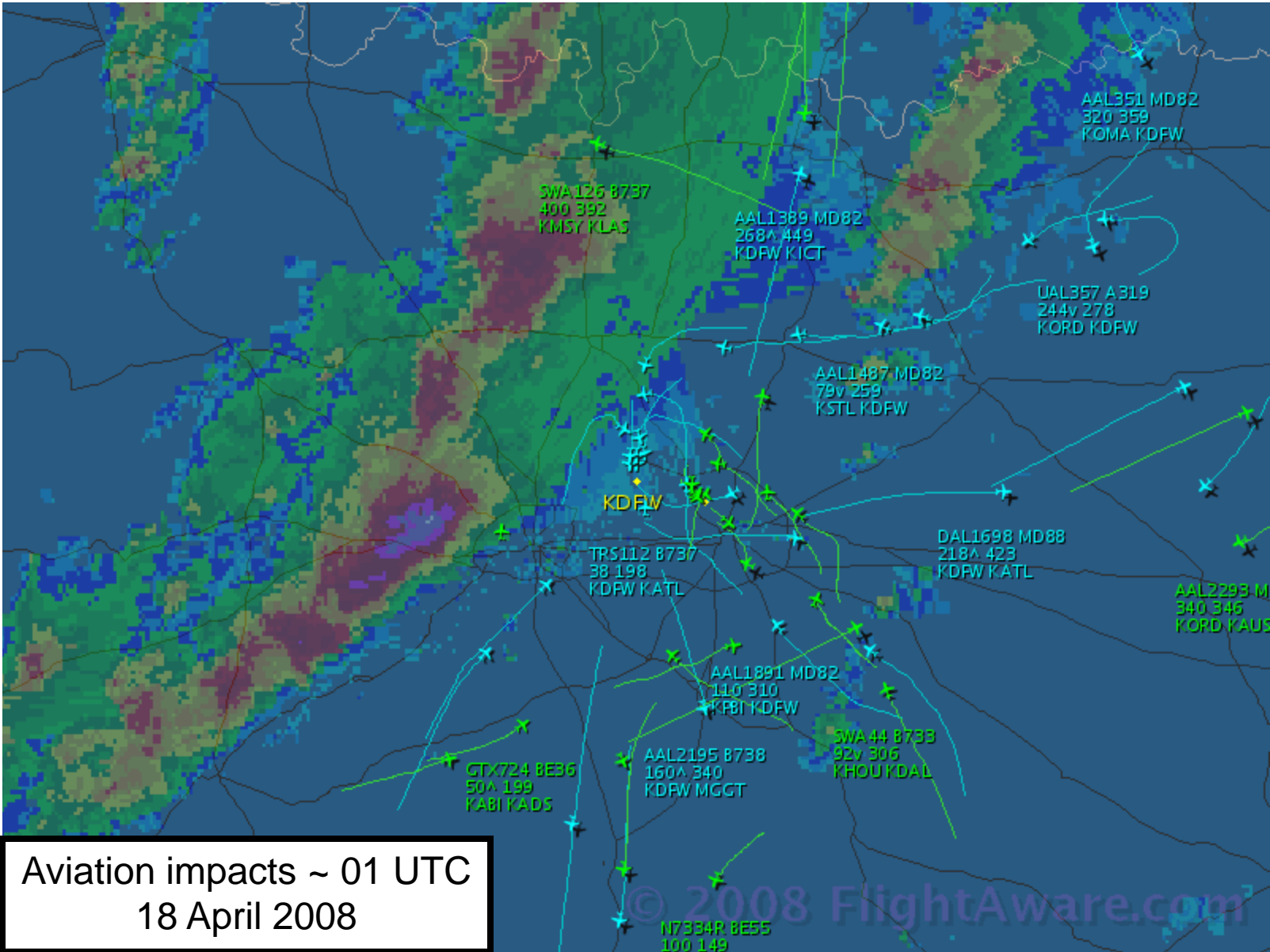
Supercell Observed



Radar BREF 0142 UTC 22 Apr 2008

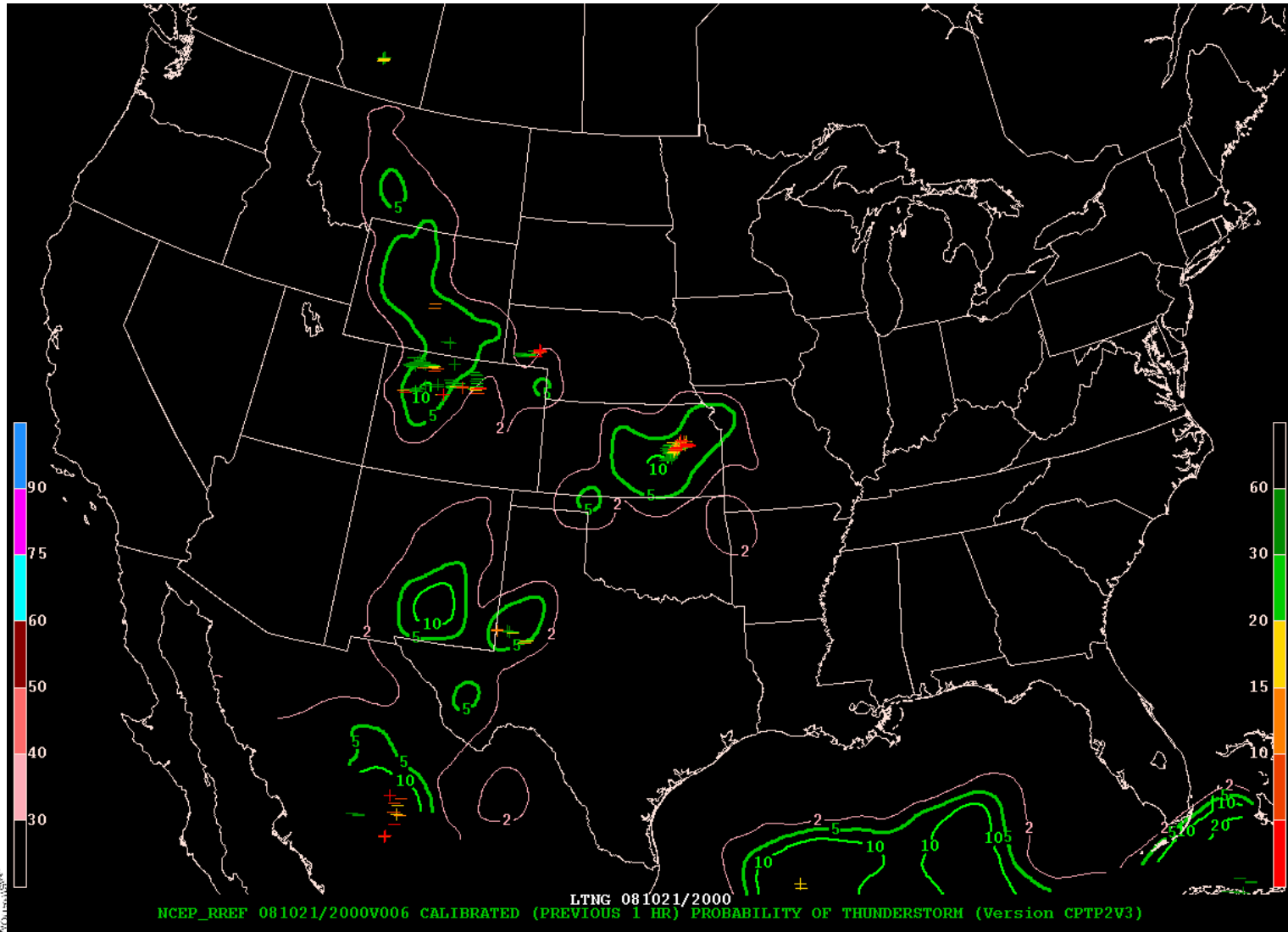


Linear Convective Mode: Impacts



Aviation impacts ~ 01 UTC
18 April 2008

RUC based Time Lagged Ensemble



Challenges

- **Service & Societal Challenges**
 - Effective communication of threat & uncertainty
 - Create a continuous decision support hazardous weather information stream
- **Major Science Challenges**
 - the **convective initiation** challenge
 - impacts of **mesoscale variability** on storm predictability
 - **appropriate NWP resolutions** for severe storm prediction
 - advanced **cloud microphysics & BL** for storm scale NWP
 - **radar (& other) data assimilation** for storm scale NWP
 - **extraction of storm information** from high resolution NWP
 - **perturbation strategies** for storm scale ensembles
 - extraction of **probabilistic information from storm scale ensembles**

