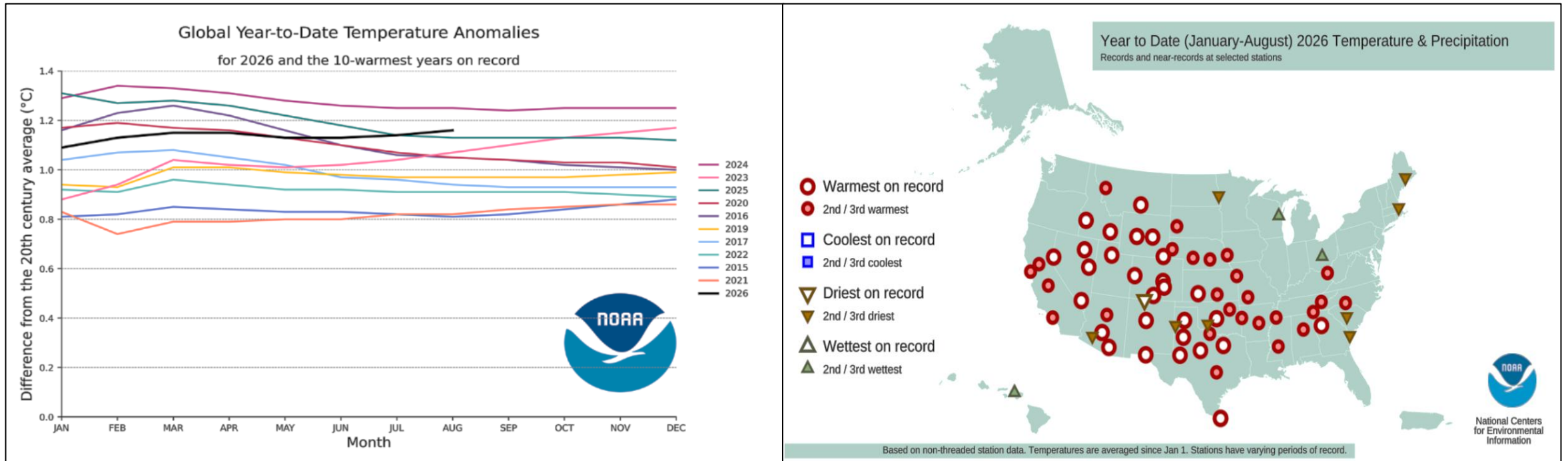


El Niño Impacts to DC-MD-VA Region

Winter 2026-2027 Outlook

*The 10 warmest years on record have all occurred **since 2015**. The January to December 2025 global surface temperature is ranked as the third warmest year in the NOAA 174-year record, which began in 1850.*

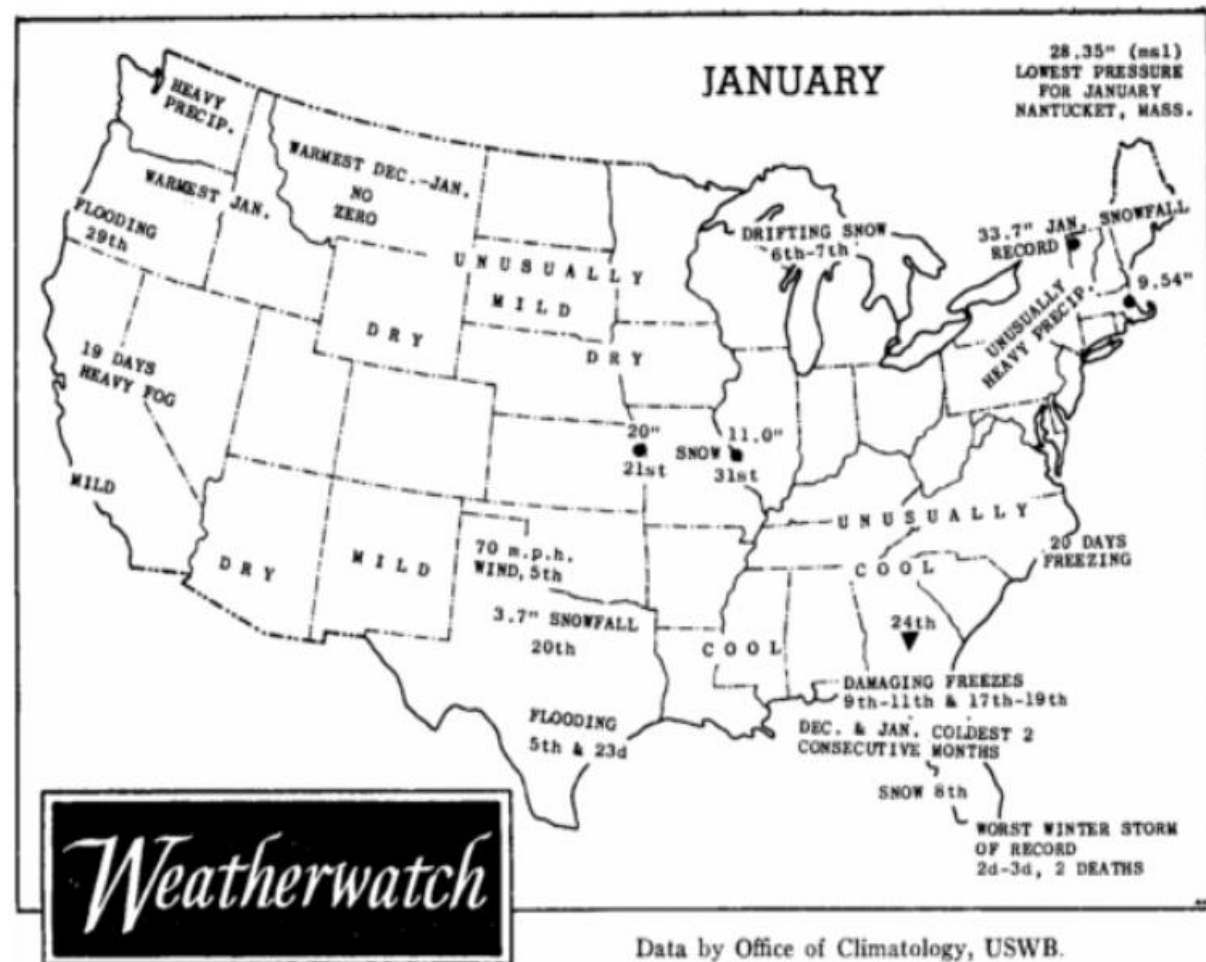


Chief Meteorologist Ms. Sunny Wescott
Critical Infrastructure and Emergency Response Operations

Jet Stream Changes in 1957-1958 – El Niño Record Chaos

The winter of 1957–58 in Washington, D.C., was an unusually severe and snowy season that accumulated a total of 40.4 inches of snow. Measurable snow fell across five consecutive months, starting in November 1957 and lasting through March 1958. Strong winds whipped up four- to five-foot snow drifts and knocked down numerous power lines across the area.

- A Nor'easter in mid-February pushed up from the Gulf of Mexico, tracking over Georgia and the Carolinas before emerging at the Virginia Capes. It pulled intense Atlantic moisture over the sub-freezing interior, dropping 12 to 15 inches of snow across a vast swath of the state. Washington, DC recorded 14.4 inches, Baltimore tracked 15.5 inches, and Charlottesville recorded 12.3 inches. A wet snow event in March caused roof collapses, widespread downed trees, and paralyzed transportation networks from Virginia through New England.



Data by Office of Climatology, USWB.

Winter 1957-1958: A Divided Nation

DAVID M. LUDLUM, *Editor*

The general circulation over the United States during the first two weeks of the New Year continued the regime which had prevailed during the very mild month of December. It will be recalled that the last five weeks of 1957 comprised a warm ending to a relatively cool year for the nation as a whole. The only exceptions to the December warmth occurred in the interior valleys of California and the Southeast coast from South Carolina to Mississippi with the atmosphere over Florida forming the core of the cold air.

For the first two weeks of January westerly flow continued to transport mild Pacific air across western United States during a high index cycle. Barometric pressure at the surface remained high in the West and relatively low in the East. Ridge conditions over the western United States and Canada excluded cyclones from penetrating inland. Mild temperatures favored both coastal and inland sections with the latter receiving much additional chinook warming. It was the warmest January on record at some Oregon points and in western Montana not one day in January 1958 averaged below that day's normal.

Over the East trough conditions prevailed with the mean trough showing a progressive eastward movement as the month wore on. The southern end

of the persistent trough in the Gulf of Mexico favored cyclonic formation there—a feature of mid- and late winter 1958 which produced an almost unprecedented period of cold storms and frigid temperatures over the entire Southeast.

The cycle of west-east flow broke down in spectacular fashion at mid-month with a very rapid decline of the strength of the westerlies in the middle latitudes. The behavior of the jet stream well illustrated the changes which were in progress on the circulation charts. The jet, which is most intense during a high index cycle, reached its peak speeds about 20 December when it was found near 47° N, close to the U. S.-Canada border. Thereafter, it migrated farther and farther southward—by mid-January it was near 40° N and by early February at 33° N over the Gulf States. At the same time there was an abnormal increase in westerly circulation across the sub-tropics of Mexico and the Gulf.

The rearrangement of ridges and troughs to accommodate the new circulation was signaled by the very rapid build-up of a blocking anticyclone of great magnitude over the Greenland-Baffin Land area. Surface barometric pressures reached extreme values there on 18 January 1958 when two stations on opposite sides of Baffin Bay reported 1064 mb (31.42") and map analysts interpolated a central

El Niño Impacts: 2003

El Nino changes the overall stability of weather across the Nation with clear indicators of abnormally warm years.

Severe Weather Events - 2003

A prolonged and destructive tornado outbreak sequence occurred across much of the Great Plains and eastern United States within the first half of May 2003.

- 363 tornadoes were reported from May 3-11 with 62 of those tornadoes being rated F2 or higher. It led way to May 2003 being the most active month for tornadoes of all-time (542) until it was surpassed by April 2011 with 773.
- The May 2003 tornado outbreak killed 42 people and injured more than 600 others.

Wildfires – 2003 Global and National Trends

In 2003, during one of the hottest summers Europe experienced up to that point, a series of extremely devastating blazes in the taiga forests of Eastern Siberia destroyed over 55 million acres (22 million hectares) of land.

From 2020-2022, drought and extreme heat caused US tree decay and degradation widespread was reported which indicates more vegetation is at risk of burn for 2023-2024.

Regional Impacts During El Niño Winter 2003-2004

In Baltimore City, bus and commuter train operations were suspended during the storm. The historic B&O Railroad Museum roof collapsed, damaging priceless exhibits.

- 24 homes were condemned and two homes were demolished after suffering structural collapses.
- A 5-story building downtown had to be evacuated after support beams buckled.
- In Harford County, the roof of two homes, a sunroom, and a deck collapsed

DISTRICT OF COLUMBIA

DCZ001

District Of Columbia

06 1900EST
07 1100EST

0

0

Winter Storm

Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Five inches of accumulation was reported at the National Arboretum. A total of 6.6 inches of snow fell at Reagan Washington National Airport. Several traffic accidents were reported across the metropolitan area.

DCZ001

District Of Columbia

14 0800EST
18 1200EST

0

0

Winter Storm

A complex storm system produced copious amounts of wintery precipitation across the Washington D.C. metropolitan area between the evening of the 14th and midday on the 18th. The first batch of precipitation fell between the evening of the 14th and the evening of the 15th in the form of light to moderate snow or rain. The second batch of precipitation fell between midnight on the 16th through midday on the 17th in the form of heavy snow or sleet. The third batch of precipitation on the back side of the storm fell between the evening of the 17th and midday on the 18th in the form of scattered snow showers. Nicknamed the President's Weekend Snowstorm of 2003, this storm will go down in history as the 5th heaviest snowstorm in Washington D.C. since records began in 1870. A total of 16.7 inches of snow and sleet was recorded at Ronald Reagan Washington National Airport.

This massive storm took a heavy toll on residents, structures, transportation systems, emergency responders, businesses, livestock, and travelers. Local officials urged people to stay off the roads during the height of the storm between the morning of the 16th and the morning of the 17th. Roads were covered by deep snow and sleet and were nearly impassible. National Airport was shut down on the 16th, stranding hundreds of travelers. Above ground subway stations and all Metrobus service was suspended during the height of the storm. Emergency personnel and those needing emergency transport had to be taken to their destinations in 4 wheel drives. Main highways were partially cleared by the 18th but it took up to 5 days to reach some secondary and residential roads. Schools were closed up to 4 days after the storm ended. Heavy accumulations weighed down on buildings and several structural collapses occurred. A portion of the roof collapsed at the historic O Street Market. A drugstore in Northeast collapsed. The awning on a Georgetown restaurant caved in. The federal government was shut down for two days by the storm.

DCZ001

District Of Columbia

22 0800EST
23 0600EST

0

0

Flood

A combination of 2.5 to 3 inches of rain that fell between the evening of the 21st and the morning of the 23rd and snow melt from the massive snowstorm of 14-18 February led to urban flooding. The Mt. Vernon Square/UDC subway station was closed by flood waters. Thirty basements across the city were flooded. In addition, Columbia Road NW, Whitney Young Bridge, and Naylor Road were covered by water.

DCZ001

District Of Columbia

23 0600EST
2200EST

0

0

0.10K

Strong Wind

A strong cold front moved through the region around dawn on the 23rd. This front ushered in winds that gusted between 40 and 50 MPH. A wind gust of 50 MPH was recorded at Children's Hospital. Due to the soft saturated soil from heavy rains and snow melt, the gusty winds downed a few trees and power lines. A handful of power outages were reported.

Past Strong El Niño Years

The **1995-1996** winter in Washington, D.C., is historically remembered for the epic Blizzard of 1996 and ranks as one of the snowiest winters in D.C. history, accumulating roughly 46 inches of total seasonal snowfall.

In the **1972-1973** and the **1997-1998** El Niño events Washington DC reported exceptionally warm swings through the season and a nearly snowless winter overall.

The **2009-2010** moderate-to-strong El Niño winter fueled a record-shattering season in Washington, D.C., delivering a historic 56.1 inches of total snowfall.

- December 18-19, 2009 Storm: Dropped 16.4 inches of snow ahead of the main winter peak.
- February 5-6, 2010 ("Snowmageddon"): Dumped roughly 18 to 24 inches of snow on the city.
- February 10-11, 2010 Follow-up: Added another foot of snow just days after Snowmageddon.

The **Virginia 2009-2010** Winter began with a December Snowstorm:

- December 18-19, 2009, western and northern parts of the state received 10 to 20 inches of snow or more

January 22-23, 2016. Impact: Dropped roughly 17.8 inches to over 2 feet of snow across the D.C. region, paralyzing the city for days.

- The 2-day storm dumped a new record of 29.2 inches of snow at BWI Airport, breaking the previous 2003 record.

Historically, El Niño and La Niña events tend to develop during the period Apr-Jun, and they tend to reach their maximum strength during Oct- Feb, typically persist for 9-12 months, occasionally persisting up to 2 years, and typically reoccur every 2-7 years.

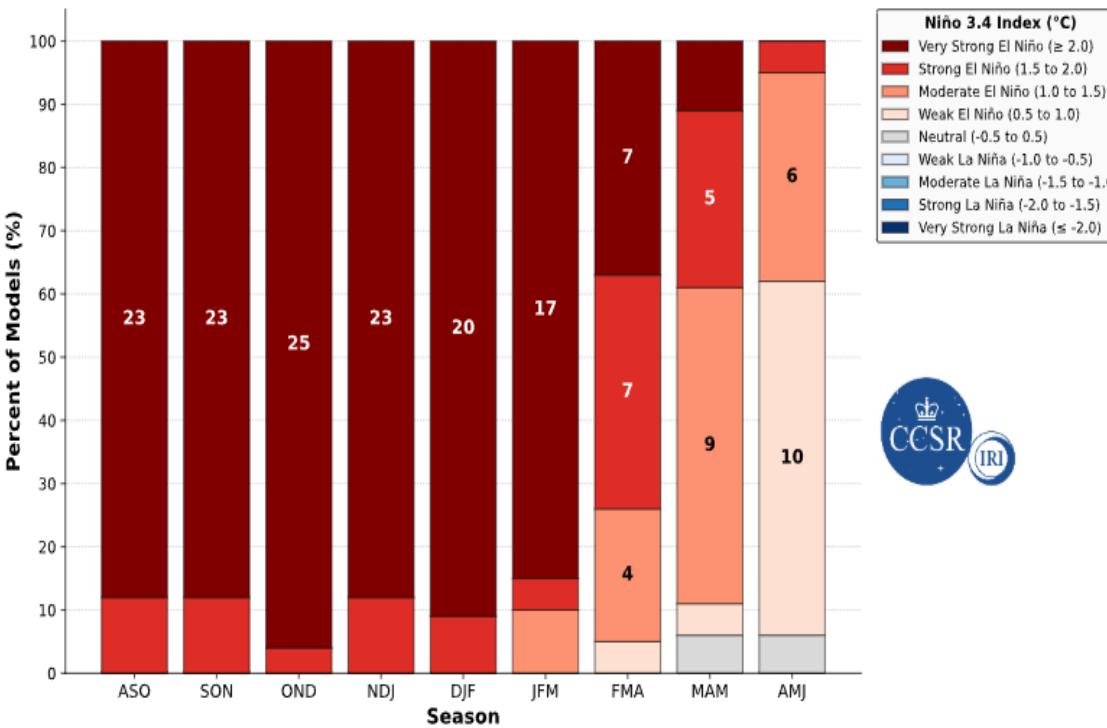
Past ENSO Years

El Niño	Neutral	La Niña
1897	1896	1904
1900	1898-1899	1909
1903	1901-1902	1910
1906	1905	1911
1915	1907-1908	1917
1919	1912-1914	1918
1926	1916	1925
1931	1920-1924	1934
1941	1927-1930	1939
1942	1932-1933	1943
1958	1935-1938	1950
1966	1940	1951
1973	1944-1949	1955
1978	1952-1954	1956
1980	1957	1962
1983	1959-1961	1971
1987	1963-1965	1974
1988	1967-1970	1976
1992	1972	1989
1995	1975	1999
1998	1977	2000
2003	1979	2008
2007	1981-1982	2011
2010	1984-1986	2012
2016	1990-1991	2021
	1993-1994	2022
	1996-1997	
	2001-2002	
	2004-2006	
	2009	
	2013-2015	
	2017-2020	

The CPC ENSO forecast is released at 9am (Eastern Time) on the second Thursday of each month.

https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/?enso_tab=enso-iri_plume

CCSR/IRI ENSO Strength Categories (Model Count: August, 2026)



MARYLAND'S MOST ACCURATE WEATHER

2nd WMAW EL NIÑO WINTER AVERAGES (1990-2023)

TYPE OF WINTER SEASON	AVERAGE (1990-2023)
All Winters	15.6"
All El Niño Winters	23.9"
Moderate to Strong El Niño Winters	29.6"

MARYLAND'S MOST ACCURATE WEATHER

2nd WMAW TOP FIVE SNOWIEST EL NIÑO WINTERS

1. 2009-10: 77"
2. 2002-03: 55.5"
3. 1986-87/82-83: 35.2"
4. 1965-66: 32.8"
5. 2015-16: 32.6"

El Niño – Helpful Trend Notes

The 1982-83 El Niño contributed to an estimated \$4.1 trillion in global income losses in the five years that followed, and the 1997-98 El Niño contributed to an estimated \$5.7 trillion in losses, according to [new research](#).

- The winter season of 1997-1998 with a very strong El Niño occurring was one of the wettest on record across California, with double the normal amount of rainfall and about \$850 million in flood and storm damage statewide.
- The winter El Niño season of 2002-2003 produced heavy rainfall across most of the Western US resulting in widespread power outages reaching over 1.1 million outages and torrents of floodwater causing damage. In coastal areas some sites saw 6 inches of rain in less than 24 hours while mountains saw heavy snowfall.

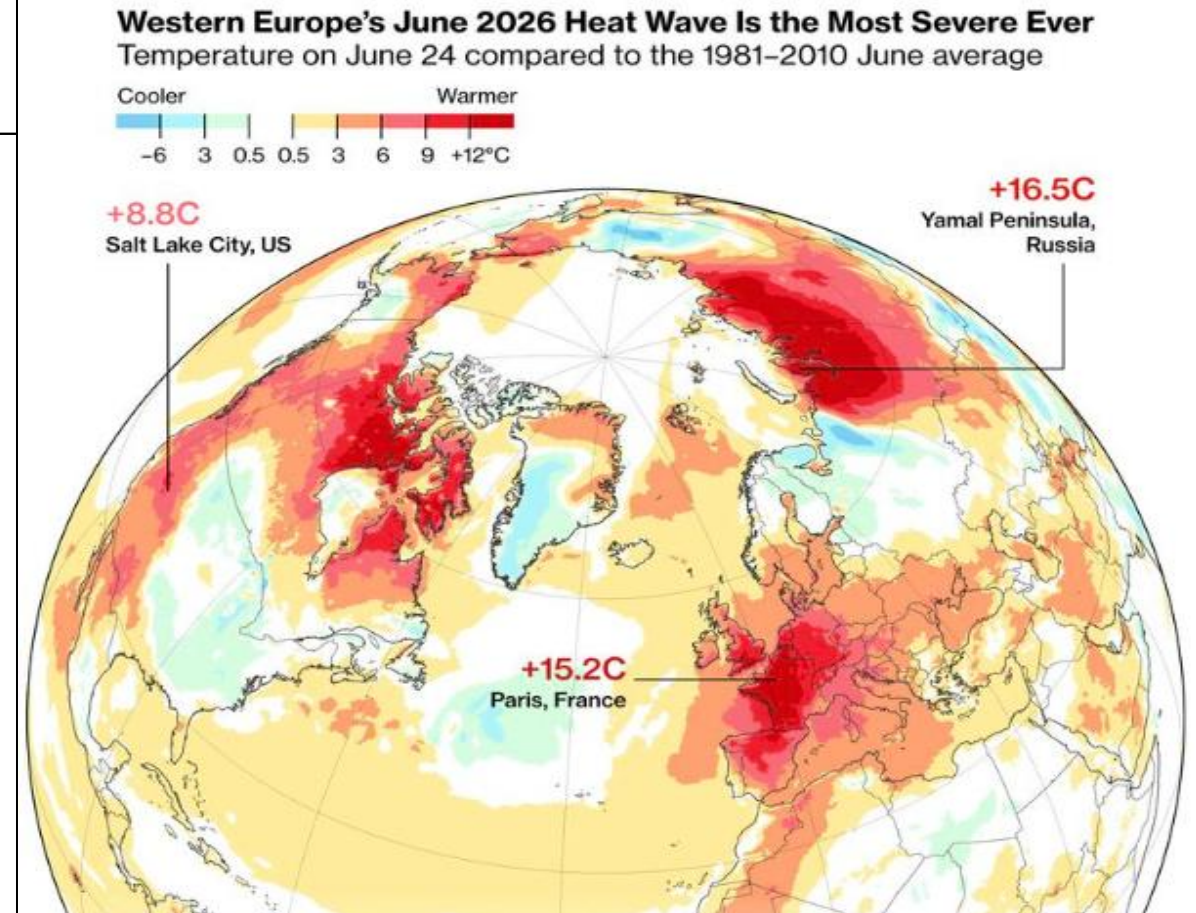
Median losses from incoming El Niño events could be at least \$3 trillion by 2029.

Major El Niño events can raise local sea level by around 6-10 inches in California during the winter rainy and stormy season through a combination of northward-propagating coastally-trapped Kelvin waves and thermal expansion of seawater.

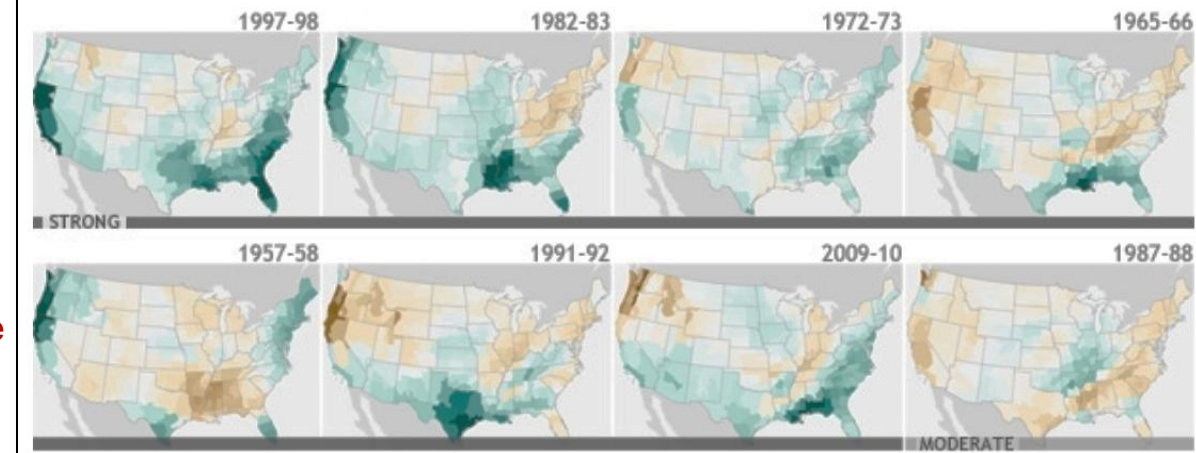
- While that might not seem like a lot, this (temporary) increase will occur atop an additional (permanent) 6-10 inches of sea level rise that has accumulated due to global warming over the past century.
- Levels could be as much as 2-3 feet higher than usual during major winter storms this year, and even higher than that should a storm coincide with the usual King Tides.

The odds of amplified or “blocking” high pressure systems in the Pacific Northwest is considerably higher during El Niño summers and autumns.

- That means that the odds of major heatwaves and fire weather events may be especially high in this region later this summer, and this could spell wildfire-related trouble given widespread drought.



Winter precipitation patterns during strong, moderate, and weak El Niño events since 1950



El Niño: Historic Comparisons

“Super El Niño” is simply a colloquial term used to refer to “very strong” El Niño events—i.e., those which are among the top 3 or 4 events in the reliable satellite record dating back to the late 1970s and characterized by an ONI/RONI value of +2°C or above.

In addition to boosting odds of a robust summer monsoon across the mountain and desert interior, there will likely also be an increased chance of abnormal convective activity across California.

Much like a snowflake, **no two El Niño, La Niña, or Neutral ENSO years are alike**. Some news outlets may attempt to draw correlations where there are none and may miss key connections to international impact.

- **2015**: Key events included historic Texas/Oklahoma floods, severe West Coast drought and wildfires, and a record-warm year for western states.
- **2016**: Key events included significant flooding in Louisiana and Texas, the destructive Gatlinburg wildfire, and severe drought.

El Niño - 28				La Niña - 25		
Weak - 12	Moderate - 7	Strong - 6	Very Strong - 3	Weak - 12	Moderate - 6	Strong - 7
1952-53	1951-52	1957-58	1982-83	1954-55	1955-56	1973-74
1953-54	1963-64	1965-66	1997-98	1964-65	1970-71	1975-76
1958-59	1968-69	1972-73	2015-16	1971-72	1995-96	1988-89
1969-70	1986-87	1987-88		1974-75	2011-12	1998-99
1976-77	1994-95	1991-92		1983-84	2020-21	1999-00
1977-78	2002-03	2023-24		1984-85	2021-22	2007-08
1979-80	2009-10			2000-01		2010-11
2004-05				2005-06		
2006-07				2008-09		
2014-15				2016-17		
2018-19				2017-18		
2019-20				2022-23		

Smoke particles can reduce the size of water droplets in cumulus clouds, increasing cloud reflectivity and potentially suppressing rainfall.

A recent study found that over the past 40 years, average yield losses due to ozone were 6.1% for soybean and 3.5% for maize, with soybean being more sensitive.

Wildfire smoke exposure lowers dairy cow milk production, reduces feed efficiency, and increases systemic inflammation.

Wildfire smoke significantly reduces egg production in chickens due to environmental stress, reduced lighting, and respiratory irritation.

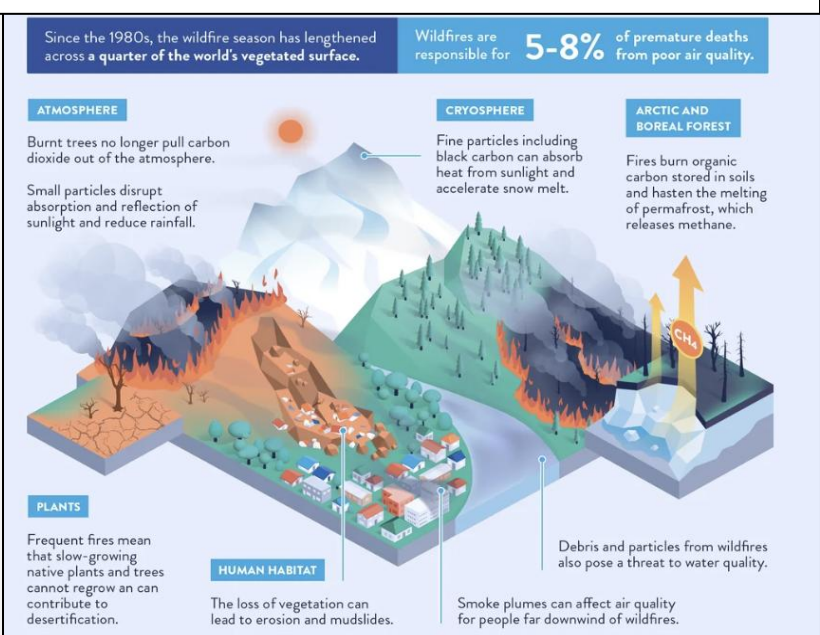
Smoke plumes actively scoop up, transport, and spread living fungal spores across long distances

Wildfire Smoke Crop Risks

A study across several agricultural areas in the U.S. found that wildfire smoke events have increased over time, affecting approximately 20% of growing season days, especially in July and August.

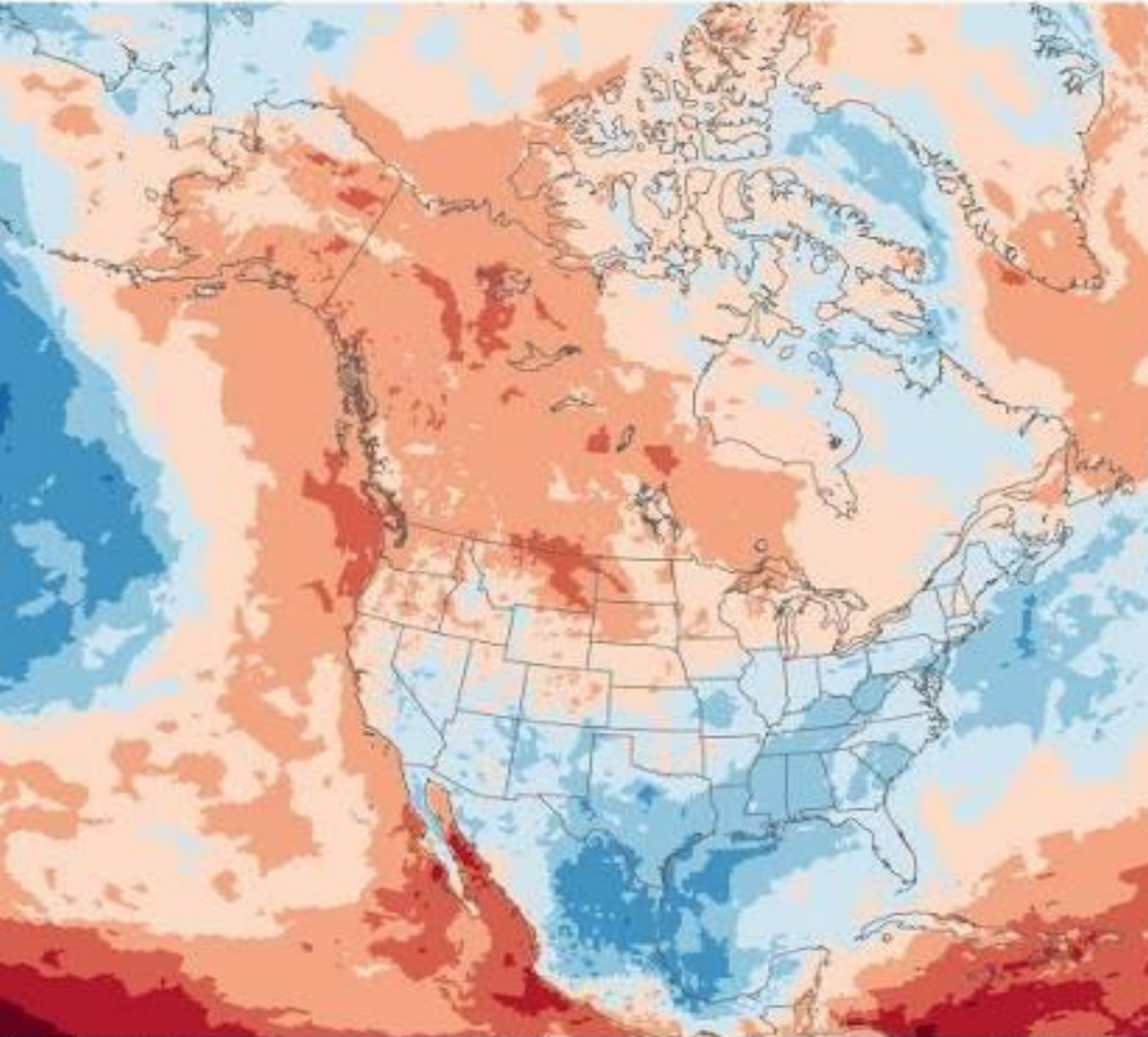
Dense wildfire smoke can reduce light intensity, limiting the energy available for photosynthesis and potentially slowing plant growth.

- Accumulation of particulate matter on leaves can interfere with normal plant function by promoting stomatal closure, reducing gas exchange, and limiting photosynthetic activity.
- Prolonged periods of haze may slow the accumulation of growing degree days (GDD), potentially delaying crop development and maturity.
- In northern production regions with shorter growing seasons, such delays could increase the risk of frost damage to crops before physiological maturity

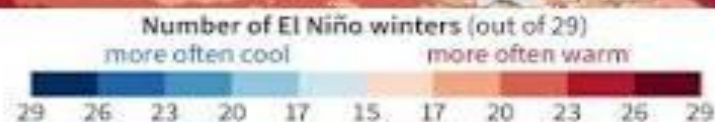


What May El Niño Bring Throughout the 2026-2027 Winter

How often have El Niño winters been **cooler than average** vs. **warmer than average**?

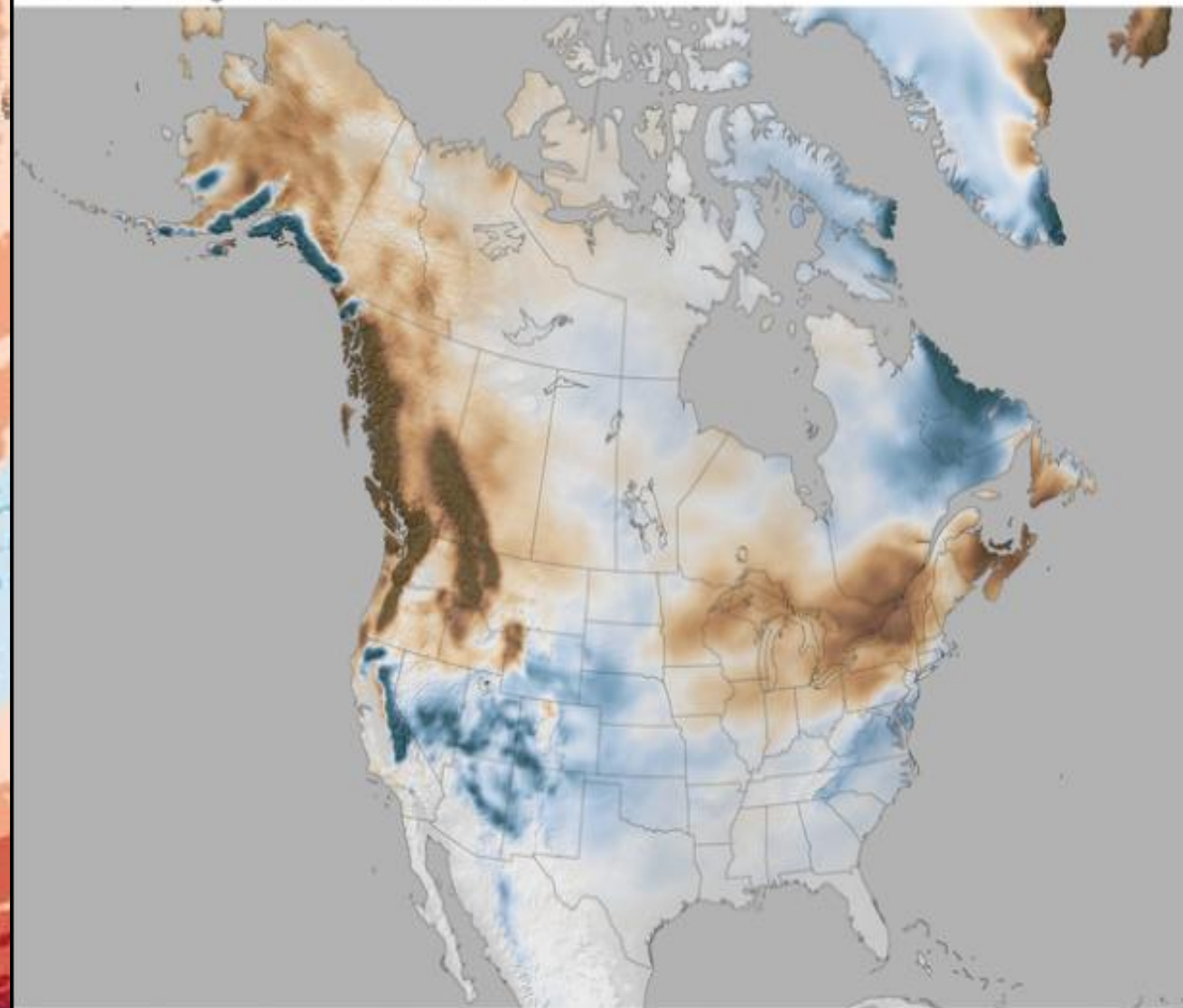


December-February



NOAA Climate.gov
Data: ECMWF ERA5

Snowfall during all El Niño winters (Jan-Mar)



El Niño winters (1959-2023)
vs. 1991-2020 average
(detrended)

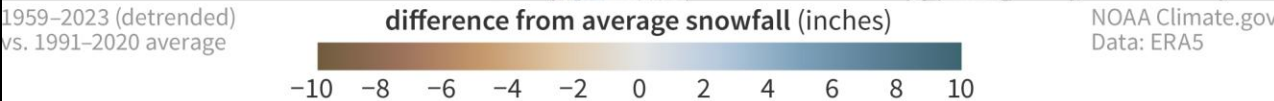
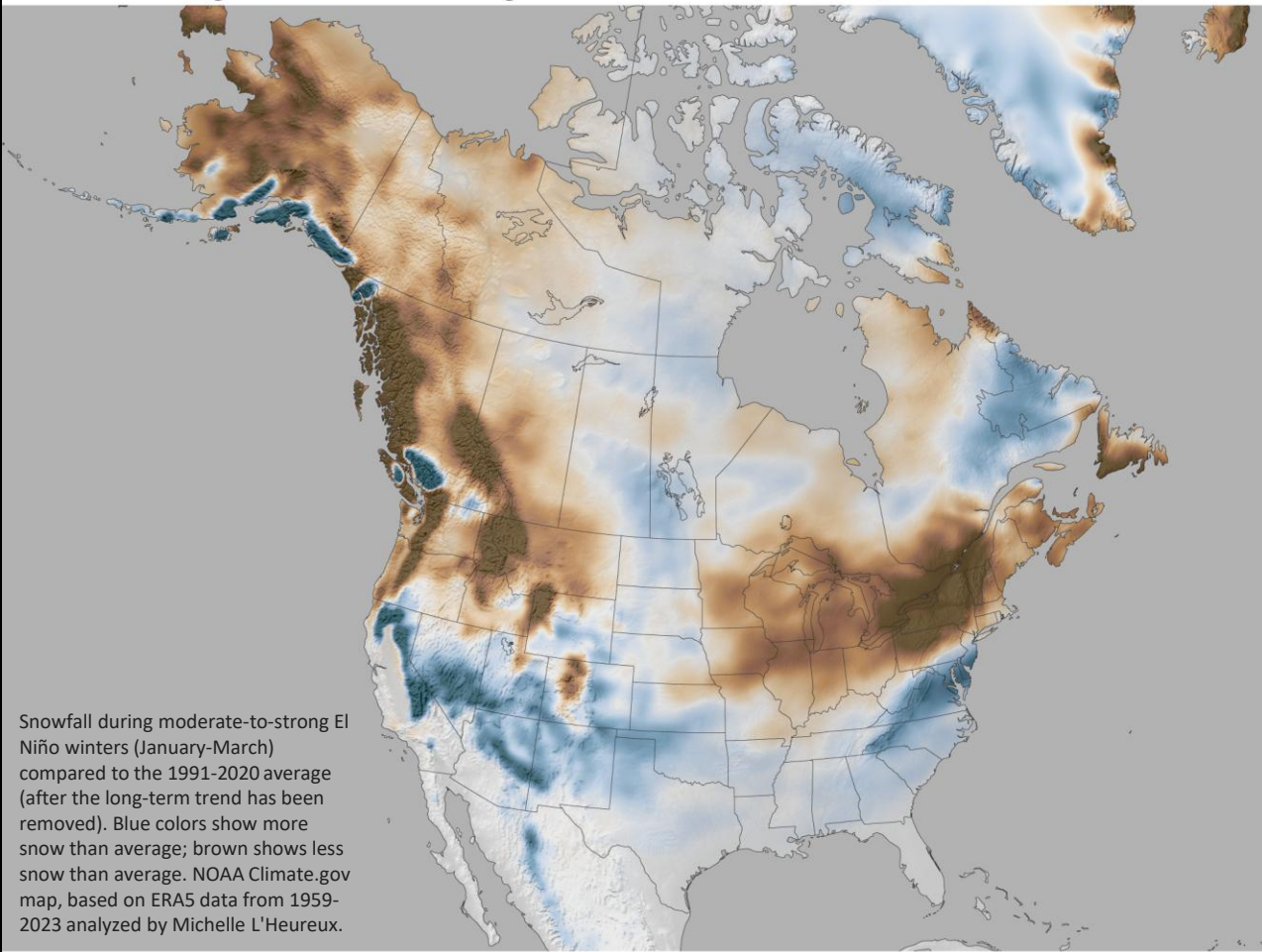
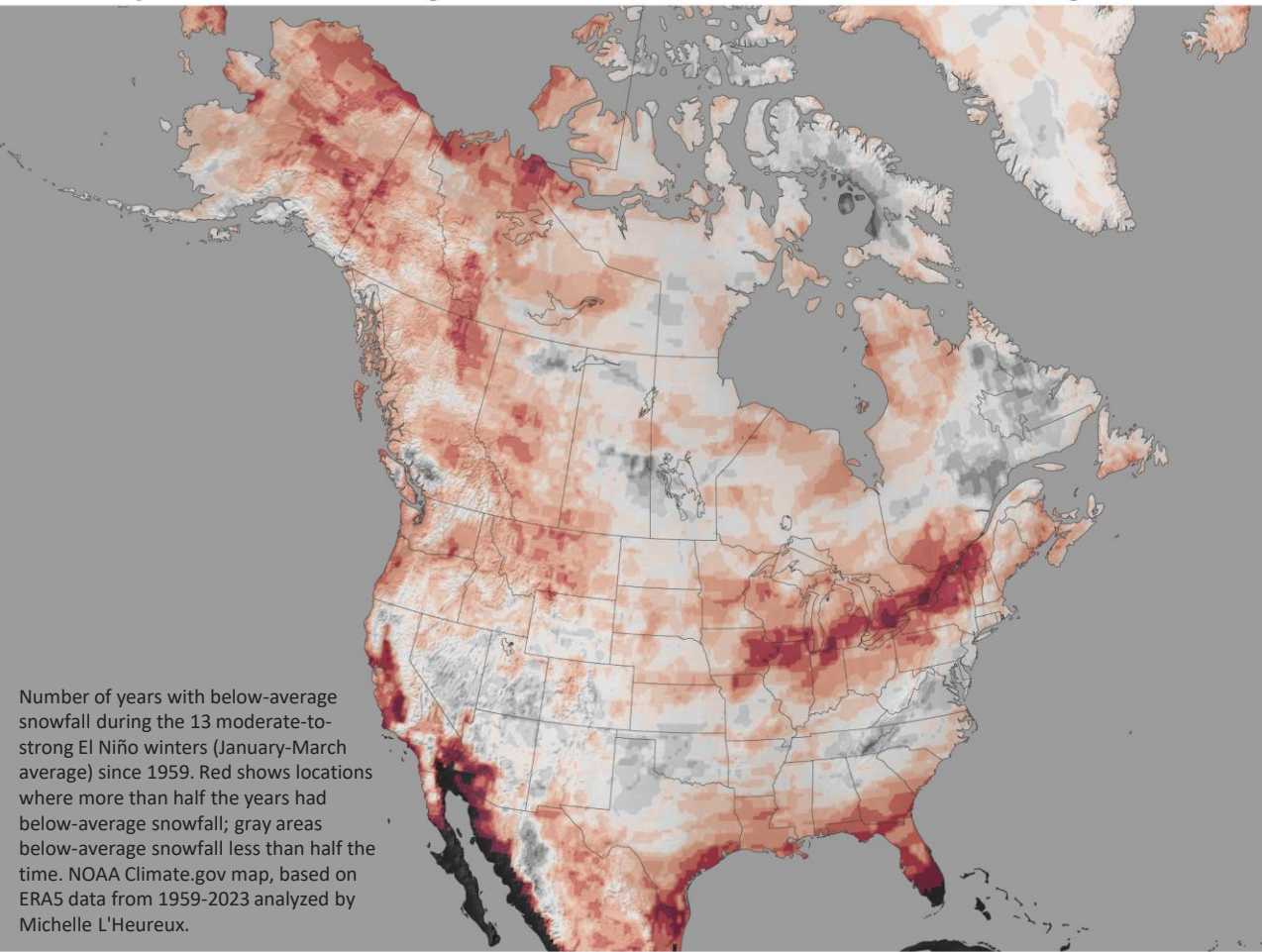


NOAA Climate.gov
Data: ERA5

ENSO Index: Strong El Niño Winter Risk

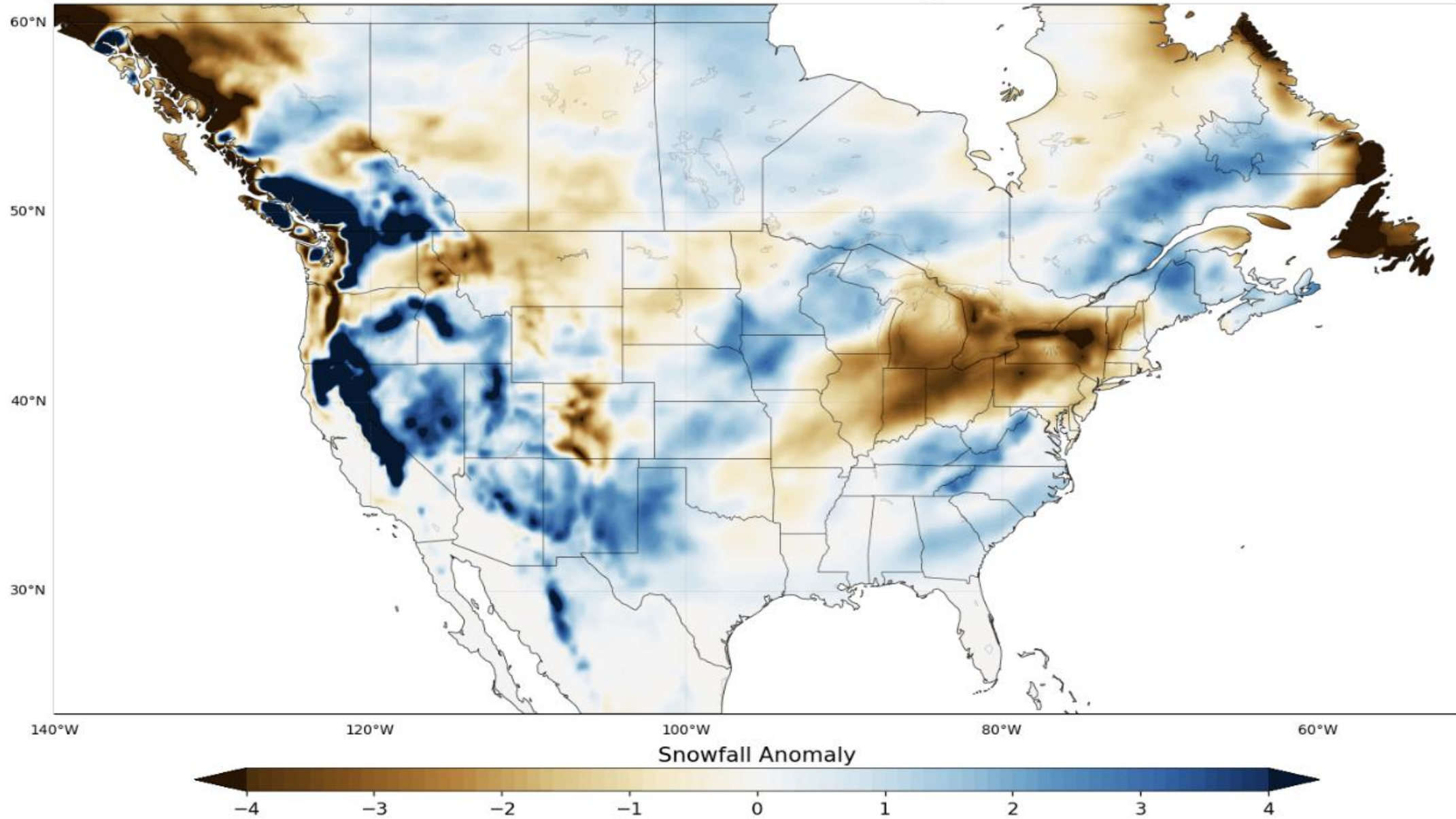
The El Niño of 2015-16 equaled the El Niño episode registered in 1997-1998. These two episodes are the strongest El Niño events observed in the recent decades. However, when measuring additional parameters, such as shifts in atmospheric deep convection and subsurface ocean temperatures, the 2015-16 event was weaker than the great El Niño of 1997-98 bringing especially unseasonal warmth in Quebec, the central Prairies, and Yukon.

How many moderate-to-strong El Niño winters (Jan-Mar) had below-average snowfall? Snowfall during moderate-to-strong El Niño winters (Jan-Mar)



Winter (Dec-Jan-Feb) - 1973, 1983, 1998, 2016 Analysis

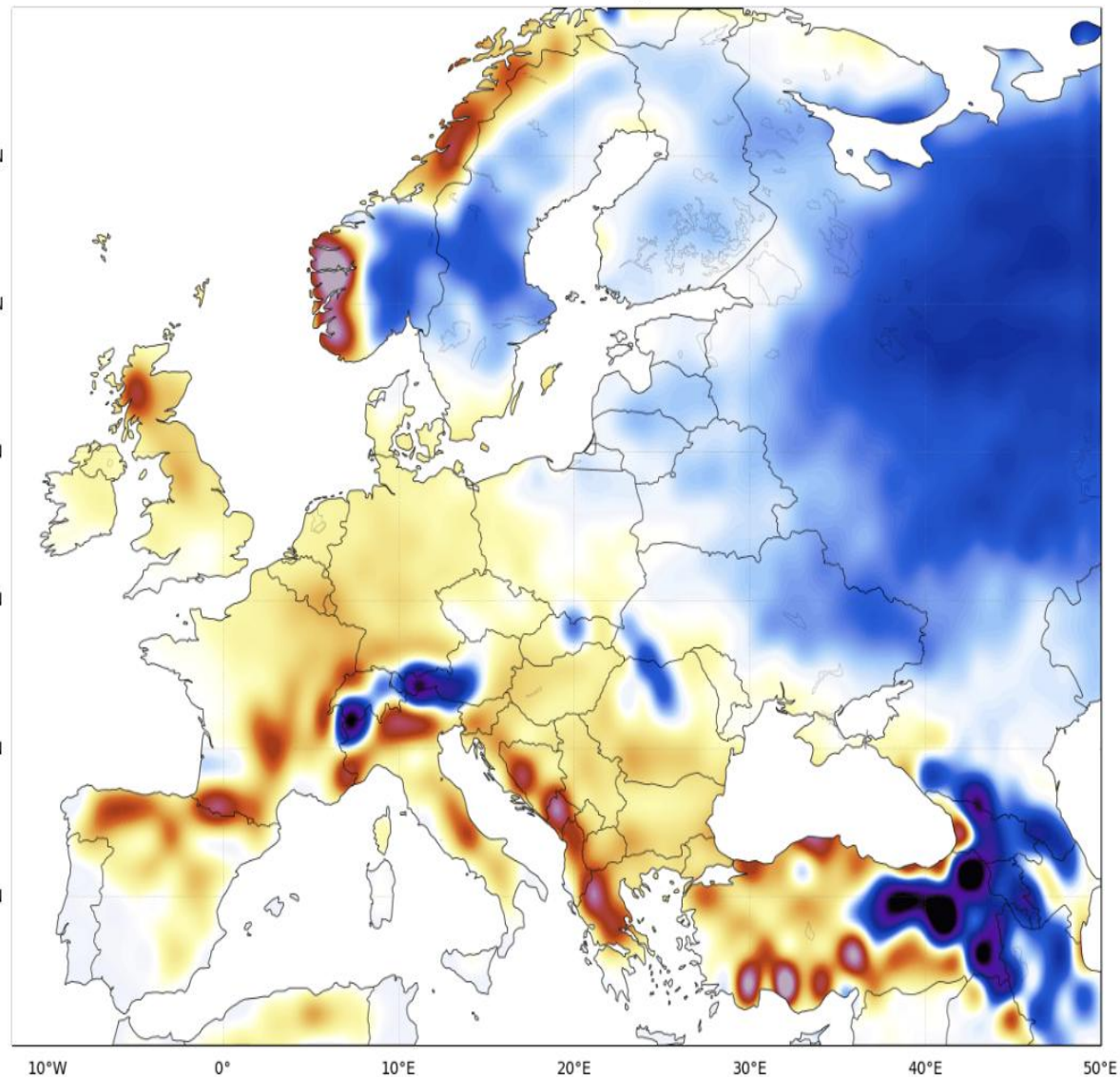
Data: ECMWF ERA5 1980-2010 Climatology



Andrej Flis (@Recretos) - www.severe-weather.eu

ECMWF Seasonal Forecast - Winter 2026/2027 Snowfall (Dec-Jan-Feb)

Data: ECMWF Init run: August 2026



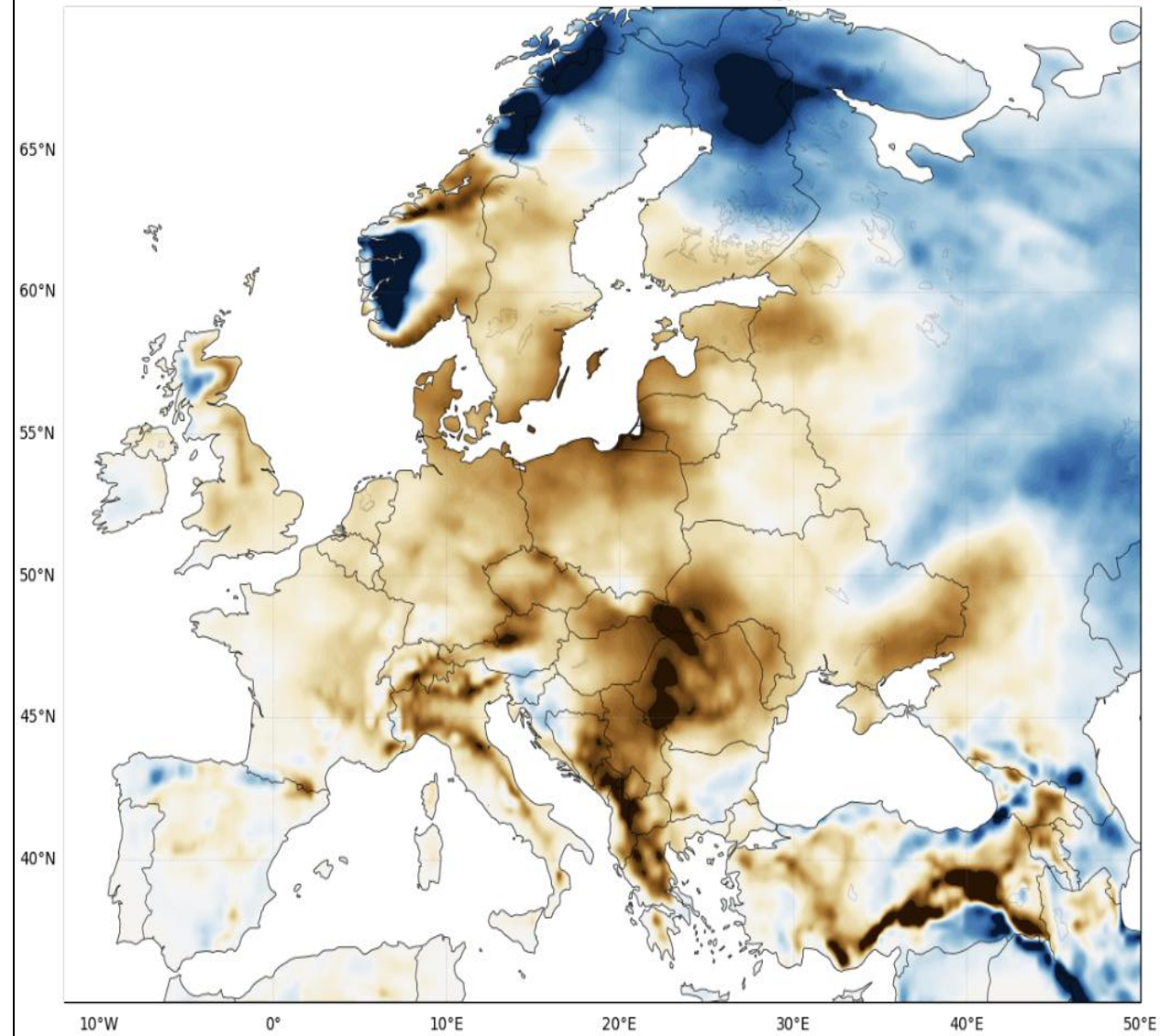
Snowfall Anomaly

-10 -8 -6 -4 -2 0 2 4 6 8 10

Andrej Flis (@Recretos) - www.severe-weather.eu

Winter (Dec-Jan-Feb) - 1973, 1983, 1998, 2016 Analysis

Data: ECMWF ERA5 1980-2010 Climatology



Snowfall Anomaly

-4 -3 -2 -1 0 1 2 3 4

Andrej Flis (@Recretos) - www.severe-weather.eu

The weakening polar jet stream

The pressure difference between cold air in the Arctic and warm air in the mid-latitudes creates the powerful belt of wind we call the “polar jet stream.” This natural barrier keeps the freezing temperatures of the Arctic winter from intruding further south.



When the polar jet stream is strong, powered by large temperature differences between the Arctic and mid-latitudes, it moves relatively straight. This keeps the coldest winter temperatures in a predictable ring: the Arctic environments of Alaska, northern Canada, Greenland, Siberia and Scandinavia.



A warming Arctic produces a weaker jet, more likely to bend off course. This wavy pattern can shift the boundary between cold Arctic air and warm mid-latitude air to strange places. Southerly regions used to mild winters may be exposed to freezing temperatures at the same time that parts of the Arctic deal with unusual warm spells.

Strong El Niño events can send more planetary wave energy into the stratosphere, frequently disrupting or weakening the polar vortex.

- When the polar vortex weakens or splits, it loses its grip on tight Arctic air containment, allowing severe cold outbreaks and winter storms to push south into North America and Europe.
- Experts warn a strengthening Super El Niño could drive a volatile, storm-heavy 2026–2027 winter.

FROST QUAKES

THE SCIENCE BEHIND THE BOOMS

- ▶ Groundwater freezes and **expands** due to **rapidly** dropping temperatures
- ▶ Frozen water takes up more space than liquid water, creating internal pressure
- ▶ Pressure from the expanding ice forces the ground to crack
- ▶ The sudden cracking can produce **loud booms** or sustained rumbling



⚠ POTENTIALLY STARTLING!

THIS WILL BE MOST LIKELY IN RAPIDLY DROPPING TEMPS

12" of Snow



6,240 lbs
Fluffy Snow
15:1 Ratio
4.1 lbs/sq. ft.

9,360 lbs
Normal Snow
10:1 Ratio
6.2 lbs/sq. ft.



18,720 lbs.
Wet Snow
5:1 Ratio
12.5 lbs/sq. ft.



6 TIPS TO HELP YOU

Prevent Freezing Pipes

If you're concerned about pipes freezing in your home, here are some simple maintenance tasks you can do to help prevent frozen pipes and the damage they can cause.

- 1 Keep garage doors closed during the winter months.



- 2 Insulate exposed and vulnerable pipes with insulating foam or fiberglass sleeves. You can purchase these items at your local home supply store.

- 3 Close and/or cover vents or windows in the basement to maintain a warmer environment.



- 4 Open cabinet doors underneath sinks to allow heat to enter.

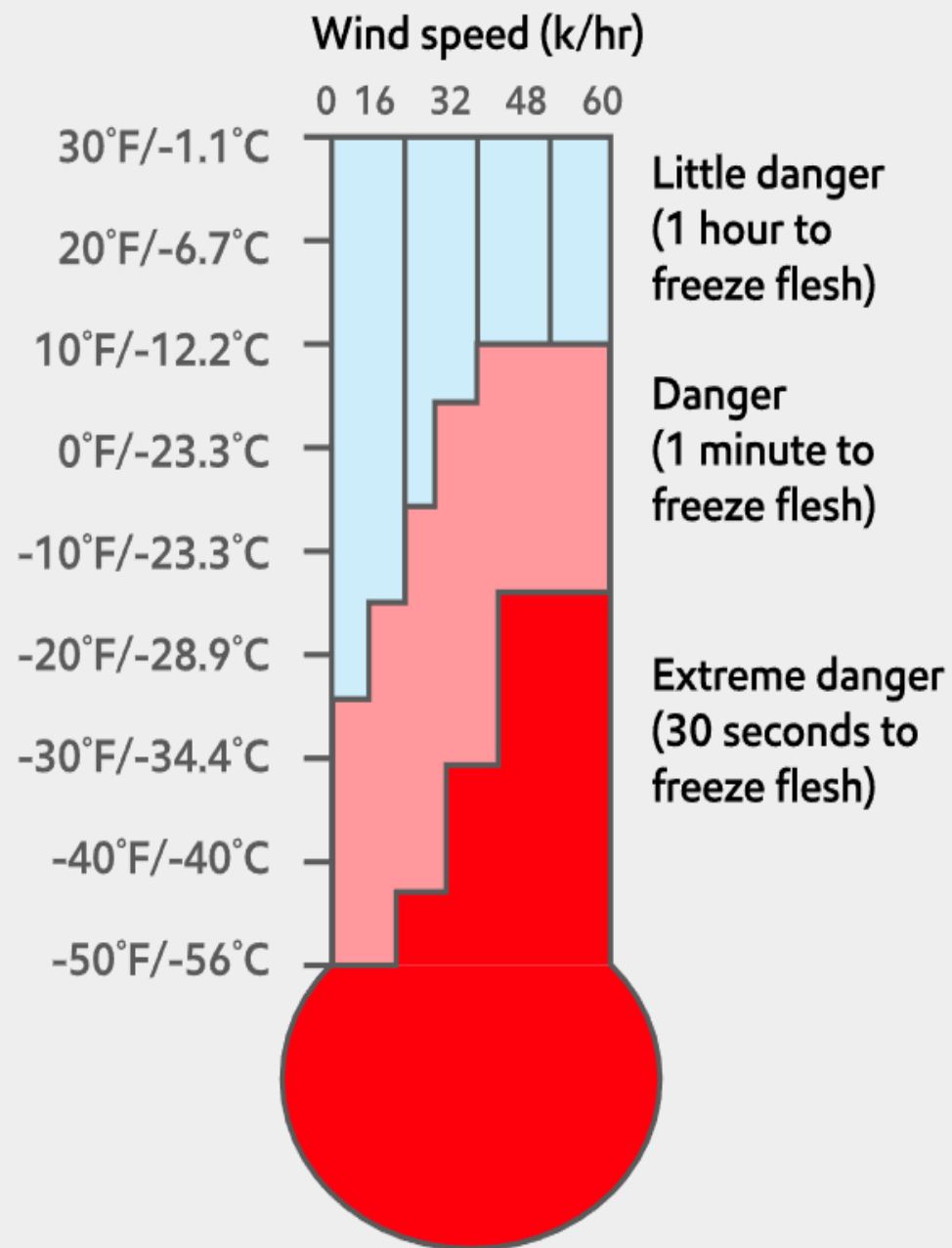
- 5 Set the thermostat to a minimum of 55° F when leaving your home for an extended period of time.



- 6 Maintain your heating equipment to ensure reliable performance throughout the heating season.

If a pipe bursts, shut off your water supply immediately and call a qualified plumber.

Wind-Chill Dangers



Date | 2026-09-14 00:00 Local ↔ UTC

Data | Wind @ 500hPa
Temperature @ 500hPa

Source | GFS / NCEP / US National Weather Service

Scale | 

Control | Now  « < > » Grid  HD 

Mode | **Air** Ocean Chem Particulates Space Bio

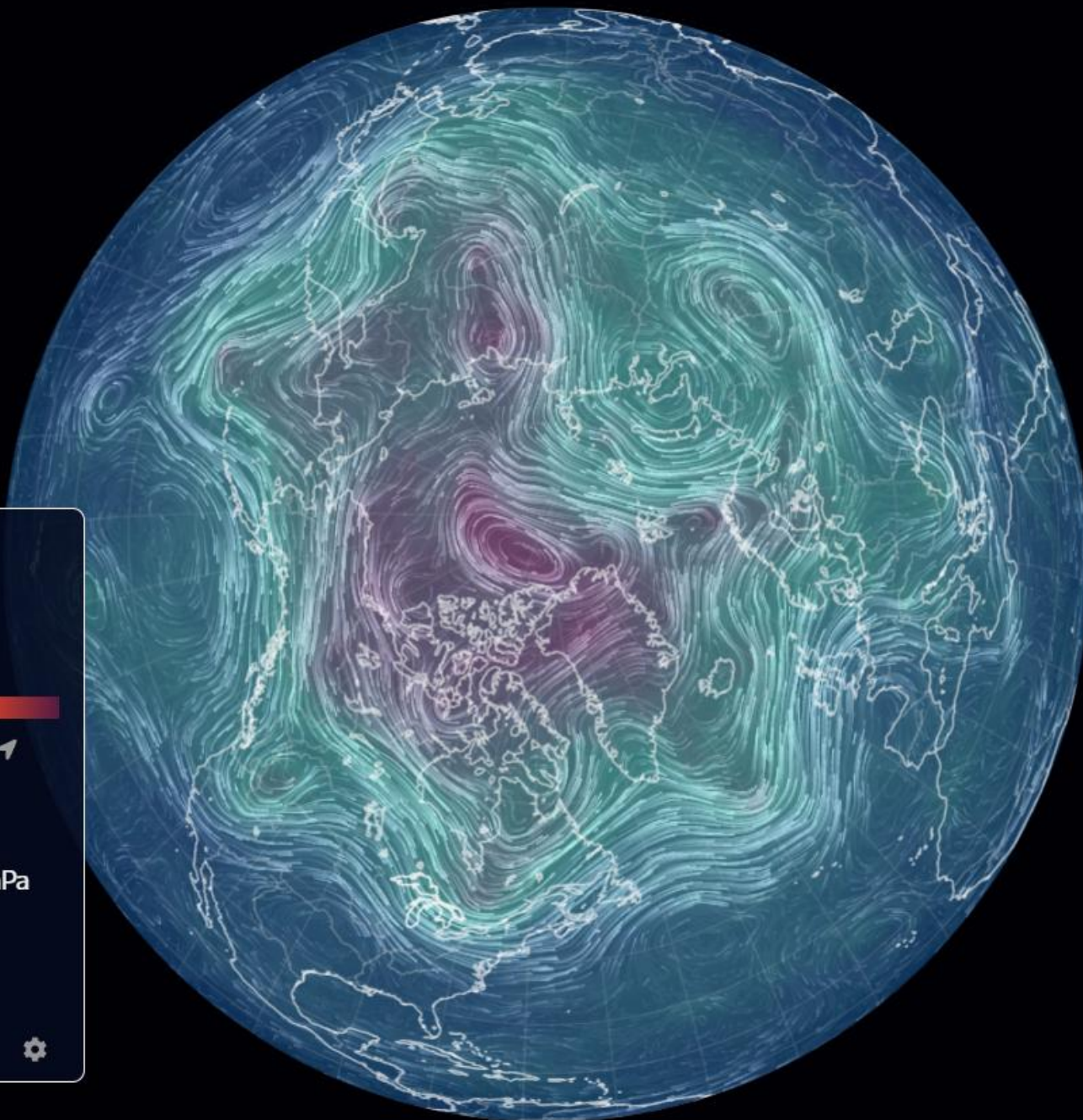
Animate | **Wind** Currents Waves

Height | Sfc 1000 850 700 **500** 250 70 10 hPa

Overlay | Wind **Temp** RH Dew WBT 3HPA CAPE
TPW TCW MSLP MI UVI WPD None

Projection | A CE E EQ **O** P S WB W3

about       feedback 



Changes to Tides: Higher Wave Heights

During El Niño years, Virginia experiences a notable increase in coastal wave heights and flood risks, primarily driven by regional atmospheric shifts alter wind patterns over the Atlantic, often translating to sustained wind events that push massive volumes of water directly toward Virginia's beaches and bays.

- Water around Hampton Roads is up to 14 inches higher than it was in 1950.

High tide flooding occurs when water levels exceed 1-2 feet above the daily average high tide (the threshold for minor high tide flooding).

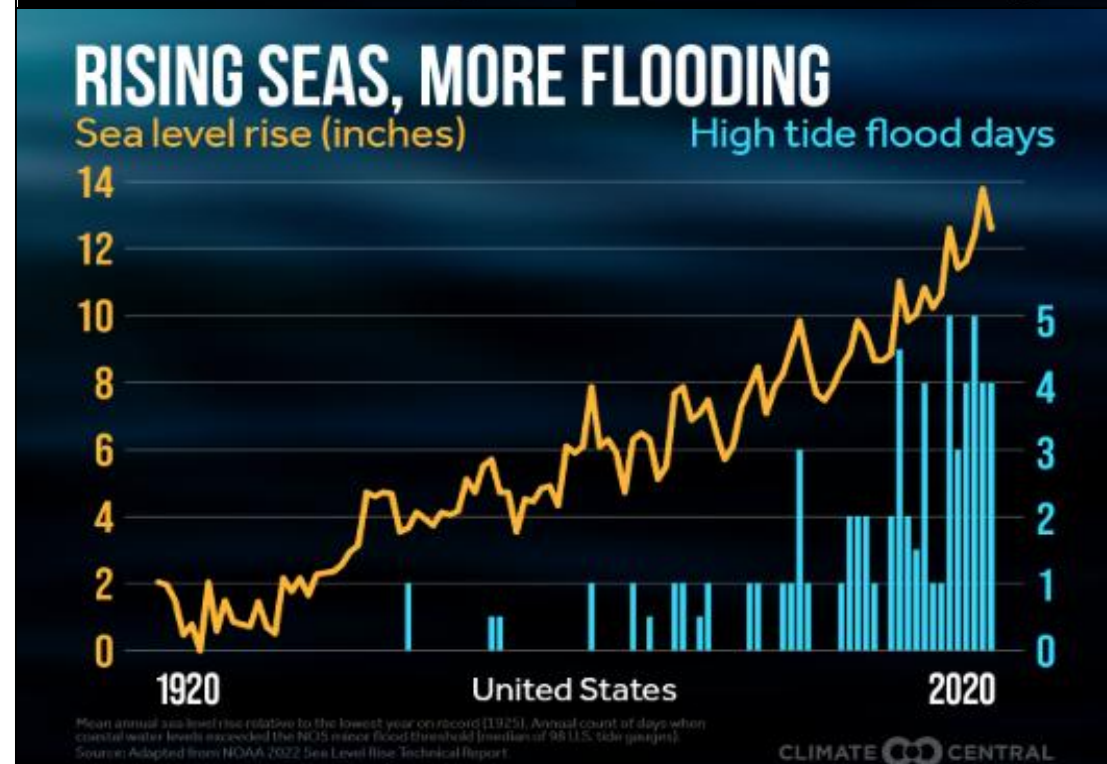
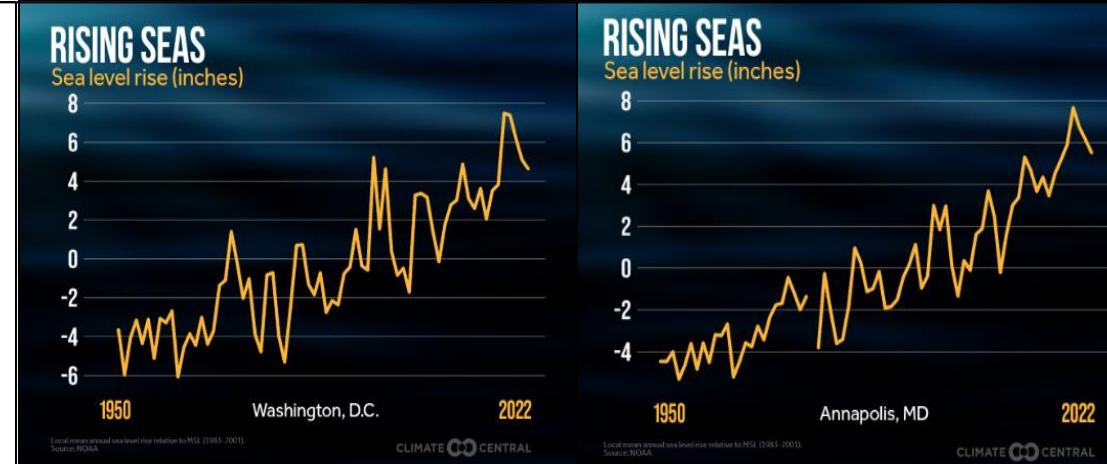
Sea levels along Maryland's coast are up to 10 inches higher than they were in 1950.

- Cities like Annapolis and Baltimore rank among the top nationwide for worsening high-tide "nuisance" flooding, which occurs independently of major storms.
- With more sediment deposit at the mouths of rivers from amplified flash flood runoff, result in greater rates of erosion and faster loss of sea floor.

Ocean eddies are getting stronger and more energetic across major parts of the world's oceans. Satellite observations and ocean studies show that swirling eddy activity is intensifying.

- Eddies alter localized nutrient distribution and water temperatures. This can disrupt plankton cycles—the foundation of the Chesapeake Bay food chain—and create optimal environments for harmful algal blooms that threaten the region's economically vital oyster and blue crab populations
- Higher sea surface temperatures feed energy into the atmosphere, creating stronger winds that generate bigger waves and greater wave power.

A new study finds *the strongest nor'easters have intensified over the last 80 years, with a 6% increase in peak wind speeds resulting in a nearly 20% increase in destruction potential.* <https://www.pnas.org/doi/10.1073/pnas.2510029122>



Defined Threat: Condensed Period to Adjust

The change in heating is not just that it is baseline creeping upwards, it is that we built to norms from a window of time in stable conditions that we will not be returning to during the next few lifetimes. This means infrastructure was simply not built to withstand.

- The weather hazards defined in previous slides will amplify rapidly in coming decades as the temperature continues to rise.
- Acclimation periods will reduce rapidly as temperatures vary outside of human capacity, and materials will face comparable strain.

When comparing the historic warming period, it is critical to annotate which materials shift from rapid heating and may push against or pull away from partnered materials or stress the binding type for future concerns of structural stability.

Chief Meteorologist Sunny Wescott

Executive Director – Geospatial Intelligence

Information Sharing and Analysis Center

Emergency Response and Operations Support

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Sunny@unlimitedweather.com

