The Role of LAPS in the National Weather Service: Now and the Future

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Overview of Topics

- LAPS configuration in the NWS (Ben)
- LAPS visualization in forecast operations (Jeffrey)
- LAPS usage across the NWS (Darrel)
- Future applications with LAPS (Ben)

The Advanced Weather Interactive Processing System (AWIPS)

AWIPS is an integrated suite of automated data-processing equipment that supports complex analysis, interactive processing, display of hydrometeorological data, and the rapid dissemination of warnings and forecasts in a highly reliable manner.

- Fielded in mid-90s
- Self contained processing and display system:
  - Decoders
  - Visualization
  - Dissemination of products (warnings)
  - Archiver

AWIPS D2D 3-monitor Display

LAPS in AWIPS

- LAPS-0-25-9
  - No national NWS training
- Background Models:
  - RUC 40
  - ETA 48
  - No capability for higher-res models

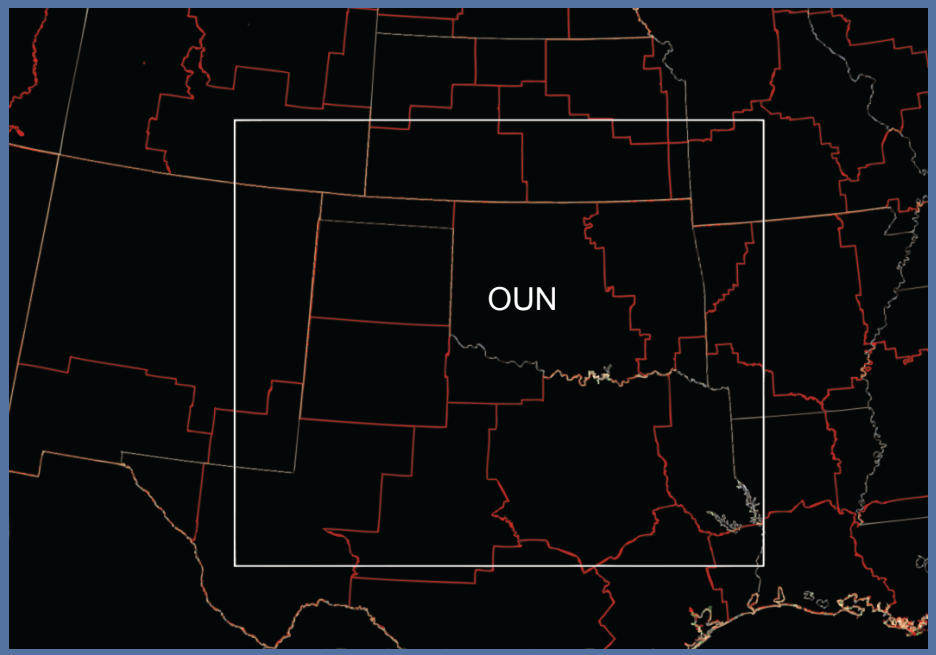
- Input data:
  - Metar
  - Maritime
  - Raob
  - Acars/Pireps
  - level-3 radar
  - Profiler
  - Satellite

CRON Entries:

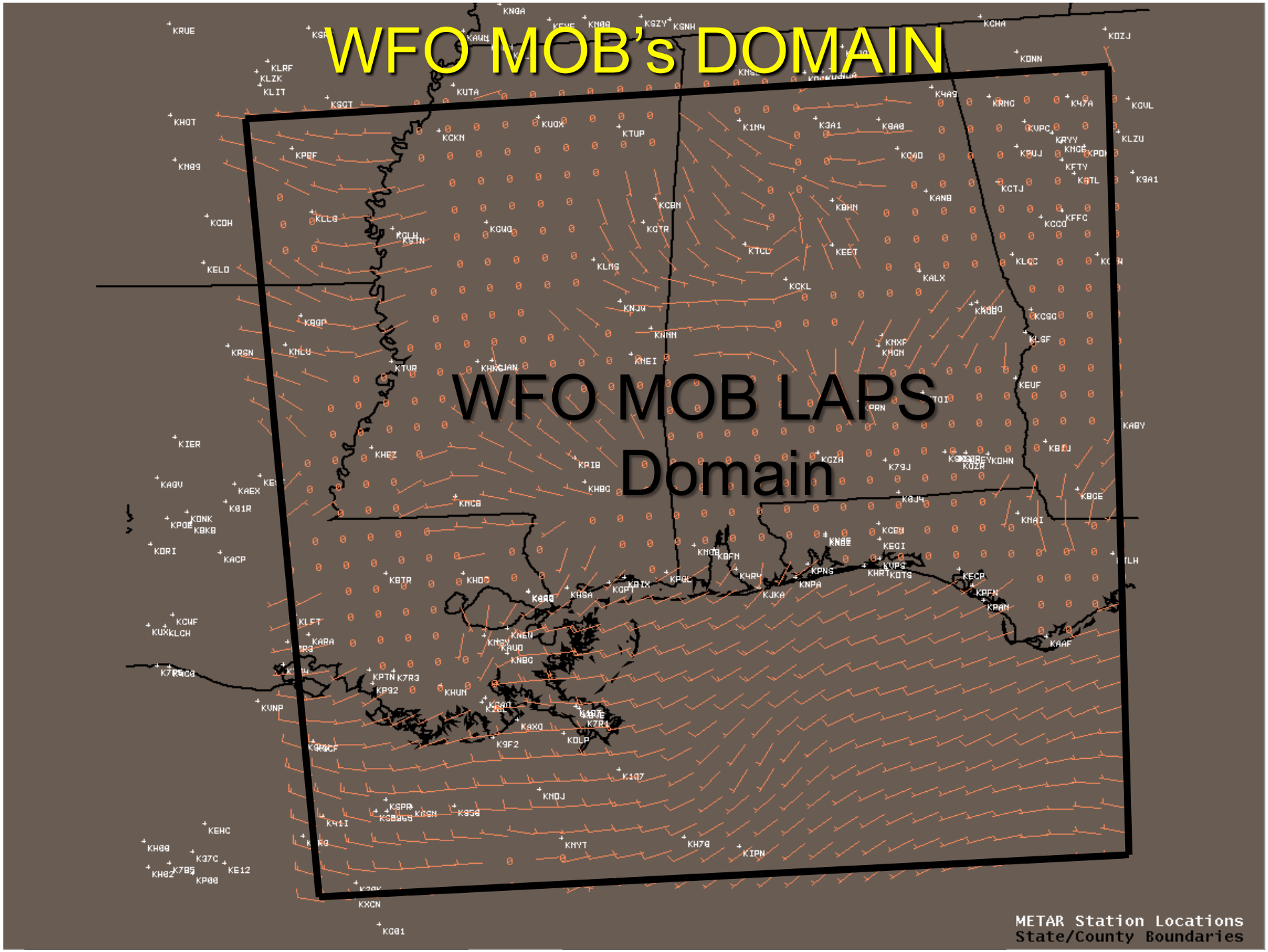
```
20 * * * * perl /awips/laps/etc/sched.pl /awips/laps/ /awips/laps/data

03,19,34,49 * * * * perl /awips/laps/etc/laps_driver.pl vrc_driver.x /awips/laps /awips/laps/data

08,14,23,29,38,45,53,59 * * * * perl /awips/laps/etc/laps_driver.pl lvd_sat_ingest.exe /awips/laps /awips/laps/data
```

LAPS Processing in AWIPS

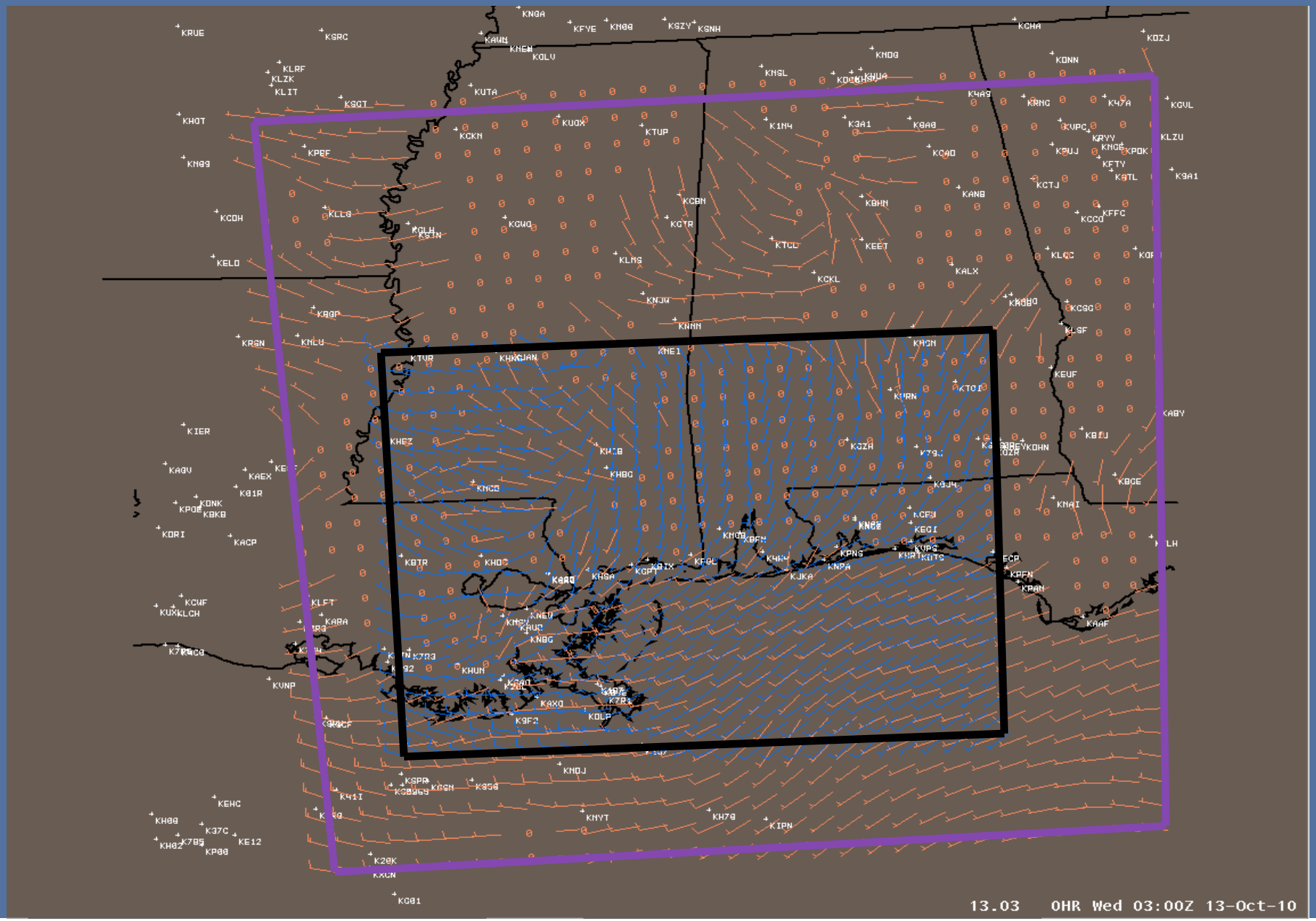
- LAPS Default Domain:
  - 10 km grid spacing
  - ~ 600 km by 600 km
  - Centered over the area of responsibility.



WFO MOB's DOMAIN

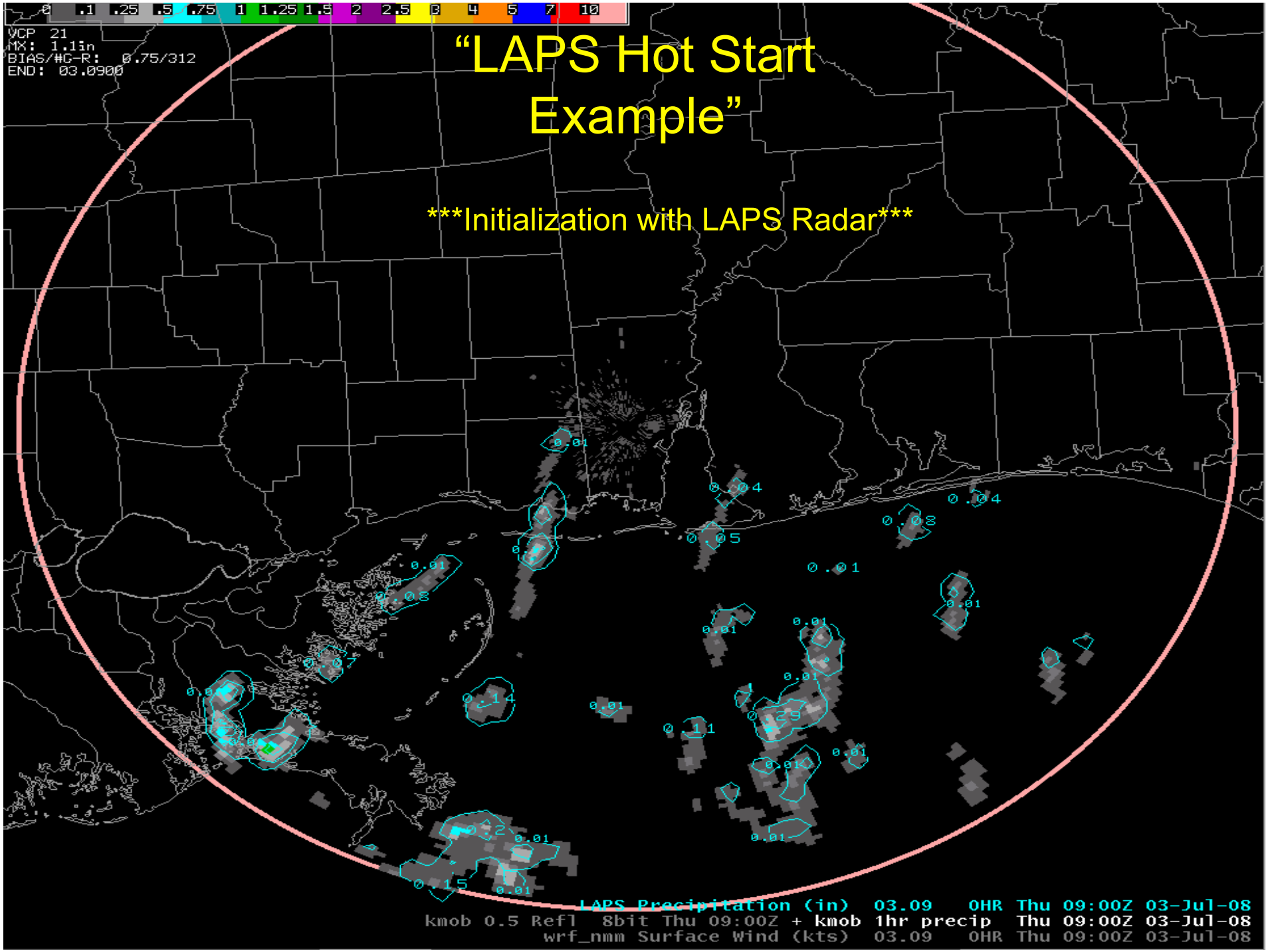


WFO MOB's WRF Domain



“LAPS Hot Start Example”

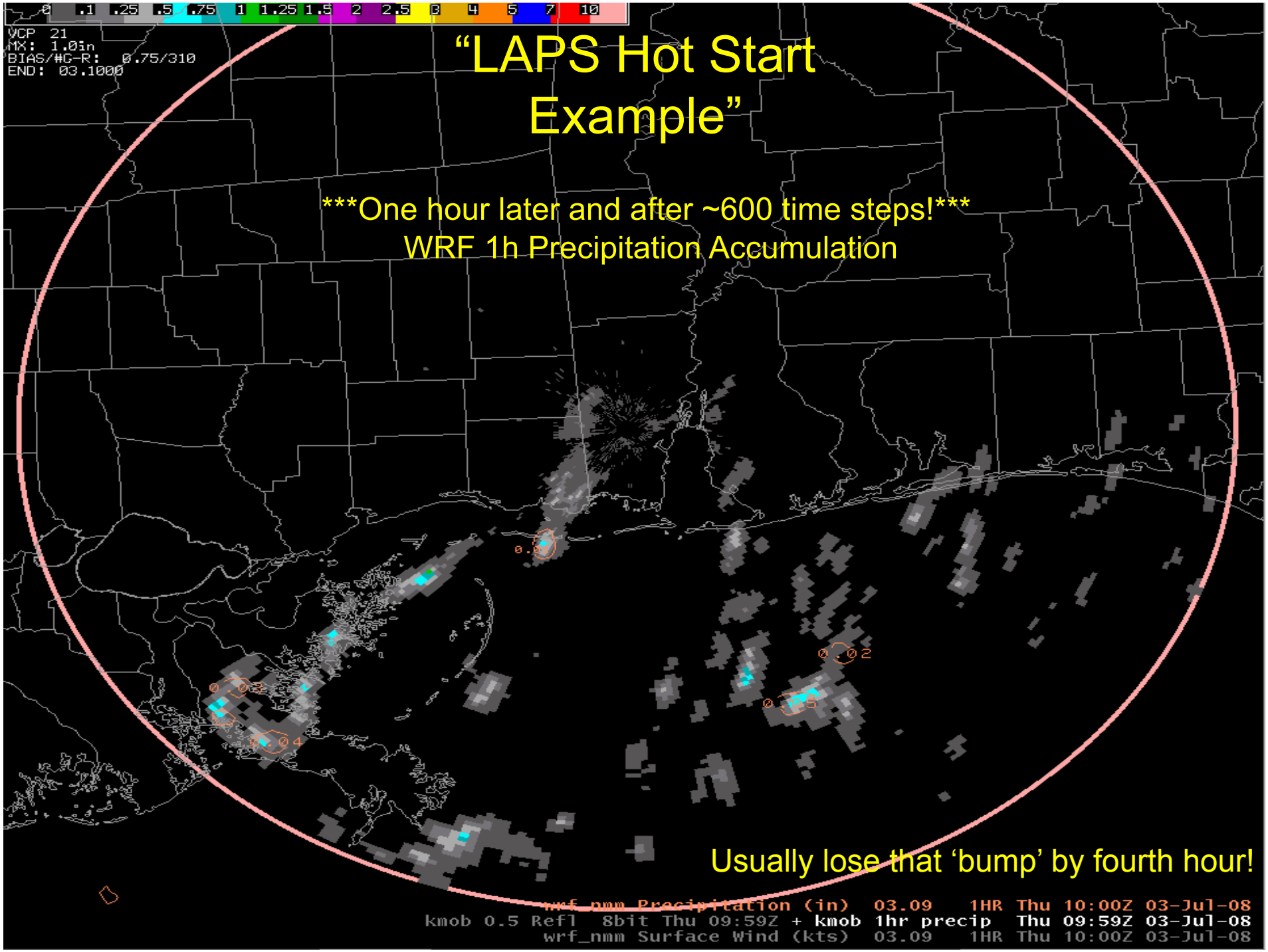
Initialization with LAPS Radar



“LAPS Hot Start Example”

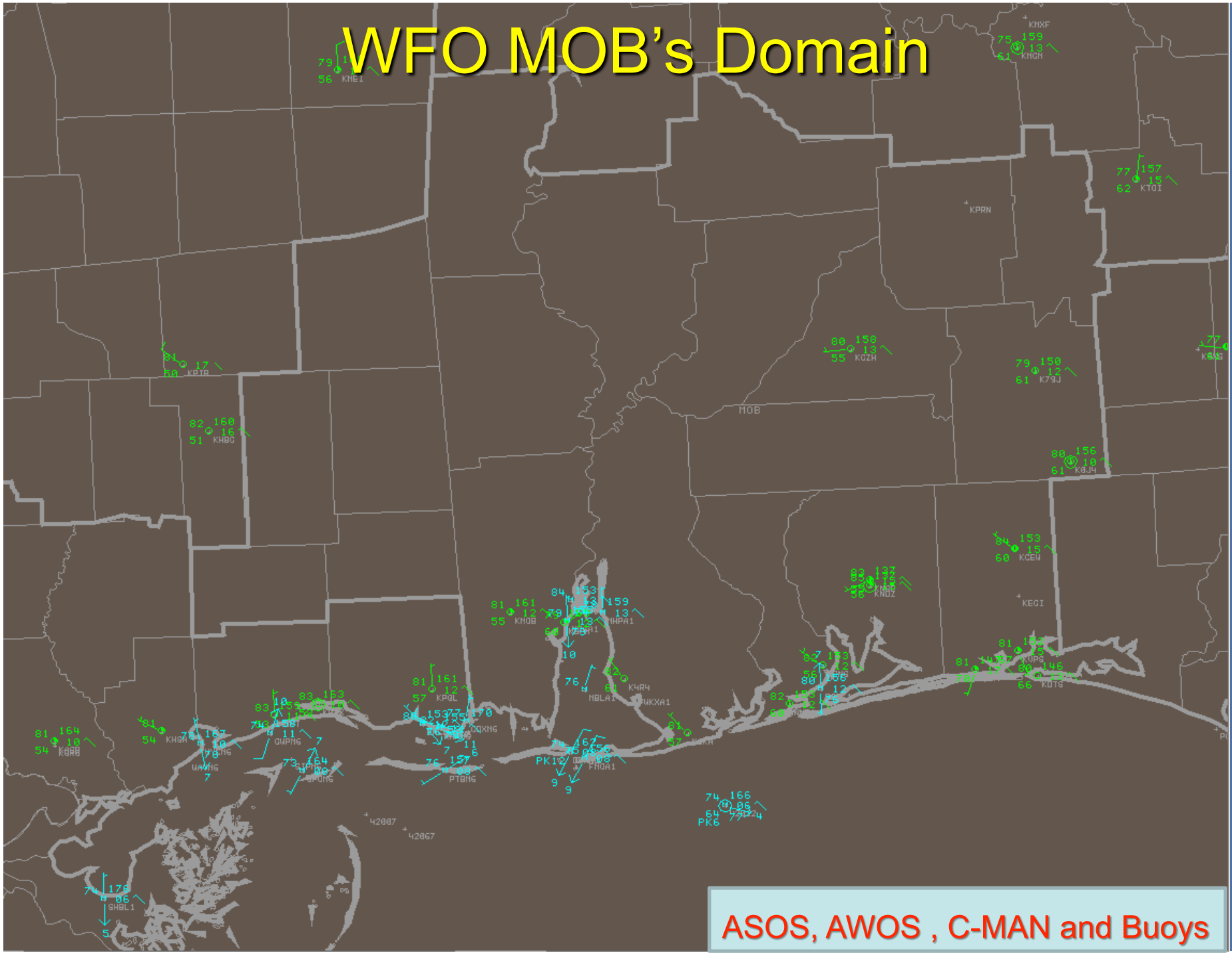
One hour later and after ~600 time steps!

WRF 1h Precipitation Accumulation



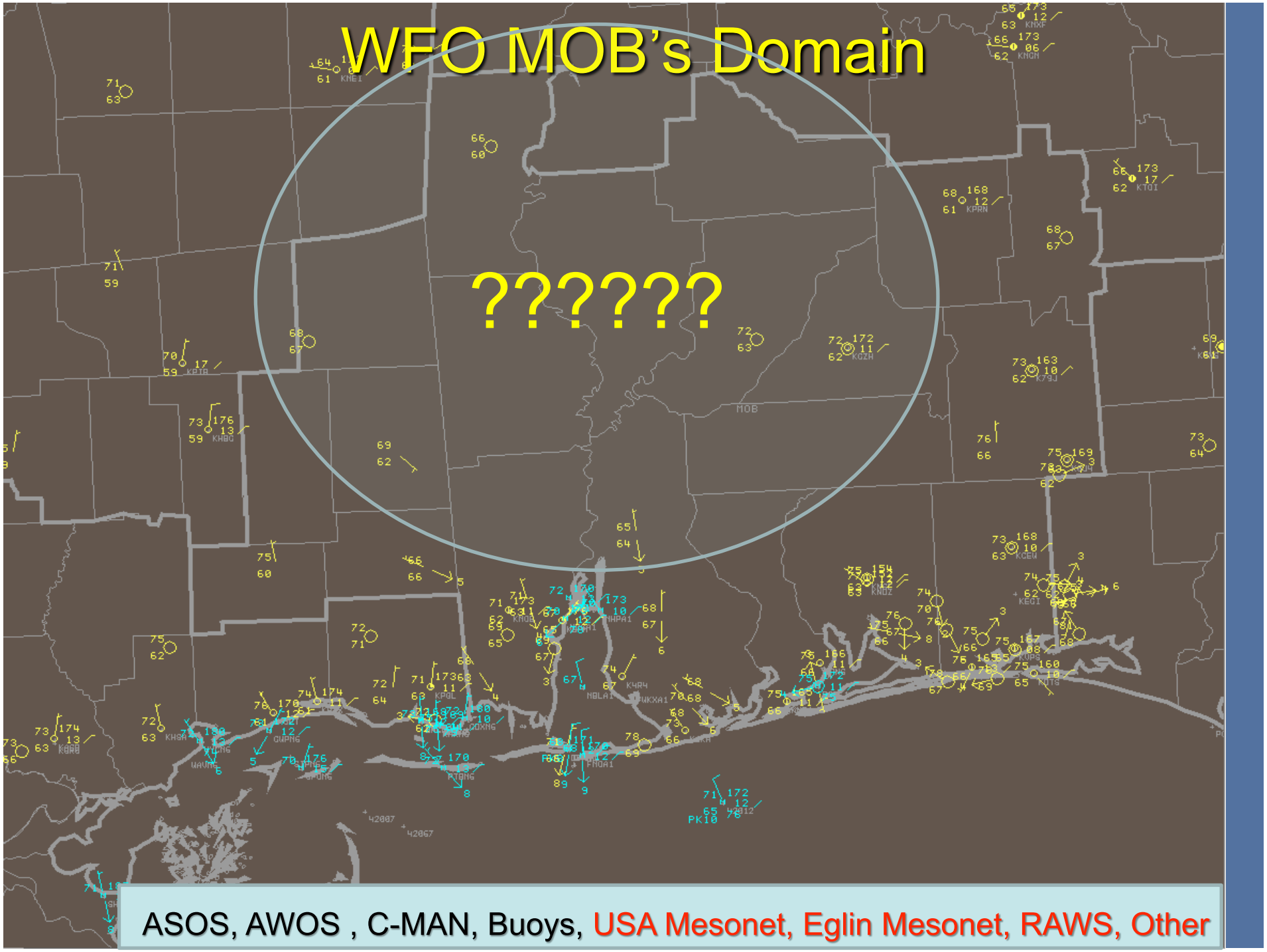
Usually lose that ‘bump’ by fourth hour!

WFO MOB's Domain



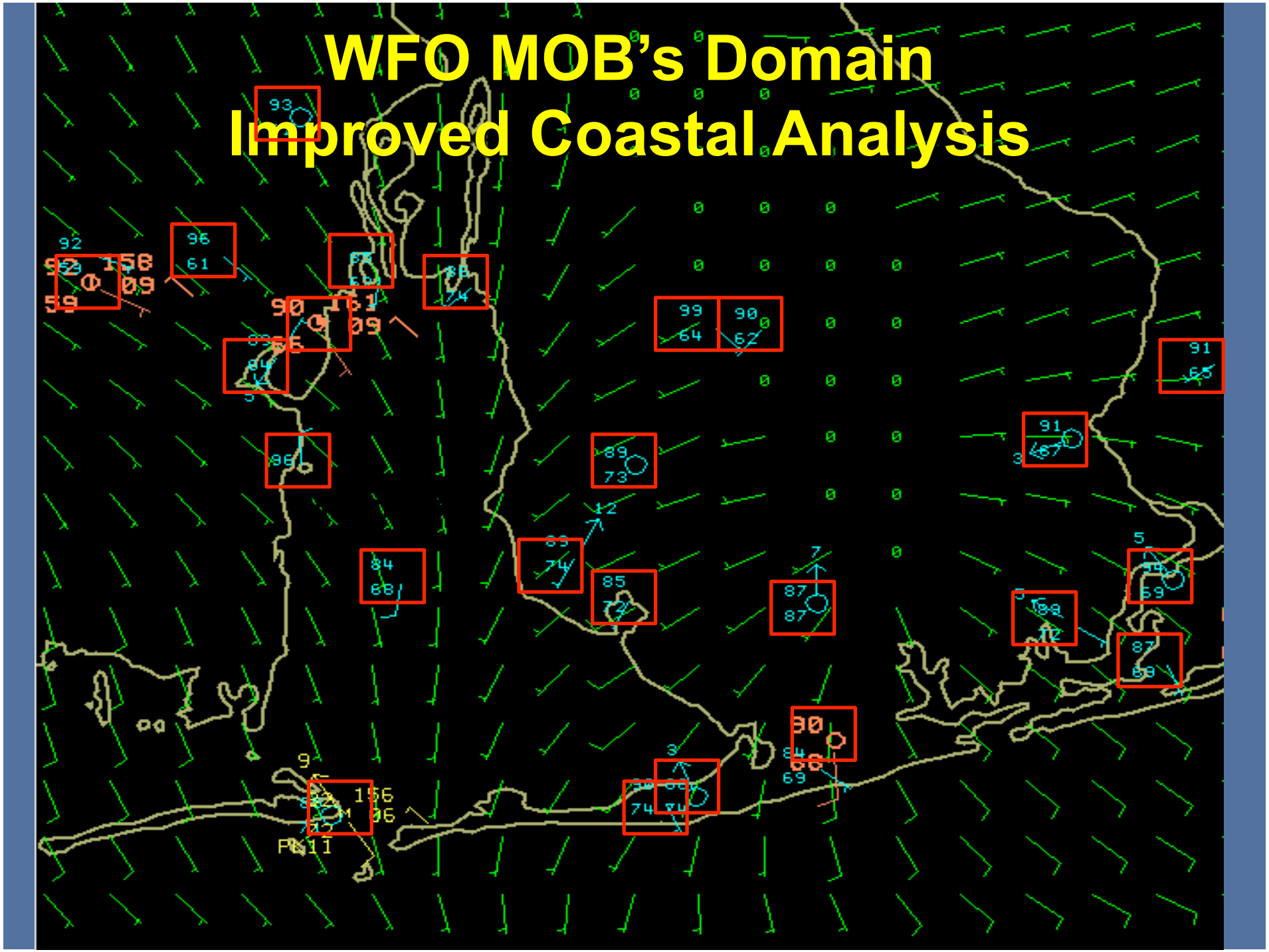
ASOS, AWOS , C-MAN and Buoys

WFO MOB's Domain

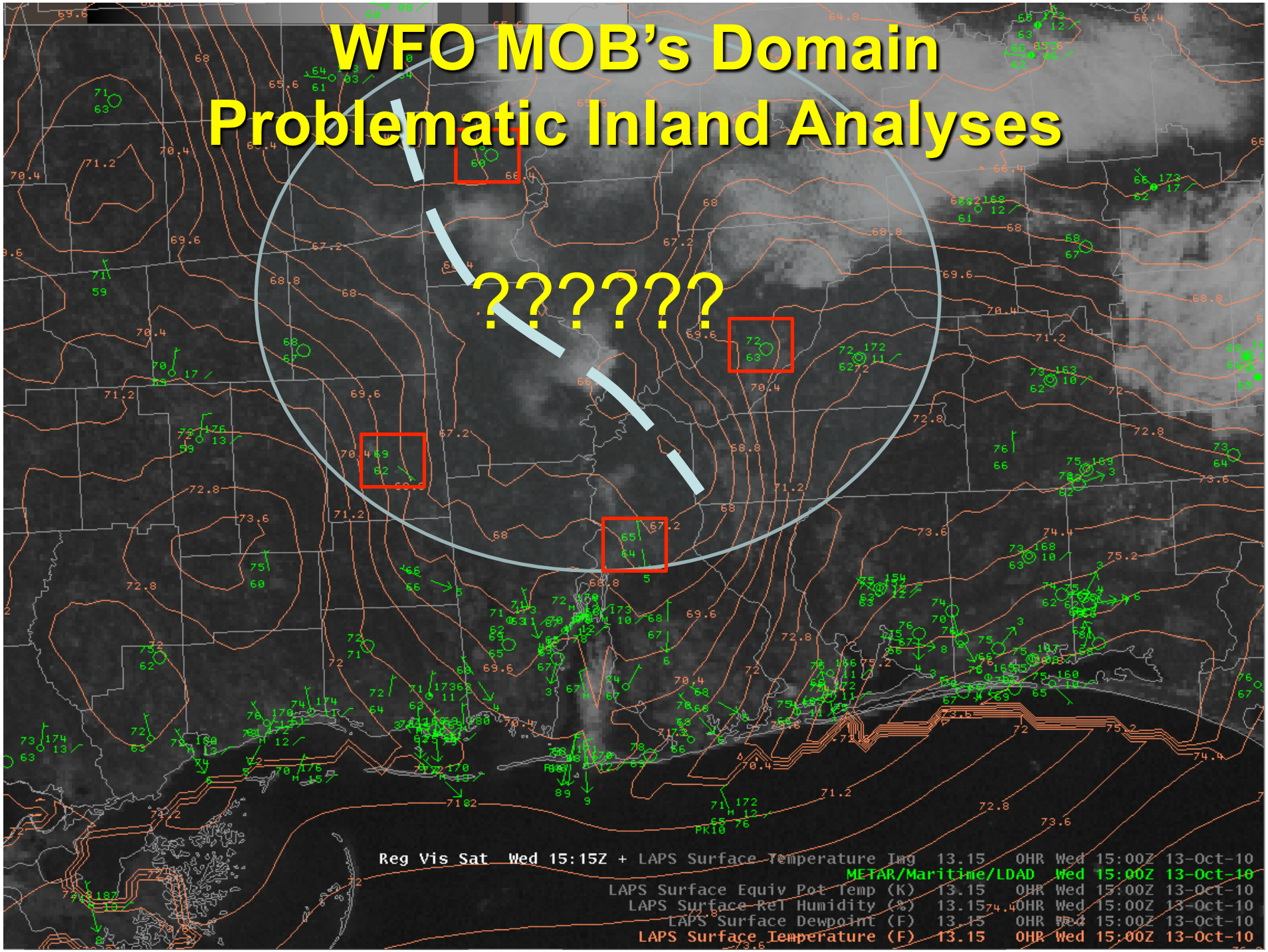


ASOS, AWOS , C-MAN, Buoys, USA Mesonet, Eglin Mesonet, RAWS, Other

WFO MOB's Domain
Improved Coastal Analysis



WFO MOB's Domain
Problematic Inland Analyses



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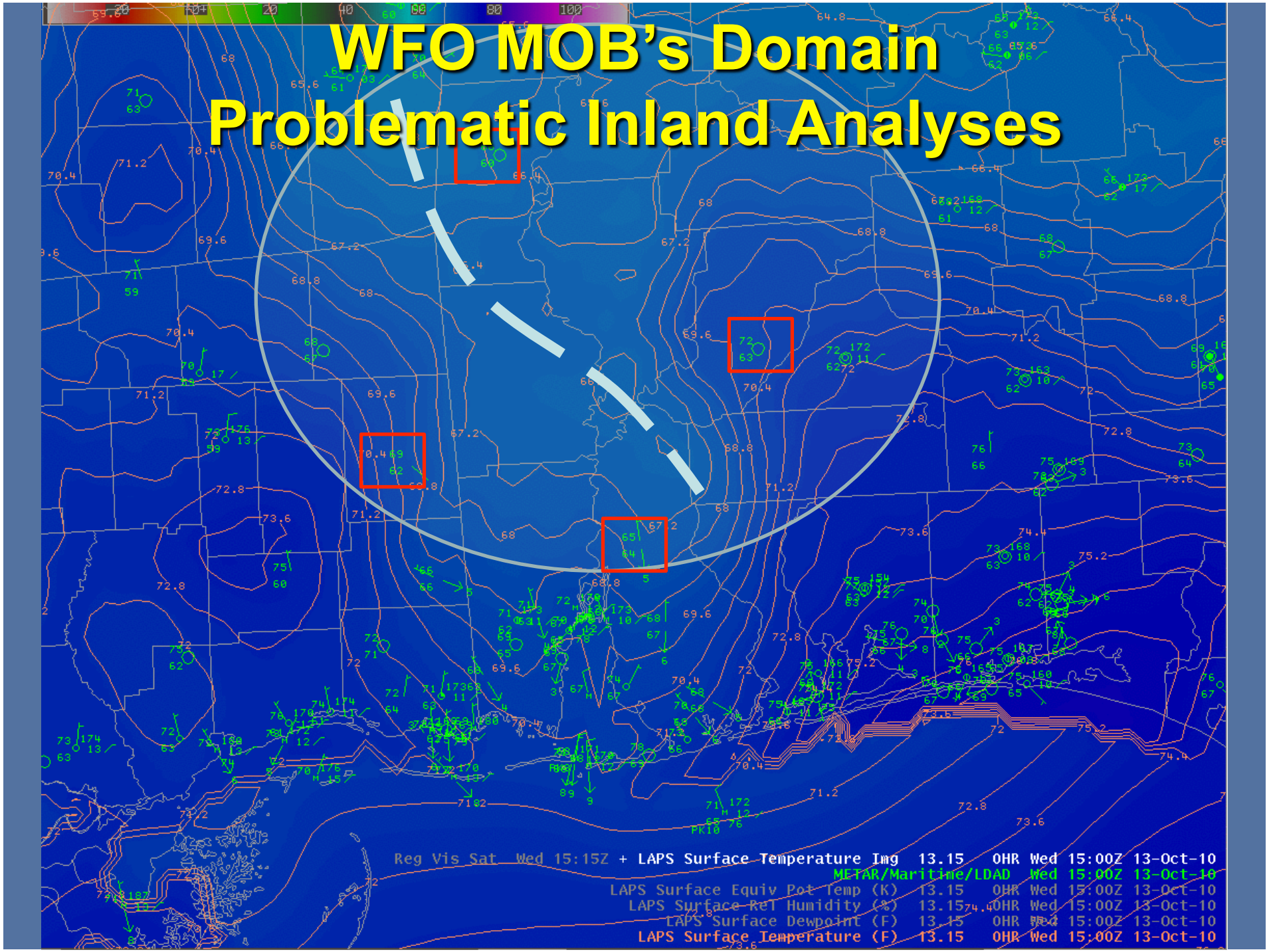
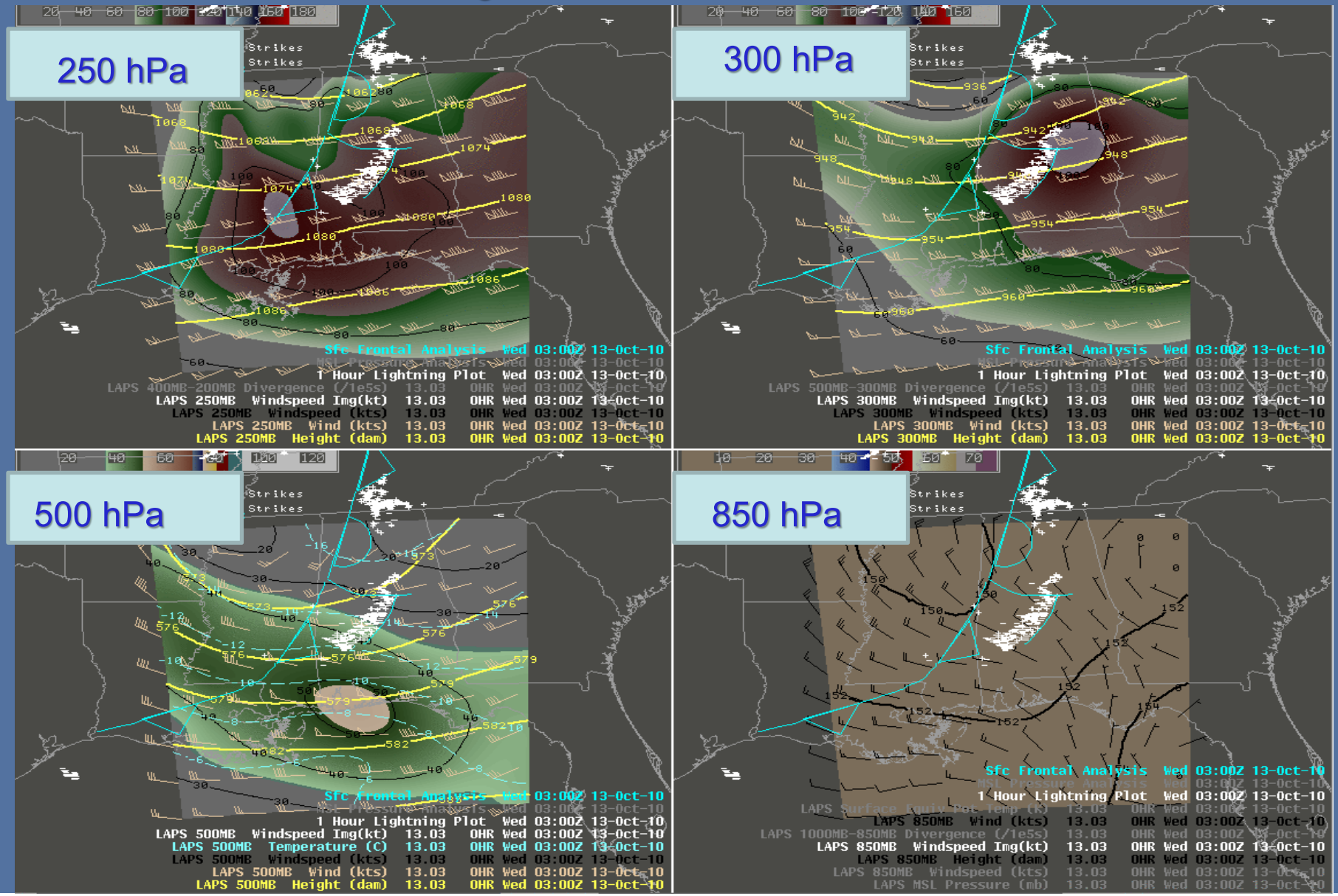


Most Popular NWS Mobile, AL Applications

- Big Picture with Local Detail!



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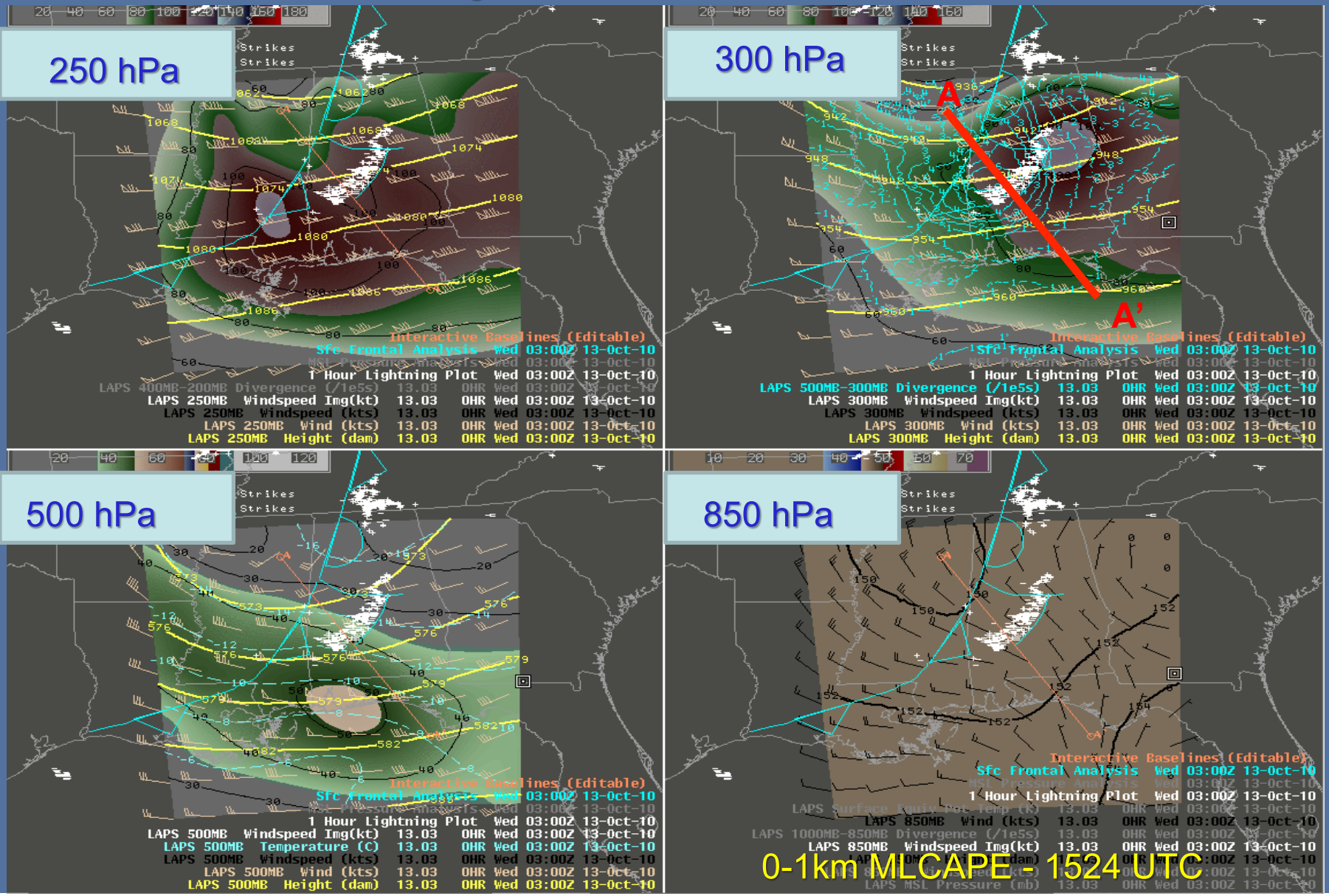

0-1km MLCAPE - 1524 UTC

Most Popular NWS Mobile, AL Applications

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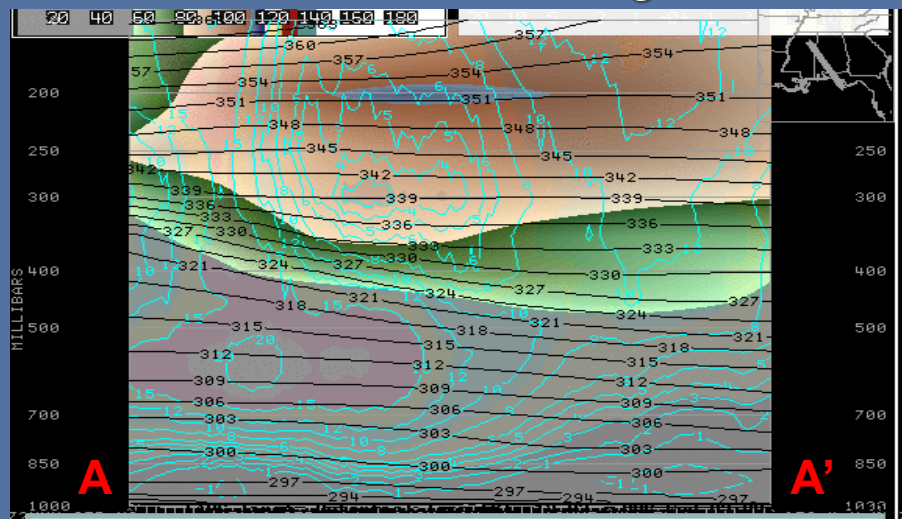
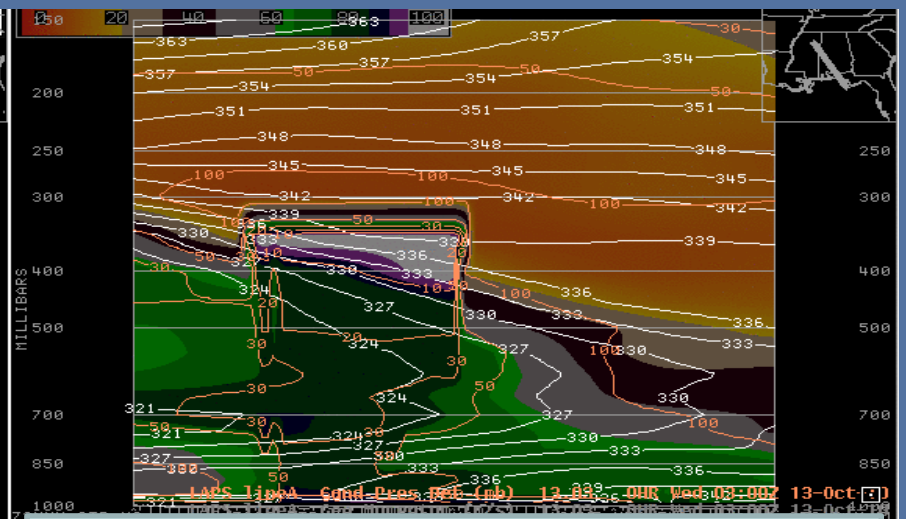
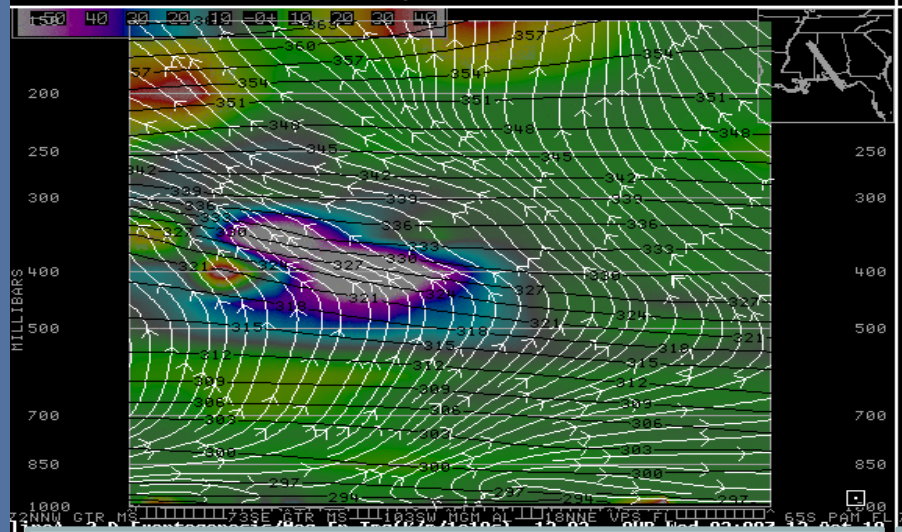


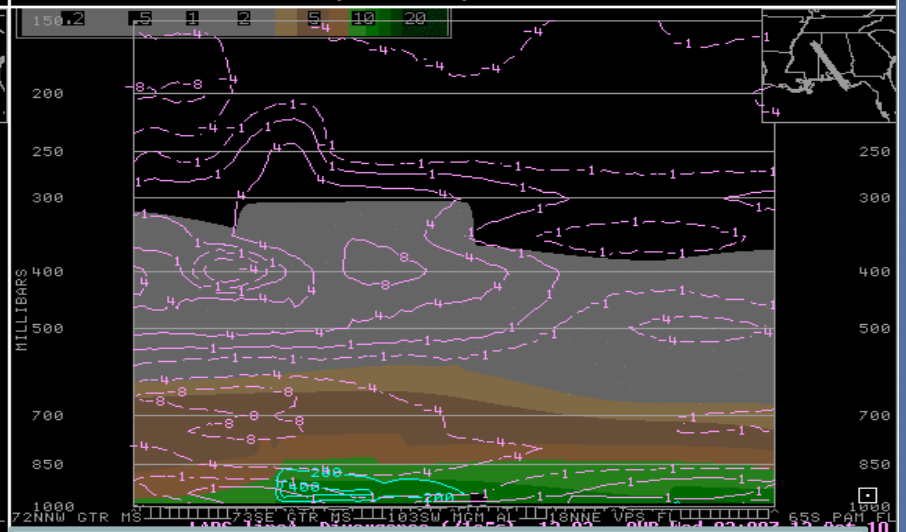
LAPS ω, isotachs and Θ



LAPS RH, Θ and condensation PDEF



LAPS frontogenesis and ageo vert crcln

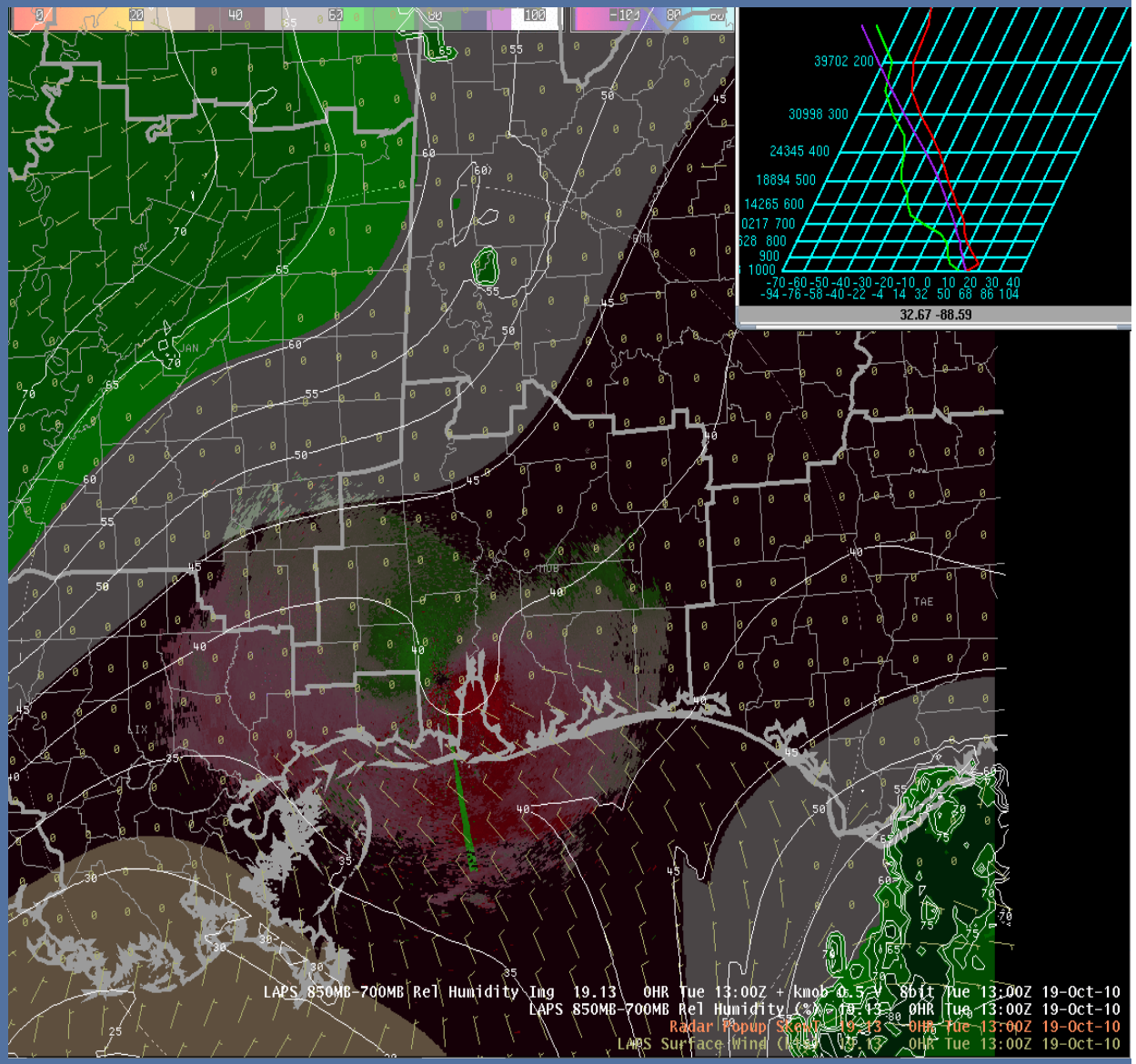


LAPS DIV, CAPE and q

Most Popular NWS Mobile, AL Applications

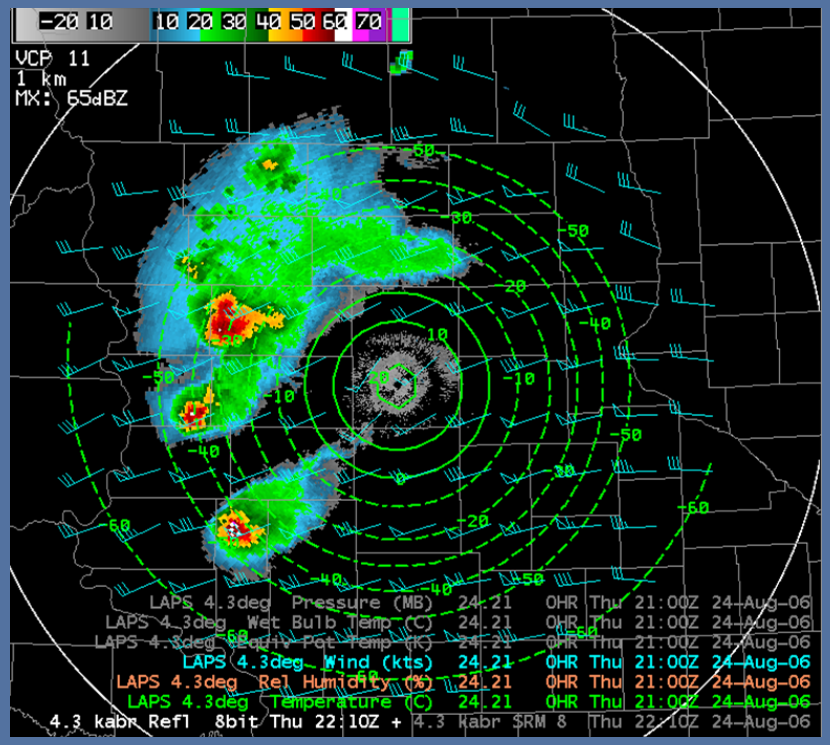
-POP-UP Skew -T *log* P

- Can quickly compare LAPS to other NWP sources.
- Very useful for quickly scanning lapse rates and moisture distribution over entire area at once without loading point soundings which can take extra time.
- Would like to see parameters display as one roams around though.
- Also feel Skew-T display could be made to be larger.

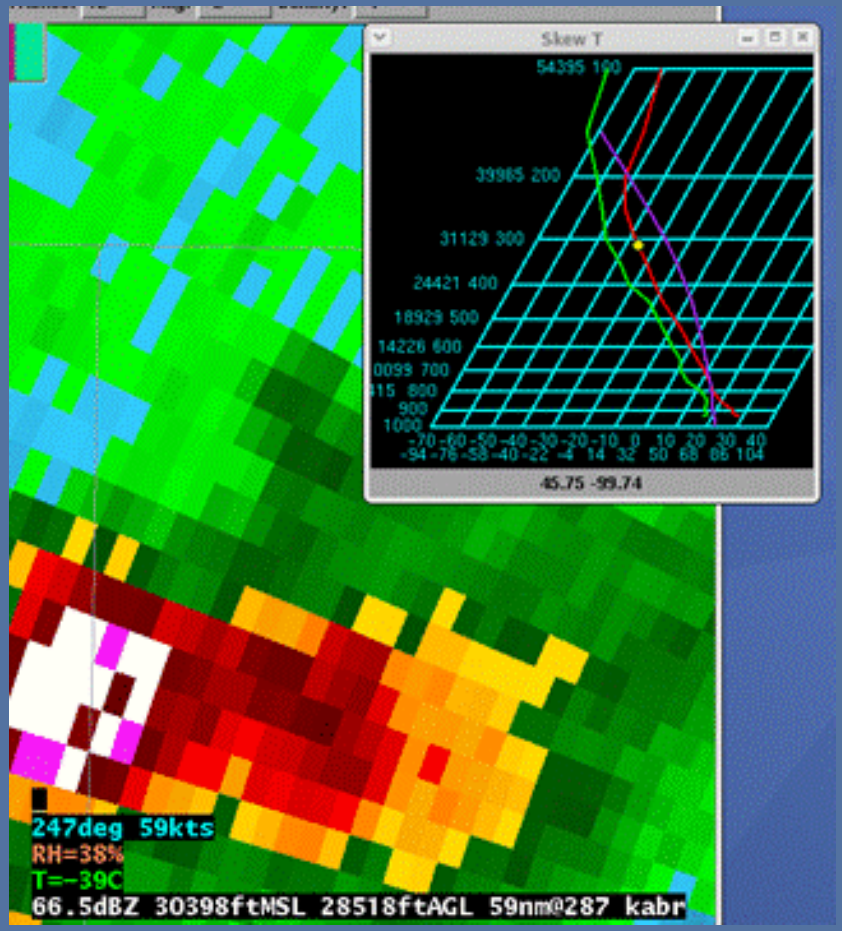


Other Tools that Use LAPS

-Standard Environmental Data Packages



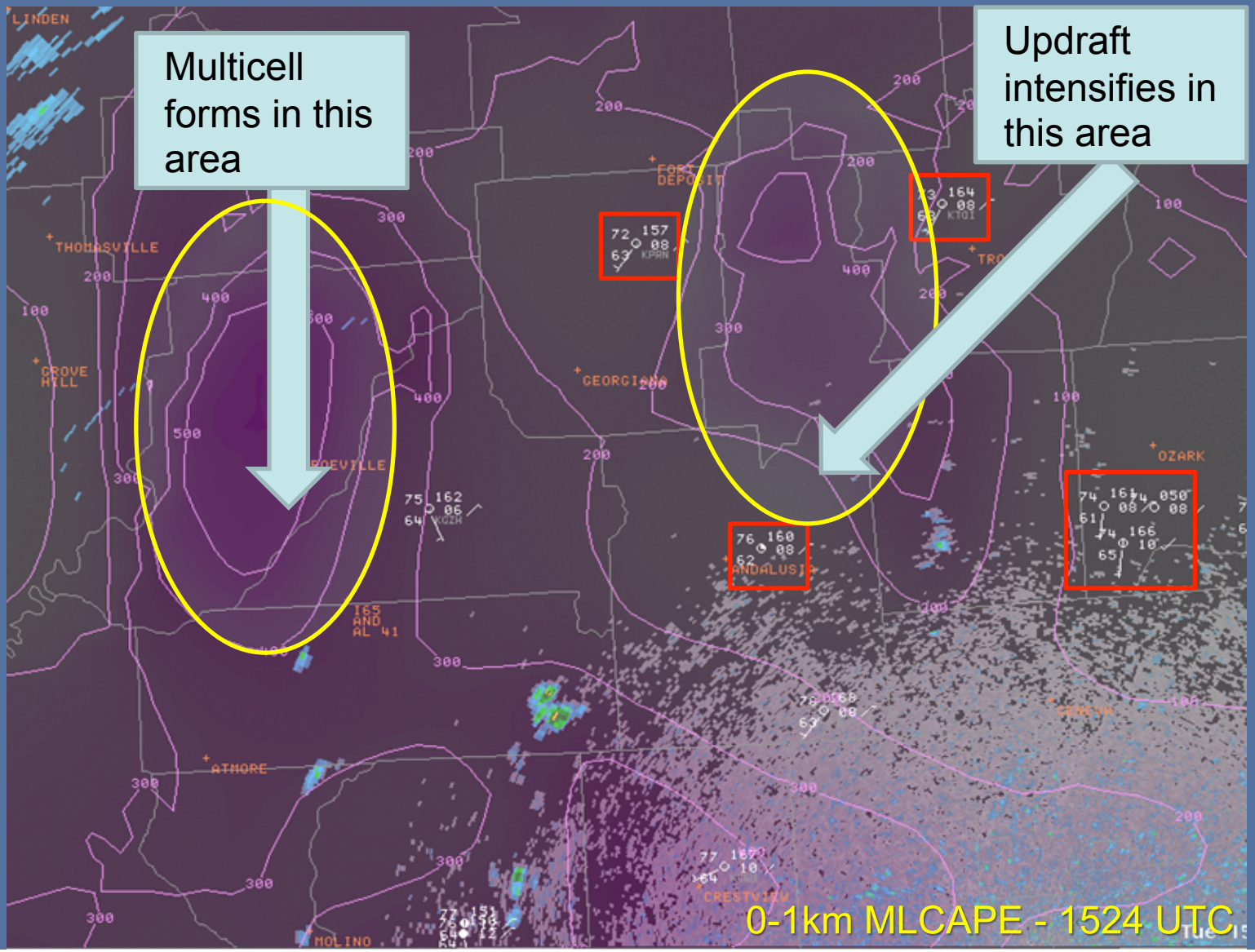
- Maps environmental data to radar tilts
  - isotherms, wind vectors, etc



- Allows cursor sampling of environment data at height of radar bin and display height on Popup SkewT

Most Popular NWS Mobile, AL Applications

- Integrated Quantities-



Most Popular NWS Mobile, AL Applications

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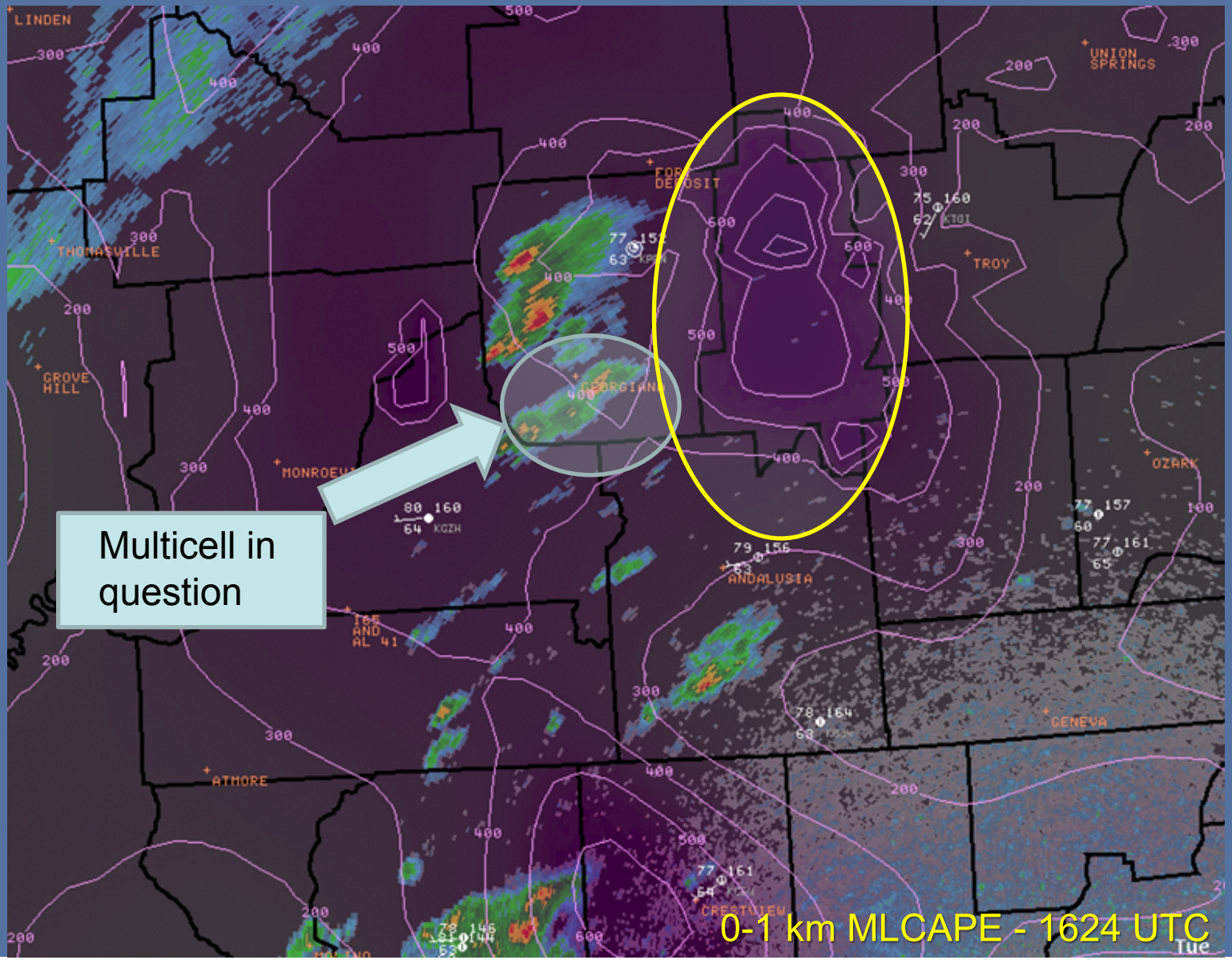

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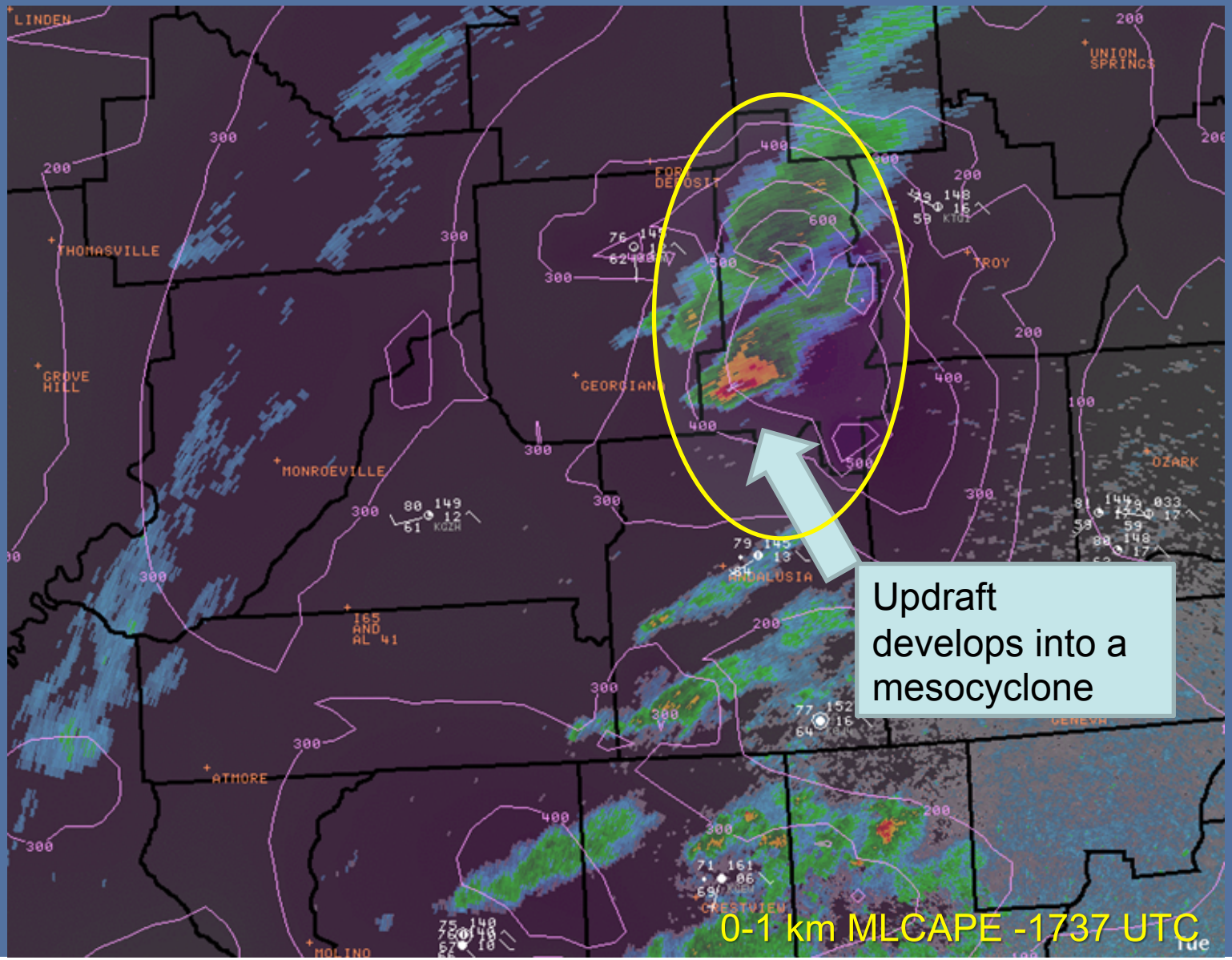
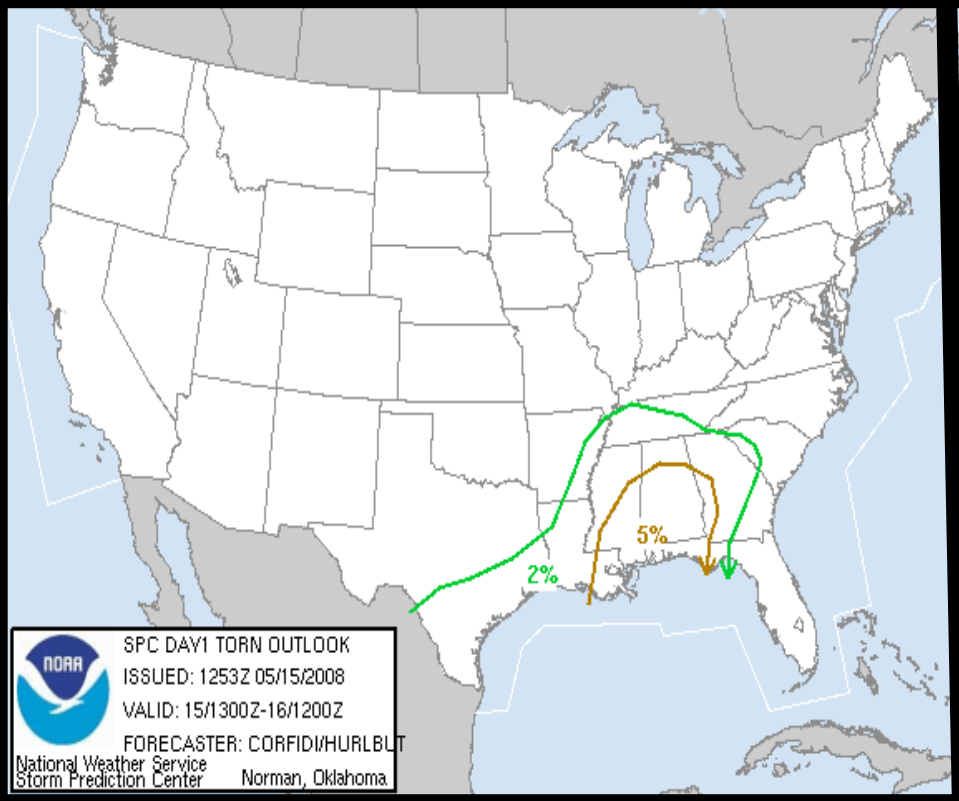
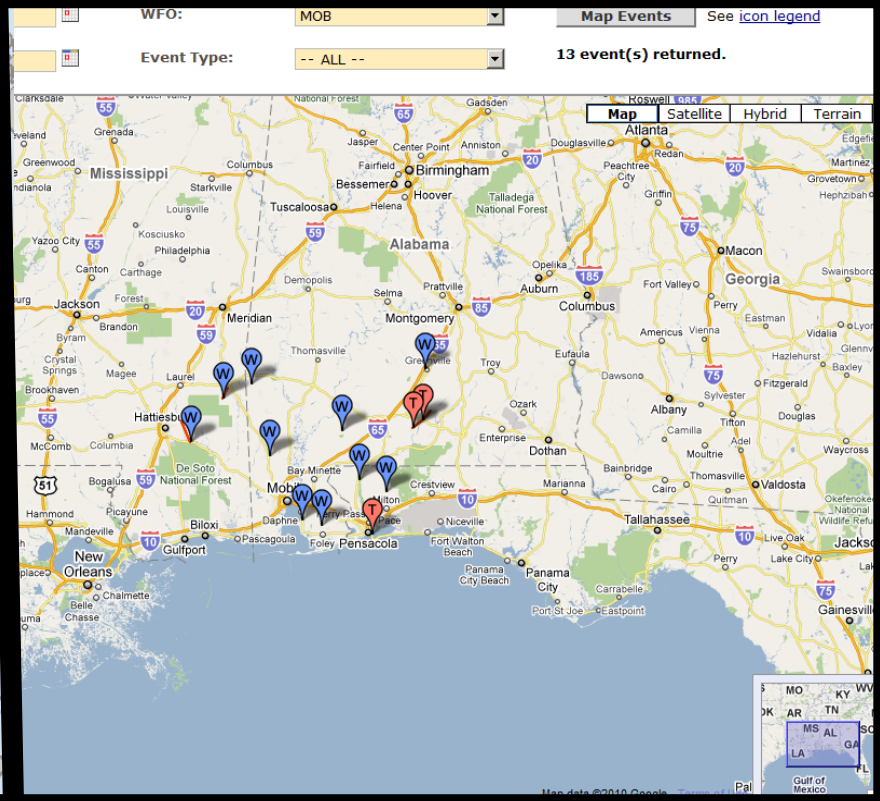


Most Popular NWS Mobile, AL Applications

- Integrated Quantities-

Local Tornado Warning Example
- 15 May 2008 -





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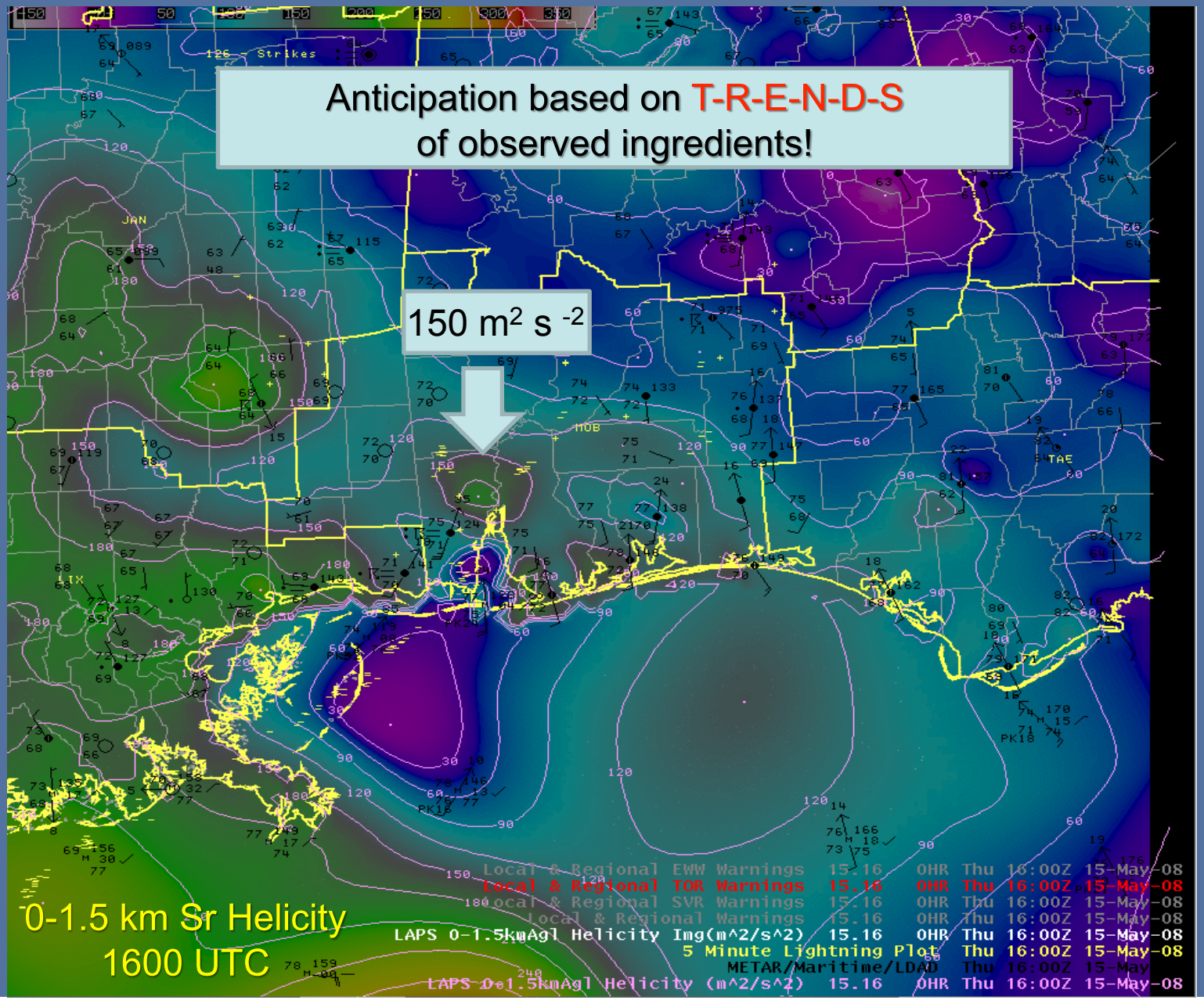

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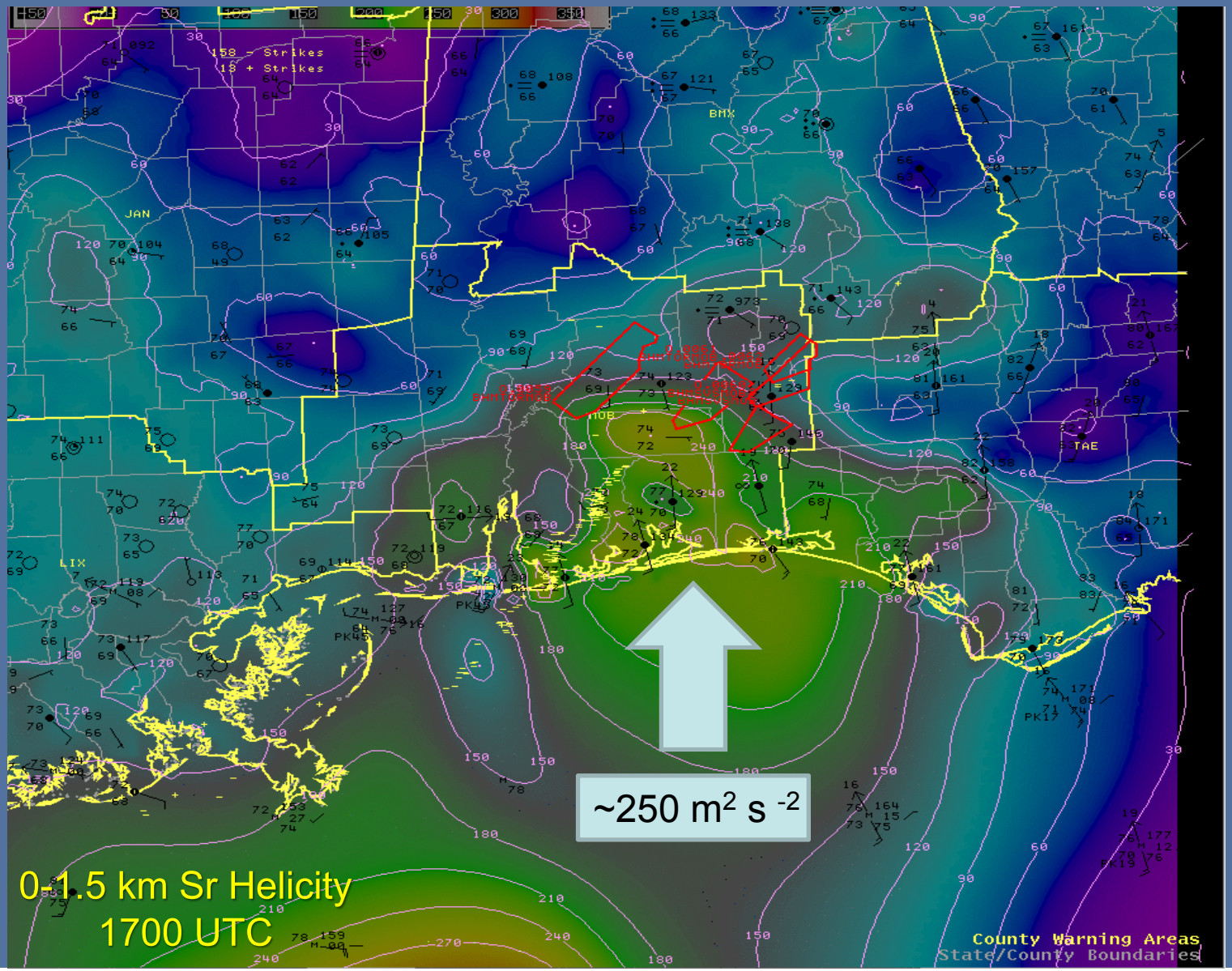

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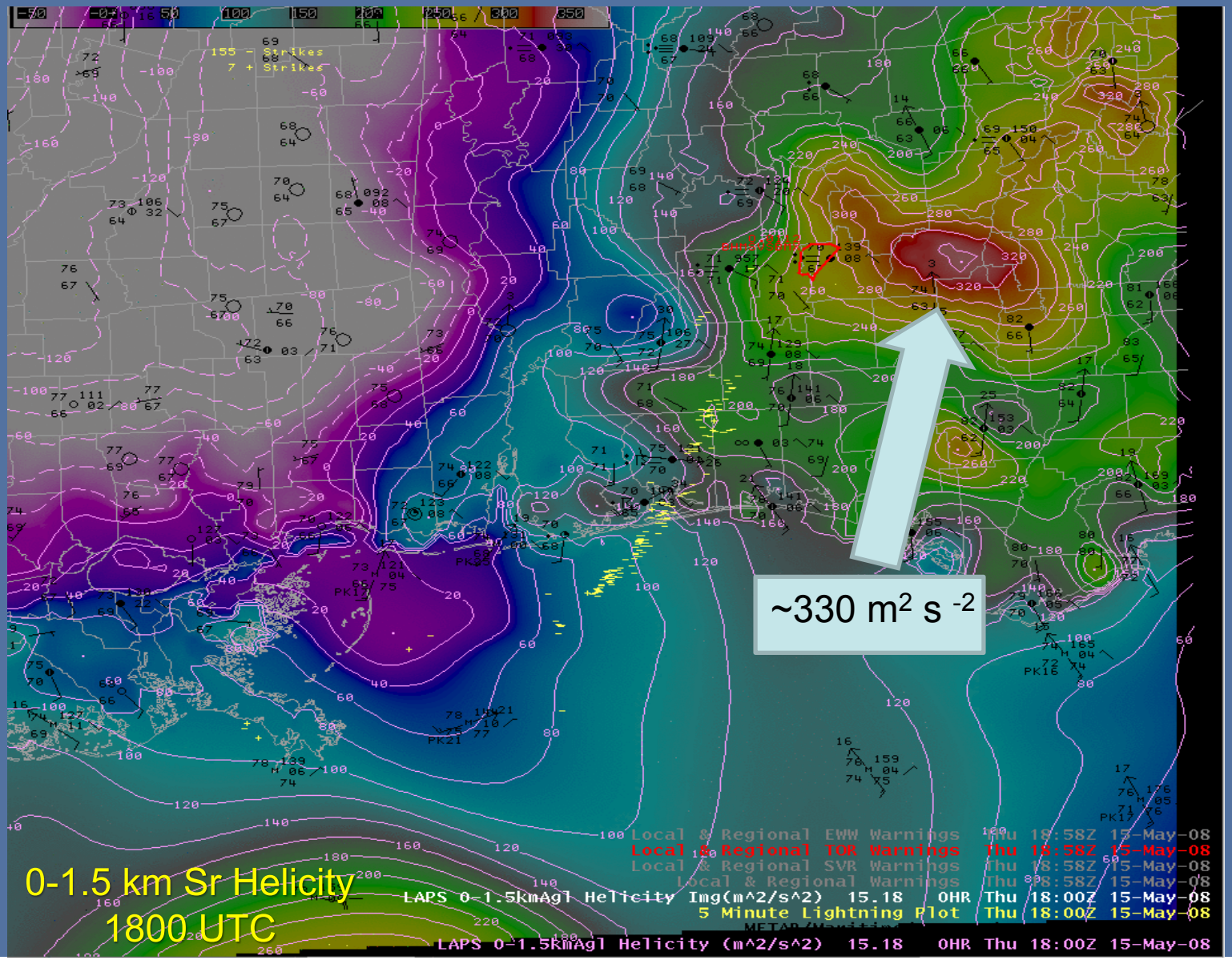

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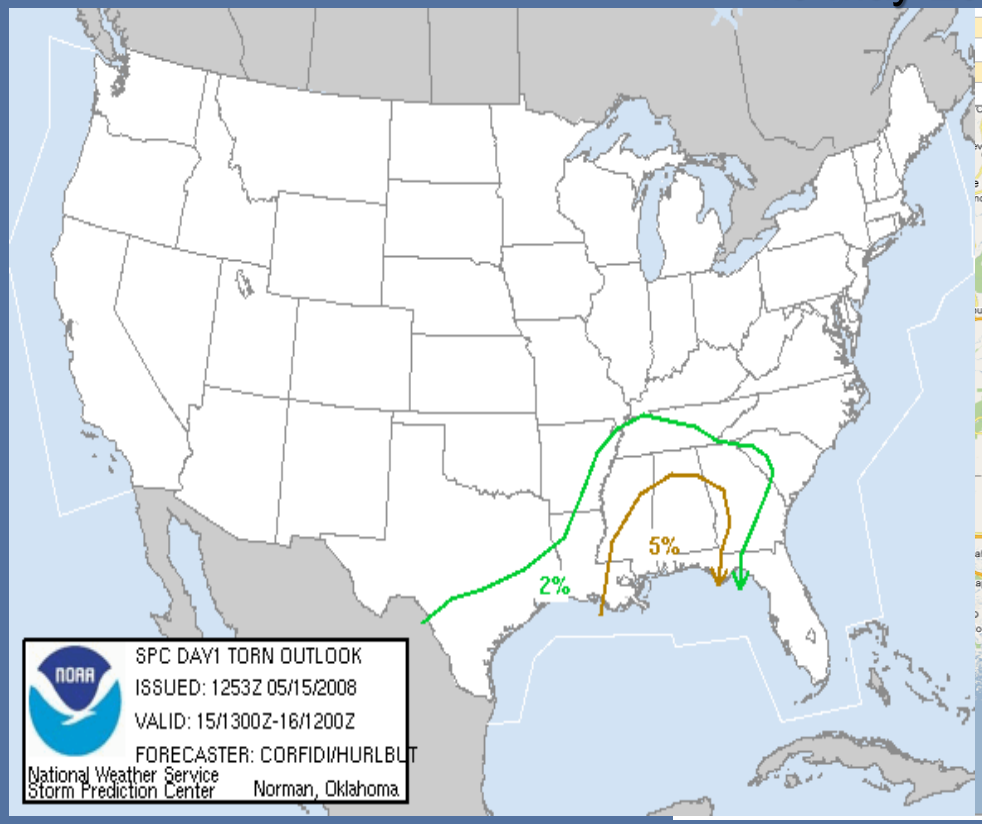
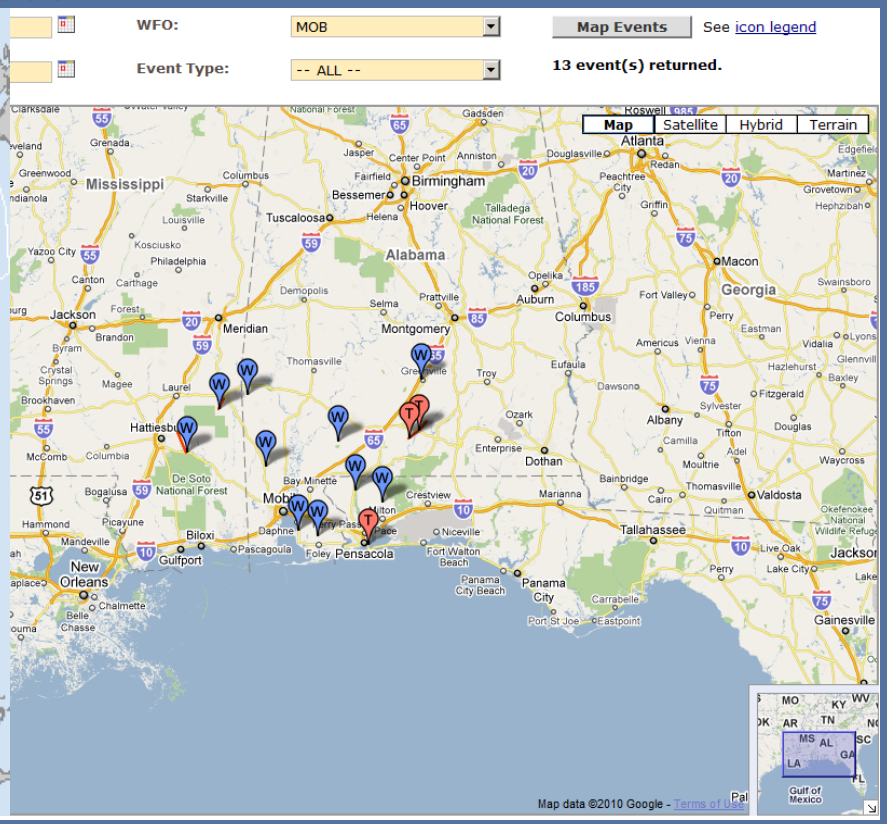
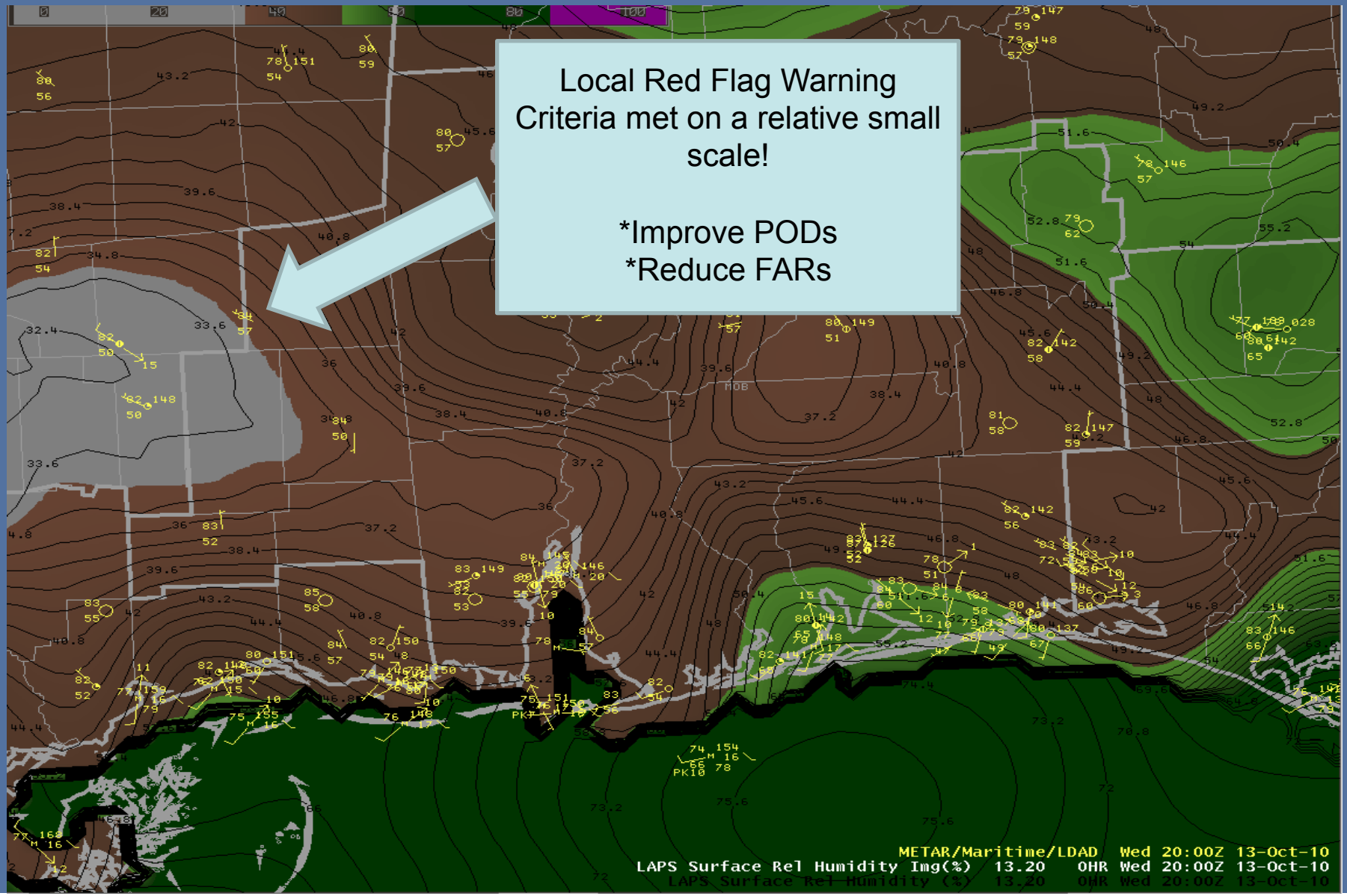




SPC watching NCEP RUC may not always observe the same thing as a WFO's local LAPS. Many times, I have collaborated positively to bring about an improved forecast simply based on a more accurate spatial distribution, magnitude and tendency of both CAPE and Sr Helicity (e.g., shaving off a row of counties from a watch).

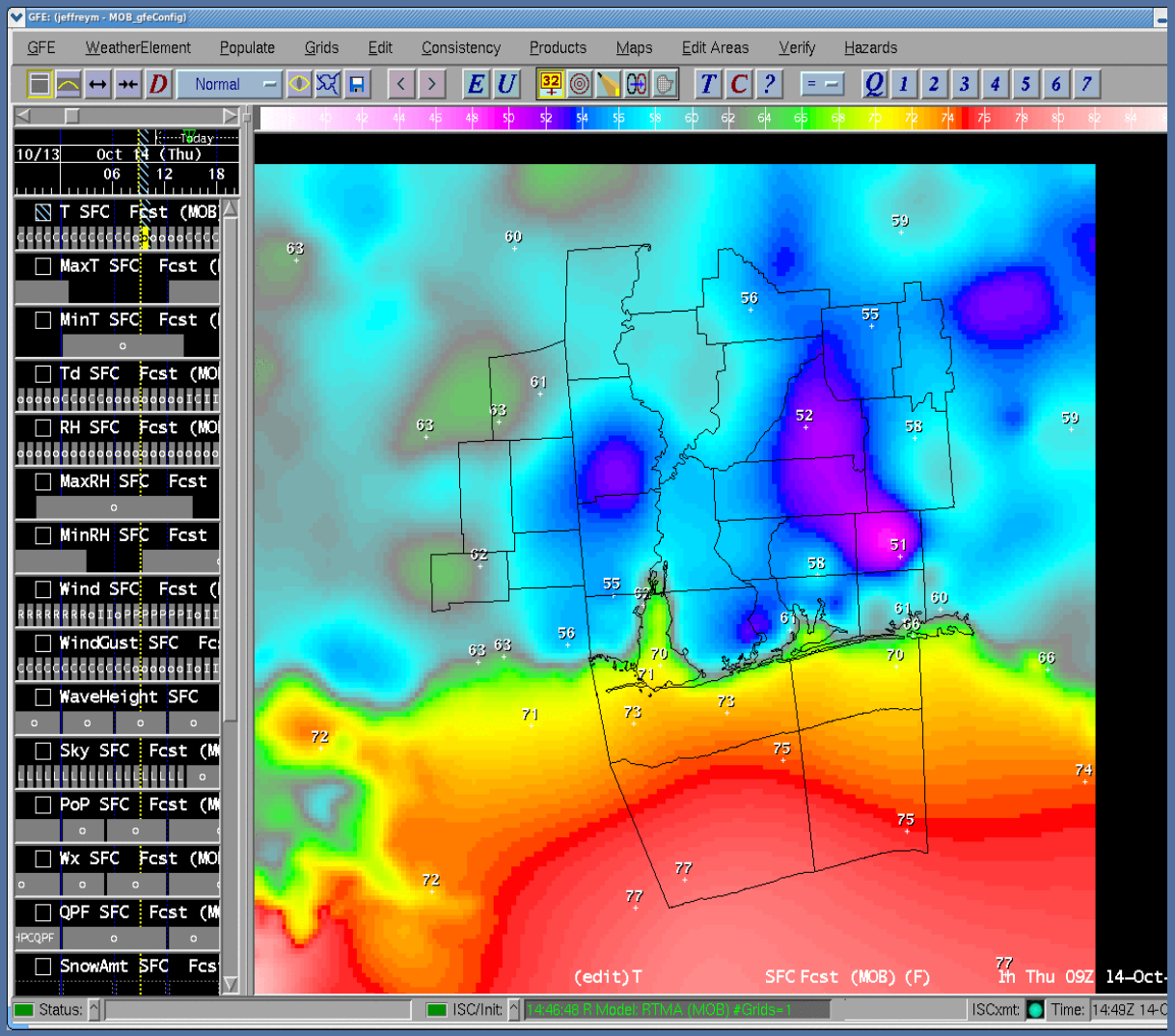
Verification



Local Red Flag Warning Criteria met on a relative small scale!

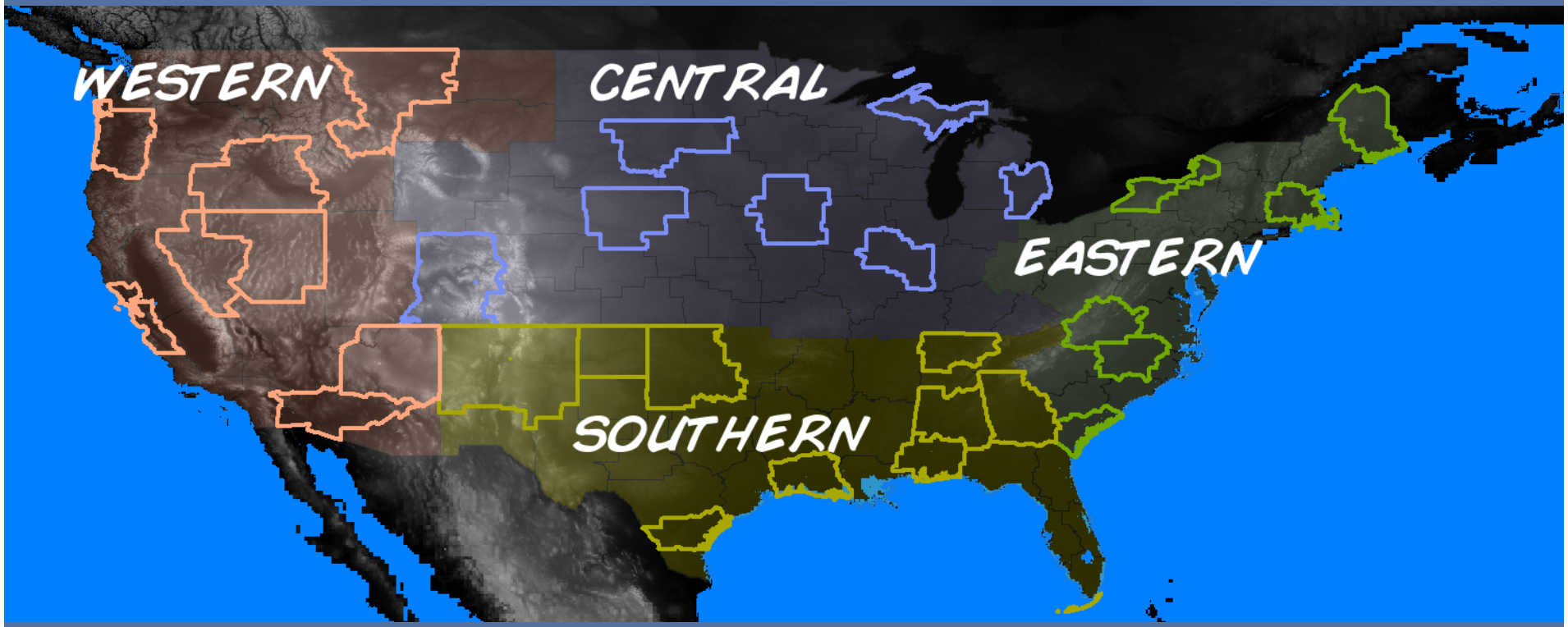
*Improve PODs
*Reduce FARs

Verification



- LAPS used exclusively in GFE to represent the "observed" condition beginning $t_0 - \Delta t$.
- Diurnal T and T_d curves generated from these grids.
- Also, during first six hours of forecast these grids can be used when the forecast is one of persistence.

LAPS Usage Across the NWS



Purpose

Office input of LAPS strengths & weaknesses

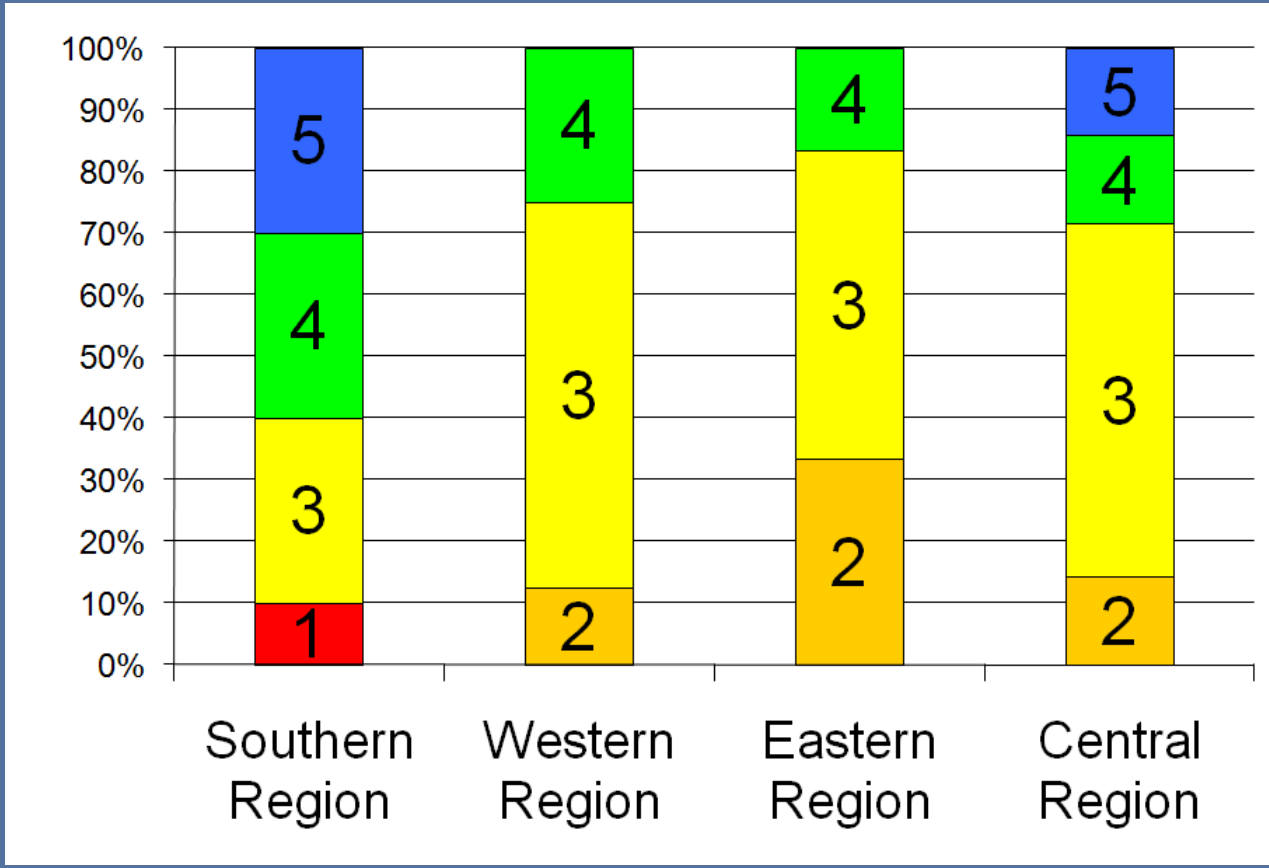
Site Selection

31 forecast offices across United States

Site selection based on geographic characteristics

Knowledge of the LAPS Software

LAPS Knowledge Response Frequency By Region

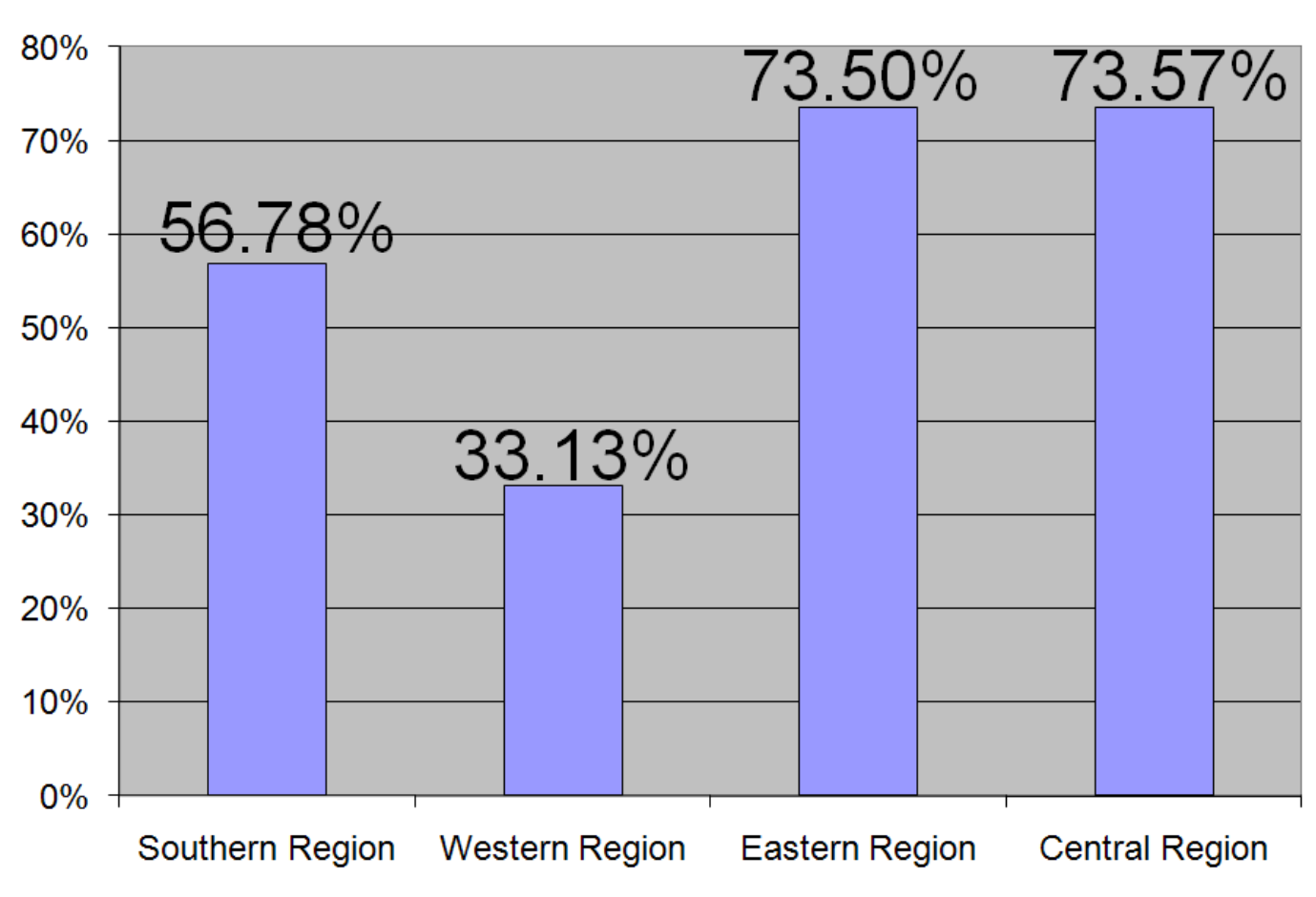


Weak Understanding

Strong Understanding

Estimate of Office LAPS Use

Mean Percentage of Forecasters Using LAPS Per Office



"LAPS is more of an event-driven tool than a situational awareness tool"

Events where LAPS is an asset

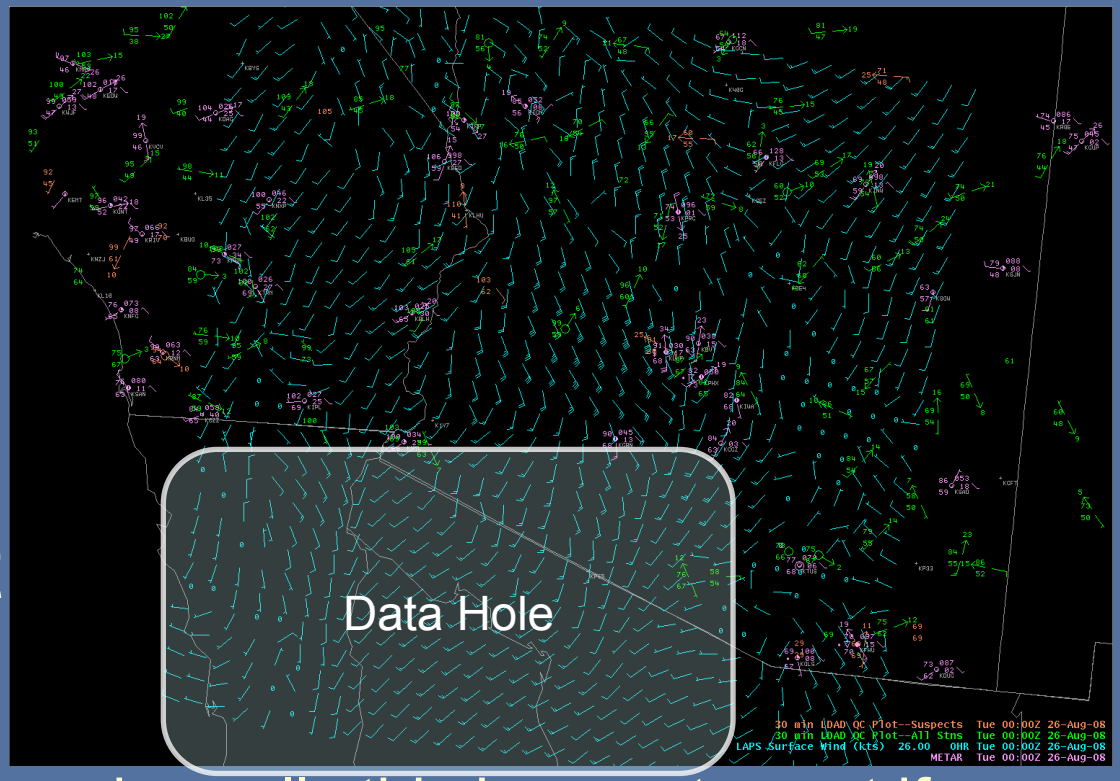
Responses fit climatology

- Central/South U.S.
  - Severe Weather Analysis, Convective Potential and Instability
- North U.S.
  - Winter Weather, melting layer, wind analysis
- Western U.S.
  - Moisture trends, synoptic-forced systems

Weather Category	Number of Responses
Severe Weather & Convective Potential	16
Wind Fields, Frontal Analysis	8
Winter Weather & Mixed Precipitation	7
Current Conditions, Benign Weather	6
Moisture Analysis	4
Temperature Trends	2
Aviation Forecasting	2

Trust in LAPS Output

- Trust dependent on 2 factors:
  - Topography
  - Surface network input density
- Vocal sites do not QC observations



"The analysis can go bad and usually this is easy to spot if you have an awareness of your geographic domain."

"Ignore remote or elevated stations."

"Lack of trust when we see bull's-eyes"

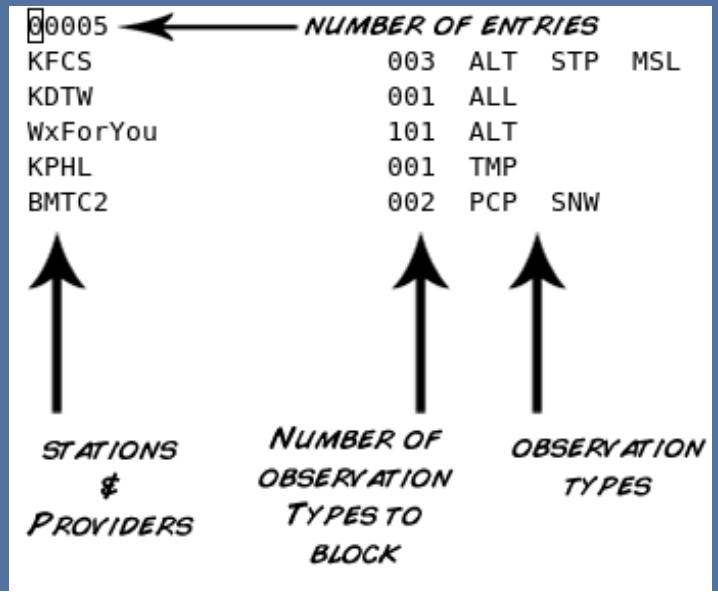
Customization of LAPS

- Minimal customization activity

Reasons Why Not…

- Unsure of customization possibilities
- Fear of interrupting live operations

Customization Procedures	Number of Responses
Use/Maintain a blacklist	10
Change domain size/ resolution	5
Added new input data for LAPS to initialize	3
Run LAPS more than once an hour	2



Blacklist Example

LAPS Output & Local Modeling

Currently initialize a local model with LAPS?	Number of Responses
No	21
No, but would like to	7
Yes	3

28 Offices – Why Not Yet?

No compatible model, do not know how, LAPS output/model domain conflict.

3 Offices – How Did You Do It?

Some use a newer version of LAPS external to AWIPS for model initialization.

Transition from AWIPS 1 to AWIPS 2

AWIPS 1
(now)

AWIPS 2
(soon)

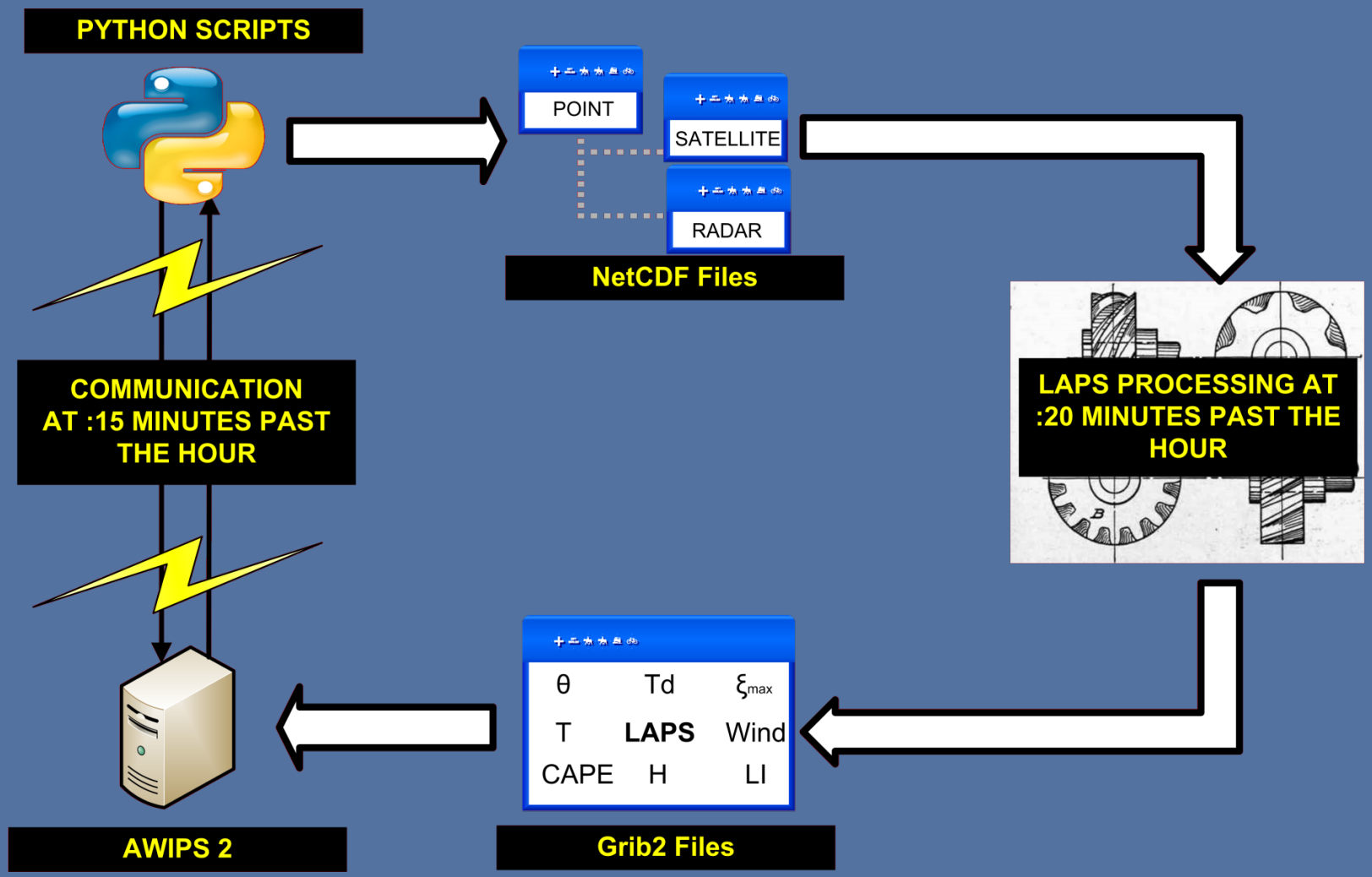
LAPS and AWIPS-2

	AWIPS 1	AWIPS 2
File Format	NetCDF	HDF5
LAPS Version	0-25-9	0-40-11
LAPS Output	AWIPS 1 NetCDF	Grib2

- New LAPS allows for RUC 13 ingest
- Bug fixes

- Common AWIPS Vis. Environment (CAVE) replaces D-2D
  - Display of LAPS is the same in CAVE as was in D-2D

AWIPS 2 LAPS Processing



NWS Suggestions on How to Increase LAPS Usage

- General Comments
  - Effective documentation
  - Training
    - Customization
    - Value
- High Expertise Comments
  - Increase grid spacing, domain size, time frequency
  - Predictive component

Potential solutions to the NWS suggestions

- High Expertise Users
  - Predictive: Incorporate LAPS into WRF
  - Config: Upgrade of AWIPS hardware
- General Comments
  - Docs: AWIPS2 Documentation
  - Training:
    - Training for AWIPS 2 LAPS Experts (~May 2011)
    - Training for forecasters?

LAPS Training

Need: Application & Example-Driven Learning

Solution: Configuration and Best practices training

- Configuration:
  - How to mitigate data and analysis issues
  - How to incorporate LAPS into local model
- Best Practices:
  - Illustrate the value of LAPS through specific relevant examples

Final Thoughts

- LAPS in AWIPS since ’90s
- Preference for LAPS is not consistent across NWS
- “LAPS is an event driven tool”
- AWIPS 2 provides an opportunity for an update to LAPS Expert Training
- Re-emphasize the value of LAPS

AWIPS 2 LAPS training contact: ben.baranowski@noaa.gov