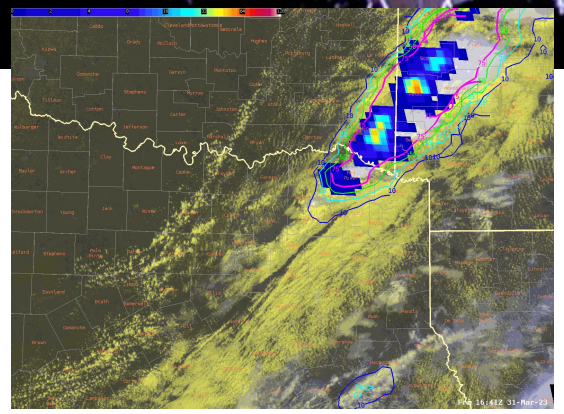
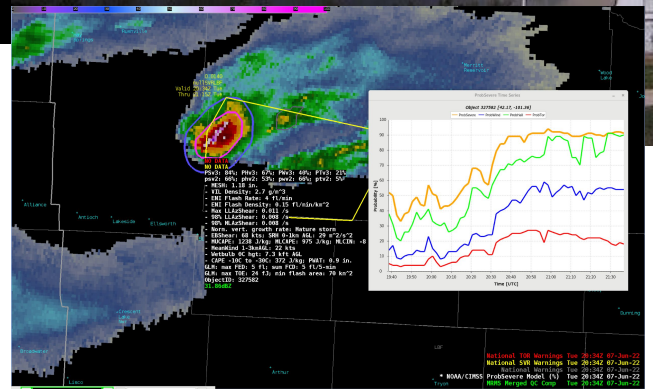
ProbSevere products in the Great Lakes

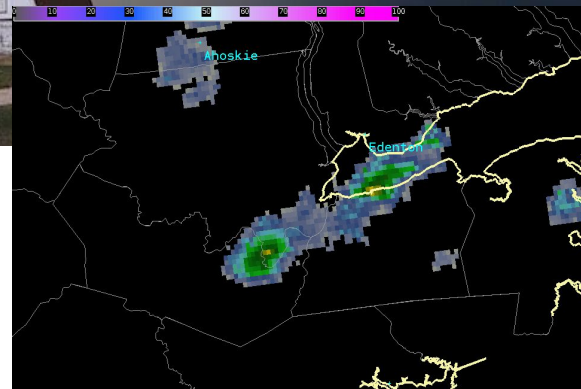
Justin Sieglaff, Mike Pavolonis, John Cintineo, Lee Cronce

weather.com

wunderground.com

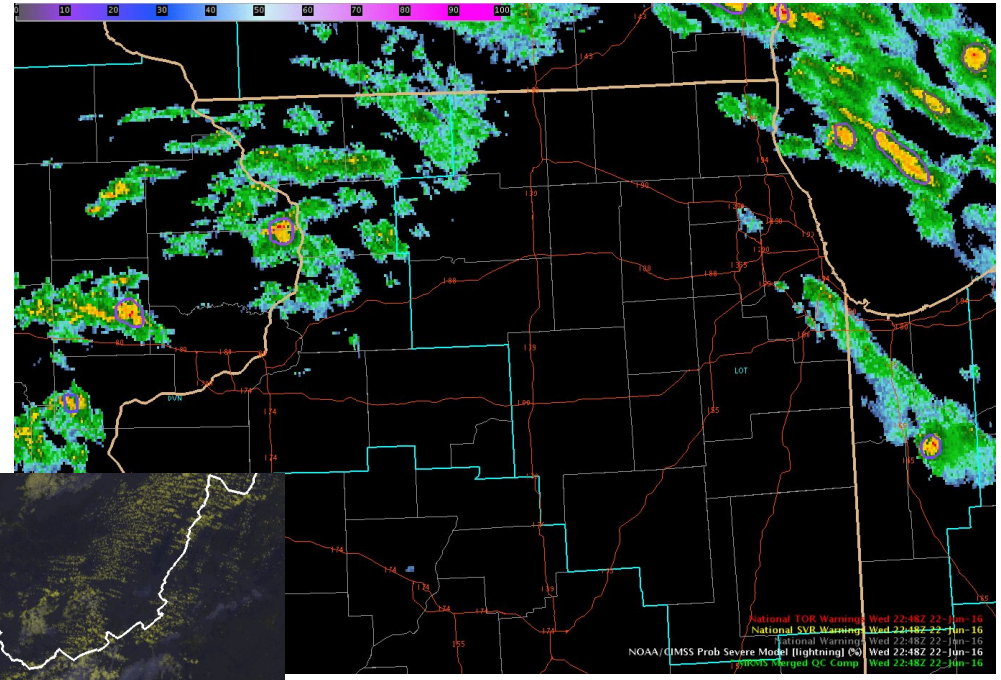


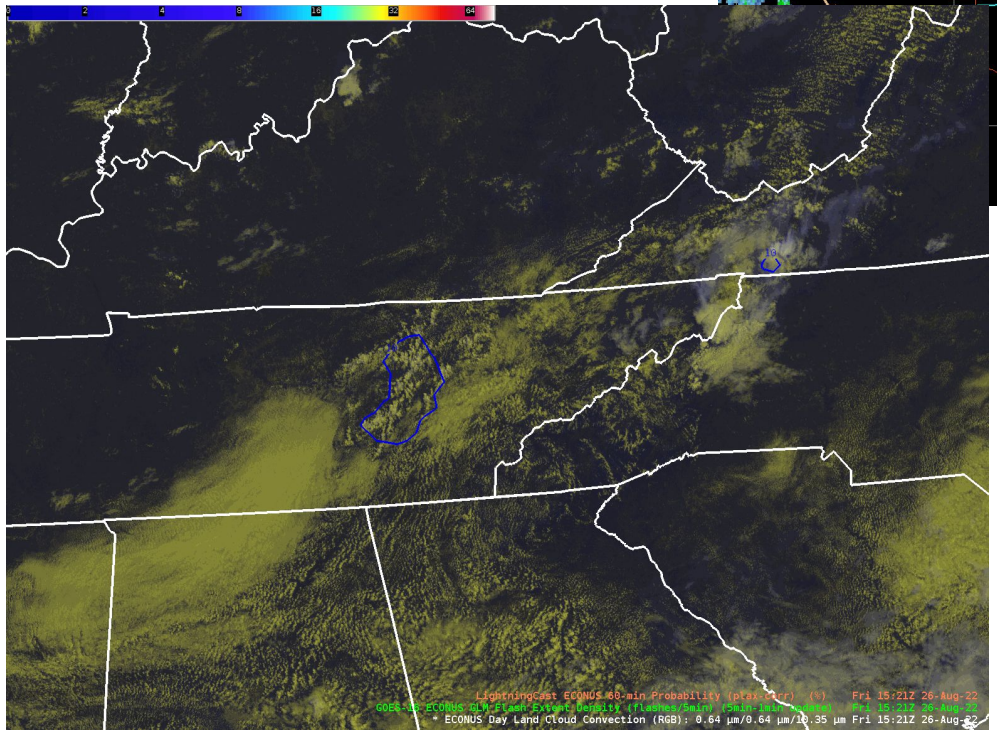




ProbSevere products

- **ProbSevere v2**
  - Operational
  - Source: NCEP
- **ProbSevere v3**
  - Experimental
  - Source: UW-CIMSS
- **ProbSevere LightningCast**
  - Experimental
  - Source: UW-CIMSS
  - T2O beginning soon
    - expected completion: Dec 2024

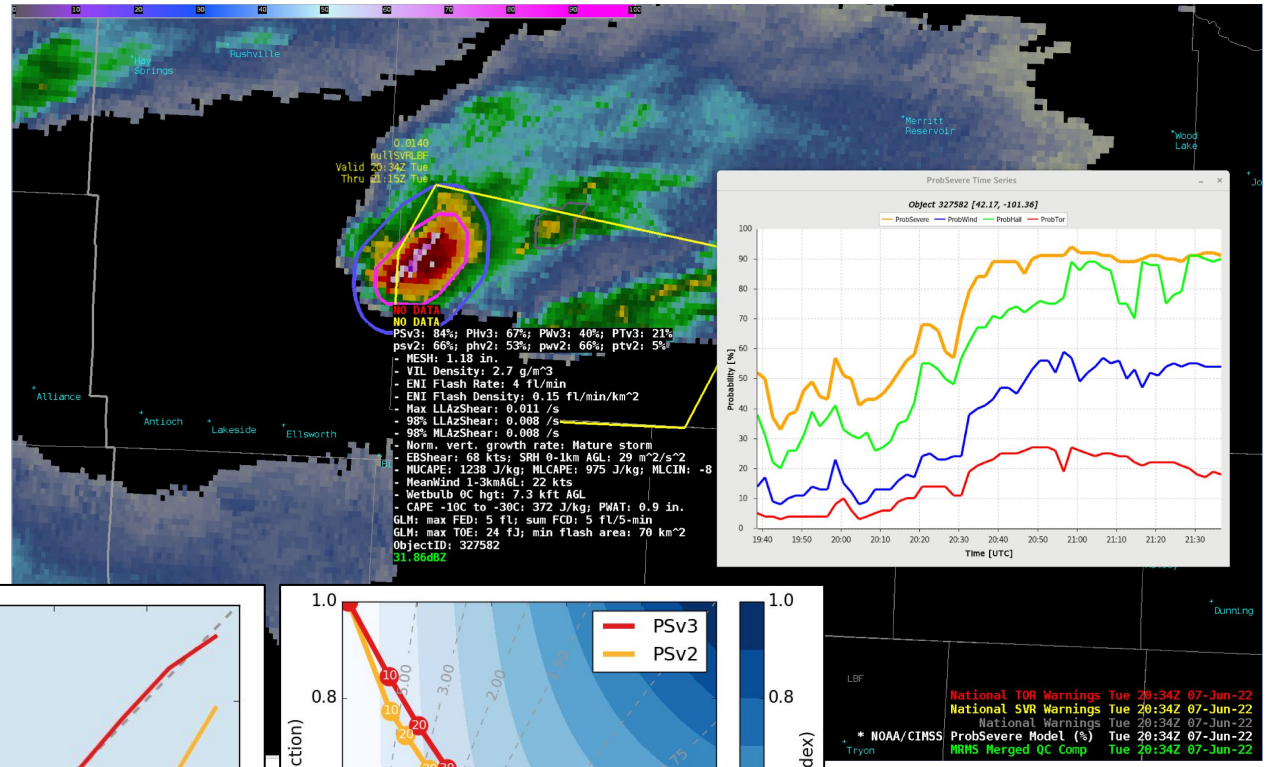


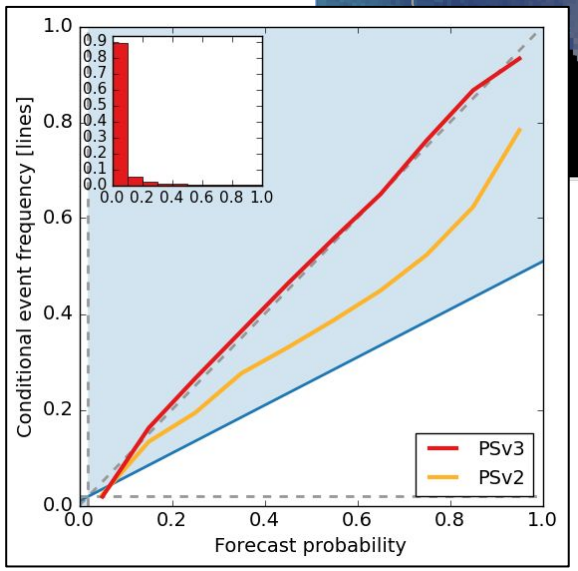


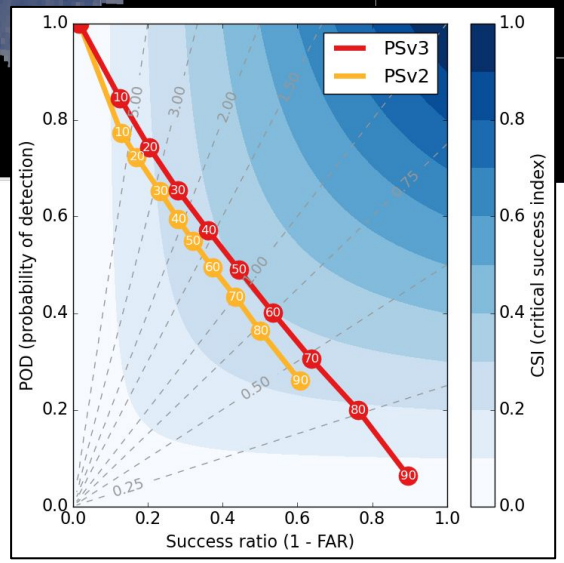
ProbSevere v3

Probabilistic next-hour severe weather models

- **Data sources**
  - MRMS
  - ENI Lightning
  - GOES-East (ABI and GLM)
  - HRRR
- **Improvements**
  - Improved overall calibration
  - Better in so-so environments
  - Better discernment among hazard types
- **Weaknesses**
  - Very weak-shear regimes
  - Dry microbursts
  - Weak tornadoes



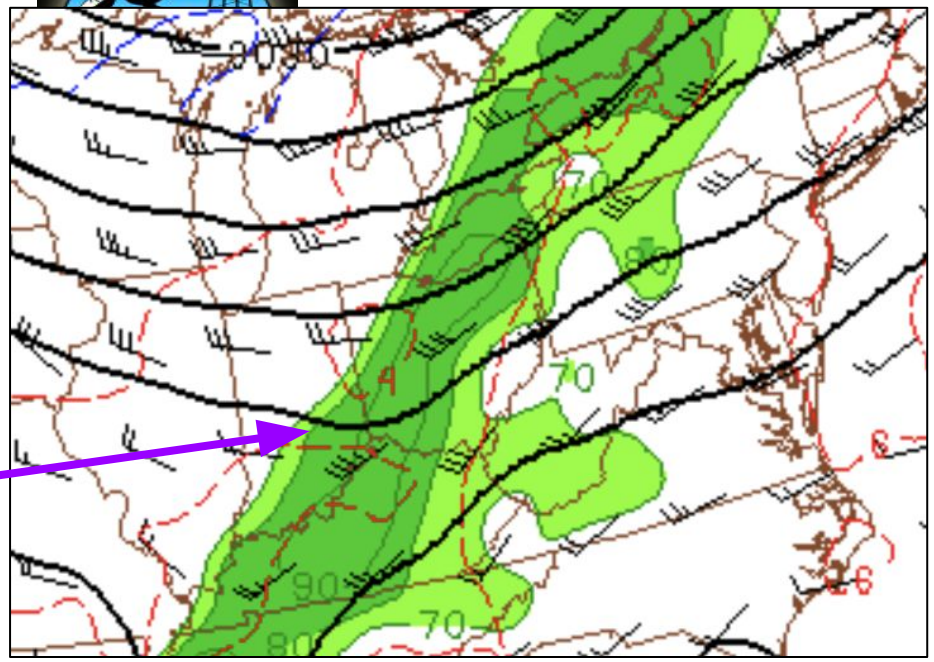


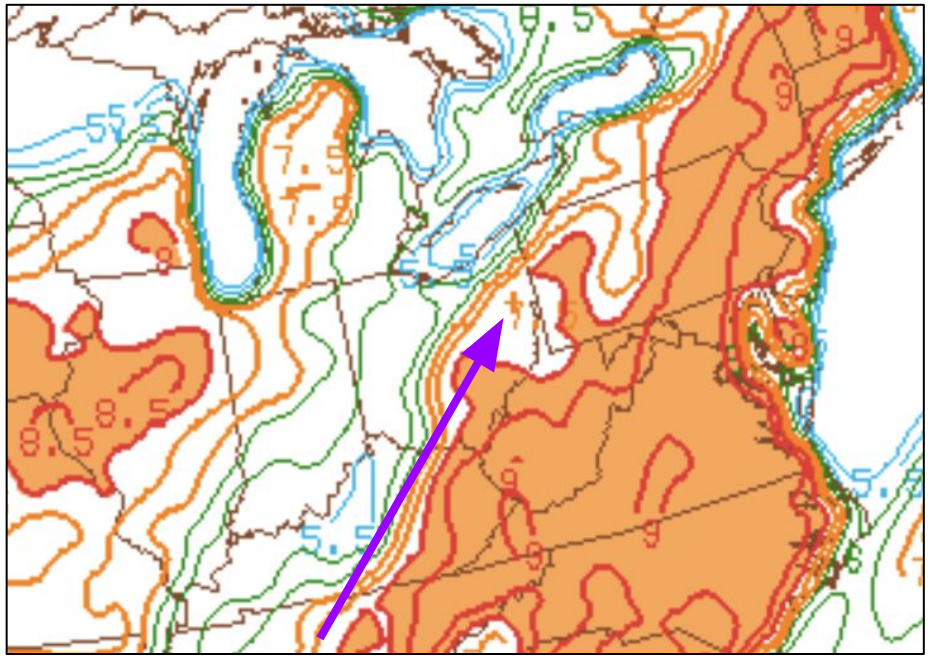


Akron, OH – 26 May 2021

700 mb mesoanalysis (18Z)

subtle shortwave

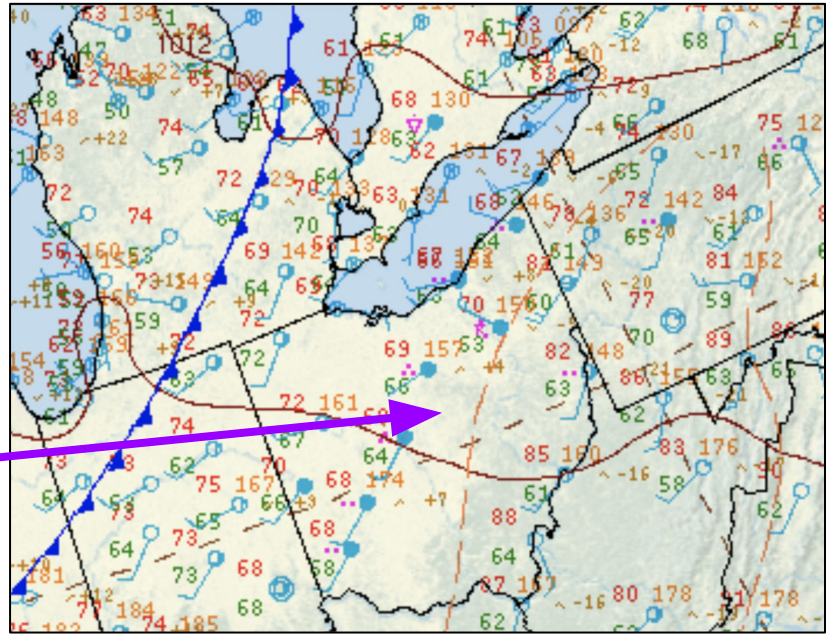




Strengthening lapse rate 0-3 km

18Z surface analysis

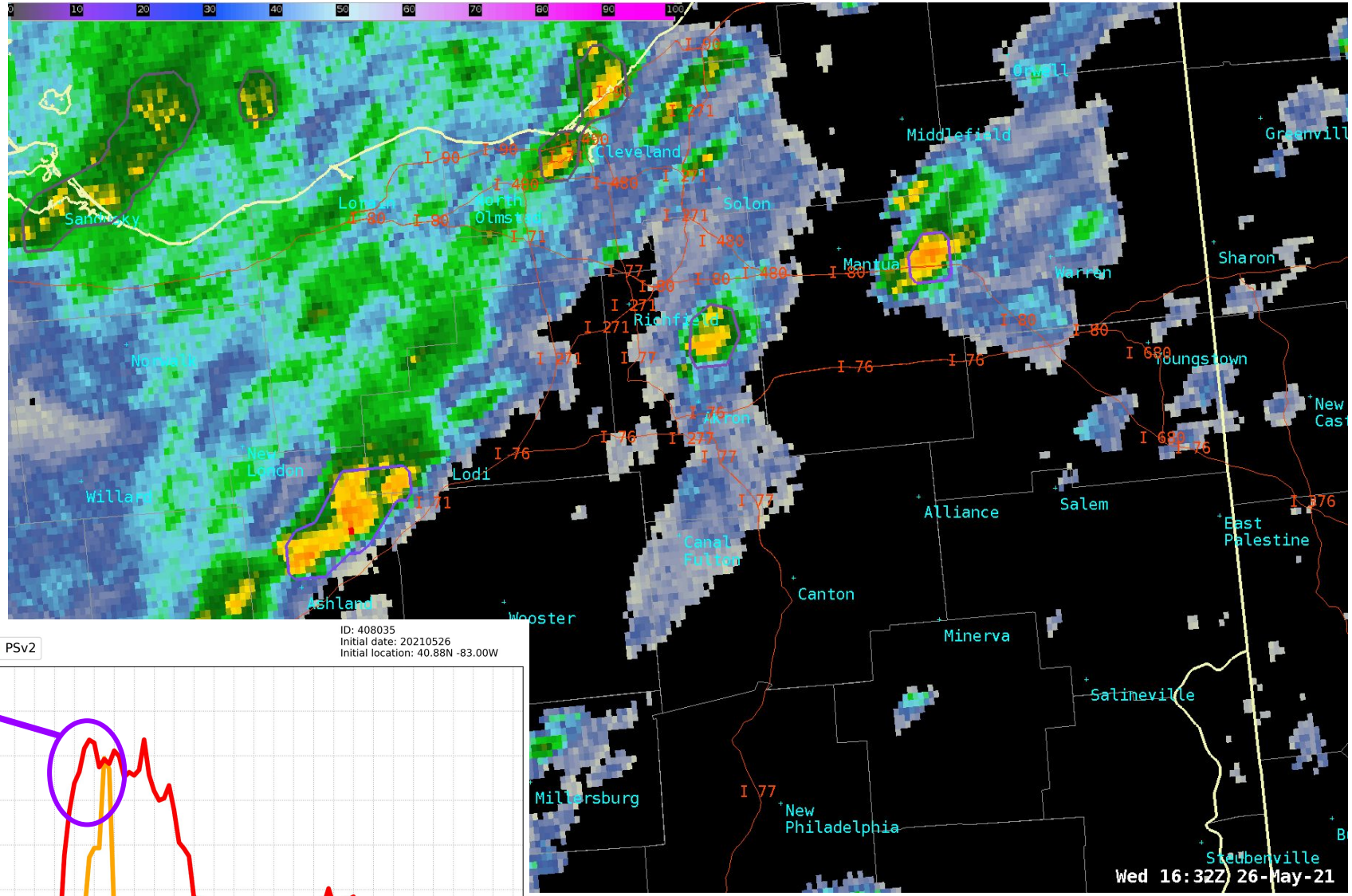
surface trough

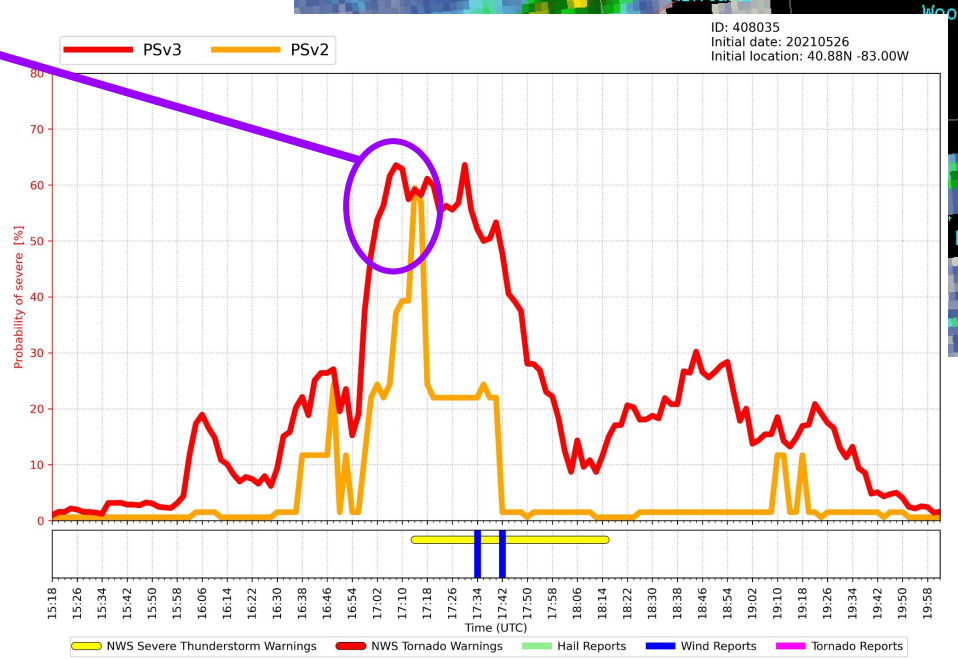


SPC's 13Z outlook

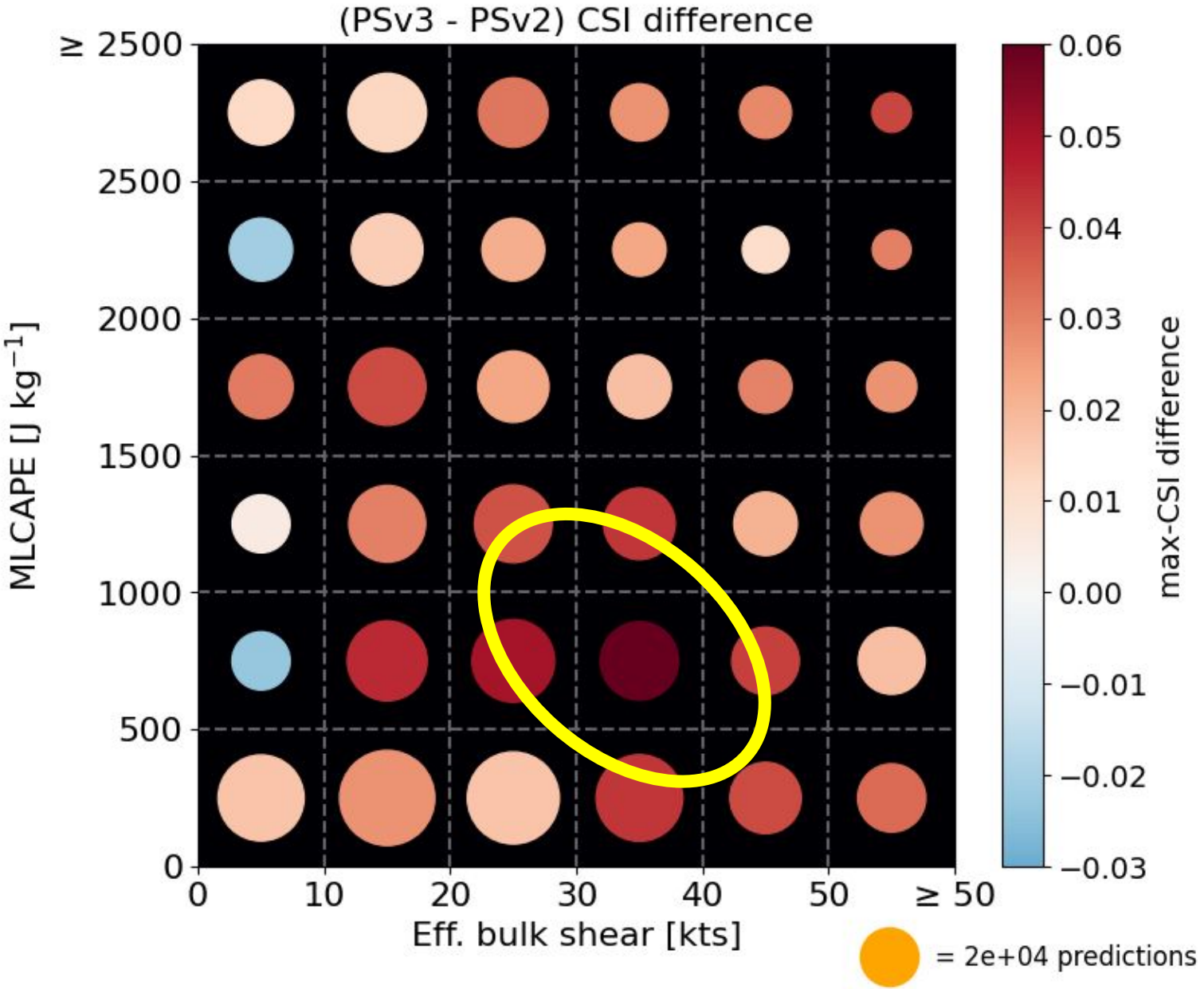
Main threat is wind

- PSv3 quickly ramped up to 60%
  - Mean wind 1-3 km : 33 kt
  - LLLR: 8.2 C/km
  - strong MRMS azshears
- Multiple wind reports in Akron
- PSv3 trends often *smoother* and *earlier ramp up* than PSv2
- PSv2 “caught up” 10 min later

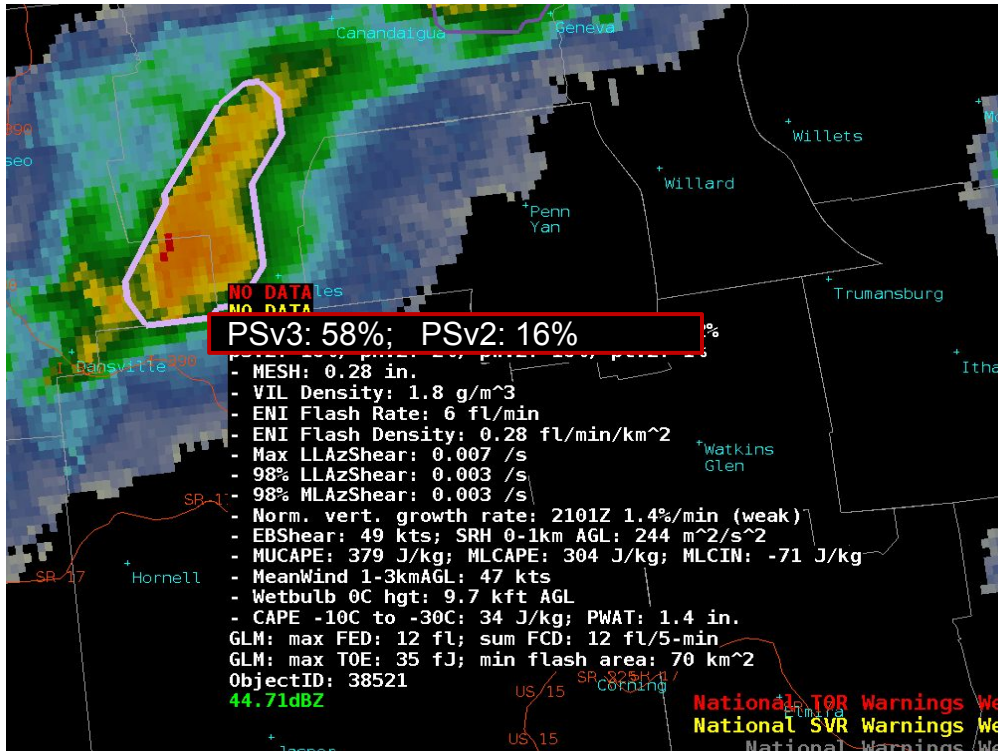


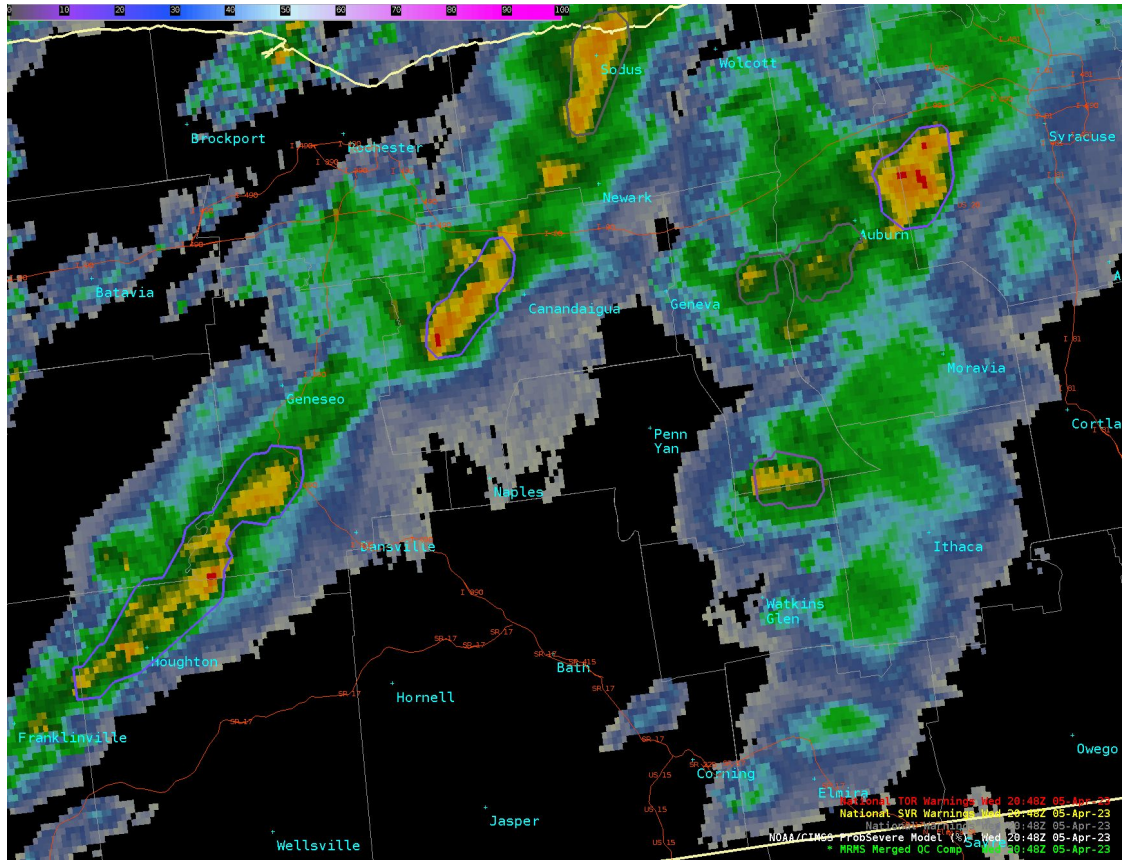


- MUCAPE of 700 J/kg and effective bulk shear of 30 kt
  - Zone of strongest improvement



Western New York – 05 April 2023



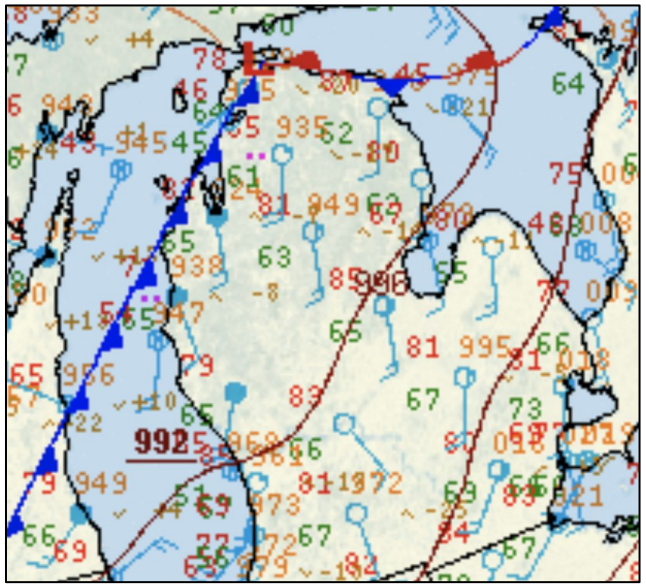


- HSLC; low lightning flash rate
  PSv3 = 58% (PSv2 = 16%) 15 min prior to warning; 22 min prior to first report
- 75-85 mph microbursts–destroying barn, power poles, and trees

Top predictors:

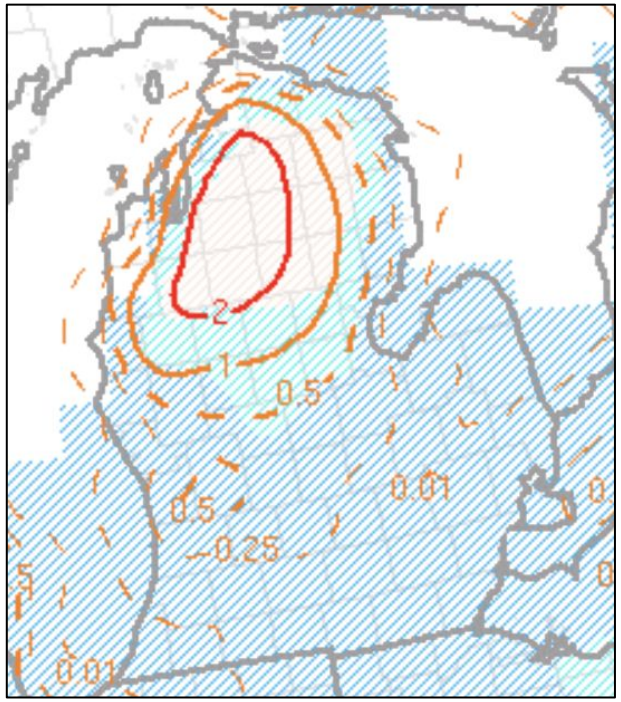
- Mean wind 1-3 km (47 kt)
- Eff. bulk shear (50 kt)
- ENI flash rate (6 fl/min)
- 0-3 km lapse rate (7.2 ºC/km)

Gaylord, MI tornado
20 May 2022



Strong cold front

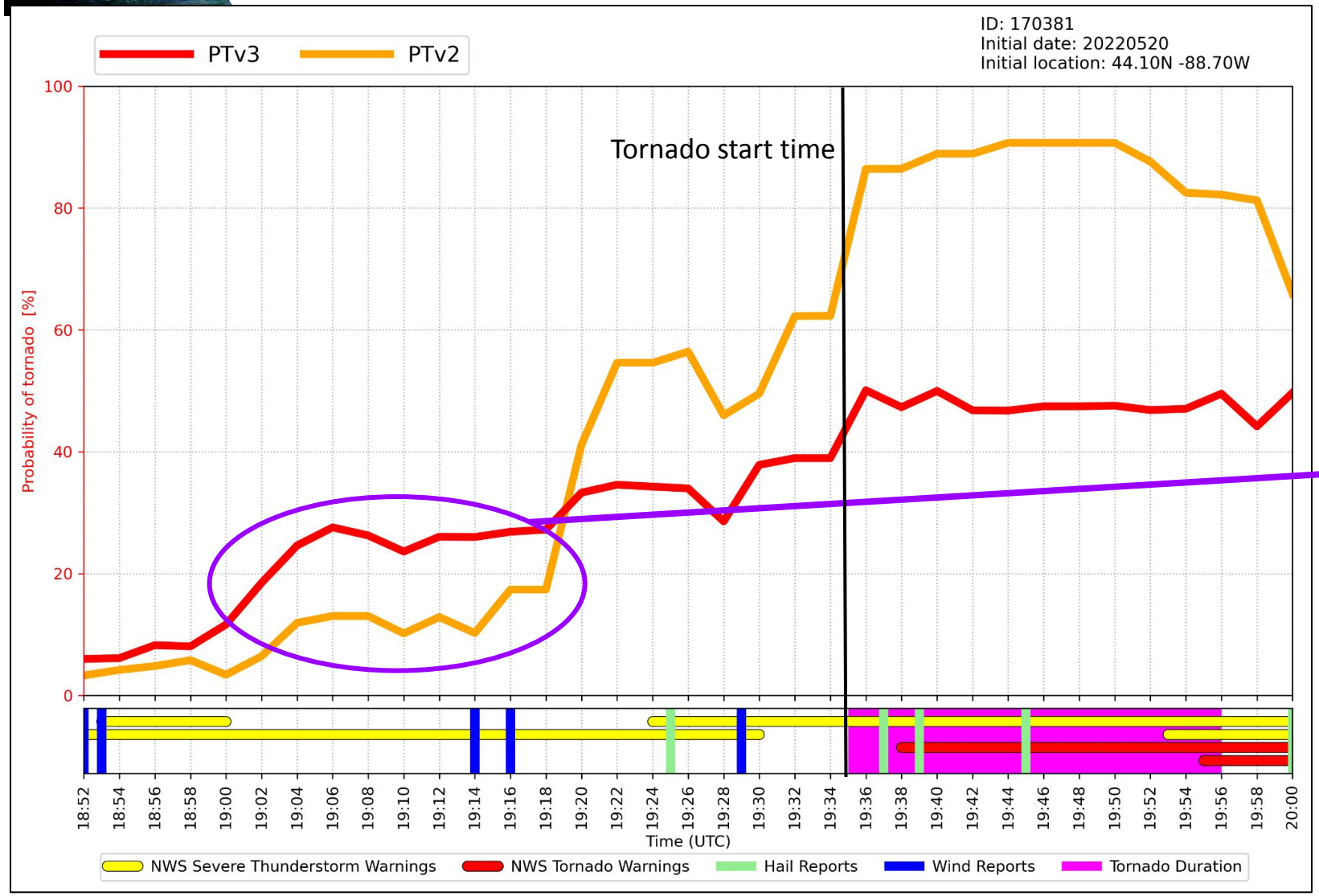
+

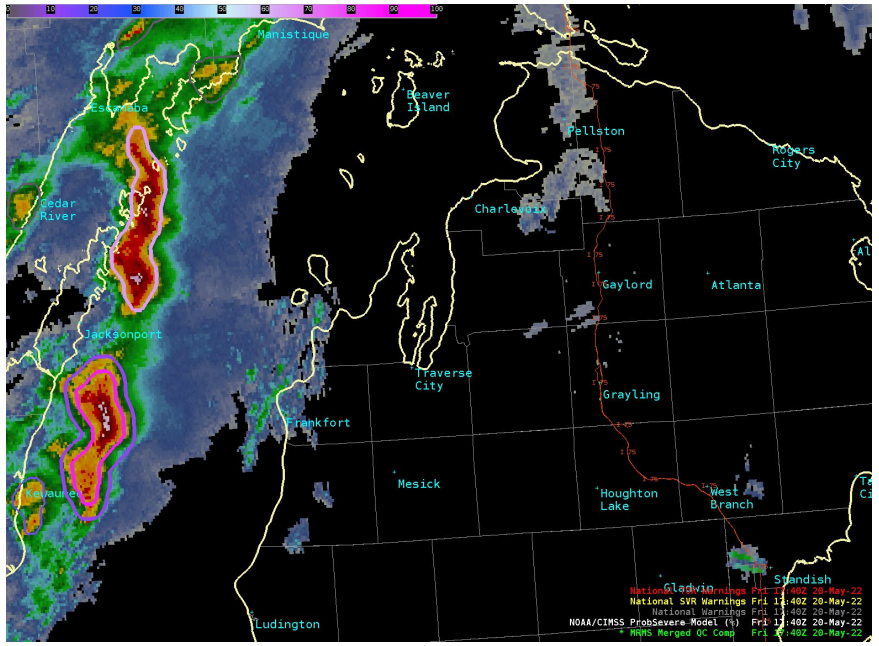


STP_{eff} > 2 (20Z mesoanalysis)

=

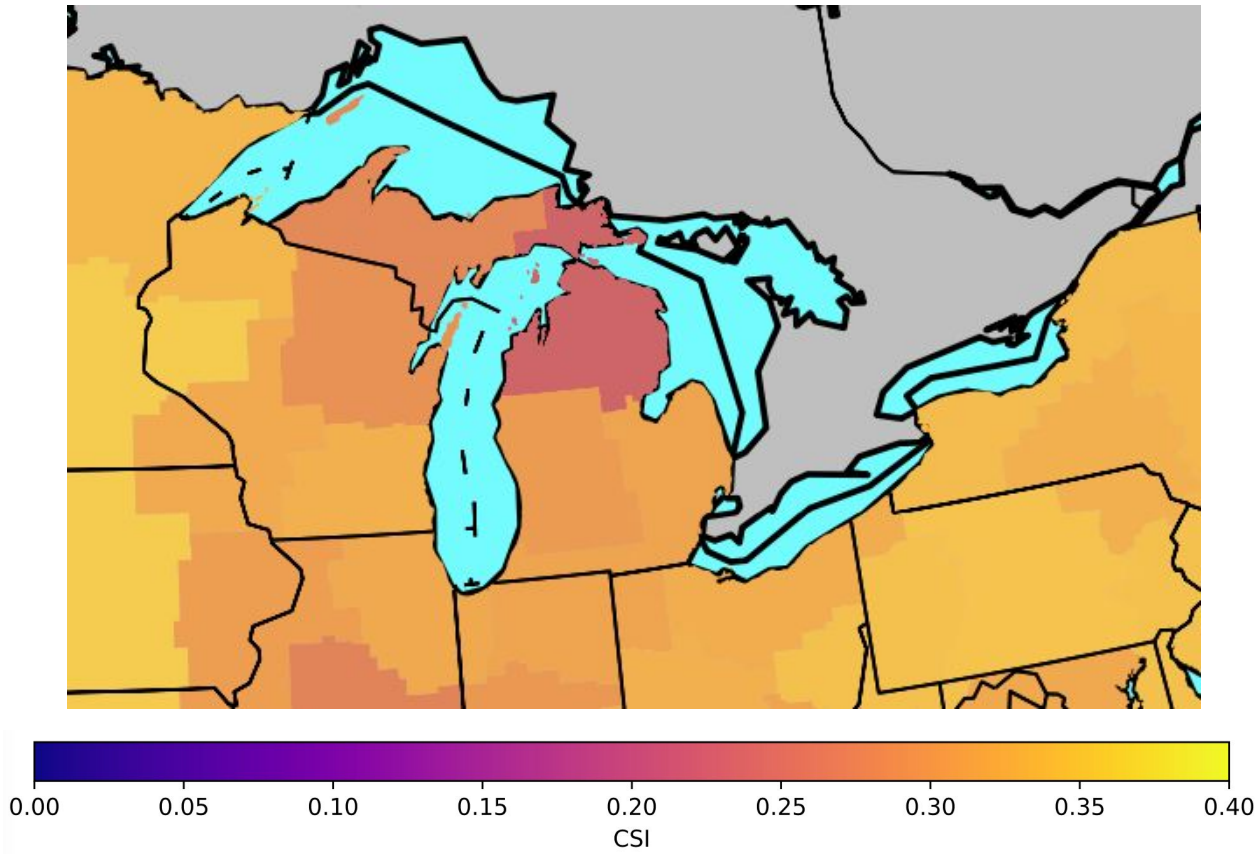
SPC tornado outlook (1630Z)



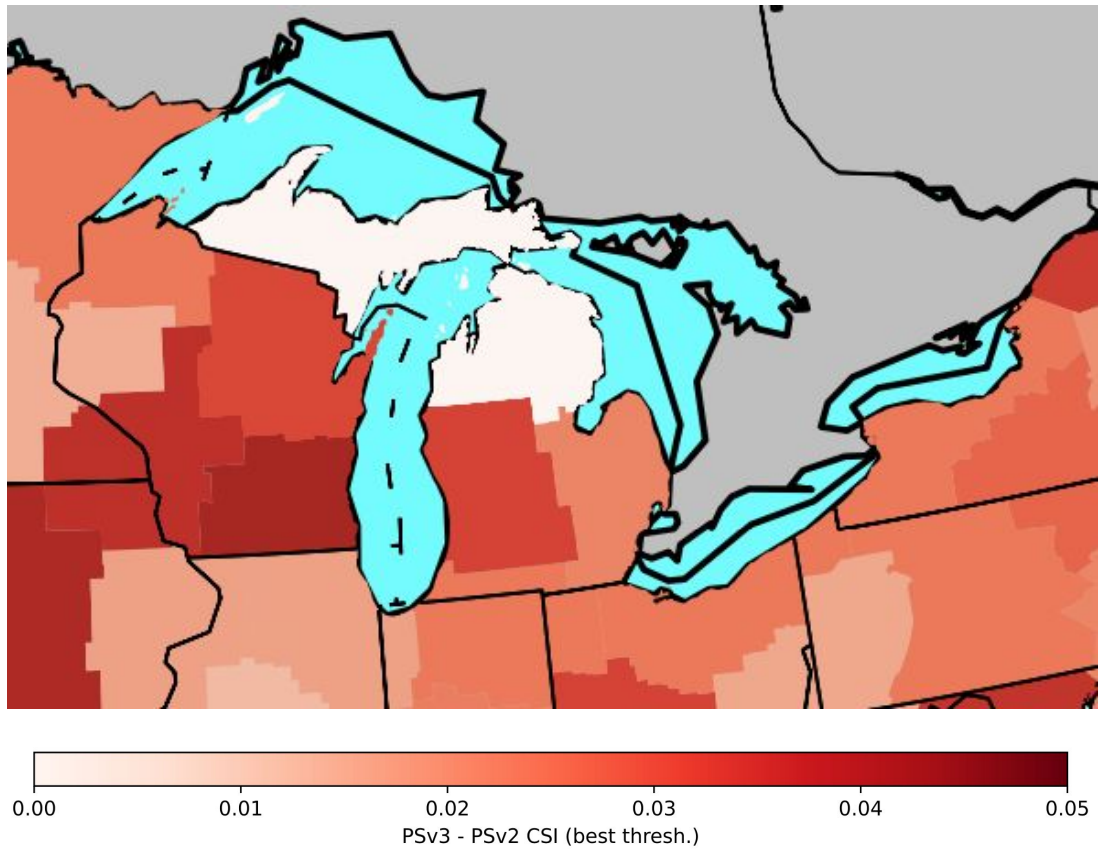


- PTv3 increases before PTv2
- PTv3 10-15% higher than PTv2
  - Have seen as much as 30% higher in other tornadic storms
- PTv3 generally maxes out at ~60% as opposed to PTv2 (~90%).
  - PTv3 captures the noise/uncertainty inherent in MRMS AzShear data

Critical Success Index (CSI) at probability ≥ 50%



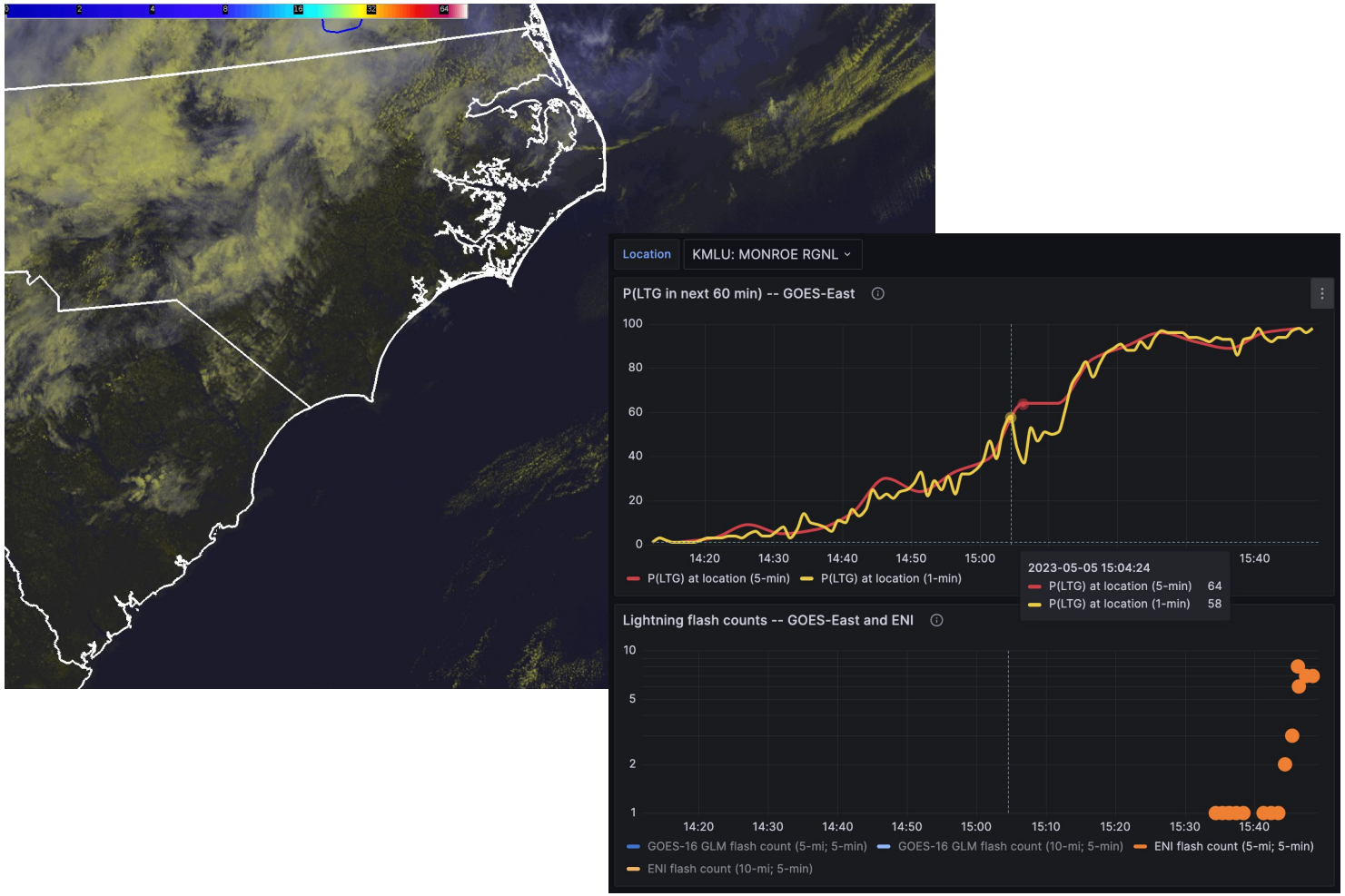
CSI difference (PSv3-PSv2 @ best-CSI prob. thresh.)



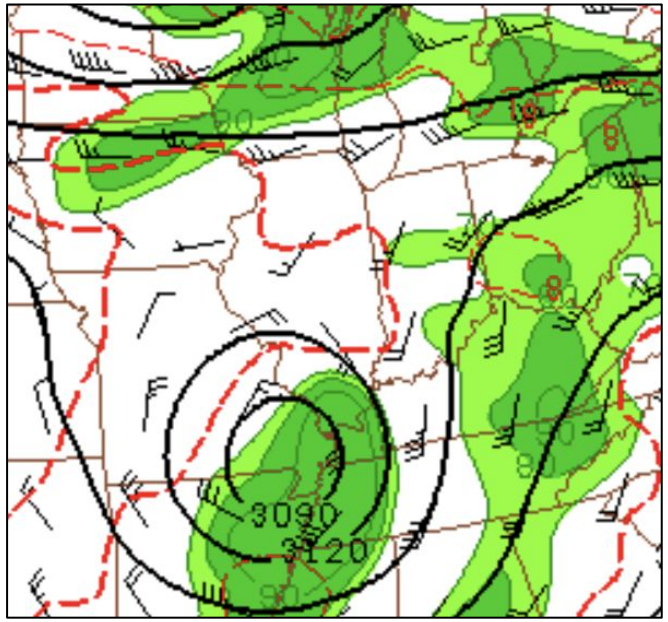
LightningCast

Probabilistic next-hour lightning nowcast model

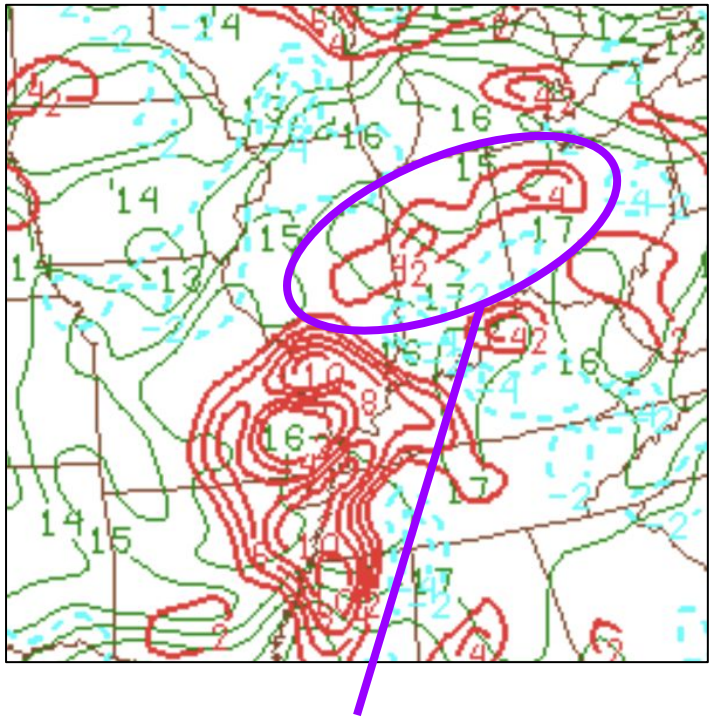
- **Data sources**
  - GOES-16 or GOES-18 ABI
  - 0.64 µm, 1.6 µm, 10.3 µm, 12.3 µm
- **Products**
  - GOES-16 or -18 CONUS, mesos
  - Parallax-corrected or uncorrected
- **Strengths**
  - Very good at lightning initiation (LI)
- **Weaknesses**
  - Developing convection under thick ice
  - Lower lead time in explosive CI
  - Less skill in cool season



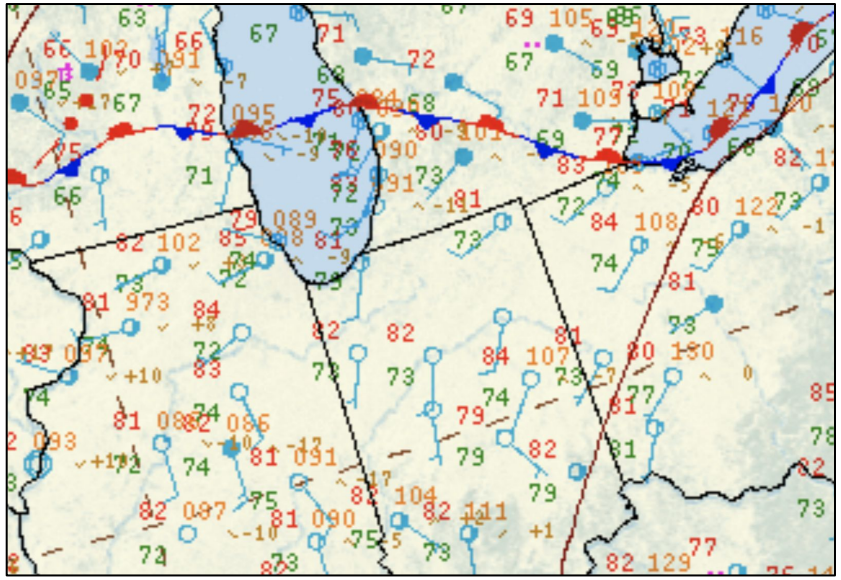
Northern Indiana – 28 August 2020



Cut-off low over southeast Missouri at 700 mb

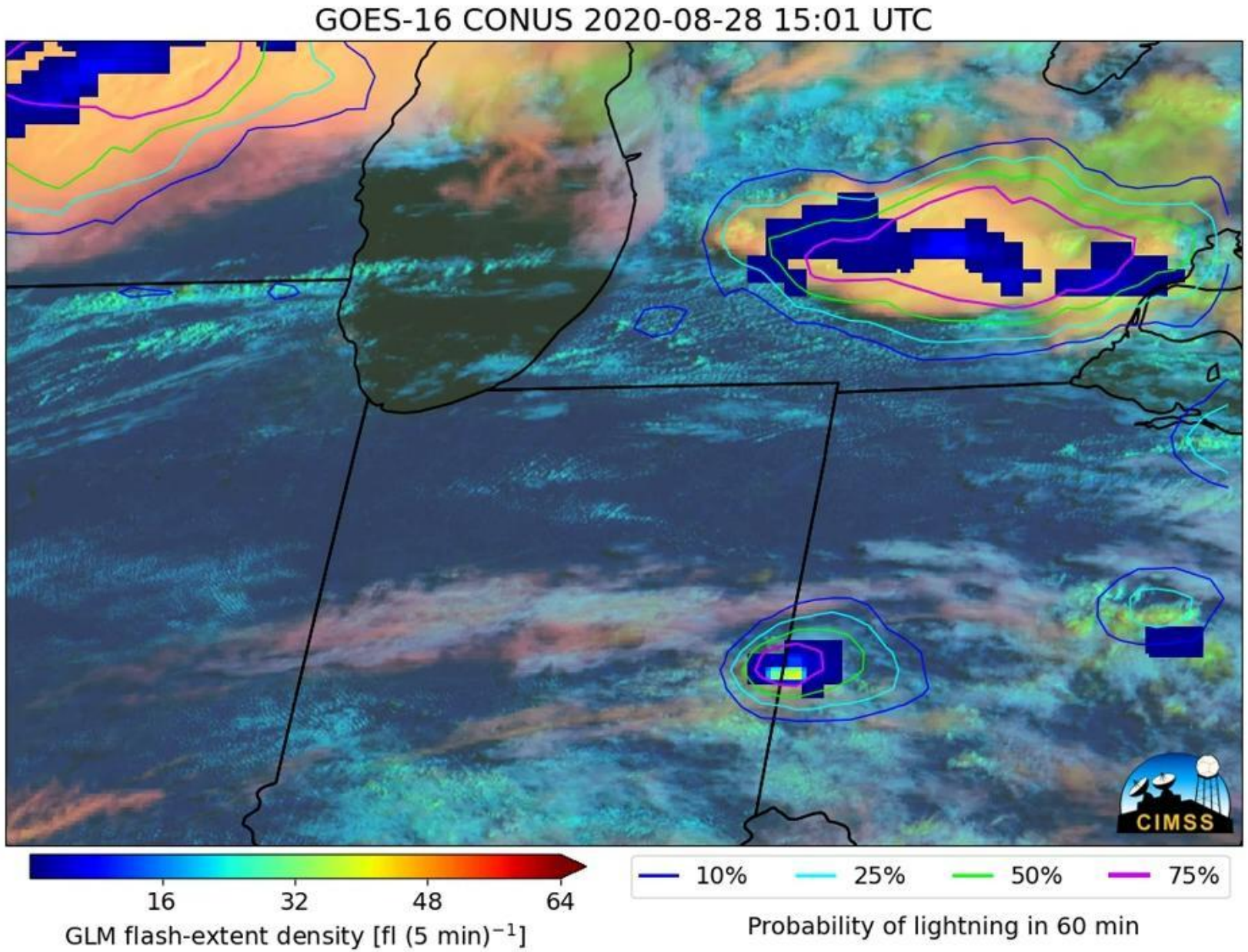


Deep moisture convergence



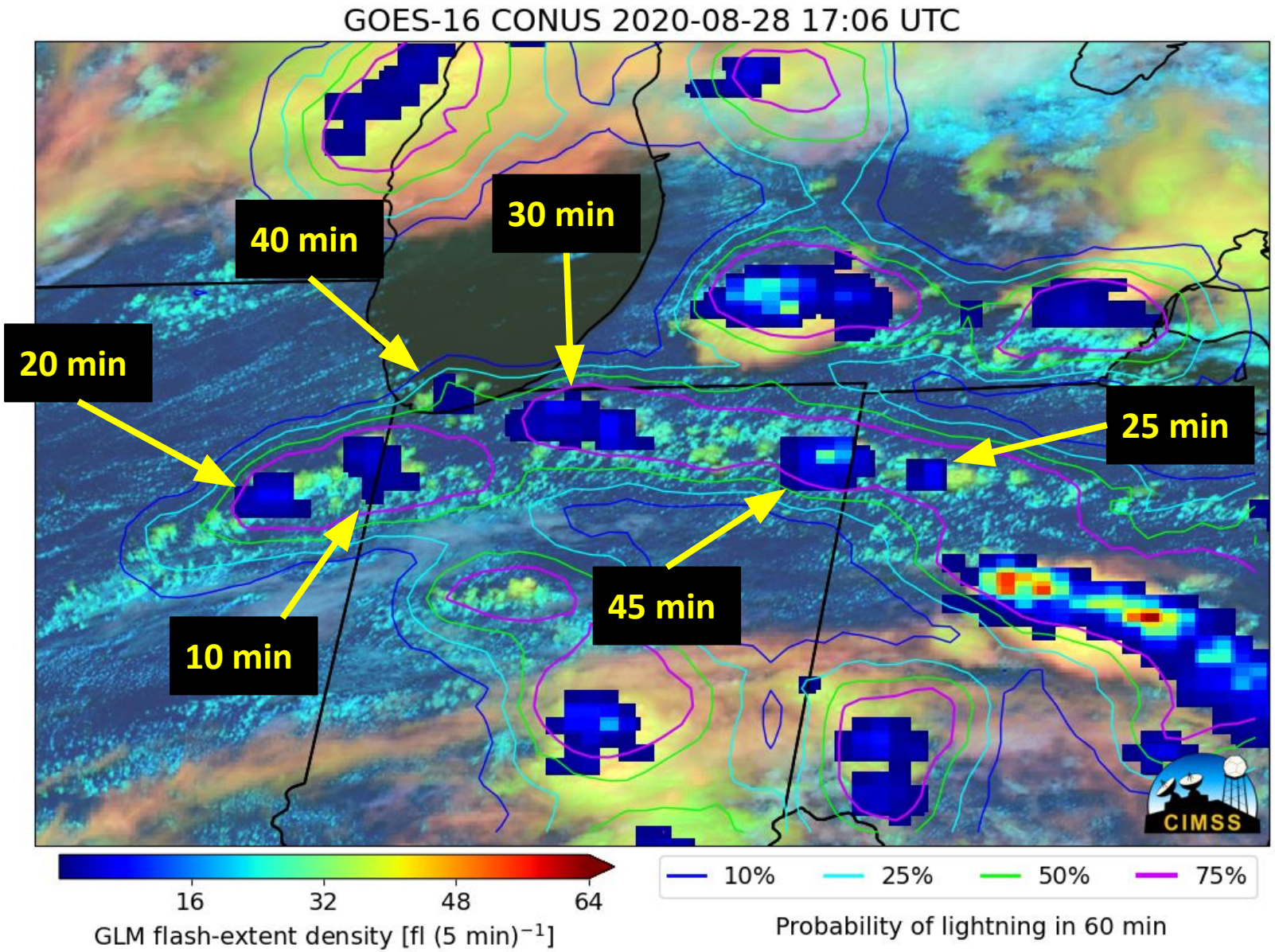
Mass convergence south of stationary boundary

Northern Indiana – 28 August 2020



Northern Indiana – 28 August 2020

Lead time to lightning initiation measured from the 25% probability contour



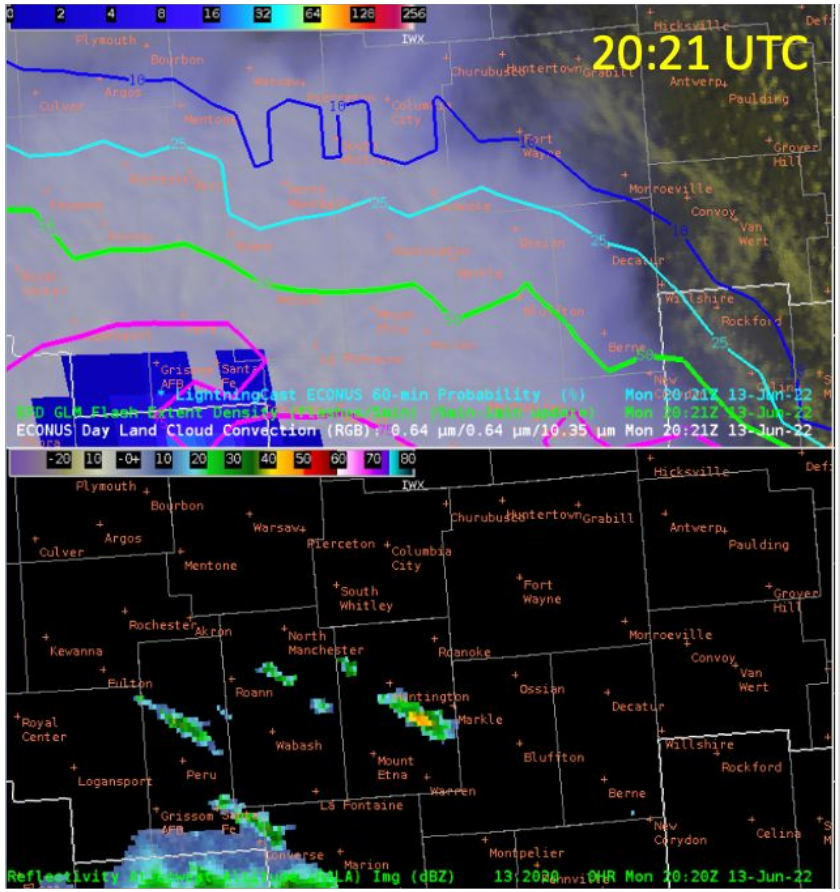
National Satellite and Information Service

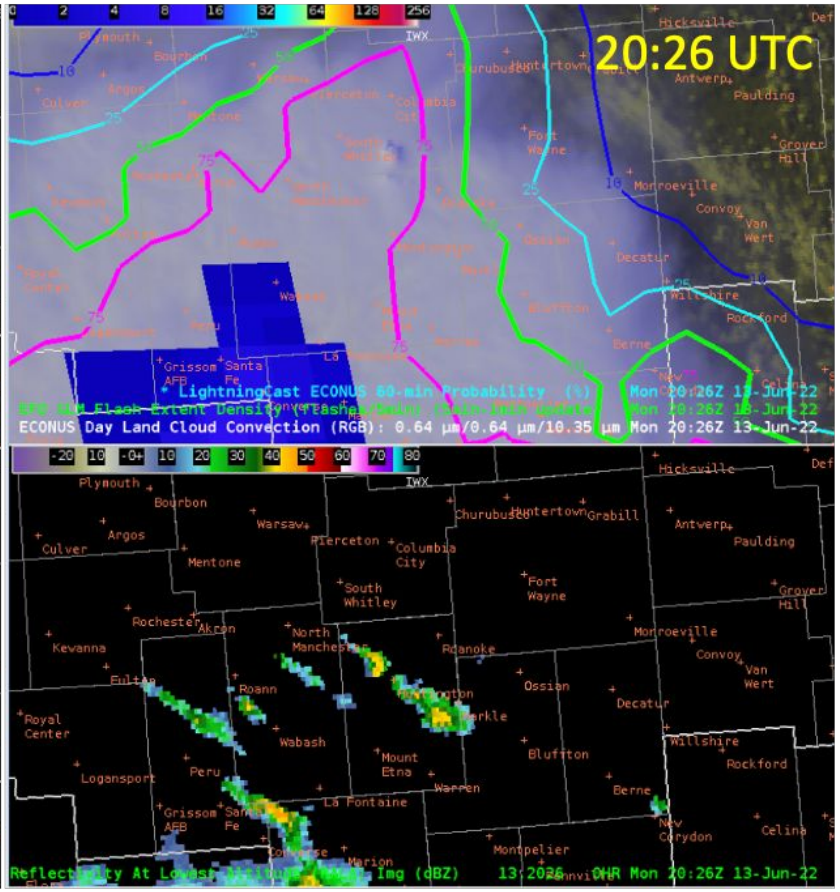
Tuesday, June 14, 2022

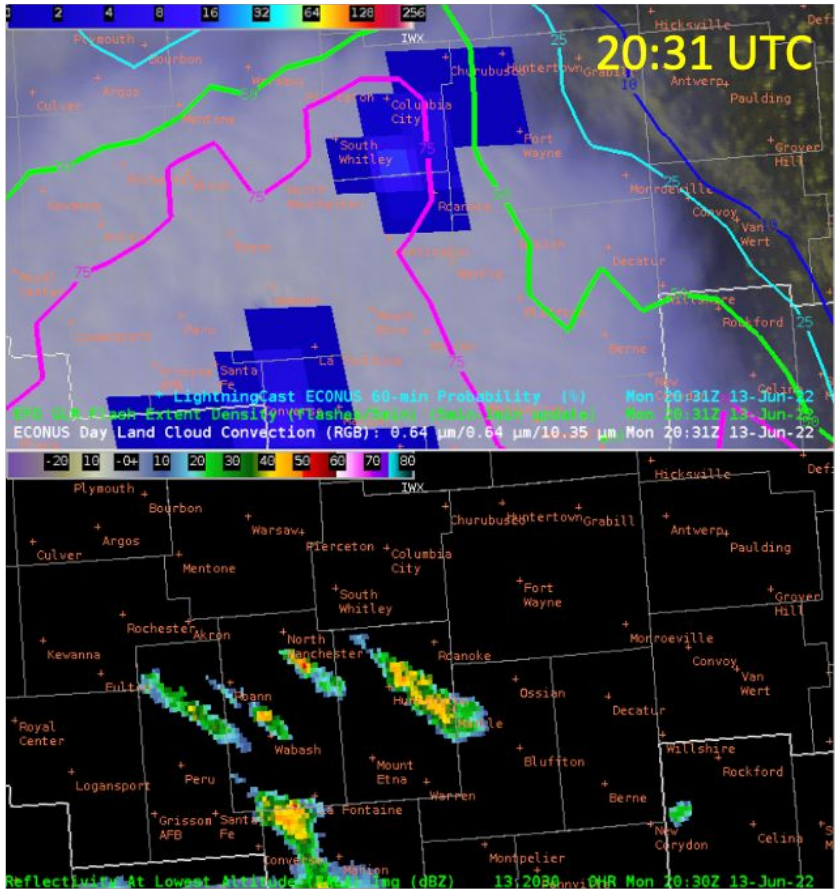
Where is the new convection going up?

https://goesrhwt.blogspot.com/2022/06/where-is-new-convection-going-up.html

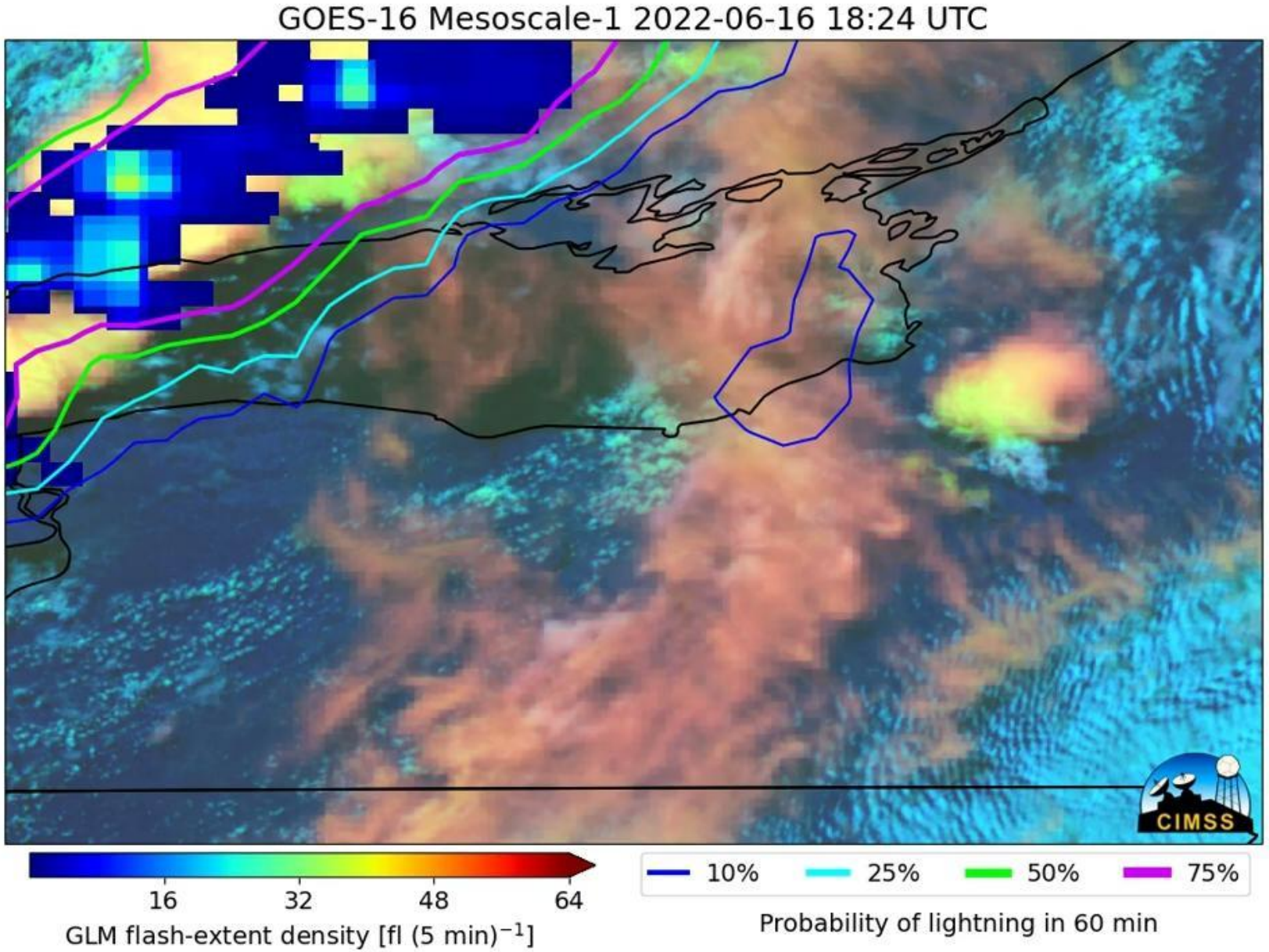
Northern Indiana – 14 June 2022



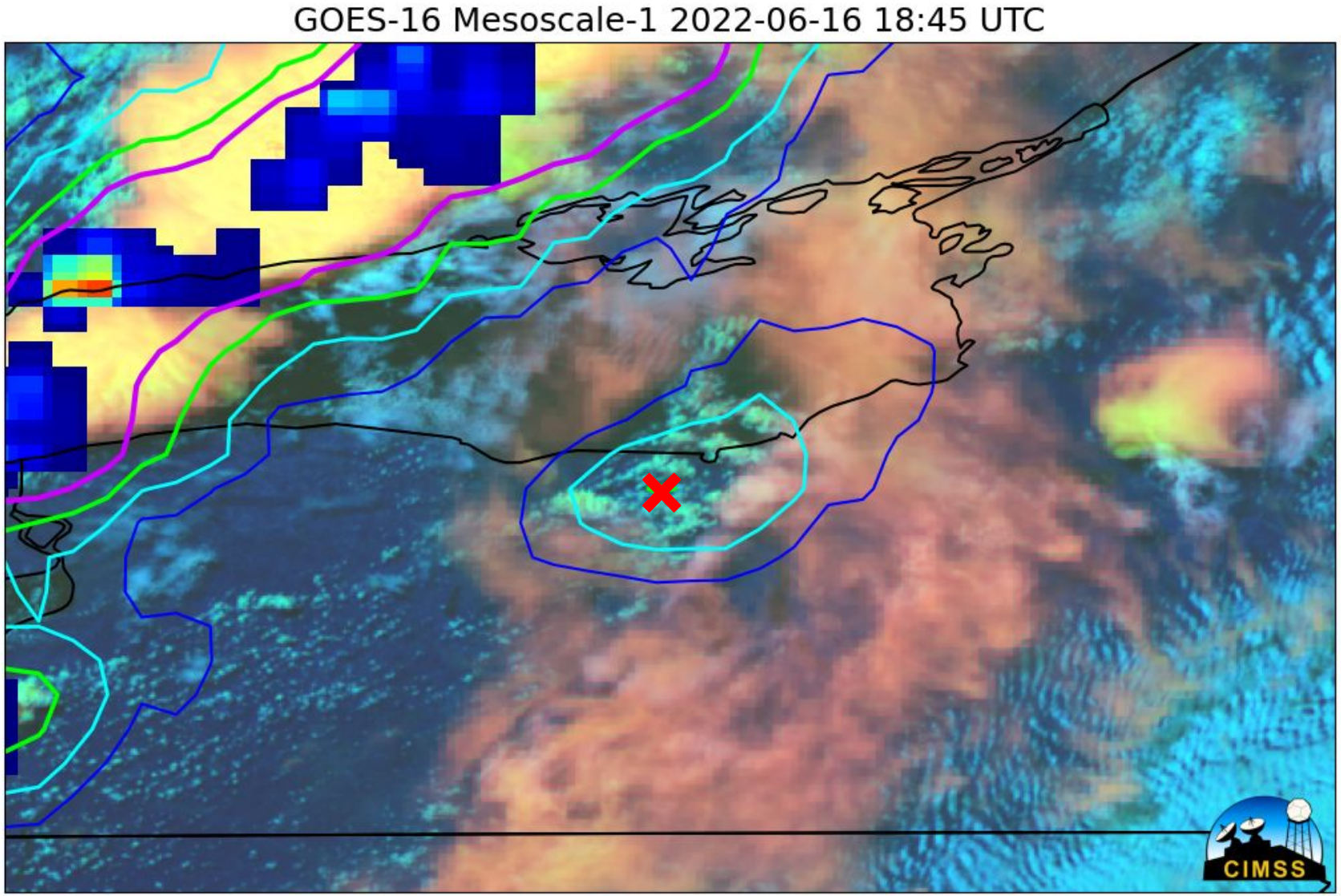




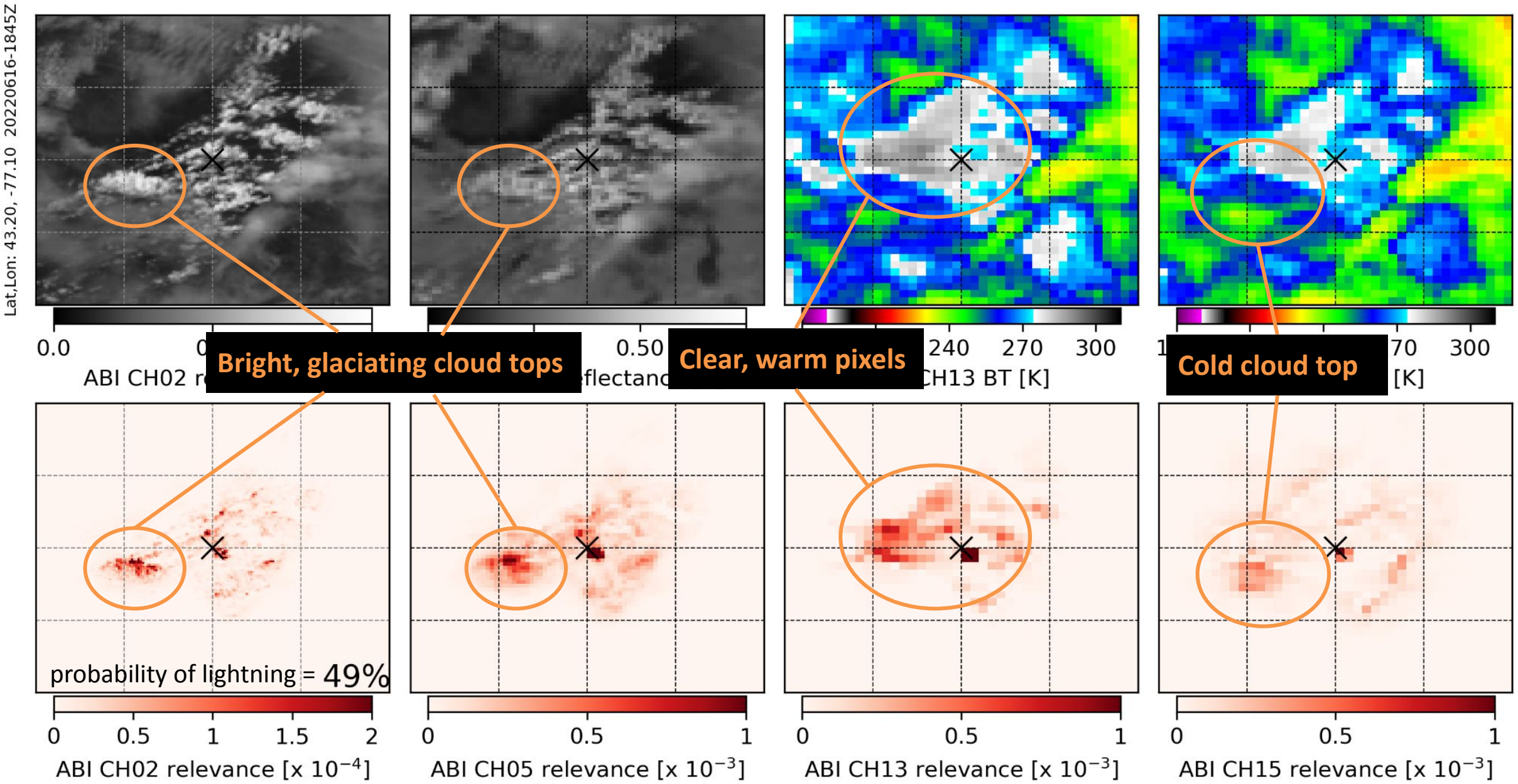
New York – 16 June 2022



New York – 16 June 2022

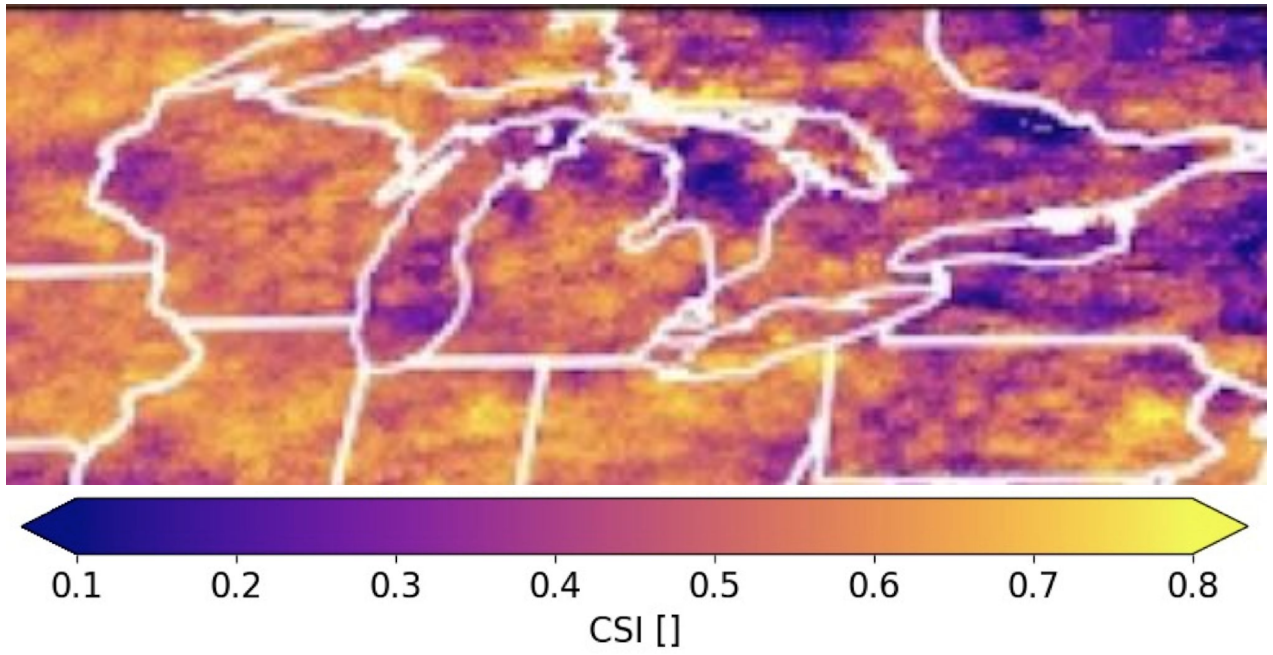


New York – 16 June 2022

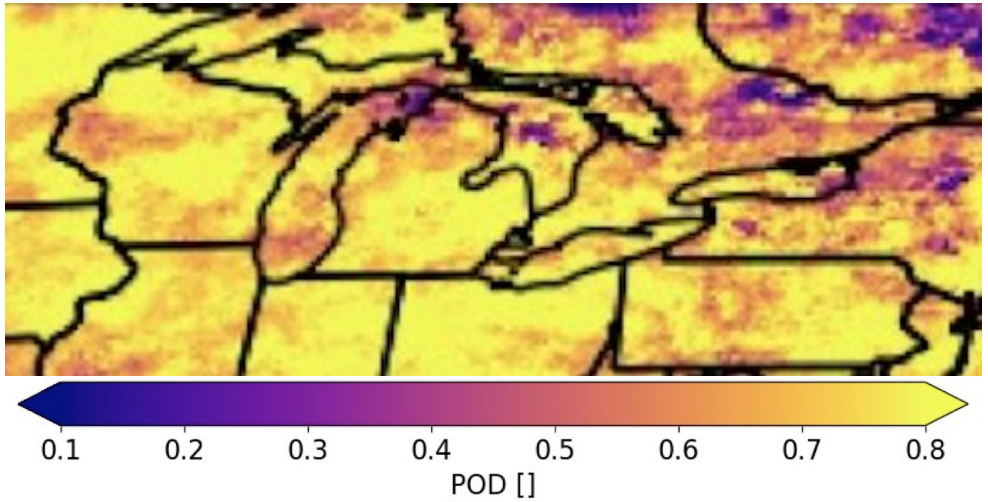


Paper details:
https://journals.ametsoc.org/view/journals/wefo/37/7/WAF-D-22-0019.1.xml

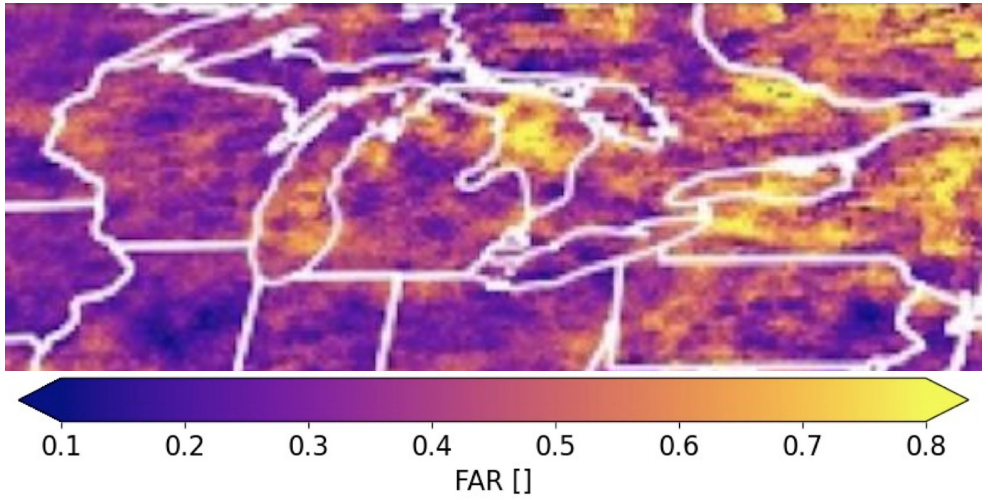
Critical Success Index (CSI) at probability ≥ 35%



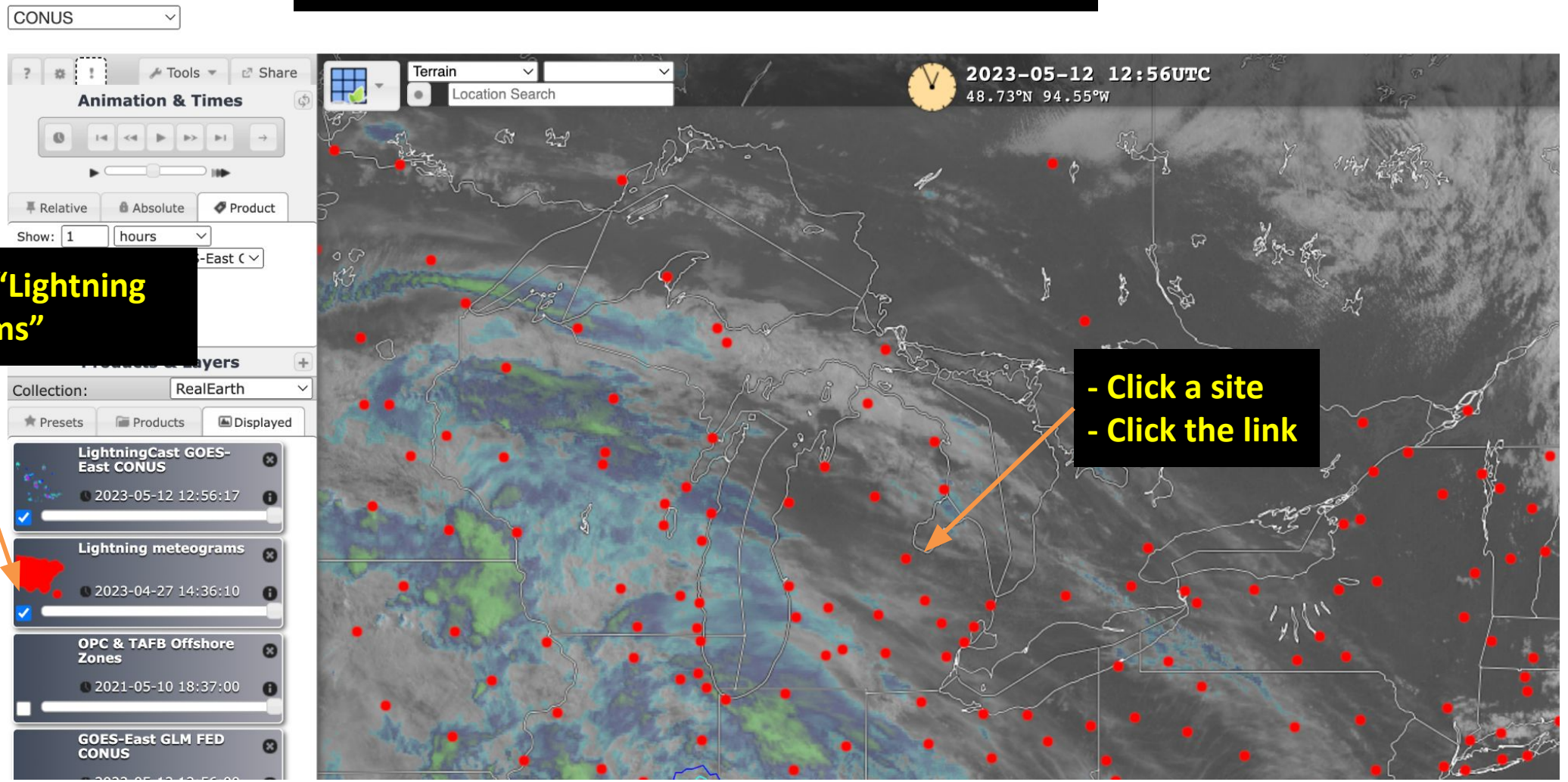
Probability of Detection (POD) at probability ≥ 35%



False Alarm Ratio (FAR) at probability ≥ 35%



https://cimss.ssec.wisc.edu/severe_conv/pltg.html
Or Google "LightningCast"



Toggle on "Lightning meteograms"

- Click a site
- Click the link

h/t to TJ Turnage for list of TAF sites

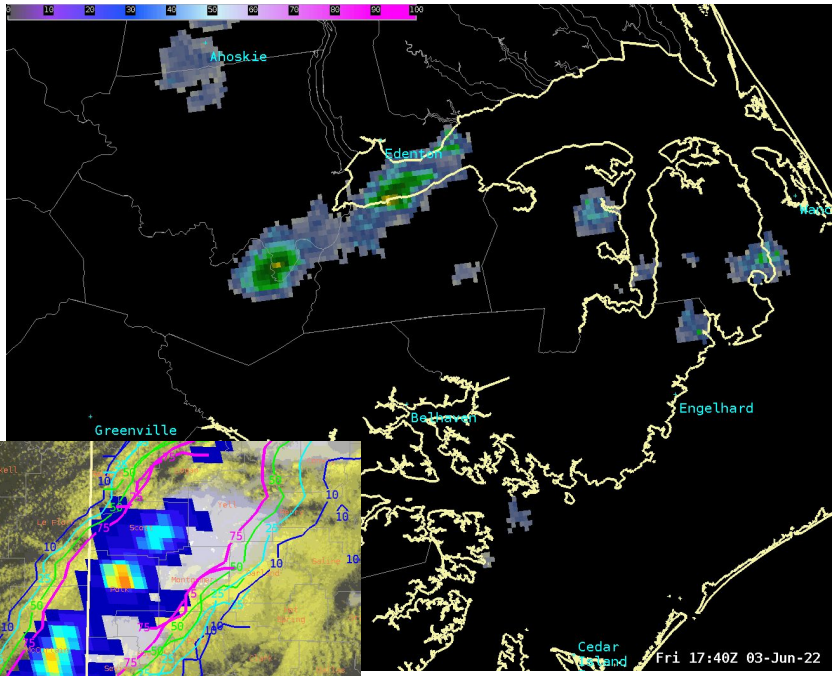
Location KHDC: HAMMOND NORTHSHORE RGNL

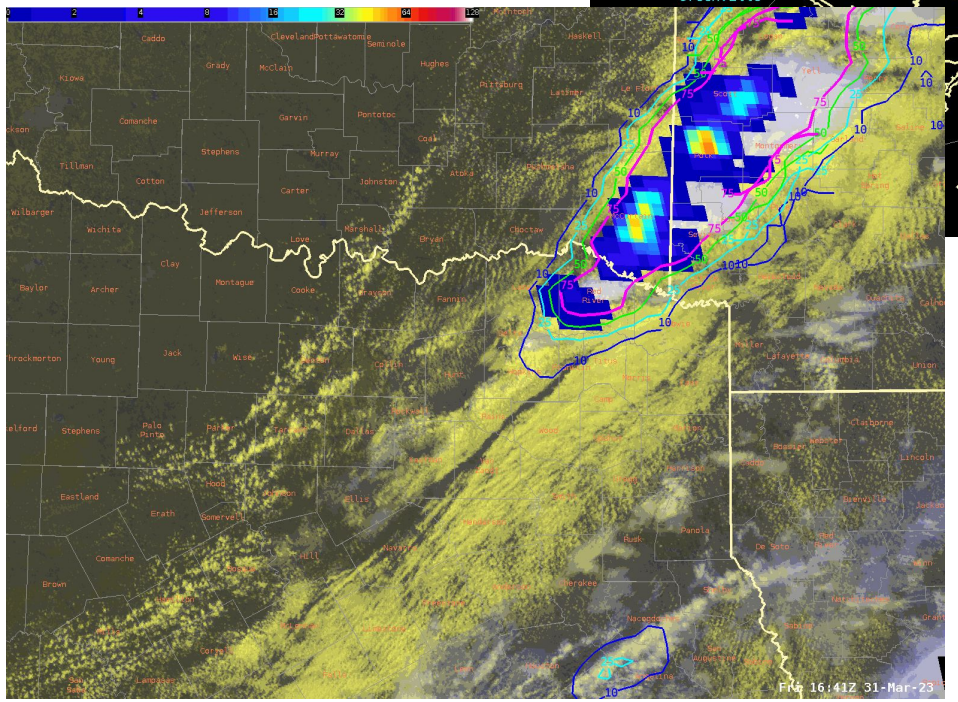
P(LTG in next 60 min) -- GOES-East

Lightning flash counts -- GOES-East and ENI

Summary

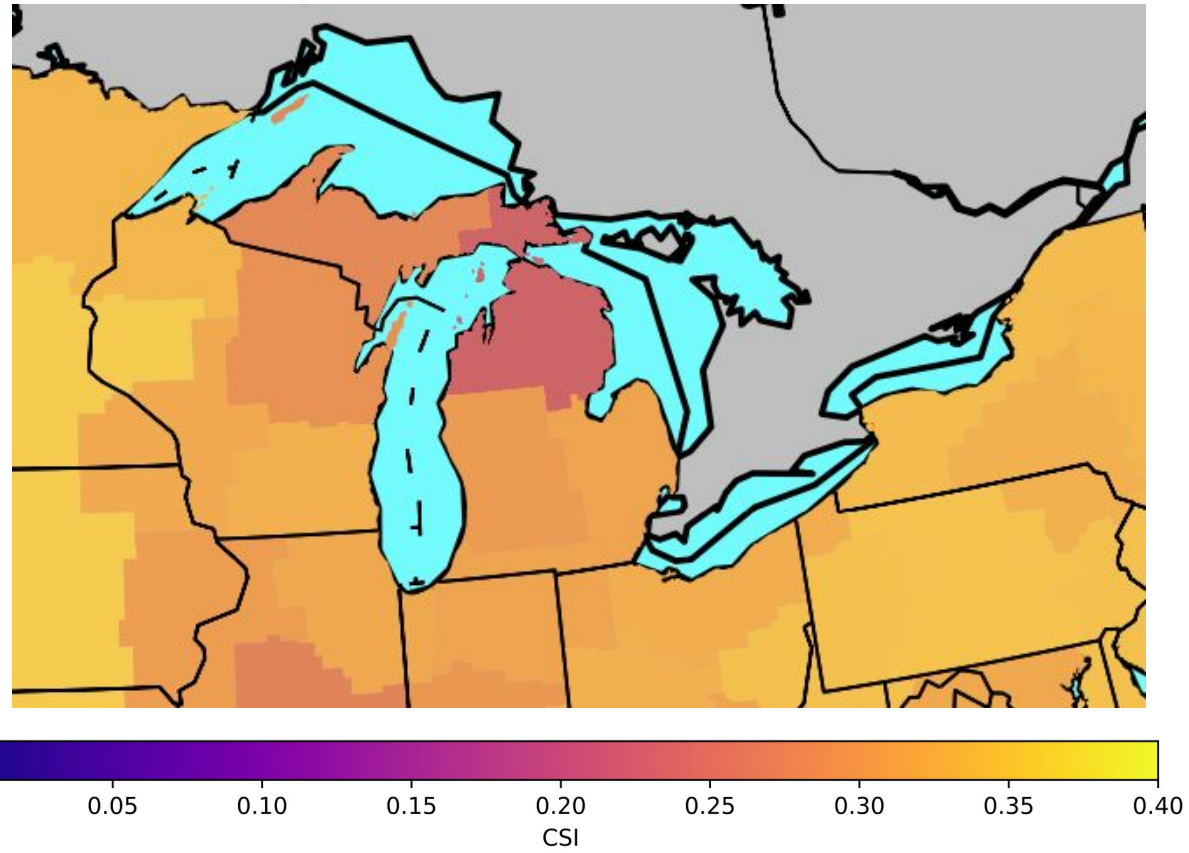
- **ProbSevere v3**
  - Better probability calibration
    - Improvement in moderate-CAPE moderate-shear environments
    - Improvement in high-shear low-CAPE environments
  - PTv3 earlier ramp up than PTv2 in tornadic storms
- **LightningCast**
  - Skillful at lightning initiation nowcasts
  - Time series capability at TAF airports
  - Working to improve cool season performance
  - T2O (NESDIS) starting soon, expected completion Dec 2024
- GRLevel placefiles available for PSv3 and LightningCast (CONUS and MESOs)
  - https://cimss.ssec.wisc.edu/severe_conv/training/training.html



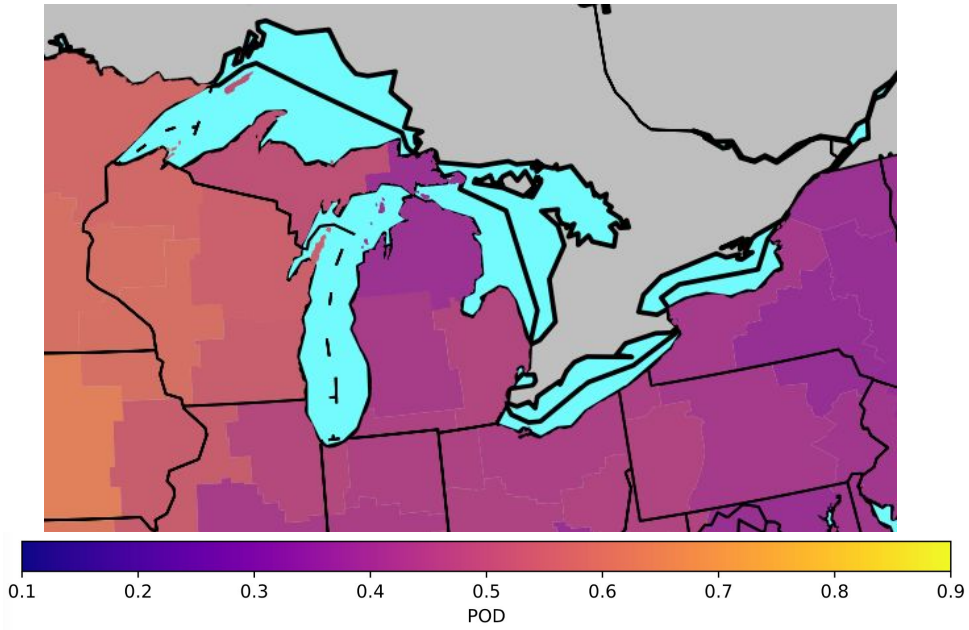


Extra slides

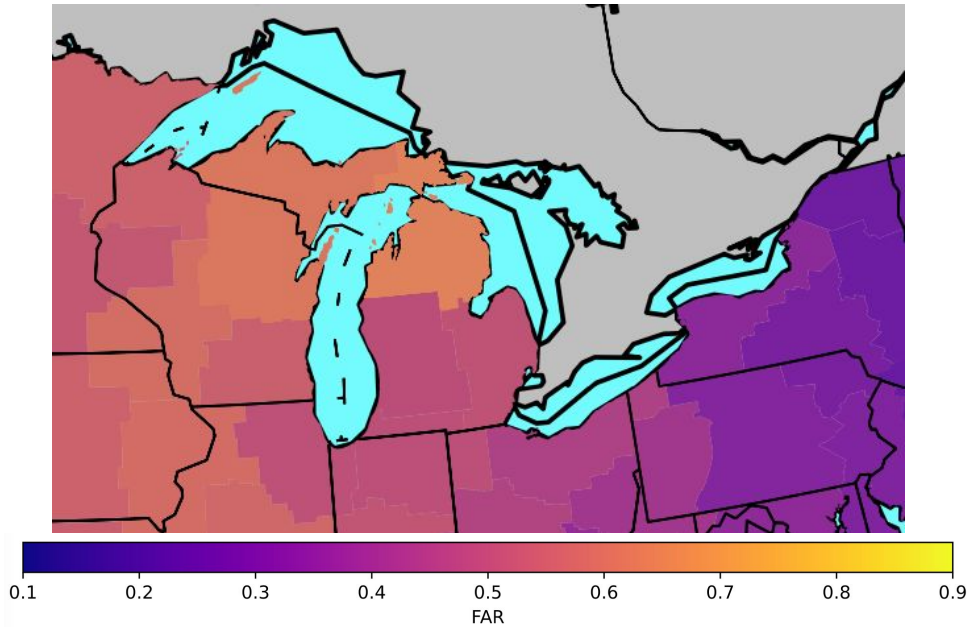
Critical Success Index (CSI) at probability ≥ 50%



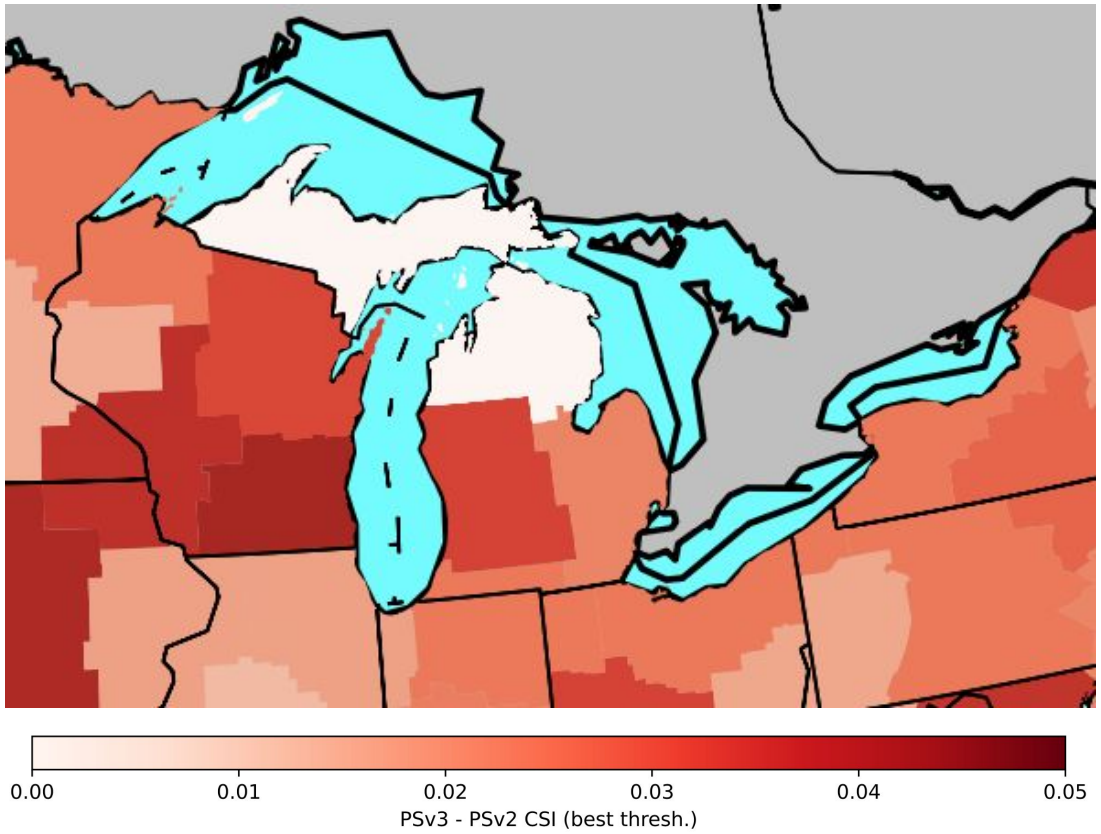
Probability of Detection (POD) at probability ≥ 50%



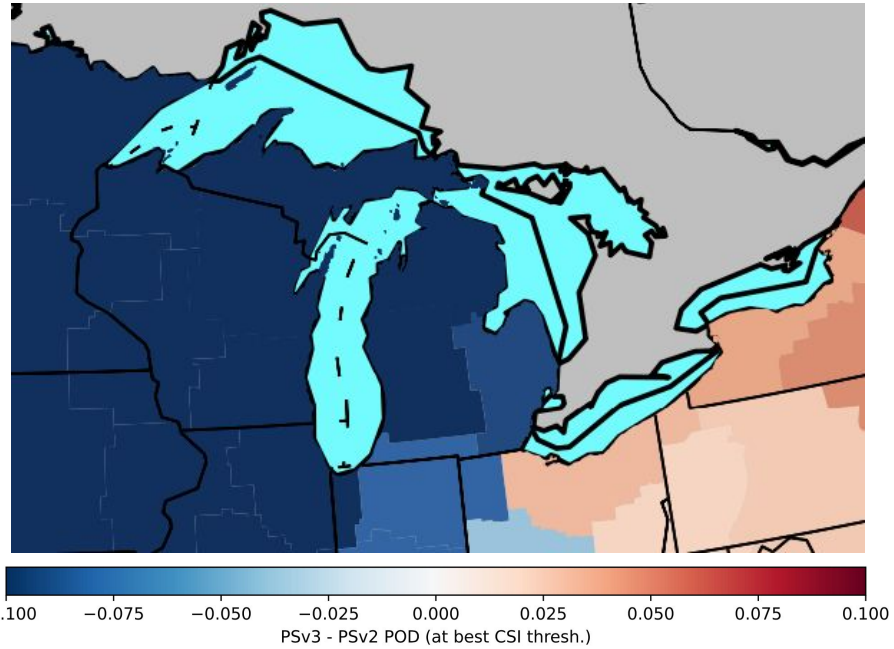
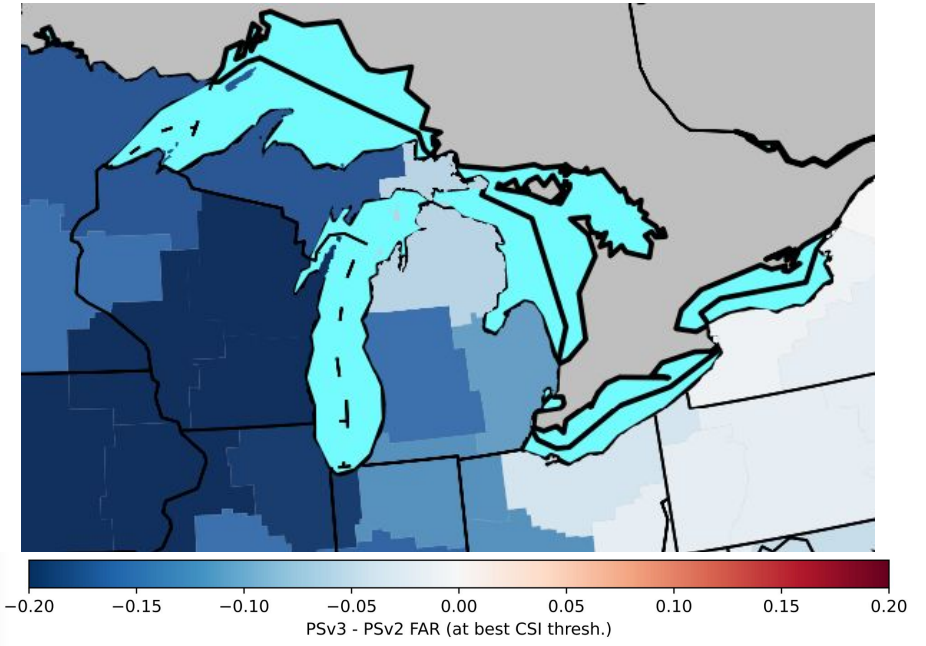
False Alarm Ratio (FAR) at probability ≥ 50%



CSI difference (PSv3-PSv2 @ best-CSI prob. thresh.)



POD difference (PSv3-PSv2 @ PSv3 best-CSI prob. thresh.)



FAR difference (PSv3-PSv2 @ PSv3 best-CSI prob. thresh.)