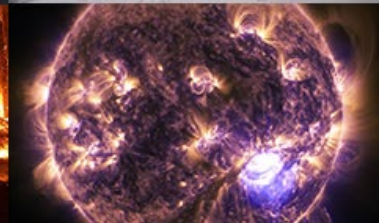
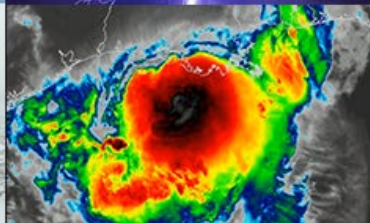
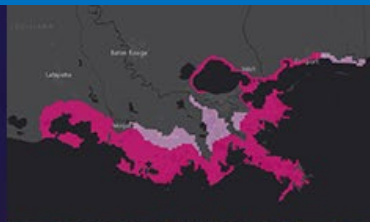
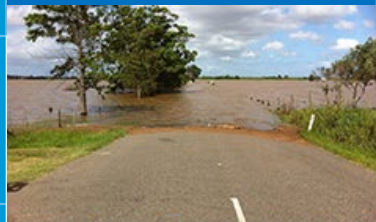




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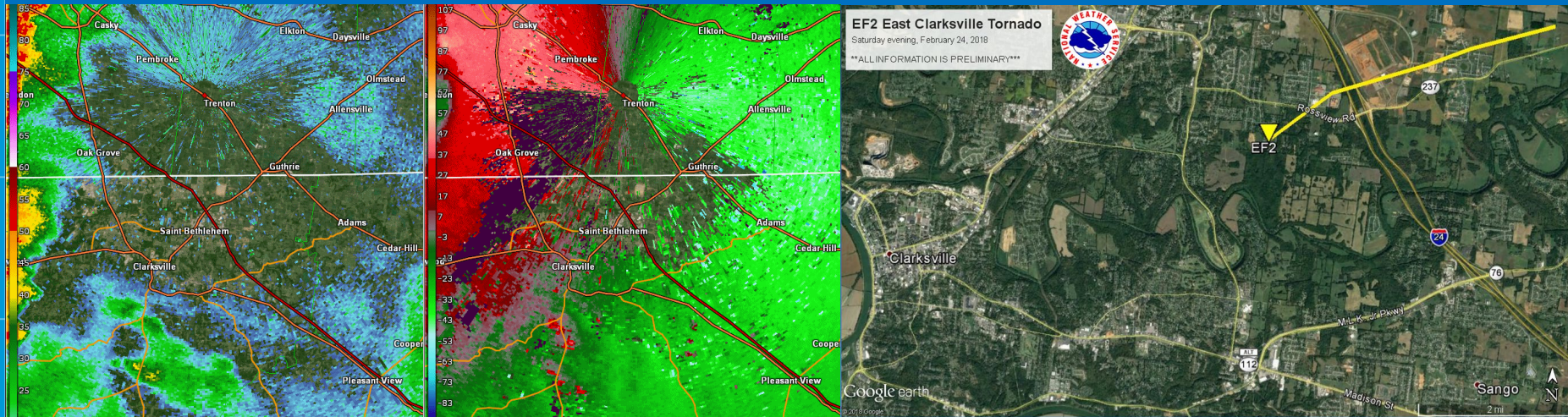
The Role of the Mesoanalyst in Severe Weather IDSS

JANUARY 15, 2020 – AMS Annual Meeting – Boston, Massachusetts
Presenter: Matt Foster, SOO, NWS Operations Proving Ground



February 24, 2018 – Clarksville, TN EF-2 Tornado

- QLCS Tornado After Dark
- Nearly 90 Homes Damaged
- Zero Fatalities and Few Injuries



February 24, 2018 – Clarksville, TN EF-2 Tornado

“Many homes were destroyed and a few people sustained serious injuries, but the NWS warning gave most people time to take cover. **There would have undoubtedly been fatalities had the warning not been issued so early.**” - *Montgomery County Emergency Manager*



2019 Mesoanalyst Experiments: Primary Objective

Champion the role of expert mesoanalysis in enhancing tactical IDSS and advance the FACETs paradigm in ops.



Much More Than Rote Parameter Chasing

Mesoanalyst/Radar Support

1. Conduct analysis of synoptic, mesoscale, and near-storm environment; communicate key insights and observations to radar operator.
2. Issue Mesoscale AFD(s) to describe expectations regarding initiation, timing, location, severity, coverage, storm mode, and threats.
3. Provide updates on NWSChat when significant changes in storm mode or warning thresholds are anticipated.
4. Participate in any SPC watch coordination discussions.
5. Provide radar briefings and updates over MERS and to SkyWarn hams, if present.
6. Assist the Warning Forecaster(s) in any mission critical aid needed (e.g., monitor web cams, serve as second pair of eyes on radar, etc.)

Some key features to include on thunderstorm composite charts

1. Instability **CAPE, LI (Orange)**
2. Lift **700mb Omega (Brown)**
3. Moisture **Dewpoints SFC or 850mb (Green)**
4. CAP **CIN or 700mb temps (Grey)**
5. Shear **SRH or BRN shear (Yellow)**
6. Forcing **SFC or elevated boundaries**

Bulk Richardson Number
 <10--High shear, low CAPE. Shear may be too strong to allow strong upright convection.
 10-45--Associated with supercells.
 >50--Weak shear, high CAPE. Multicells likely.

Supercell Composite
 3-5 Lower threshold for supercells
 5-8 Weak tornadoes
 8-10 Significant tornadoes

Significant Tornado Parameter
 0.5-1.5 Threshold for supercells
 1.5-3.0 Weak tornadoes
 3.0+ Significant tornadoes

GOES Rapid Scan Operations (RSO)
 If RSO will be beneficial to warning operations:
 1. Call [REDACTED]
 2. Give at least 1 hr. lead time before RSO initiation.
 3. Provide Detroit with start and stop time for RSO.
 * On Moderate and High Risk days, SPC will make the RSO request. [REDACTED]

Severe Weather Indices

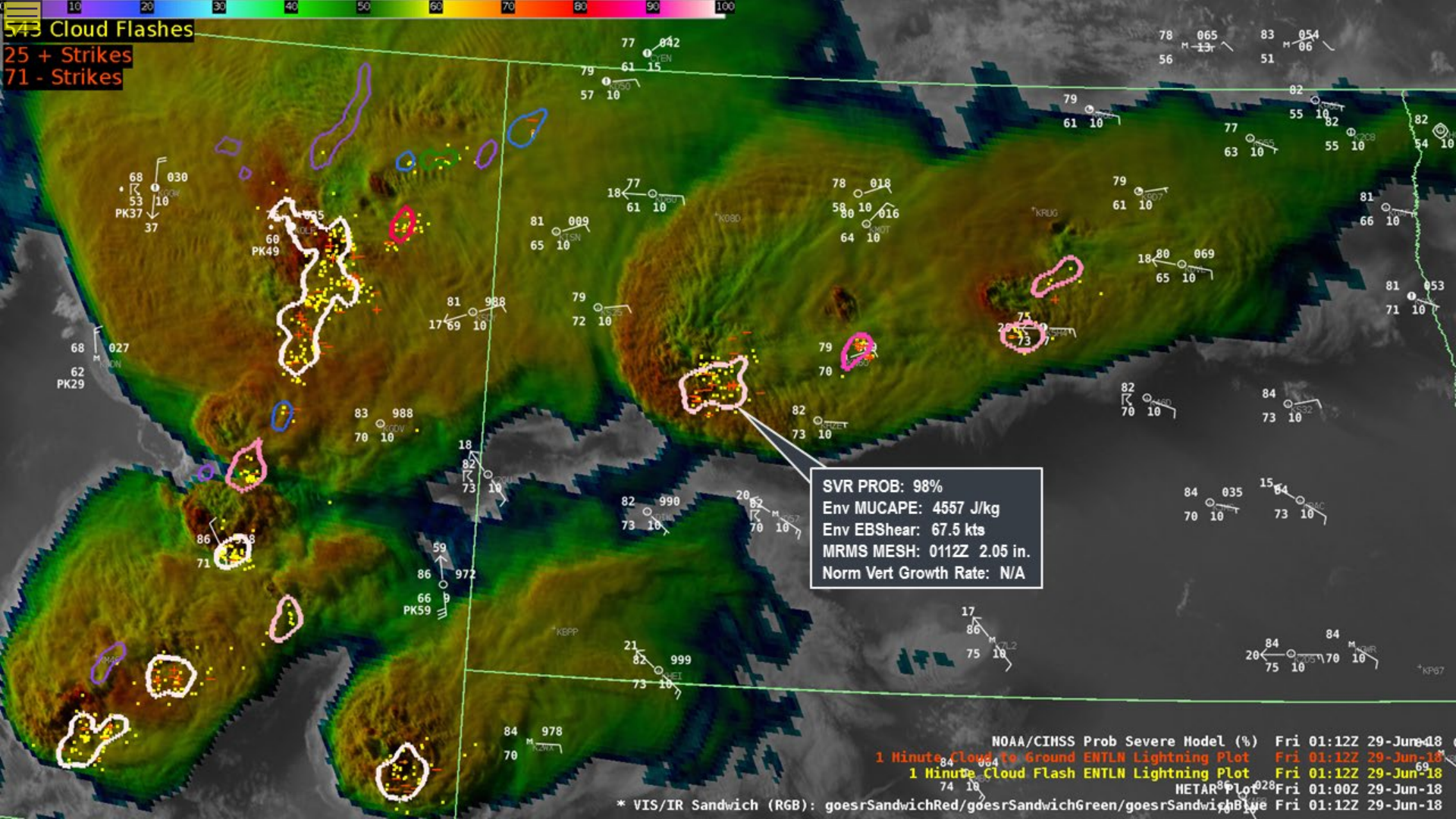
| Instability | Low | Moderate | High | Extreme |
|-------------|----------|------------|------------|---------|
| CAPE | <1000 | 1000-2500 | 2500-3500 | >3500 |
| LI | 0 to -3 | -3 to -5 | -6 to -9 | <-9 |
| Showalter | -1 to -2 | -2 to -3 | -4 to -6 | <-6 |
| CIN | >150 | 100-149 | 50-99 | <50 |
| LCL | 1500m | 1250-1499m | 1000-1249m | <1000m |
| LFC | >2500m | 2000-2499m | 1500-1999m | <1500m |

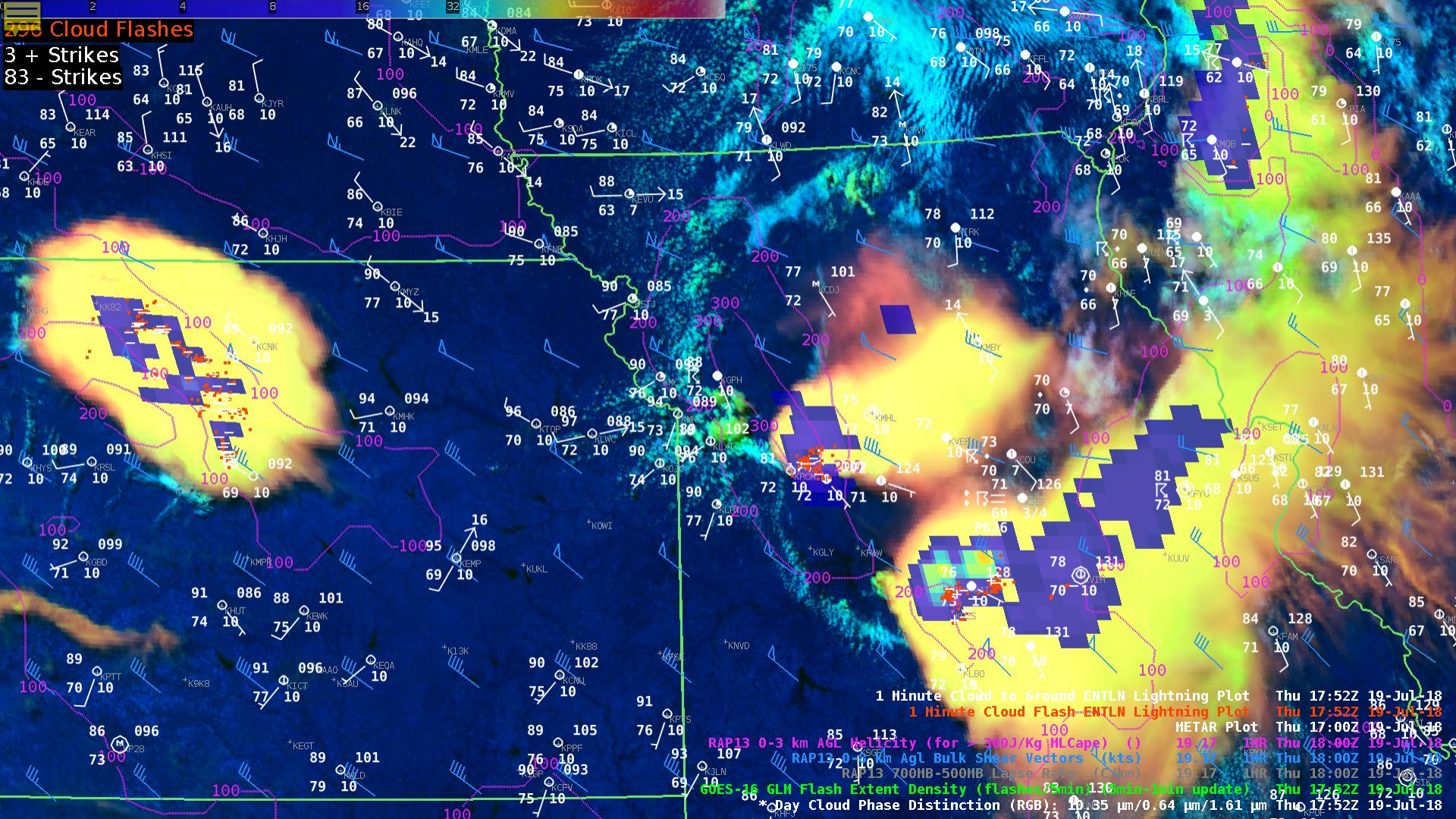
| Wind Shear | Poor | Marginal | Favors | Strong |
|----------------|-------|----------|---------|--------|
| 0-1km EHI | <1.0 | 1.0-1.9 | 2.0-2.9 | >=3.0 |
| 0-6km shear | <30kt | 30-37kt | 38-44kt | >45kt |
| ESREH | <150 | 150-299 | 300-449 | >450 |
| BRN Shear | 35-45 | 45-55 | 55-65 | >65 |
| Eff Bulk Shear | <25kt | 25-30kt | 30-40kt | >40kt |

SPC Hourly Mesoscale Analysis <http://spc.noaa.gov/expert/mesoanalysis/>







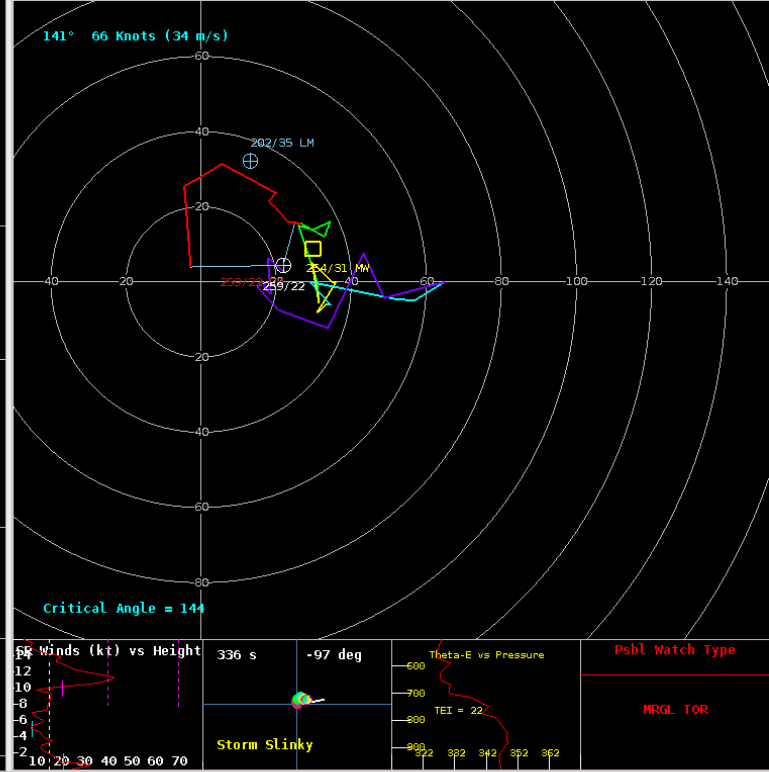
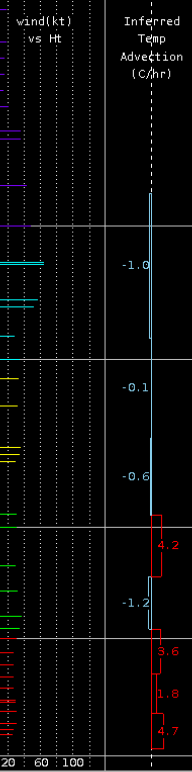
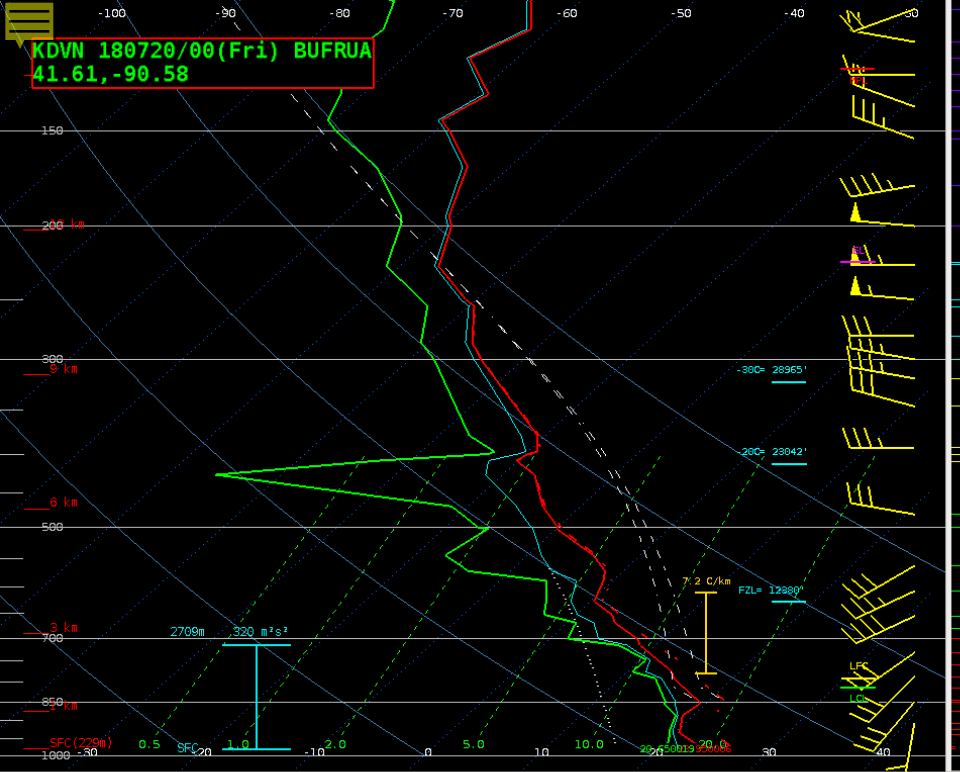


200 Cloud Flashes

3 + Strikes
83 - Strikes

1 Minute Cloud to Ground ENTNL Lightning Plot Thu 17:52Z 19-Jul-18
 1 Minute Cloud Flash-ENTNL Lightning Plot Thu 17:52Z 19-Jul-18
 METAR Plot Thu 17:00Z 19-Jul-18
 RAP13 0-3 km Agl Velocity (for > 300J/Kg MLCaps) () 18:21 1HR Thu 18:00Z 19-Jul-18
 RAP13 0-3 km Agl Bulk Shear Vectors (kts) 19:11 1HR Thu 18:00Z 19-Jul-18
 RAP13 700MB-500MB Large Scale (C/Nm) 19:17 1HR Thu 18:00Z 19-Jul-18
 GOES-16 GLM Flash Extent Density (Flashes/3min/130kmx1min update) 87u 17:52Z 19-Jul-18
 *Day Cloud Phase Distinction (RGB): 0.35 μm/0.64 μm/1.61 μm Thu 17:52Z 19-Jul-18

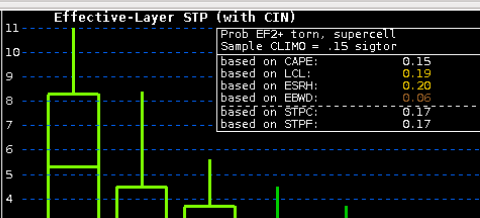
KDVN 180720/00(Fri) BUFRUA
41.61, -90.58



| PARCEL | CAPE | CIN | LCL | LI | LFC | EL |
|-------------|------|-----|-------|----|--------|--------|
| SURFACE | 1313 | -67 | 427m | -7 | 2144m | 34249' |
| M 100 mb | 1360 | -56 | 653m | -7 | 2069m | 34249' |
| FOST SFC | 2311 | -3 | 1234m | -9 | 3936m | 37249' |
| M1 (850 mb) | 1630 | -6 | 1525m | -8 | 37249' | 37249' |
| EFF LAYER | 1106 | -39 | 1551m | -6 | 2921m | 33498' |
| USER DEF | 1630 | -6 | 1629m | -8 | 1861m | 37249' |

| | | | |
|--------------|------------------|--------------|--------------|
| PW = 1.791in | SCAPE = 633J/kg | WBZ = 11277' | WINDG = 0.00 |
| K = 89 | DCAPE = 694J/kg | FZL = 12880' | ESP = 0.00 |
| MaxRH = 79% | DownT = 61F | ConvT = 67F | MHP = 0.27 |
| LowRH = 88% | MeanW = 15.3g/kg | MaxT = 88F | NCAPE = 0.17 |

| Supercell = | 9.0 |
|--------------|-----|
| STP(eff) = | 1.7 |
| STP(fixed) = | 1.6 |
| SHIP = | 0.7 |



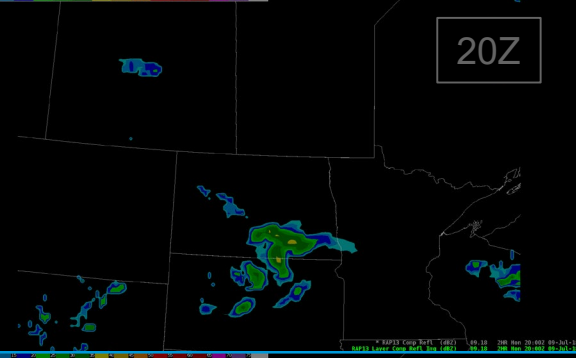


RAP 13

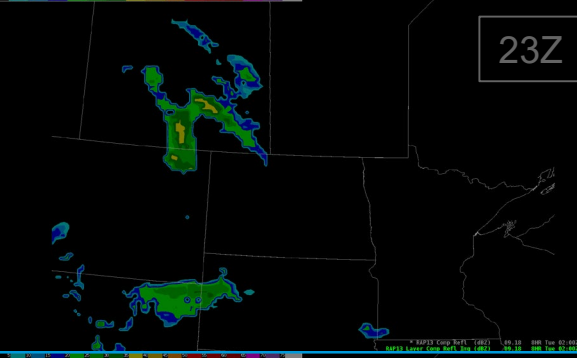
OPTNL HRRR

ESRL HRRR

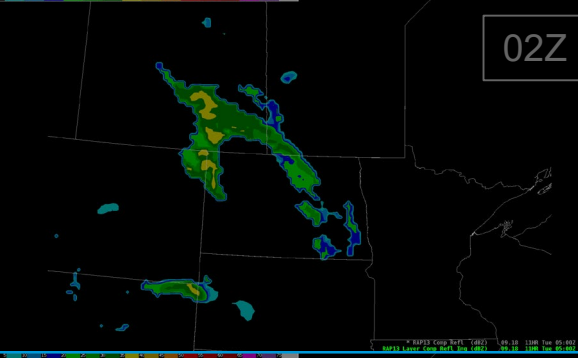
20Z



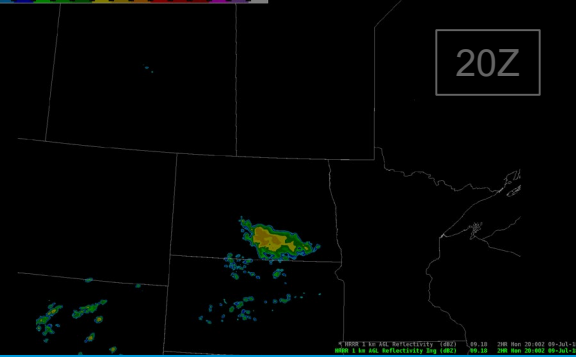
23Z



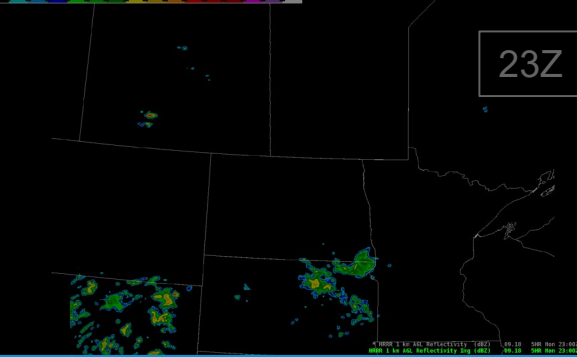
02Z



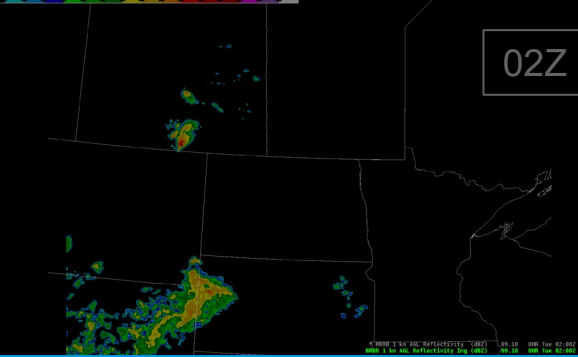
20Z



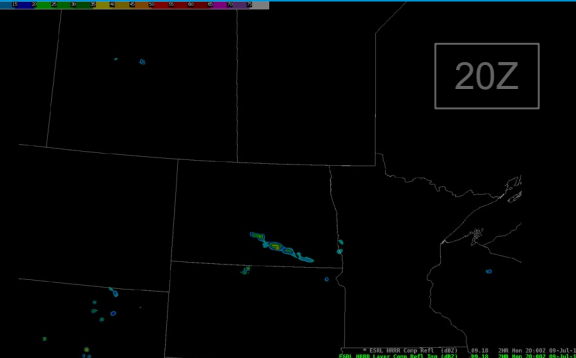
23Z



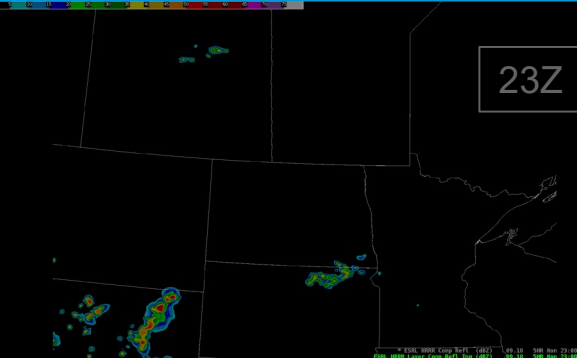
02Z



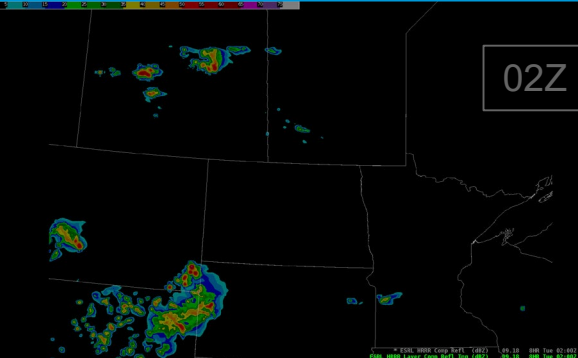
20Z



23Z



02Z



IDSS Event

North Dakota State Fair Minot Fairgrounds

EOC staffed 24/7 during the fair

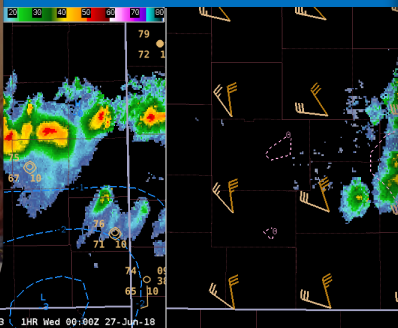
Critical Weather Thresholds

40+ mph wind
Lightning
Large hail
Heavy rain

*Need at least 30 minutes to execute
safe sheltering procedures*



Enhanced Service Delivery



Severe Thunderstorm Potential

Valid | * 500-700PM * | TODAY (Tuesday, June 26, 2018)

WHAT

- Conditional threat (unsure if storms will form)
- Isolated storms producing hail and damaging wind
- Heavy Rain capable of flash flooding
- Tornado cannot be ruled out east of Wichita

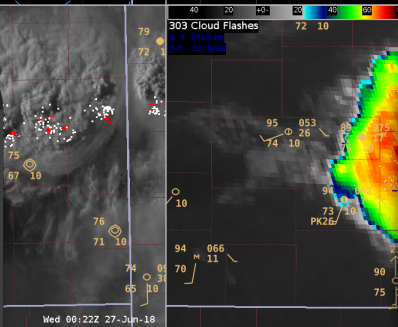
WHERE

Near and east of Wichita

ACTION

If storms form, be prepared to seek shelter

NATIONAL WEATHER SERVICE



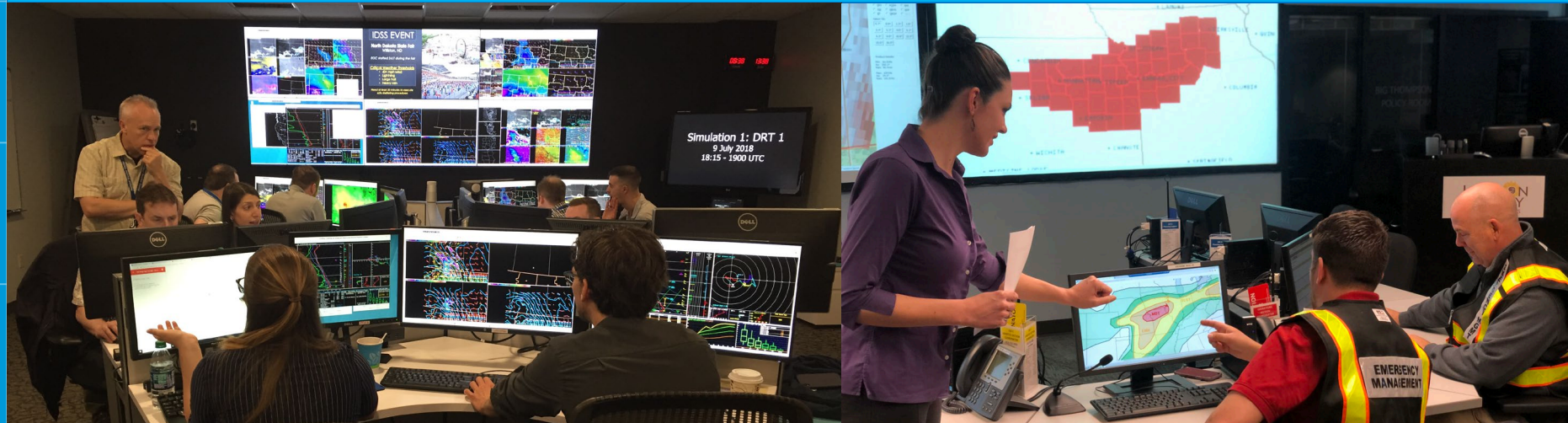
MESOSCALE AREA FORECAST DISCUSSION

We are still monitoring potential storm to severe convection developing in the next 1-2 hours. The previously mentioned residual outflow from earlier convection is still expected to be the focus. Current satellite observations confirm destabilization across the western tiers of CWA. With this in mind, ample buoyancy with surface dewpoints in the upper 60s to mid 70s in this region and upstream, should support very strong updrafts. Deep northerly shear, nearly orthogonal to the decaying outflow boundary should support initially discrete supercells, if CI is achieved. Though storm-relative anvil flow is weak, with right-moving supercells SR anvil flow will become more modest. A fairly deep boundary layer, with an inverted-V profile, cannot rule very strong downdrafts leading to strong straight-line winds and local microburst potential. Amid very strong CAPE through the hail growth region, and through the entire storm depth for that matter, large hail is expected to be the primary threat with developing convection this evening. There will be a slight window favoring tornado potential with near-surface cooling, but confidence is still fairly low.

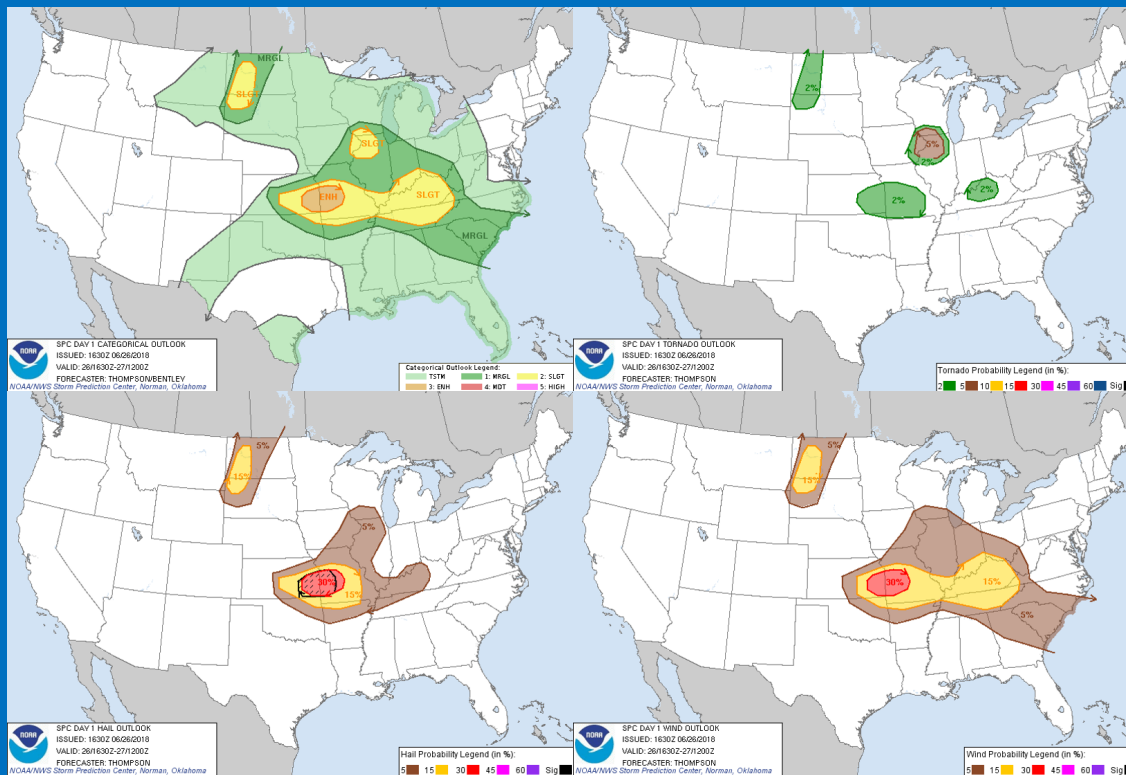


Benefits of Skillful Mesoanalysis

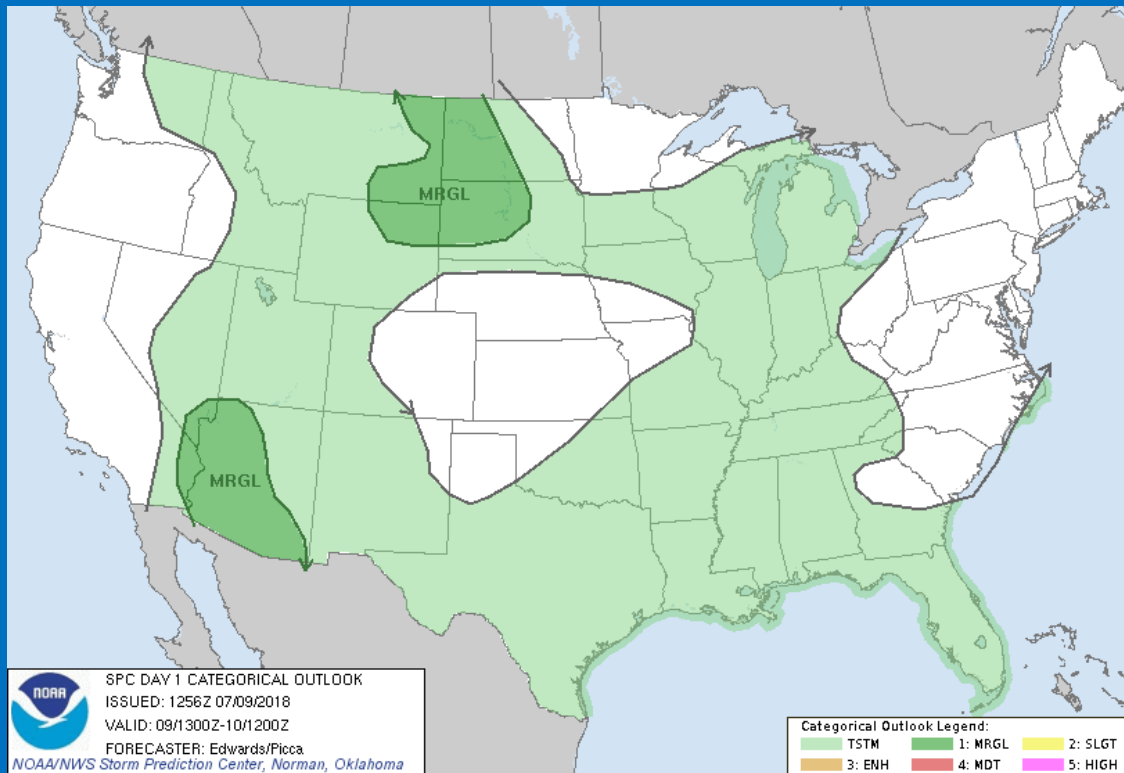
- Improves tactical IDSS, especially in the watch-warning gap
- Promotes more effective national center/WFO collaboration
- Addresses perception that science is diluted by IDSS focus
- Exploits probabilistic space driving better risk mgmt decisions



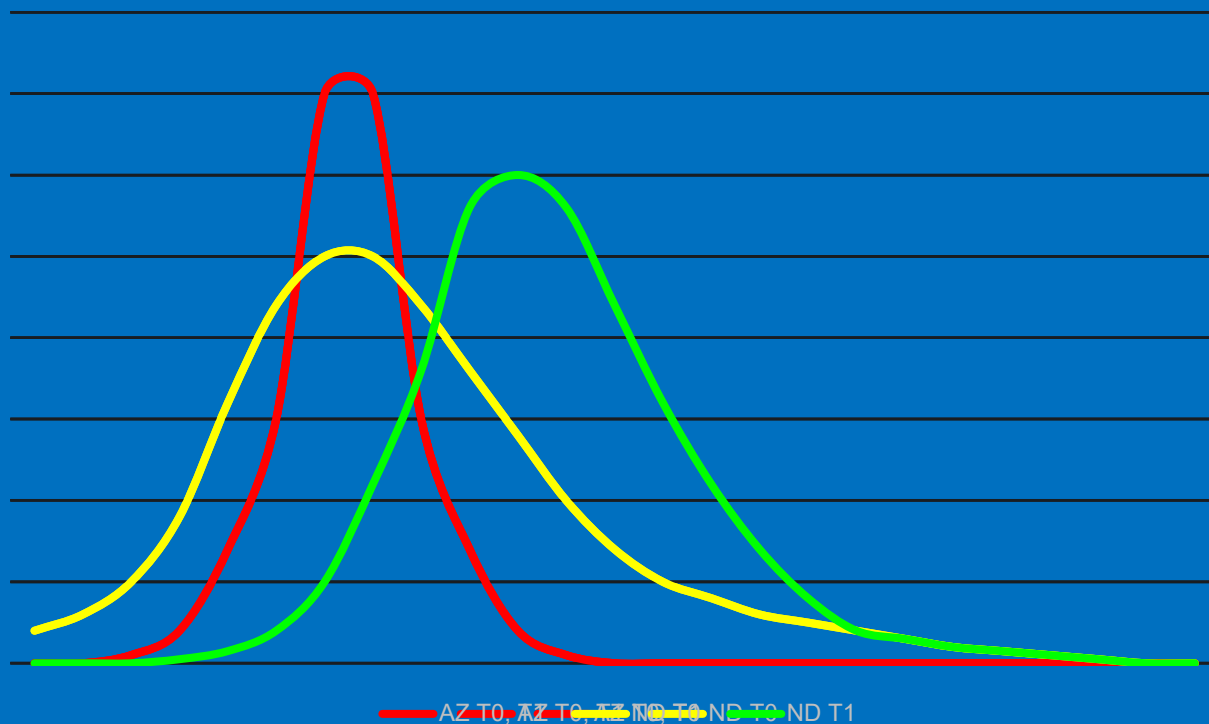
Exploring Probabilistic Space



Exploring Probabilistic Space



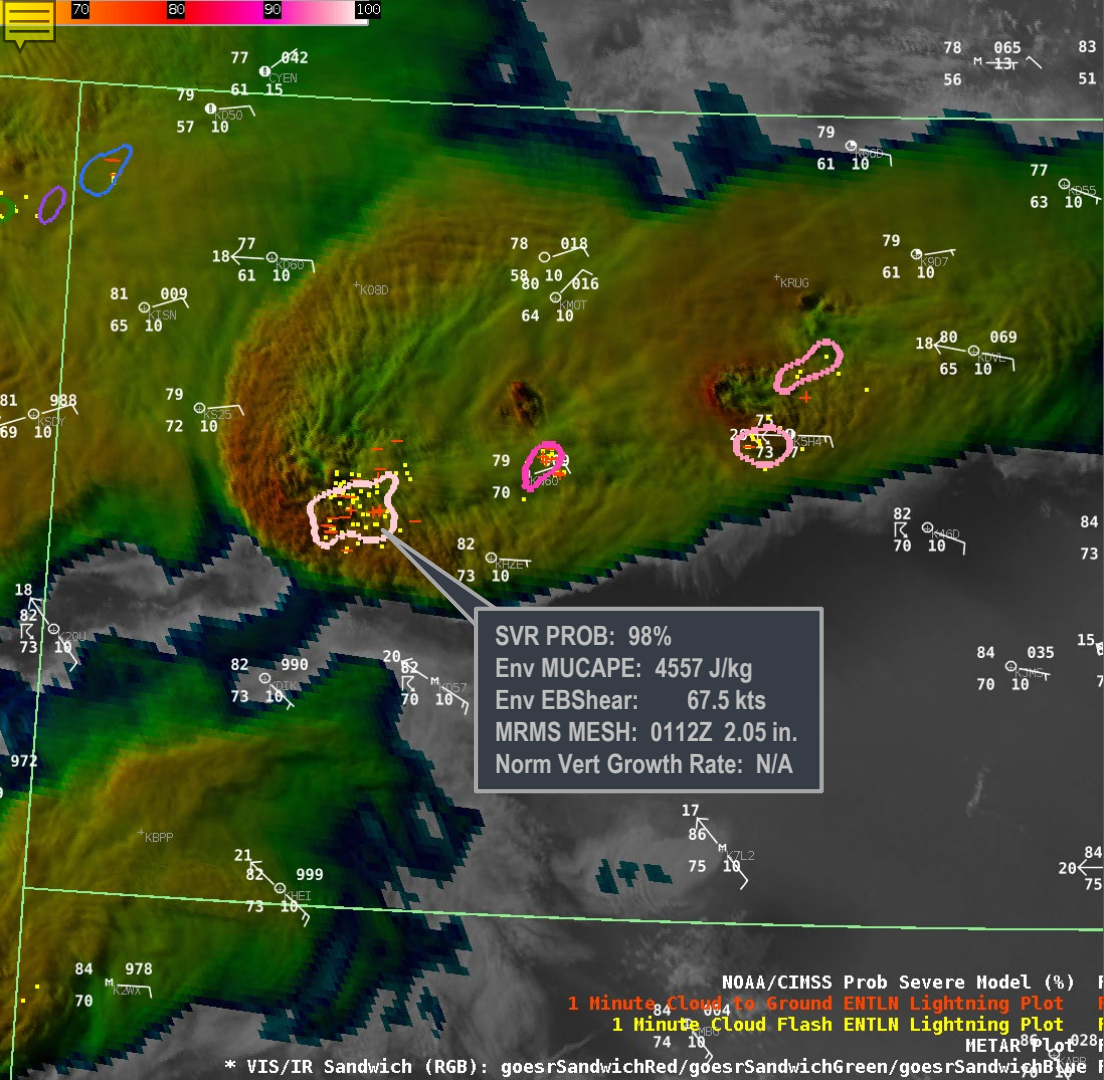
Exploring Probabilistic Space



Next Steps

Two workshops in 2020; focus on SOOs & OCLO transition plan
Experimental multi-office collaborative simulation exercises
Prototype SME-led road shows, sub-regional mutual aid teams
Co-host Think Tank: Mesoanalysis Applications for Fire Wx Services





SVR PROB: 98%
 Env MUCAPE: 4557 J/kg
 Env EBShear: 67.5 kts
 MRMS MESH: 0112Z 2.05 in.
 Norm Vert Growth Rate: N/A

Key Takeaways

Investing in mesoanalysis expertise

- ...enhances situational awareness
- ...enables accurate, actionable messaging
- ...facilitates continuous information flow
- ...supports effective decision making
- ...applies to multiple service sectors
- ...integrates physical/social sciences
- ...strengthens collaboration process
- ...leverages strengths of science-oriented forecasters to support IDSS

