Model Review of the Historic Flash Flood Events of August 18-19, 2024

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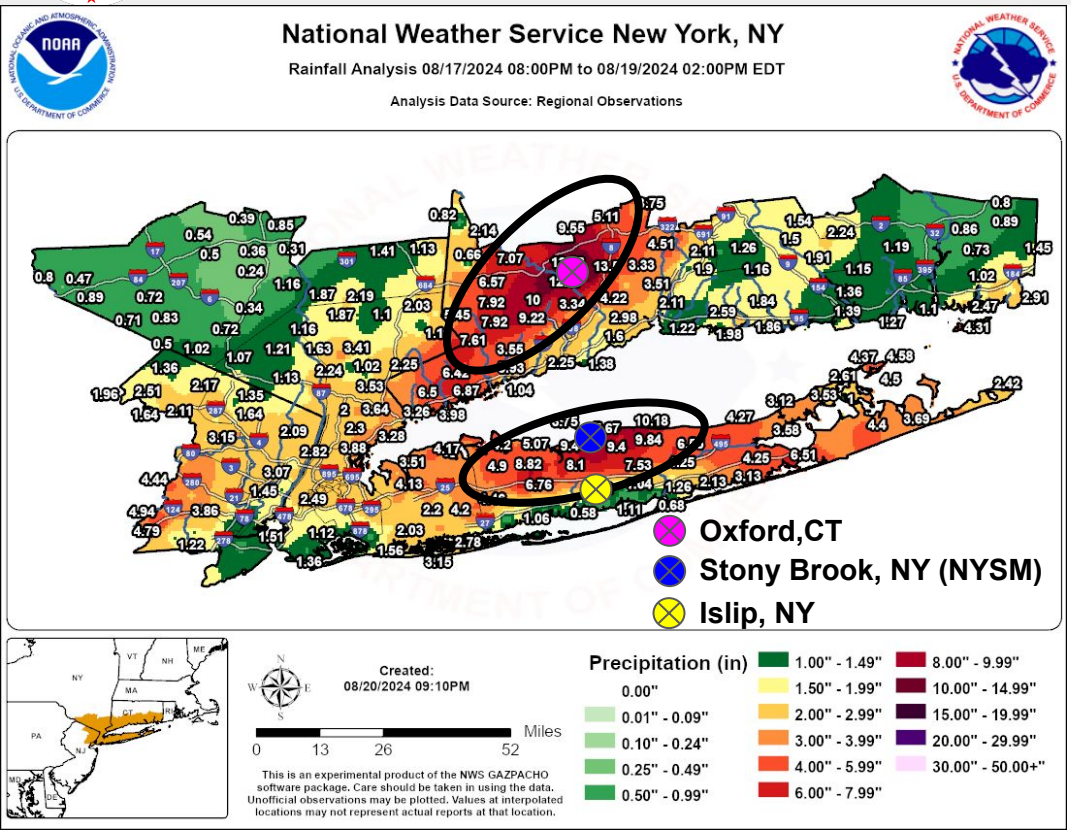
NROW XXV
November 15, 2024

Refresher: Observed Rainfall Analysis

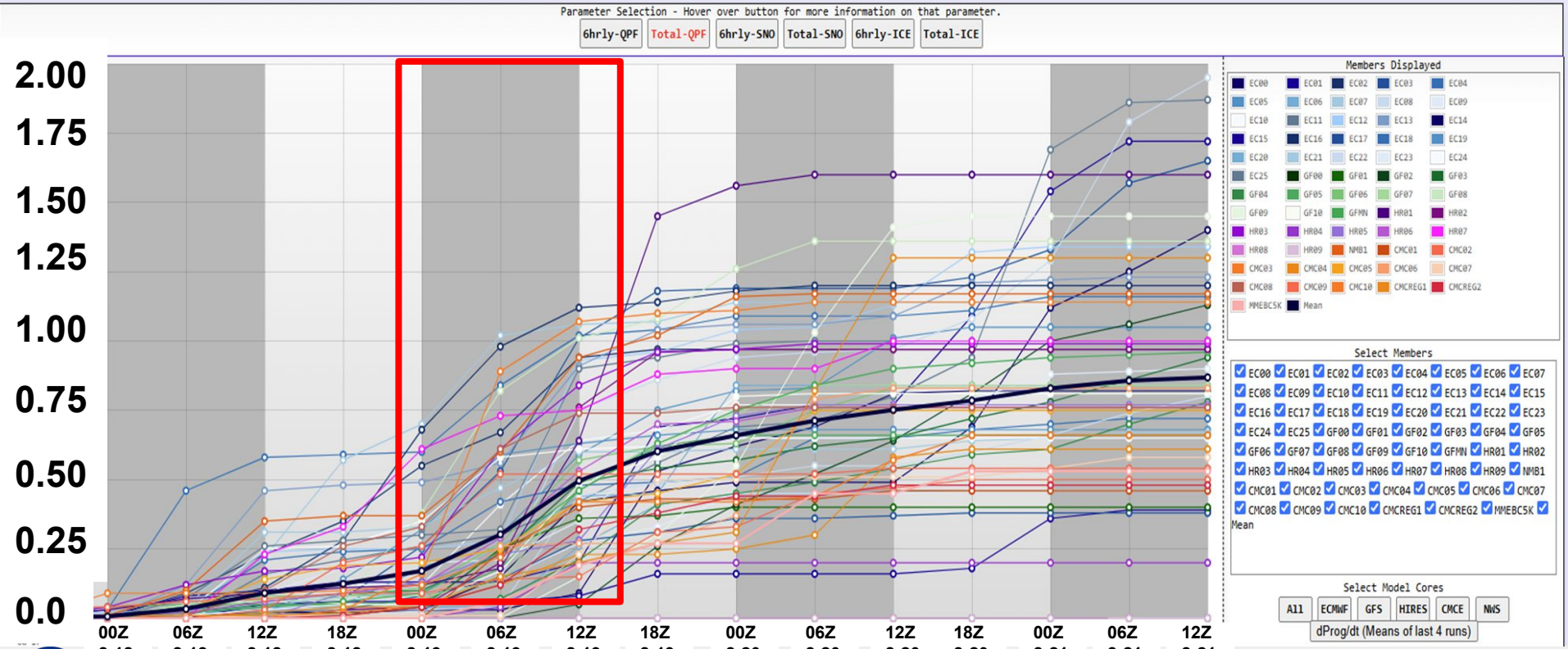


Fast Facts

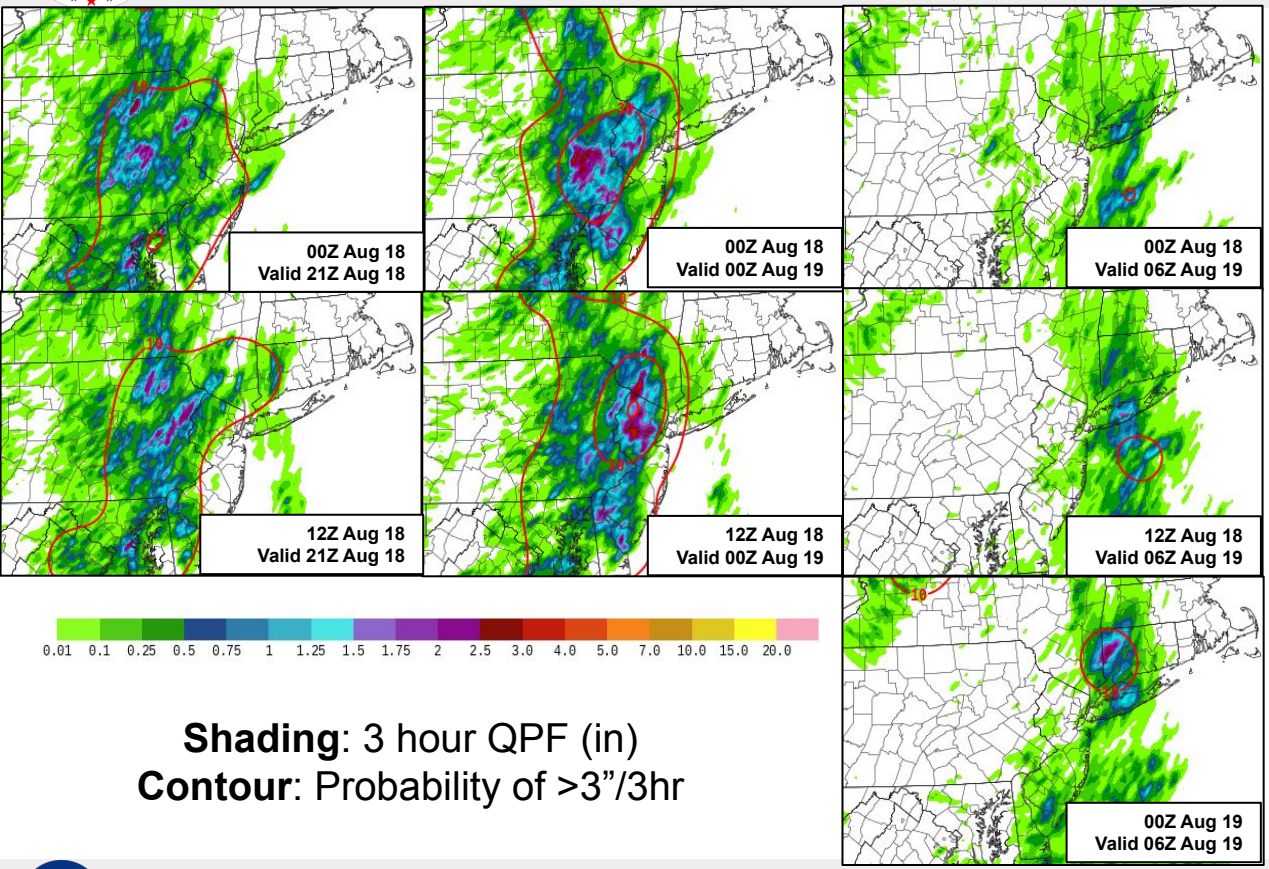
- Unofficial totals in Oxford, CT of **12-14”**
  - 5-minute rates of **0.25-0.3”** and peaks ~ **0.5”**
- Event total at the Stony Brook, NY NYSM was 9.40”
  - **5.7”** between 12:00-2:00 am August 19th
  - Peak hourly rate of **3.79”** (12:40-1:40 am)
  - **1.58”** in just 20 minutes from 1:05-1:25 am
  - 5-minute rates of **0.25-0.4”** with a peak of **0.48”**

WPC Super Ensemble Plumes

Aug 17, 2024 1200 UTC WPC Super Ensemble for Total QPF Islip, NY (ISP)



HREF Probabilistic Guidance



Shading: 3 hour QPF (in)
Contour: Probability of >3"/3hr

HREF Takeaways:

1) Weak signal for 30-50% >3" in 3 hours. - This historically correlates well for us with higher end Flash Flood events.

2) It was focused between the actual events and also too far west (East PA into N NJ)

3) Small area of 1.5-2" across Central Long Island and weak >3 in 3 hour signal, but misplaced

Science Questions

1. How does a 1-km ensemble, the NSSL Warn-on-Forecast System (WoFS), resolve the Oxford, CT and Stony Brook, NY events since the WPC super ensemble and HREF struggled to show an extreme rainfall signal?

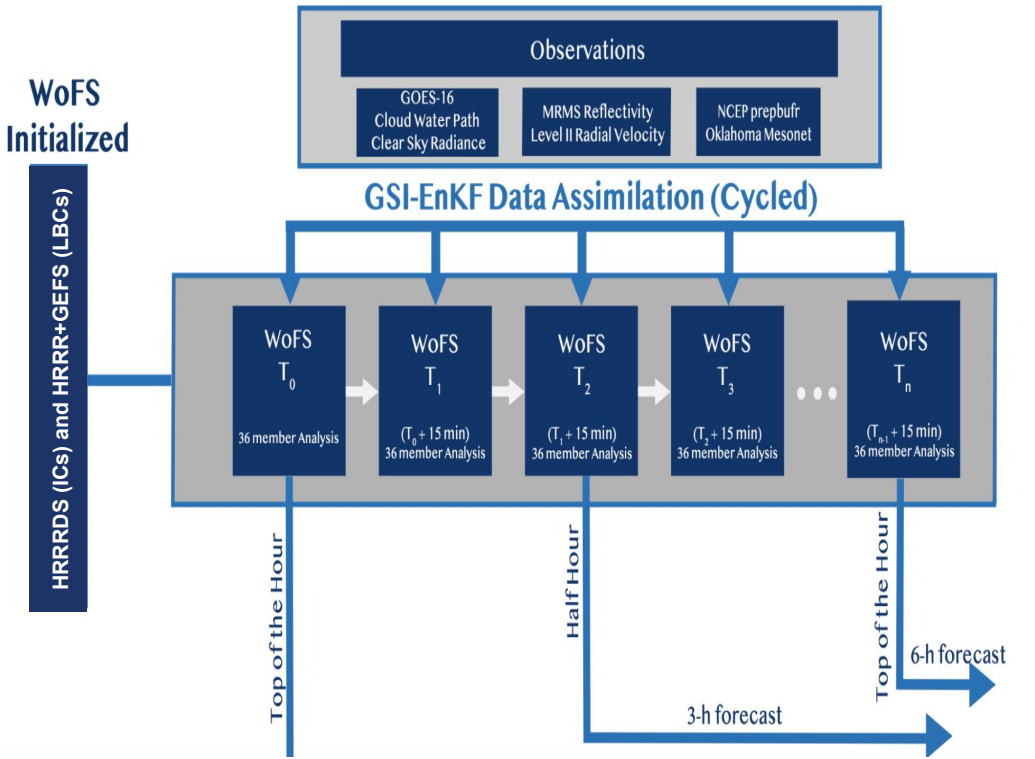
2. How well did the 1-km WoFS assimilate the radar information?

3. Did the 1-km WoFS resolve some of the mesoscale features such as low level convergence zones and frontal boundaries/outflow boundaries?

4. Did the 1-km WoFS simulate extreme 5-minute rainfall rates (0.25-0.40”), similar to what was observed in the emergencies?

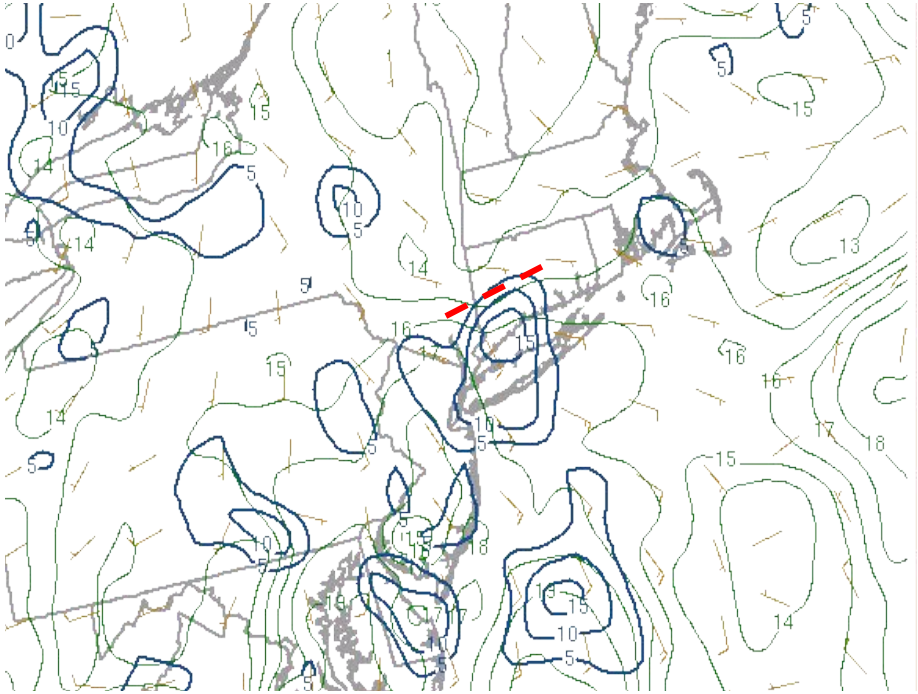
WoFS Background

- Targeted regional domain, 3-km or 1-km grid, using WRF-ARW core.
- 36 member analysis,18 member forecast.
- Initial conditions (ICs) generated from 36 member HRRRDAS
- Boundary conditions (LBCs) from HRRR + GEFS.
- Each member has a unique combo of (ICs/LBCs) and physics schemes.
- 15-min data assimilation intervals of GOES-16, radar, NCEP PREPBUFR (surface and upper-air), and OK mesonet.

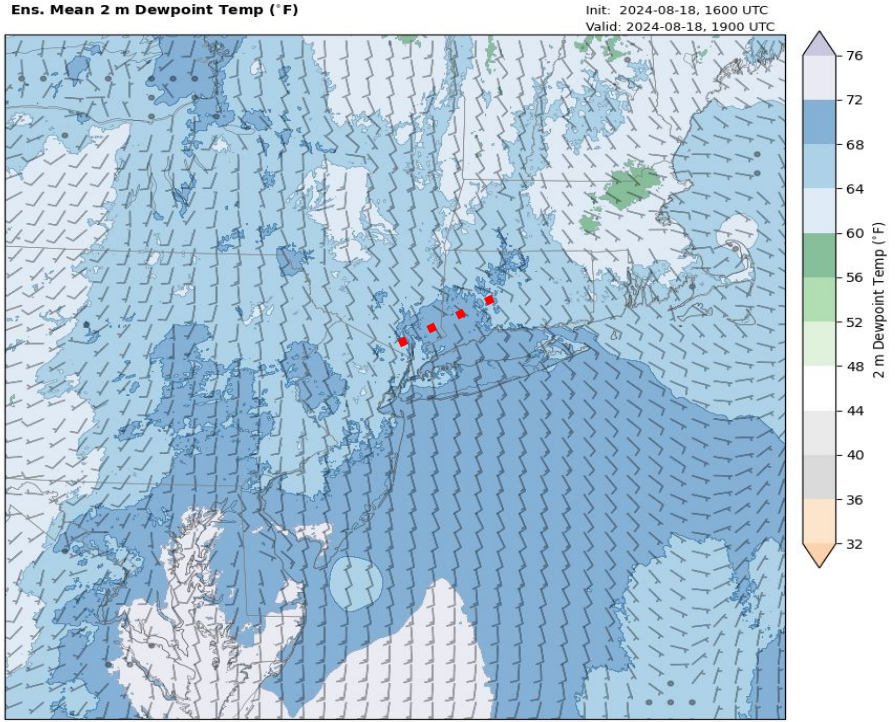


Observed Surface | 16Z 1-km WoFS

Valid 19Z Aug 18, 2024



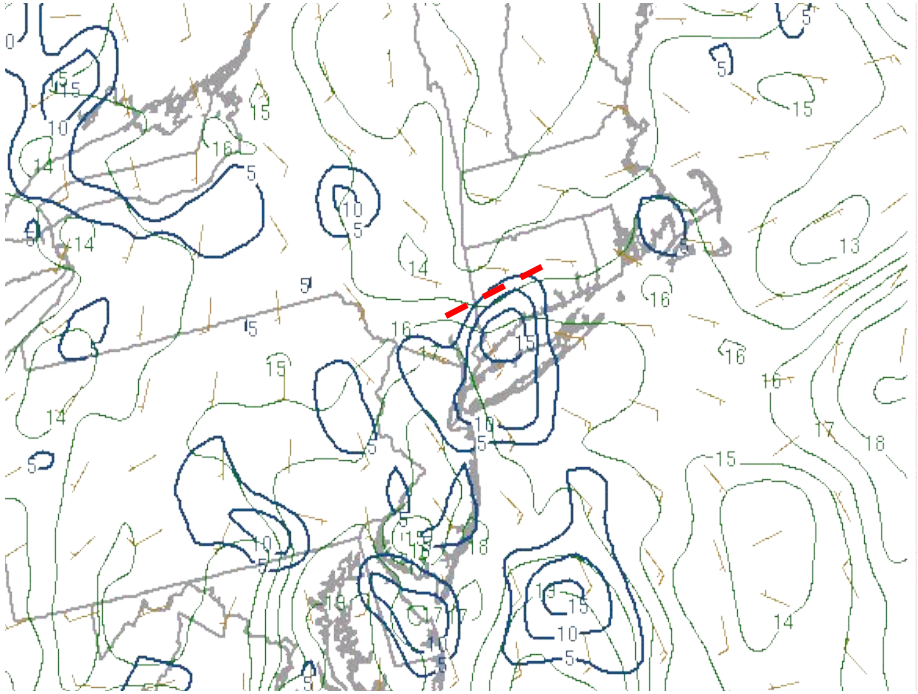
19Z SPC mesoanalysis
(surface wind, moisture conv)



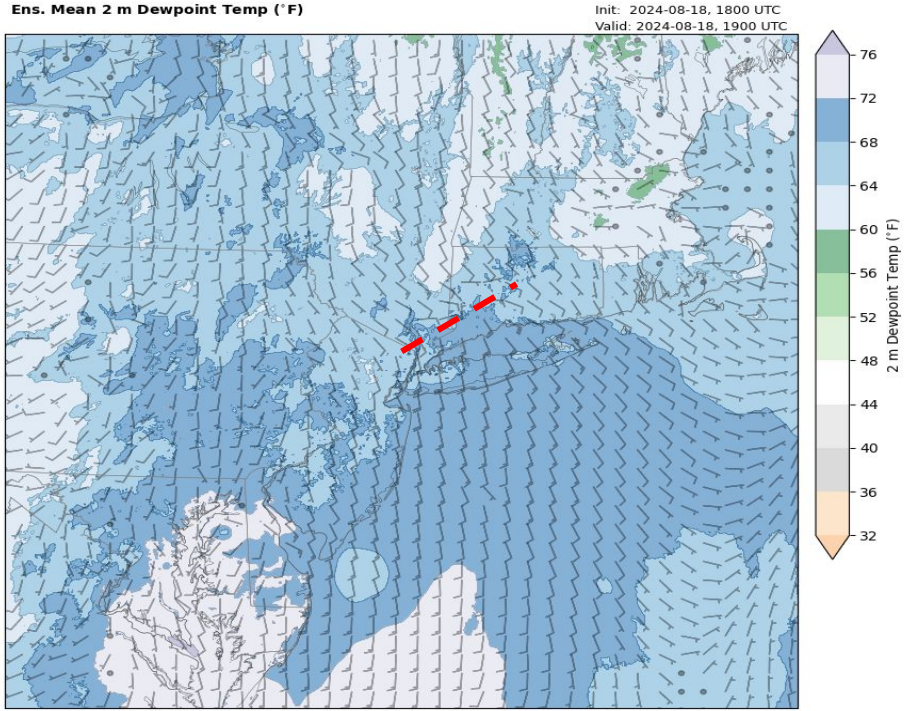
1-km WoFS 3-hour Forecast Valid 19z
Surface Winds and Surface Dew Points

Observed Surface | 18Z 1-km WoFS

Valid 19Z Aug 18, 2024

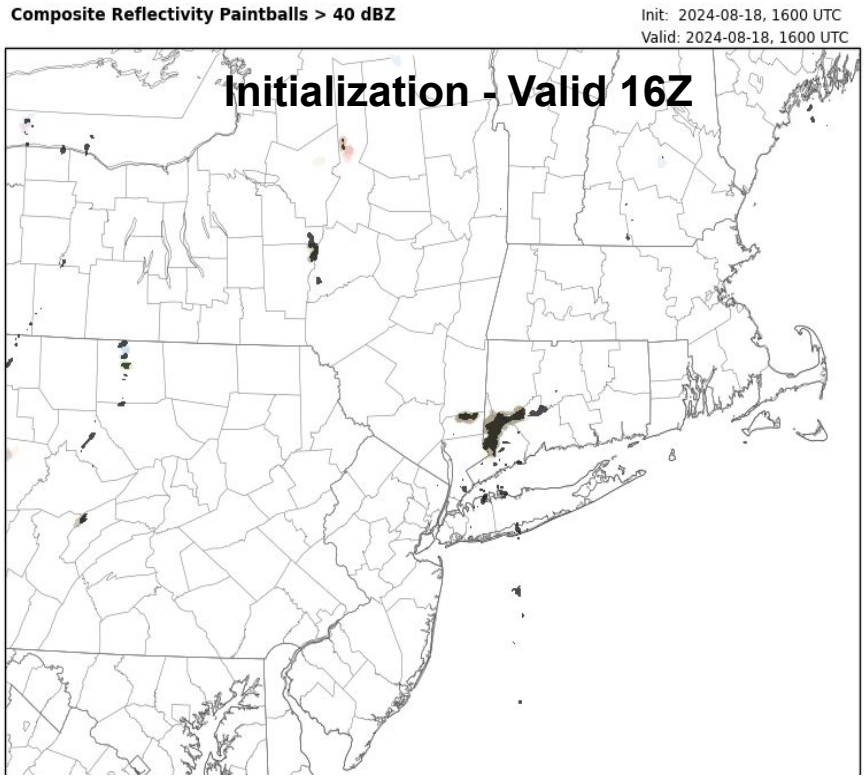


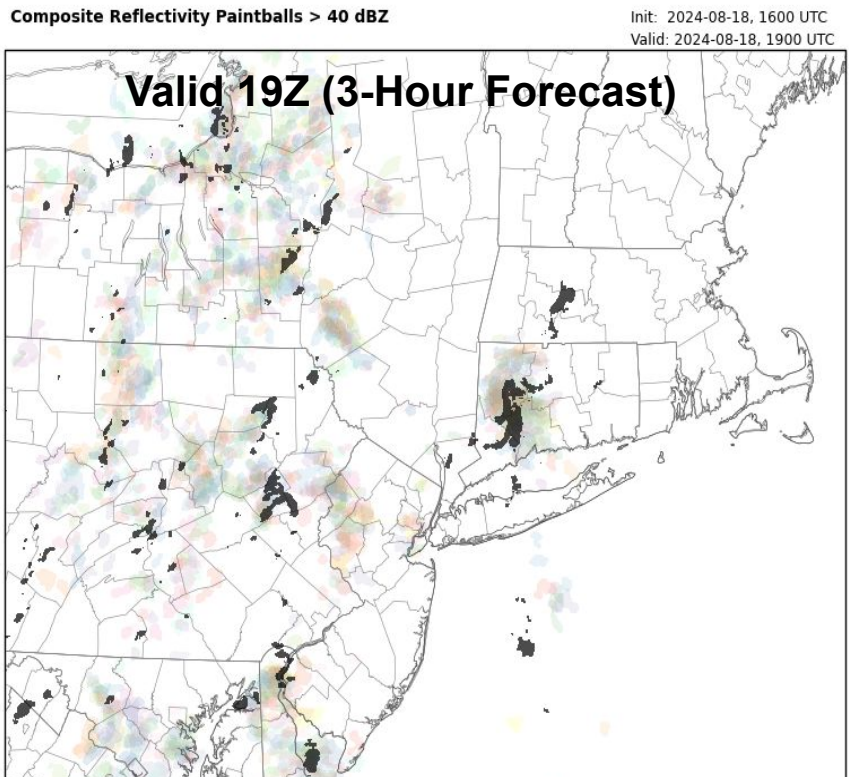
19Z SPC mesoanalysis
(surface wind, moisture conv)



1-km WoFS 1-hour Forecast Valid 19z
Surface Winds and Surface Dew Points

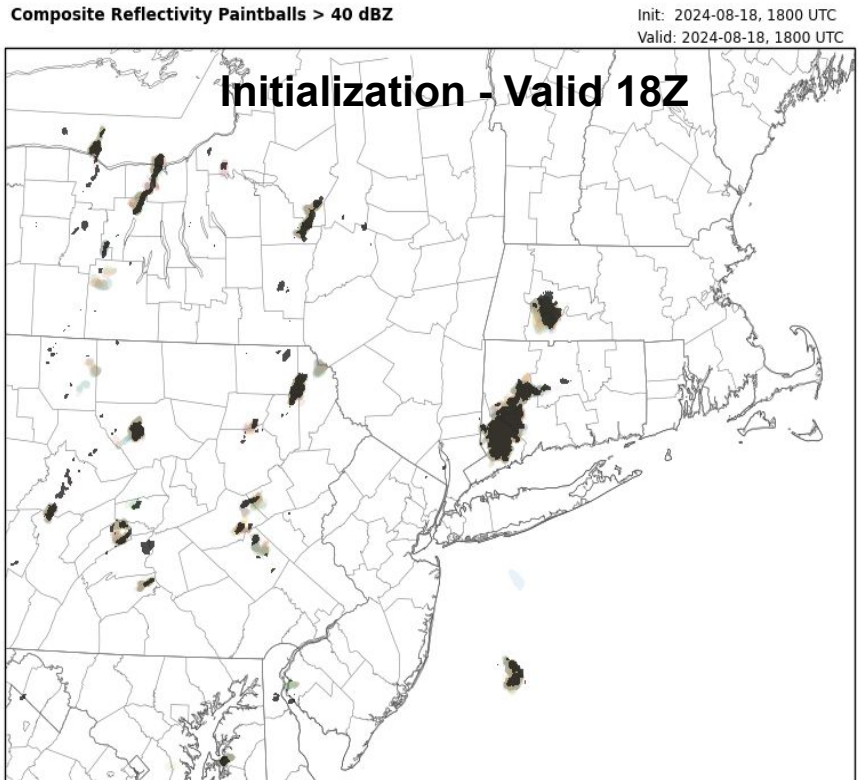
16Z 1-km WoFS - Reflectivity Paintballs > 40 dBZ

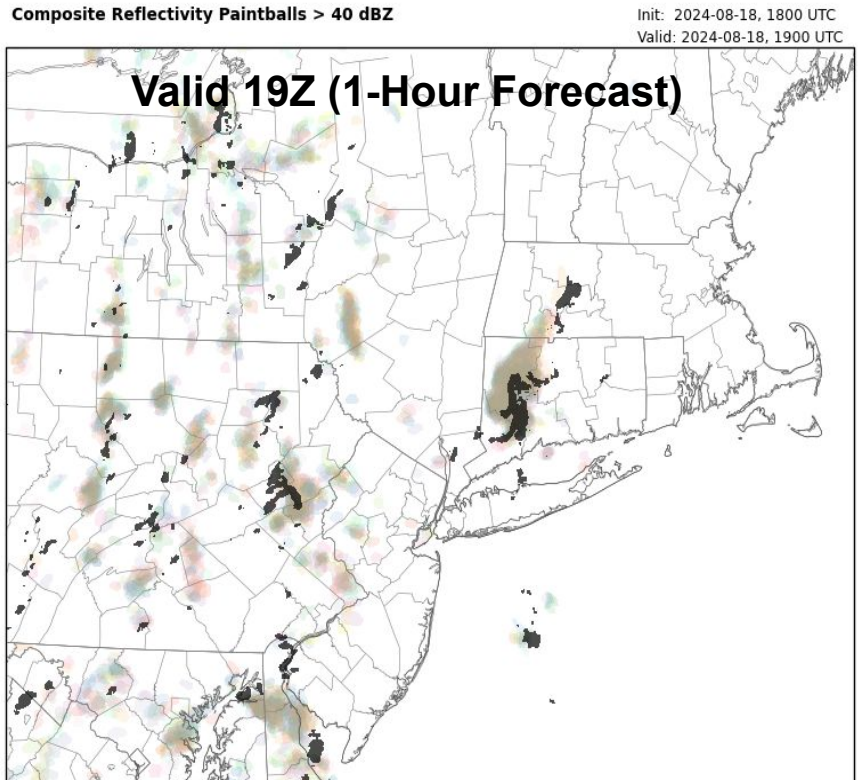




Black shading: MRMS Reflectivity Paintballs > 40 dBZ

18Z 1-km WoFS - Reflectivity Paintballs > 40 dBZ

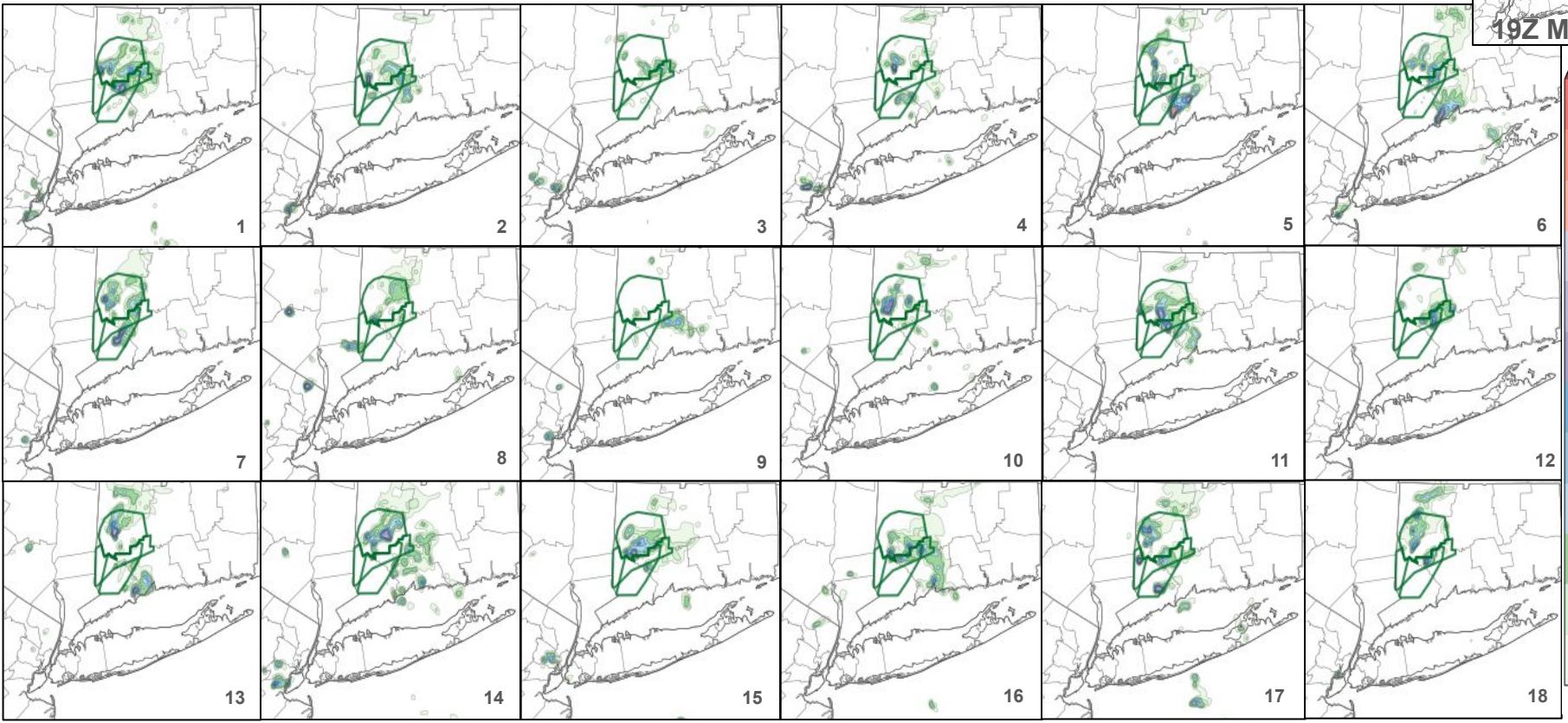




Black shading: MRMS Reflectivity Paintballs > 40 dBZ

1-km WoFS 5-Minute Rain Rate (in)

16Z Run Valid 19Z Aug 18, 2024 (3-Hour Forecast)



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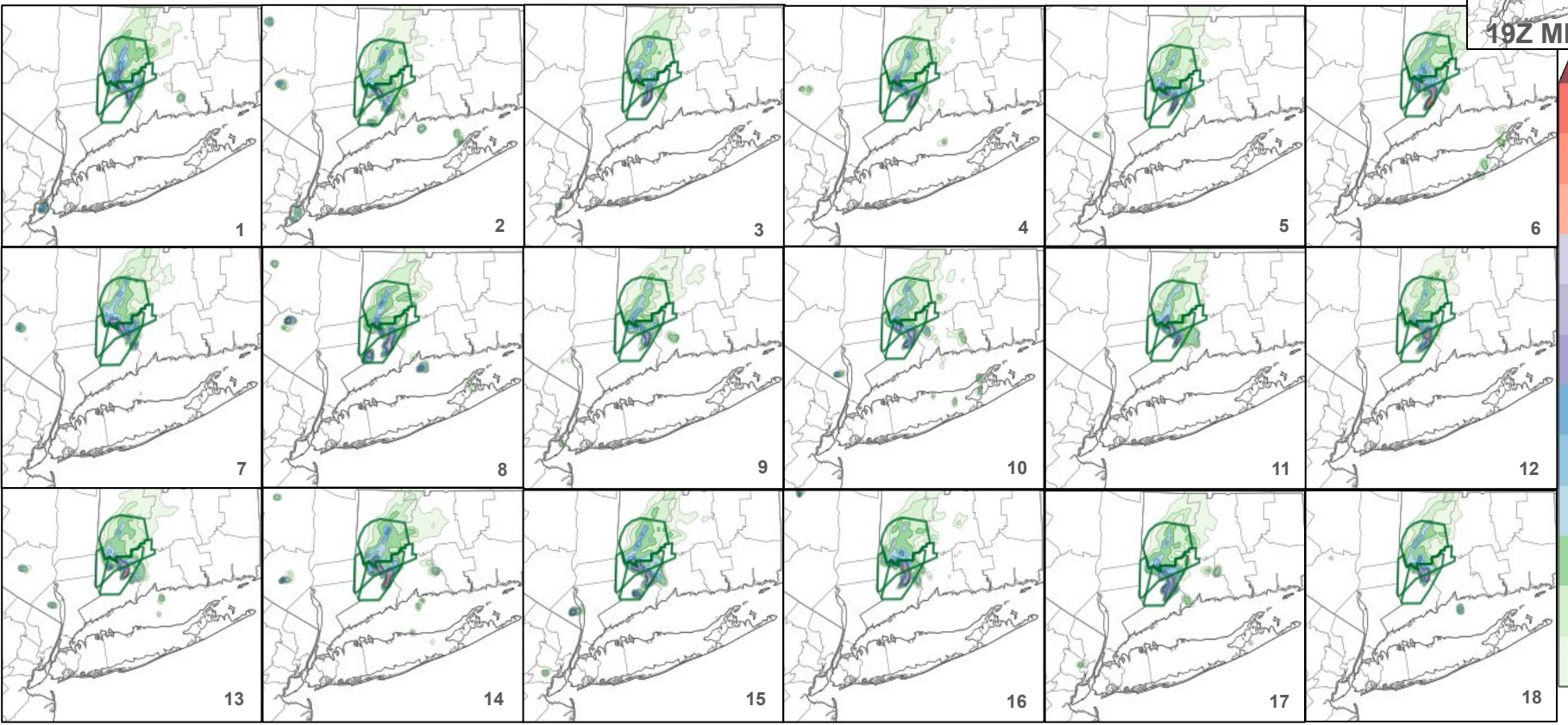
1-km WoFS 5-Minute Rain Rate (in)

18Z Run Valid 19Z Aug 18, 2024 (1-Hour Forecast)



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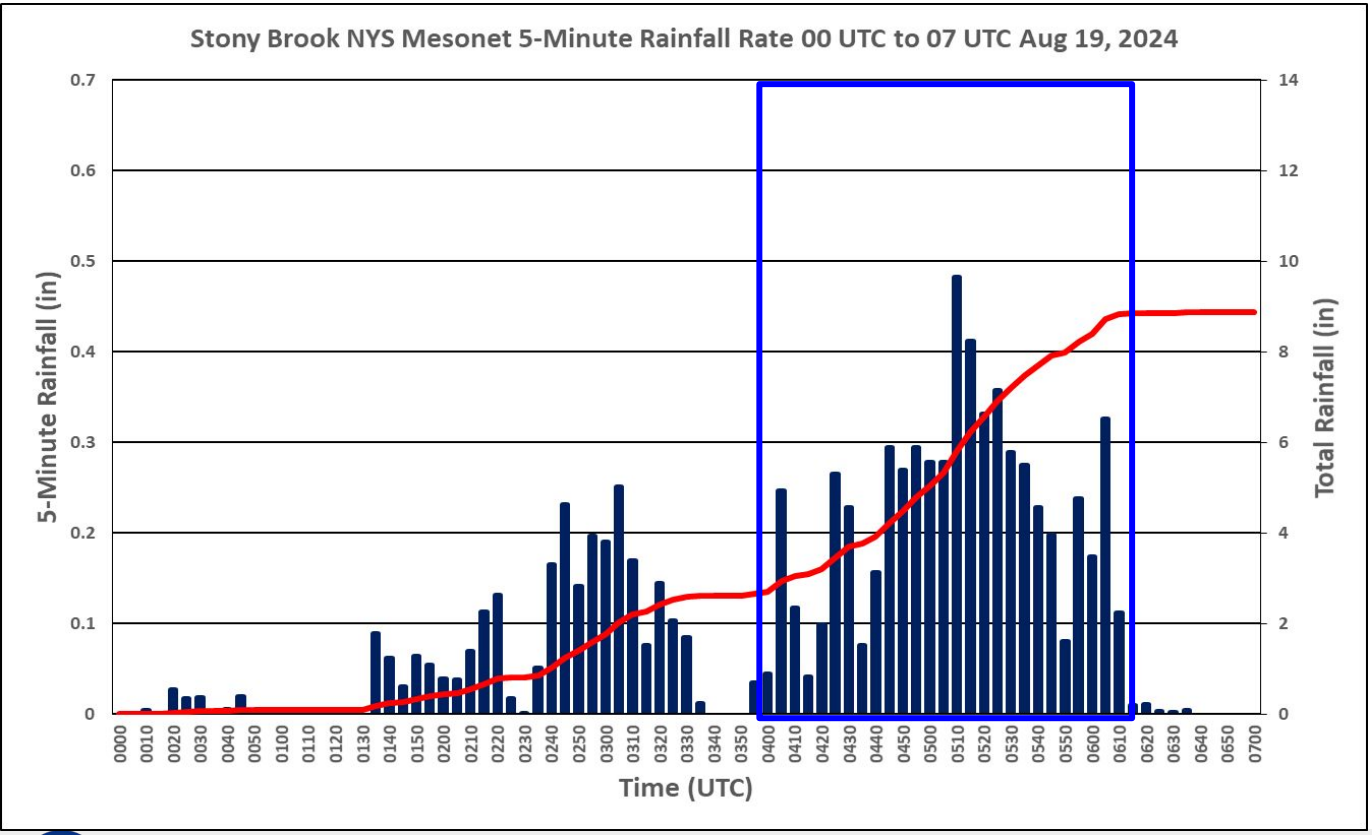
KOKX Reflectivity/Velocity 00z-06z Aug 19, 2024

Stony Brook Mesonet 5-minute Rainfall Rates

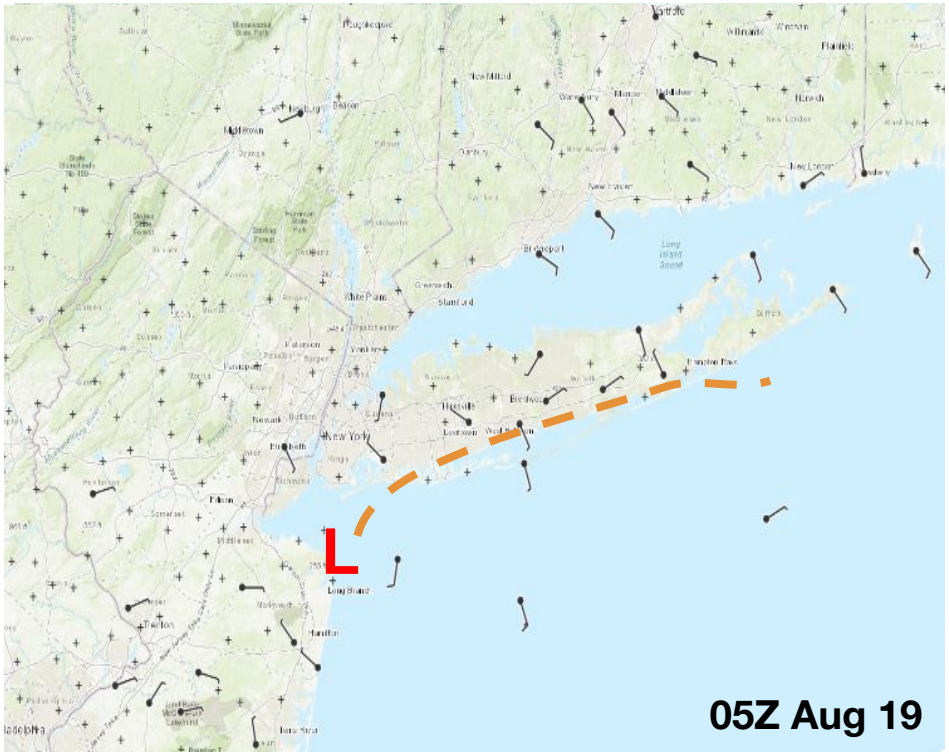


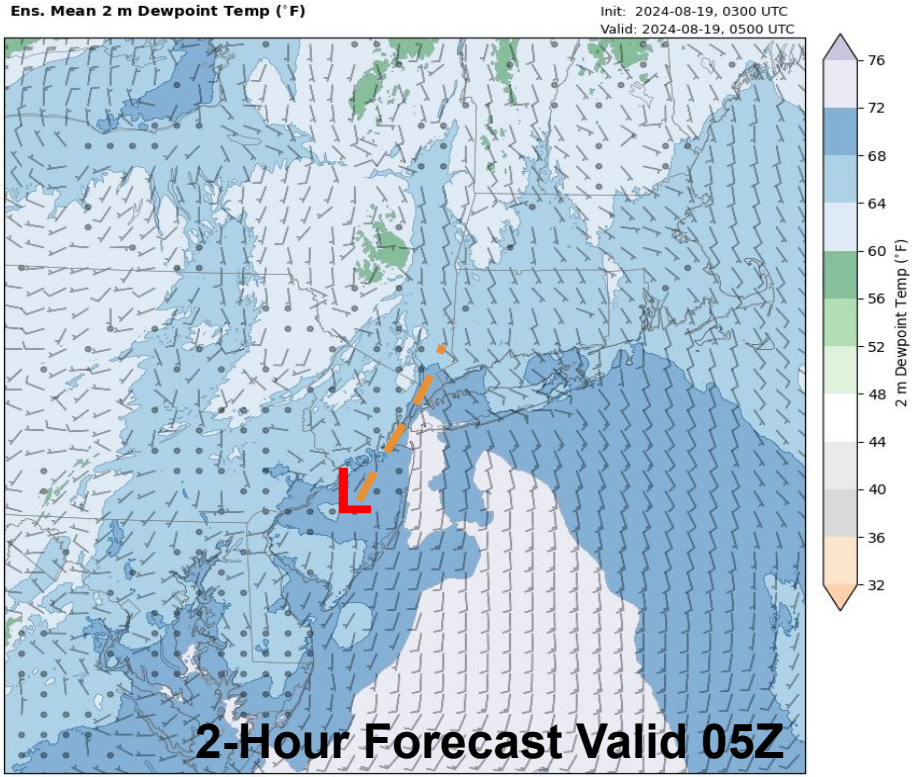
Emphasis on 04-06Z (12-2am) time frame

Considerable tag warning was issued at 12:10 am (0410Z)

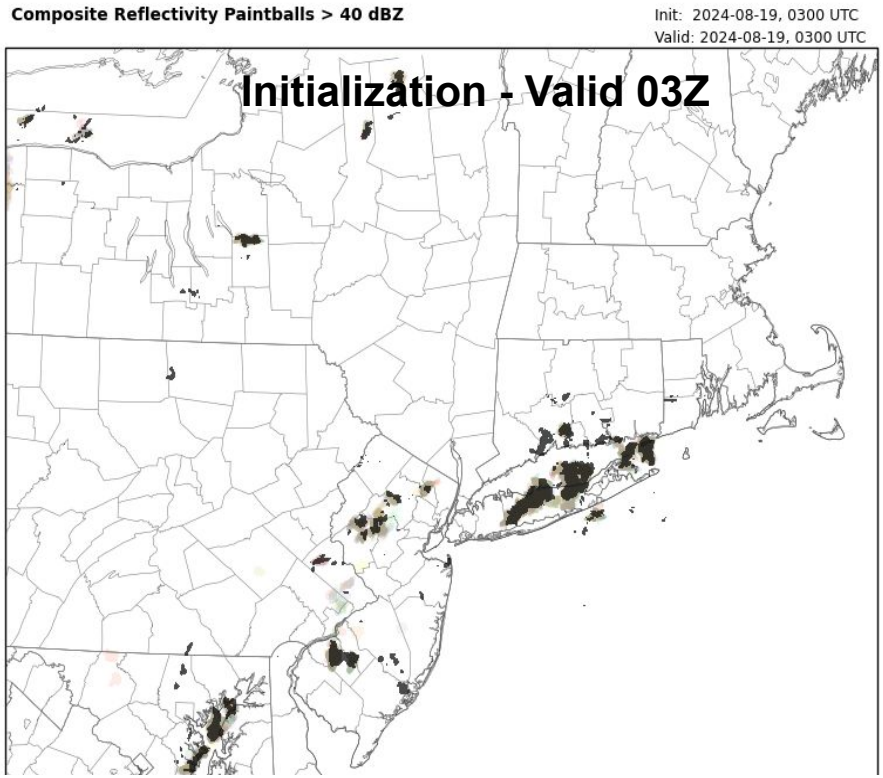
Emergency was issued at 1:20 am (0520Z)

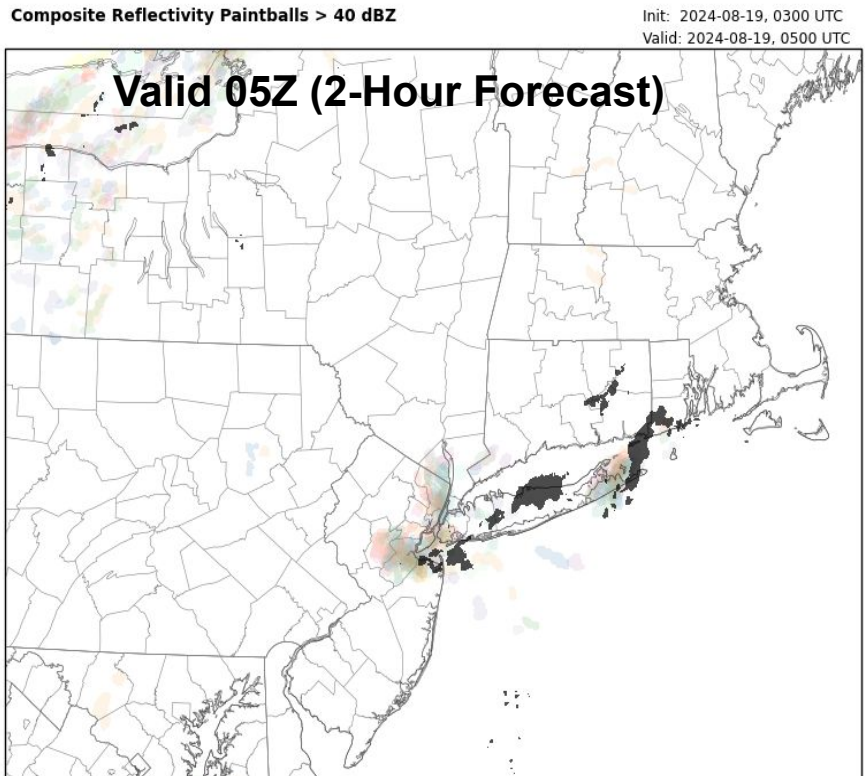
Surface Wind Observations | 03Z Aug 19 1-km WoFS





03Z Aug 19 1-km WoFS - Paintballs > 40 dBZ

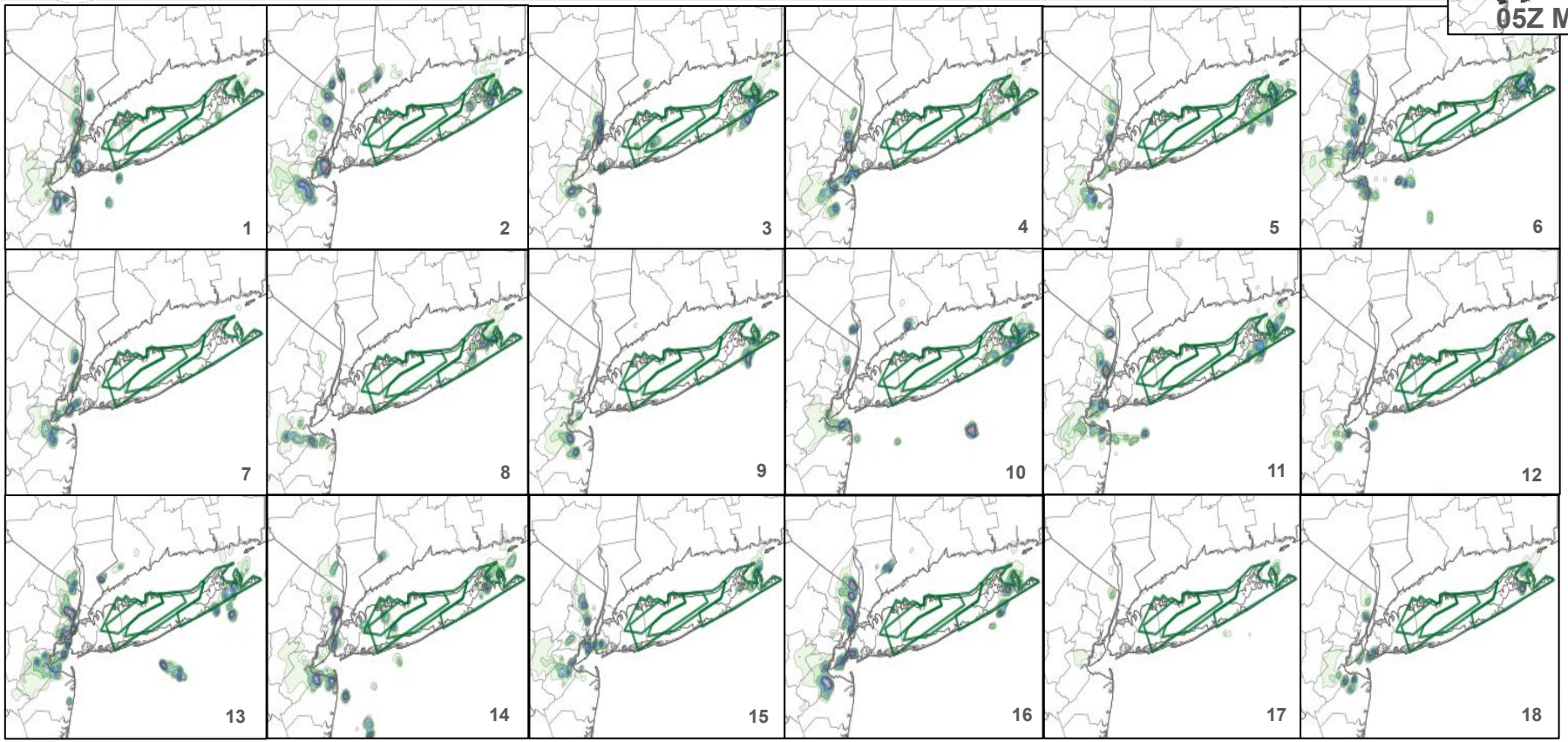




Black shading: MRMS Reflectivity Paintballs > 40 dBZ

1-km WoFS 5-Minute Rain Rate (in)

03Z Run Valid 05Z Aug 19, 2024 (2-Hour Forecast)



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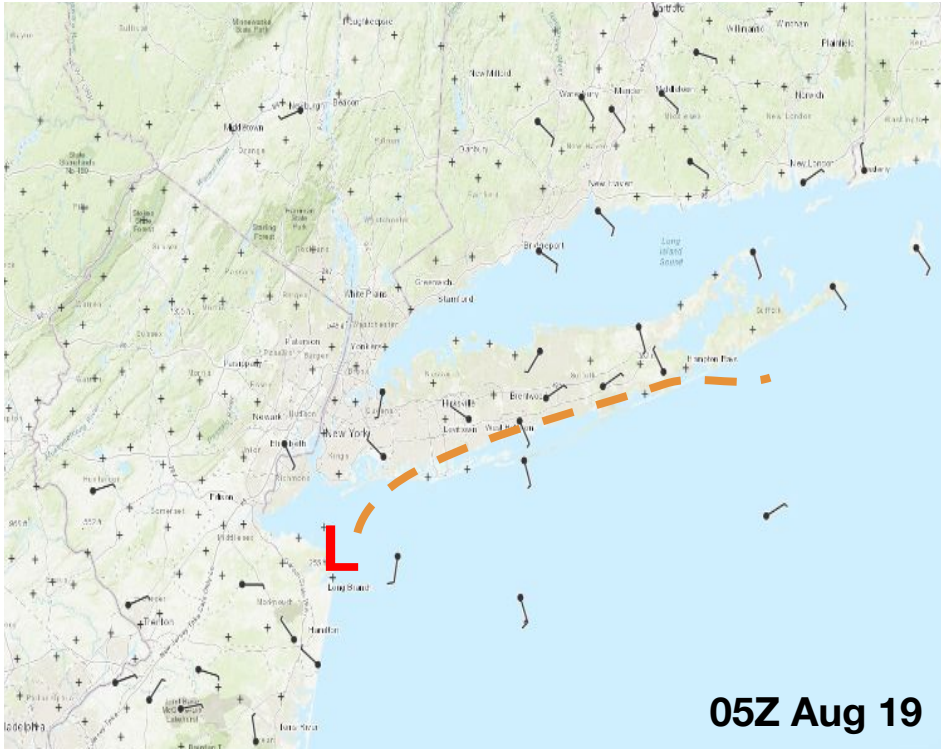
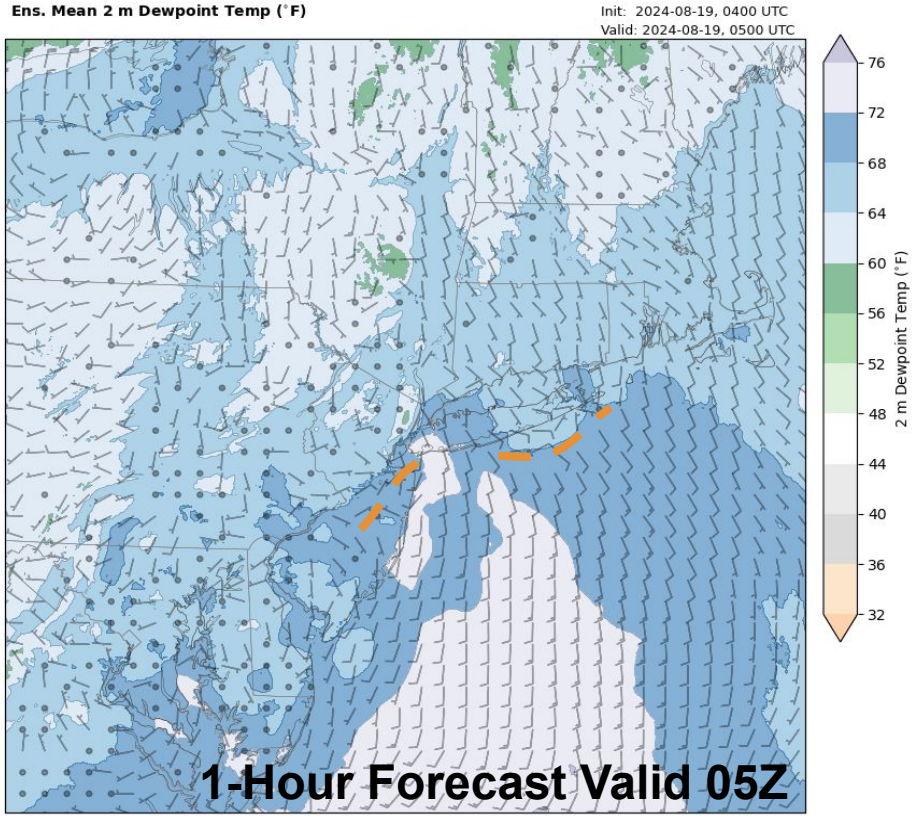
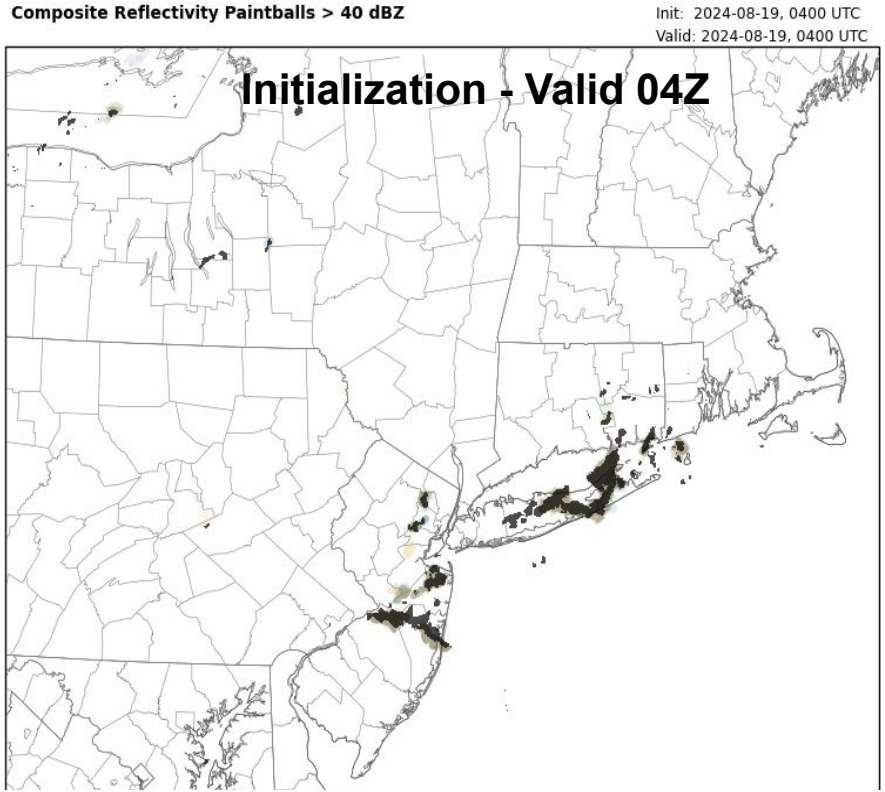
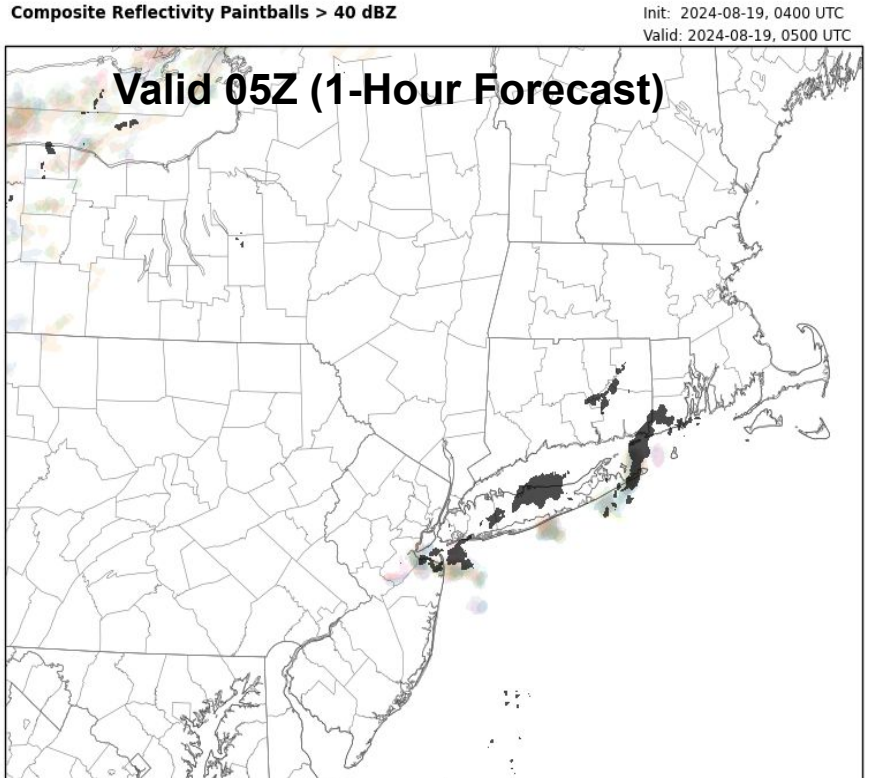
Surface Wind Observations | 04Z Aug 19 1-km WoFS





04Z Aug 19 1-km WoFS - Paintballs > 40 dBZ

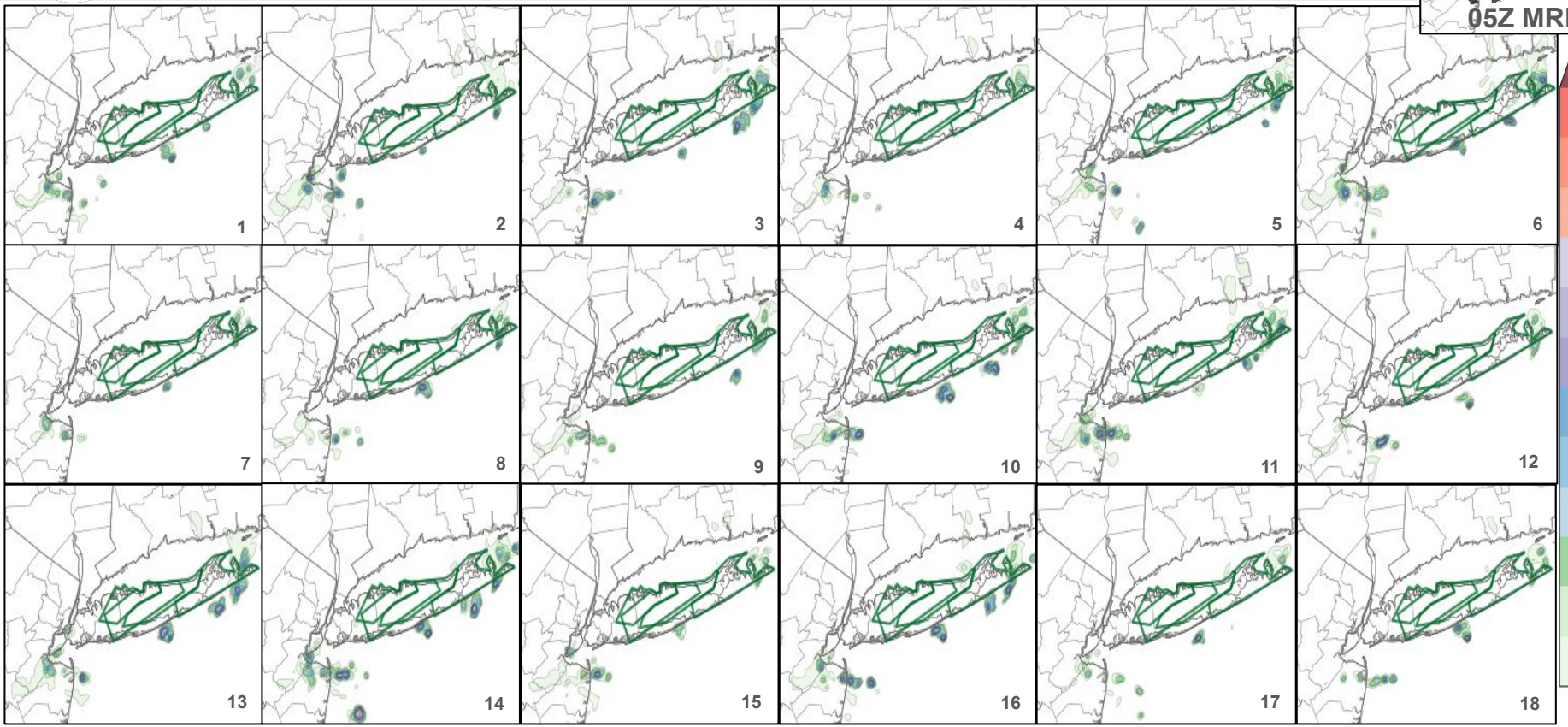




Black shading: MRMS Reflectivity Paintballs > 40 dBZ

1-km WoFS 5-Minute Rain Rate (in)

04Z Run Valid 05Z Aug 19, 2024 (1-Hour Forecast)



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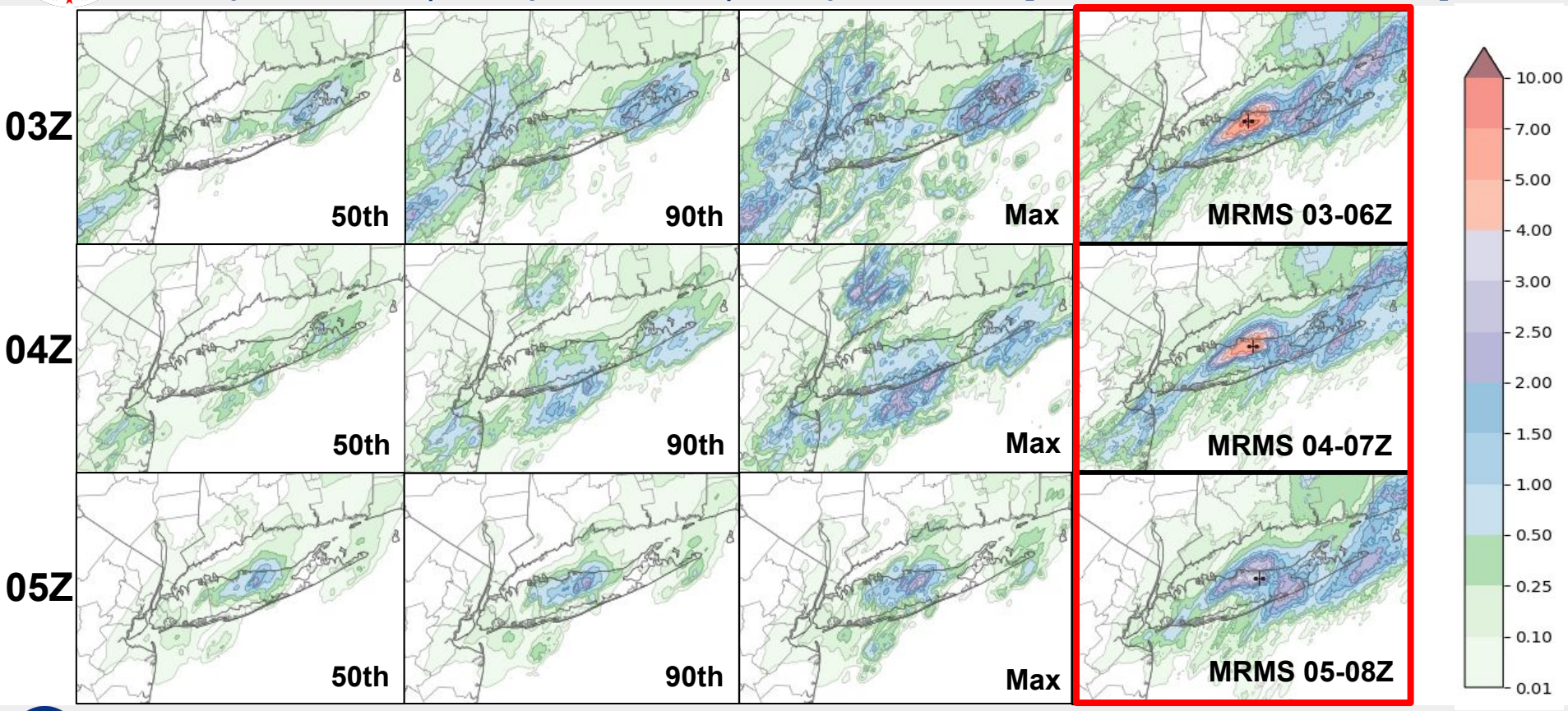
WoFS Ensemble 50th, 90th, and Max QPF Vs MRMS QPE

03Z Cycle - 03-06Z | 04Z Cycle - 04-07Z | 05Z Cycle - 05-08Z [Peak Observed Rain 04-06Z]



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1-km WoFS Takeaways

1. **How does a 1-km ensemble, the NSSL Warn-on-Forecast System (WoFS), resolve the Oxford, CT and Stony Brook, NY events since the WPC super ensemble and HREF struggled to show an extreme rainfall signal?**
    a. Developed convection and extreme rainfall rates for CT, but location was a bit erratic with the 3-hour forecast and much more aligned with 1-hour forecast.
    b. Did not handle Stony Brook event well
        i. Developed convection around NYC metro compared to central Long Island (2-hour forecast) and then along Long Island south coast (1-hour forecast). Started to become more consistent with observed convection when extreme rain was well underway at Stony Brook.

2. **How well did the 1-km WoFS assimilate the radar information?**
    a. Assimilated well at initialization, but diverged as early as in 1-hour forecasts in both the Oxford and Stony Brook events.

1-km WoFS Takeaways

3. **Did the 1-km WoFS resolve some of the mesoscale features such as low level convergence zones and frontal boundaries/outflow boundaries?**
   a. Yes - especially for the Oxford event. Weak signal for convergence zone on 16Z run (3hr lead time), but signal much more apparent with the 18Z run (1-hour lead time).
   b. Struggled with location and magnitude for Stony Brook - Too far NW on 03Z run (2hr lead time) and much weaker on 04Z (1-hour lead time) for Stony Brook event. - *Could ingesting more local mesonet data (NYSM) improve this?*

4. **Did the 1-km WoFS simulate extreme 5-minute rainfall rates (0.25-0.40”), similar to what was observed in the emergencies?**
   a. Yes - About 77% (14/18) of members on 16Z run, but locations not consistent with actual Oxford event. All members on 18Z run did and about 5 showed 0.50” 5-minute rates - Promising!
   b. About 72% (13/18) of members on 03Z run for Stony Brook, but locations near NYC metro. Less members (10/18), less coverage and too far south on 04z. - *Started to catch on to extreme rates at Stony Brook too late for any utility during warning ops.*

Contact Information

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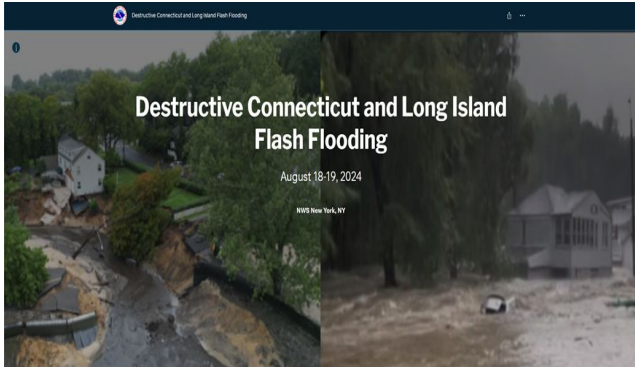
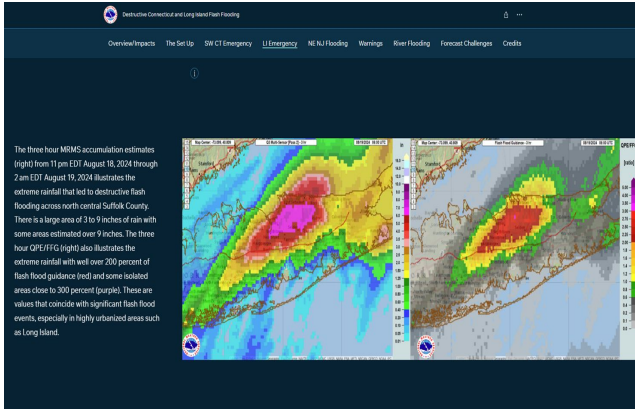
david.radell@noaa.gov

Check out our arcGIS Story Map on this historic event!!

https://storymaps.arcgis.com/stories/8e046d3c23494b18a3a154af809965cf

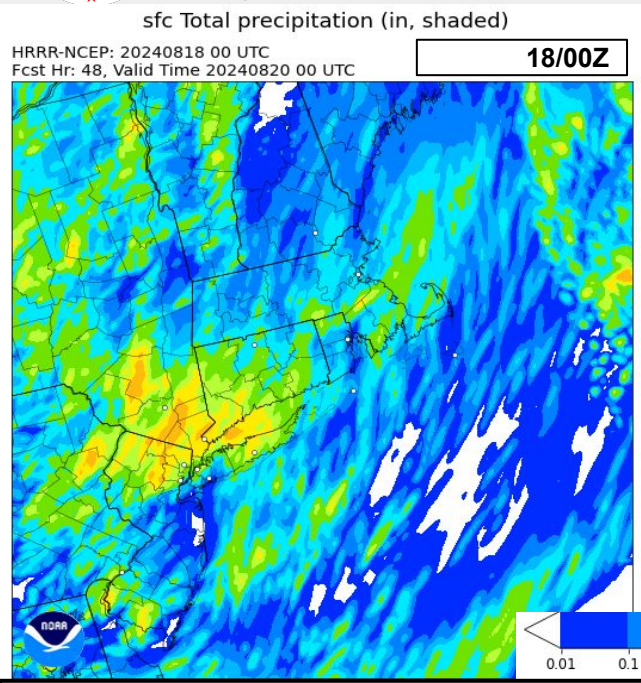
https://www.weather.gov/okx/stormevents

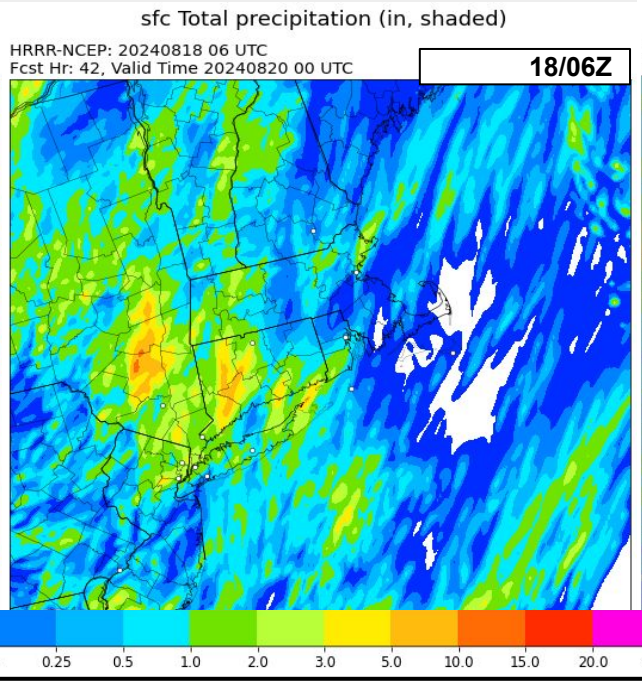


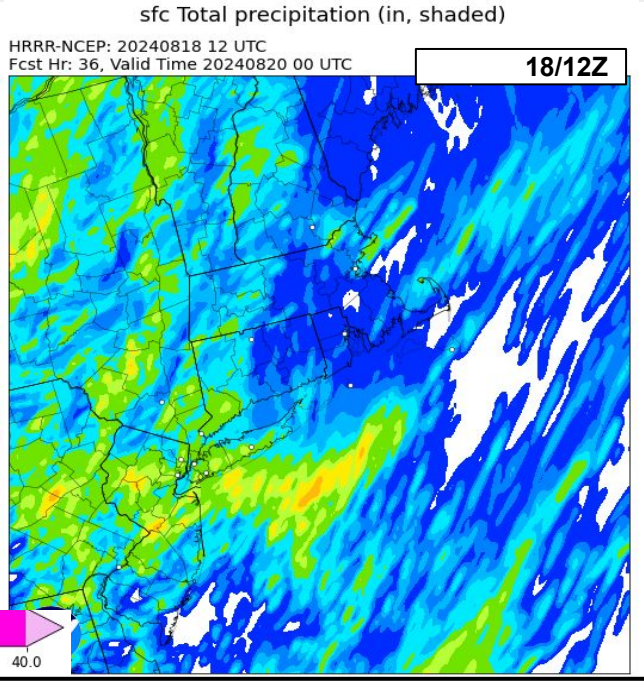


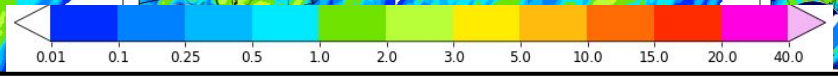
HRRR Guidance

August 18, 2024 00Z, 06Z, and 12Z Cycles









★ **Heavy rain signal > 5” across SW CT, 06z run in particular**

★ **Signal is lost on the 00z and 12z runs, swaths back to the west, and more numerous in coverage**