

## 2020: A Record Breaking Hurricane Season



**Daniel Noah**

Warning Coordination Meteorologist  
National Weather Service – Tampa Bay Area  
[daniel.noah@noaa.gov](mailto:daniel.noah@noaa.gov)

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<https://radar.weather.gov>  
<https://weather.gov/forecastpoints>

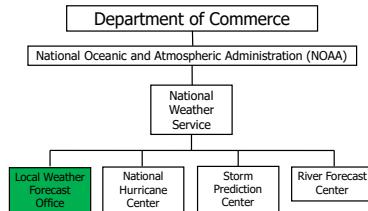


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1

## We are a Federal Government Agency



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## 122 NWS Local Weather Forecast Offices



- 23 Employees
- 17 are Meteorologists
- 24 hours a day
- 365 days a year



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## We Issue the Weather Warnings You Hear on Radio/TV



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## Members of the Integrated Warning Team



Emergency Management and Public Officials



National Weather Service



America's Weather and Climate Industry  
(e.g. TV, Radio, Newspaper, Media, Private Companies, & App Developers)

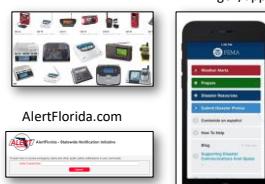
## Does the NWS Have an App?

Have multiple ways to receive a weather warning

Weather Radio



FEMA.gov/app



Commercial Apps



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## Florida Hurricanes



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## The Top Five Costliest U.S. Hurricanes on Record



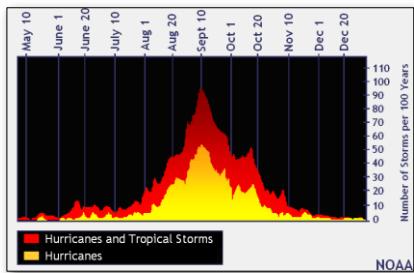
Name	Year	Cost
Katrina	2005	\$161 Billion
Harvey	2017	\$125 Billion
Maria	2017	\$90 Billion
Sandy	2012	\$71 Billion
Irma	2017	\$50 Billion

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## Hurricanes in the Atlantic Basin



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9

## Remember when 2005 Hurricane Season Ran Out of Names



28 Named Storms (normal is 12)  
 15 Hurricanes  
 7 Major Hurricanes

Began June 8, 2005  
 Ended January 6, 2006

Ran out of names and used 6 Greek letters

- Alpha, Beta, Gamma, Delta, Epsilon, Zeta

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10

## 2020 Hurricane Season

Arthur	Gonzalo	Marco	Teddy
Bertha	Hanna	Nana	Vicky
Cristobal	Isaias	Omar	Wilfred
Dolly	Josephine	Paulette	
Edouard	Kyle	Rene	
Fay	Laura	Sally	

No names for Q, U, X, Y, or Z

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11

## 2020 Hurricane Season Greek Alphabet Names

Alpha	Eta	Nu	Tau
Beta	Theta	Xi	Upsilon
Gamma	Iota	Omicron	Phi
Delta	Kappa	Pi	Chi
Epsilon	Lambda	Rho	Psi
Zeta	Mu	Sigma	Omega

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12

## 2020 Hurricane Season

30 Named Storms  
13 Hurricanes  
6 Major Hurricanes  
Began May 16, 2020



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## Entire Gulf/East Coast was in a Tropical Watch/Warn in 2021



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## Hurricane Season Started on May 16, 2020

May 17, 2020 - Tropical Storm Arthur spinning toward the Carolinas



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## September 20, 2020

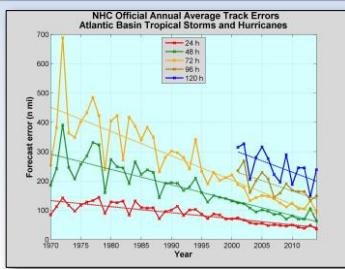


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16

## Hurricane Forecasting



## Advances in Technology



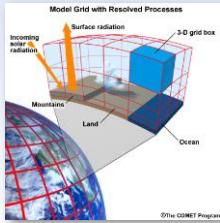
Everything in this Ad from the 80s can now be down with a single smart phone



## Computer Simulation (Model)

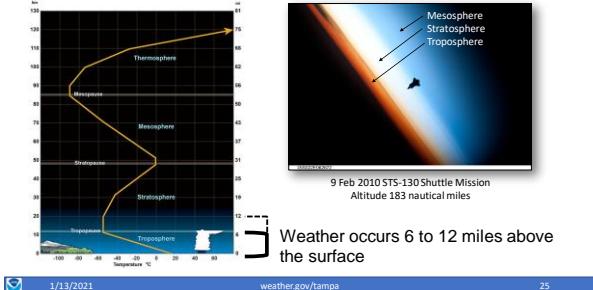


Dynamic Models solve equations that govern the atmosphere/ocean



- Global Models
  - GFS – U.S. Global Forecast System
  - ECMWF - European Center for Medium-range Weather Forecasting
  - UKMET - United Kingdom METeorological
- Small Scale Models
  - NAM – North American Model
  - RAP – Rapid Refresh Model

## Layers of the Atmosphere



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25



## NWS Supercomputers

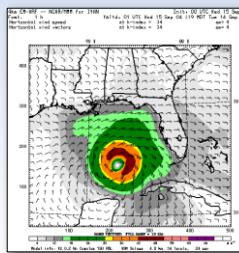


1 petaFLOPS = quadrillion (thousand trillion)  
FLoating Operations Per Second



- 2005: NWS 0.0005 petaFLOPS
- 2013: Sony Play Station 4
  - GPU 0.0002 petaFLOPS
- 2009: 1<sup>st</sup> petaflop computer
- 2014: NWS 0.4 petaFLOPS
- 2018: NWS 0.4 petaFLOPS
  - 393,216 CPU cores
  - 180 petaFLOPS

## NWS Supercomputer



Allows atmospheric simulations that have higher resolution in both time and space

## Review of the Hurricane Forecast Cone



## What Does the Cone Mean?



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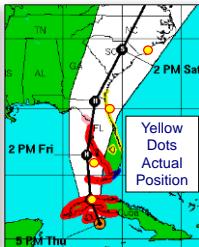
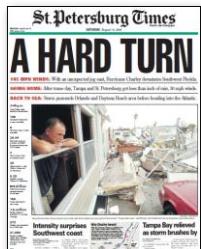
29

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## 2004 Hurricane Charley: Perception is Reality



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31

## Hurricane Isaias

Tuesday Briefing, impacts on Sunday



POTENTIAL TROPICAL CYCLONE ISAIAS

Advisory #1

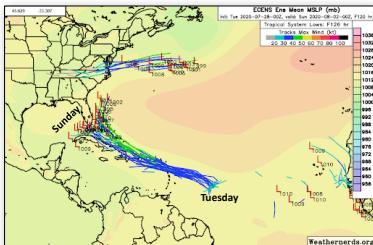
Initial Location: 13.8 N, 53.7 W

Tuesday, July 28, 2020 11:49 AM EDT

- Maximum Sustained Winds: 40 mph

Movement: 23 mph W

## European Ensemble Model – Tropical Cyclone Isaias



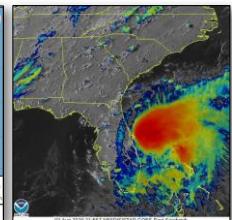
- Model run numerous times with data put into model differently each time
- Started on Tuesday, ended on Sunday
- High uncertainty on track forecast

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33

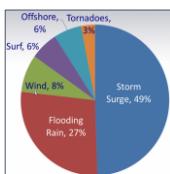
## Hurricane Isaias



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34

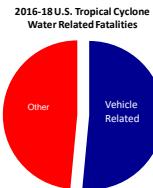
When you close your eyes, what do you see when you think of a hurricane?



9 out of 10 U.S. tropical cyclone fatalities are due to water

## 2016-2018 Water Continues to Kill

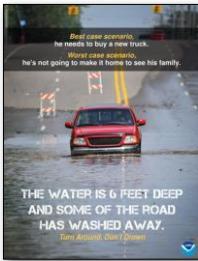
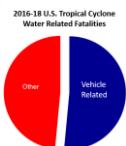
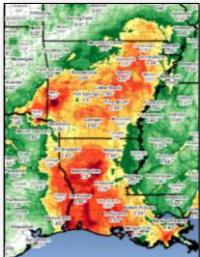
During the past three seasons, **more than half** the U.S. tropical cyclone water-related fatalities were vehicle related!



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37

## Flooding Rains from Major Hurricane Laura



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38

## Fast Fact



Flood Insurance is required on your mortgage if your home is in a 1-in-100 year flood plain

That is a 1% chance each year

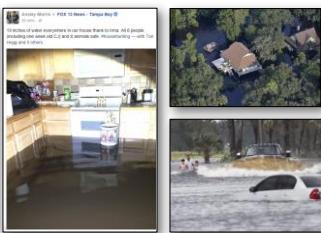
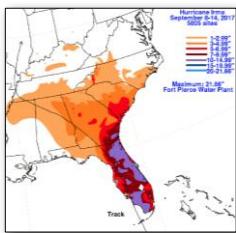
That is a 26% chance over a 30-year mortgage (don't ask me how they did the math)

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39

## 2017 Hurricane Irma Rain and Flooding



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40

## Flooding from Heavy Rain is Dangerous

2016 Hurricane Matthew  
North Carolina



2012 Tropical Storm Debby  
Pinellas County

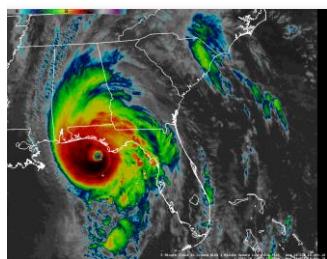


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41

## 2018 Major Hurricane Michael



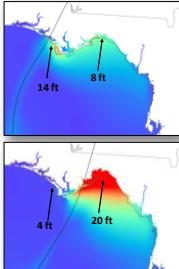
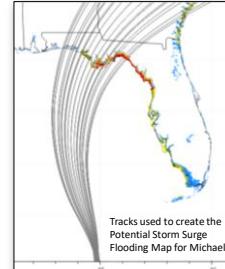
- CAT 5 with 160 mph wind
- Surge, tide, and waves reached 19 feet at Mexico Beach
- At least 59 people killed in the United States
- 4<sup>th</sup> CAT 5 to hit the United States

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42

## 100s of Surge Forecasts Varying Size, Intensity, & Speed

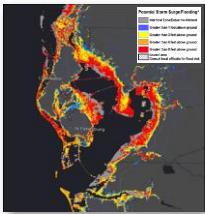


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43

## Potential Storm Surge Flooding Map if Michael Hit Tampa



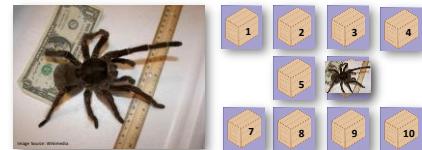
Does not show what is expected, this map shows a reasonable worst case scenario (10% chance)

10% of the time the surge will be higher than what is shown

90% of the time the surge will be lower

## Visualizing a 10% Chance

This spider is inside one of ten boxes.  
Pick a box and stick your hand in it.



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## Cameron, LA – 2020 Hurricane Laura



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## Unsurvivable Storm Surge



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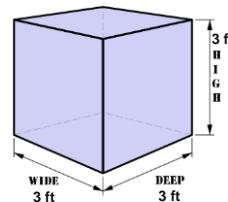
## Storm Surge Mexico Beach, FL on 10/10/2017



Instagram.com/talarico.tessa

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## Water is Heavy, Moving Water can be Deadly



1 cubic yard of water weighs 1,700 pounds!

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### Every Red Dot on Map is a Home Washed Off Foundation



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### On the Ground in Mexico Beach



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### Mexico Beach Storm Surge Debris



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### Public Risk Perception is Based on Previous Experience

- **“My house is elevated, I thought we would be just fine”**
- **“It’s never flooded here before”**
- **“They always turn”**
- **“I didn’t know it would be this bad, I’ll never stay again”**
- **“This wasn’t that bad, I’ll never leave again”**

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### Storm Surge Created a New Pass



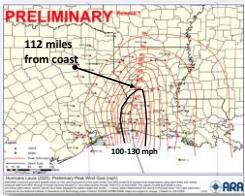
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### Our Barrier Islands are no Different



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## Major Hurricane Laura Wind



- Major Hurricane Laura made landfall at approximately 1:00 am CDT on 27 Aug 2020 with maximum sustained winds of 150 mph. For comparison, Katrina's winds at landfall were 125 mph.
- This is at the higher end of Category 4 on the Saffir-Simpson scale (130-156 mph).
- Hurricane Laura tied the Last Island hurricane (1856) for the strongest landfalling hurricane in Louisiana on record. This makes it the strongest hurricane to hit Louisiana in 164 years.
- Laura is tied for the fifth-strongest storm (in terms of wind speed at landfall) to hit the Continental United States.
- Its central barometric pressure at landfall was 938 millibars (27.699 inches of mercury), making it the fourth strongest hurricane to hit anywhere on the Louisiana coastline.
- Laura is the only Category 4 or 5 hurricane to make landfall in SW Louisiana.

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57

## Fast Fact

One inch of rain over one square mile

- 17 million gallons of water
- 145 million pounds

This is a lot of weight being held aloft by the storm updraft



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58

## Non-Severe Thunderstorm Downdraft in Tampa



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59

## Lake Charles, LA

31 miles from the Gulf Coast



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## Chemical Fire in Lake Charles



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61

## NWS Lake Charles



NWS Lake Charles evacuated ahead of storm

Two employees lost their homes

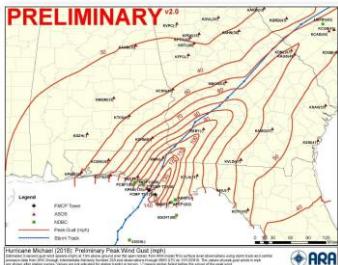
Radar knocked out

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62

## 2018 Hurricane Michael Wind Field



CAT 3, 115+ MPH winds went all the way into southwest Georgia

## 2018 Hurricane Michael Wind



The damage is not just from wind, but is from the weight of the water in the wind moving at that wind speed

Sustained winds don't cause as much damage as gusty wind which pounds on structures

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64

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65

## 2018 Hurricane Michael Wind



Trees snapped in half in large sections of forest



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## Hurricane Michael Power Outages



Power Out For Nearly 350,000 In Northwest Florida After Hurricane

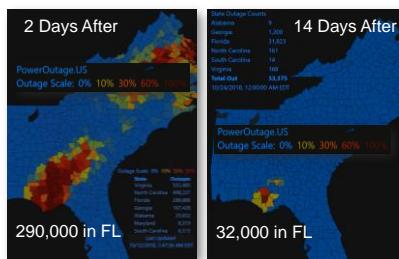


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## Hurricane Michael Power Outages



290,000 in FL

32,000 in FL

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68

## Evacuations are Called for One of Two Reasons

1. Live in the storm surge zone



Hurricane Charley – 2004  
Motorists fleeing Pinellas County on the Howard Franklin Bridge

2. Live in manufactured home



Hurricane Charley – 2004  
Punta Gorda area

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## Evacuations can be a Problem

Evacuate 10s of miles, not 100s of miles



Motorists trapped on I-26 as Hurricane Floyd approached Charleston, SC in 1999



Houston as Hurricane Rita approached in 2004

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70

## The Five Most Difficult Hurricane Evacuation Areas in U.S.

According to Donald Lewis, VP of ATKINS at the 2012 National Hurricane Conference

5. Southeast Florida
4. New York City / New Jersey Coast
3. Delmarva Peninsula (DE, MD, VA)
2. Tampa Bay Area, FL
1. Southwest Florida

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## 2017 Hurricane Irma Caused Largest Florida Evacuation

About 6 million Floridians evacuated



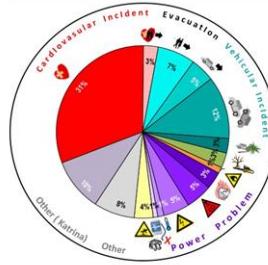
Nexusnewsfeed.com

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72

## Surviving the Aftermath of a Hurricane



Reagan and Blanchard, 8/1/2005

### Most frequent factors in Fatalities After the Storm:

- Cardiovascular
- Electricity
- Vehicle accident
- Evacuation

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73

## Survive the Aftermath of a Hurricane



### Disease Outbreaks

- From Contaminated Water – sewage release
- From Contaminated or Spoiled Food
  - Loss of Power = Improper Refrigeration
  - Danger Zone between 40F and 140F
  - Potentially Hazardous Foods in as little as 4 hours

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74

## Survive the Aftermath of a Hurricane



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- Displaced wild animals
  - Snakes, spiders, bears, fire ants
  - Abandoned domestic animals can form into packs and they are scared and hungry



## Surviving the Aftermath of a Hurricane



- Fires & Electrocution
  - Downed power lines
  - Water intrusion into electrical systems
  - Increased use of generators
- Carbon Monoxide Poisoning
  - Improper generator use
  - Running in garage or house
    - Underneath open window

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76

## Stress Can Kill



- Physical Stress
  - Temperature & Humidity
  - Diet Changes
  - Unusual Activities
  - Long Hours / Lack of Sleep
- Emotional Stress
  - Loss & Grief
  - Depression
  - Anger
  - Post Traumatic Stress Disorder

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77

## What can you do?



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91

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92

## Become an Ambassador!

Sign up for your group at [weather.gov/wrn](http://weather.gov/wrn)

An Ambassador receives and Email about once a month with preparedness resources

1. Knowledge at Your Fingertips – Useful safety information will keep you safe when dangerous weather strikes.
2. Peer Influence – Your peers will follow your example during dangerous weather events, keeping them safe.

Some of the 212 Ambassadors in West Central Florida

- Hillsborough ARES/RACES
- TECO Energy
- Fox 13 WTVT-TV Tampa Bay
- Tampa International Airport
- St Pete Astronomy Club
- U.S. Central Command
- Ellenton Premium Outlets
- Frontier Communications
- University of South Florida

## Examples of Ambassador Resources



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93

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94

## Ambassador Resources – Social Media Plans

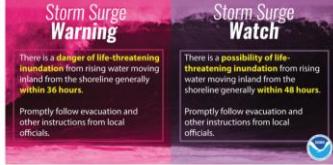
### Storm Surge Watch vs. Warning

#### Facebook

Do you know the difference between a Storm Surge Warning and a Storm Surge Watch? A Storm Surge Warning means there is a danger of life-threatening flooding within 36 hours. A Storm Surge Watch means there is a possibility of life-threatening flooding within the next 48 hours. In either case, please promptly follow evacuation and other instructions from local officials.

#### Twitter

Do you know the difference between a Storm Surge Warning and Watch? Visit [weather.gov/hurricane/safety](https://weather.gov/hurricane/safety) for more tips.



## Questions or Comments?



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<https://radar.weather.gov>  
<https://weather.gov/forecastpoints>  
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96

1/13/2021

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95

1/13/2021

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96