NWS Reno 2023-24 Winter Outlook

After another “once in a career” year, what’s next?

weather.gov/reno

Weather Forecast Office
Reno, NV
Thursday, October 19
775-673-8100

Dawn Johnson

Warning Coordination Meteorologist

National Weather Service

Reno, Nevada

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2022-23: The Year That Kept on Giving

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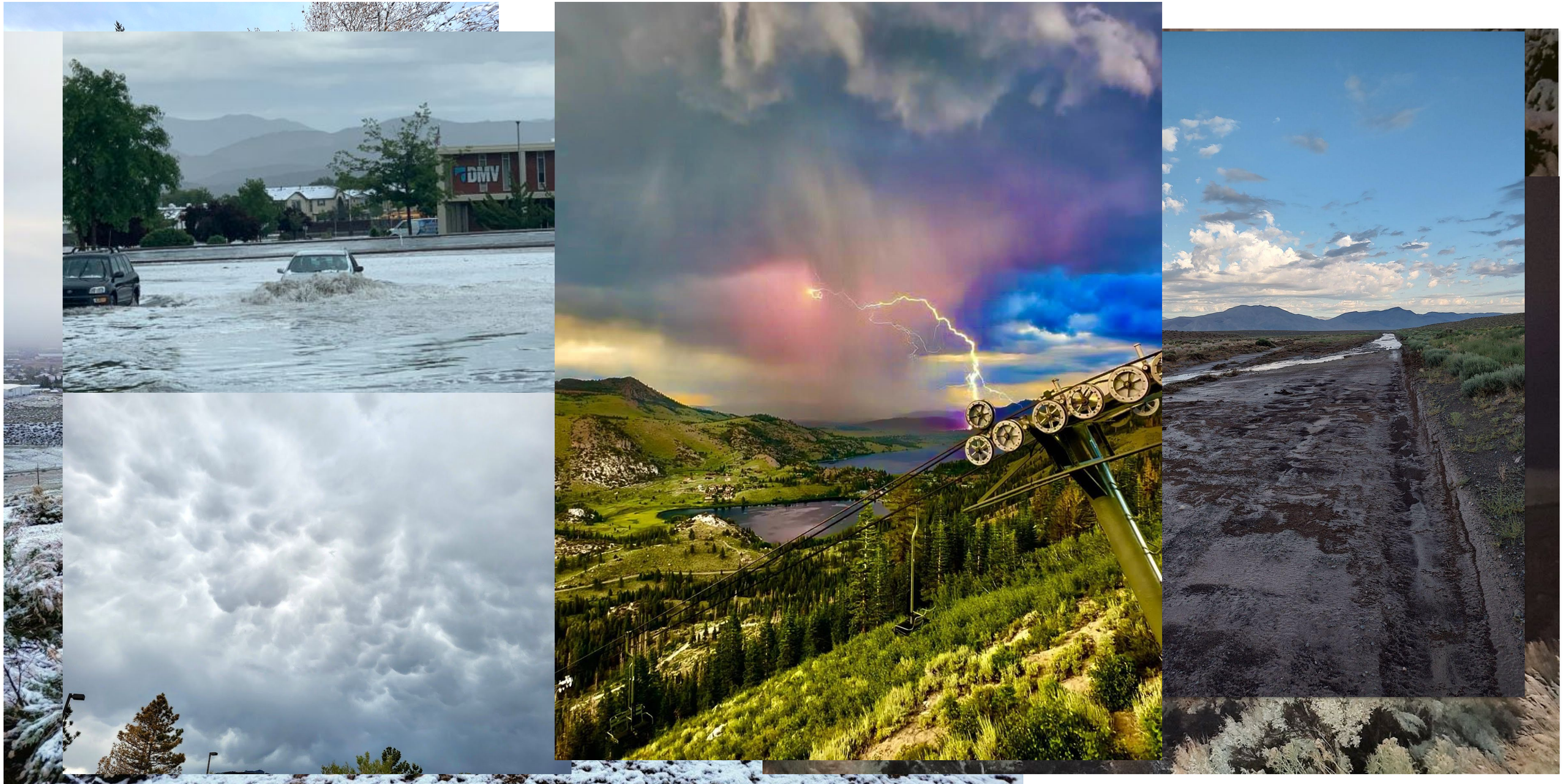

Some Stats…2022-23 H2O Year KRNO

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Most days with measurable precipitation: 87 days! Previous record 82 days in 1997-98, and average is 50 days.

Most days with measurable snowfall: 40 days. Previous record is 35 days in 1921-22. Only 10 years in KRNO climate history with greater than 25 days!


Credit: K. Davis

7th highest snow total (50.2”) with the most recent “close” winter being 2004-05 (49.7” total), where over 3 feet fell in 10 days with back-to-back storms.

A Big Winter:

- Two significant snowstorms back to back: Dec 30 – Jan 1, 2005 saw **22 inches** at the Reno airport, and another **17”** on Jan 7-9. Several feet in the foothills, 10+ feet in the Sierra. Followed by weeks of freezing fog.
- Top snow producing storms in past century from Reno to Susanville.
- Airport closed, stranded cars, power outages, roof collapses from snow weight.


Credit: NWS Reno

2nd wettest water year behind 2016-17 (15.38 vs 15.95), both of these blow 3rd place (1982-83 12.72”) out the window.

Summer Heatwaves, Yes. But They Were Short.

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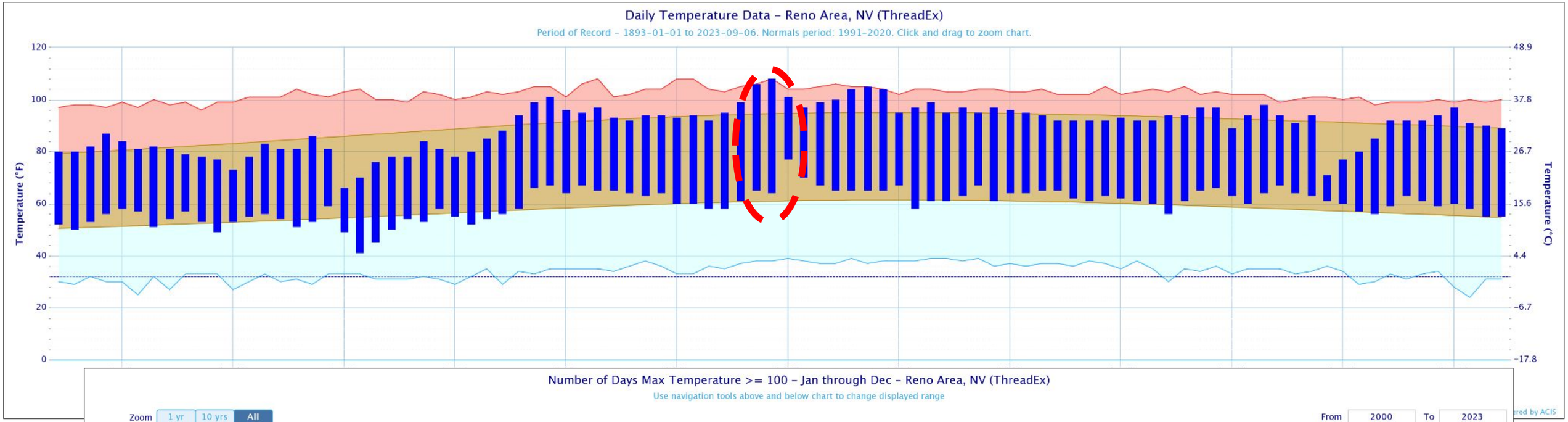

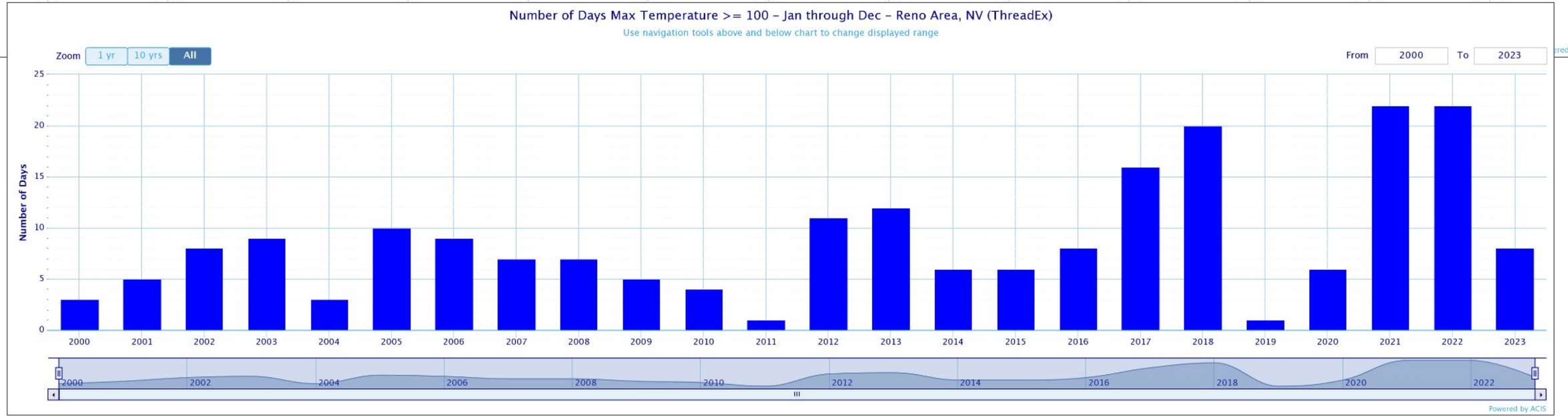

Summer: Few Red Flags, Clear Skies

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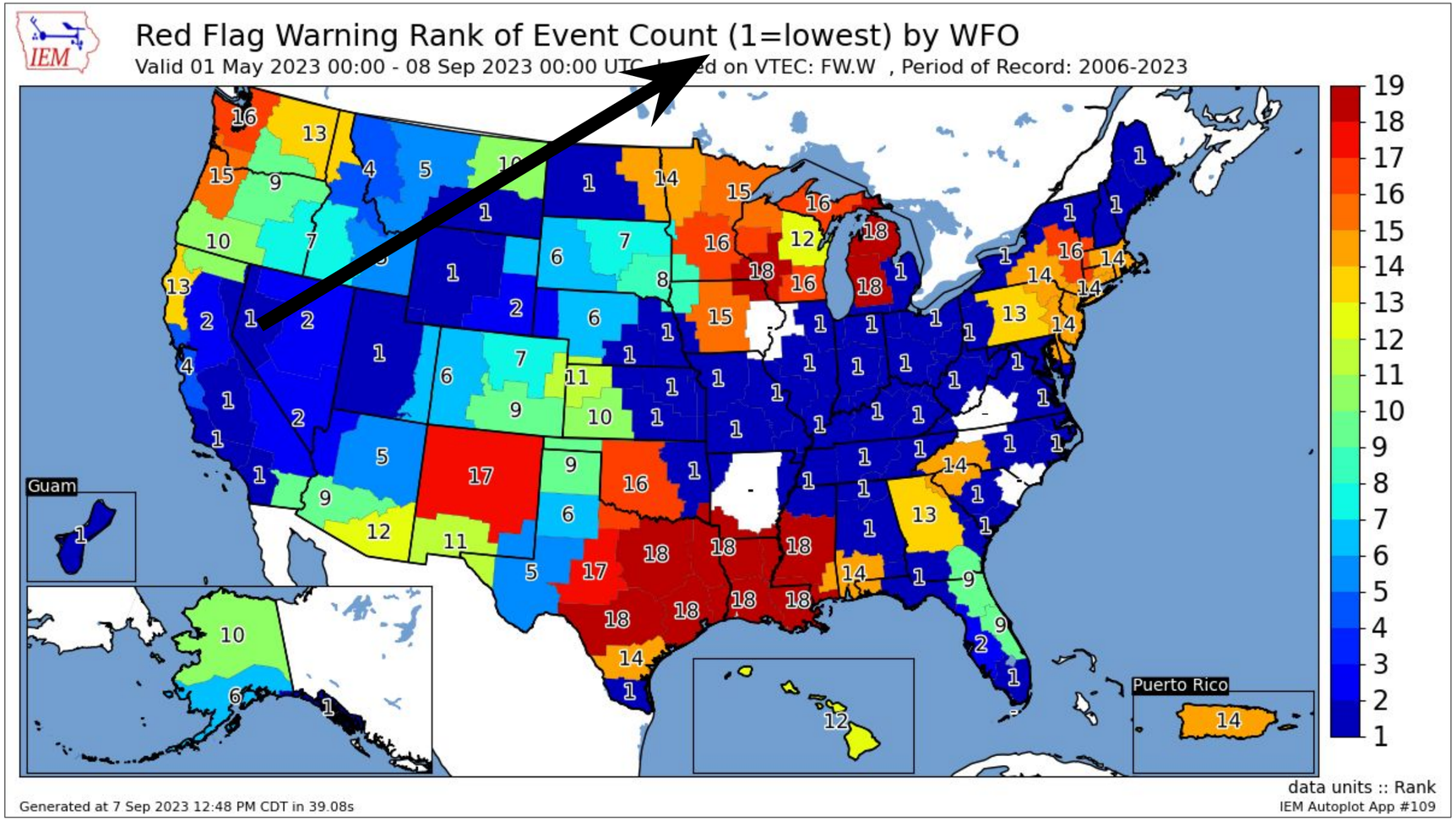

…and a Hurricane

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Abnormally Wet Winter, Spring, Summer

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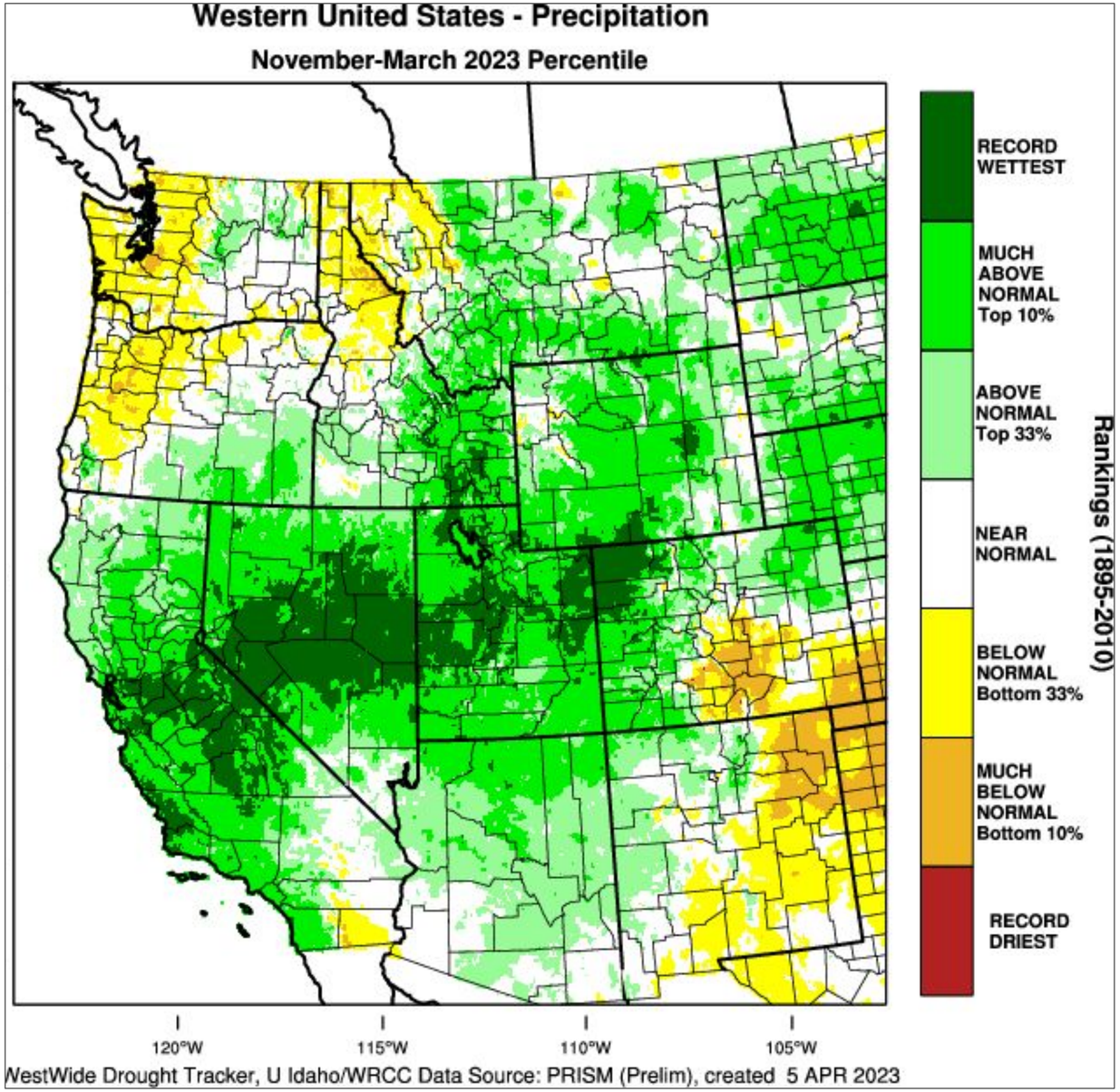

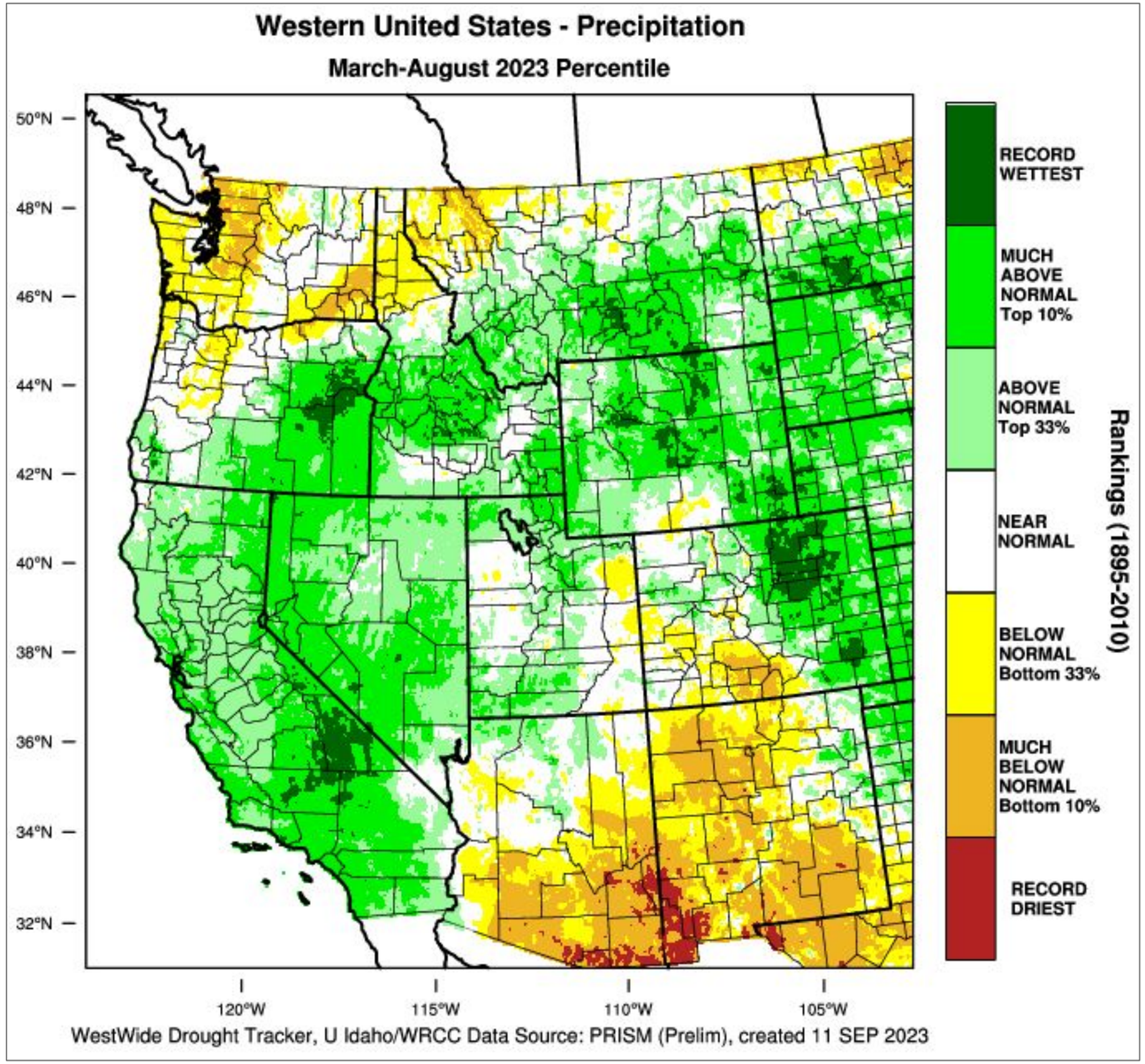

Drought - Nothing to See Here

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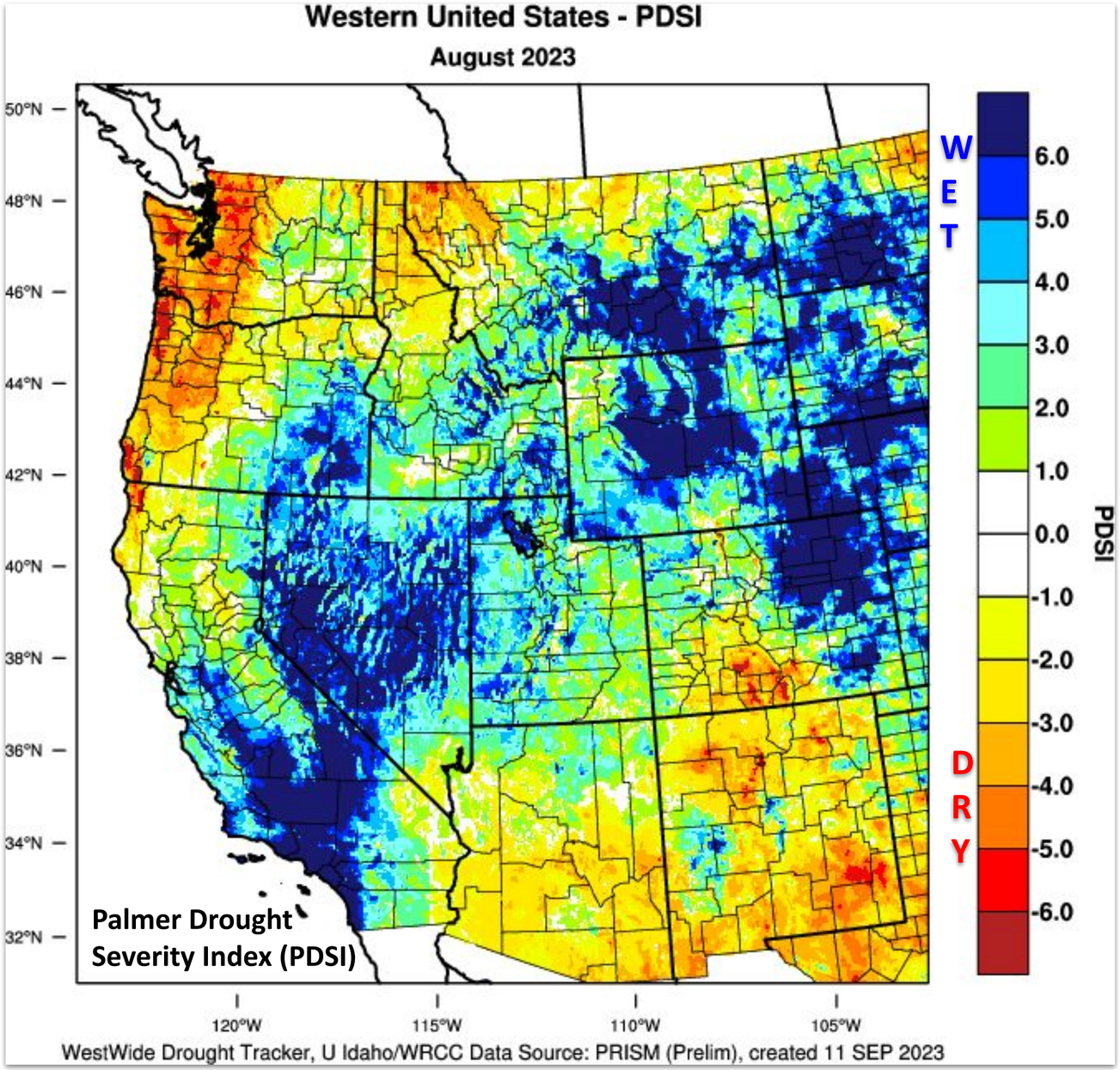

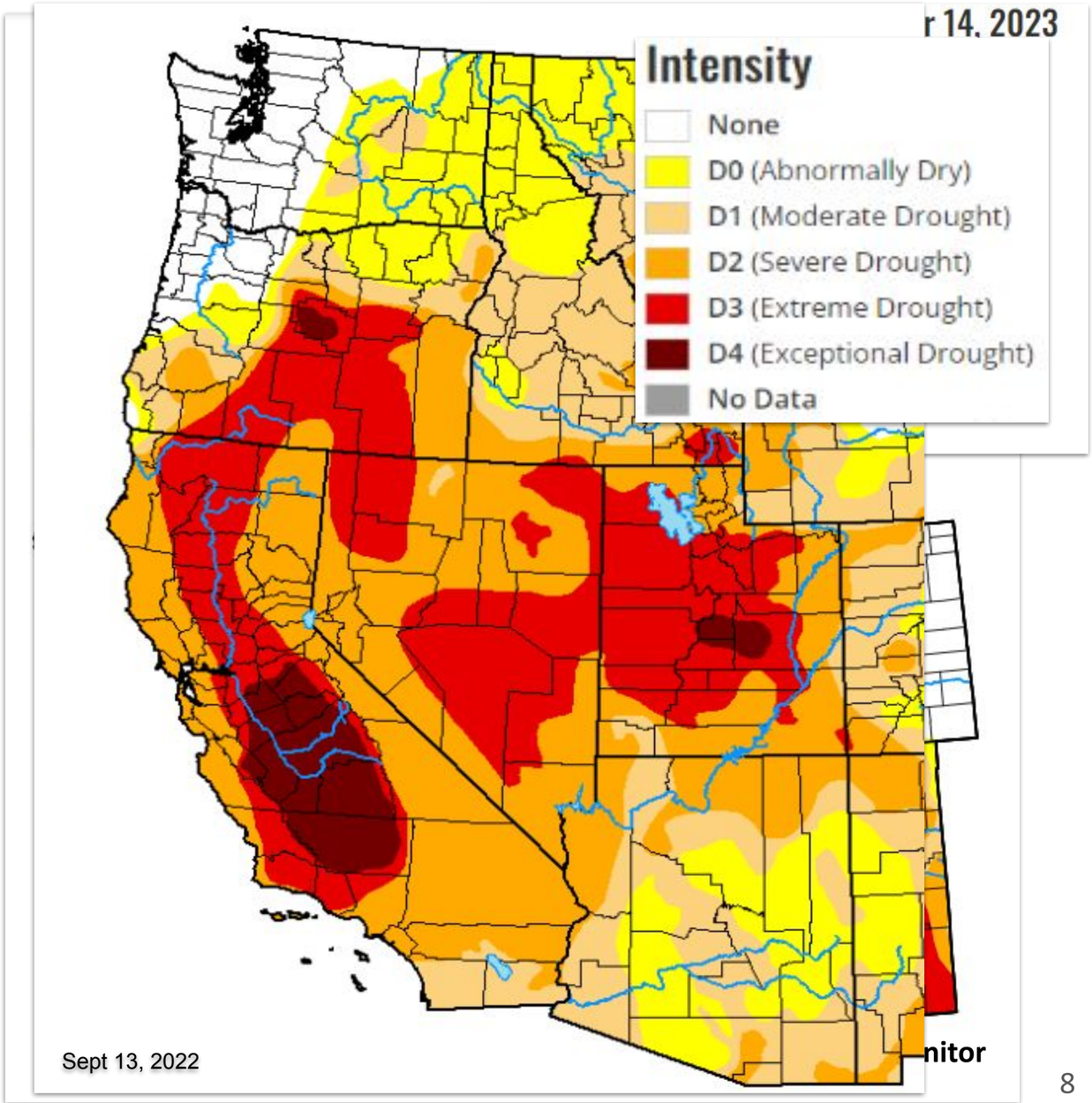

Fire Concerns Going into Fall

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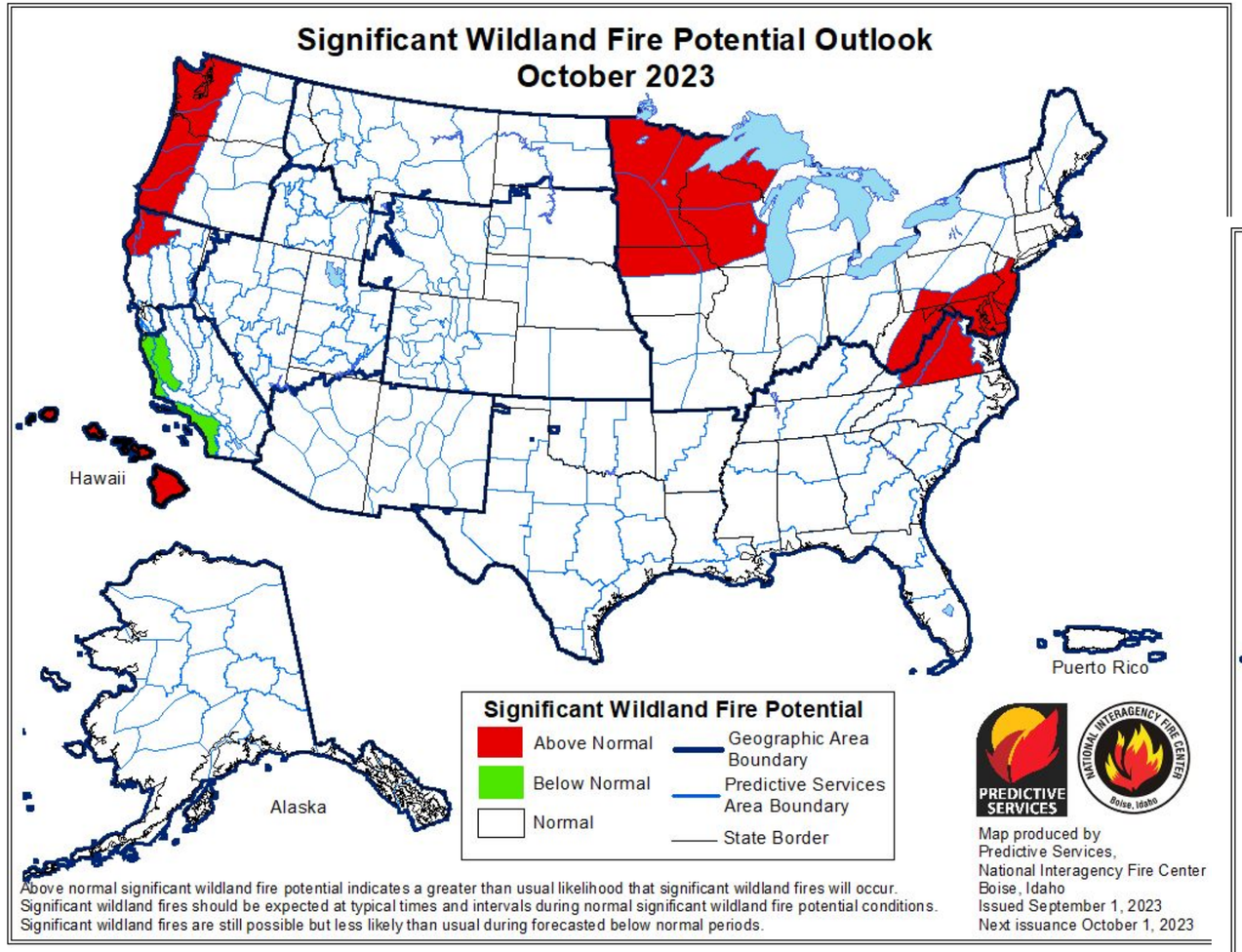

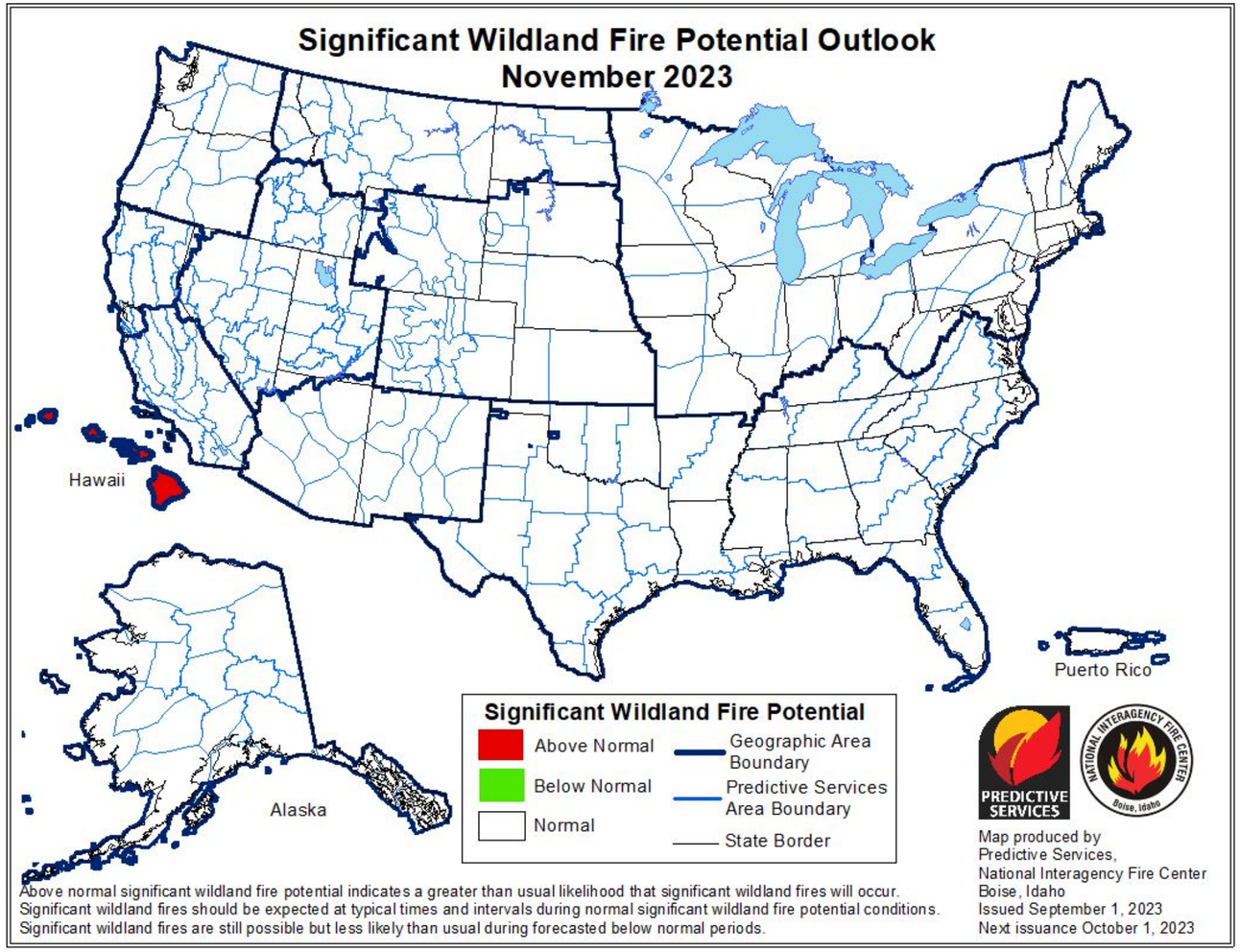

El Niño vs La Niña…Here we go again

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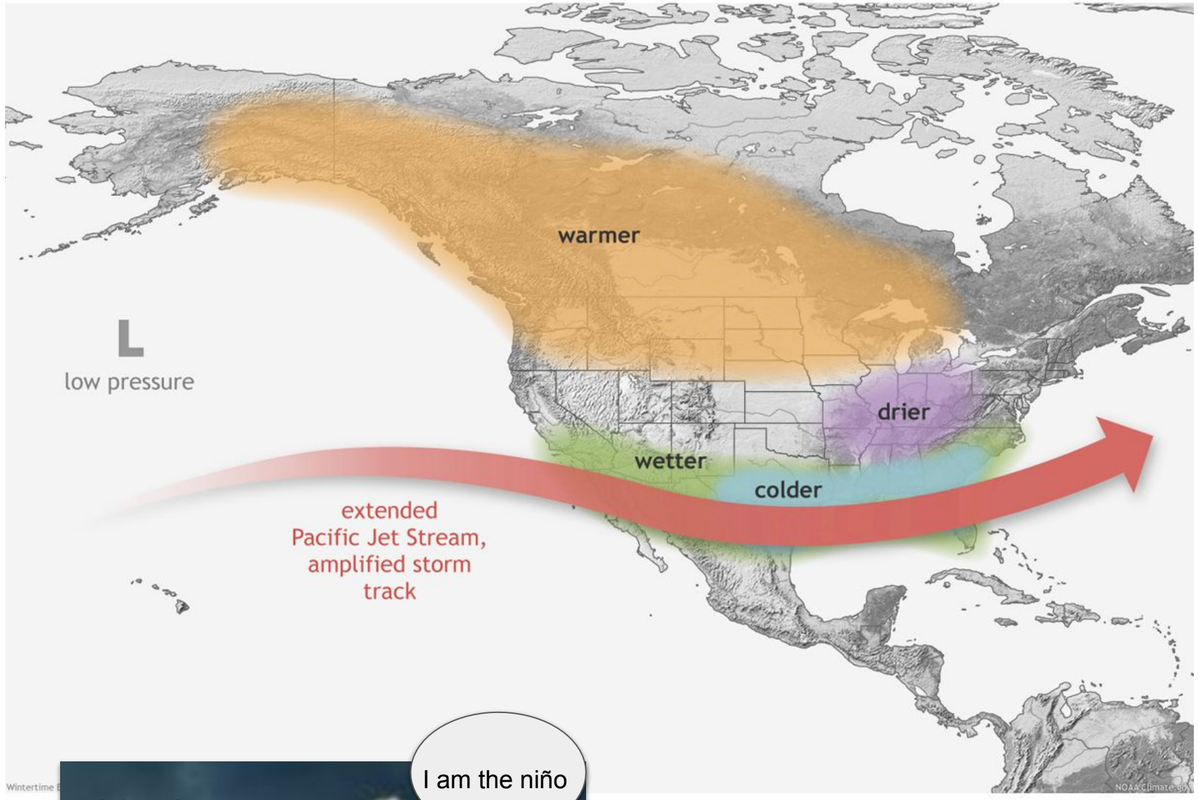
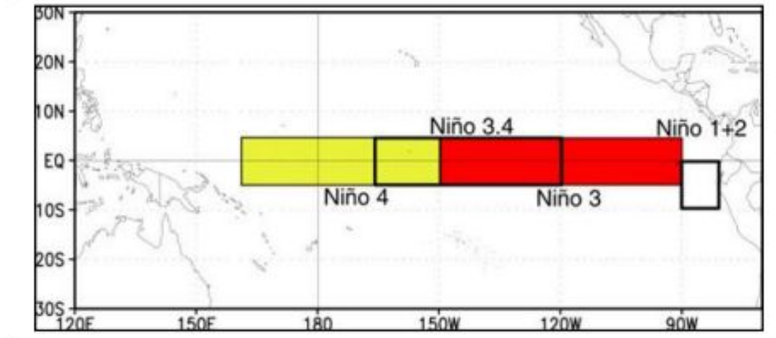
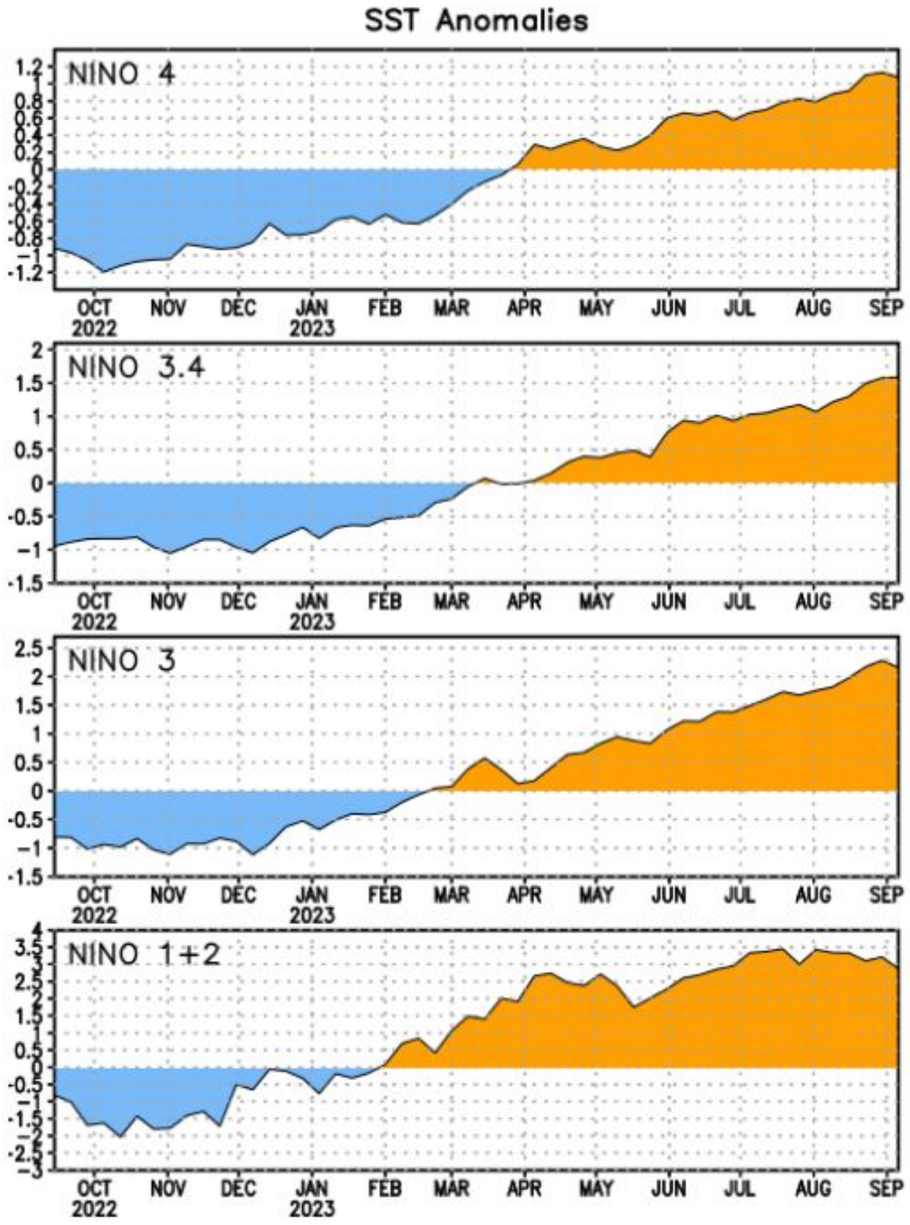
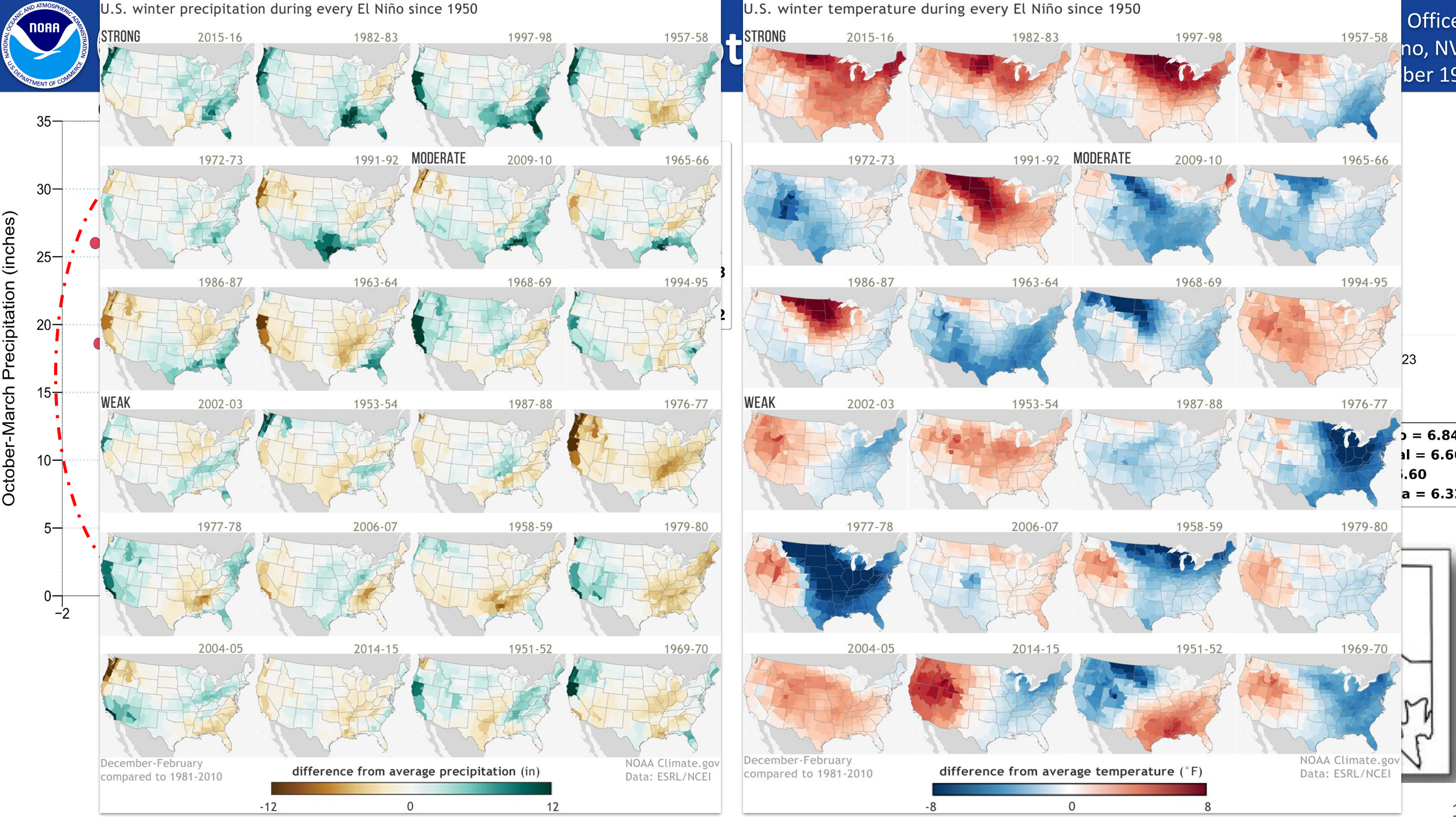
TYPICAL EL NIÑO WINTERS



TYPICAL LA NIÑA






U.S. winter precipitation during every El Niño since 1950
STRONG
2015-16
1982-83
1997-98
1957-58
1972-73
1991-92
MODERATE
2009-10
1965-66
1986-87
1963-64
1968-69
1994-95
WEAK
2002-03
1953-54
1987-88
1976-77
1977-78
2006-07
1958-59
1979-80
2004-05
2014-15
1951-52
1969-70
December-February
compared to 1981-2010
difference from average precipitation (in)
-12
0
12
NOAA Climate.gov
Data: ESRL/NCEI
October-March Precipitation (inches)
35
30
25
20
15
10
5
0
−2
U.S. winter temperature during every El Niño since 1950
STRONG
2015-16
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1977-78
2006-07
1958-59
1979-80
2004-05
2014-15
1951-52
1969-70
December-February
compared to 1981-2010
difference from average temperature (°F)
-8
0
8
NOAA Climate.gov
Data: ESRL/NCEI

The Atlantic Quadpole Mode (AQM)

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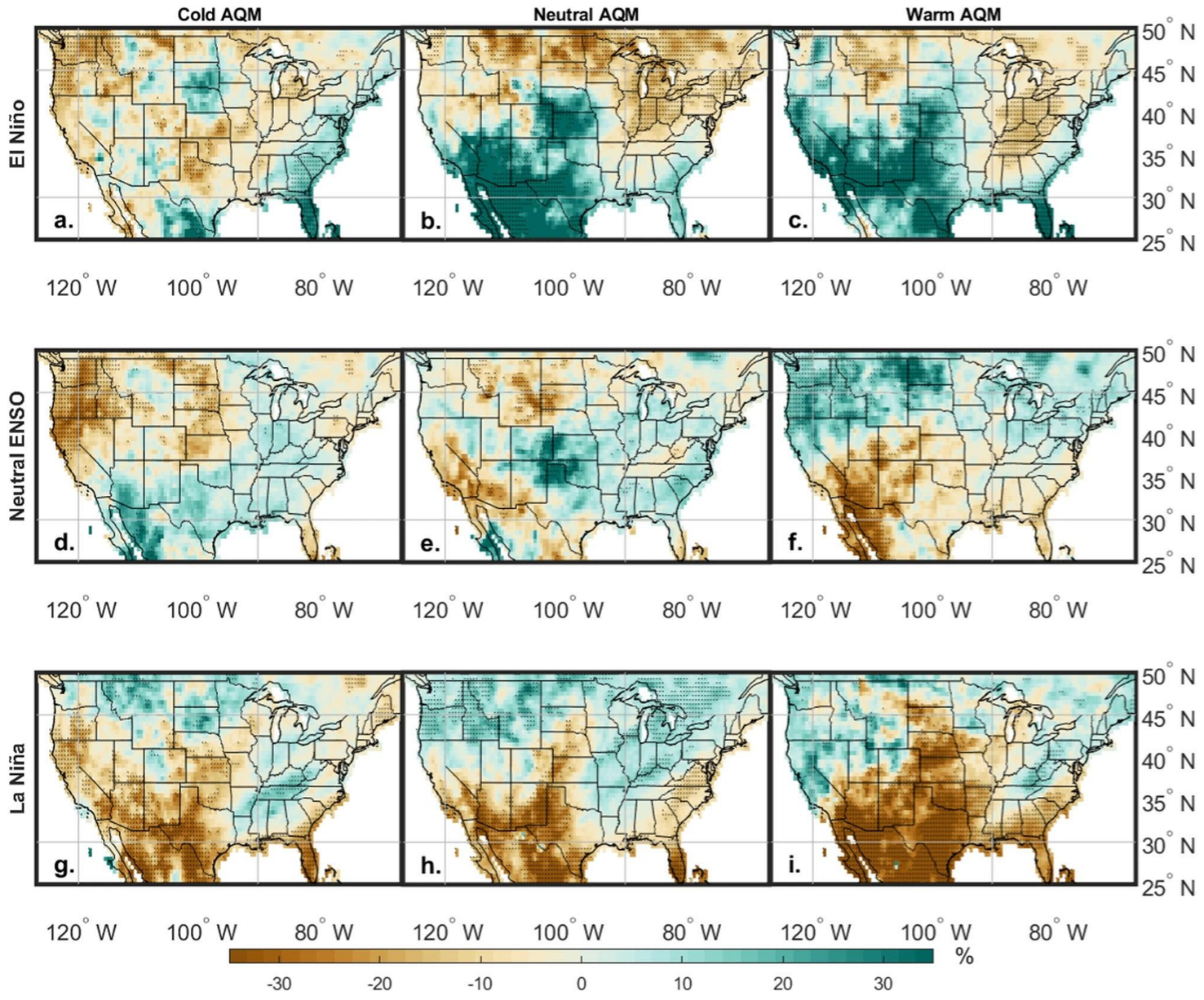
New research: Atlantic-Pacific Influence on Western U.S. Water

ENSO's Atlantic "Sibling"

AQM of sea surface temperature variability appears to have a link with ENSO phases.

Warm AQM phases tend to be wetter in the west in any ENSO phase.



El Niño and Winter River Flooding…

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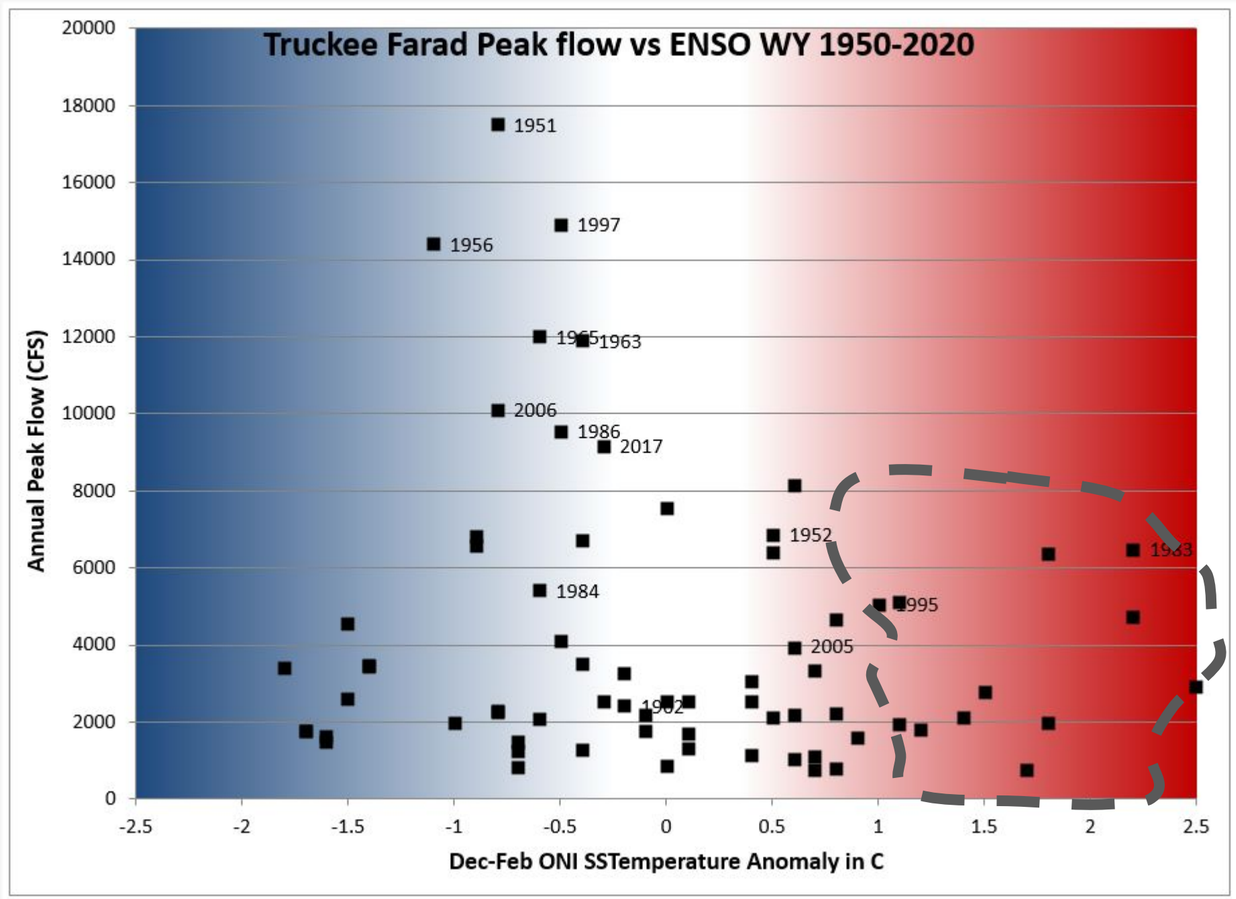

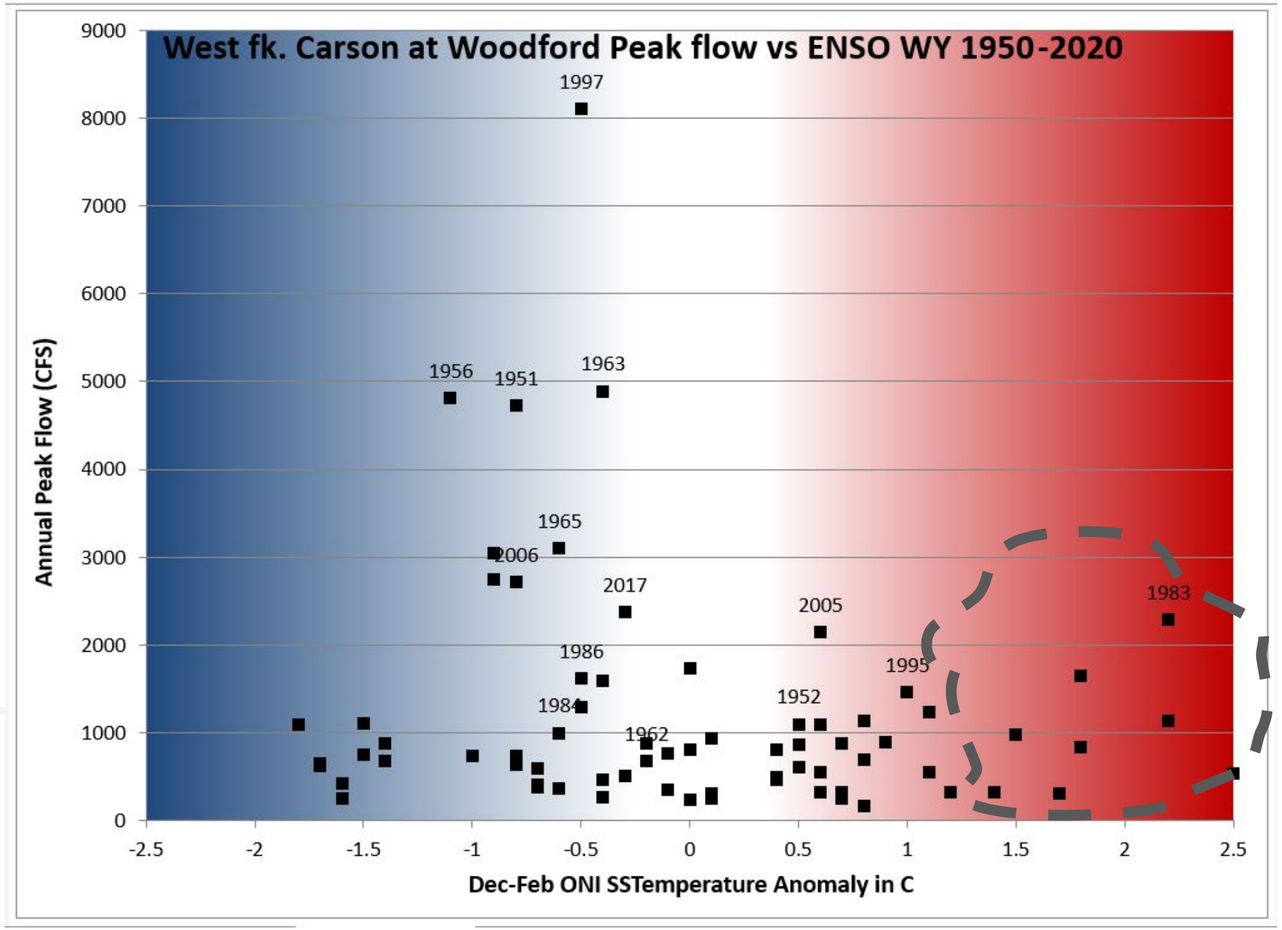

El Niño years have tended to NOT produce incredibly high river flows

How About Snow?

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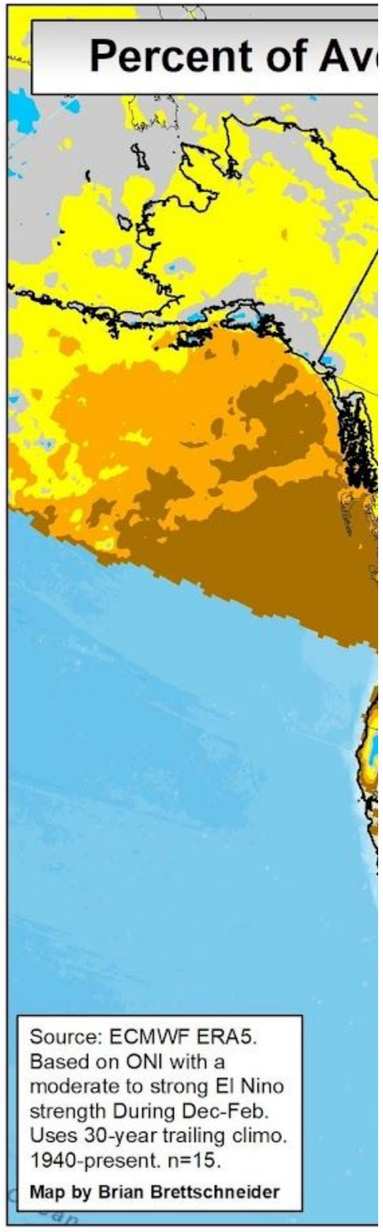

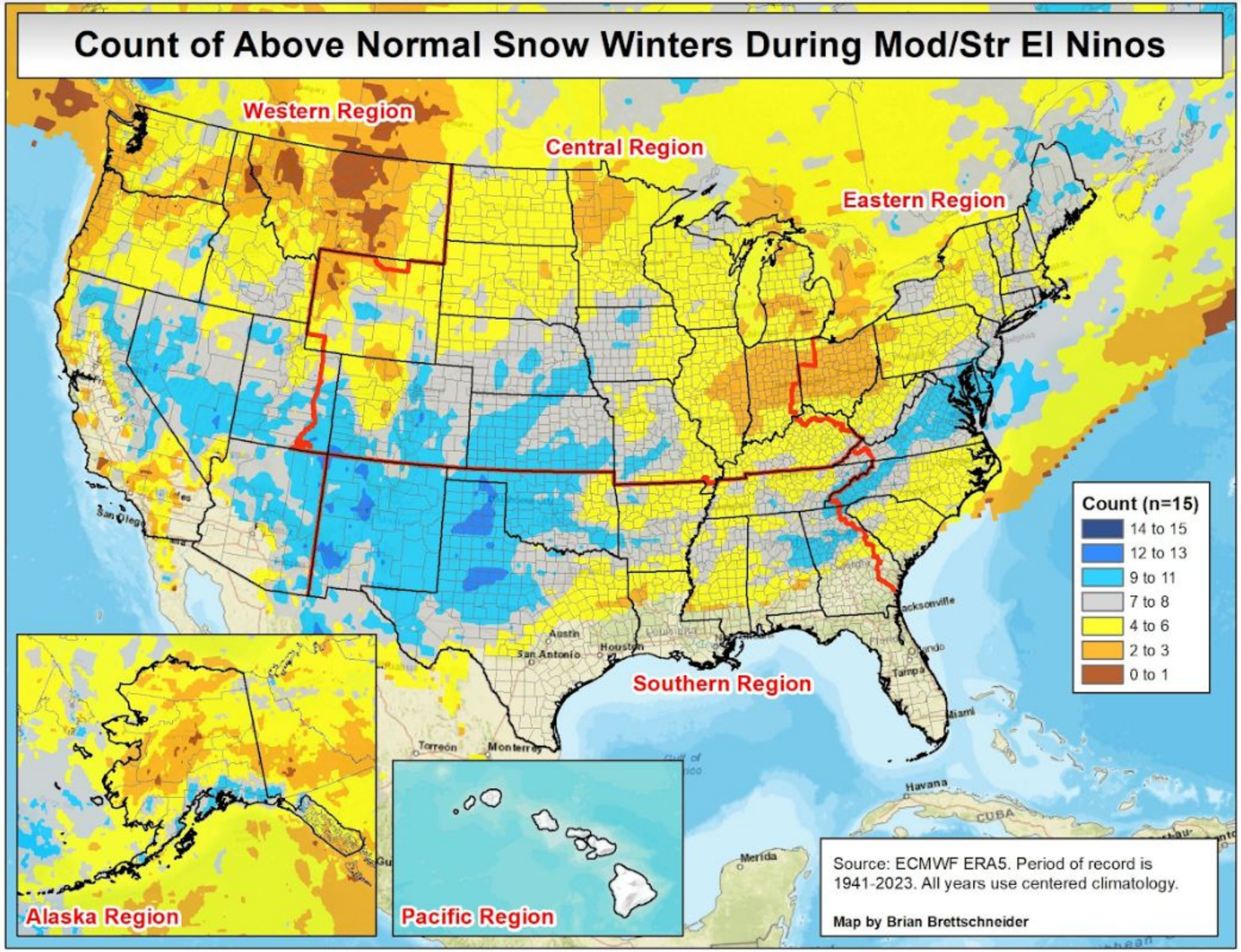

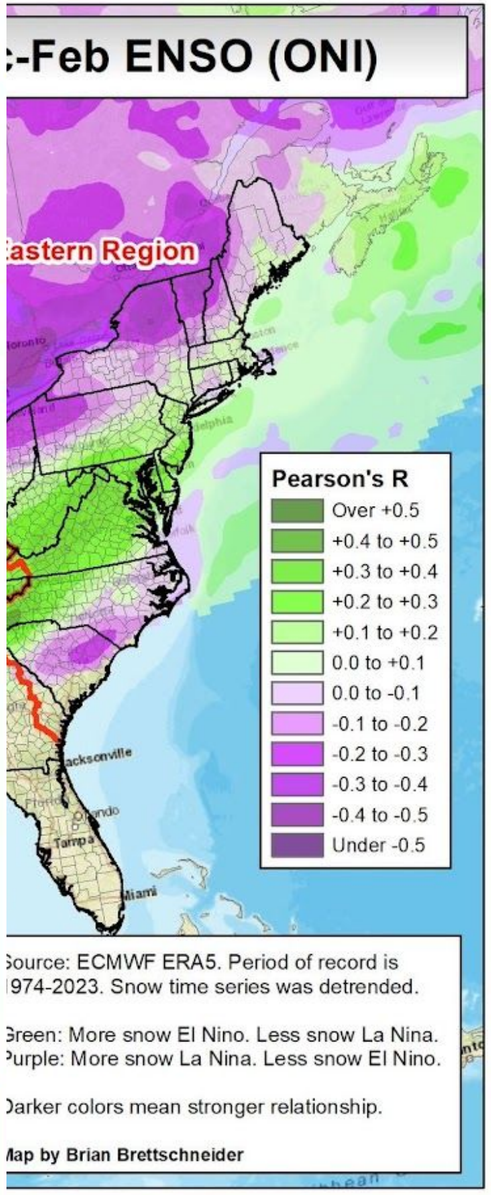

Analog Years - Rapid La Niña to El Niño Transition

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WATER YEAR

	Reno	Tahoe City	Bishop	Susanville
2018-2019	Very Wet	Very Wet	Very Wet	Very Wet
2009-2010	Slightly Wet	Near Normal	Near Normal	Slightly Dry
2006-2007	Very Dry	Very Dry	Extremely Dry	Very Dry
1976-1977	Very Dry	Extremely Dry	Very Dry	Very Dry
1972-1973	Slightly Wet	Near Normal	Slightly Wet	Near Normal

Winter 2023-24: Back to Back Wet Years?

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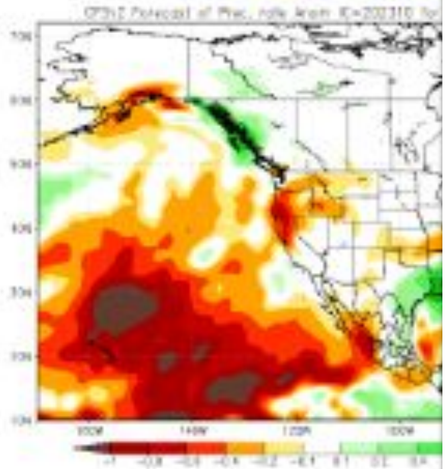
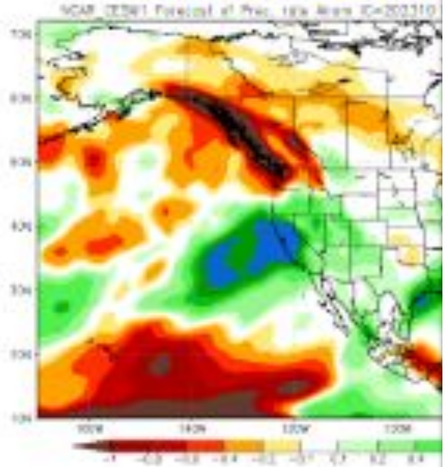
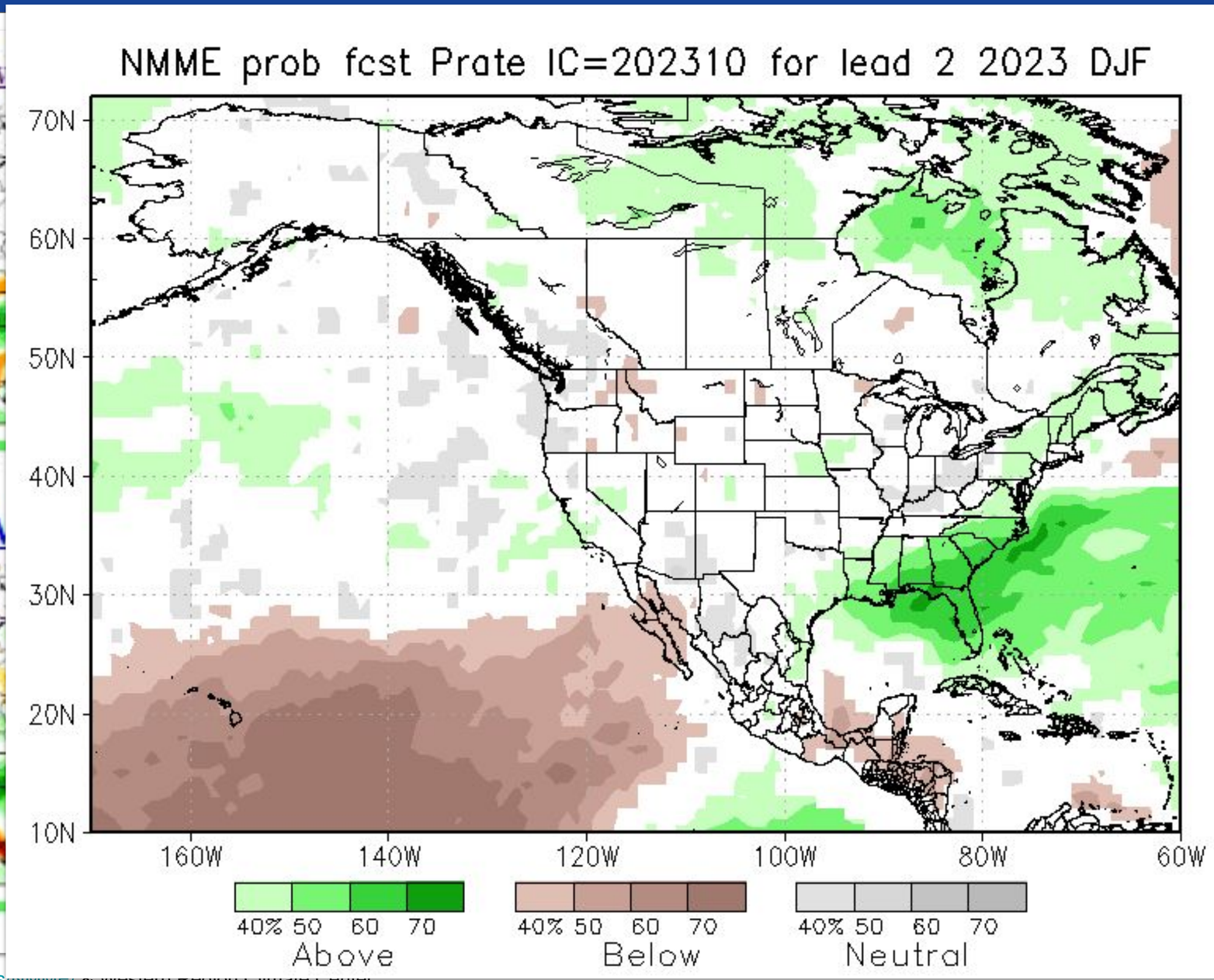
NCEP_CFSv

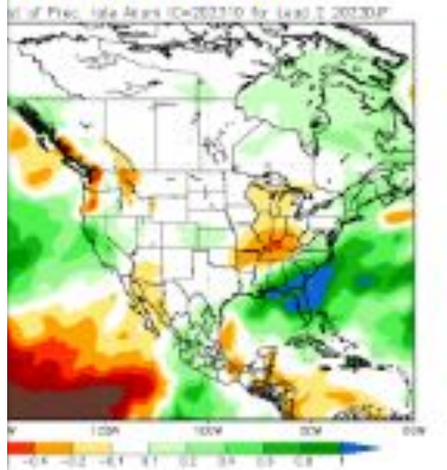


NCAR_CESM

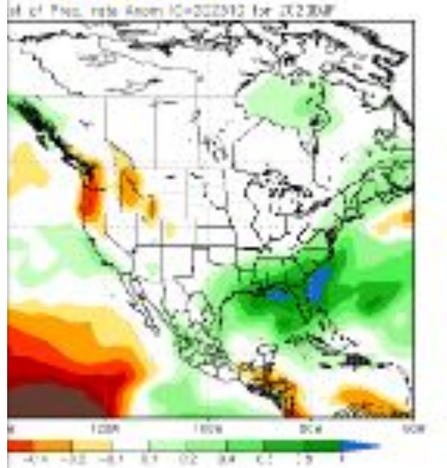




FDL_SPEAR



IMME



Source: www.cpc.ncep.noaa.gov/products/NMME/ & Western Region Climate Center

CPC Outlooks - Near Term

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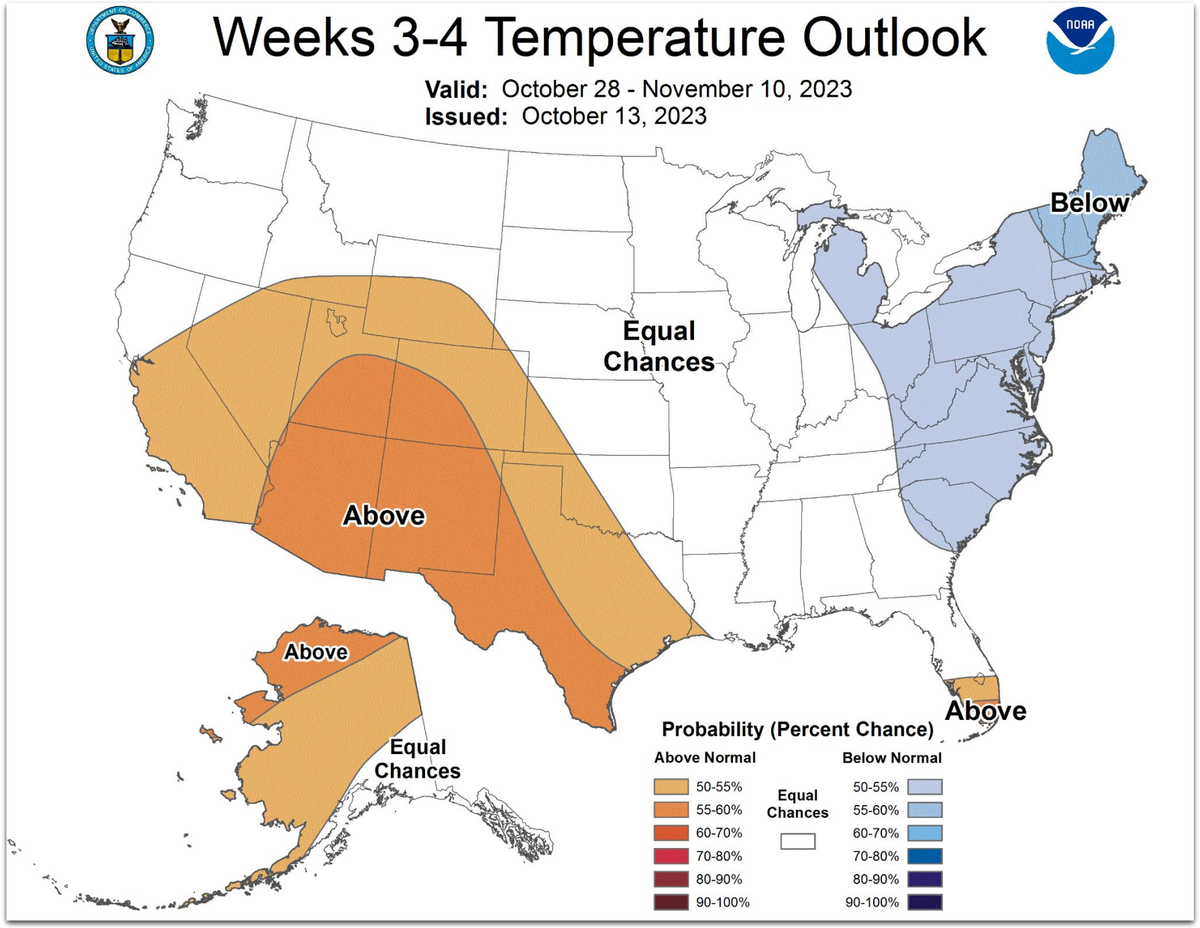

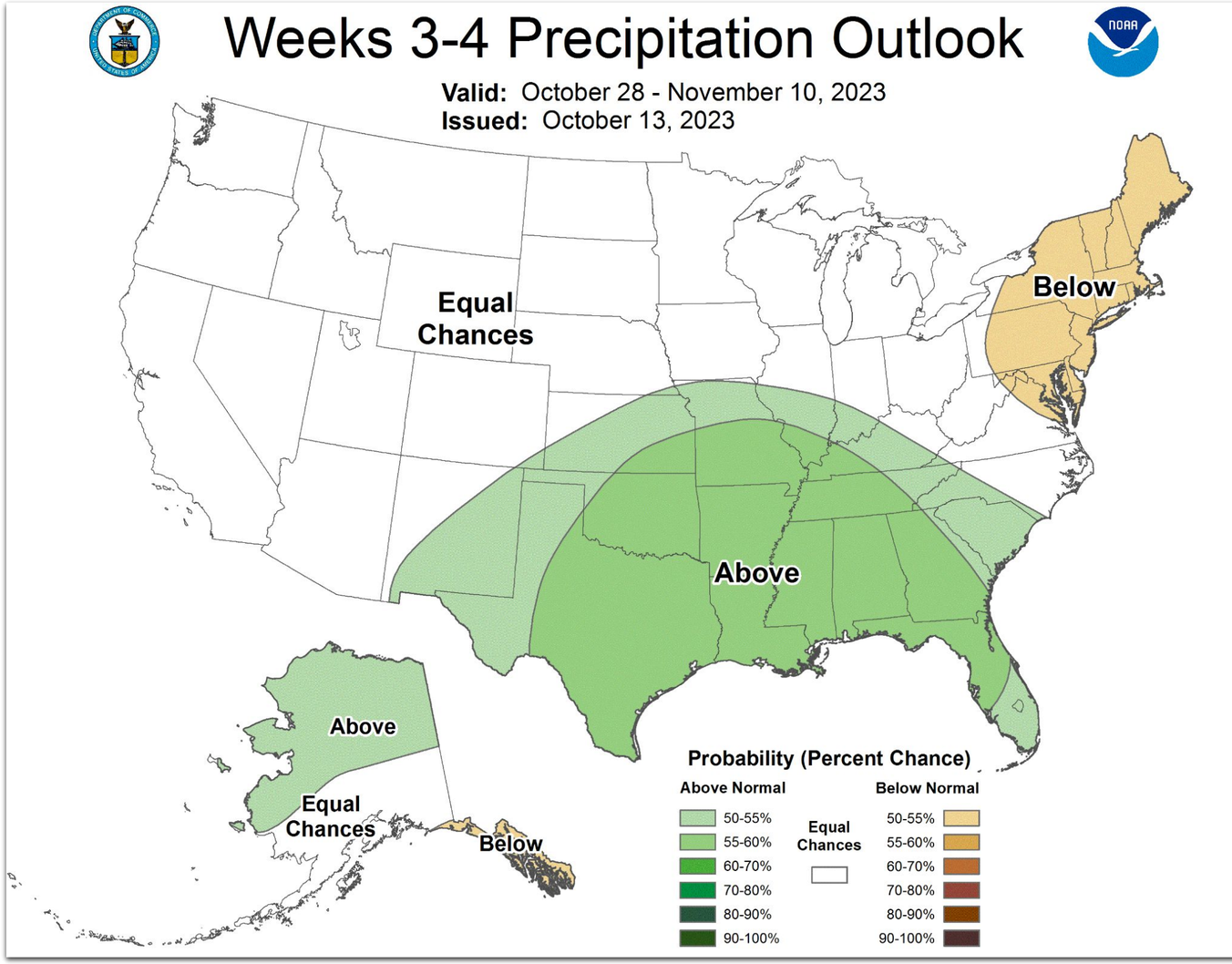

Appetizer Winter: October - December

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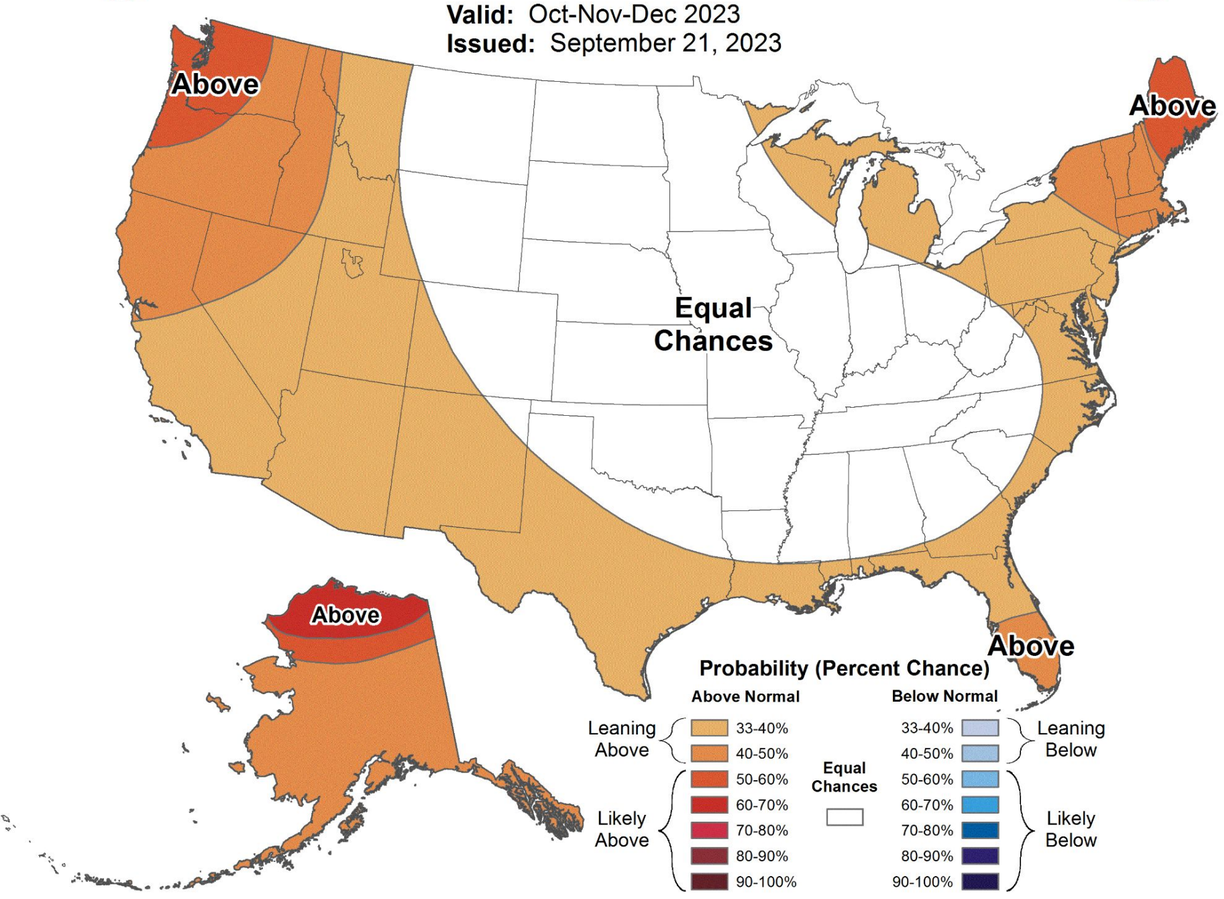
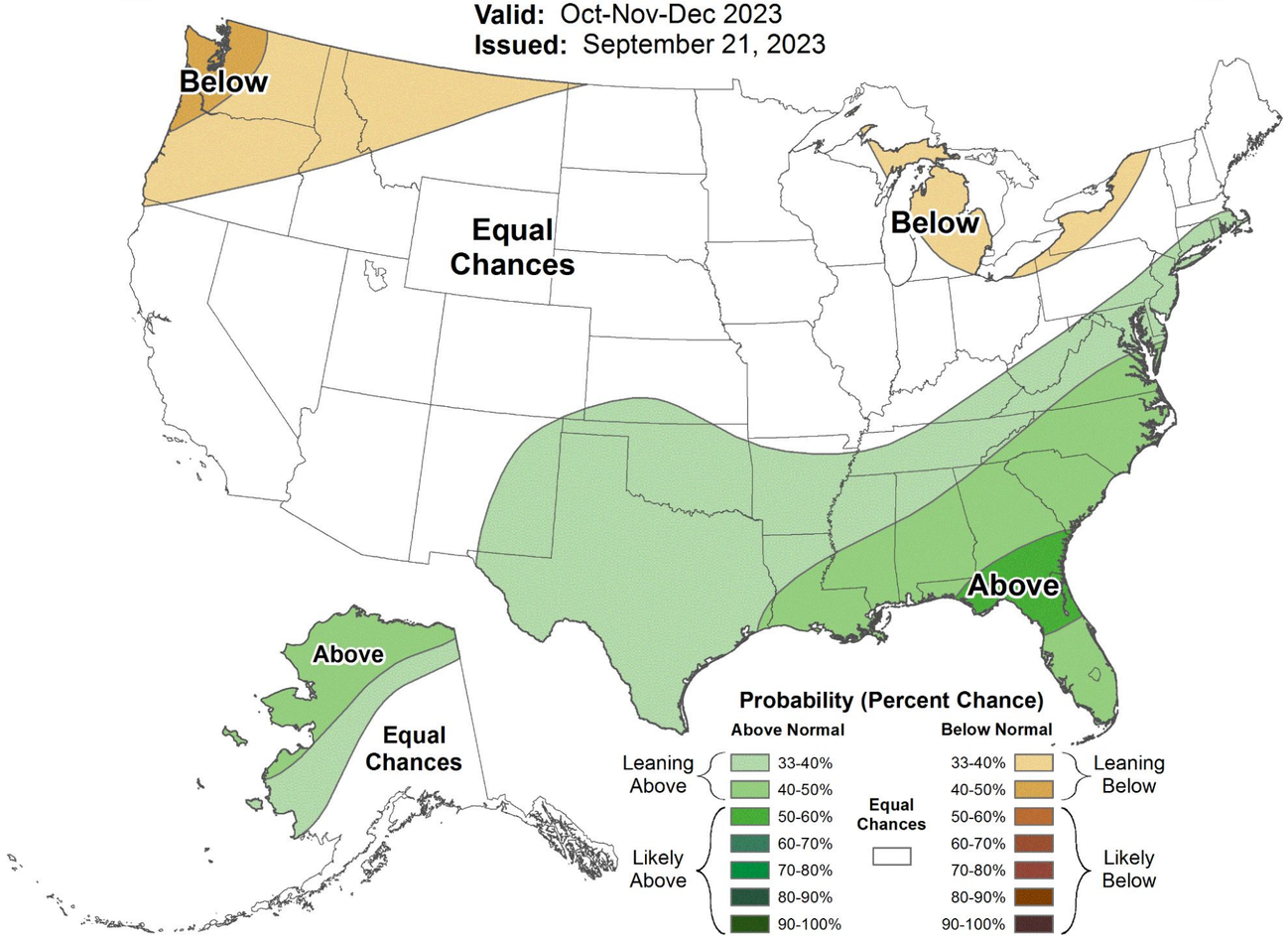
Seasonal Temperature Outlook

Valid: Oct-Nov-Dec 2023
Issued: September 21, 2023



Seasonal Precipitation Outlook

Valid: Oct-Nov-Dec 2023
Issued: September 21, 2023



Main Course Outlook: Dec-Jan-Feb

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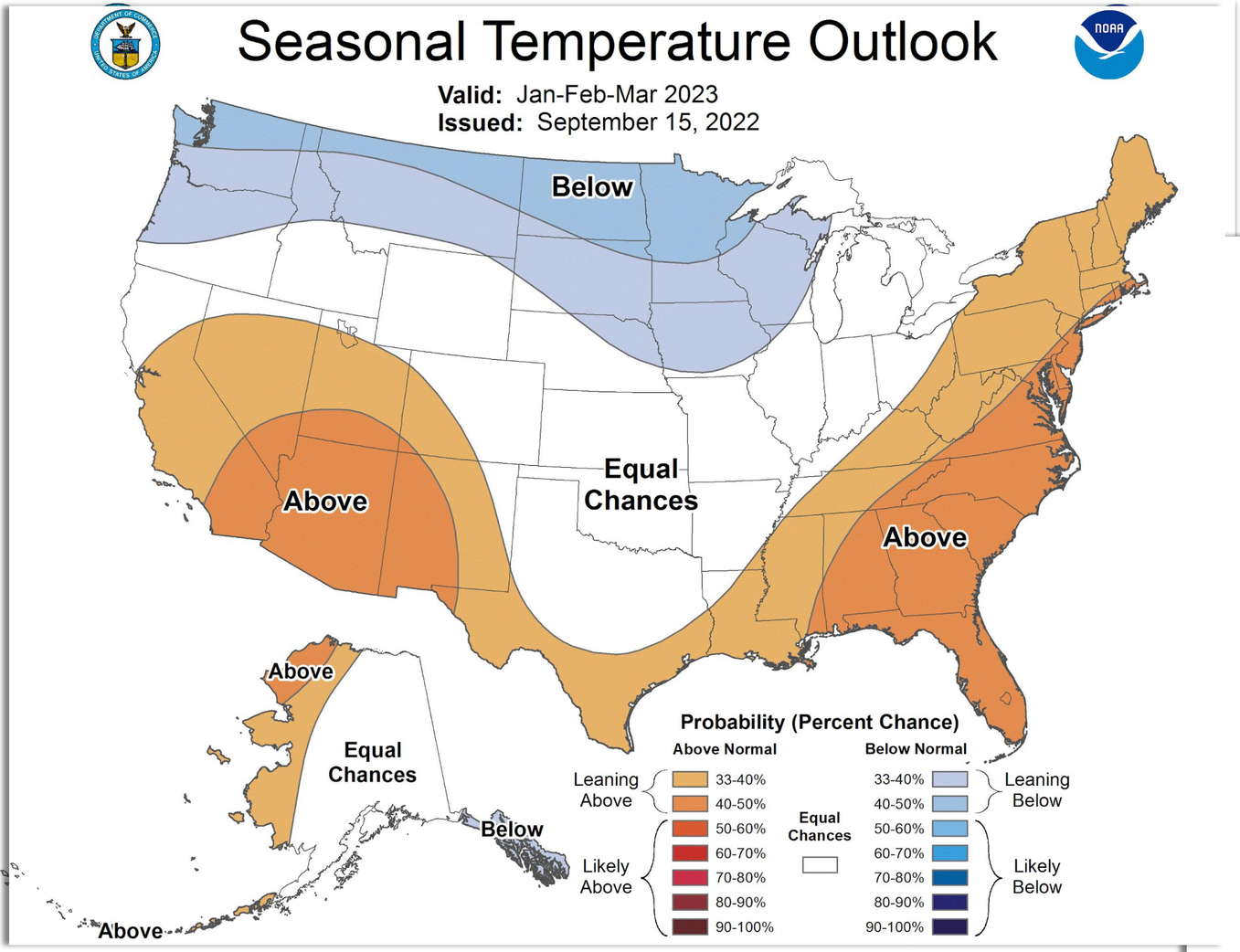
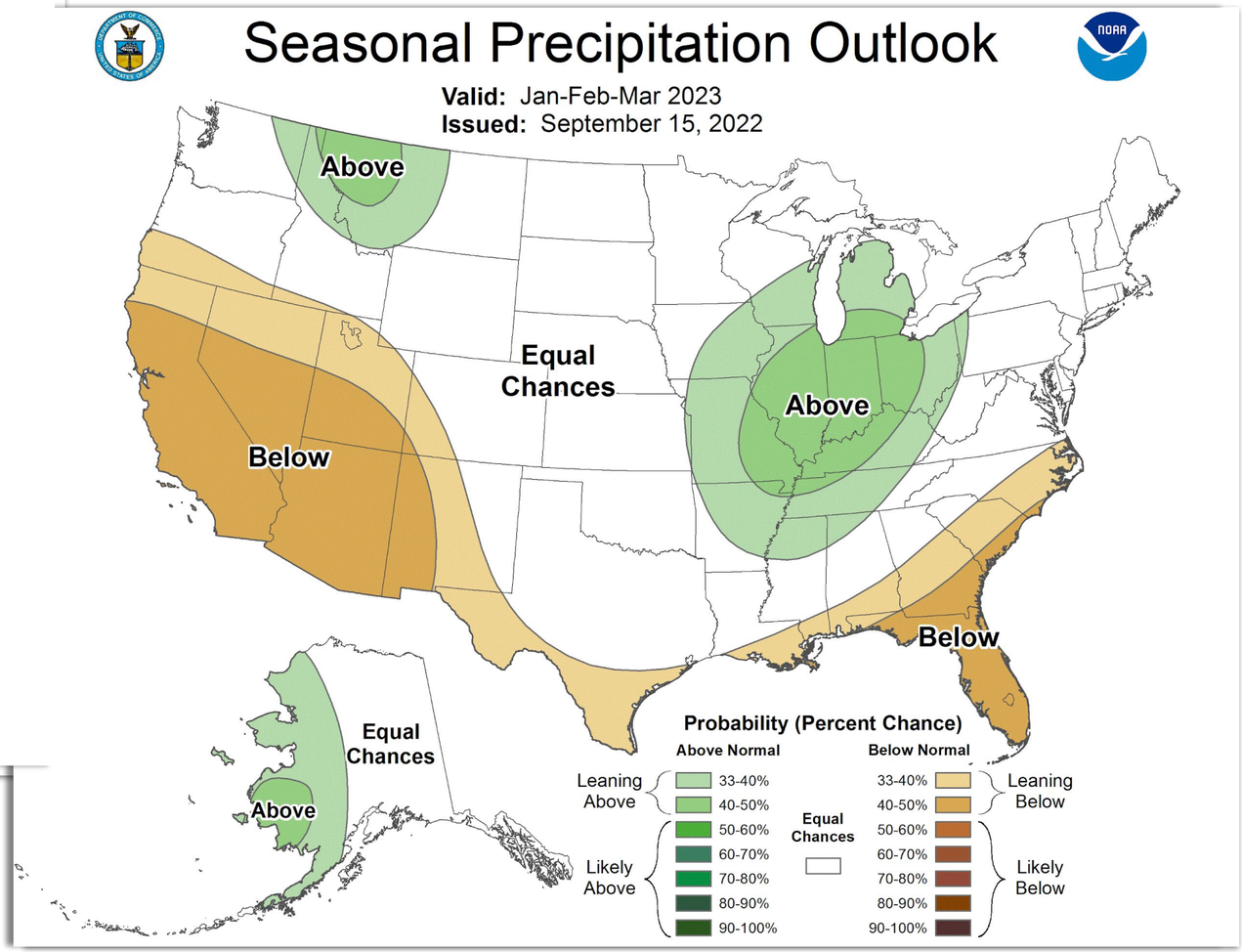




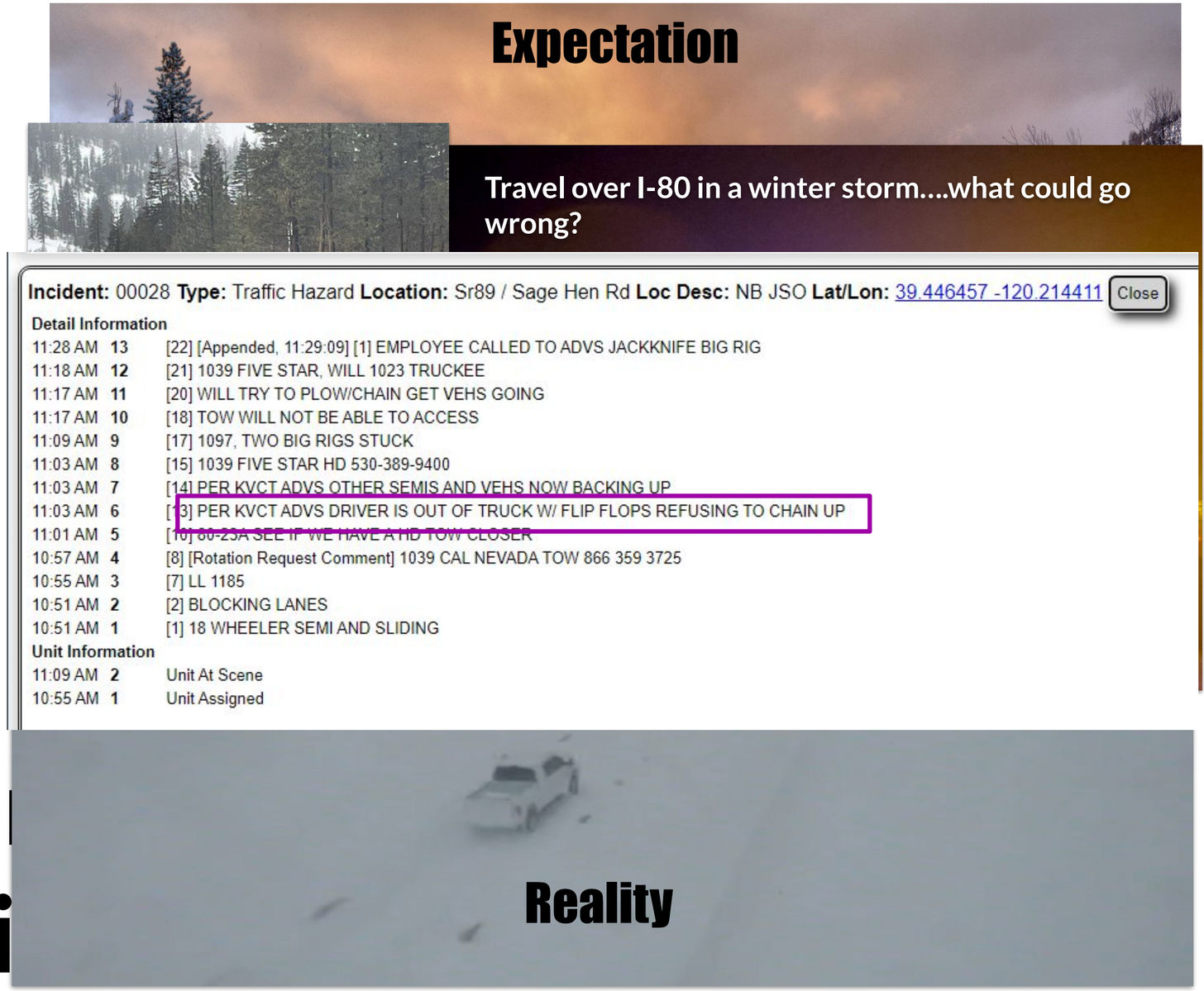
So What Does All This Mean??

- Really, anything remains on the table at this point.
- Same logic applies to snowpack and 2024 water supply.
- We're heading into this winter in a good spot, but if we get into long dry stretches, during the typical wet periods, things may quickly change.
- Flooding not as likely given past history, but you never know…
  - Plus – the ground is saturated and reservoirs are starting fuller
- We can still have: big snow storms, floods, cold spells, inside sliders, and wind storms even in a "drier than normal winter".
- Fires are not a huge concern at this point given the antecedent conditions, but we know that can change.

Changing How We Think About Forecasts

Ultimate value of any weather forecast…

…was it accurate e
make a good decisi



Changing How We Think About Forecasts

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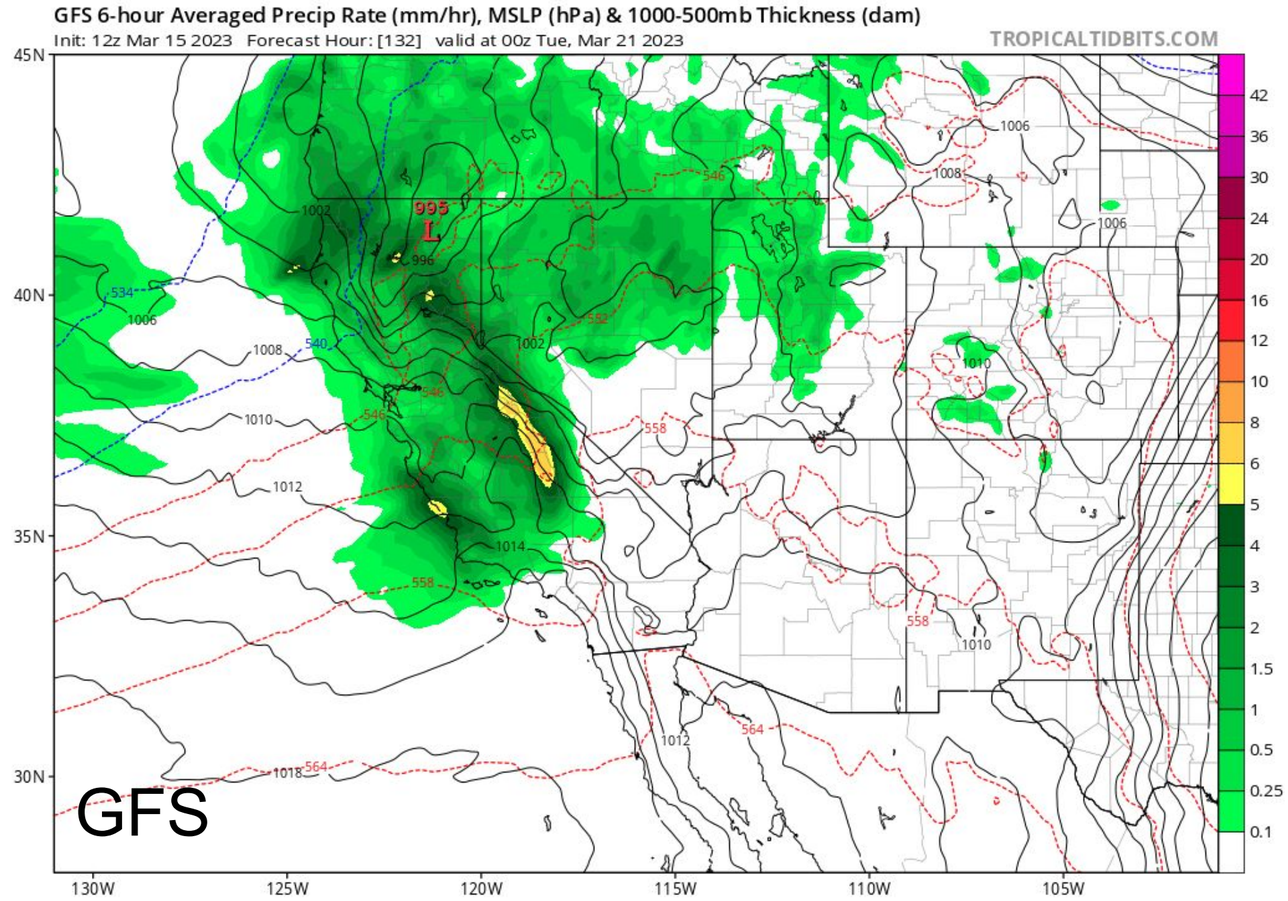
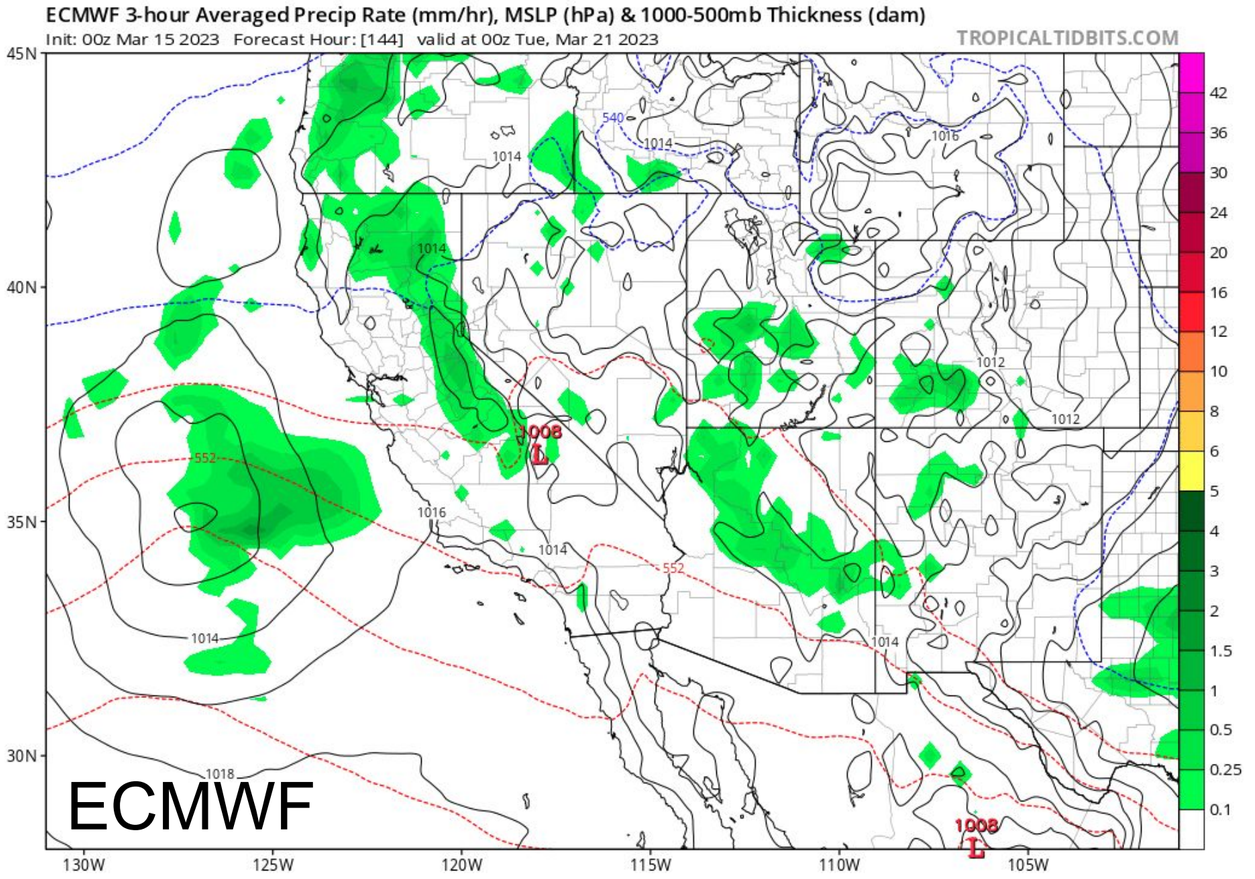
OLD WAY: GFS versus the European. Who knows which is right? Maybe I should just go with “my gut”...





Changing How We Think About Forecasts

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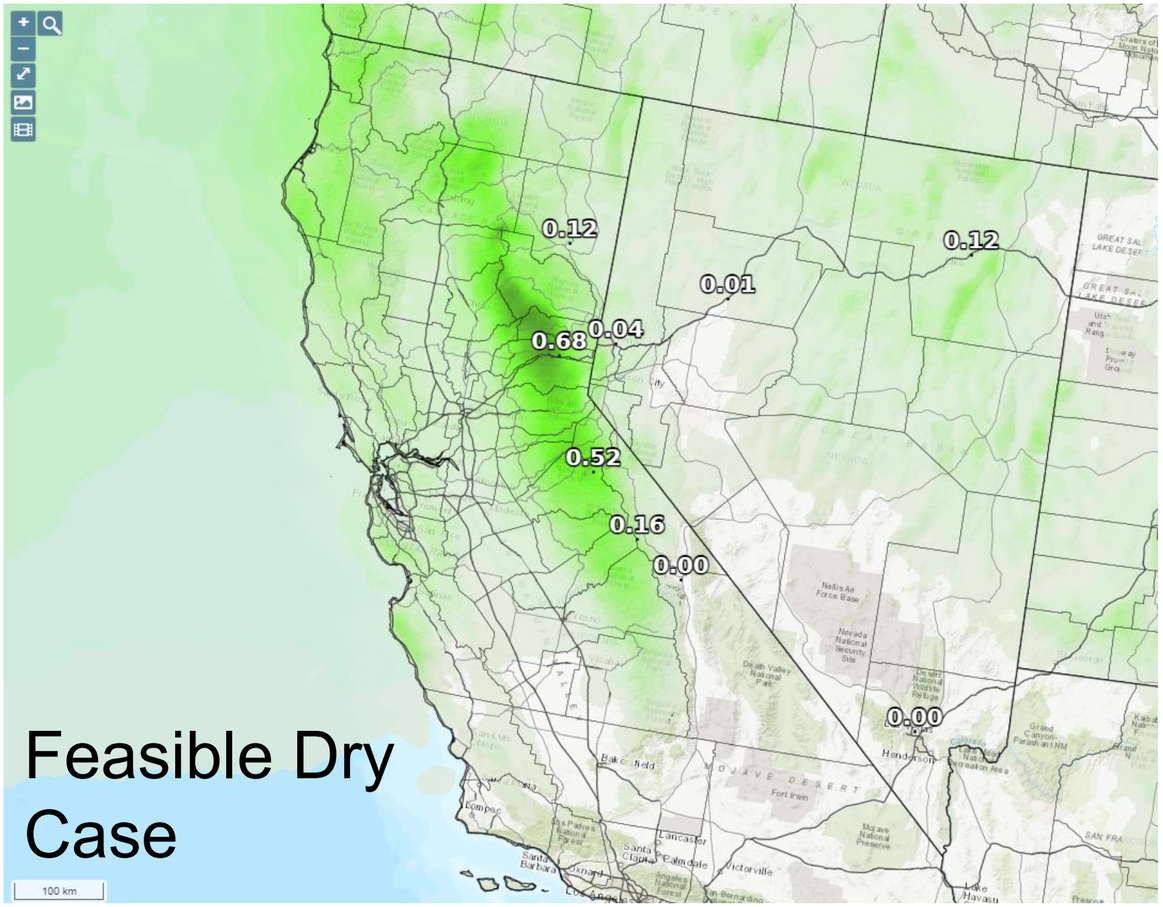
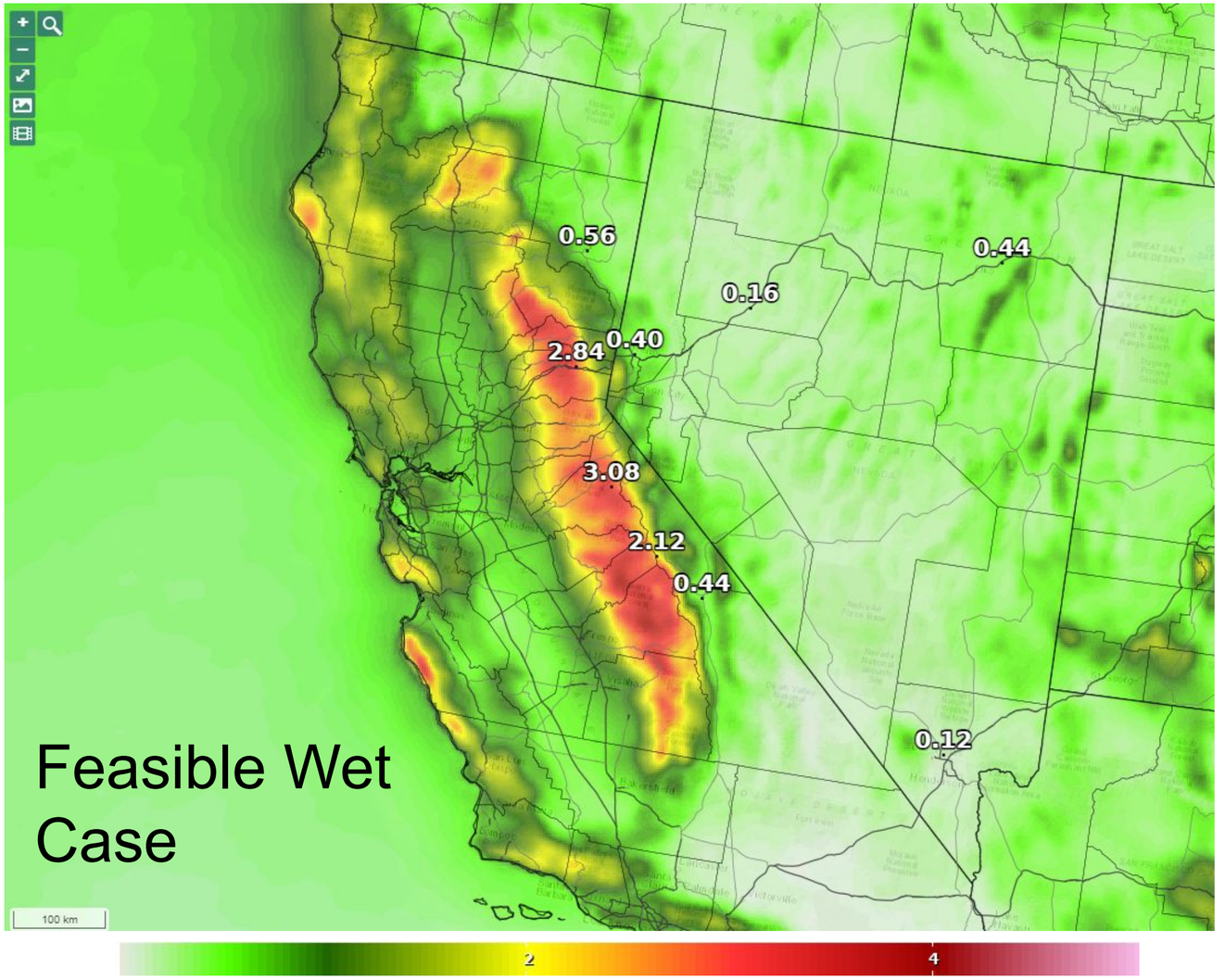
NEW WAY: All the models - blended together. Calibrated scenarios and threshold probabilities of impactful weather.





Predictability Spectrum

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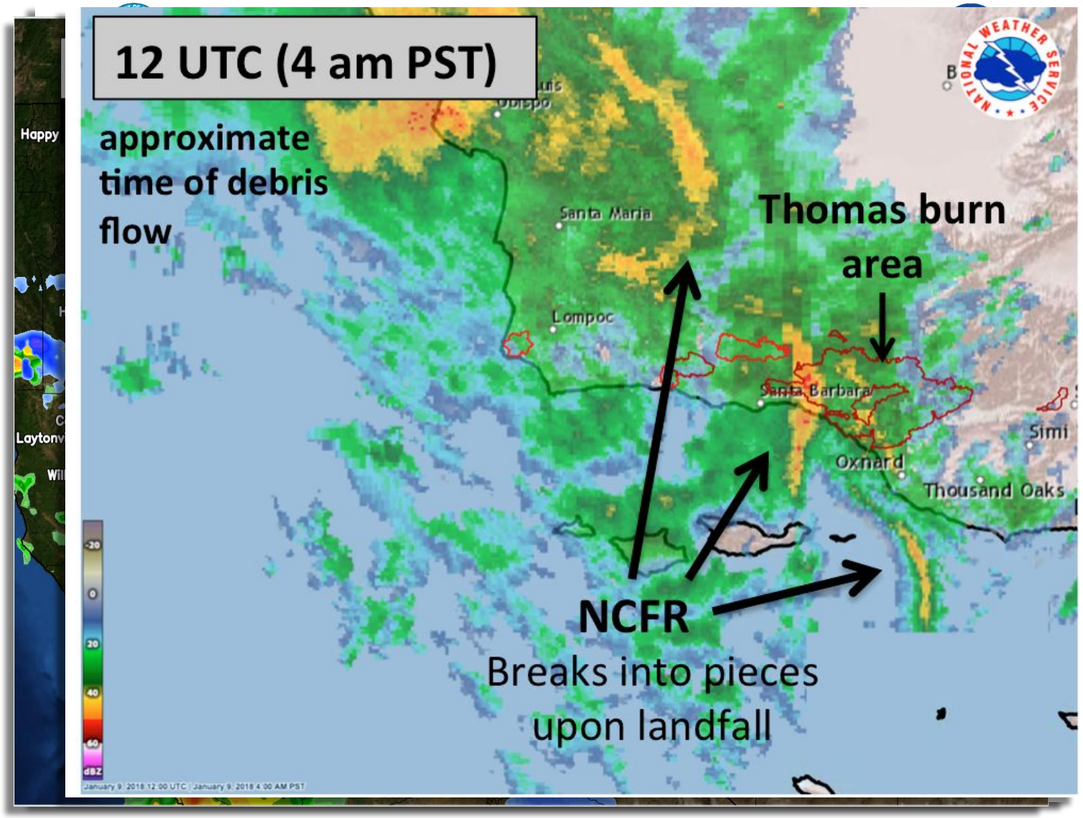
7-14 Days

Broad trends: wetter vs drier, heavily probabilistic outlooks (e.g. lean wet).

2-5 Days

What kind of storm: flood vs blizzard vs high wind scenarios become clearer.



6-24 Hours

Small scale but high impact features: rapid snow level drops, inside sliders, cold frontal squall lines.

Changing the Way we Communicate

All weather forecasts are wrong, but some are useful.

Forecasting anything beyond Day 3 is about being a good statistician. Closer in it's about being a good meteorologist.

Helping Partners Make More Informed Decisions

Scenarios

"Most Likely" vs "Worst Case"
Being Prepared.


Backyard lightning display 2019

Confidence

Forecaster experience & what the models say.
High vs low confidence = different decisions.

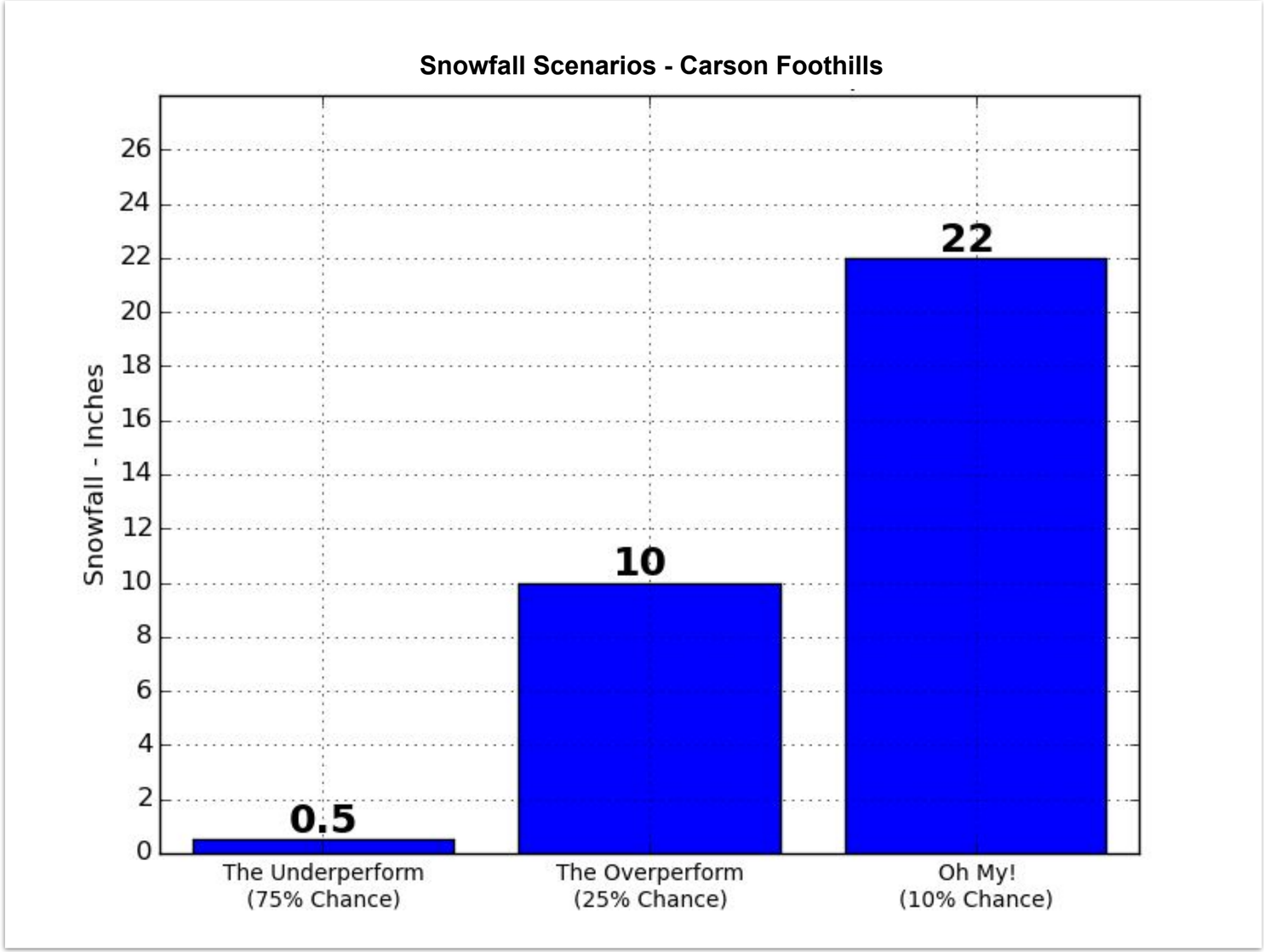
Probabilities

What weather is important to you and how likely is that to happen?

Examples of Probabilistic Information

Scenarios

"Most Likely" vs "Worst Case"
Being Prepared.



Does Having Additional Probability Data Help?

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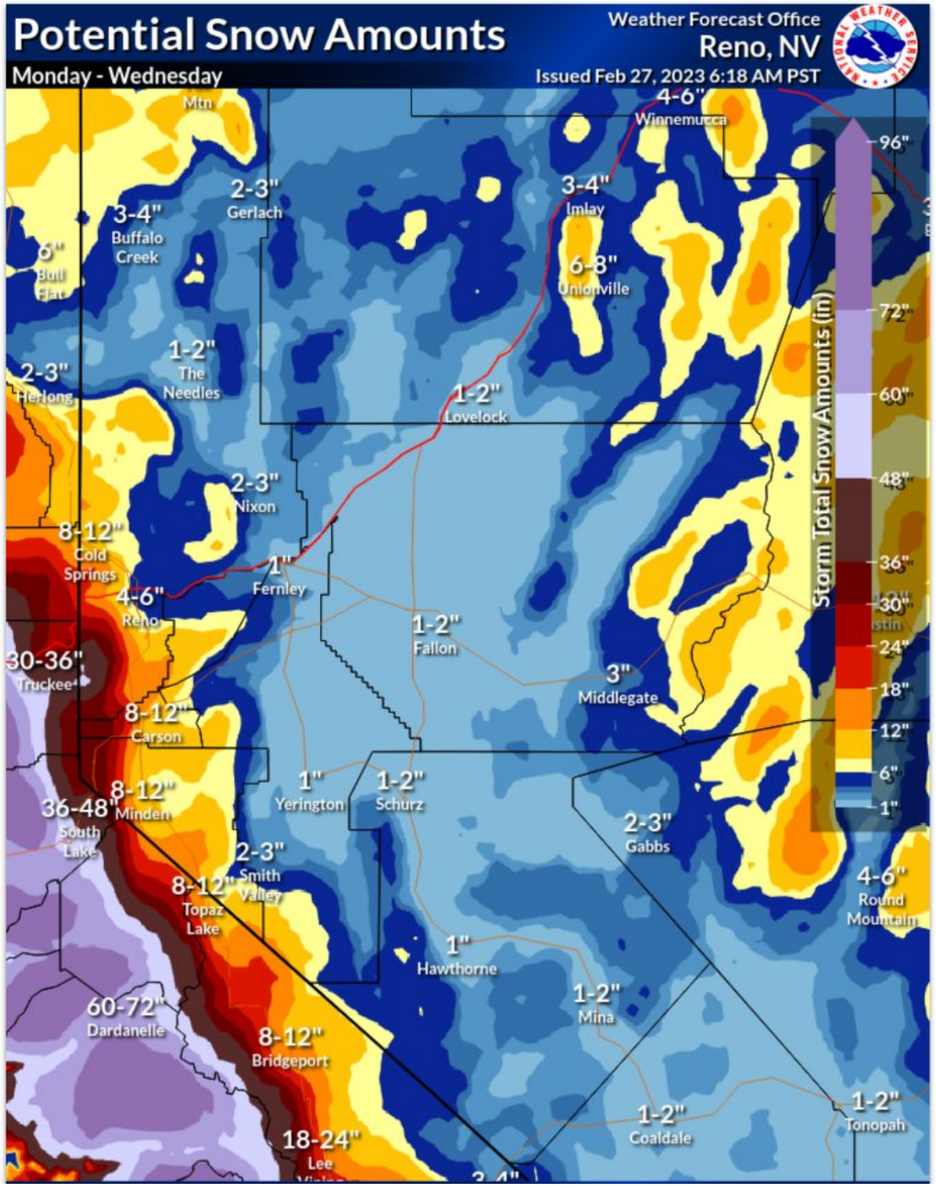

The more impactful storm will bring low elevation snowfall and strong winds Monday into Tuesday for western NV.

Commute headaches are a possibility down here.

The main period for snow for western Nevada will be Monday afternoon through Tuesday morning.

Examples of Probabilistic Information

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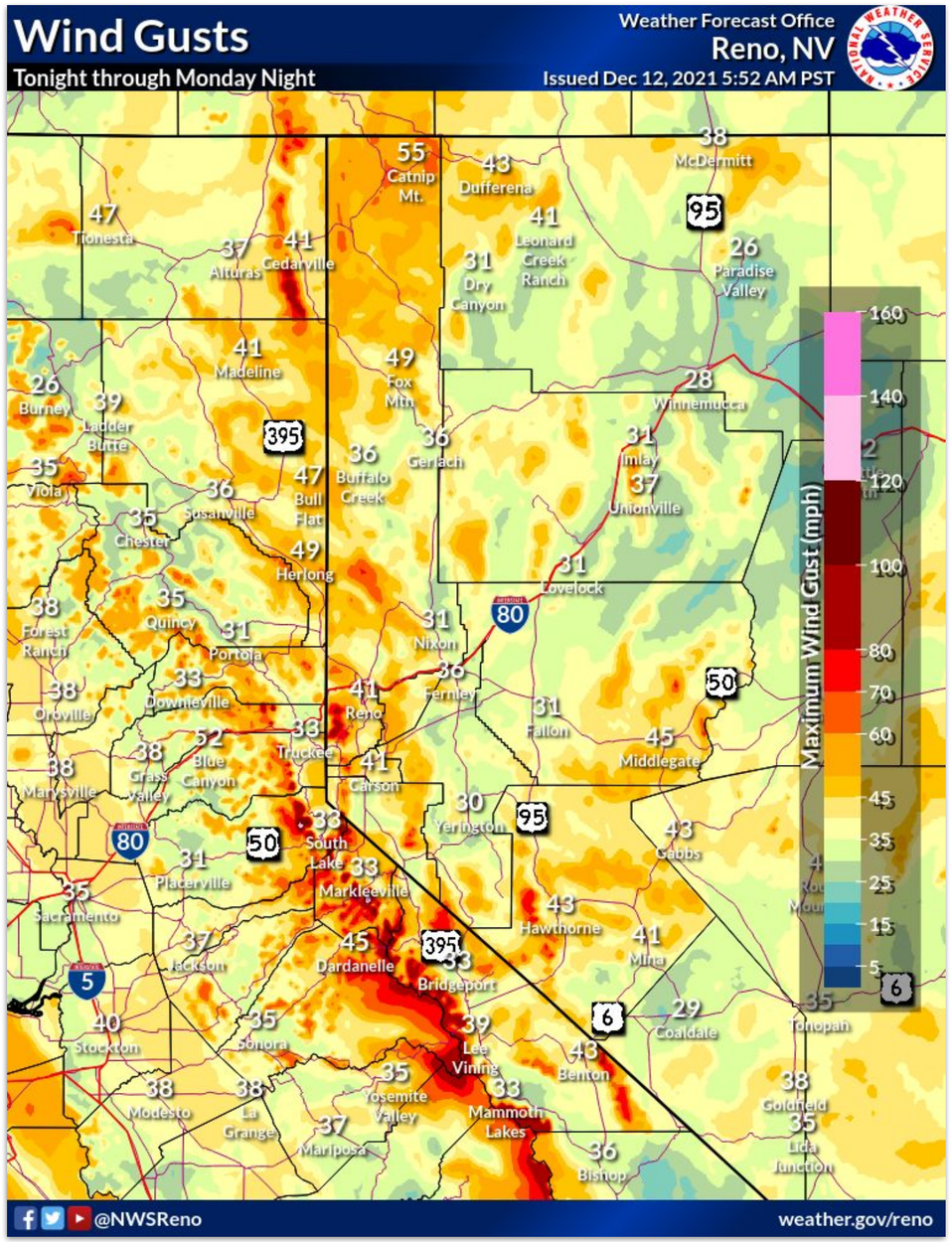
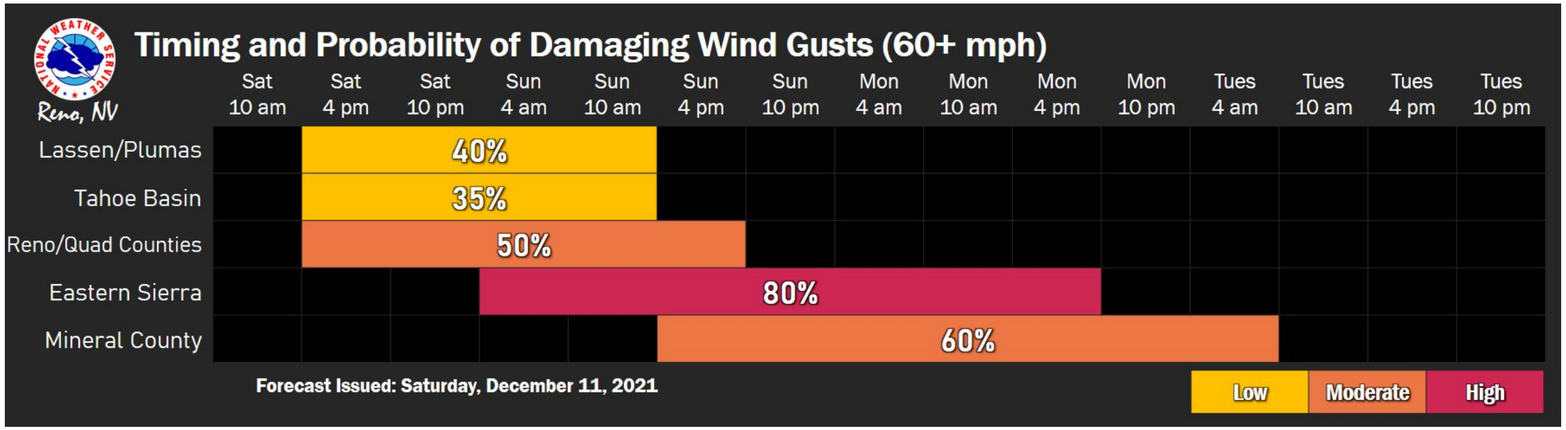


Bridging the deterministic “one number” forecast with the probabilistic forecast.



Probabilities

What weather is important to you and how likely is that to happen?

WATCH VS WARNING

WATCH: We have the ingredients to make tacos.

WARNING: We're having tacos. RIGHT NOW!

TACO WATCH

TACO WARNING

ww

Watch, W
associate

Idea
Note:
much

Confidence

1 Month

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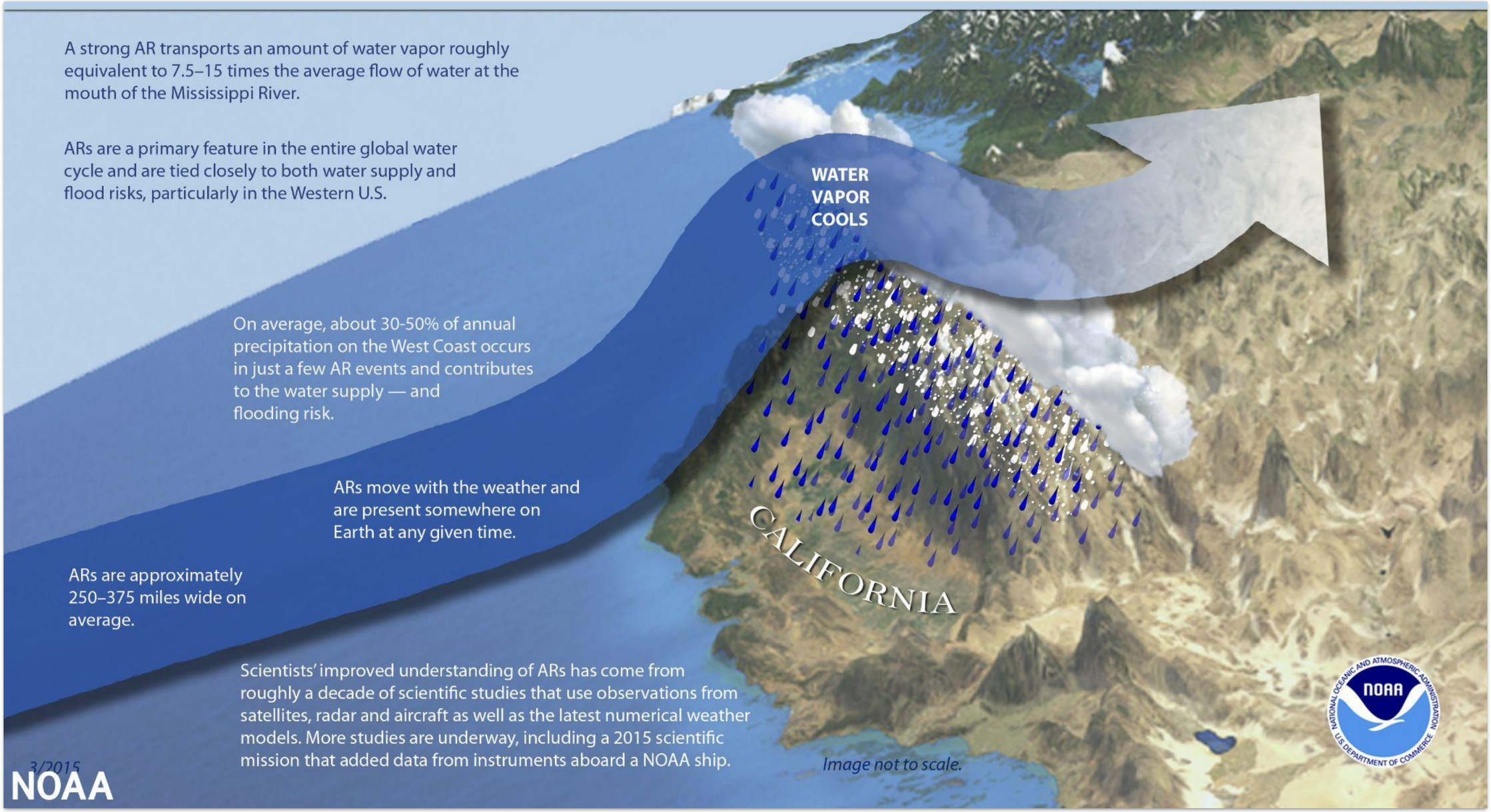
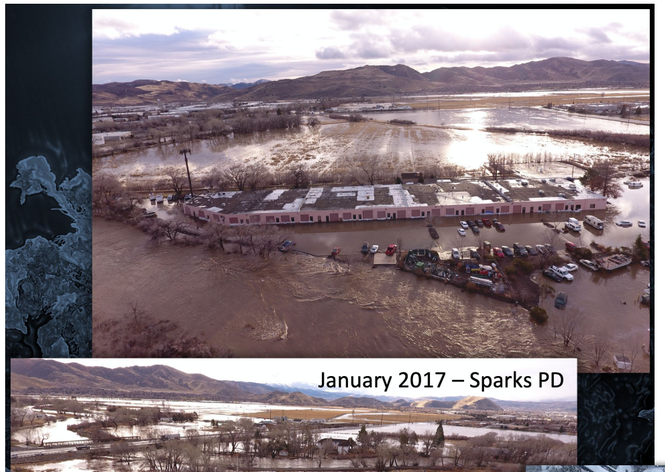
Atmospheric Rivers - Winter's Moisture Tap



Freakout Scenarios: Atmospheric Rivers



- Giant plumes of moisture crossing the Pacific Ocean. Can usually see these coming 5+ days in advance at a broad scale.
- Most AR's are beneficial - 50% or more of annual precip, snowpack come from just a handful of these events.
- Strong or extreme AR's = hazardous snow, wind, and/or flooding. Often from stalling ARs.
- Rain - snow line elevations are critical but often a source of the largest forecast errors.
- Climate change trends - increased risk of more extreme ARs with heavier precipitation including spillover east of the Sierra.

Atmospheric Rivers Drive our Climate!

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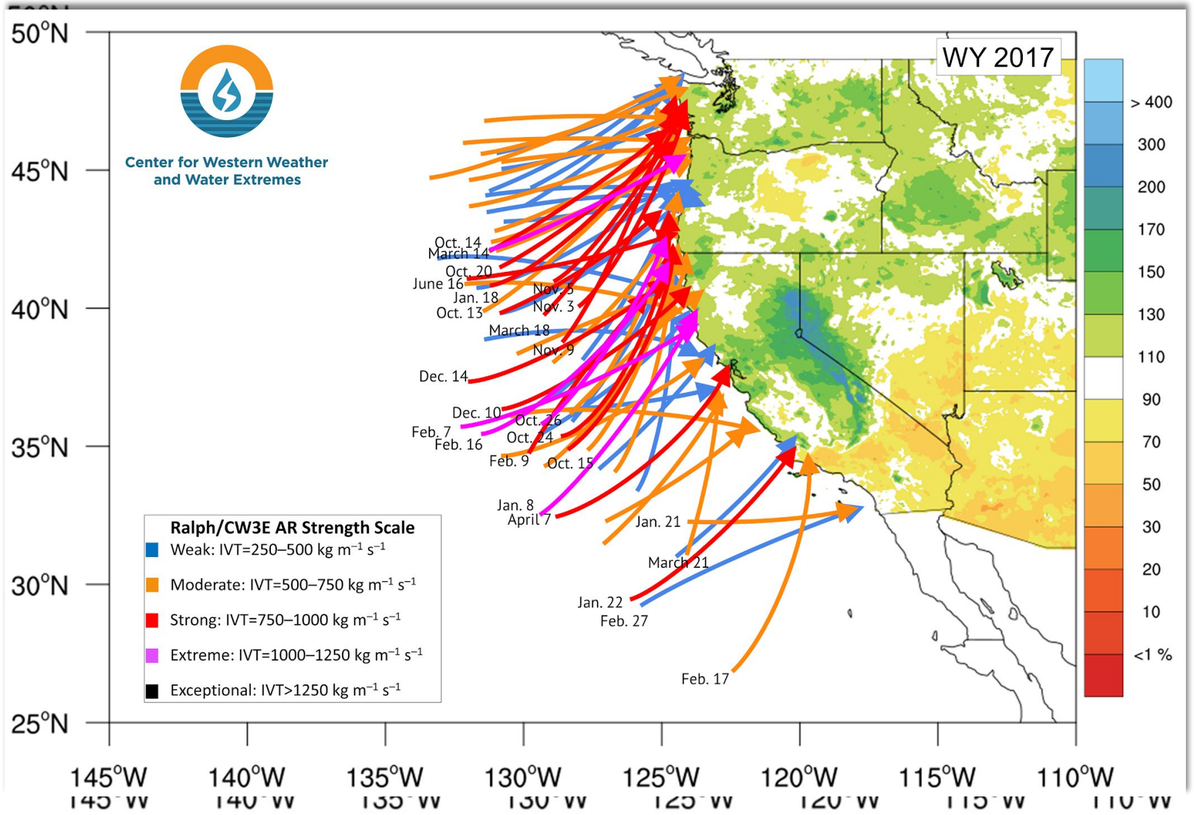
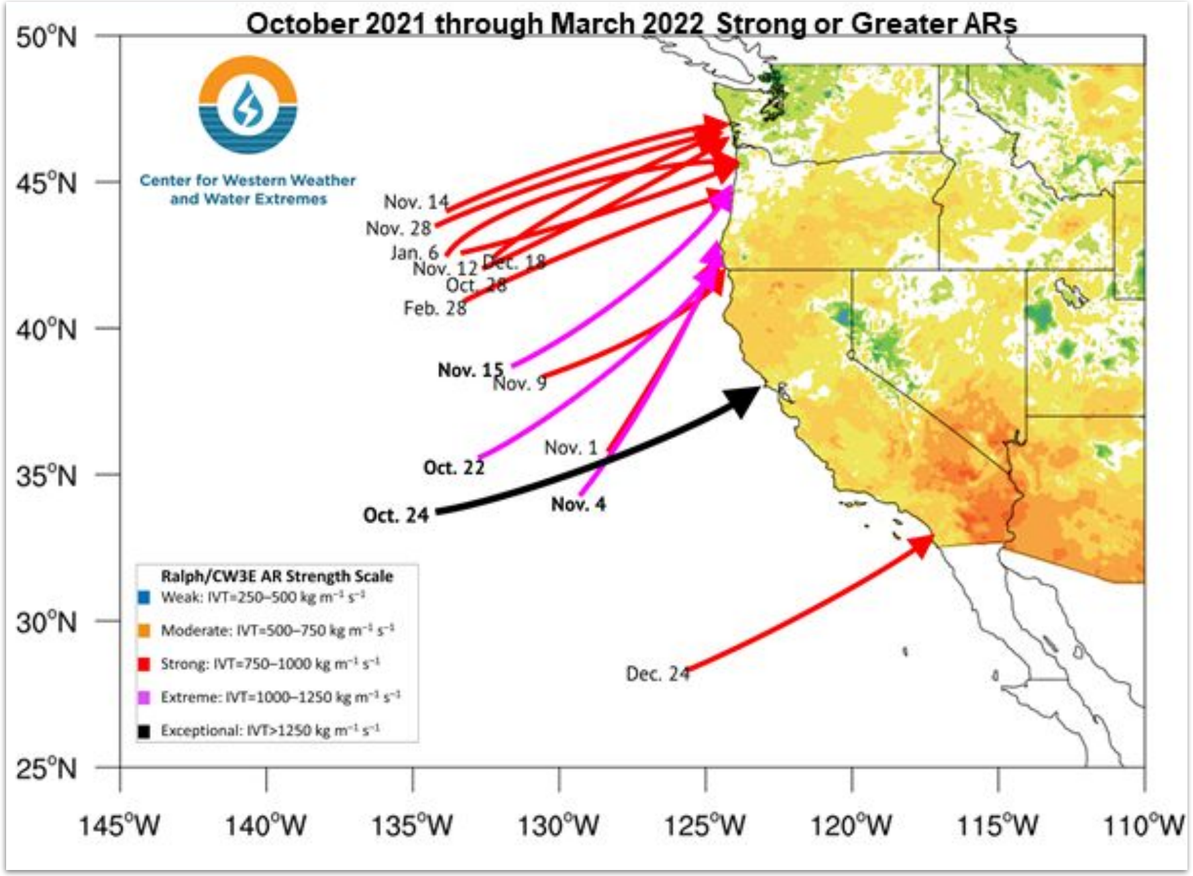
Reno, NV
Thursday, October 19



Winter of 2022-23 versus the much drier winter of 2021-22.



Oct 2021 Atmospheric River - The New Norm?

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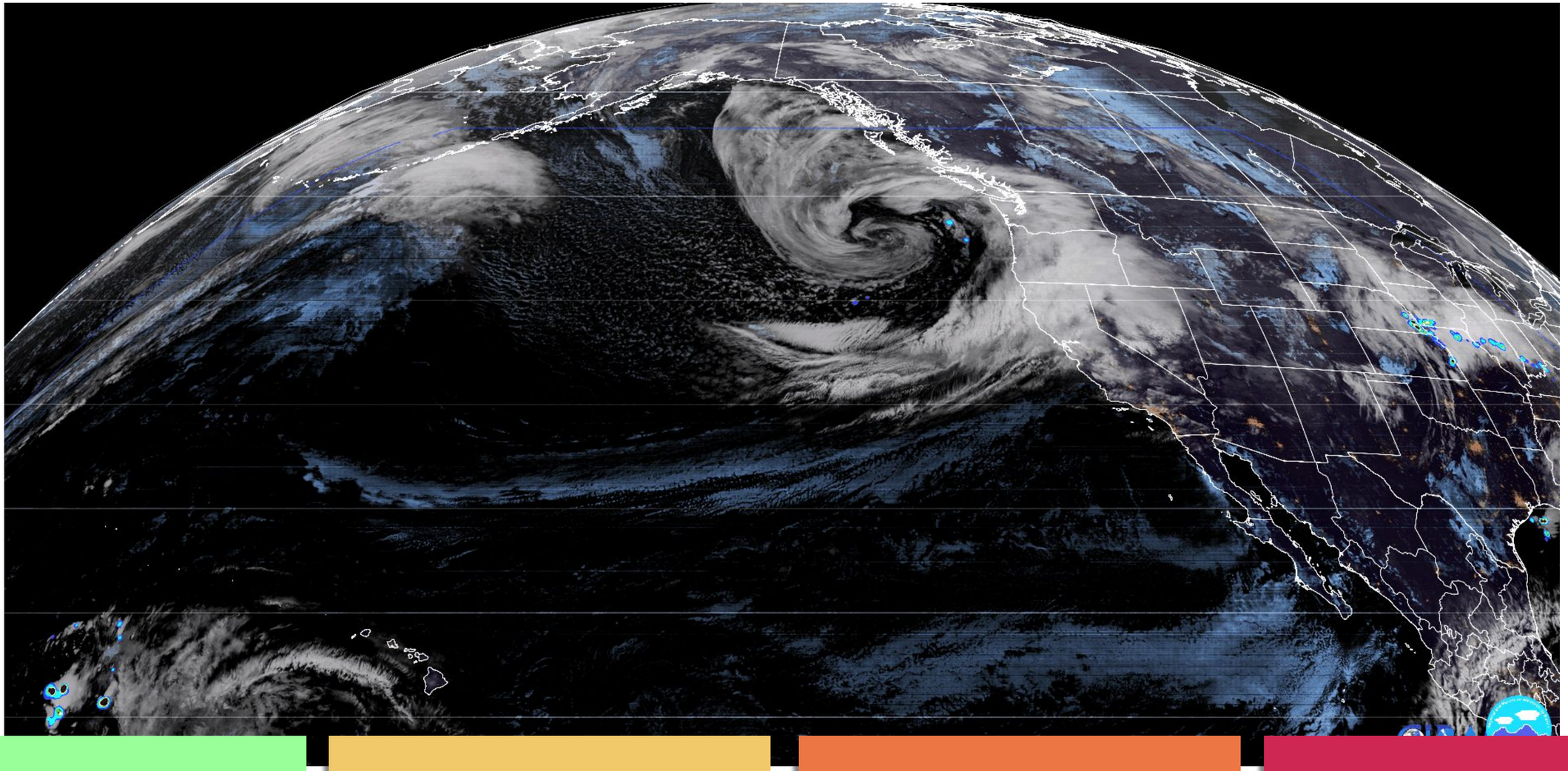
Thursday, October 19



Strongest October atmospheric river to make landfall the last 40 years.

Rain shadow non-existent. Reno 3” of rain in 2 days is 40% of annual average.

10-15” rain in Sierra caused near-flood spikes in rivers, even with parched ground.

We are SO LUCKY this storm didn’t hit in January with snowpack and cold ground.

Fall and Winter Wind Events (Did you know it gets windy here?)

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Thursday, October 19

Downslope Wind Storms

- Mountain wave driven (think hydraulic jump)
- Most typical fall and winter with a strong low level jet stream
- Gusts typically greater than 60 mph
- Strongest along the Eastern Sierra Front
  - Maximized wind prone areas, typically adjacent to US-395

Gradient Driven Wind Storms

- Mainly driven by pressure/temperature gradients
- Most typical during spring/fall (transition seasons)

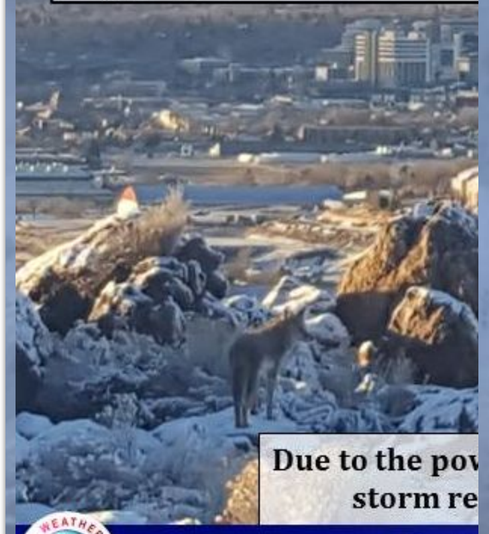
Gusts can reach 40-60+ mph valleys

  - Little difference in speeds between wind prone and valley locations.

Crippling Snow Storm, not over yet

Biggest snowstorm to hit the Sierra in 6 years has crippled the region.

	Prelim
Mammoth -	24 hr =
Kirkwood -	24 hr =
Squaw Valley -	24 hr =
Sugar Bowl -	24 hr =



Due to the pov
storm re

Ren
Forec

luxury of staying home

s – Jan 2-13

9-15+ feet

2-5 feet (6-8 feet west shore)

2+ feet

1-4 feet

Photo:
Former NWS
Reno
employee

Tag Photo Options Send Like

Increase!

(Roads, Avalanche Centers, EMS, Schools...)

SIERRA AVALANCHE CENTER.ORG

Freakout Scenarios: Inside Sliders

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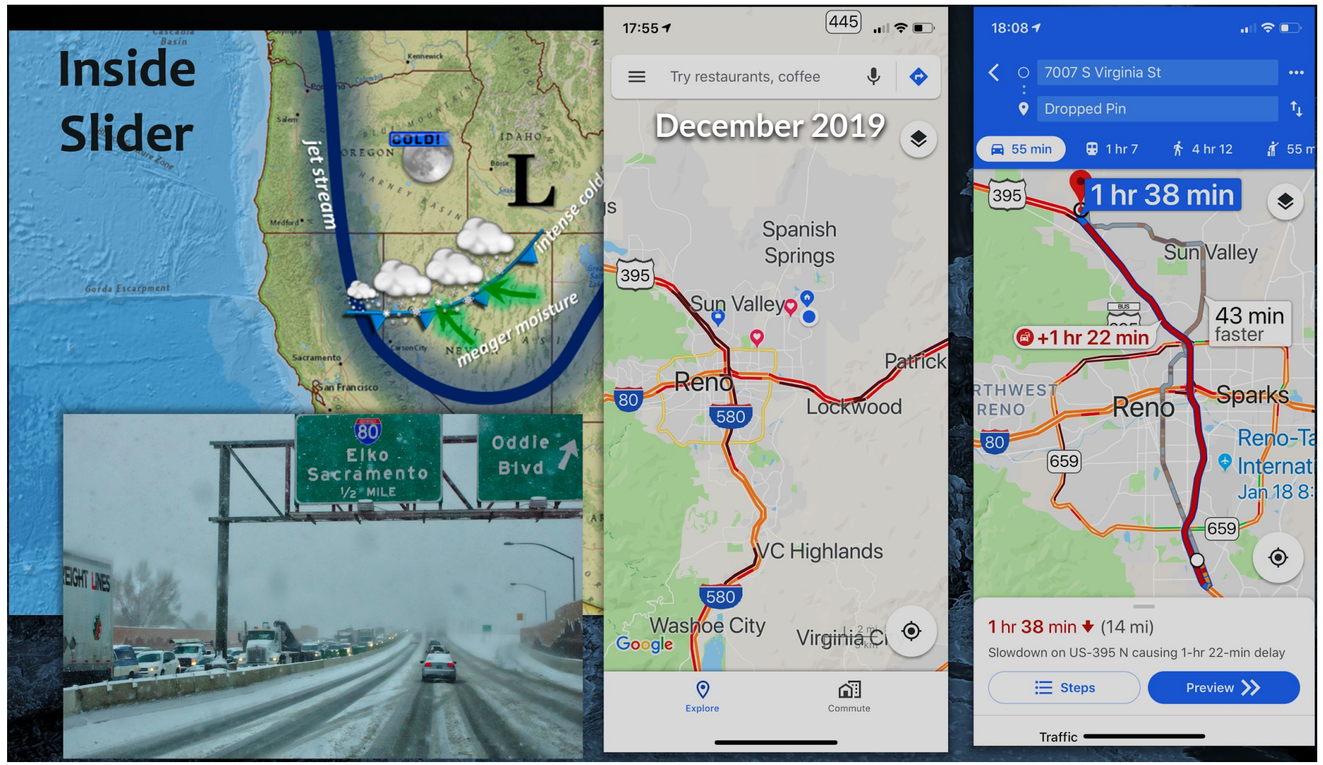
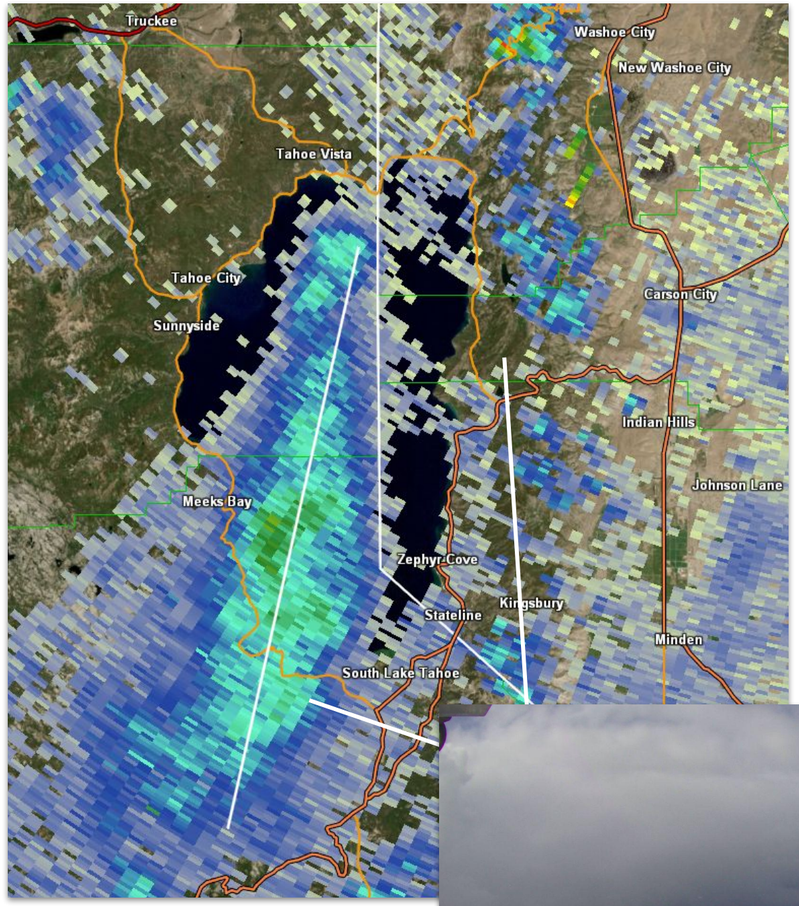
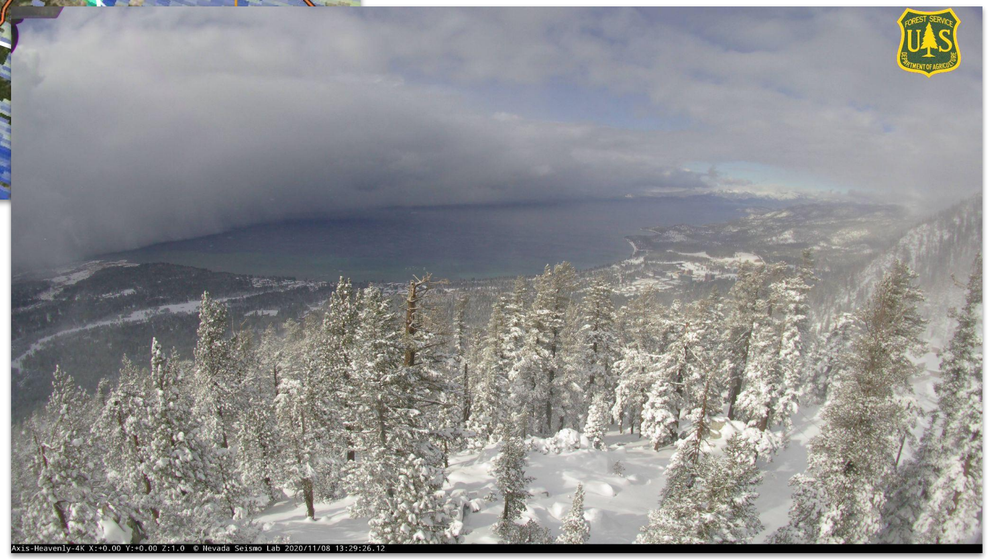


- Analogous to “Alberta Clippers” in midwest.
- Fast moving, high intensity bursts of snow with cold air - so snow sticks on valley floors.
- If it hits during commute, it <u>will</u> be a train wreck. 3-5x normal travel times.
- Messaging challenge: Public doesn’t react to 1” snowfall forecast, no preemptive closures.
- Predictability: not too good, maybe 1-3 days.
- More common in drought years, due to position of blocking high pressure ridge off west coast.

Freakout Scenarios: Lake Effect Snow

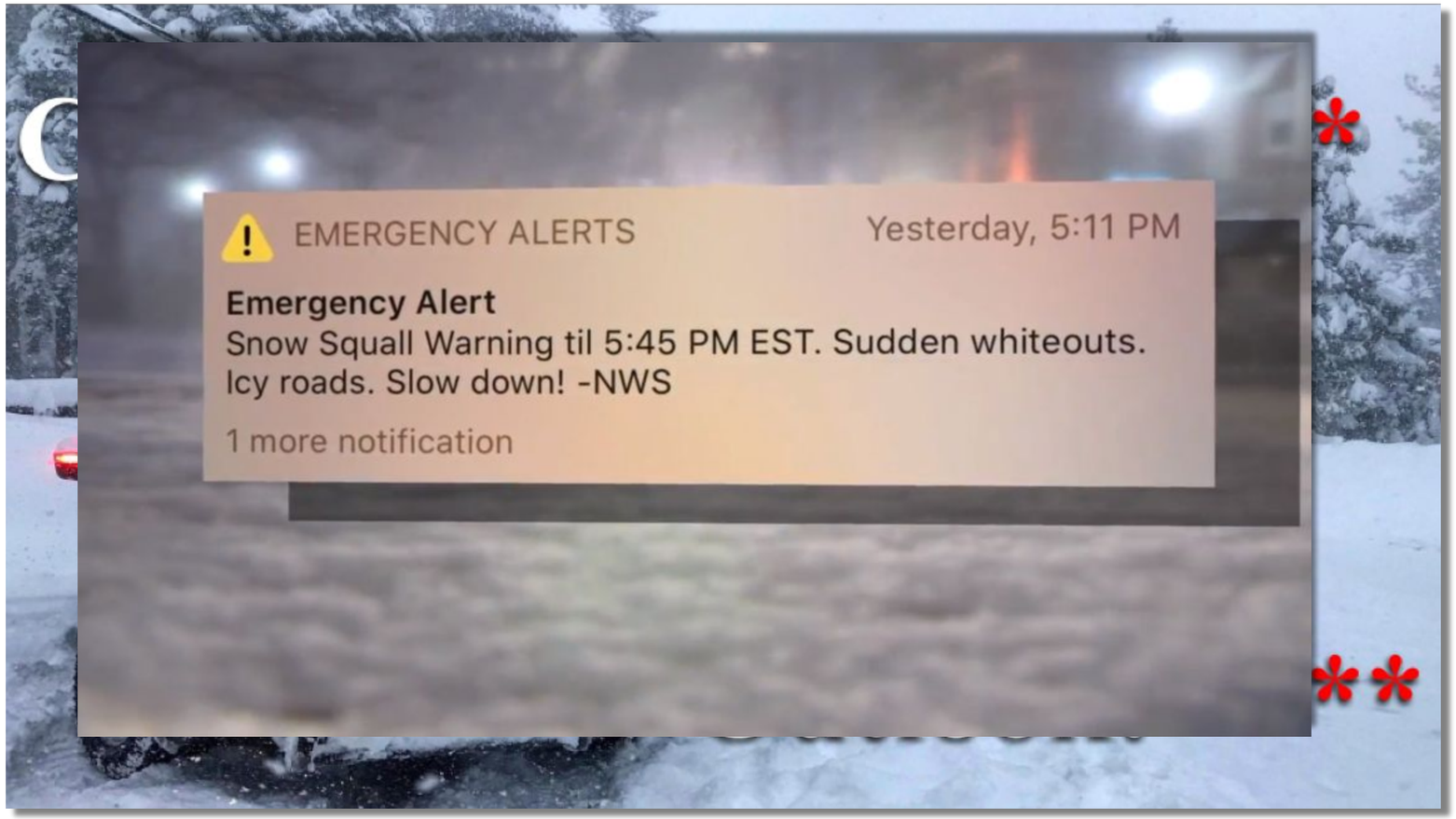


November 2020



- Hot spots: Carson City, Washoe Valley, Reno, Spanish Springs, Fernley, South Lake Tahoe, June Lake, Lee Vining.
- Localized high intensity snow, 2-4”/hour not uncommon. No snow just a few miles away.
- Often peak intensity at night or early morning - bad news for AM commute & schools.
- Predictability is limited - 1-3 days on general potential, 0-12 hours on specifics.
- Snow Squall Warning can be used for these high intensity bursts of snow.
- Climate change aspect - LE snow becoming more common as lakes stay warmer, longer into the winter months.

Freakout Scenarios: Snow Squall



Snow Squall Warning

- Short Duration
- High Intensity
- Rapid Changes
- Big Travel Impact

WEA = yes!

Think of it as a snow-version of a thunderstorm warning

Freakout Scenarios: Flash Freeze

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Freakout Scenarios: Freezing Fog and Freezing Rain

- Freezing fog is common, freezing rain is not.
- Fog can cause icy deposit and especially slick conditions on bridges, along with very low visibility.
- Even minimal amounts of freezing rain can have huge impacts.

Road Forecasts - Winter Specific

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What We Know

- When conditions are lining up for snowfall.
- If the storm is more of a “nuisance” or major event.
- General timing, better details the closer we get to the event.

Photo: NDOT, Mt Rose Hwy 2/2017

Photo: Marilyn Newton, RGJ

What We Don’t Know

- Snow levels can be +/- several hundred or more feet. Big boom/bust potential!
- Exact timing several days out.
- Will snow stick to the roads, esp during shoulder seasons.
- Spillover amounts can be tricky - huge gradients!

How Can You Prepare? Stay Informed!

Hydrologist Tim Bardsley briefing Nevada DEM in the State EOC.

Where's your app?

mobile.weather.gov

- Forecast Discussion, 2x/day [link]
- Briefing emails, aka "the freakout" (each NWS office is separate)
- Social media: @NWSReno
- iNWS: Watches & Warnings [link]
- Call Us (775.673.8107 for 24/7 weather support - non-public #)
- Various support options

Any Questions?

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