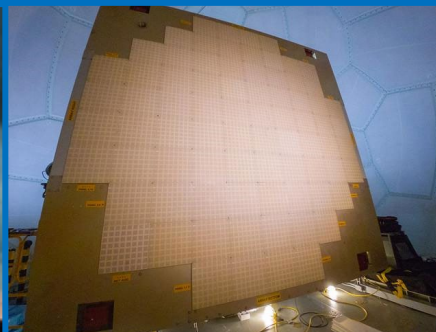


Research-to-Operations/Applications Success Stories

Alan Gerard, NSSL Division Chief, WRDD





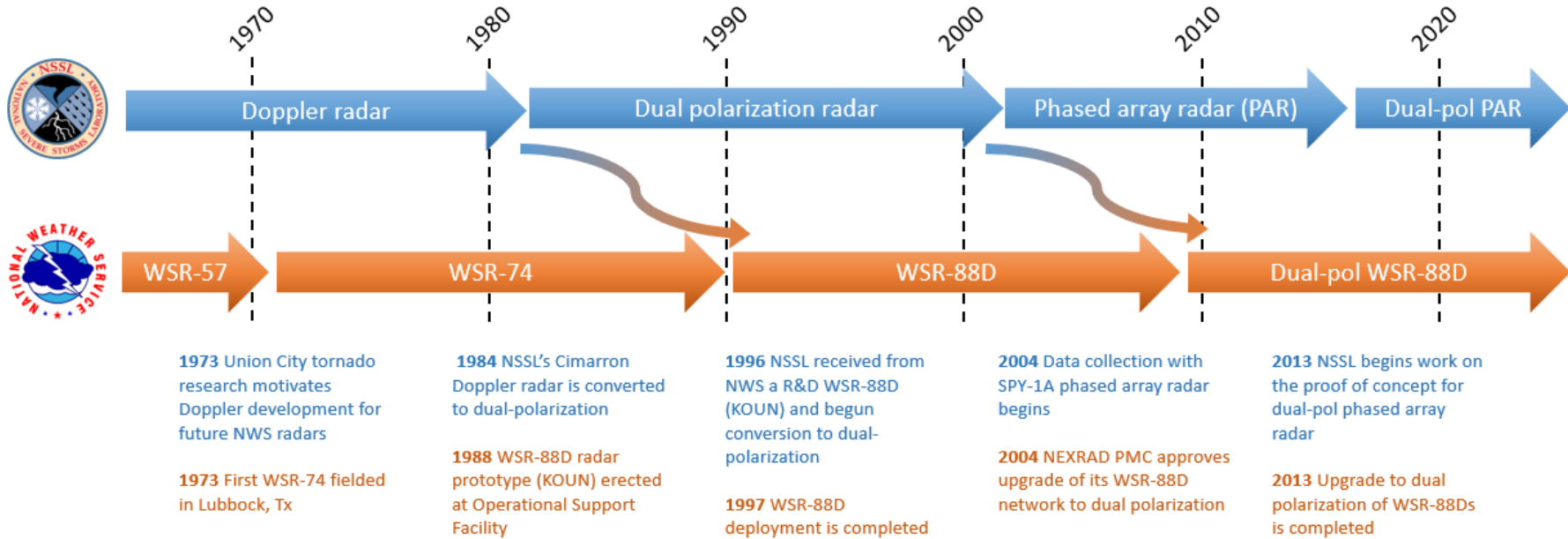
Research-to-Operations...

...is at the heart of what
NSSL has been since
we started...





Weather Radar





Multi-Radar Multi-Sensor System (MRMS)



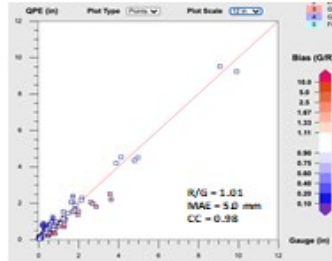
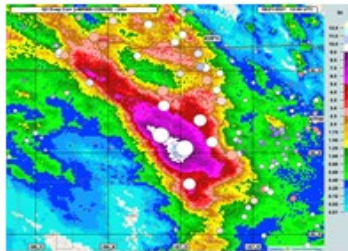


Research → Improved Operations → Improved Services

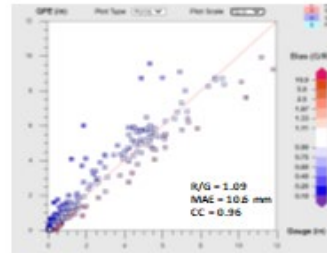
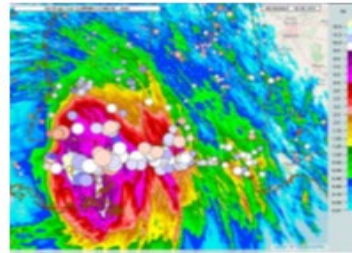
Polarimetric QPE performance during past summer flash flood events

The R(A) / R(Kdp) algorithm. 24 –hour total

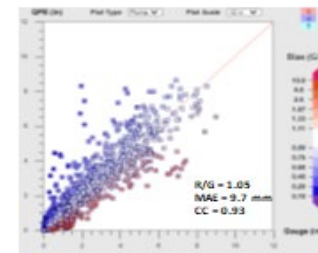
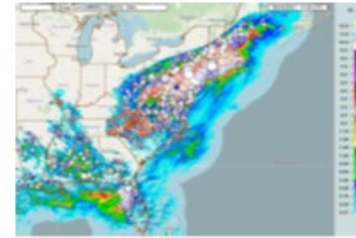
Tennessee flash flood



Ida. Louisiana, Mississippi

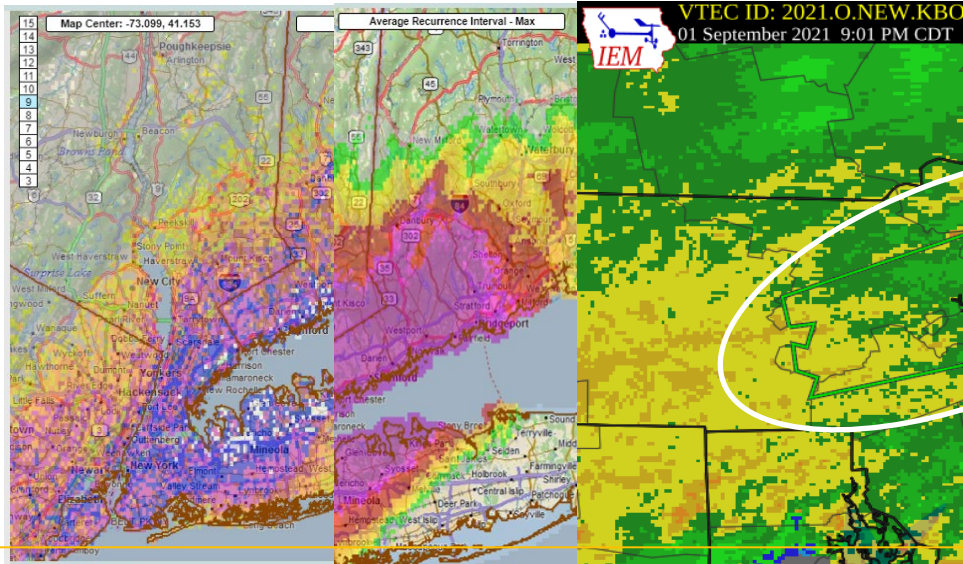


Ida. US Northeast





Research → Improved Operations → Improved Services



Photos: Here's a look at the destruction left by the remnants of Ida in Mass.

Some areas are thought to have received 7 to 8 inches of rain, with one report of 9.5 inches in New Bedford.



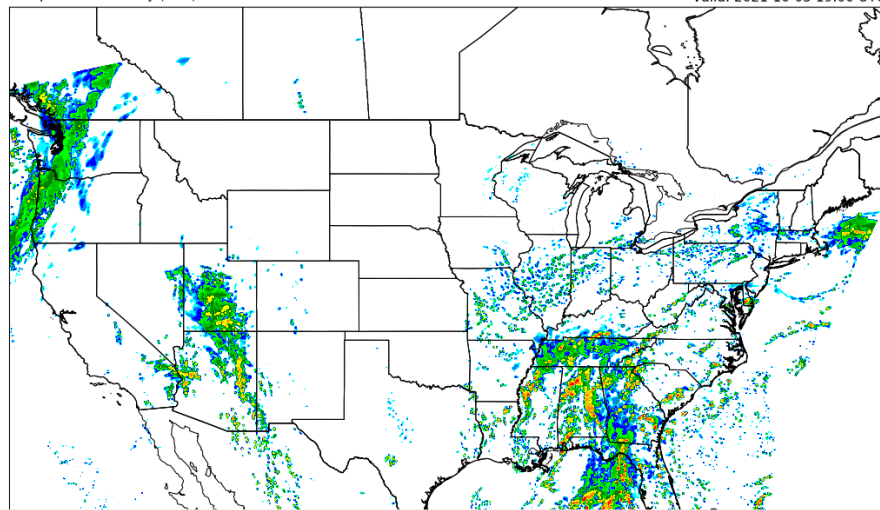
*Given significant reports of flash flooding and extremely high values from our flash flood parameters like **CREST unit streamflow (3000+ units in some cases)**, hourly rain rates (an ASOS in NJ had an hourly rate of almost 3") etc. coming out of PA/NJ/NY we have high confidence that flash flooding will occur in our area. Several areas of the mid Atlantic are currently experiencing greater than **1 in 200 year (our scale stops at 200) flooding**, which is quite a concerning figure given this wall of water will be pushing into our area. In an effort to alert the public before they wind down for bed and to really push messaging to encourage people to stay off roadways during the morning commute, we have tossed out flash flood warnings for several of our "flashy" counties*



R20, R2X and Knowledge Transfer

WRF-NSSL
Composite reflectivity (dBZ) and 2-5 km UH >75 m²/s²

Run: 2021-10-05 00:00 UTC
Valid: 2021-10-05 19:00 UTC

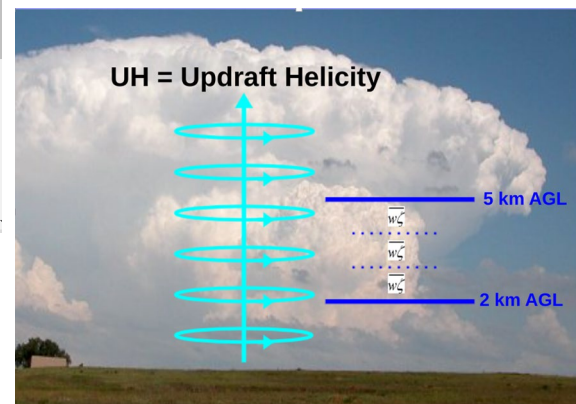


Keyboard Shortcuts

| | | | |
|---|-----------------|---|----------------------|
| < | prev fcst time | > | next fcst time |
| p | play/pause loop | b | last run (hold down) |
| h | toggle top menu | | |

More Information

- CAM daily run schedules
- FV3-NSSL now uses the FV3-LAM configuration

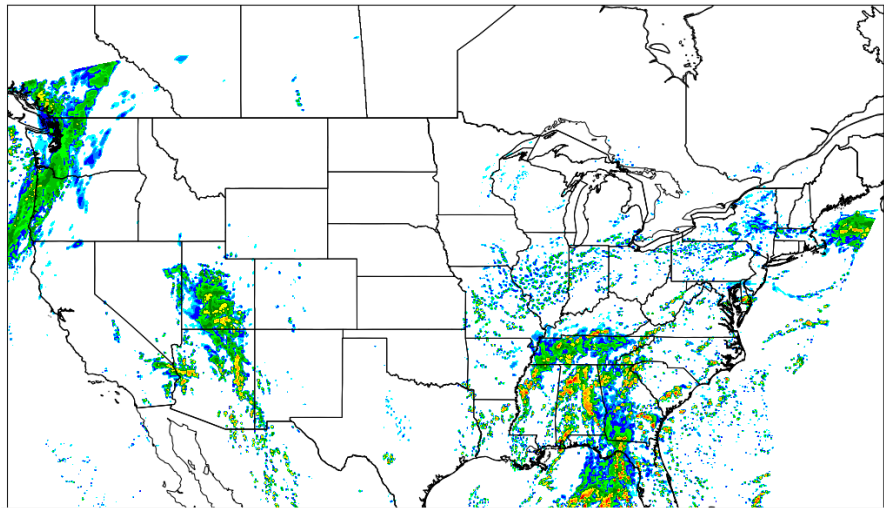




R20, R2X and Knowledge Transfer

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| h | toggle top menu | | |

More Information

- [CAM daily run schedules](#)
- [FV3-NSSL now uses the FV3-LAM configuration](#)

MESOSCALE DISCUSSION 0120

NWS STORM PREDICTION CENTER NORMAN OK
1101 AM CST THU FEB 20 2014

AREAS AFFECTED...NERN TX...SRN AR...NWRN LA

CONCERNING...SEVERE POTENTIAL...WATCH LIKELY

VALID 201701Z - 201900Z

PROBABILITY OF WATCH ISSUANCE...80 PERCENT

SUMMARY...PRE-FRONTAL DEEP CONVECTION HAS JUST COMMENCED ACROSS THE ARKLATEX. THIS ACTIVITY WILL INTENSIFY THIS AFTERNOON WITH A PREDOMINANT MODE OF SHORT LINE SEGMENTS AND EMBEDDED SUPERCELL STRUCTURES LIKELY. ALL SEVERE RISKS APPEAR POSSIBLE...BUT SHOULD GENERALLY REMAIN ISOLATED IN COVERAGE THROUGH MID-AFTERNOON.

DISCUSSION...WITHIN A PRE-FRONTAL CONFLUENCE BAND ALONG THE AXIS OF RICHEST LOW-LEVEL MOISTURE ACROSS THE ARKLATEX...LIGHTNING-PRODUCING CONVECTION HAS COMMENCED JUST WEST OF SHV IN NERN TX AS A STOUT EML NOTED IN 12Z SHV/PWD RAOBS HAS ERODED. ALTHOUGH SURFACE HEATING HAS BEEN SLOWED BY ABUNDANT CLOUDINESS WITHIN THE WARM SECTOR...GRADUAL DESTABILIZATION WILL CONTINUE AND SHOULD YIELD MODEST BUOYANCY WITH MLCAPE INCREASING TO 1000-1500 J/KG. WITH DEEP-LAYER SHEAR GENERALLY PARALLELING THIS INITIATION CORRIDOR...ALONG WITH VEER-BACK WIND PROFILES SAMPLED IN SHV VWP DATA...CONVECTIVE MODE SHOULD LARGELY CONSIST OF SHORT-LINE SEGMENTS. NEVERTHELESS...SUFFICIENT LOW-LEVEL SRH WILL EXIST FOR ROTATING UPDRAFTS CAPABLE OF PRODUCING ALL SEVERE HAZARDS. 12Z NSSL-WRF APPEARS TO HAVE A REASONABLE SCENARIO WITH REGARD TO TIMING OF THIS CONVECTION AND SUGGESTS INTENSITY/COVERAGE WILL INCREASE DURING THE AFTERNOON WITH APPROACH OF THE SURFACE COLD FRONT.

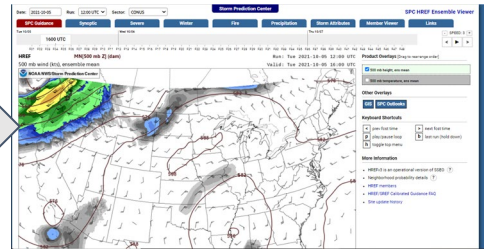
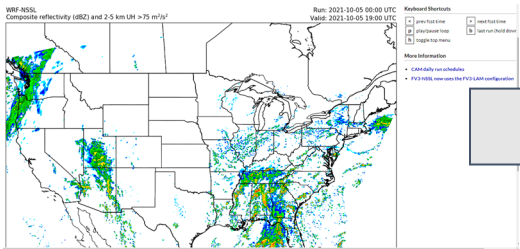
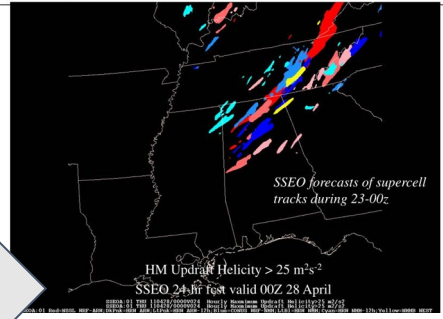




R2O, R2X and Knowledge Transfer

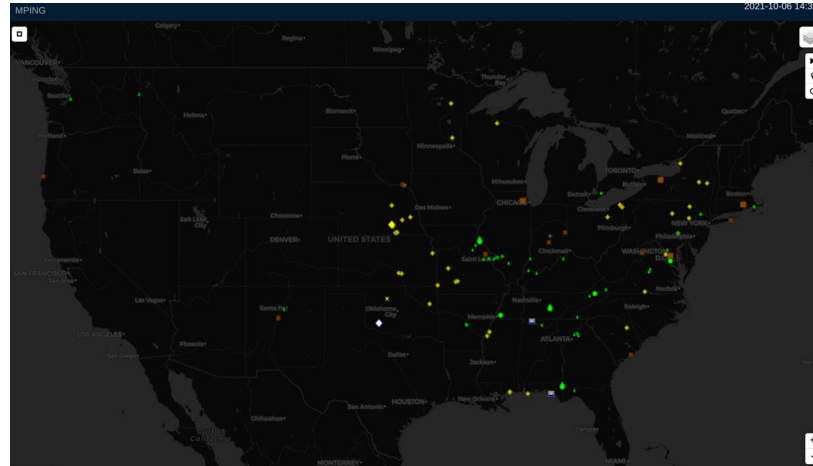
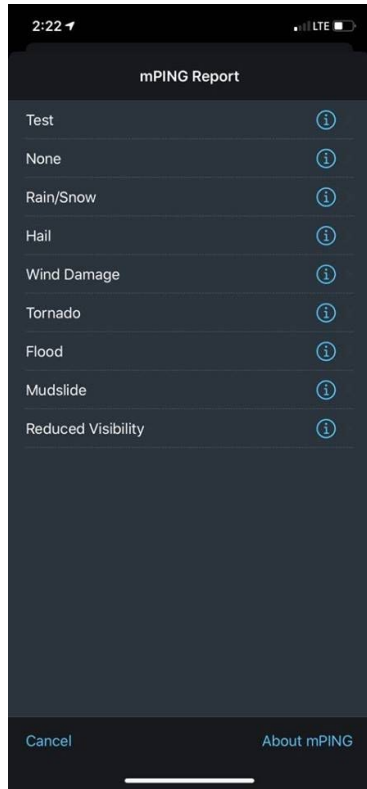


SSEO Severe
[SP]:HM Updraft Helicity $\geq 25 \text{ m}^2\text{s}^{-2}$





Citizen Science/mPING



Since January 2020: 632,744 reports
Database queried 268.3 million
times; over 5 million NWS queries

- Started in 2010 as an outgrowth of the local (central OK) Winter Hydrometeor Ground Truth Experiment to support research and validation of the WSR-88D Hydrometeorological Classification Algorithm
- With time, potential operational application of crowdsourced obs became apparent, and NSSL partnered with NWS personnel to make data available through LDM into AWIPS



Citizen Science/mPING

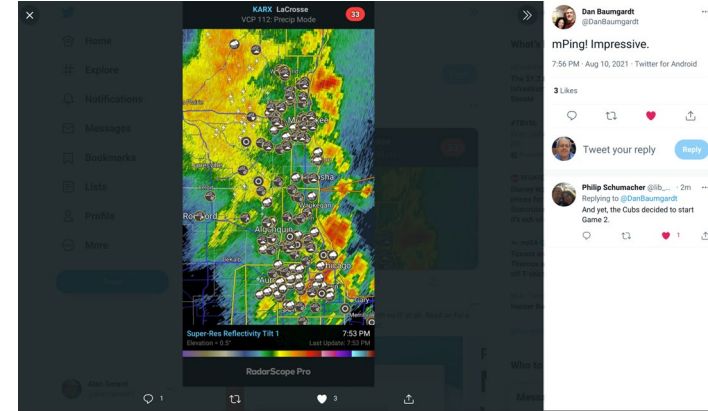
2020 NWS Weather Forecast Office (WFO) Survey Results

mPING is used operationally in large majority of responding WFOs

mPING mainly used for situational awareness, but also to: monitor and verify forecasts, verify warnings, cross-check against spotter reports, and (at times) in the warning decision making process

mPING is used often by about half the respondents to adjust short term forecasts out to 12 hours

Bottom line: based on this survey, mPING has significant operational utility for the NWS WFOs



| Filtered Hail Reports (CSV) (Raw Hail CSV?) | | | | | | | |
|---|------|--------------------------|-------------|-------|-----------|-------|--|
| Time | Size | Location | County | State | Lat Lon | | Comments |
| 1213 | 100 | HOUNT CARREL | WABASH | IL | 3842 8776 | (PAX) | |
| 0431 | 175 | WHITE CITY | MORRIS | KS | 3680 9673 | (TOP) | |
| 0550 | 100 | BELTON | CASS | MO | 3801 9453 | | MOSTLY NICKEL SIZED HAIL WITH A FEW UP TO QUARTER SIZE. (EAX) |
| 0612 | 100 | 2 NW ASHLAND | BOONE | MO | 3879 9228 | | LOTS OF HAIL ACCUMULATING ON THE GROUND. (LSX) |
| 0628 | 175 | S OLATHE | JOHNSON | KS | 3889 9481 | | GOLF BALL SIZED HAIL REPORTED AT 175TH AND HUR-LEN (EAX) |
| 0642 | 100 | BELTON | CASS | MO | 3801 9453 | | PEA AND DIME SIZE HAIL COVERING THE GROUND A FEW AS LARGE AS QUARTERS. (EAX) |
| 0710 | 150 | HOLDEN | JOHNSON | MO | 3871 9399 | (EAX) | |
| 0737 | 150 | WHITETOWN AIR FORCE BASE | JOHNSON | MO | 3873 9355 | (EAX) | |
| 0744 | 100 | WARRENTON | WARREN | MO | 3882 9114 | | REPORT FROM HPING: QUARTER (1.00 IN.), (LSX) |
| 0748 | 125 | 2 NE SAINT PETERS | ST. CHARLES | MO | 3880 9057 | | REPORT FROM HPING: HALF DOLLAR (1.25 IN.), (LSX) |
| 0750 | 100 | HELL | CHARLES | MO | 3888 9092 | (LSX) | |
| 0800 | 100 | SEDALIA | PETTIS | MO | 3870 9323 | | PEA TO QUARTER SIZED HAIL REPORTED AT WALMART AND 50 HIGHWAY IN SEDALIA. (EAX) |
| 0800 | 100 | INDEPENDENCE | JACKSON | MO | 3909 9442 | | NICKEL TO QUARTER SIZED HAIL. (EAX) |
| 0814 | 150 | 2 W SAINT CHARLES | ST. CHARLES | MO | 3880 9055 | | REPORT FROM HPING: PING PONG BALL (1.50 IN.), (LSX) |
| 0826 | 125 | 2 NNE FLORESANT | ST. LOUIS | MO | 3883 9031 | (LSX) | |
| 0840 | 125 | 1 NW POAS | MADISON | IL | 3880 8084 | | VIA TWITTER. (LSX) |
| 0858 | 150 | 1 SE HIGHLAND | MADISON | IL | 3873 8965 | | REPORT FROM HPING: PING PONG BALL (1.50 IN.), (LSX) |





Citizen Science/mPING

2020 NWS Weather Forecast Office (WFO) Survey Results

mPING is used operationally in large majority of responding WFOs

mPING mainly used for situational awareness, but also to: monitor and verify forecasts, verify warnings, cross-check against spotter reports, and (at times) in the warning decision making process

mPING is used often by about half the respondents to adjust short term forecasts out to 12 hours

Bottom line: based on this survey, mPING has significant operational utility for the NWS WFOs



NWSHonolulu
@NWSHonolulu

Follow

Another active weather day is in progress across the state. Please send us your reports of flooding via social media or the mPING app (owl.li/Q93830jtS4X)! Monitor weather.gov/honolulu for updates to all watches and warnings. #hiwx #hisurf

Flash Flood Warnings The entire island of Kauai
Timing: Until 1pm today
Hazard: Heavy showers with rain rates of more than 2"/hour
Impacts: Flash flooding is occurring. Streams are high and some roads are closed. Additional rainfall could quickly produce flash flooding across already saturated grounds.
Flash Flood Watch: All islands
Timing: Through late tonight
Hazard: An upper level low combined with enhanced low level moisture will bring heavy rains and the threat of flash flooding.
Impacts: Flash flooding of poor drainage areas, streams, and low lying areas is possible, especially in areas where the ground is already saturated.
High Surf Warning: **Advisory:** North and West facing shores of Niihau and Kauai, Oahu, Molokai (warning); North facing shores of Maui (warning) and the Big Island (advisory).
Timing: Until 6am Sunday
See weather.gov/honolulu for details

Current Advisories, Watches and Warnings
as of 11am HST April 14, 2018

Please monitor weather.gov/Honolulu for updates

National Weather Service Honolulu
 April 14th, 2018 issued at 11am HST

2:15 PM - 14 Apr 2018

8 Retweets 11 Likes



Robert Ballard
@firebomb56

Following

#hiwx Flash Flood Watch for Kauai & Oahu starting at 6 pm this evening, and continuing until 6 pm Wednesday. Please send reports of rain & flooding using the #mPING app! Mahalo.

1:05 PM - 3 Apr 2018





March 22-25 2021 Southeast Severe/Flash Flood Event

NSSL's influence in the operational community

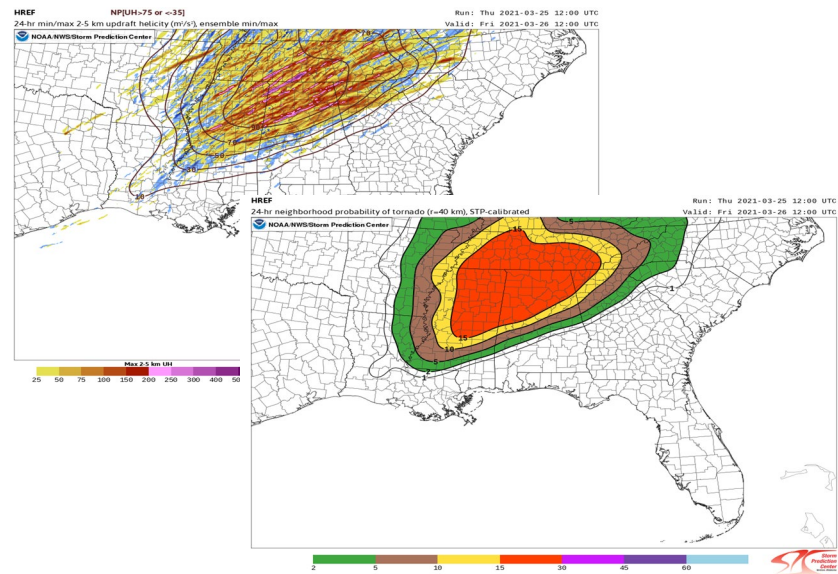
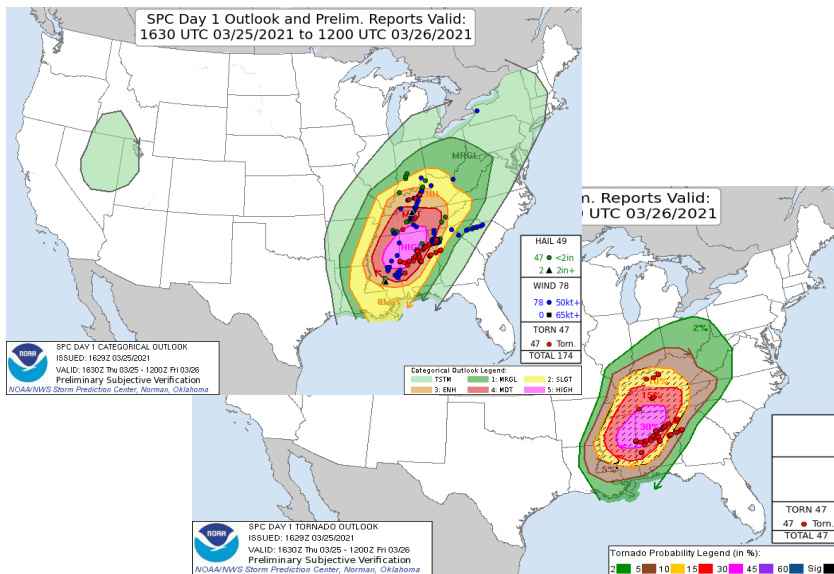




CAM Ensembles and SPC Forecasts

SPC forecasts

HREF output

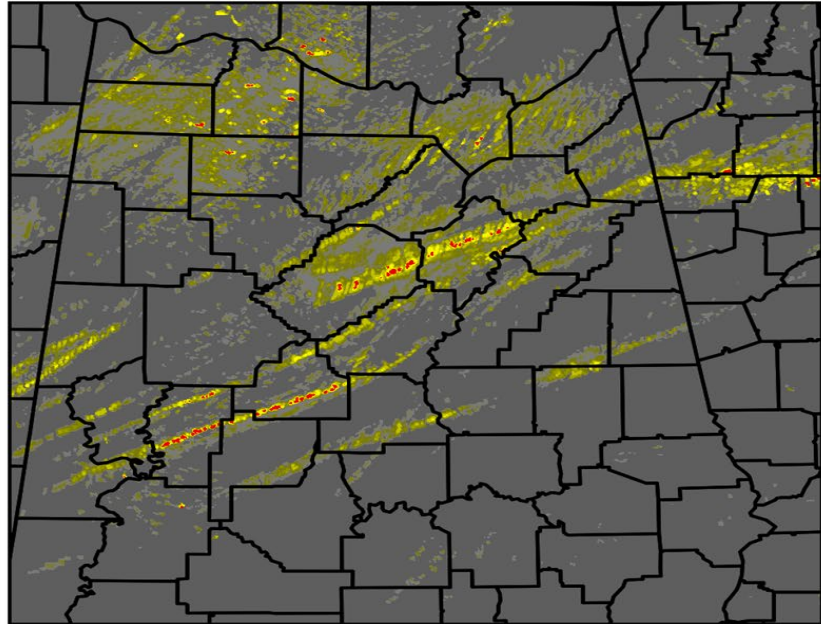




MRMS Severe in Operations

“Clean” MRMS rotation tracks for Alabama supercells

In addition to being used in warning operations, critical for providing post-event decision support to emergency management and damage surveys



MRMS Severe in Operations



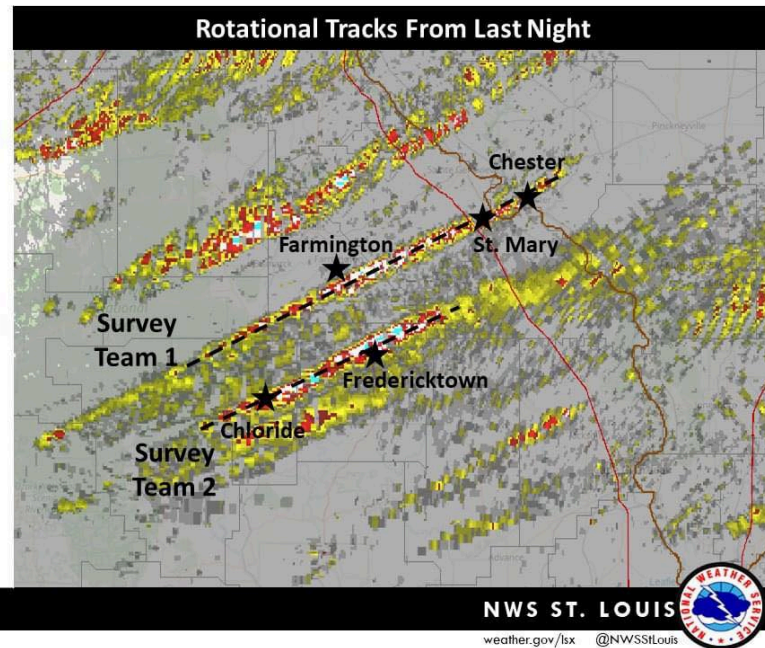
Recent example of NWS use of MRMS rotation tracks product in post-event damage assessment (NWS St. Louis, October 24 2021 tornado event)

Storm Survey Underway

Two survey teams have been sent to assess the extent and severity of the damage in:

- Chester, IL
- Coffman, MO
- St. Mary, MO
- Chloride, MO
- Catherine Place, MO
- Fredericktown, MO

Please let us know if you have any information about damage in these areas!

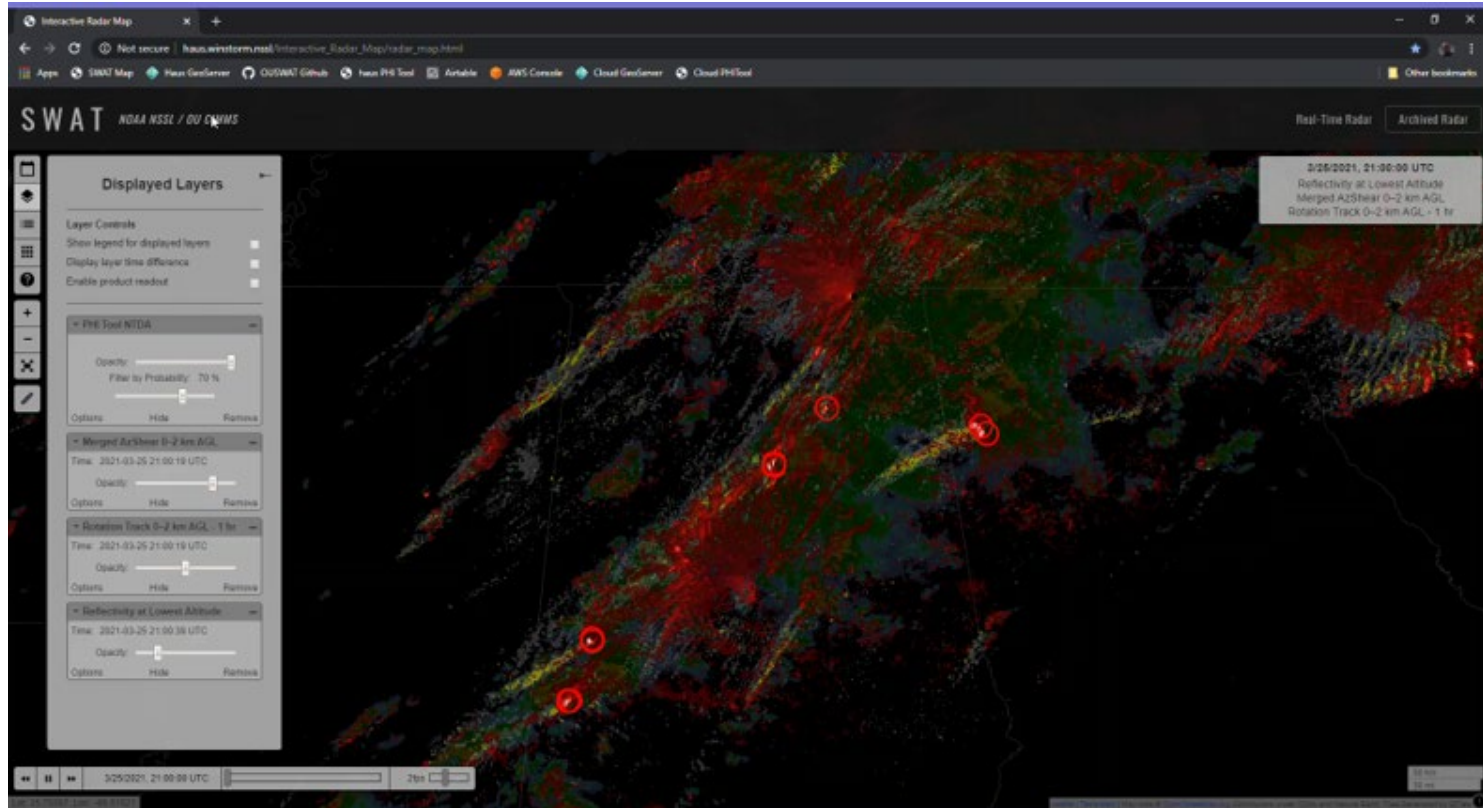


Issued: 10/25/2021 7:25 AM





Warning Ops R20





Dual-pol Radar in Warning Ops

- [04:03:15] <nws-stein.nelson@nwschat.weather.gov/78e4de59> Really need to hit this hard, Vr increasing heading for south Newnan
- [04:03:27] <nws-david.nadler@nwschat.weather.gov/NWSChatLive_207.64.72.94_033628> ****IMPORTANT NOTE**** Given the trajectory of tornadic storm approaching FFC office, we may need to evacuate quickly...within next 20 minutes. If this occurs, NWS Birmingham would assume warning operations until the threat has cleared our office.
- [04:04:11] <media-kris.w.jackson@nwschat.weather.gov/Home> be safe
- [04:04:30] <gtri-ssrc-john.trostel@nwschat.weather.gov/NWSChatLive_130.207.218.254_033102> That looks quite alarming! CC, reflectivity, SRV, etc...
- [04:04:35] <em-michael.f.rega@nwschat.weather.gov/NWSChatLive_98.251.15.191_033912> Please be safe
- [04:04:55] <nws-stein.nelson@nwschat.weather.gov/78e4de59> Large TDS still growing some
- [04:05:58] <nws-stein.nelson@nwschat.weather.gov/78e4de59> 63kt Vr
- [04:06:09] <nws-stein.nelson@nwschat.weather.gov/78e4de59> Heading into Newnan now
- [04:06:56] <nws-dylan.lusk@nwschat.weather.gov/Office> Tornado emergency for newnan
- [04:08:32] <nws-stein.nelson@nwschat.weather.gov/78e4de59> Were extending the TOR into Fayette
- [04:12:59] <ham-dave.christie@nwschat.weather.gov/NWSChatLive_73.106.222.116_031358> Report from trained weather spotter ham - at 12:10 tornado hit homes near High School in Newnan. Major damage.





Dual-pol Radar in Warning Ops

GAC077-260415-
/O.CON.KFFC.TO.W.0014.00000T0000Z-210326T0415Z/
Coweta GA-
1157 PM EDT Thu Mar 25 2021

...A TORNADO WARNING REMAINS IN EFFECT UNTIL 1215 AM EDT FOR
NORTHWESTERN COWETA COUNTY...

At 1157 PM EDT, a confirmed large and extremely dangerous tornado was located near Powers Crossroads, or 8 miles southwest of Newnan, moving east at 45 mph.

This is a PARTICULARLY DANGEROUS SITUATION. TAKE COVER NOW!

HAZARD...Damaging tornado.

SOURCE...Radar confirmed tornado.

IMPACT...You are in a life-threatening situation. Flying debris may be deadly to those caught without shelter. Mobile homes will be destroyed. Considerable damage to homes, businesses, and vehicles is likely and complete destruction is possible.

Locations impacted include...

Newnan, Moreland, East Newnan, Arnco-Sargent, Powers Crossroads, Handy and Madras.





Dual-pol Radar in Warning Ops

Severe Weather Statement

National Weather Service Peachtree City GA
1206 AM EDT Fri Mar 26 2021

GAC077-260415-
/O.CON.KFFC.TO.W.0014.000000T0000Z-210326T0415Z/
Coweta GA-
1206 AM EDT Fri Mar 26 2021

...TORNADO EMERGENCY FOR The City of Newnan...

...A TORNADO WARNING REMAINS IN EFFECT UNTIL 1215 AM EDT FOR CENTRAL COWETA COUNTY...

At 1206 AM EDT, a confirmed large and destructive tornado was located over Newnan, moving northeast at 55 mph.

TORNADO EMERGENCY for Newnan. This is a PARTICULARLY DANGEROUS SITUATION. TAKE COVER NOW!

HAZARD...Deadly tornado.

SOURCE...Radar confirmed tornado.

IMPACT...You are in a life-threatening situation. Flying debris may be deadly to those caught without shelter. Mobile homes will be destroyed. Considerable damage to homes, businesses, and vehicles is likely and complete destruction is possible.

Locations impacted include...

Newnan, East Newnan, Arnco-Sargent and Madras.



Uncrewed Aerial Systems in Damage Surveys



Skydio 2

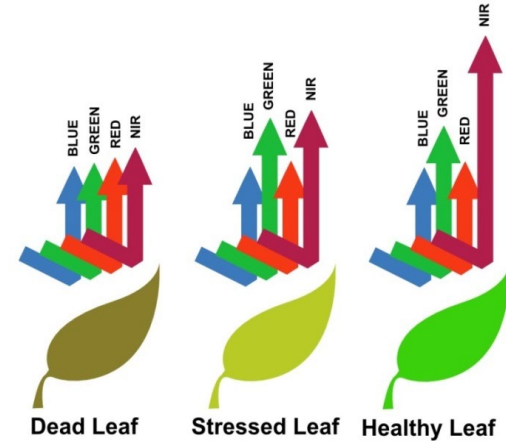


Quantum Trinity F90+

Collaboration with
NWS WFOs and EMs



Large-scale mapping Visible & Multispectral (RGB, RedEdge, NIR) imagery

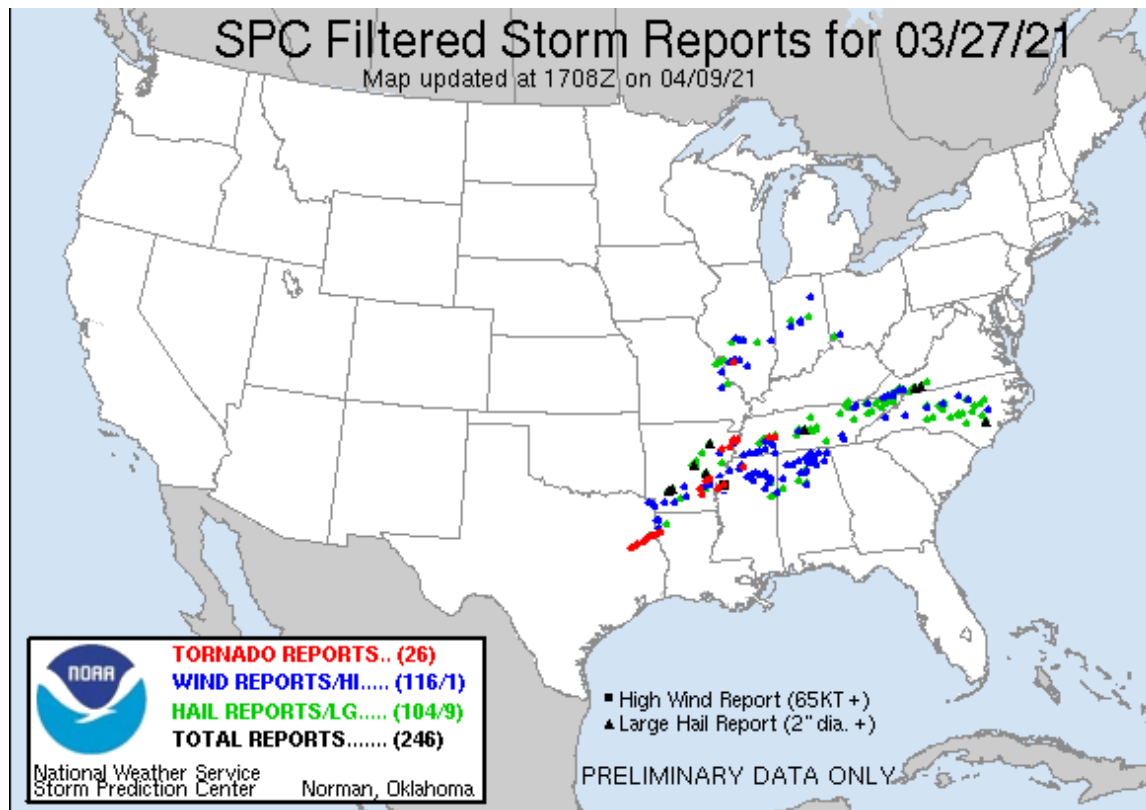


UAS Damage Surveys



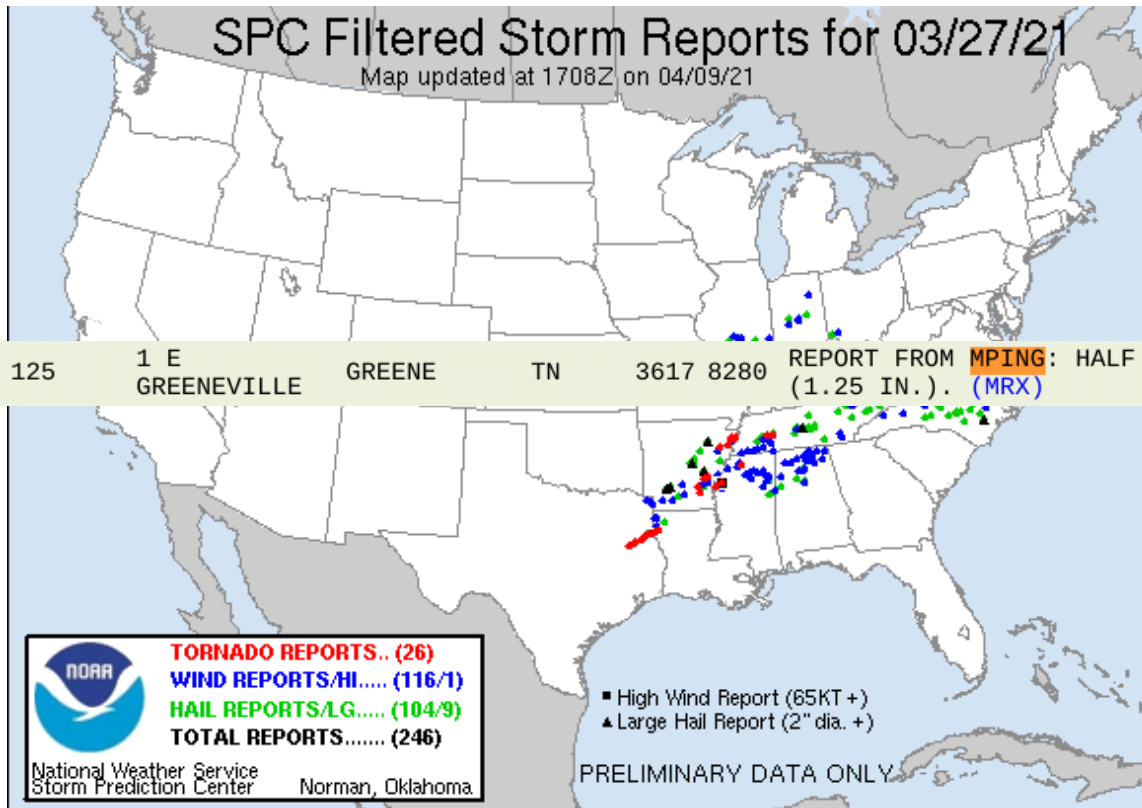


27-28 March Severe Weather



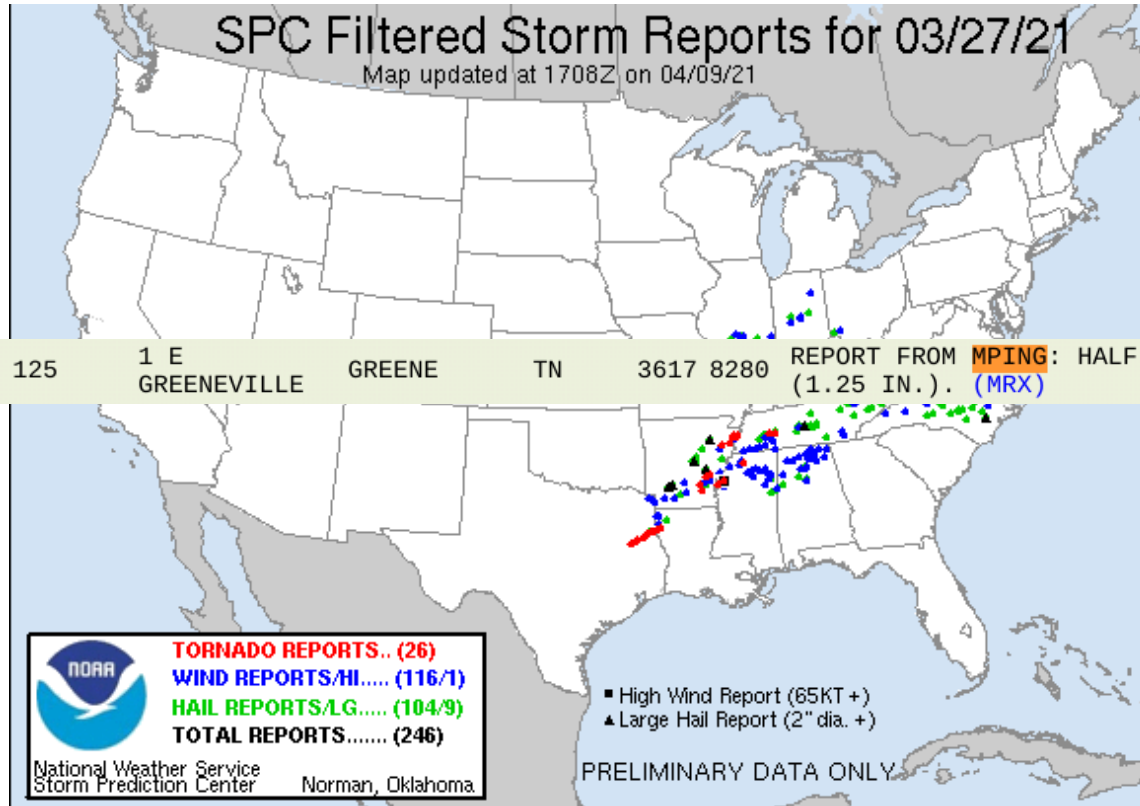


27-28 March Severe Weather





27-28 March Severe Weather



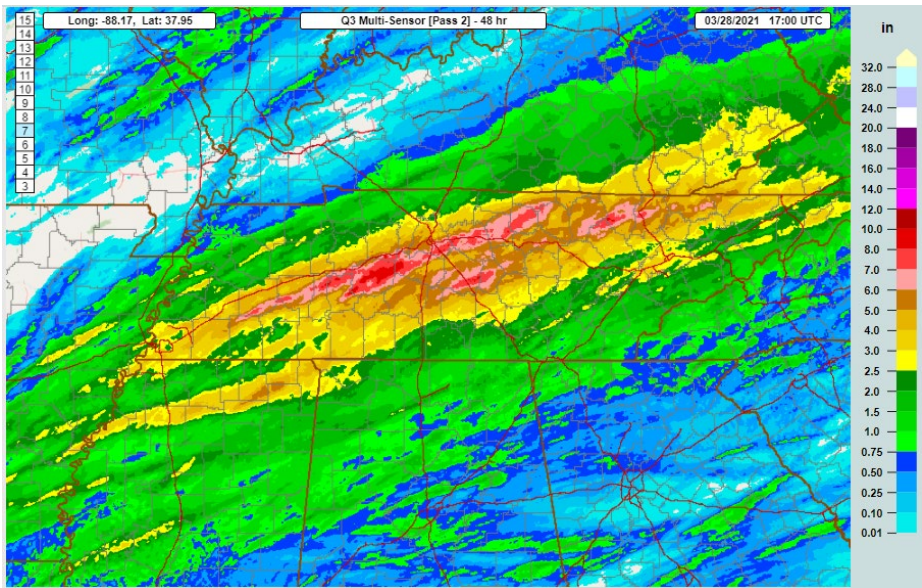
18 mPING reports of severe weather in SPC report log

Additional reports of flash flooding





Tennessee Flash Flooding 27-28 March



NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Local forecast by "City, St" or ZIP code
 [Location Help](#)

News Headlines

- [Online SKYWARN Spotter Class Tonight at 630 pm CDT -- Sign Up Now!](#)
- [List of Tornadoes across Tennessee in 2021](#)
- [6 To 10 Day Outlook](#)
- [Temperature and Precipitation Outlook for Nov-Dec-Jan 2021-22](#)

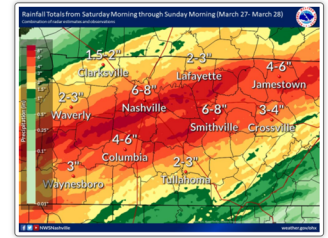
March 27-28, 2021 Historic Flash Flooding
[Weather.gov > Nashville, TN > March 27-28, 2021 Historic Flash Flooding](#)

Nashville, TN
Weather Forecast Office

Current Hazards Current Conditions Radar Forecasts Rivers and Lakes Climate and Past Weather Local Programs

Overview

An historic flash flooding event affected the central third of Middle Tennessee from the early morning hours on March 27 through the day into the early morning hours on March 28. A warm front moved northward into Middle Tennessee early on March 27 before stalling near the I-40 corridor. Between 300-400 AM CDT, numerous showers and thunderstorms developed along the warm front, many of which became severe and produced large hail up to half dollar size along with frequent lightning and heavy rainfall. Showers and storms continued off and on the rest of the day across Middle Tennessee, particularly near the stalled warm front. In fact, another round of severe thunderstorms including supercells developed during the afternoon and evening hours near and south of the warm front. These storms dropped large hail up to tennis ball size and caused a few reports of wind damage, but the main impact was additional heavy rainfall which began causing flash flooding south of Nashville. Flooding only worsened as showers and storms redeveloped over the same areas through the evening, with numerous Flash Flood Warnings issued and several reports of flooded roads and water rescues.



After midnight, even more heavy rainfall falling along the already waterlogged I-40 corridor prompted a rare Flash Flood Emergency for the southern and eastern Nashville metro area, including southeastern Davidson County, western Wilson County, and northern Williamson County. These areas received between 7" to 9" of rain, causing rapid rises on several Nashville metro creeks and streams, including Sevenmile Creek (which reached its highest level on record), Browns Creek, and Mill Creek, among others. Many of these creeks reached within their 2nd or 3rd highest water levels on record. The rapid water rises flooded hundreds of homes and businesses, with reports of some people trapped in the attics or on the roofs of their houses. Dozens of roadways were flooded and impassable, including both I-24 and I-40, with many cars submerged in the flood waters and people forced to cling onto

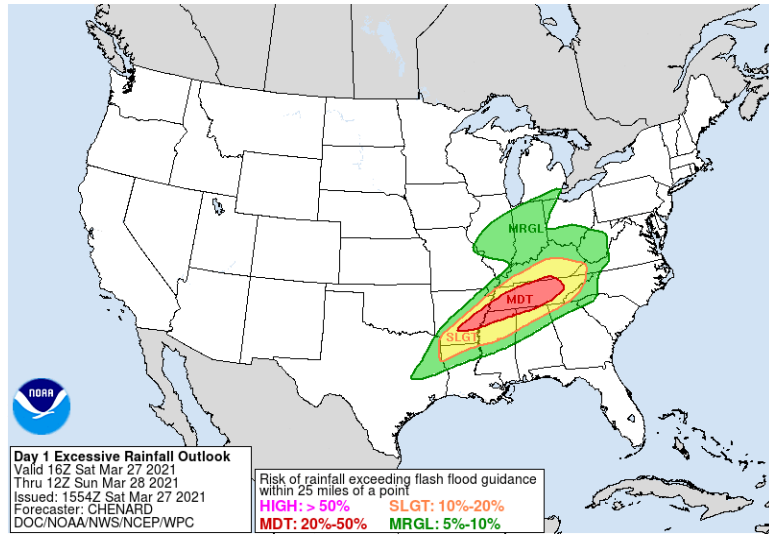
Rainfall Estimates for March 27-28, 2021



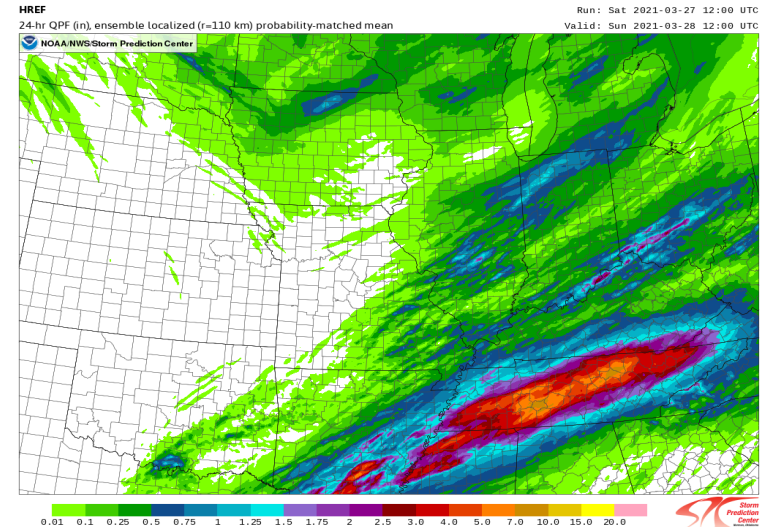


CAM Ensemble and WPC Forecasts

WPC forecast

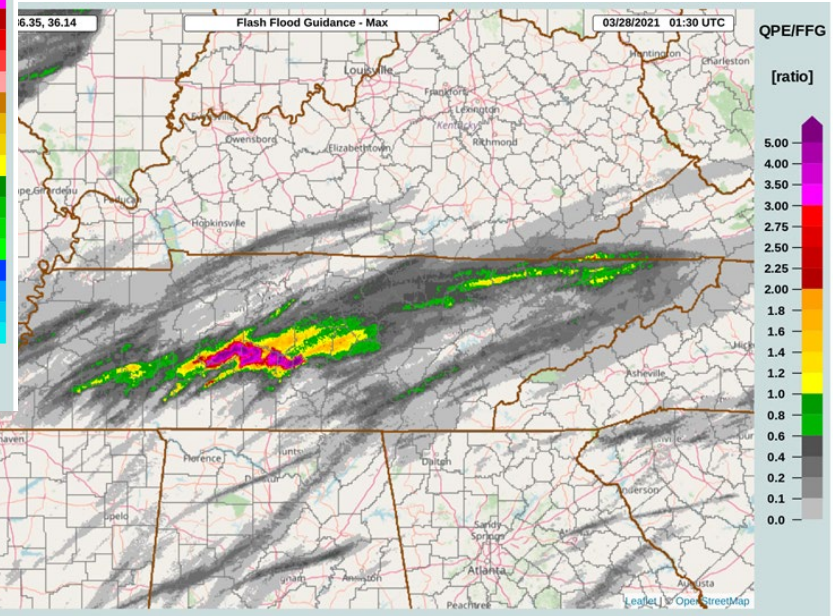
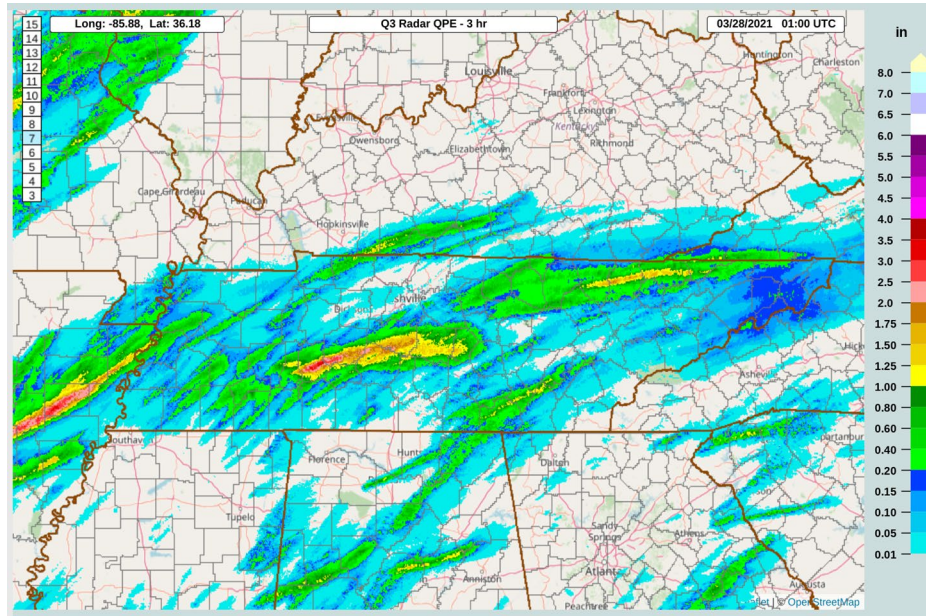


HREF output



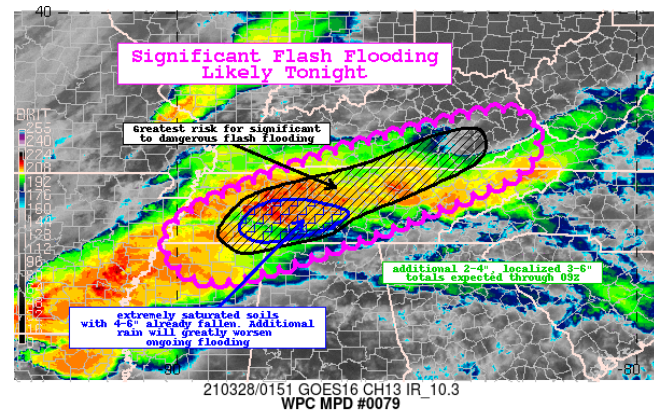
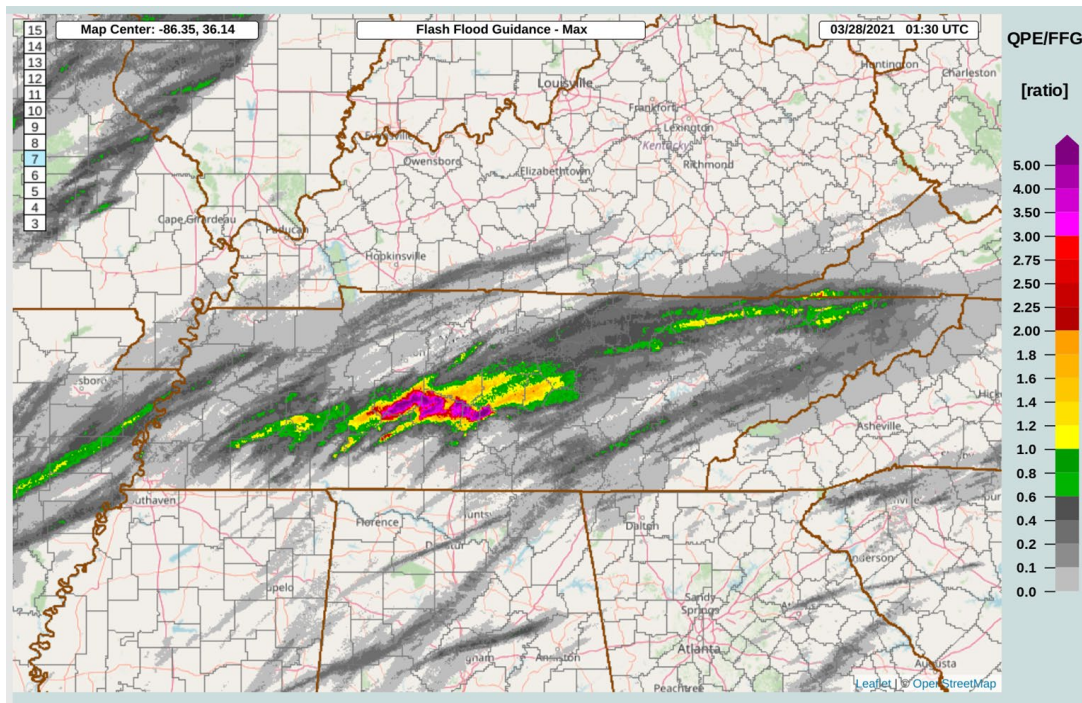


MRMS/FLASH in WPC Operations





MRMS/FLASH in WPC Operations



Mesoscale Precipitation Discussion 0079
NWS Weather Prediction Center College Park MD
959 PM EDT Sat Mar 27 2021

Areas affected...Tennessee...South-Central to Southeastern Kentucky

Concerning...Heavy rainfall...Flash flooding likely

Valid 280155Z - 280800Z

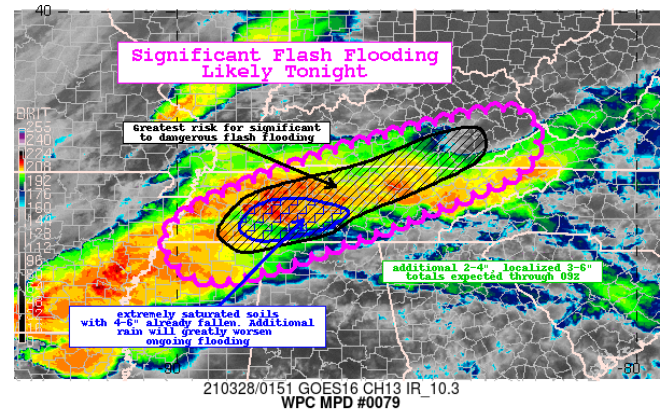
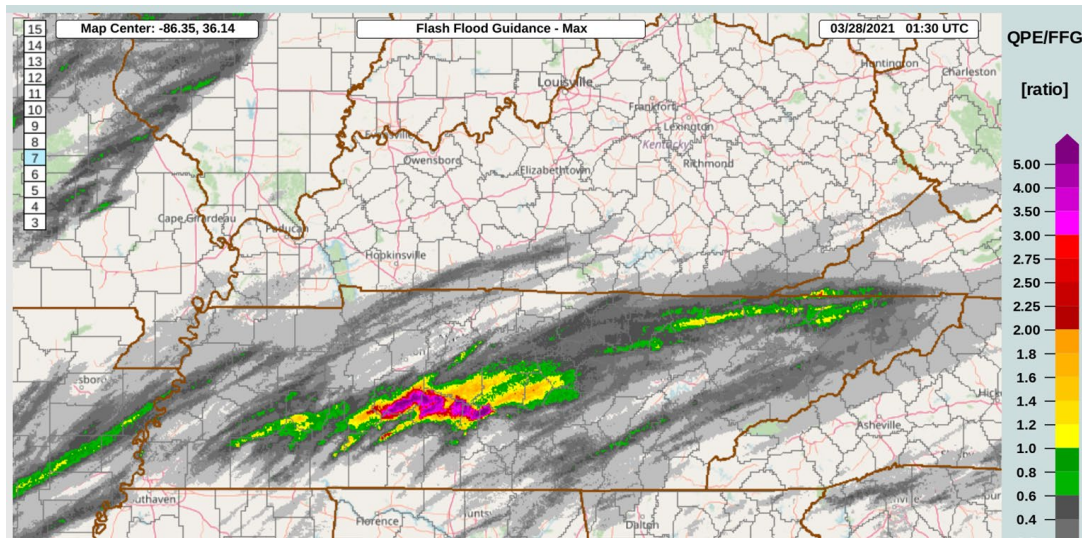
Summary...Significant to dangerous flash flooding is likely over portions of western to middle Tennessee this evening, including the Nashville metro, and could also extend into portions of southeastern Kentucky. Heavy rainfall due to thunderstorms are expected to produce additional localized 3-6" totals through 4 AM CDT.

Discussion...Large scale forcing for ascent provided by the approach of a mid/upper level shortwave and the increasing low level convergence an advancing cold front has pooled copious amounts of moisture and instability over the region this evening. Recent IR satellite imagery shows a blossom of deeper convection continuing across much of western to middle Tennessee and regional radar indicates that individual/discrete cells earlier have morphed into several clusters/line segments due to multiple boundary interactions. The recent MRMS QPE suggests upwards of 2"/hr totals are common in the strongest convection and FLASH QPE/FFG ratios are already 200-300 percent across portions of middle TN.





MRMS/FLASH in WPC Operations



Mesoscale Precipitation Discussion #0079
 NWS Weather Prediction Center College Park MD
 959 PM EDT Sat Mar 27 2021

Areas affected...Tennessee...South-Central to Southeastern Kentucky

Concerning...Heavy rainfall...Flash flooding likely

boundary interactions. The recent MRMS QPE suggests upwards of 2"/hr totals are common in the strongest convection and FLASH QPE/FFG ratios are already 200-300 percent across portions of middle TN.

LEVEL convergence an advancing cold front has pooled copious amounts of moisture and instability over the region this evening. Recent IR satellite imagery shows a blossom of deeper convection continuing across much of western to middle Tennessee and regional radar indicates that individual/discrete cells earlier have morphed into several clusters/line segments due to multiple boundary interactions. The recent MRMS QPE suggests upwards of 2"/hr totals are common in the strongest convection and FLASH QPE/FFG ratios are already 200-300 percent across portions of middle TN.





Research-to-Operations...

...is at the heart of what NSSL has been since we started...and will continue to be moving forward...

