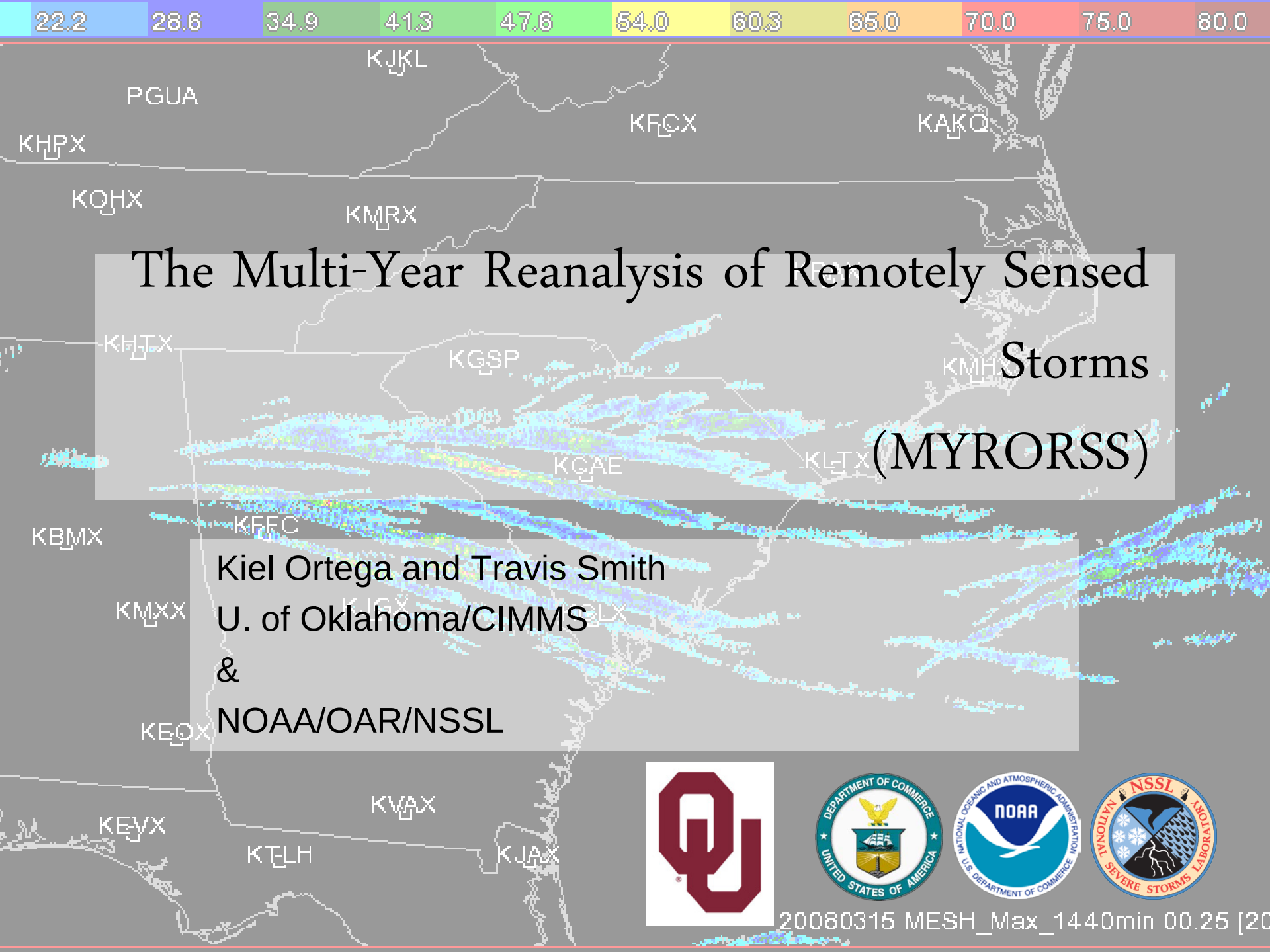


The Multi-Year Reanalysis of Remotely Sensed Storms (MYRORSS)

Kiel Ortega and Travis Smith
U. of Oklahoma/CIMMS
&
NOAA/OAR/NSSL

Important People

Sam Degelia
Rachel Gaal
Paul Goree
Wolfgang Hanft
Corey Howard
Ken Howard
Dave King
Carrie Langston

Garrett Layne
Brian Nelson
Brittany Newman
Youcun Qi
Scott Stevens
Jennifer Tate
Skylar Williams
Jian Zhang

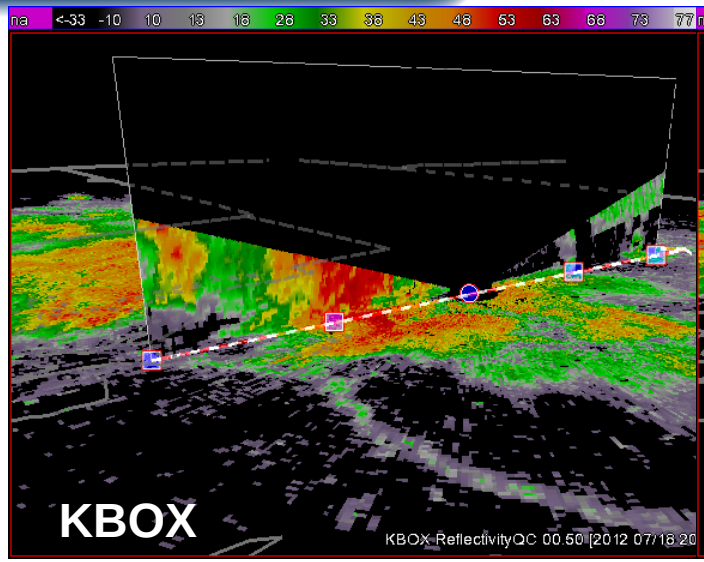
Why MYRORSS?

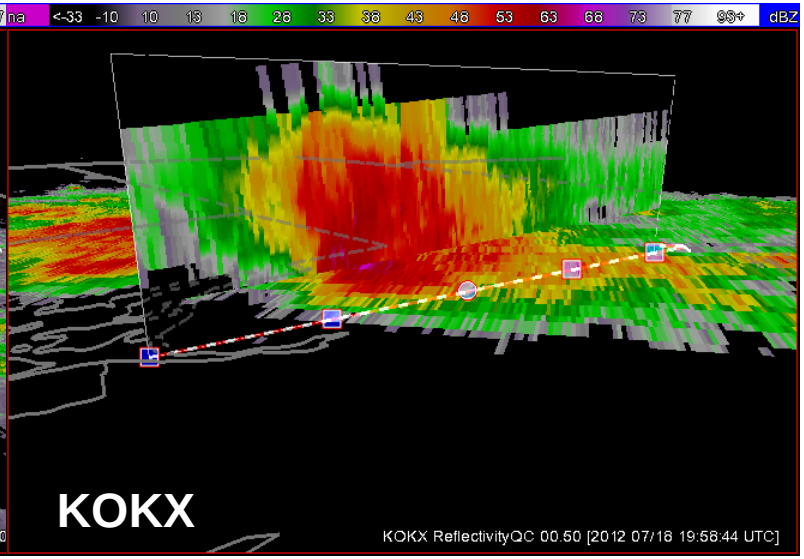
Provide a consistent radar data set across the CONUS

Support research in the development of probabilistic information for warnings

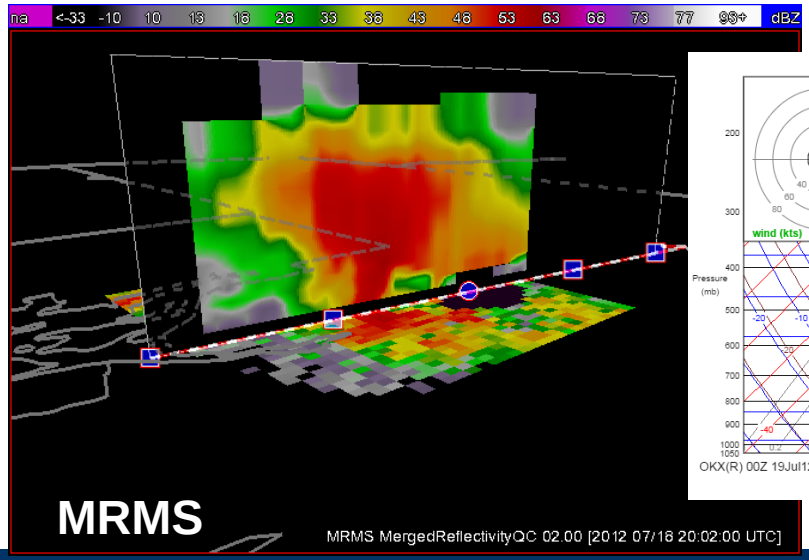
Support implementation of MRMS to operations

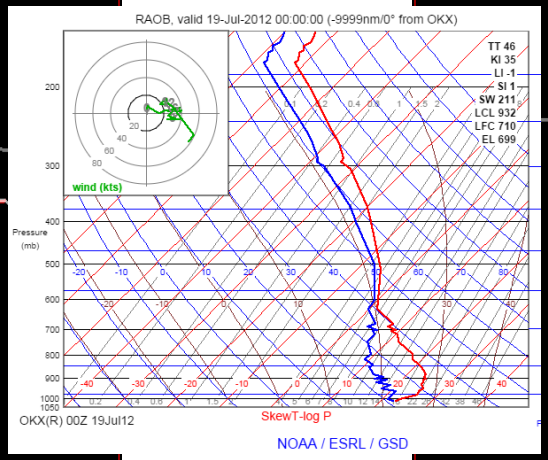
Multi-Radar Multi-Sensor System

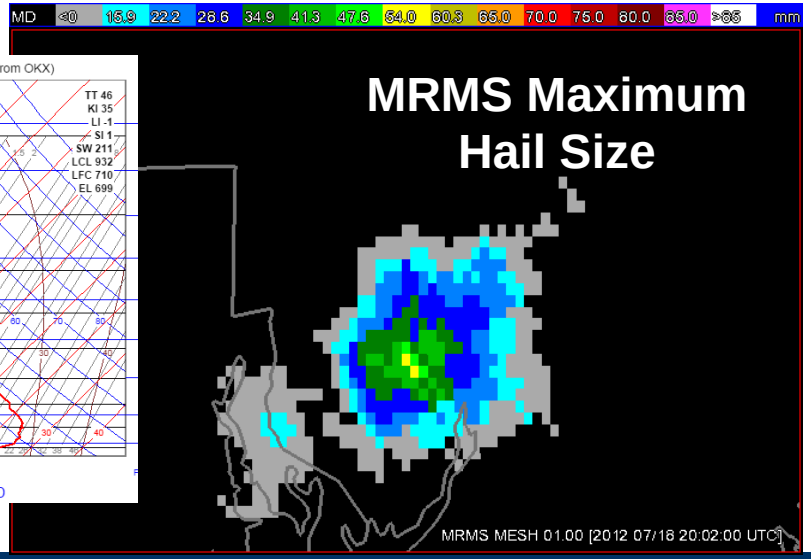




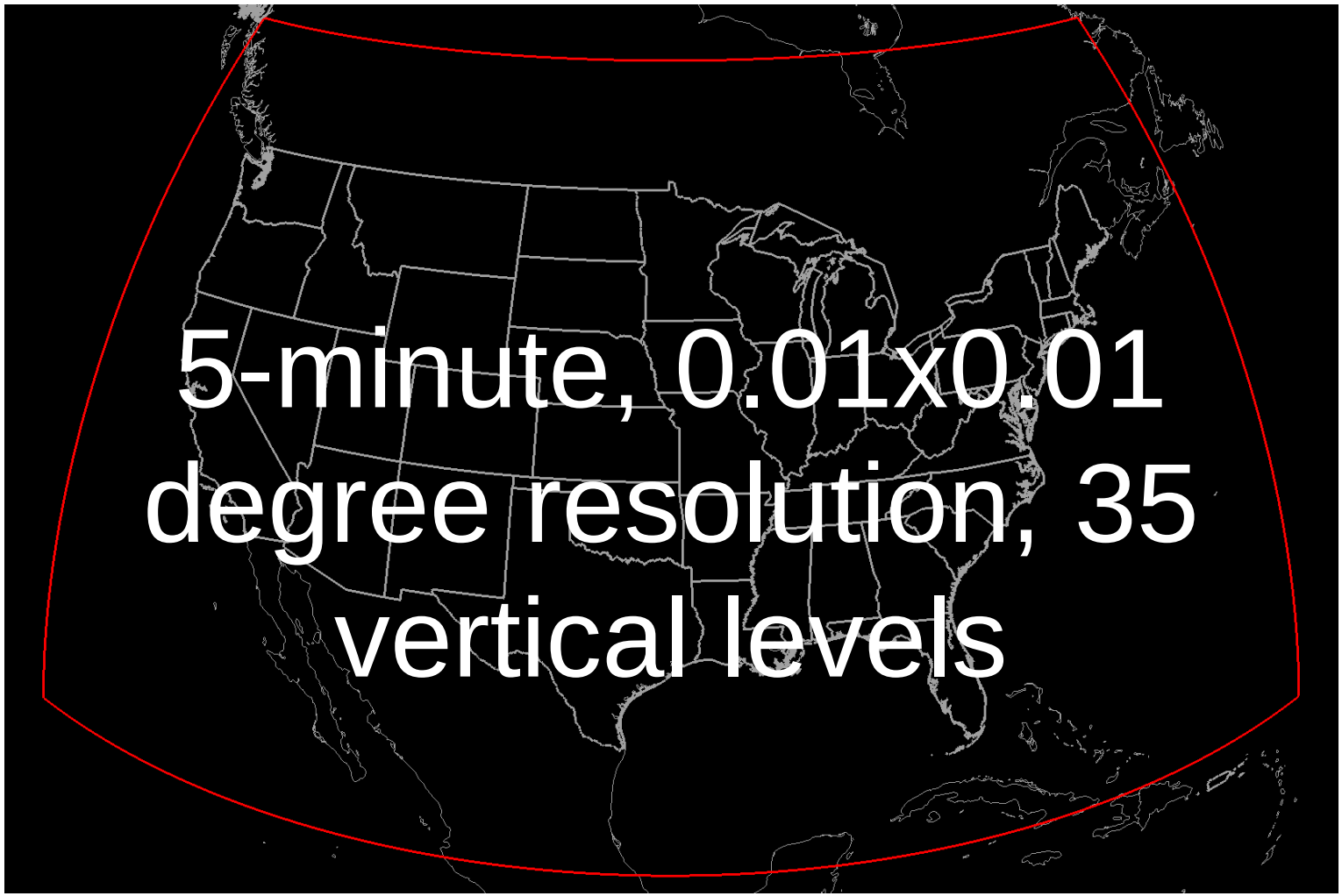
\+
other
neighboring
radars



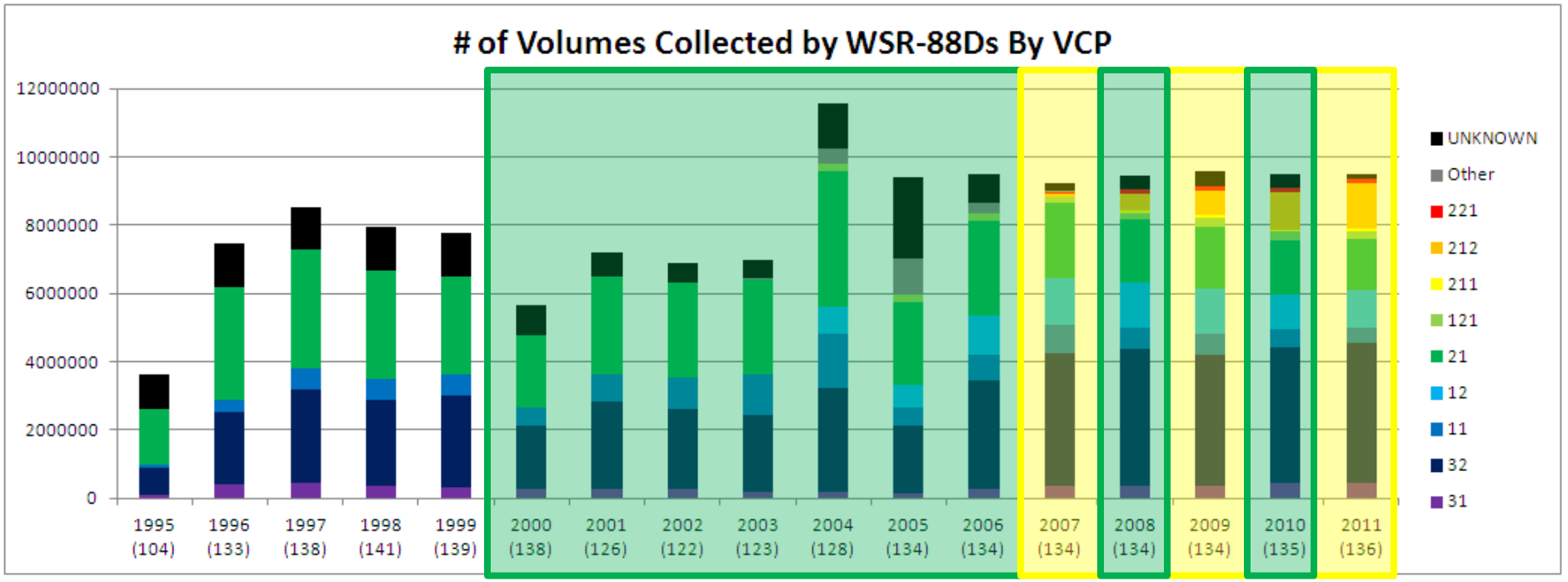




MYRORSS Domain



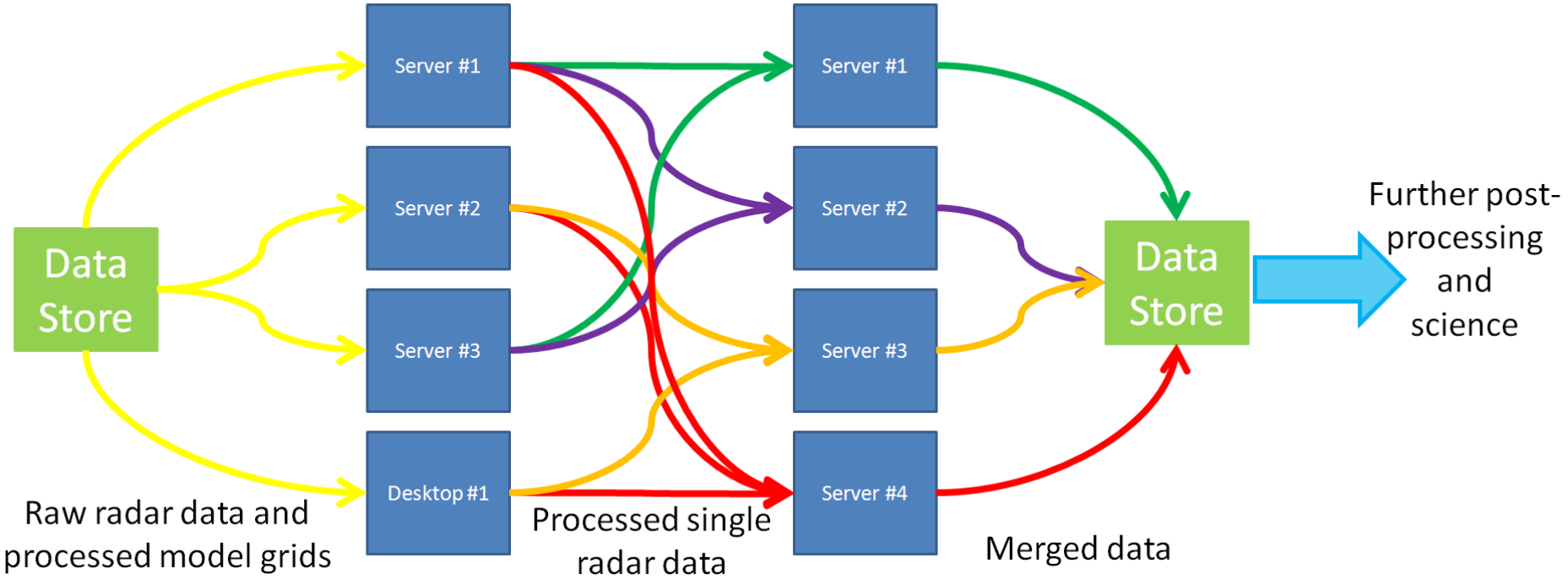
MYRORSS Data



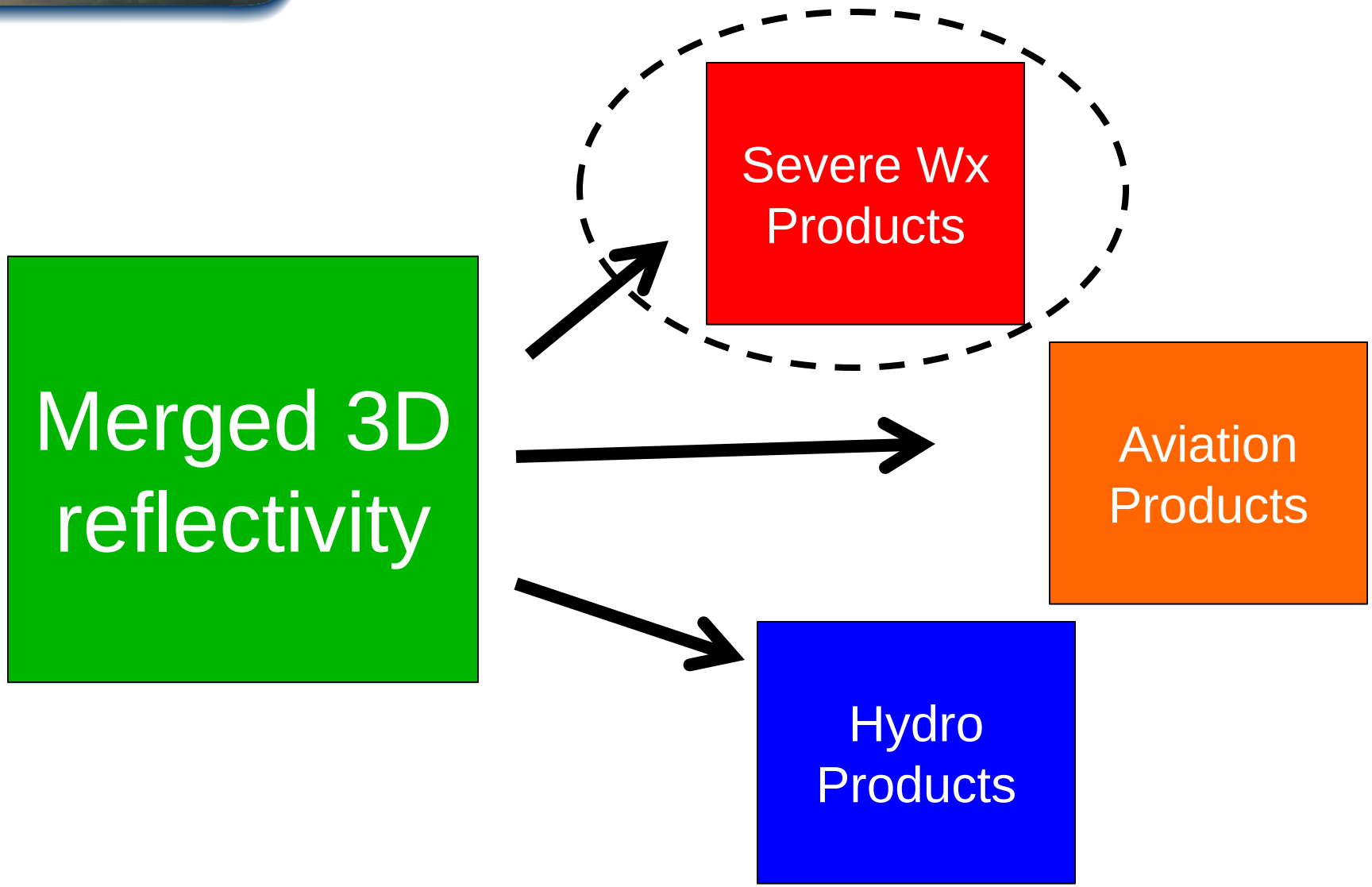
- complete - needs QC

Σ ~ 105 million volume scans

MYRORSS Processing



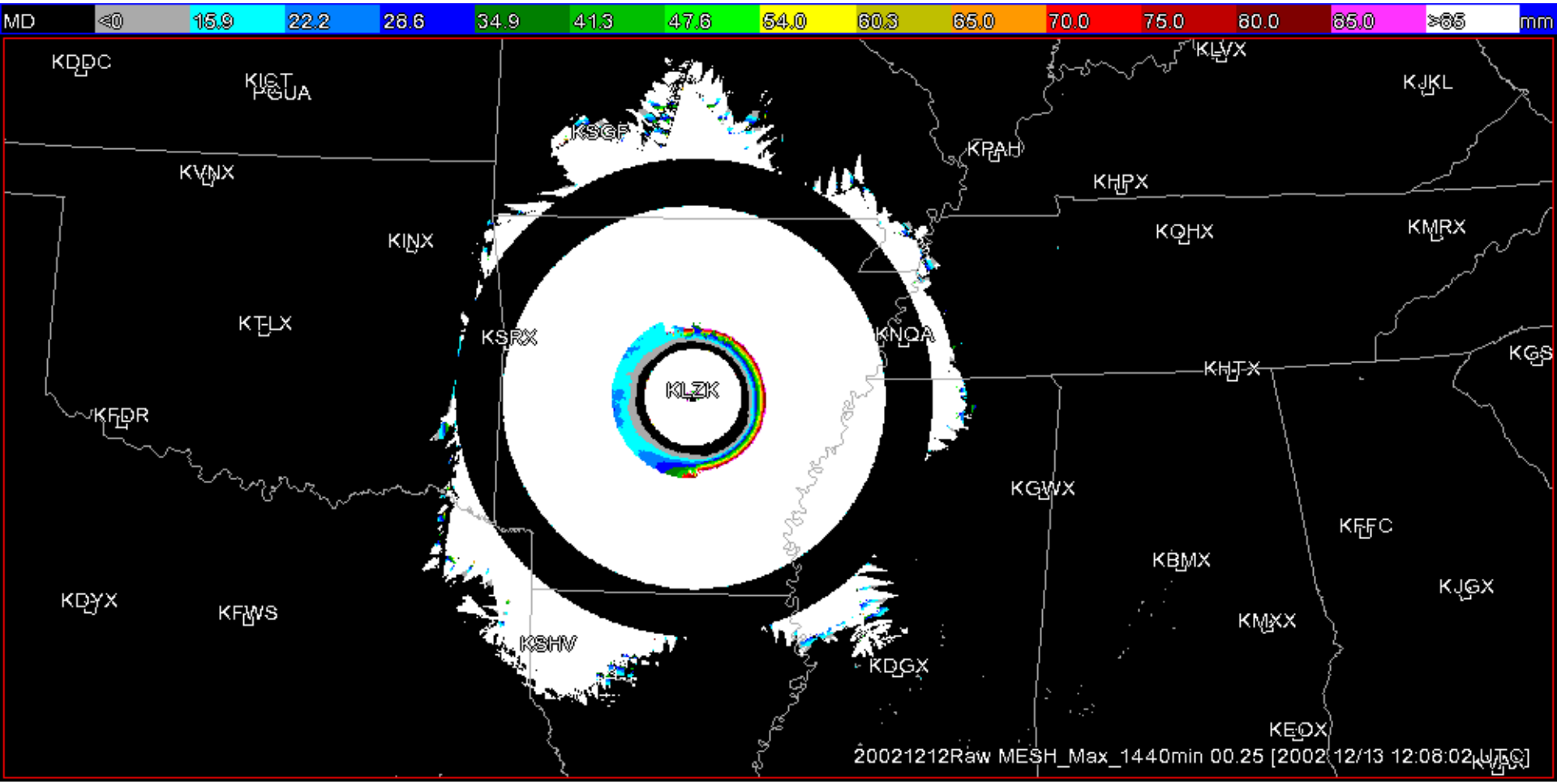
MYRORSS post processing



MYRORSS Processing (single radar)

1. Conversion into netCDF
2. Radar QC
   a) QCNN – Lakshmanan et al. 2007 & 2010
   b) Further bloom QC for biological scatterers—Tang et al. 2011
3. Dealiasing
   a) 2D dealiasing—Jing & Weiner 1993
4. Azimuthal Shear Calculations
   a) LLSD—Smith and Elmore 2004
   b) Range correction—Newman et al. 2013
   c) Composite layers (0-3 km AGL and 3-6 km AGL)

MYRORSS QC


MD
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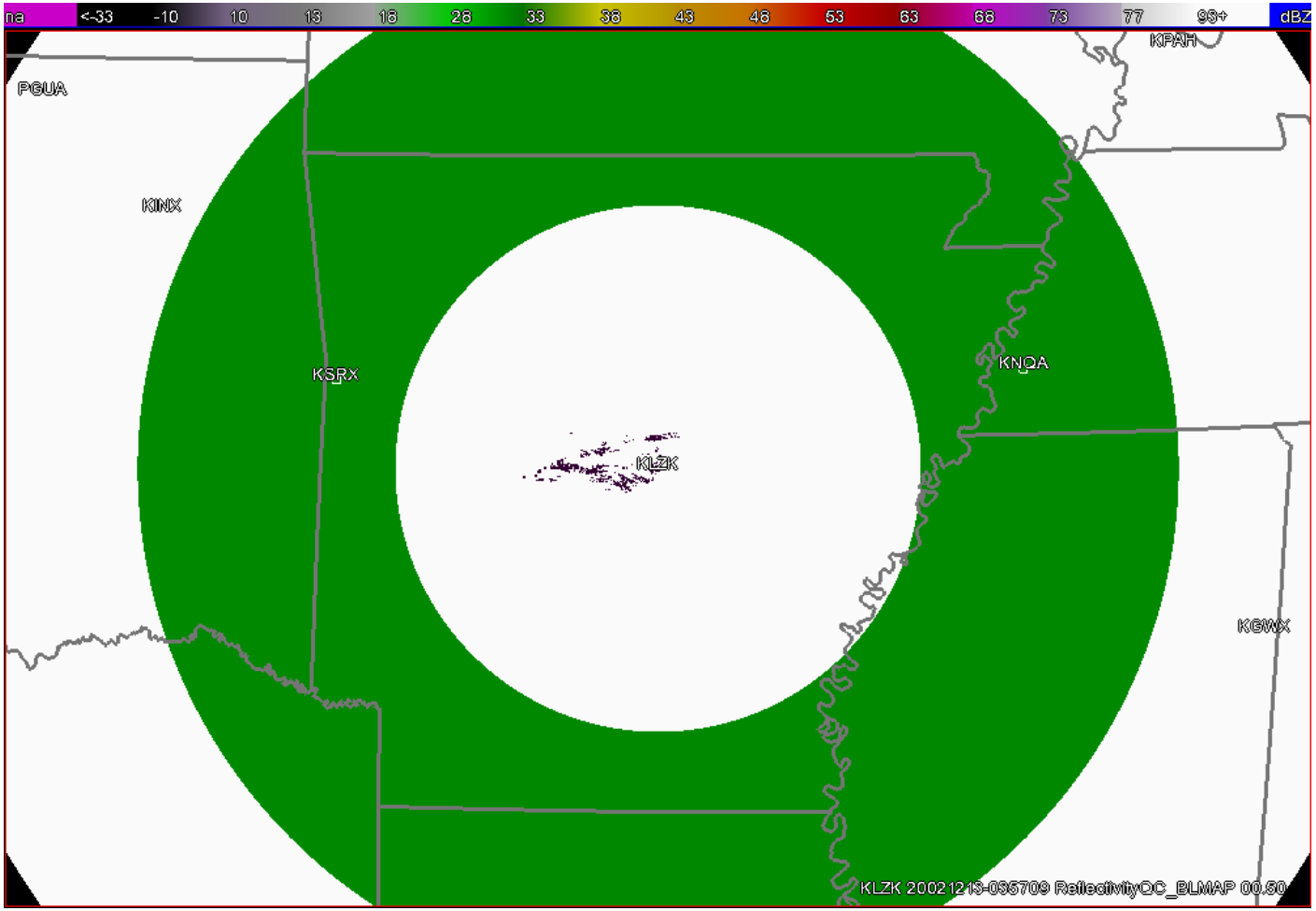
KMRX
KTLX
KSRX
KNQA
KLZK
KHTX
KGS
KFDR
KGWX
KFFC
KBMX
KJGX
KDYX
KFWS
KMXX
KSHV
KDGX
KEOX
20021212Raw MESH_Max_1440min 00.25 [2002 12/13 12:08:02 UTC]

MYRORSS QC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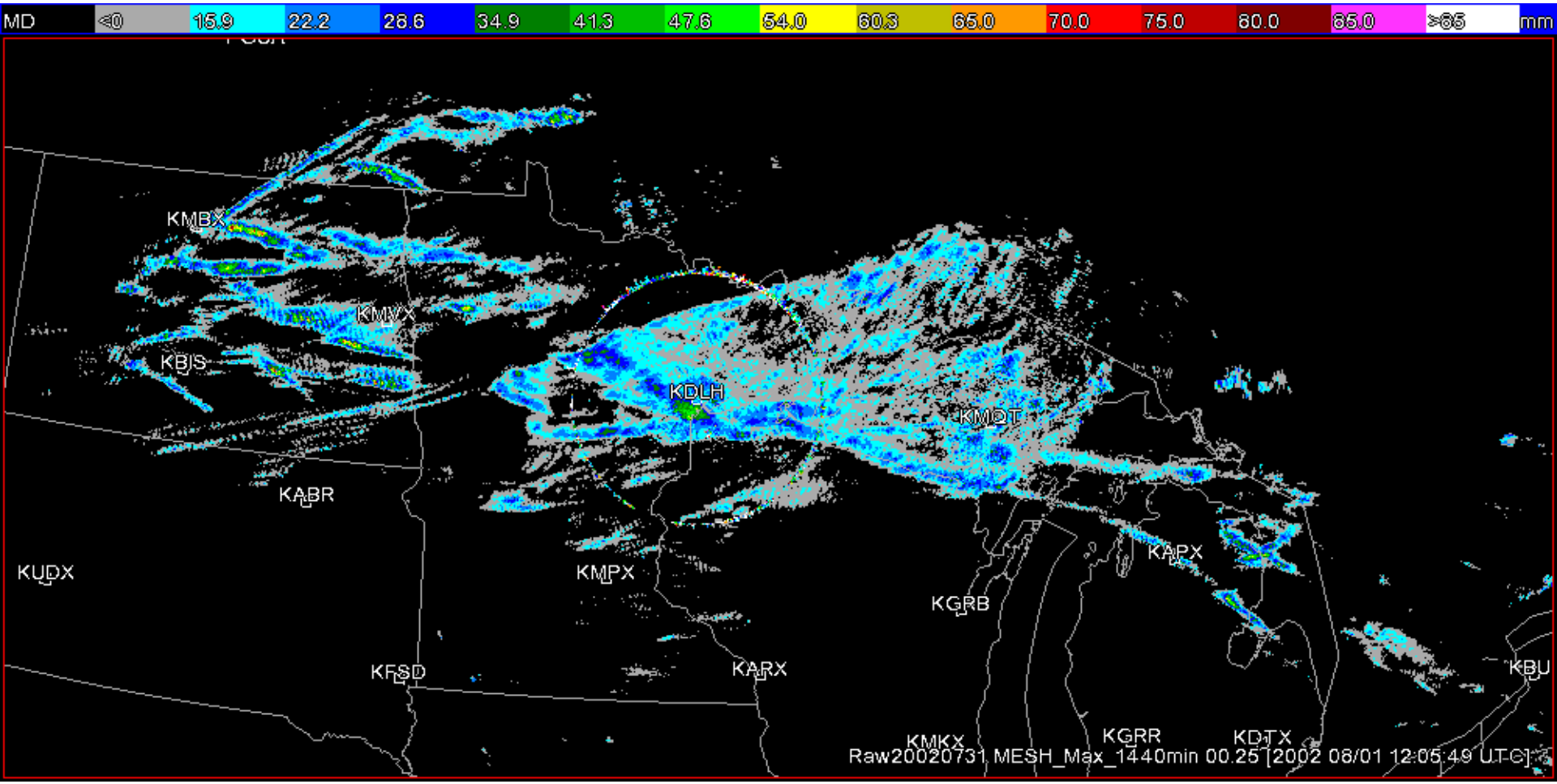
KSRX
KNQA
KLZK
KGWX
KLZK 20021213-035709 ReflectivityQC_BLMAP 00.50

MYRORSS QC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KMQT
KABR
KUDX
KMPX
KAPX
KGRB
KFSD
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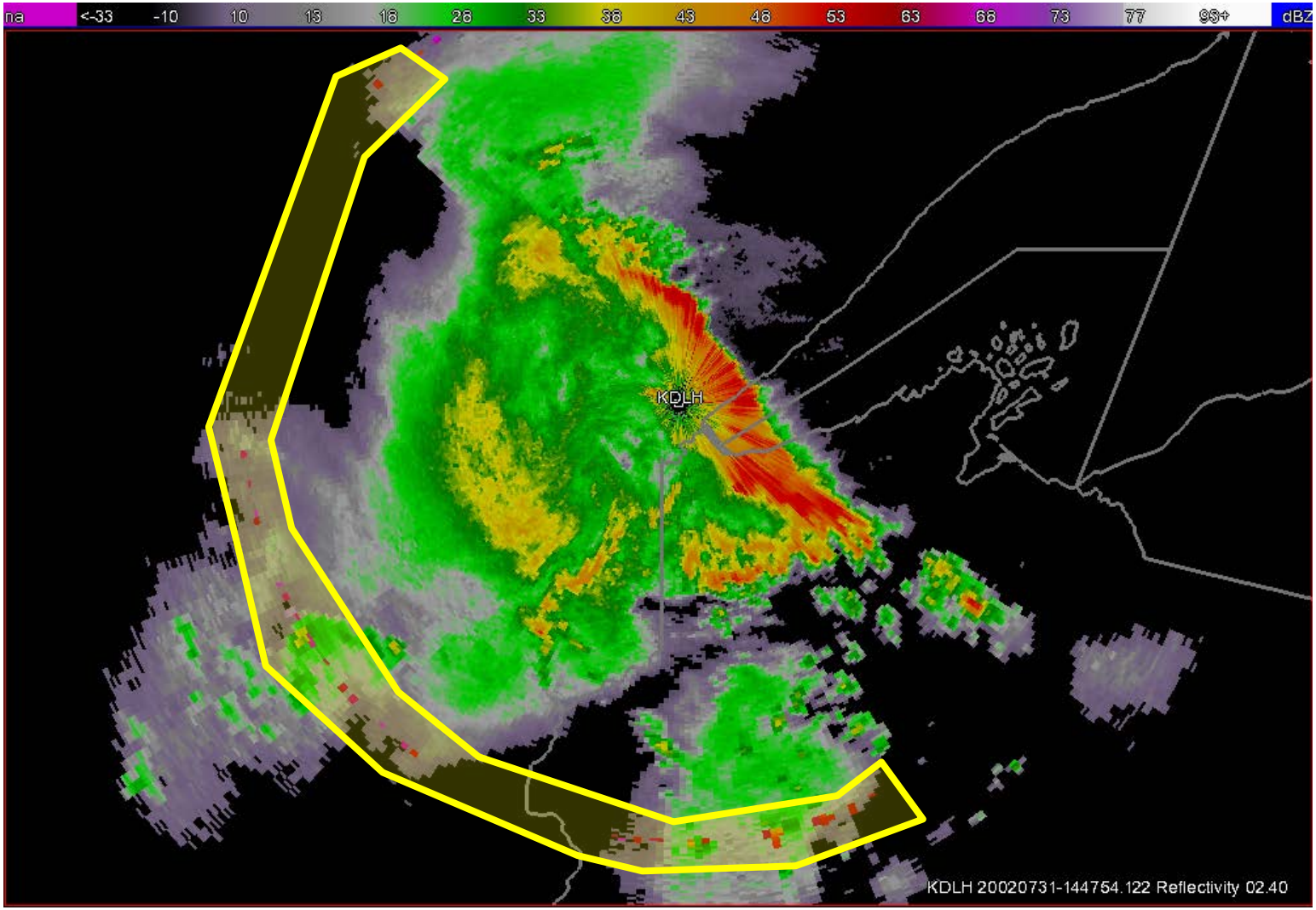
MYRORSS QC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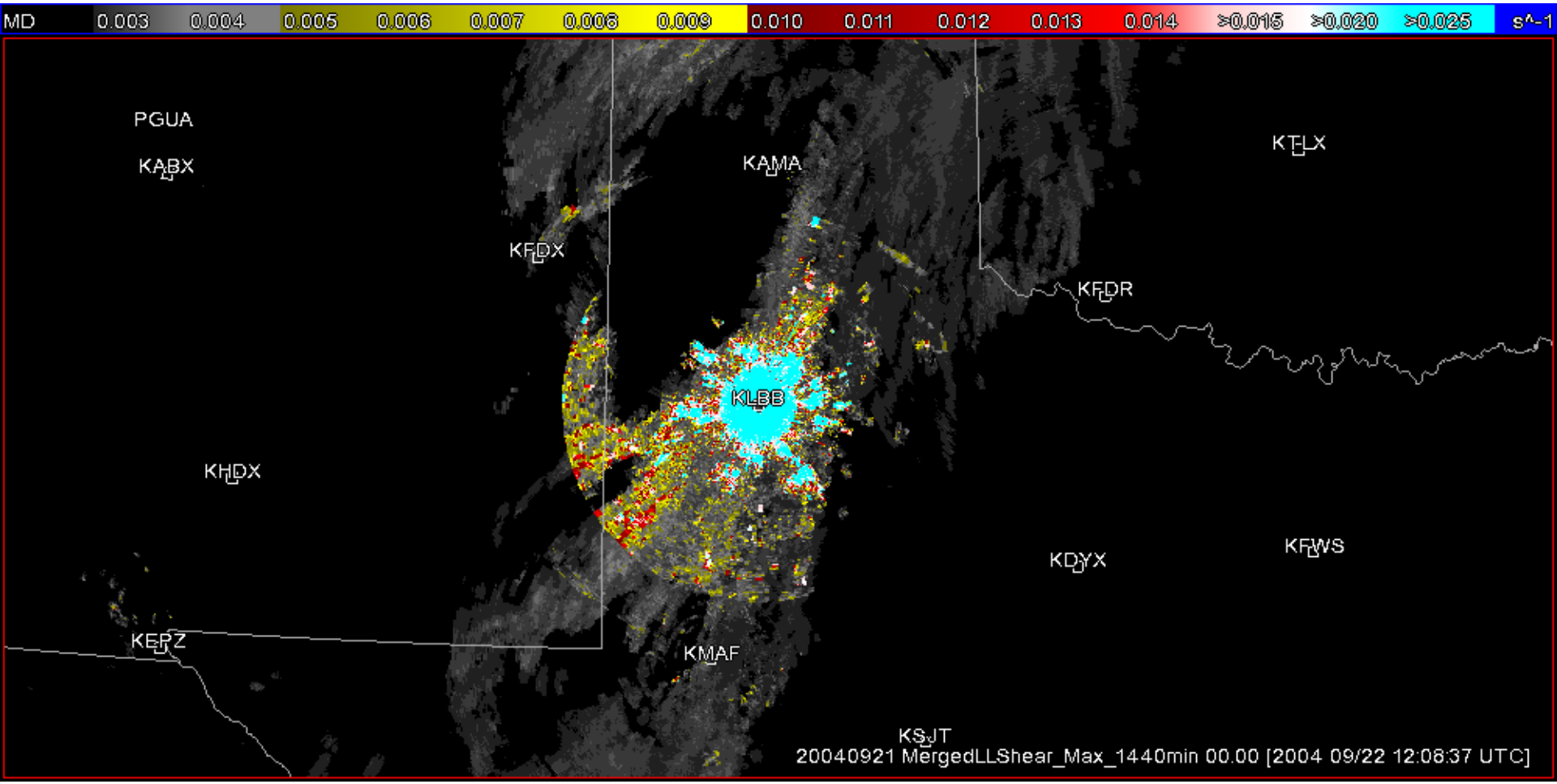
KDLH
KDLH 20020731-144754.122 Reflectivity 02.40

MYRORSS QC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s^-1
PGUA
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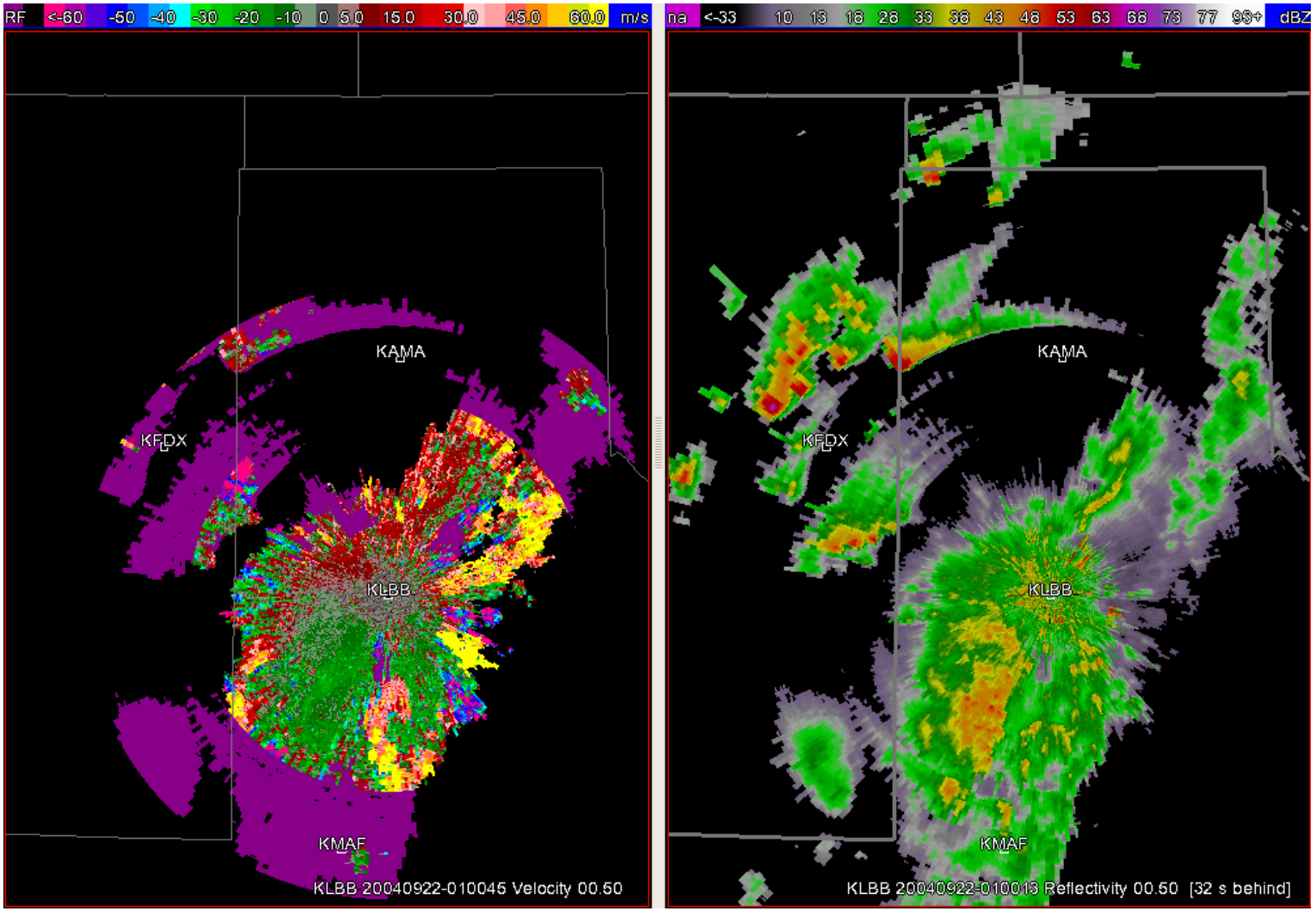
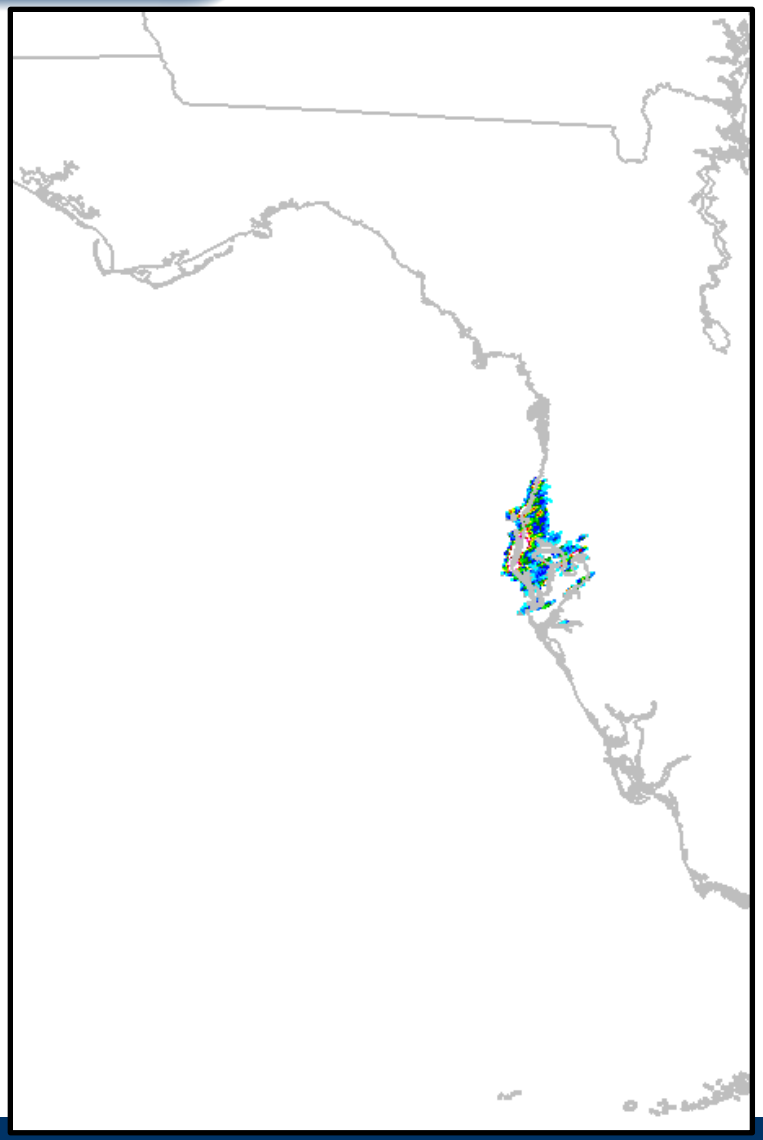
KAMA
KTLX
KFDX
KFDR
KLBB
KHDX
KDYX
KFWS
KEPZ
KMAF
KSJT
20040921 MergedLLShear_Max_1440min 00.00 [2004 09/22 12:08:37 UTC]

MYRORSS QC

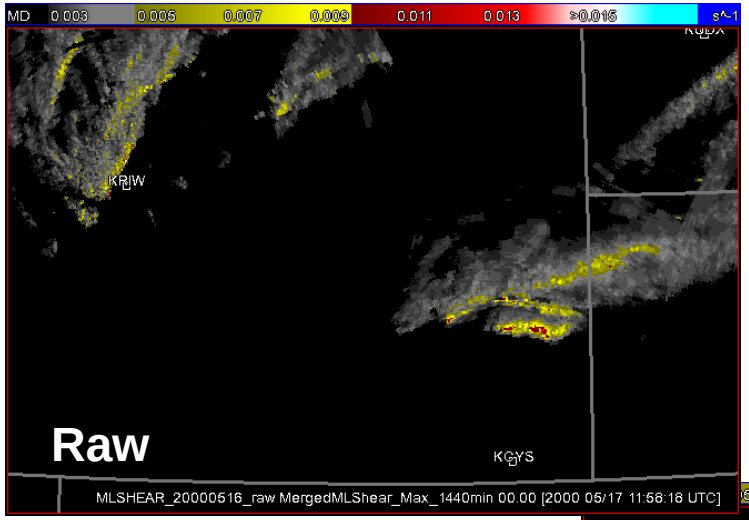

RF <-60 -50 -40 -30 -20 -10 0 5.0 15.0 30.0 45.0 60.0 m/s
KAMA
KFDX
KLBB
KMAF
KLBB 20040922-010045 Velocity 00.50
na <-33 10 13 18 28 33 38 43 48 53 63 68 73 77 83+ dBZ
KAMA
KFDX
KLBB
KMAF
KLBB 20040922-010013 Reflectivity 00.50 [32 s behind]

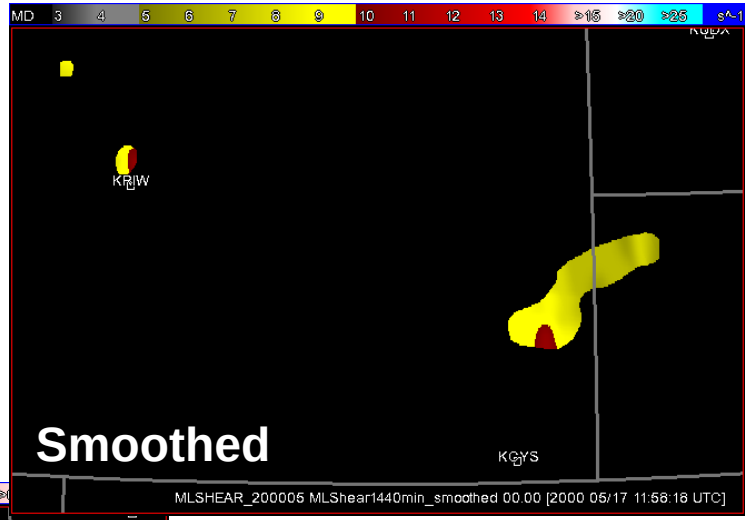
MYRORSS QC

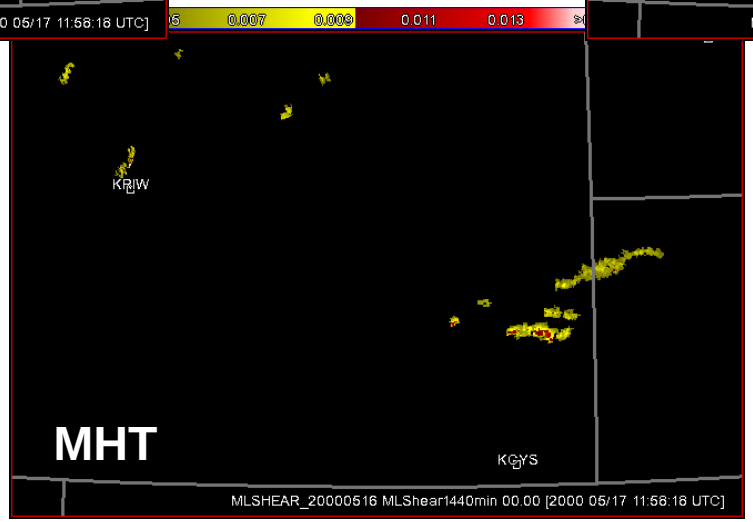


Erroneous MESH detections—large areas and large values—due to radar ducting and coastline interactions. The most common QC problem.

Using the Data: Radar-based Climatologies



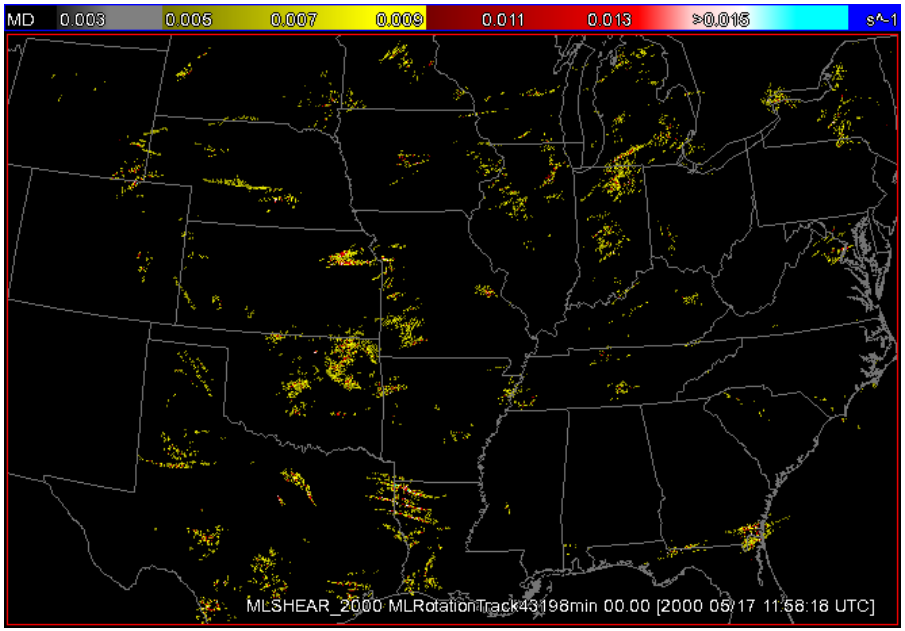




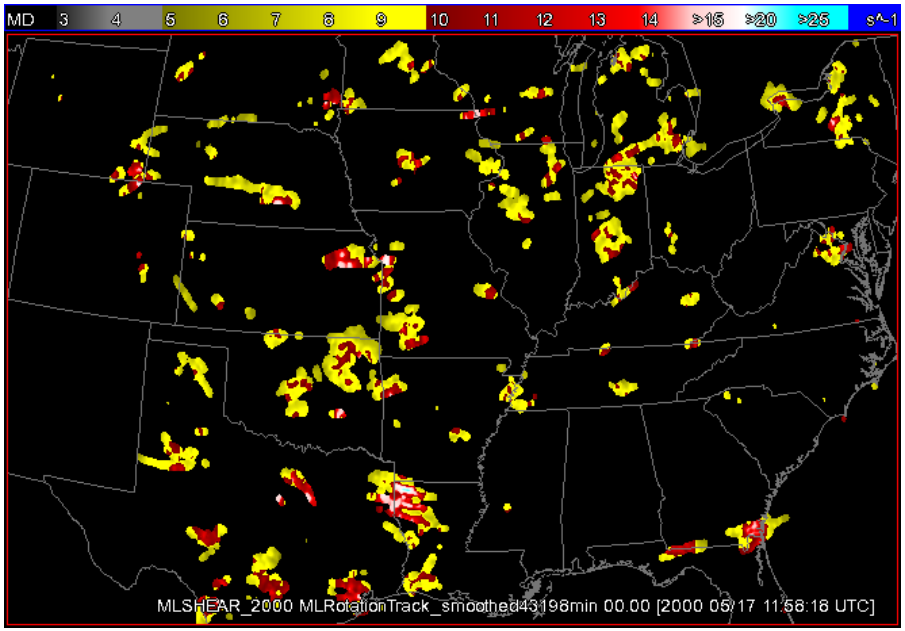
Individual timesteps are cleaned up using a threshold, minimum size of clusters and temporally using a multiple-hypothesis tracking method

MHT accumulations are then run through a series of smoothers to futher clean up the field and make the size of the fields appropriate for climatology generation

Using the Data: Radar-based Climatologies



Yearly Accumulation (MHT)—2000



Yearly Accumulation (MHT & Smoothed)—2000

Future Fixes

Make timing of products smooth (right now ~5 minutes, need exactly 5 minutes)

Fix LLSD corrected shear calculations

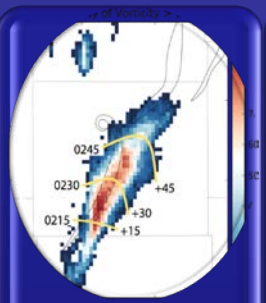
Produce un-QC'd composite

Identify and correct reflectivity issues affecting QPE estimates

What's Next?

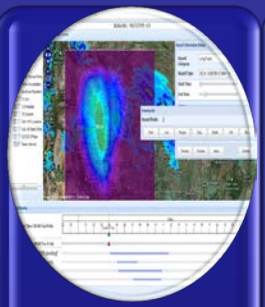
Forecasting a Continuum of Environmental Threats

Grid-Based Probabilistic Threats



Observations & Guidance

The Forecaster



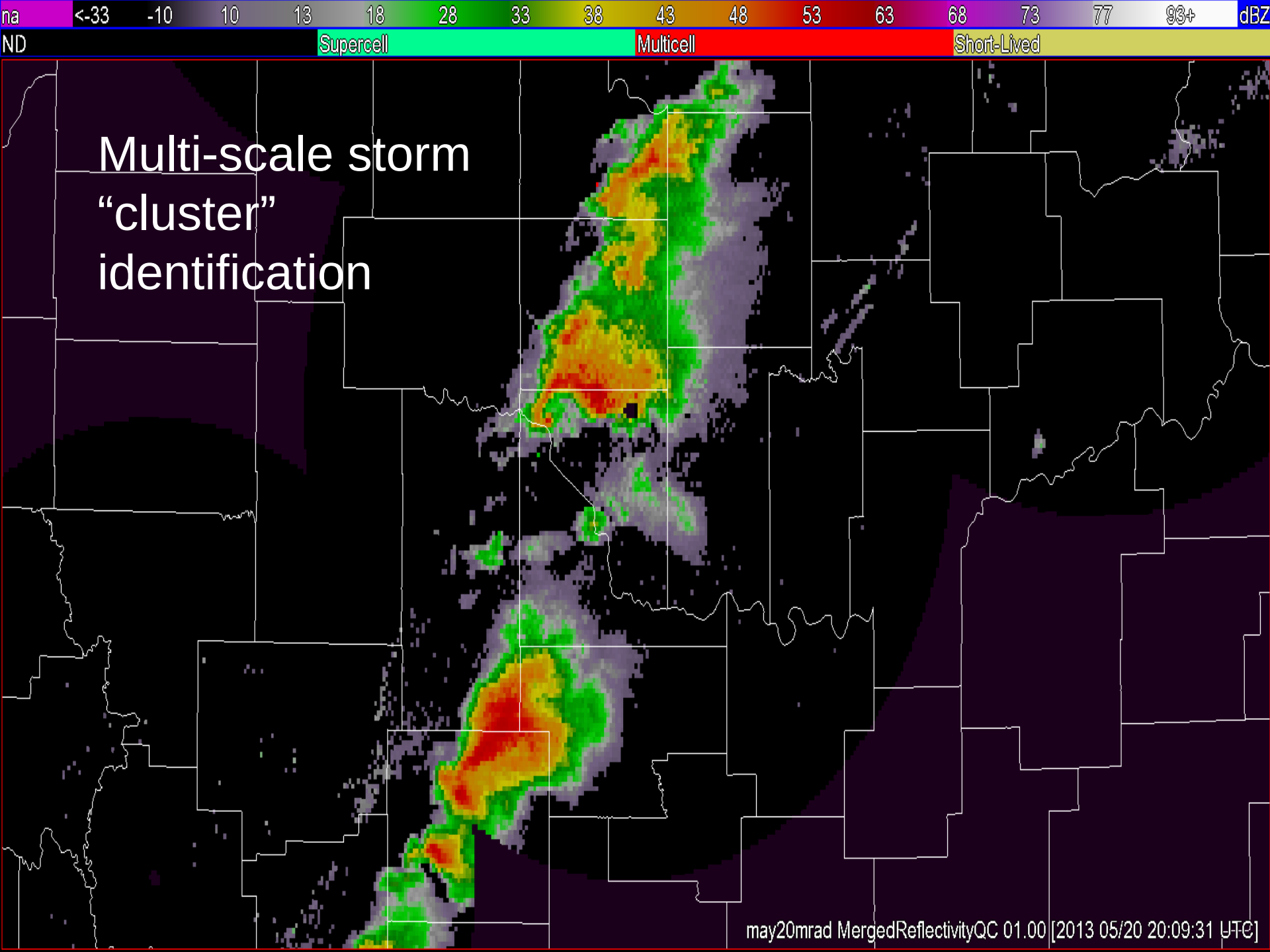
Threat Grid Tools

Useful Output

Effective Response

Verification Methods

Follows the flow of "The Warning Process"


na
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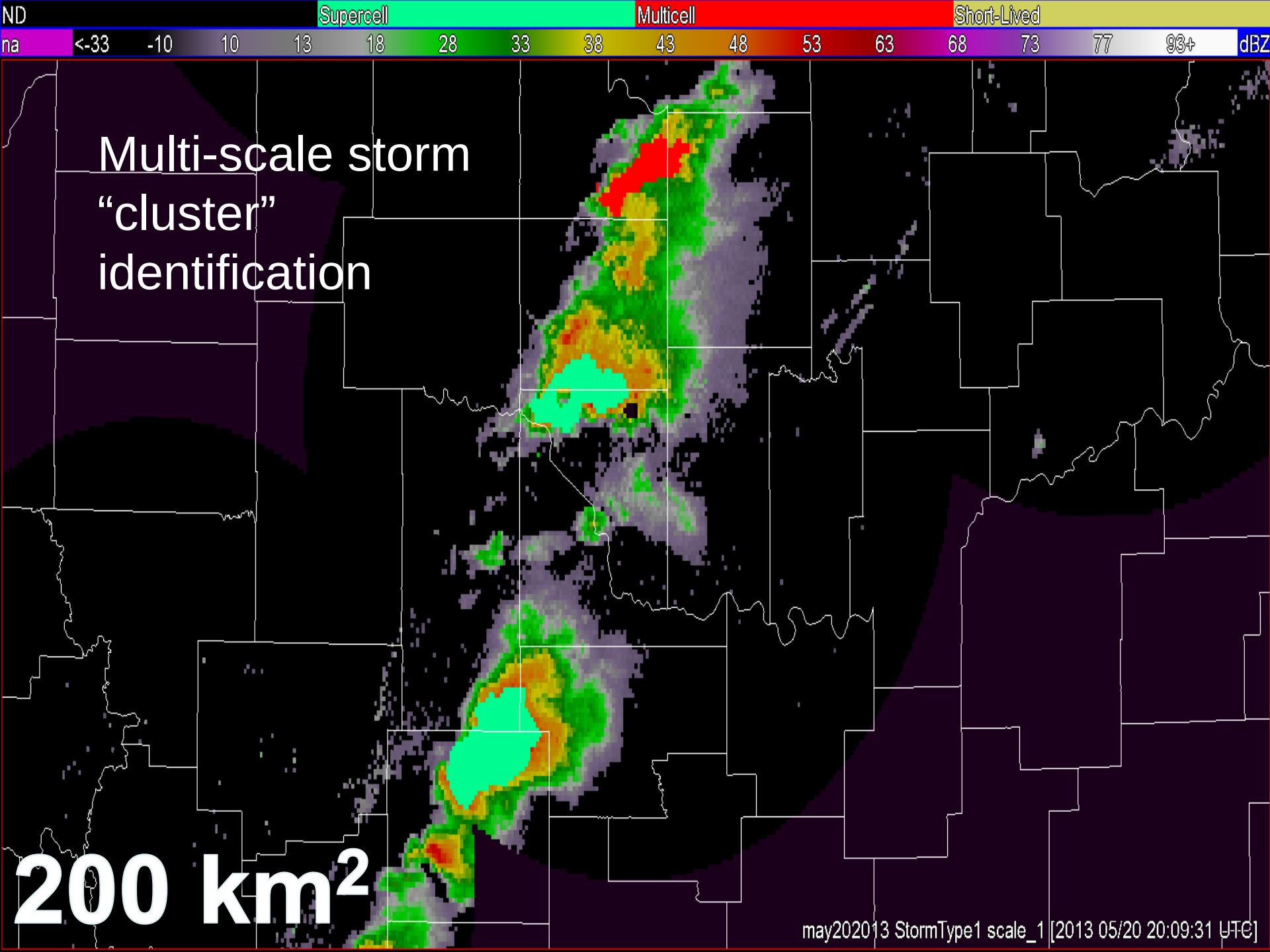
93+
dBZ
ND
Supercell
Multicell
Short-Lived
Multi-scale storm
“cluster”
identification
may20mrad MergedReflectivityQC 01.00 [2013 05/20 20:09:31 UTC]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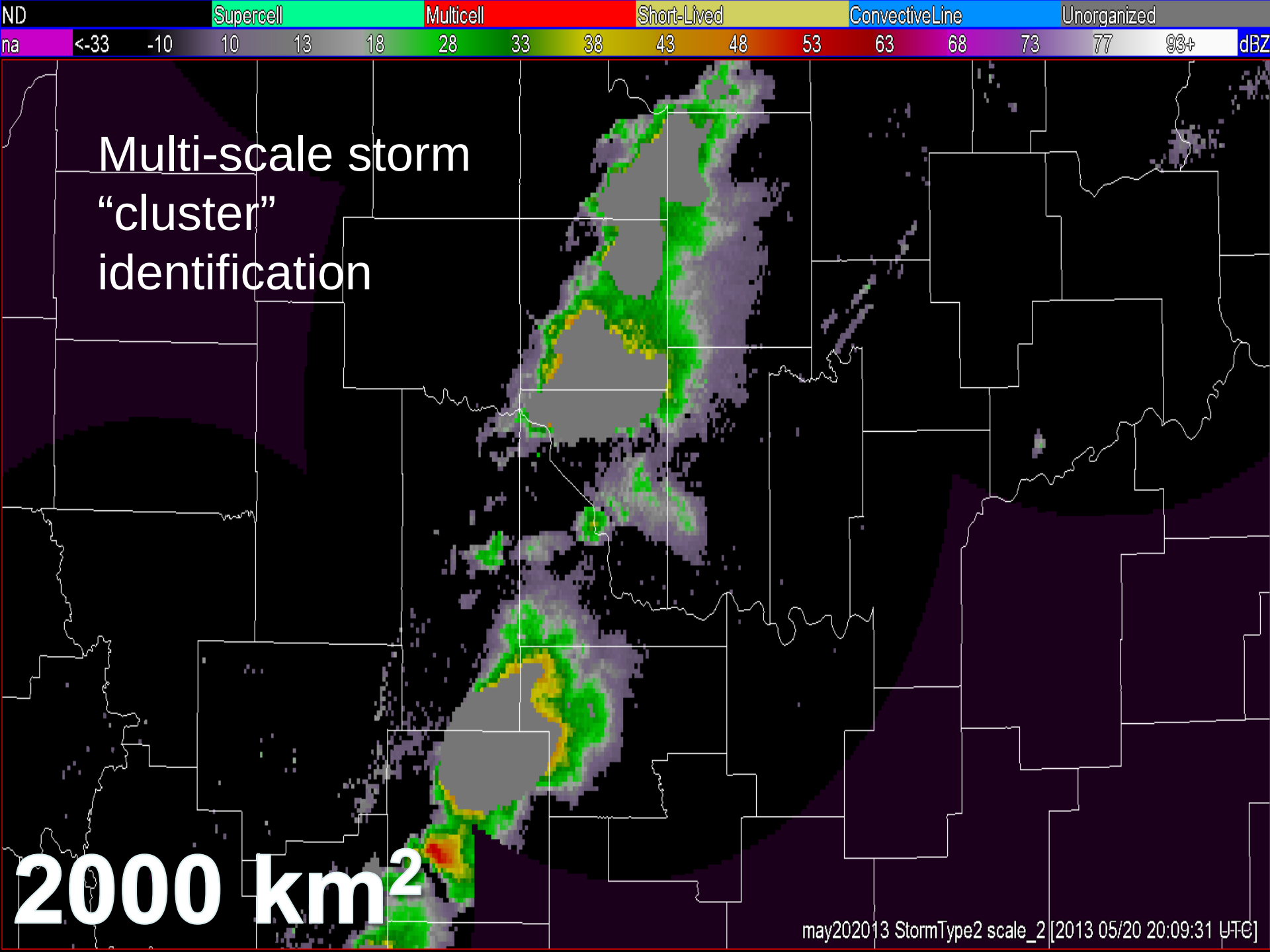
dBZ
Multi-scale storm "cluster" identification
200 km²
may202013 StormType1 scale_1 [2013 05/20 20:09:31 UTC]


ND
Supercell
Multicell
Short-Lived
ConvectiveLine
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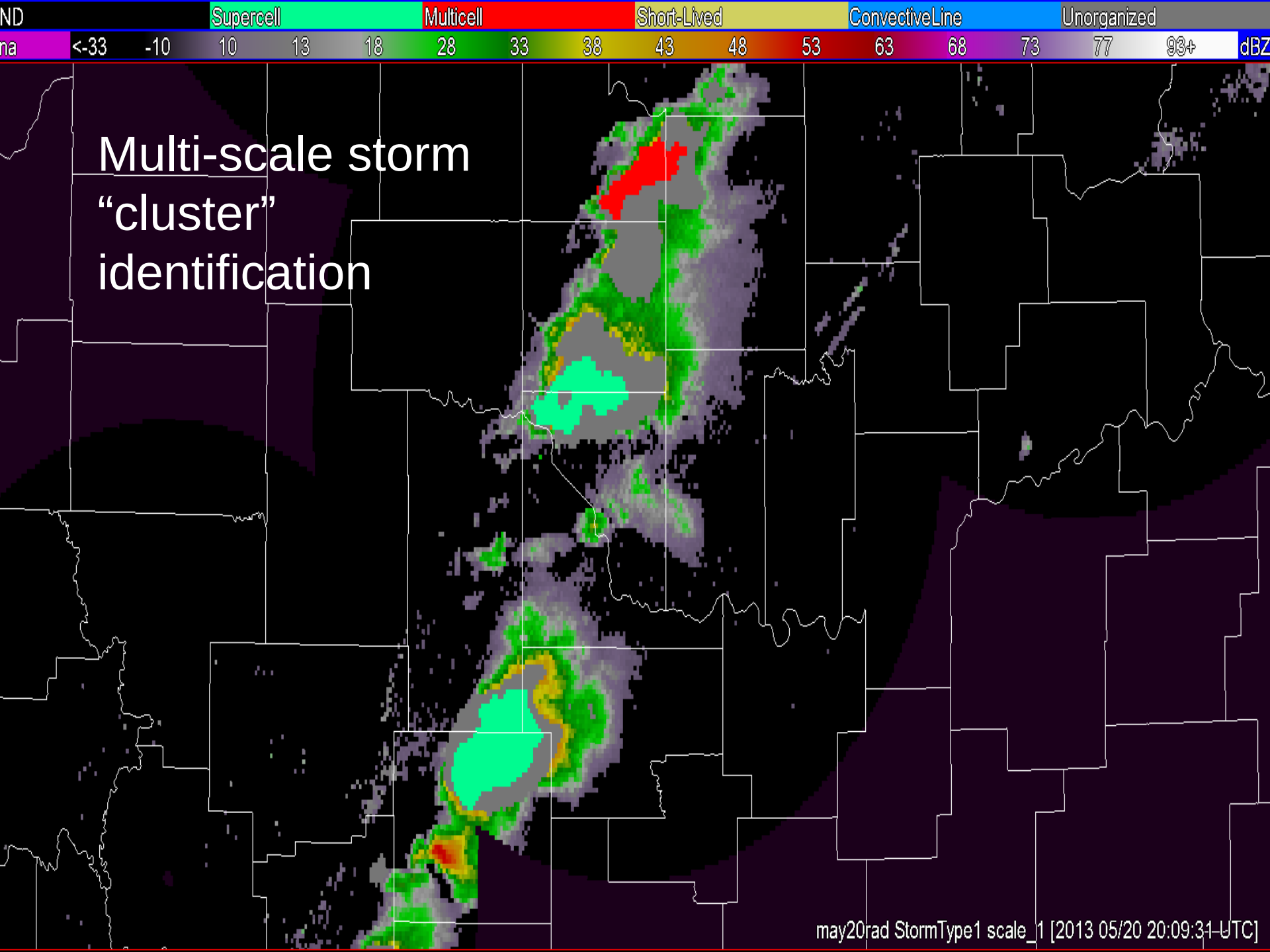
dBZ
Multi-scale storm
“cluster”
identification
2000 km²
may202013 StormType2 scale_2 [2013 05/20 20:09:31 UTC]


ND
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Short-Lived
ConvectiveLine
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93+
dBZ
Multi-scale storm
“cluster”
identification
may20rad StormType1 scale_1 [2013 05/20 20:09:31 UTC]

Storm classification inputs from MYRORSS / MRMS

Storm Attribute

-20 C Merged Reflectivity

0 C Merged Reflectivity

Aspect Ratio

0-2 km Merged Azimuthal Shear

3-6 km Merged Azimuthal Shear

0-6 km Shear Magnitude

0-1 km Storm Relative Helicity

0-3 km Storm Relative Helicity

Longevity

Maximum Expected Size of Hail (MESH)

Max 30 Minute MESH

Most Unstable CAPE

Most Unstable LCL Height

Probability of Severe Hail (POSH)

Quality Controled Merged Reflectivity Composite

Severe Hail Index (SHI)

Storm Size

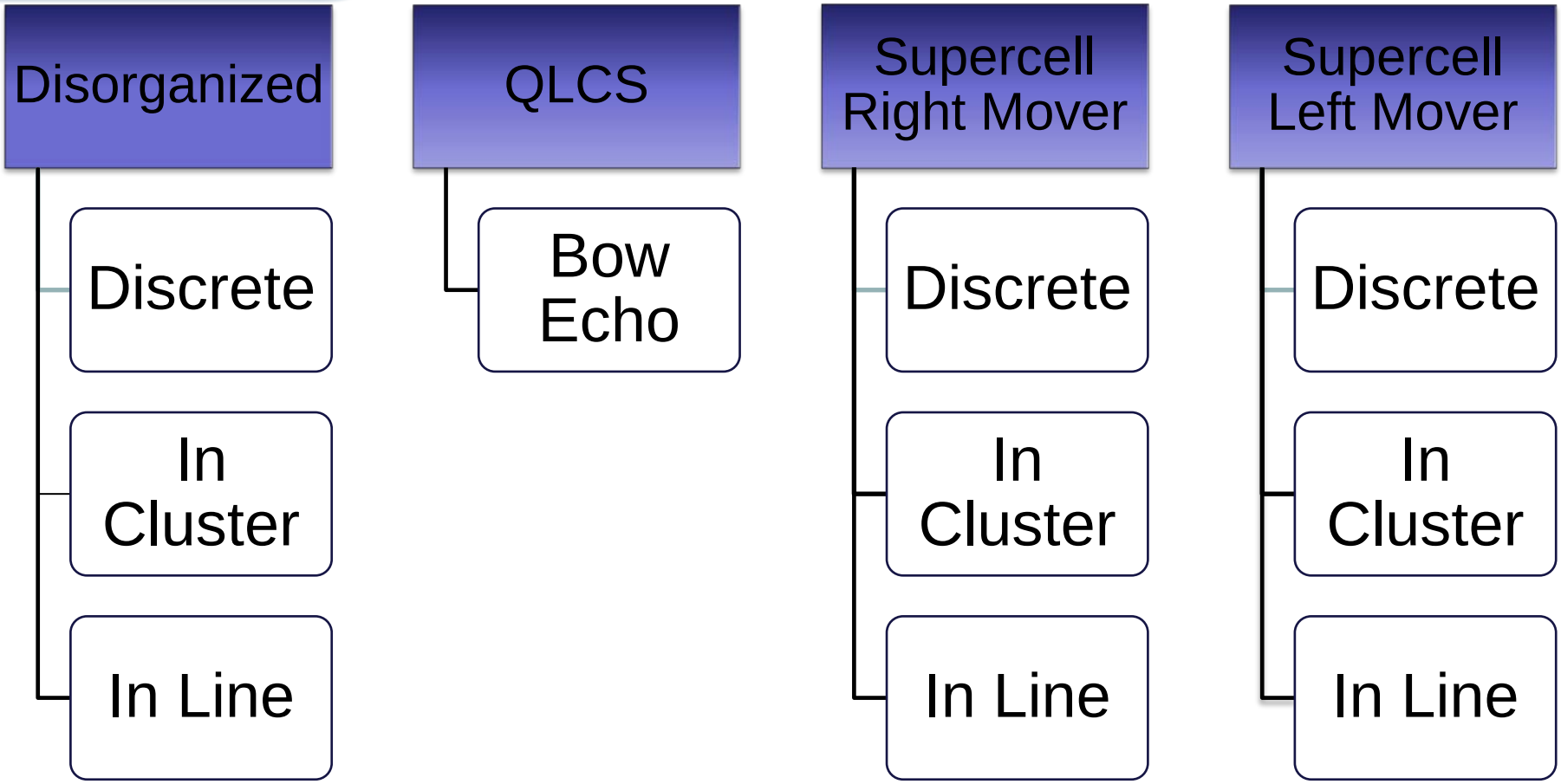
Surface CAPE

Surface Dewpoint

Surface Temperature

Vertically Integrated Liquid (VIL)

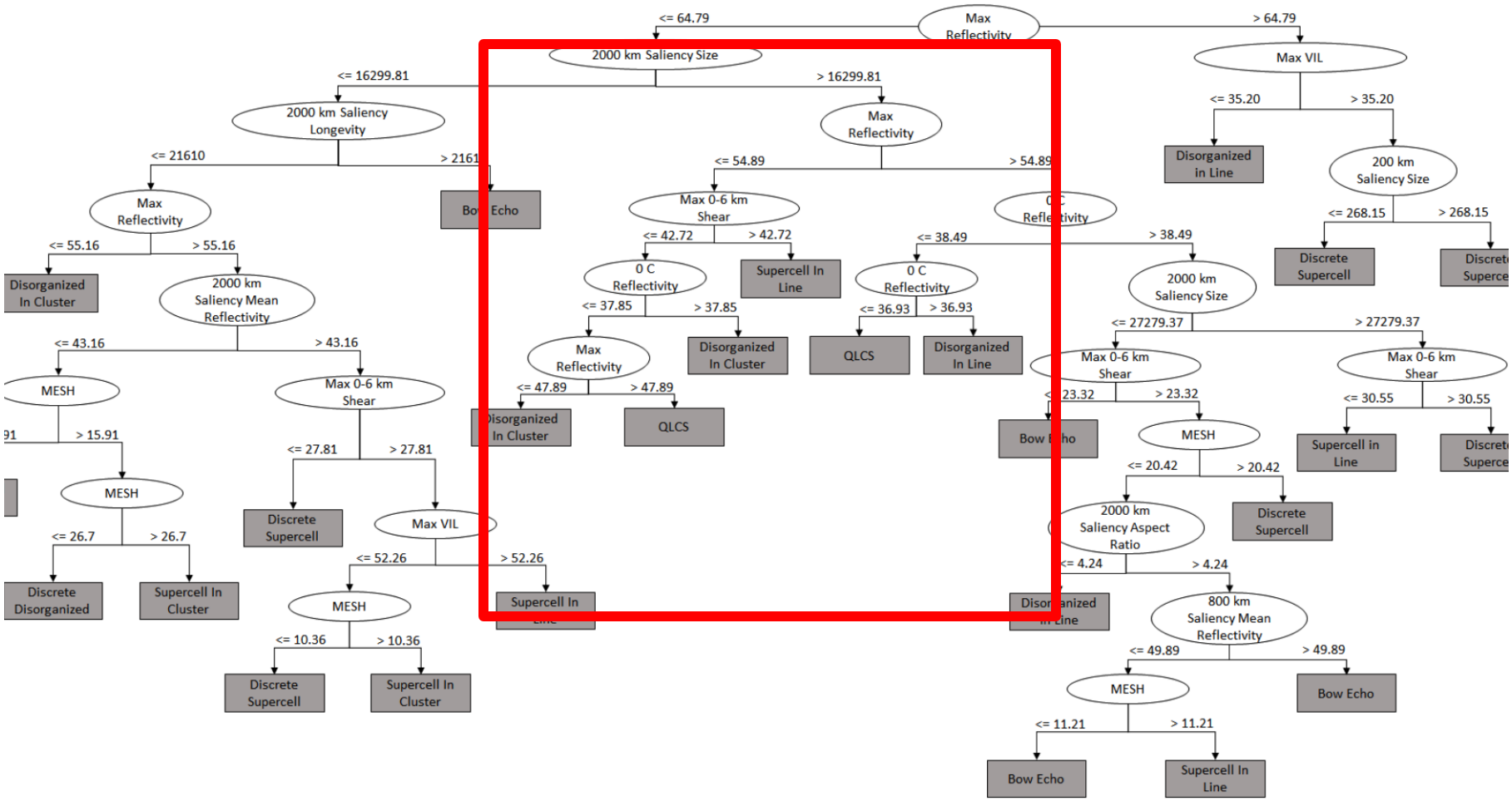
Storm classification

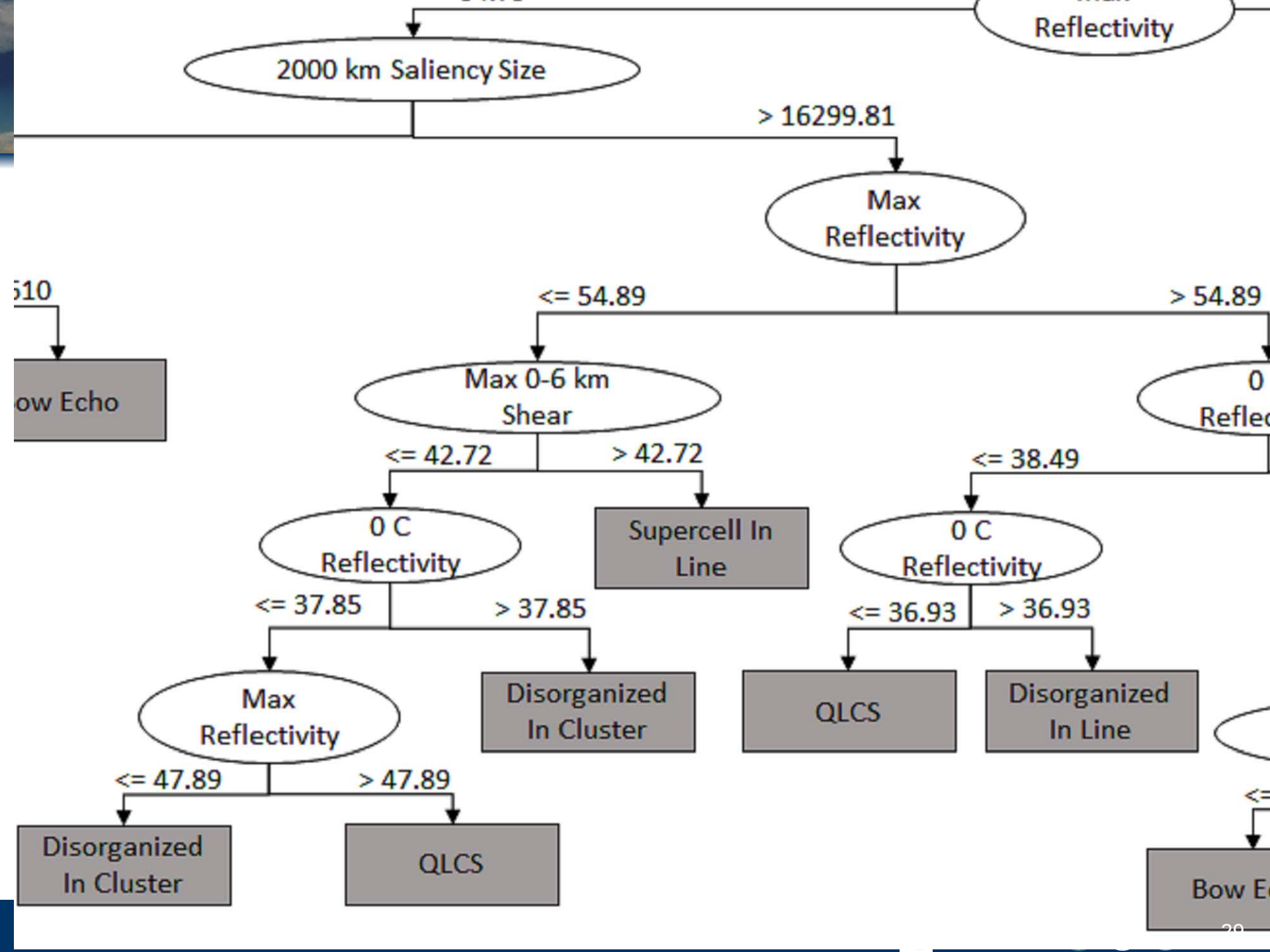


Based on:

Smith, B. T., R. L. Thompson, J. S. Grams, C. Broyles, and H. E. Brooks, 2012: Convective modes for significant severe thunderstorms in the contiguous United States. Part I: Storm classification and climatology. *Wea. Forecasting*, **27**, 1114–1135.

Storm classification: Example Decision Tree




Reflectivity
2000 km Saliency Size
> 16299.81
Max Reflectivity
<= 54.89
> 54.89
ow Echo
Max 0-6 km Shear
<= 42.72
> 42.72
<= 38.49
0 C Reflectivity
Supercell In Line
0 C Reflectivity
<= 37.85
> 37.85
<= 36.93
> 36.93
Max Reflectivity
Disorganized In Cluster
QLCS
Disorganized In Line
<= 47.89
> 47.89
Disorganized In Cluster
QLCS

Data mining & Nowcasting

Generate probability (P) of:

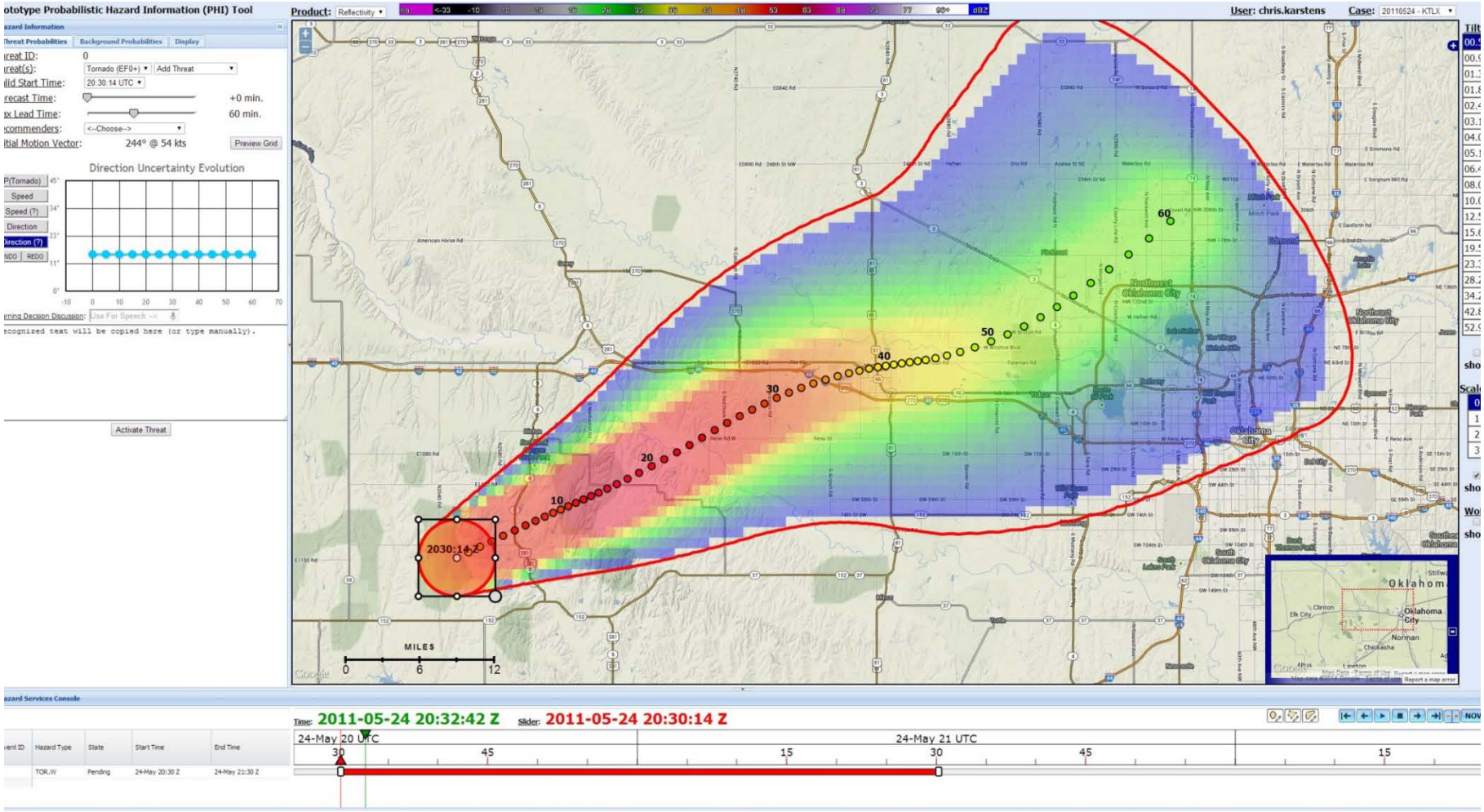
[tornado/wind/hail/heavy precip/lightning/mesocyclone/etc.]

For each storm cluster.

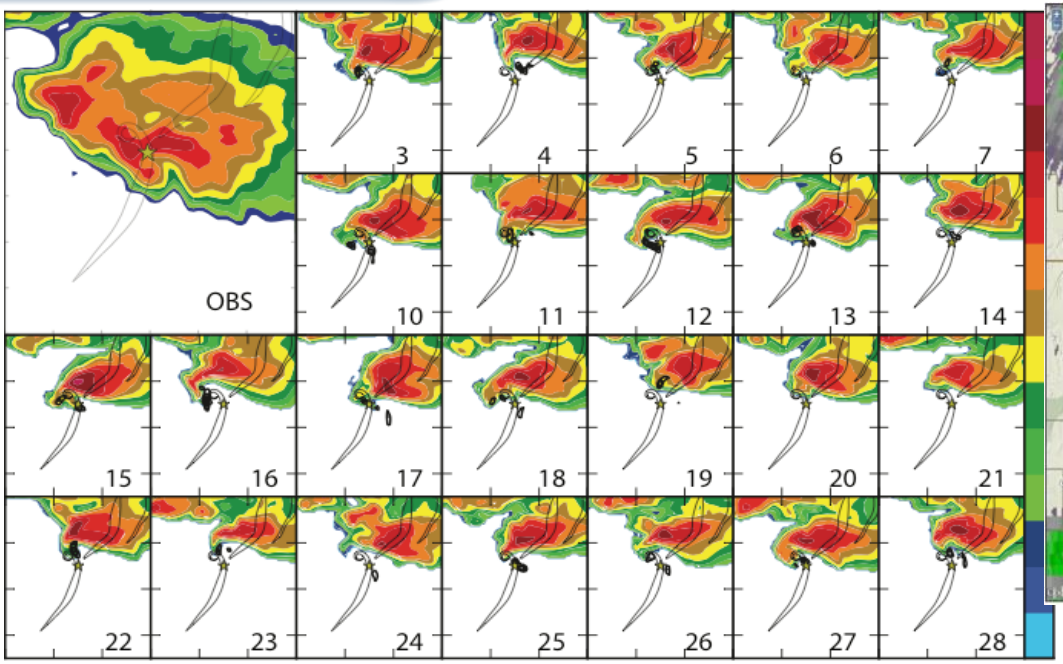
- P(event is ongoing)
- P(event will occur in X minutes)

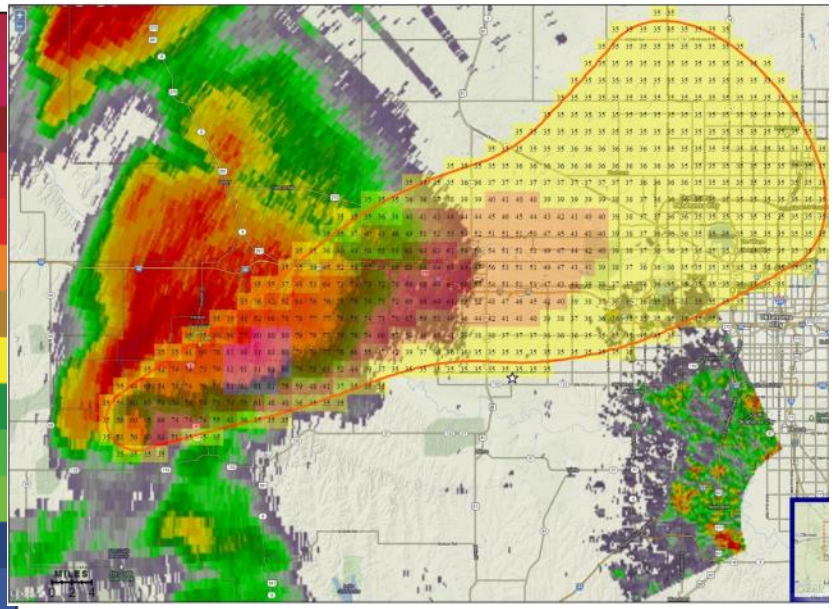
Probabilistic 0-60 minute Nowcast

Informed Probabilistic Hazard Information (PHI)



MYRORSS and NWP

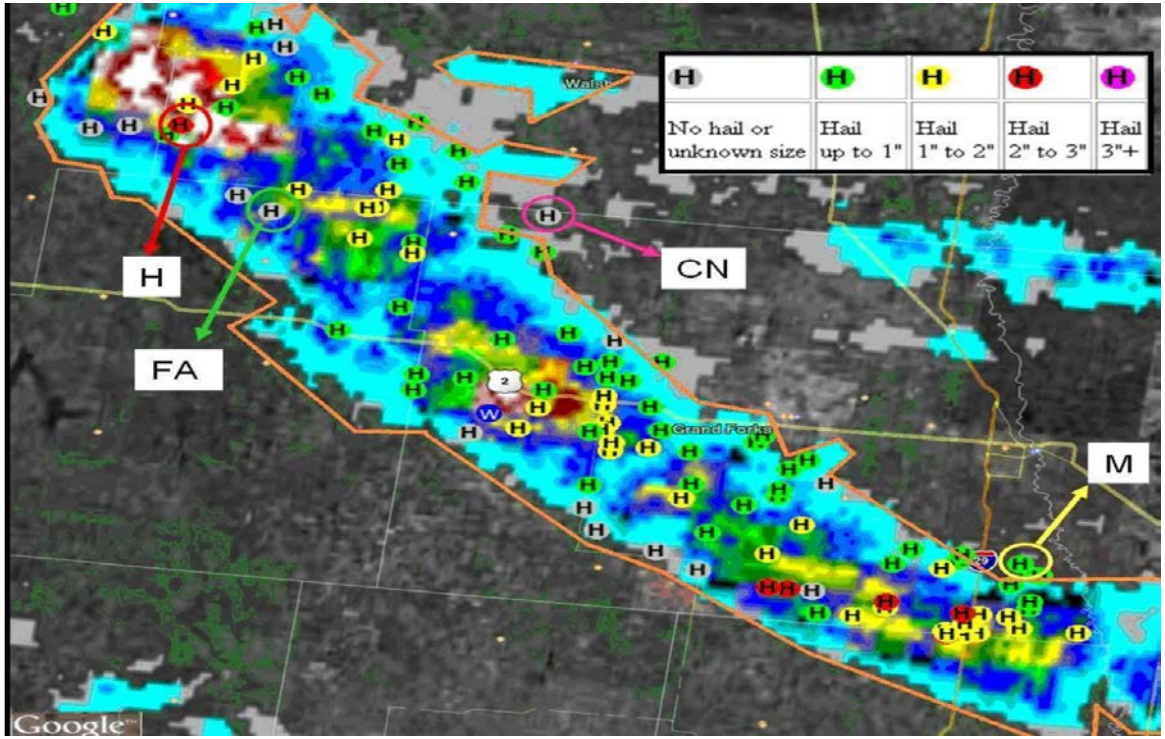




- Blending with 0-2 hour storm-scale ensembles
- Validation of storm mode in convection-allow models
- Baseline for evaluation of Warn-on-Forecast: beating climatology

High resolution verification & Synthetic verification

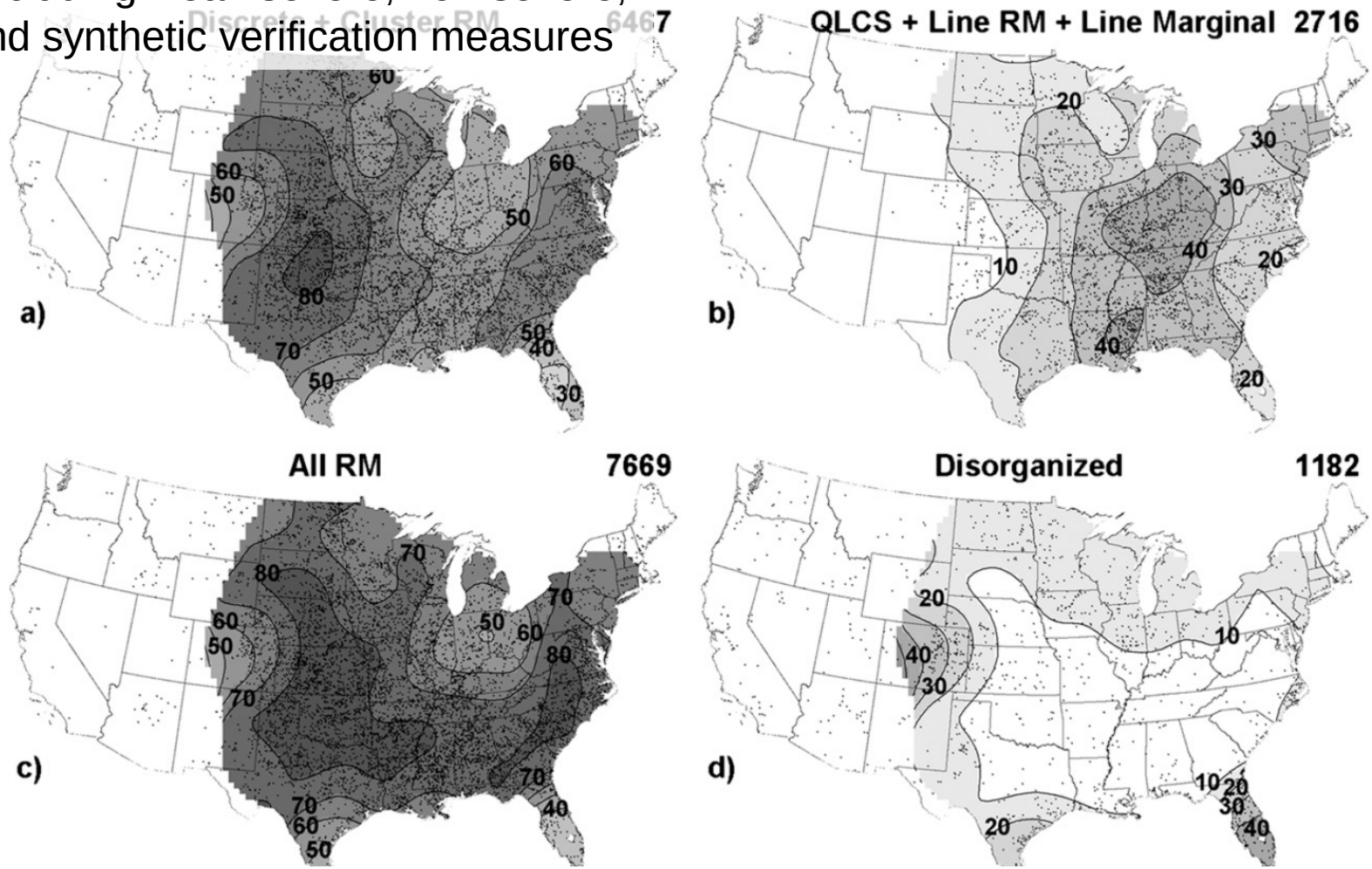
e.g. Severe Hazards Analysis and Verification Experiment; mPING; radar proxies for severe wx…



Days of operation:	554
Total data points:	63353
Hail data points:	45406
Wind data points:	6456
Flood data points:	9313
Winter data points:	2178
Questionable time:	33371
'No wind' reports:	4117
'No flood' reports:	6821
'No hail' reports:	20226
Non-svr hail reports:	15196
Svr hail reports:	8848
Sig hail reports:	1021
Measured hail reports:	380
Measure avg reports:	89

Relational database: storm type / severity by environment

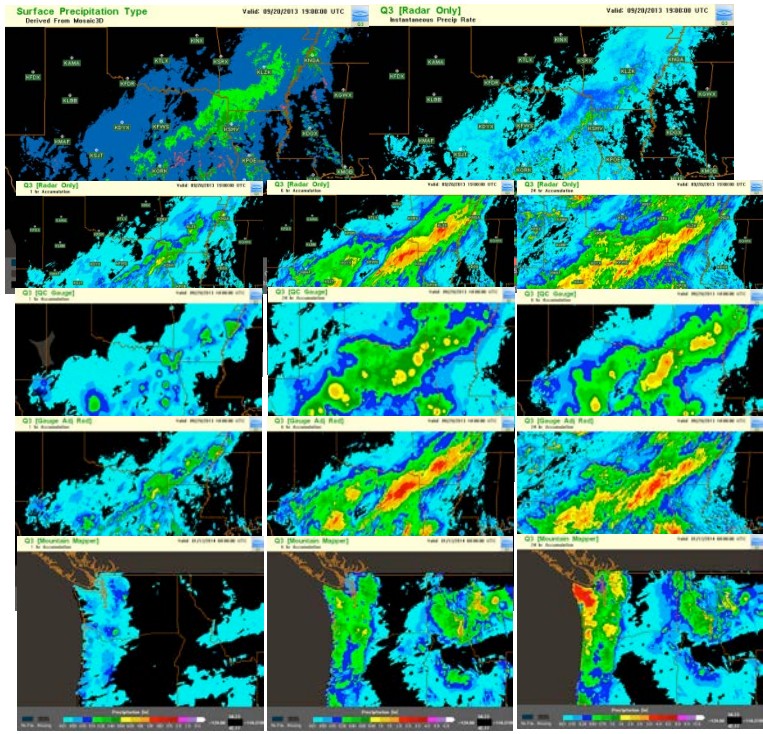
Supplement to Smith et al. 2012, including weak severe, non-severe, and synthetic verification measures

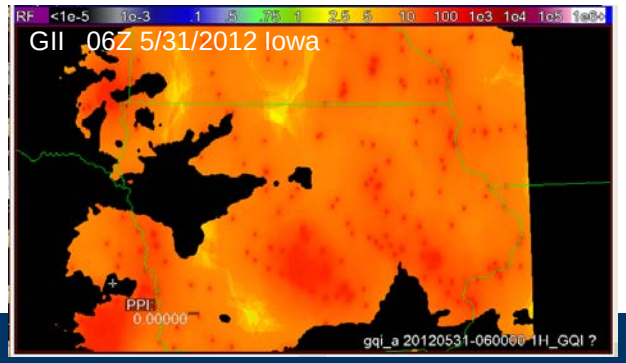


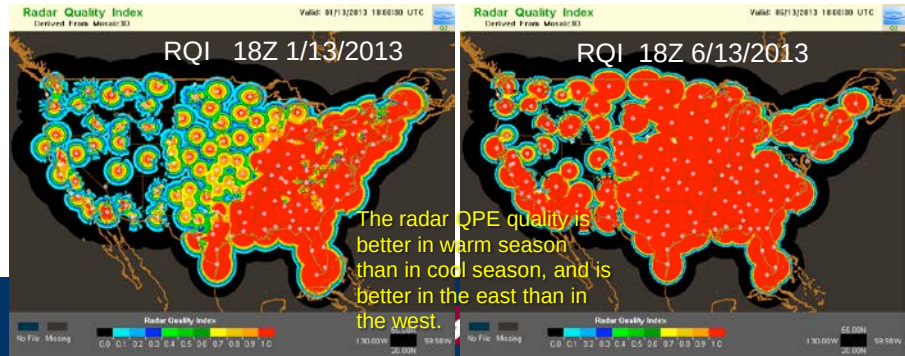
Quantitative Precipitation Estimation

Key MRMS *QPE* Products

- Surface Precip Type
- Surface Precip Rate
- Radar QPE (1, 6, 24, 48, 72h, 10day acc)
- Gauge QPE
- Local gauge bias corrected radar QPE
- Gauge + orographic pcp climatology QPE
- Radar QPE Quality Index (RQI)
- Gauge Influence Index (GII)







Other Opportunities & Plans

- Fix issues, re-run! (and again, and again…)
- Near real time addition of new data
- Web front end for data mining / case studies by collaborators
- Aviation
- Insurance / Reinsurance
- Climate
- Agriculture
- And more!

Summary

MYRORSS processing is ongoing

Many QC issues identified

Next: post processing

QPE radar retrospective is another talk

Many science opportunities at many time/space scales

Kiel.Ortega@noaa.gov; Travis.Smith@noaa.gov