

Weather Prediction Center Services in Support of FIRO

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Workshop on Texas FIRO
Sep 21, 2023

Major Focus: Extreme Precipitation

We do a lot of different types of weather forecasting over a very large area, but one common thread...

WPC is the national center of expertise in NOAA/NWS for extreme precipitation

Rain



AP Photo/David J. Phillip

Snow and Ice



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A core focus for WPC forecasters is when and where extreme precipitation can be expected in the next seven days



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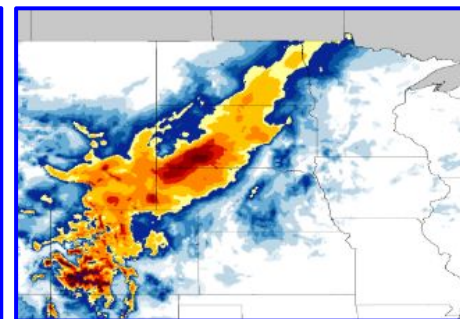
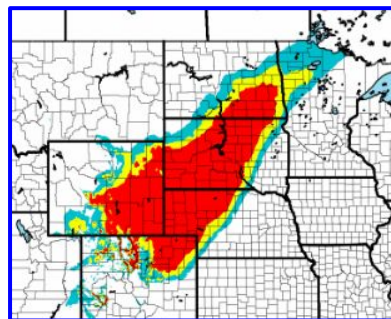
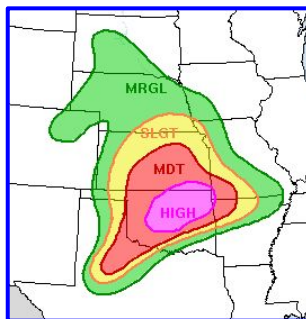
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Collaboration: Major Precipitation Events

WPC engages entire field structure including WFOs, RFCs, Operations Centers, National Water Center



Higher outlook probabilities
drive conference calls —
Excessive Rainfall Outlook
and Winter Storm Outlook



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Day 7

Day 6

Day 5

Day 4

Day 3

Day 2

Day 1

QPF (or “most likely” rainfall)

Zoomed Tropical Cyclone Rainfall Graphic
(Begins ~84 hours out; 3-5 days worth of rain)

Probabilistic QPF (PQPF)

(Probability of X” of rain; “Worst case”; “At least this much”)

Extreme Precipitation Monitor

(Compares forecast QPF to Recurrence Interval)

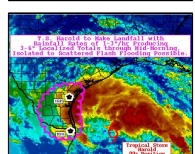
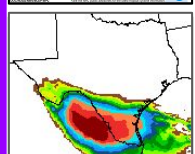
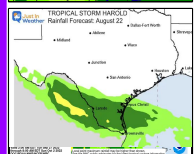
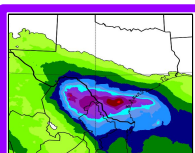
These are all related and are in some way based around the official QPF that is issued by WPC forecasters

Evaluating extension to all 7 days

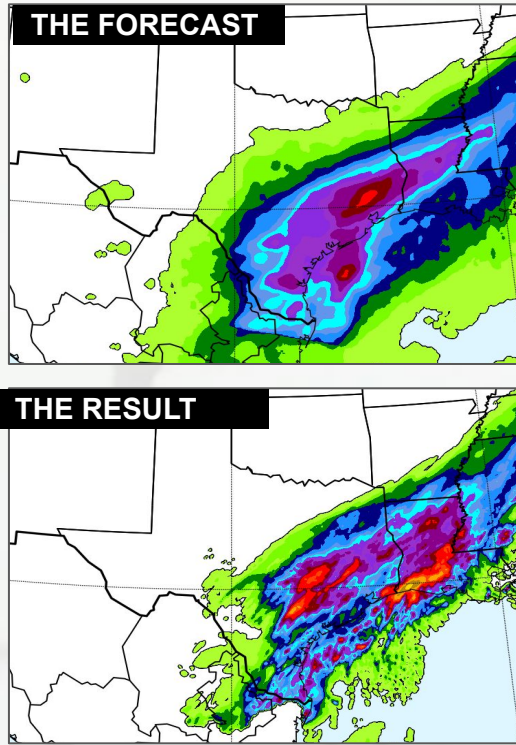
Excessive Rainfall Outlook (ERO)

(Probability of rainfall-induced flash flooding within 25 miles of a point)

Mesoscale Precipitation Discussion (MPD)
(Next 6-12 hours; where is the flash flood threat ramping up)



Quantitative Precipitation Forecast (QPF)



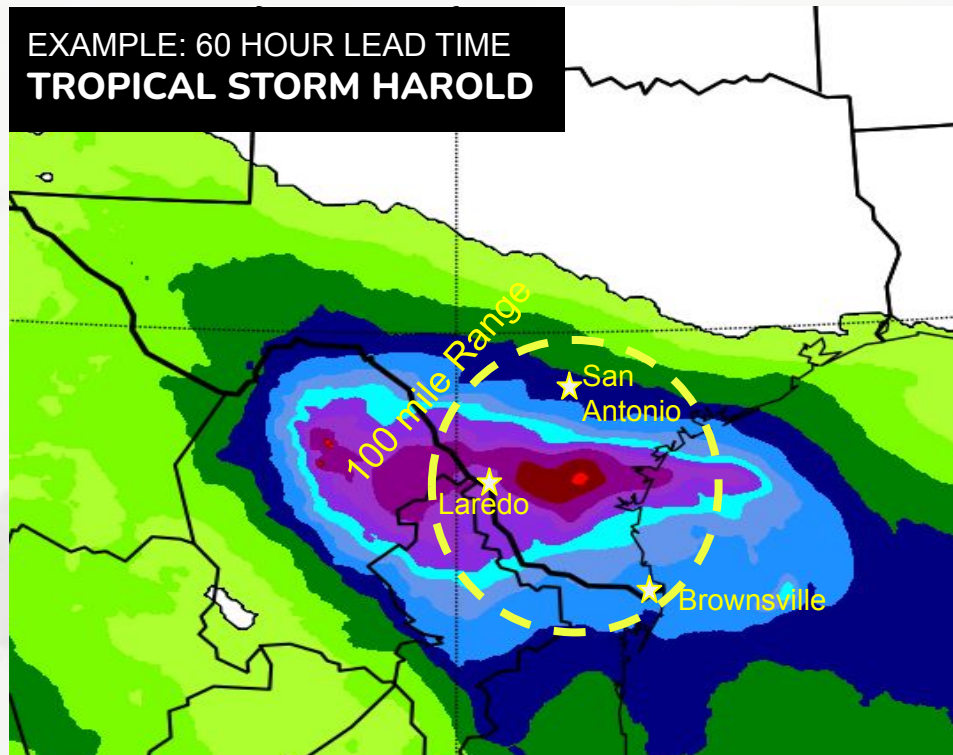
- QPF is forecast precipitation over a given period of time.
- One of several precipitation forecast options in HEFS
- The forecast depicts areal average amounts. It gives you a general idea of what to expect, but will not capture every localized minimum or maximum.
- Will generally be more accurate in situations with large, organized weather systems as compared to scattered, summertime thunderstorms.

Updated Tropical Rainfall Error Statistics

Official rain forecast is the “most likely”, but can end up displaced from what you see on the map

*2016-2022 Displacement Error of
2" Rainfall Forecast Contour*

Lead Time	Avg. Error
12 hours	54 miles
36 hours	70 miles
60 hours	98 miles
84 hours	132 miles
108 hours	159 miles

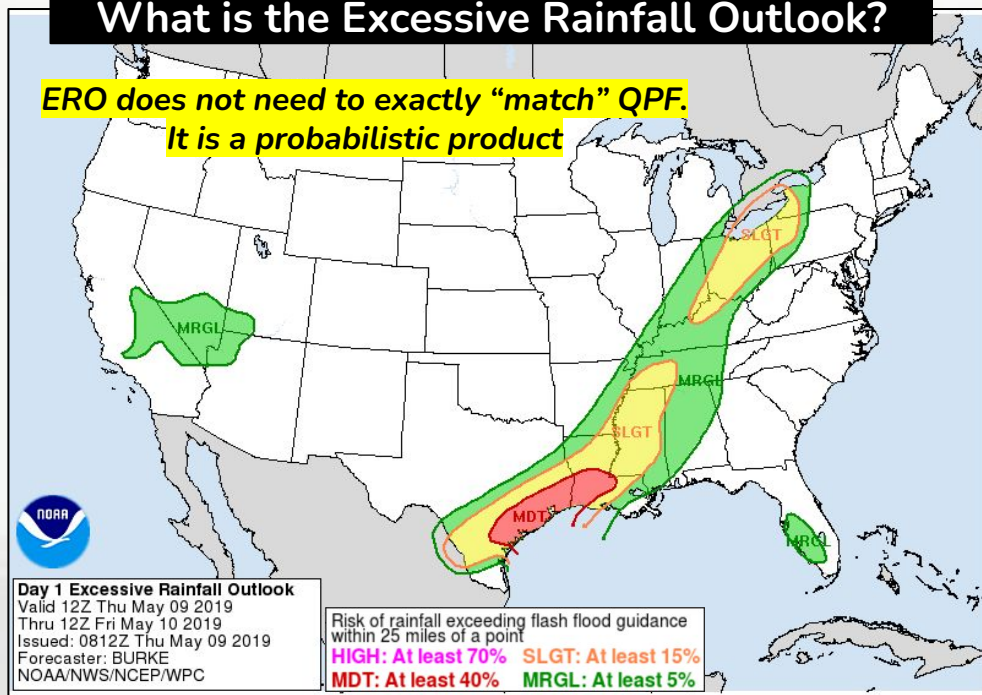


Excessive Rainfall Outlook (ERO)

What is the Excessive Rainfall Outlook?

ERO does not need to exactly “match” QPF.

It is a probabilistic product



Graphic legend updated for new probability definitions as of February 10, 2022

Answers the question:

What are the chances of rainfall intense enough that it would be expected to cause impacts?

Other things to know:

- ✓ A situational awareness and planning tool that “gets your head in the game”
- ✗ Not an explicit forecast of flash flooding at a specific location
- ✓ Accounts for uncertainty in placement, timing of intense rainfall and summarizes the larger scale risk factors. Issued for Days 1-5.



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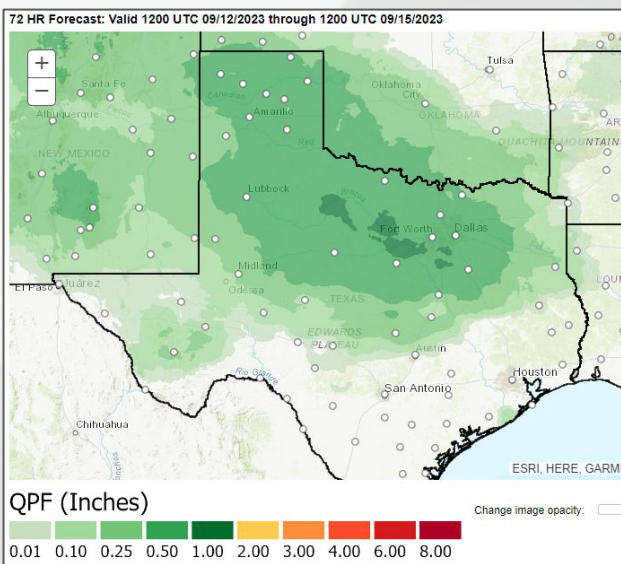
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Probabilistic QPF

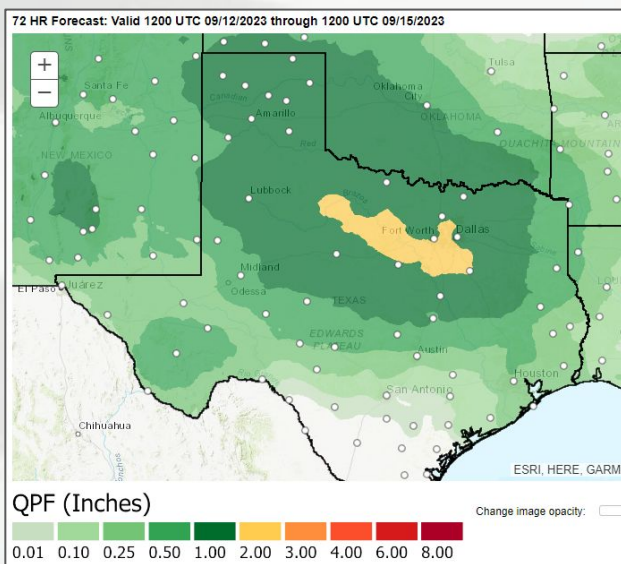
Full Range of probability of exceedance amounts (e.g., probability of 1" / 24 h)

Synthesized Scenarios (based on 10th percentile, NDFD Official, and 90th percentile)

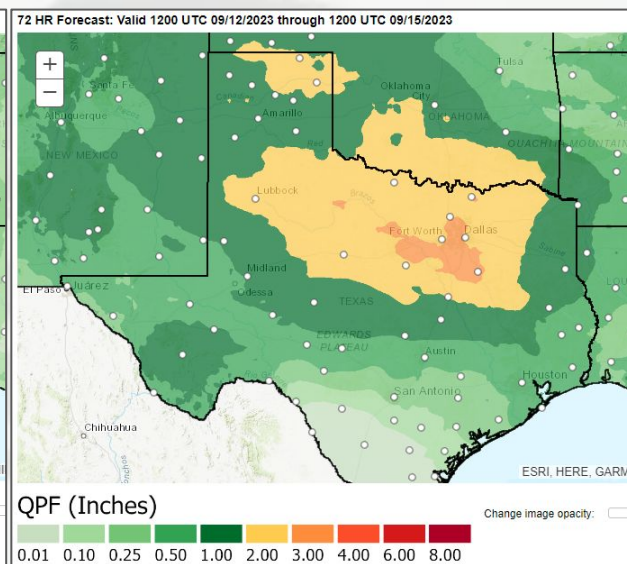
Low End Amount



Most Likely Amount

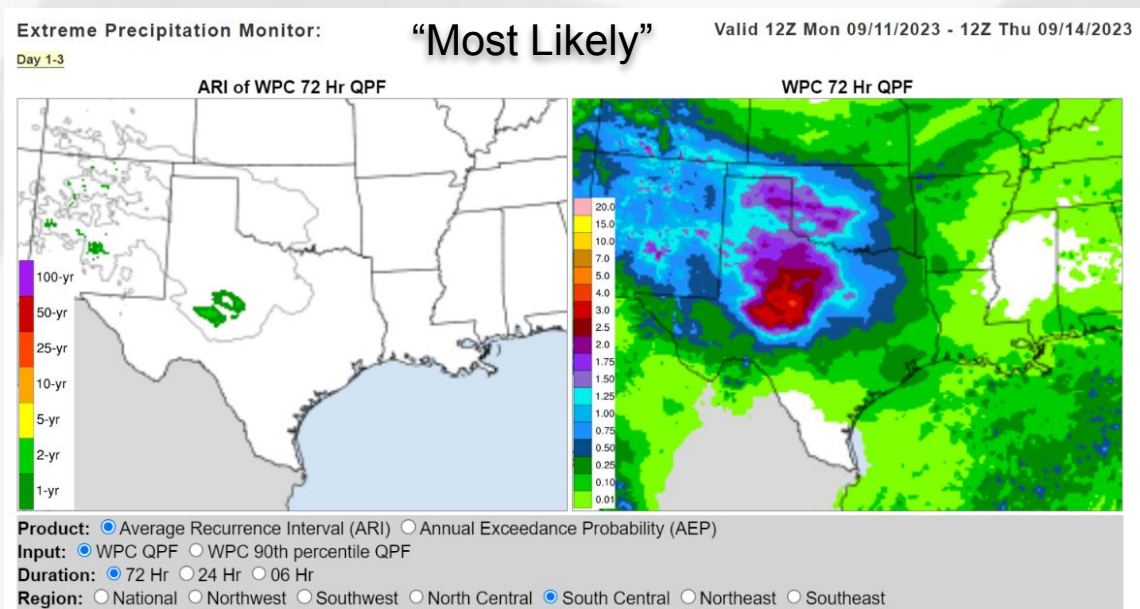


High End Amount



The Extreme Precipitation Monitor

- Answers the question: “How rare is that rainfall forecast?”
- Tool provides both the most likely and the reasonable-worst case
- Helps distinguish between a ‘bad event’ and a ‘REALLY bad event’

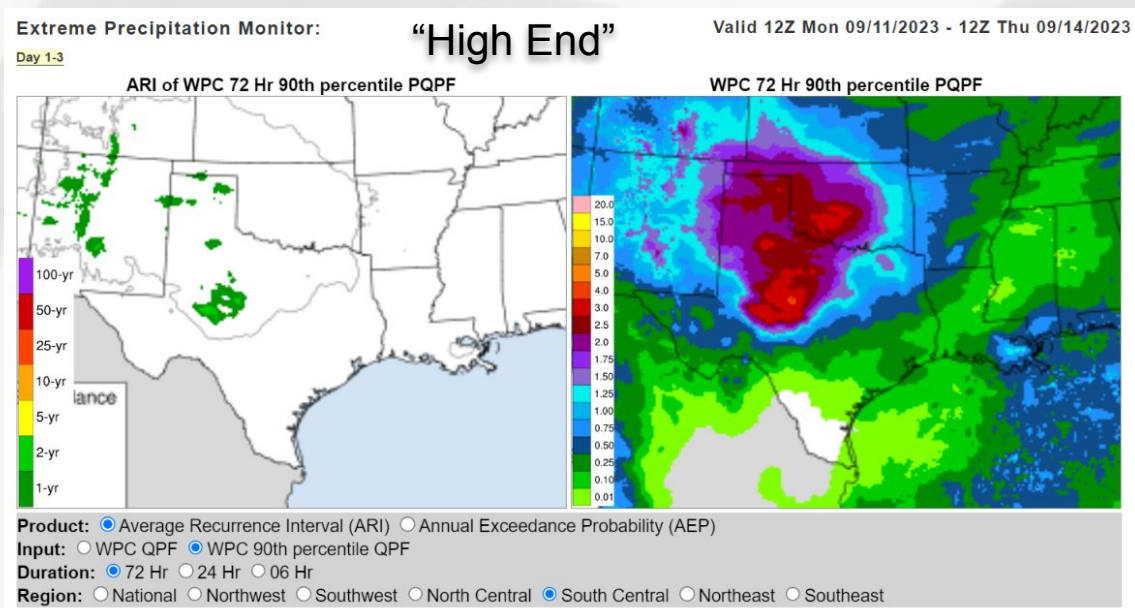


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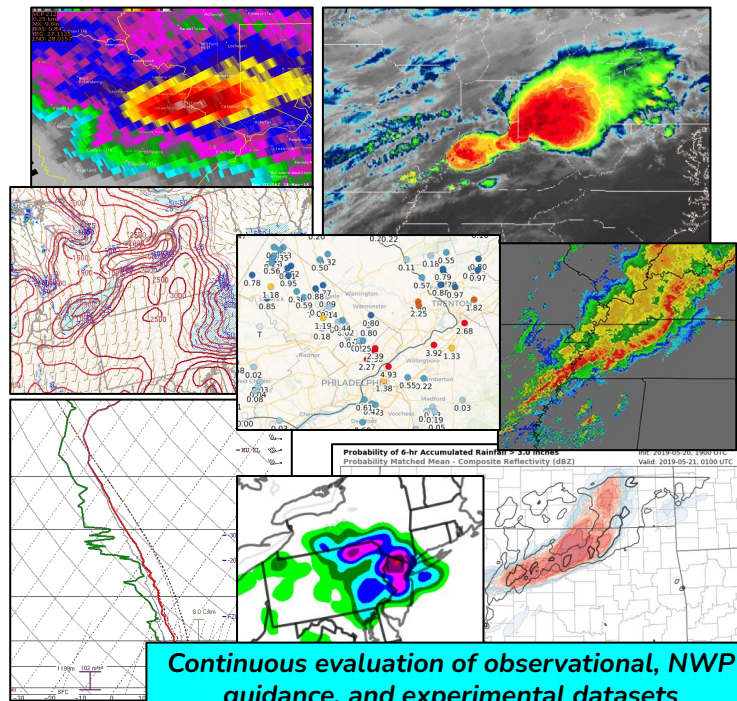


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WPC Metwatch Desk

Evaluation



Continuous evaluation of observational, NWP guidance, and experimental datasets

Integration

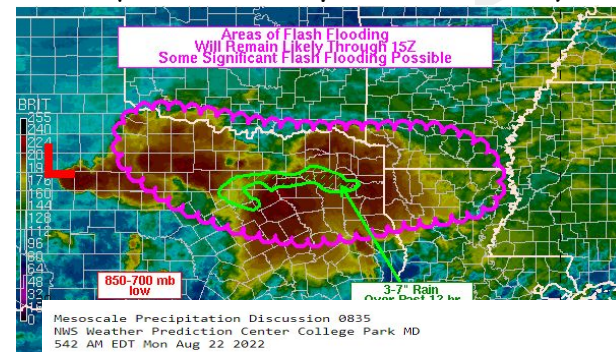
Forecaster integrates this to anticipate growing flash flood threats in the next 6 hours



Deep connection to the National Water Center

Product

(Mesoscale Precipitation Discussion)



Areas affected...north-central to northeastern TX into adjacent OK, AR and LA
Concerning...Heavy rainfall...Flash flooding likely
Valid 220939Z - 221535Z

SUMMARY...Slow moving areas of heavy rain with rates of 2 to 3+ in/hr will continue to translate slowly ESE over the next 3-6 hours from northern TX into the ArkLaTex and southern AR/northern LA. Flash flooding will be likely from additional 6-hr rainfall totals of 3 to 6 inches, with some significant flash flooding possible where overlap occurs with urban centers and/or locations that have already observed 3 to 7 inches of rain over the past 12 hours.

DISCUSSION...GOES East 10.3 micron imagery at 09Z showed several areas of cloud tops colder than -60 C tied to an expanding cluster of thunderstorms associated with NWS-derived rainfall rates of 2 to 3+ in/hr over northern TX. Numerous embedded mesocyclones were associated with observed localized rain rates over 3 in/hr via the Wunderground.com network in Hill, Stephens, Knox and Dallas counties over the past 1-3 hours. These heavy rainfall rates were generally located between the Red River and I-20, though some higher rates existed south of the DFW Metroplex where 3-7 inches has been observed over the past 12 hours. Precipitable water



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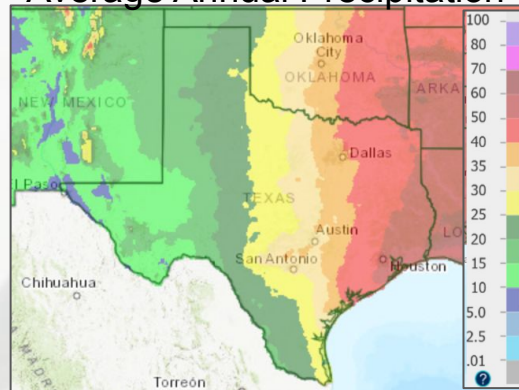
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Texas is Tough

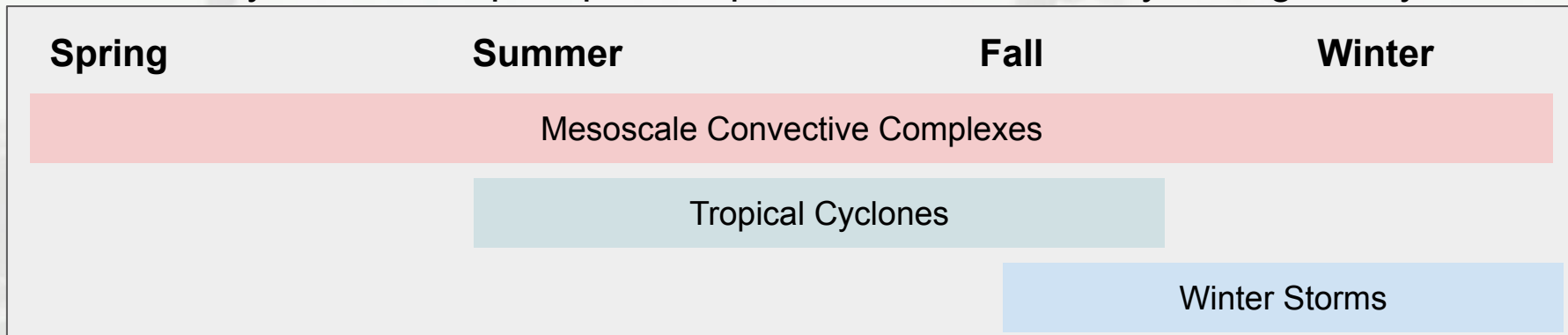
Wide variety of climates

- From the **arid high plains** (~10" a year) to the **tropical Gulf Coast** (~50" a year)
- From 8700 ft (Guadalupe Peak) to sea level

Average Annual Precipitation



Wide variety of extreme precipitation phenomenon, that vary through the year



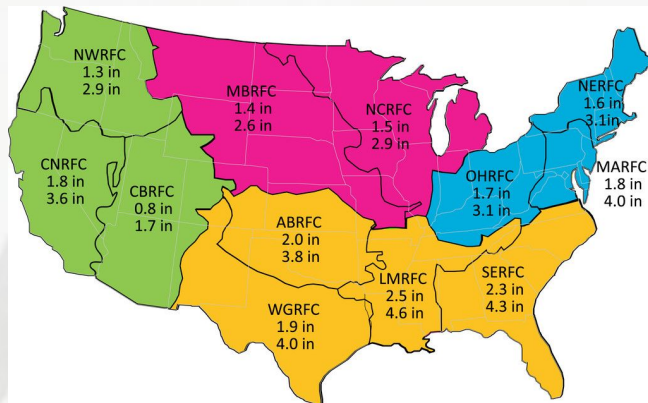
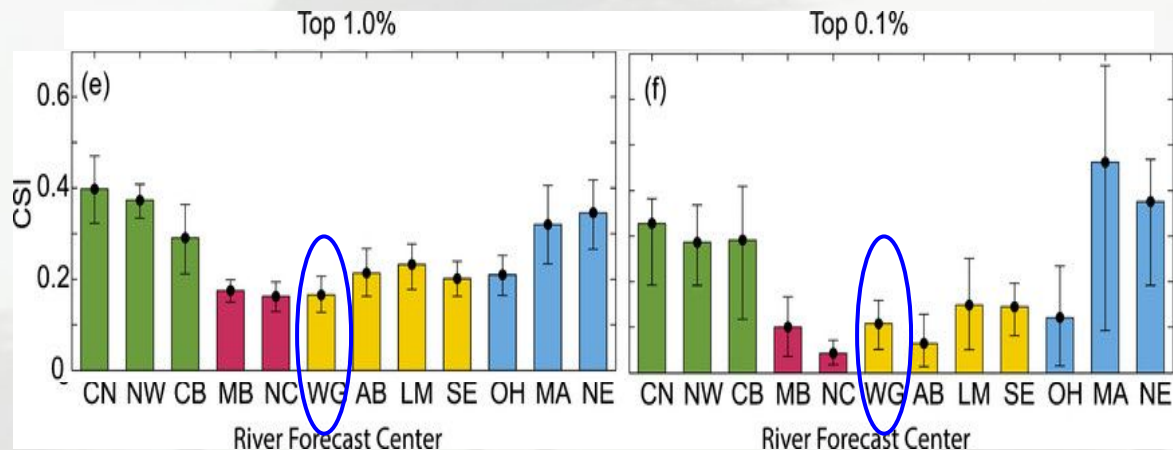
Texas is Tough

Sukovich et al. (2014) looked at WPC's precipitation skill broken out by River Forecast Center Domain.

WGRFC 1% event threshold = 1.9 in/24h

WGRFC 0.1% event threshold = 4 in/24h

Critical Success Index (CSI) for the 24-h forecast was calculated for 2007-2011 period:



BOTTOM LINE:
The West and the Northeast
have the best skill

Texas is a challenging area

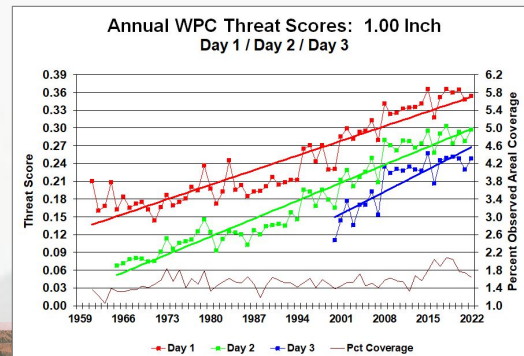
Some Hope

However,

1) forecast skill in general is (slowly) improving

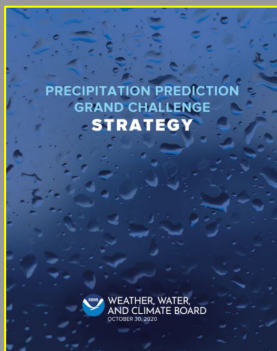
2) the winter months are more predictable

3) there are terrain features that help 'anchor' precipitation for greater predictability



PPGC Strategic Goal:

Provide more accurate, reliable, and timely precipitation forecasts across timescales, from hours to decades, through the development and application of a seamless, fully coupled Earth System prediction model.



6 Strategic Objectives:



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