2024-25 Willamette Valley Winter Weather Predictions

By: Tanis Leach

Disclaimer

- This is a long-range forecast and is intended to provide a general sense of what may happen in the coming months. It is not a “this is for sure happening,” nor is it an excuse not to be prepared for a wind/snow/ice storm or cold temperatures.

2023-24 Scorecard

Predictions	Actual/Projected	Oct	Dec
Water Year Rain: 31-39" (Dec: 33-41") Winter less than 14.97"	39.9"	✗	✓
Average Temperature Departure: Within 1.5°F of Average Dec: 0-3°F above average	1.7°F Above Average	✗	✓
Lowest Winter Temperature: >20°F	15°F	✗	✗
Peak Wind Gust: 45-55 mph December Update: <49 mph	47 MPH	✓	✓
Most Active Time: December Dec Update: Dec 25 to Jan 25, Mar 1-10	Jan 9-20th, March 1st-10th	✗	✓
April 1st Snow Depth: 75-110% of normal December Update: 60-100% of normal	~85% Basin, 84% at the Snowtel. 70-100% at lower elevations	✓	✓
Valley Snowfall: 0-3" (1-5" in Central/South Valley) December Update: 0-3" entire valley.	Portland: 1.6 in. Eugene: 1.4 in. All Valley Average (Population Weighted): 2.69 inches	✓	✓

Methodology

- Adjusted analog year approach using:
  - ENSO via the Oceanic Nino Index (ONI) and confirmed using the Southern Oscillation Index (SOI).
  - Pacific ~~and Atlantic Multidecadal Oscillation~~ (PDO ~~and AMO~~).
  - Quasi-Biannual Index (QBO) (Note: This is experimental for at least this year)
  - Sunspot Count.
  - **Analogs are not weighted equally. Analogs closer to this year's conditions have a higher weighting.**
- Adjustments to analog years made using statistical analysis (since 1940):
  - If there is a statistically likely/unlikely chance (90%) of something occurring, analogs will be adjusted unless there is a clear trend in the analog years showing the opposite.
  - General trends based on the previous season when appropriate.
- Snow before the 1970s has been adjusted to a 4.3-inch average per winter on analogs.
- Temperature departures adjusted to averages at the time they occurred.
- All forecasts will cover what has happened in 1 out of 3 winters at the Portland Airport.
- Analogs now go back to 1872.


Data and Oscillations

ENSO Outlook: The US's Look

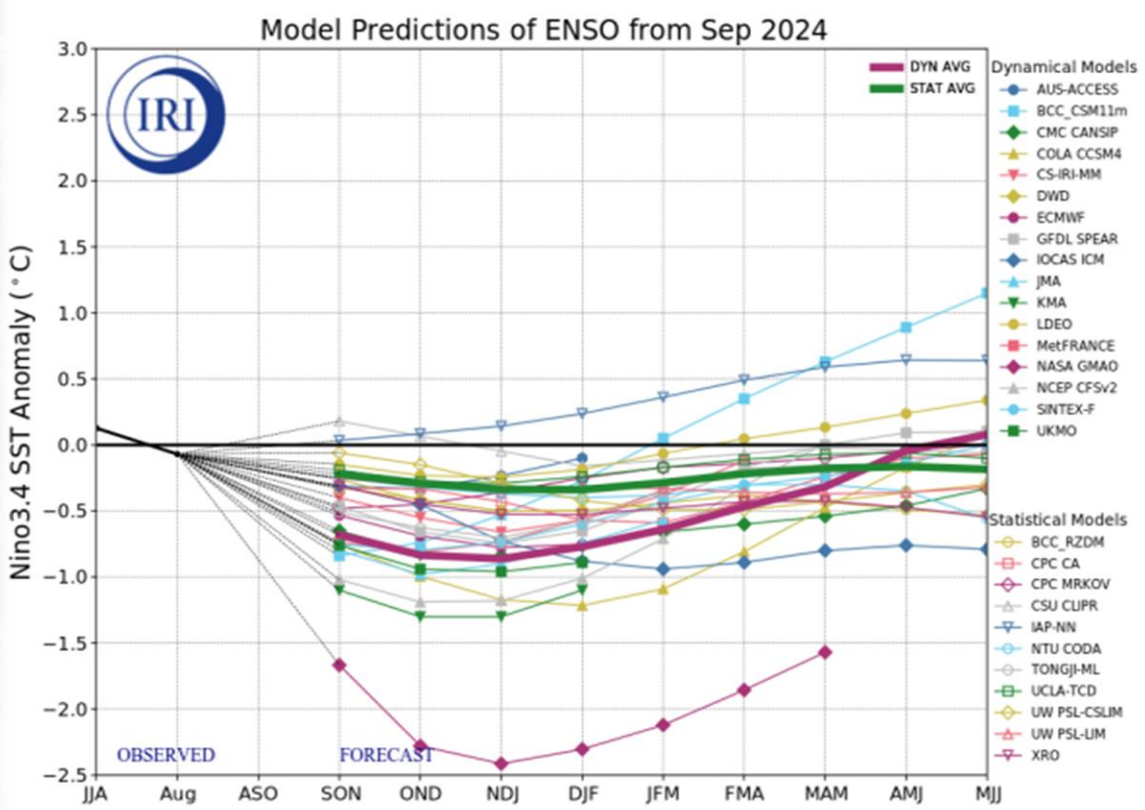
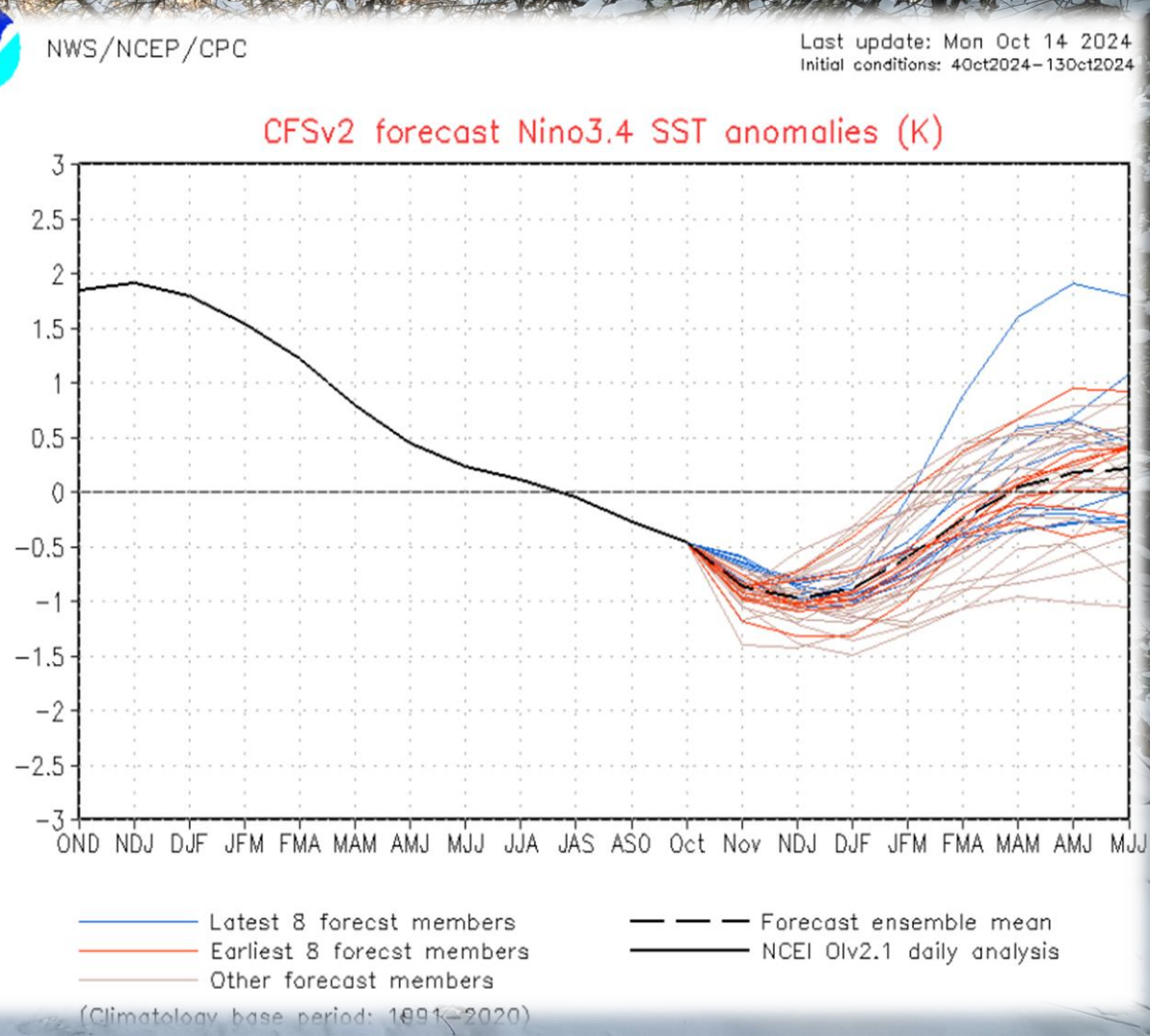
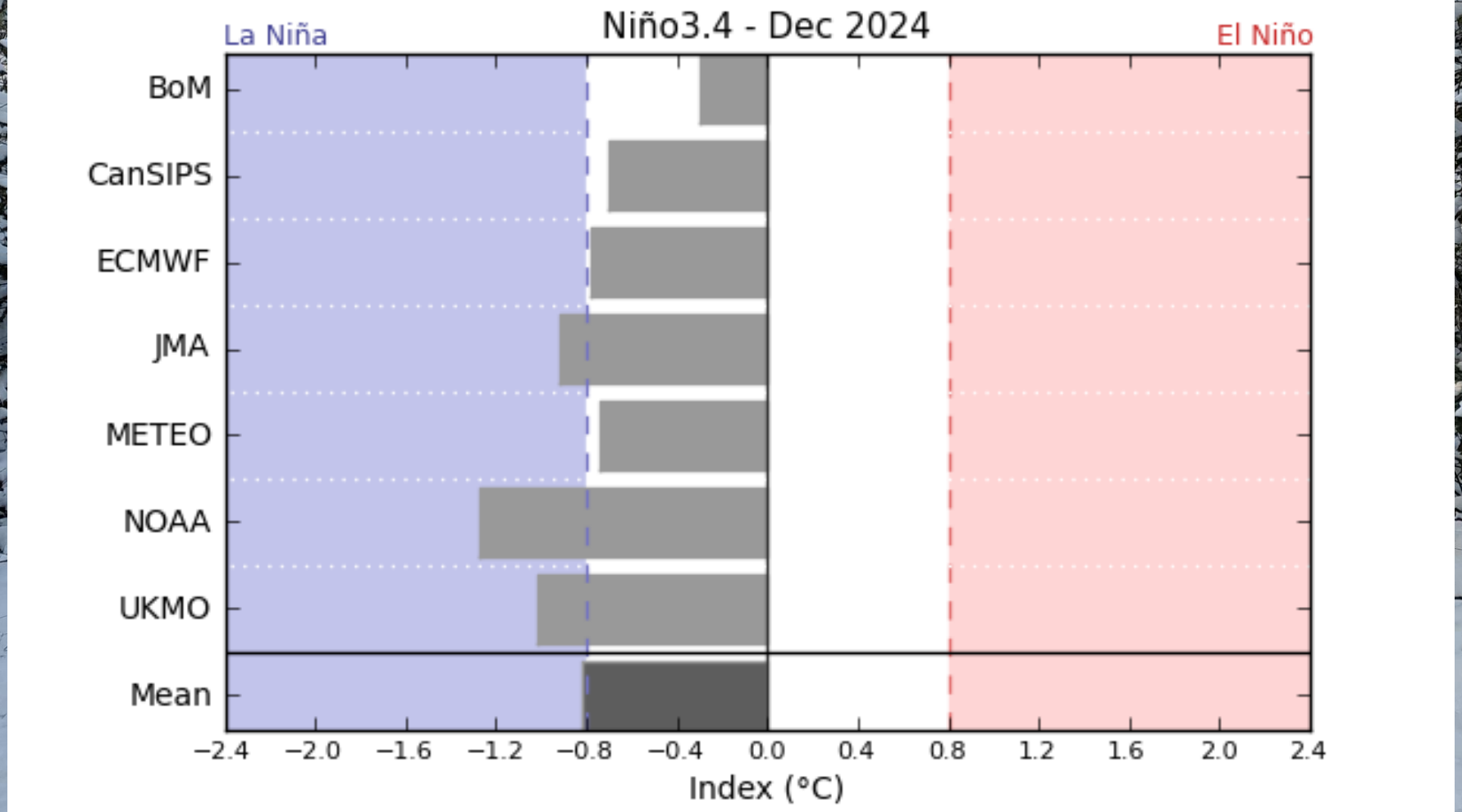


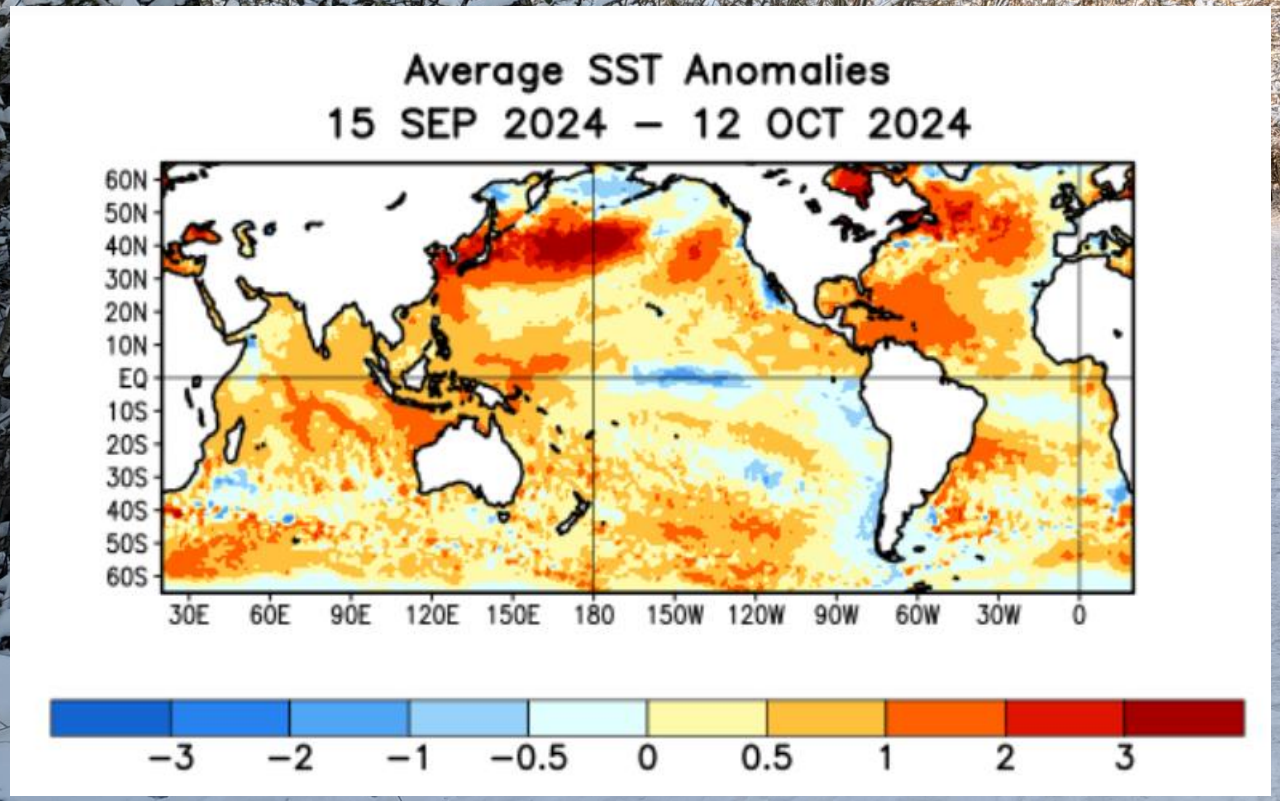
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 September 2024).

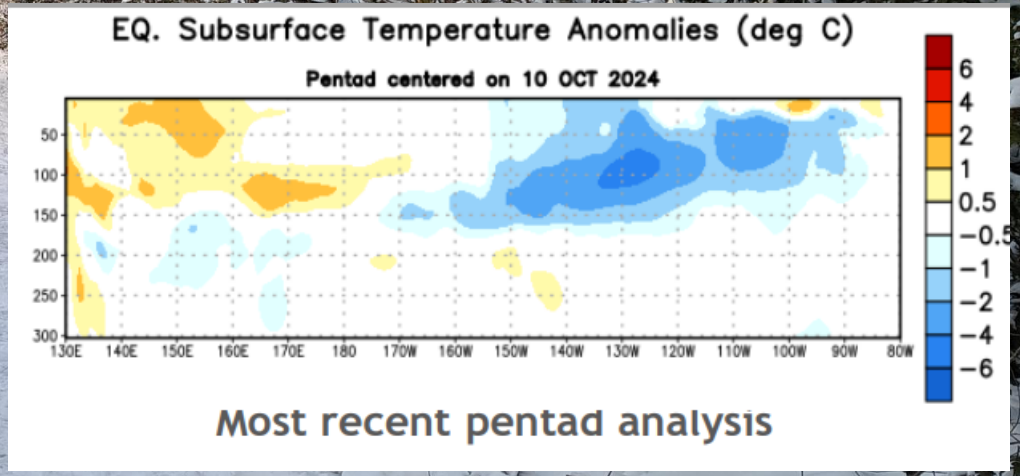


ENSO Outlook: The World's Look

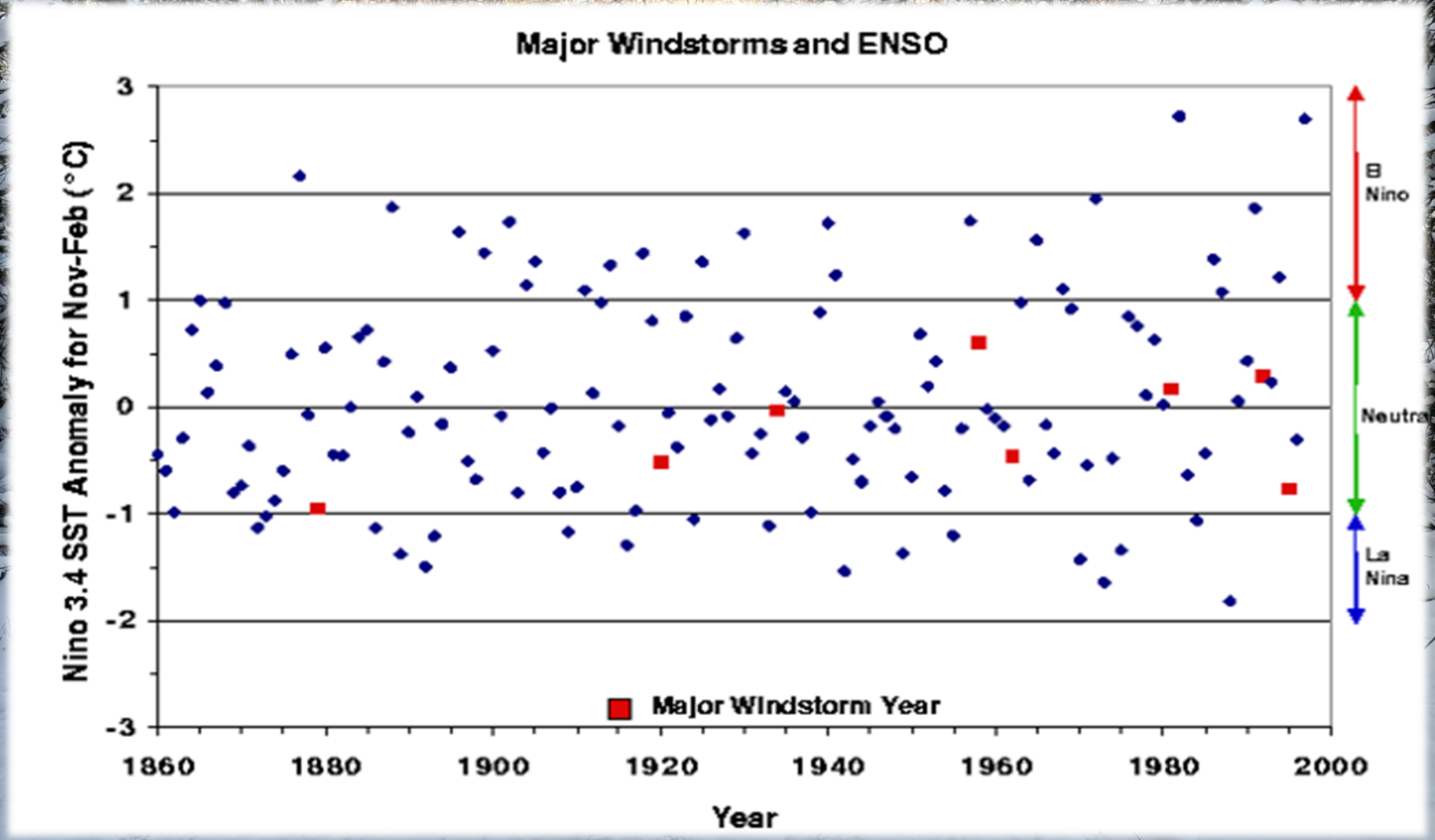


Ocean Temperatures: At the Surface





Major Windstorms and ENSO



What Happens During These ENSO States

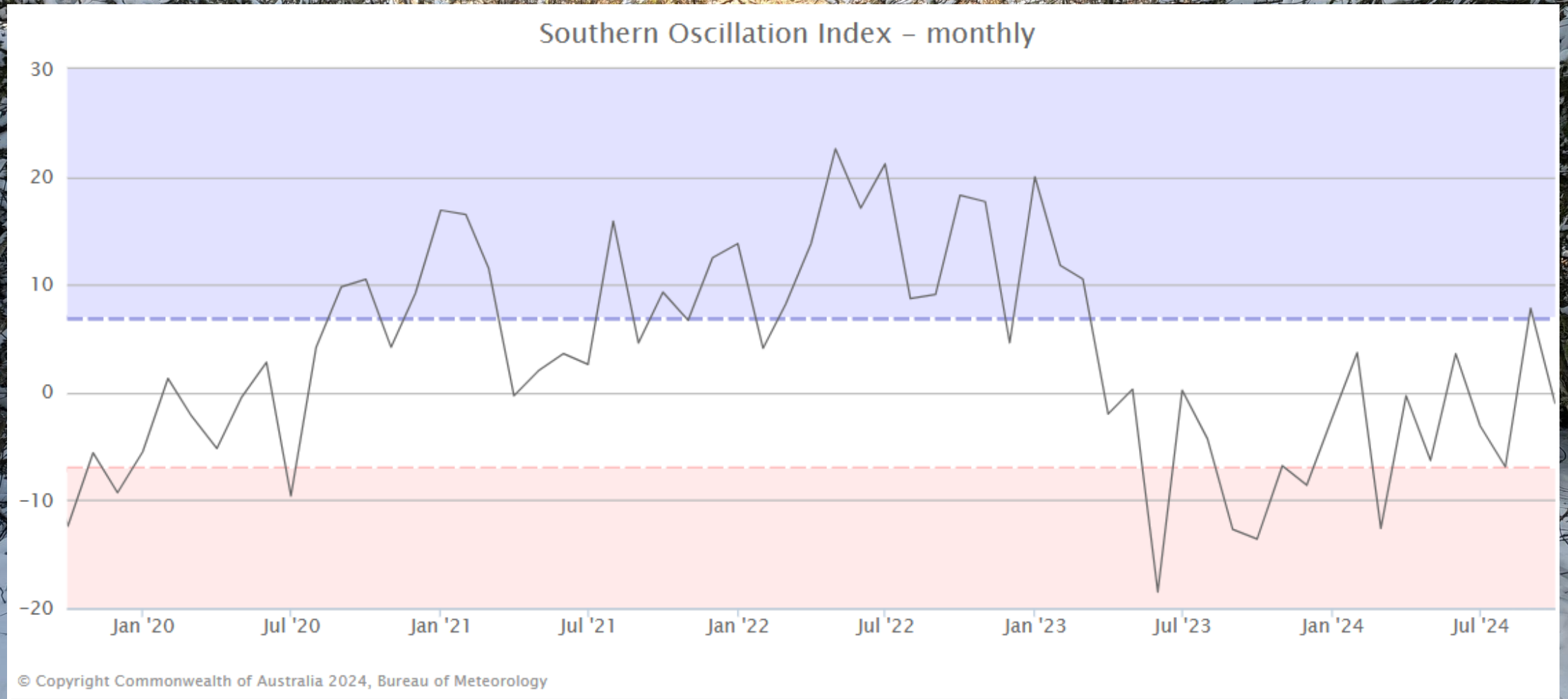
Neutral

- Median snowfall 2.6 inches
- Average temperature (decade adjusted): -0.06°F.
- Median lowest temperature: 19°F
- Water year rainfall median: 32.5” at PDX
- Typical Mountain snowfall.

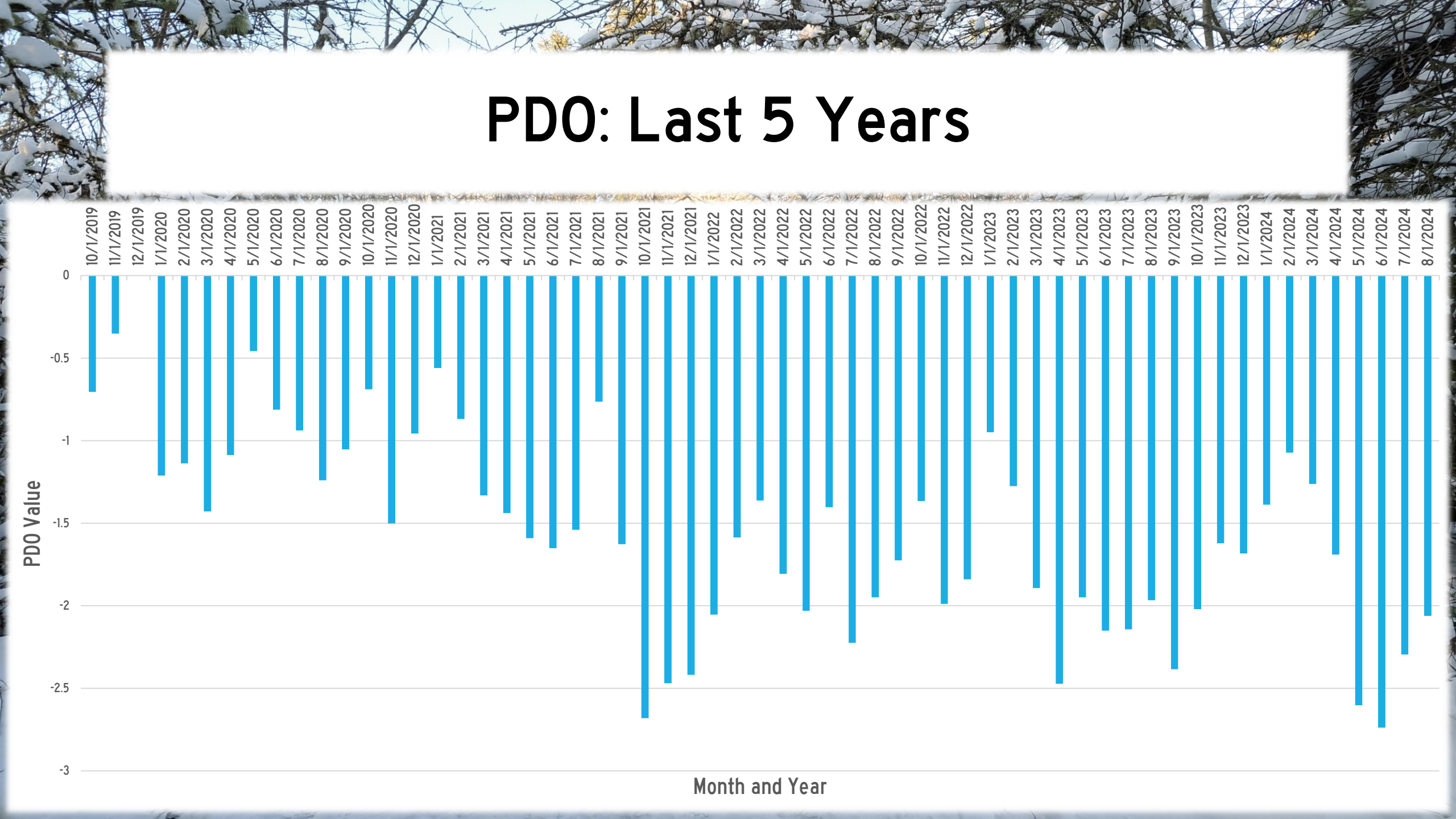
Weak La Ninas

- Snowiest ENSO state, with a median of 7.3” (adjusted)
- Average temperature (decade adjusted): -0.64°F.
- Median Lowest temperature: 17°F
- Water year rainfall median: 38.44” at PDX
    - The driest water year was a weak La Nina.
- 115% of Mountain Snowfall.

Southern Oscillation Index: Last 5 Years



PDO: Last 5 Years



AMO.....

Climate Timeseries

AMO (Atlantic Multidecadal Oscillation) Index

The AMO is currently not updated due to the source dataset (Kaplan SST) not being updated. We apologize for the inconvience. NOAA/NCEI has a time-series of the AMO based on the NOAA ERSSTV5. NCAR has AMO code. Note their definition removes the global mean.

Description:

The timeseries are calculated from the Kaplan SST dataset which is updated monthly. It is basically an index of the N Atlantic temperatures. Time series are created; a smoothed version and an unsmoothed version. In addition, two files starting at 1948 are produced to be used in the Correlation webpages.

Time Interval: Monthly
Time Coverage: 1856 to Jan 2023
Update Status: updated monthly

Get Data:

AMO unsmooth, long: Standard PSL Format (***What is standard format?***)
AMO smoothed, long.
AMO unsmoothed, short (1948 to Jan 2023).
AMO smoothed, short (1948 to Jan 2023).

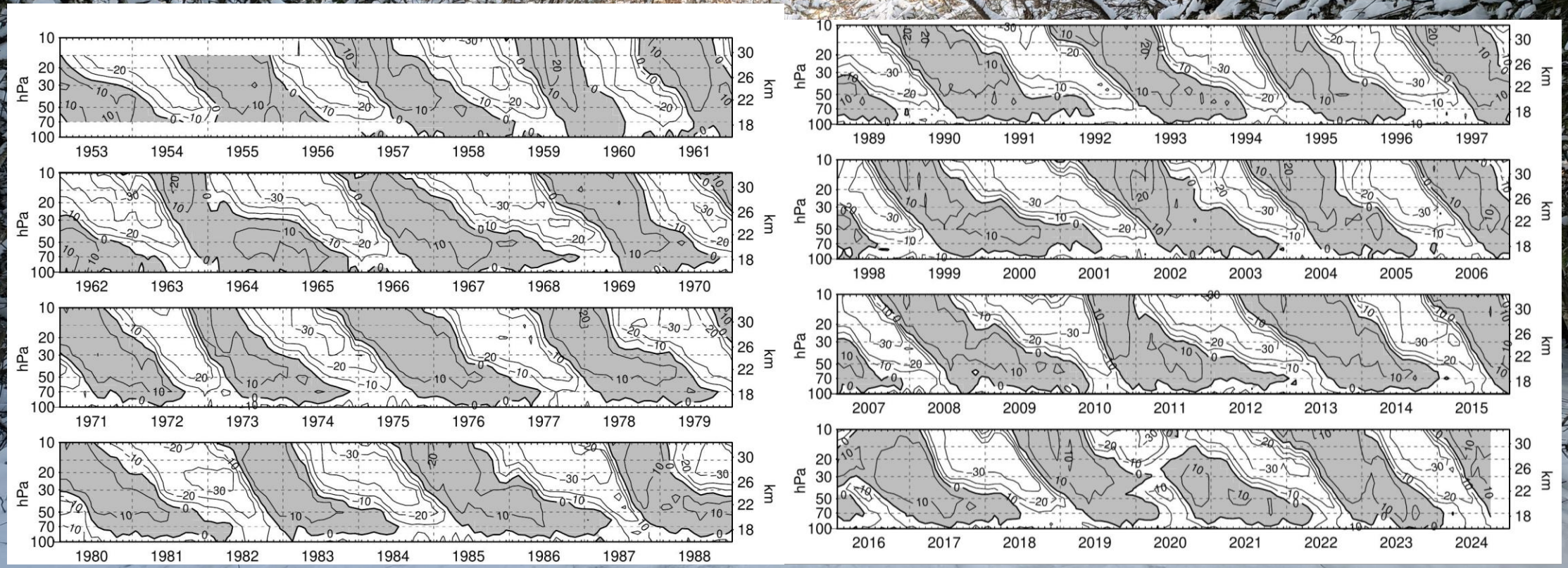
Source:

Timeseries is calculated at NOAA PSL

QBO: A Primer

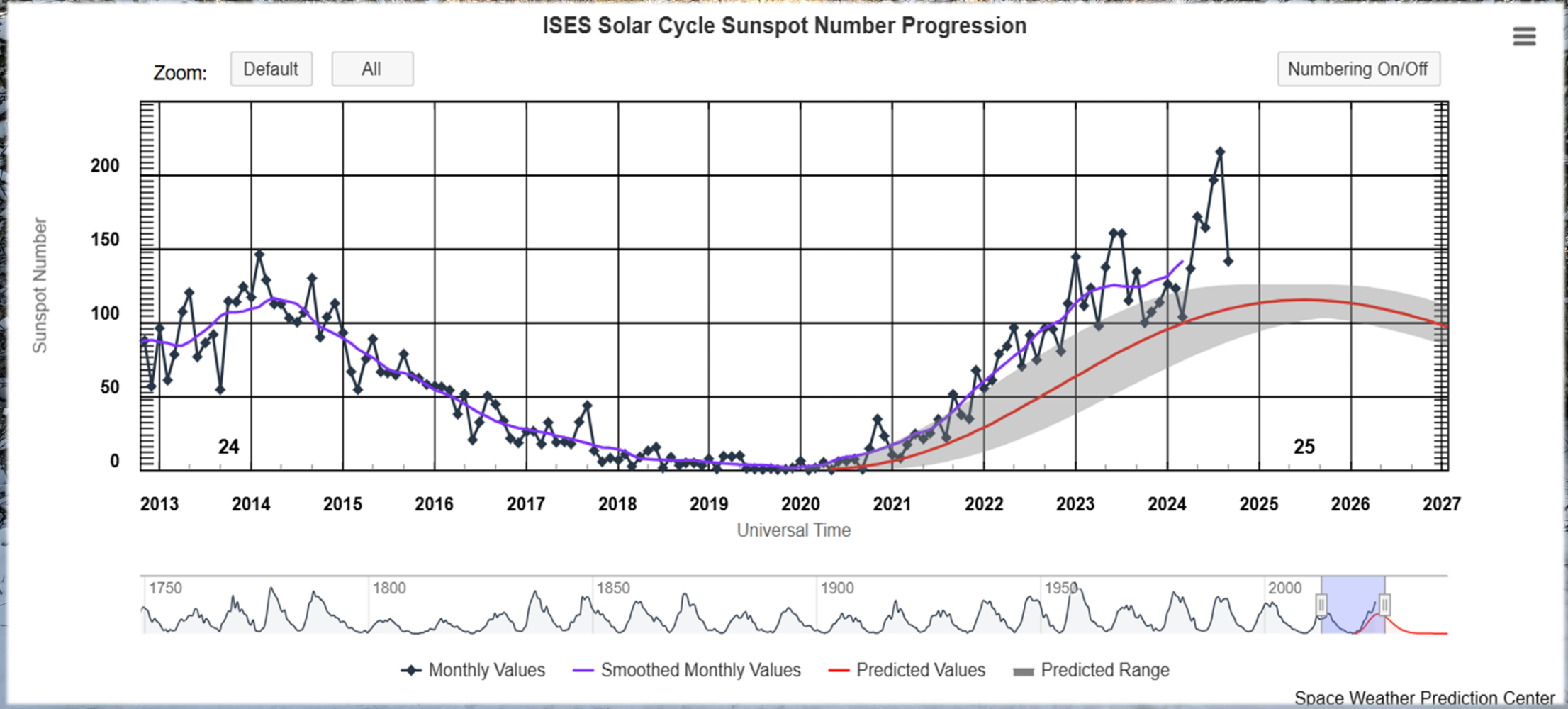
- The QBO is on average a 27-month cycle measuring winds between 10mb and 100mb in the upper atmosphere divided into 2 phases:
  - The Westerly Phase produces heightened odds of below-normal temperatures, arctic blasts, and slightly higher-than-normal precipitation.
  - The Easterly Phase produces above-normal temperatures and slightly below-normal precipitation. Increased chance of sudden stratospheric warming events.
- Slightly more often in the westerly phase, but the easterly phase tends to be stronger.

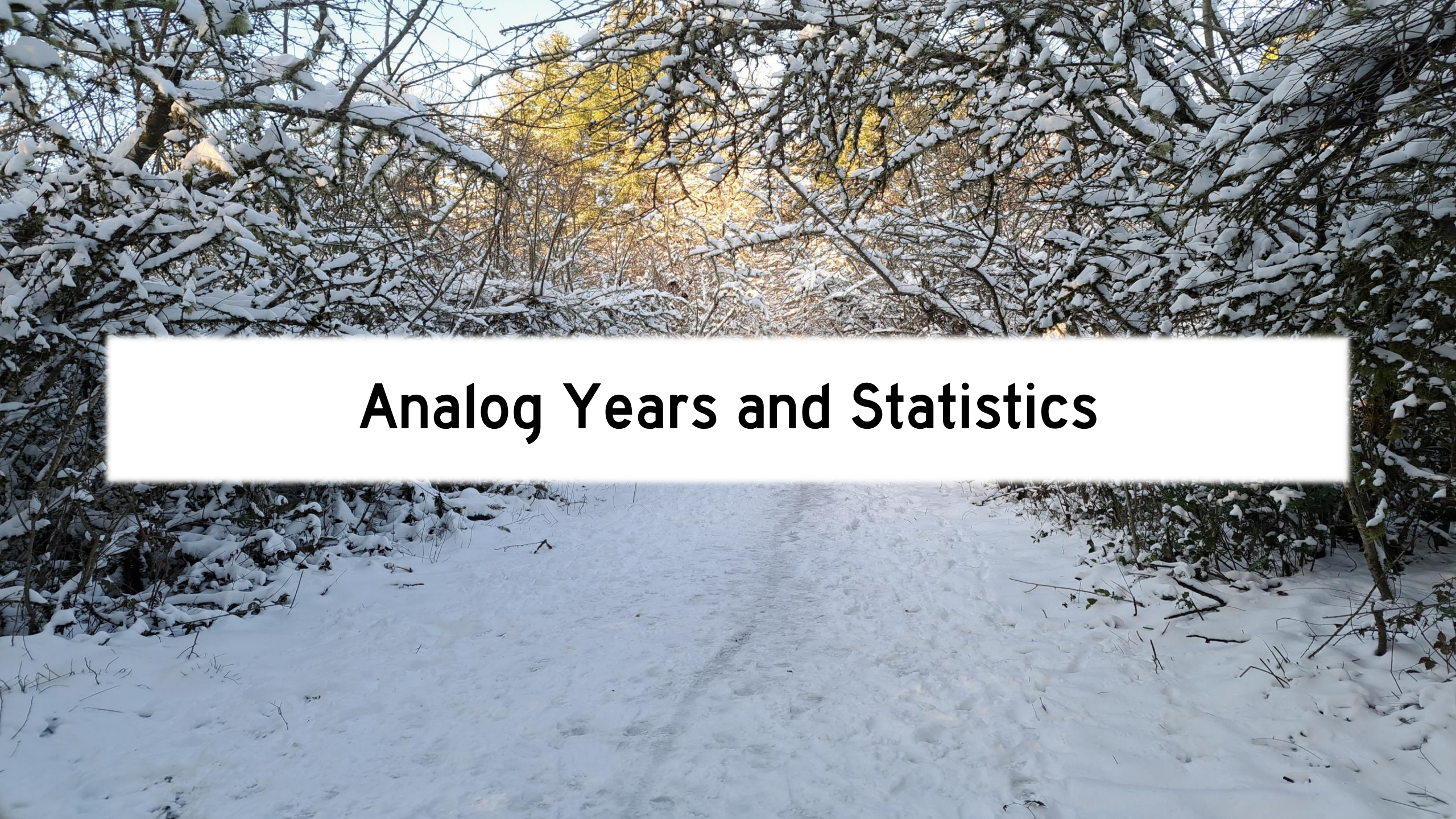
QBO Values



Data from Karlsruhe Institute of Technology

Sunspot Count





Analog Years and Statistics

Analog Years

- 1878-79
- 1886-87
- 1889-90
- 1897-98
- 1903-04
- 1906-07
- 1912-13
- 1915-16
- 1924-25
- 1931-32
- 1942-43
- 1947-48
- 1964-65
- 1966-67
- 1973-74
- 1983-84
- 1988-89
- 1992-93
- 1995-96
- 1998-99
- 2003-04
- 2010-11
- 2016-17

Top analog Year

Top Analog Year Comparisons Pre-1950

	1886-87	1915-16	2024-25
La Nina Strength	Moderate	Super Cold Neutral	Weak
PDO	Negative	Flip to Negative	Negative
Sunspot progression	65%	70%	45%

Top Analog Year Comparisons Since 1950

	1966-67	1992-93	2016-17	2024-25
La Nina Strength	Cold Neutral	Neutral	Weak	Weak
PDO	Neutral (Negative Tilt)	Positive	Neutral	Negative
QBO	Transitioning to Westerly	Transitioning to Westerly	Transitioning to Westerly	Transitioning to Westerly
Sunspot progression	27%	78%	70%	45%

Top Analog Year Extreme Events Pre-1950

1886-87

- 2nd warmest December day downtown at 65°F on the 13th.
  - Not due to an atmospheric river.
- Early February major arctic blast.
  - February 3rd high of 16°F, low of 9°F the next morning.
  - 6 days in a row failing to go above freezing (would be 5 in today's climate).
  - 11.4 inches of snow in the blast alone (plus another 7.5 inches in more marginal setups later in the month).

1915-16

- Two Major Arctic Blasts. Portland's January average temperature was 29.7°F
- Early January Blast:
  - 7 days in a row at or below 30°F highs in PDX.
    - Eugene didn't stay consistently below 32°F
  - 11.2" of snow at PDX, 6.7" of snow at EUG.
- Late January to Early February Blast:
  - Another 7 days failing to get above freezing at PDX.
  - 26.8" of snow at PDX (plus unknown ice and flooding).
  - Eugene dodged most of the cold/snow/ice, except one day with 7.3".
- March 4th, 1916 in Eugene: 10.7" inches of snow.
  - Marginal setup, likely wouldn't happen today.
- Hyperactive Water Year: 56.42" Downtown Portland, 55.96" in Eugene.

Top Analog Year Extreme Events Since-1950

1966-67

- Dud.

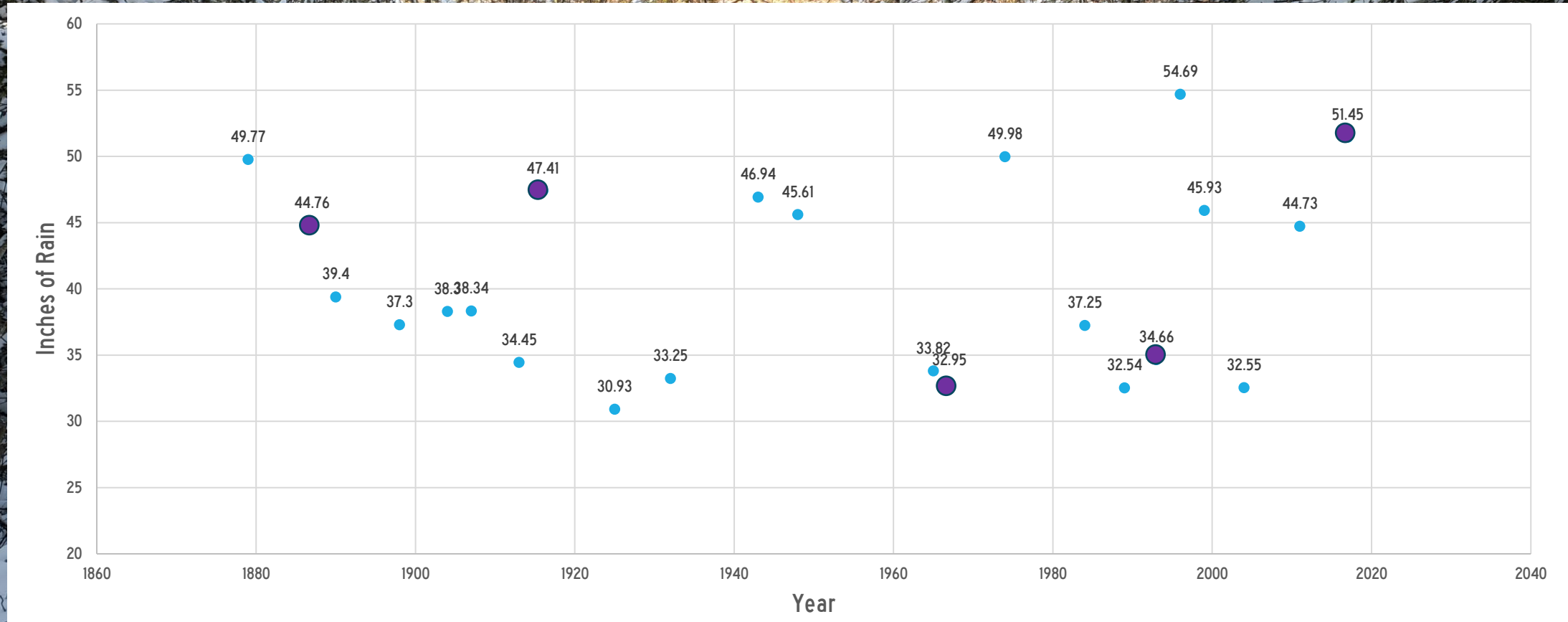
1992-93

- 14.1" Snowfall in PDX, 18.2" in EUG.
  - PDX had snow Dec-Feb, with February being the most favorable. Contained February's 1-day snowfall record until Feb 22, 2023.
- January minor arctic blast Southern Valley.
  - EUG Bottomed out at 8°F
- Puget Sound Inauguration Day Windstorm.
- Eugene hyperactive water year: 63.21"

2016-17

- Most Active Winter since 1995-96.
- 4 separate Snow and Ice events in PDX (3 in EUG).
- Windstorm in April with a peak gust of 56 mph.
- Hyperactive Water Year: 51.45" at PDX.

Water Year Rainfall PDX

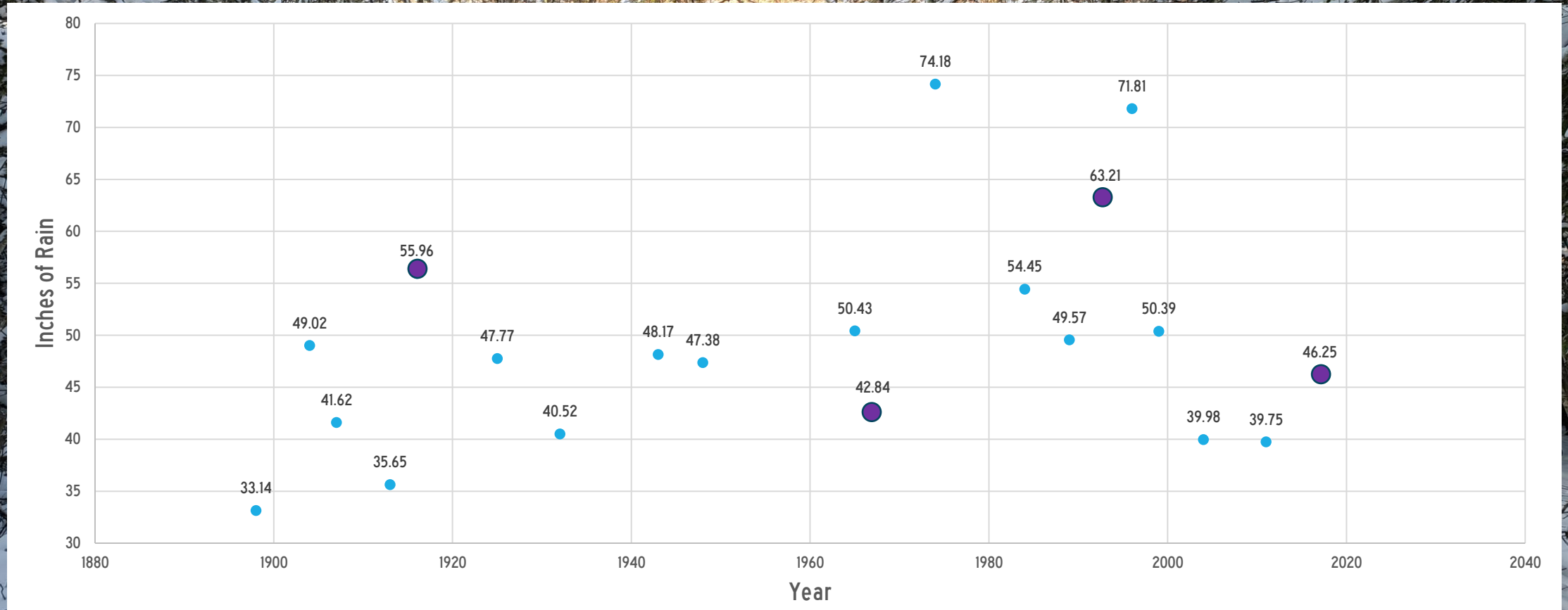


Median: 38.34”

Top Analog Median: 44.76”

Weighted Analog Median: 41.32”

Water Year Rainfall EUG

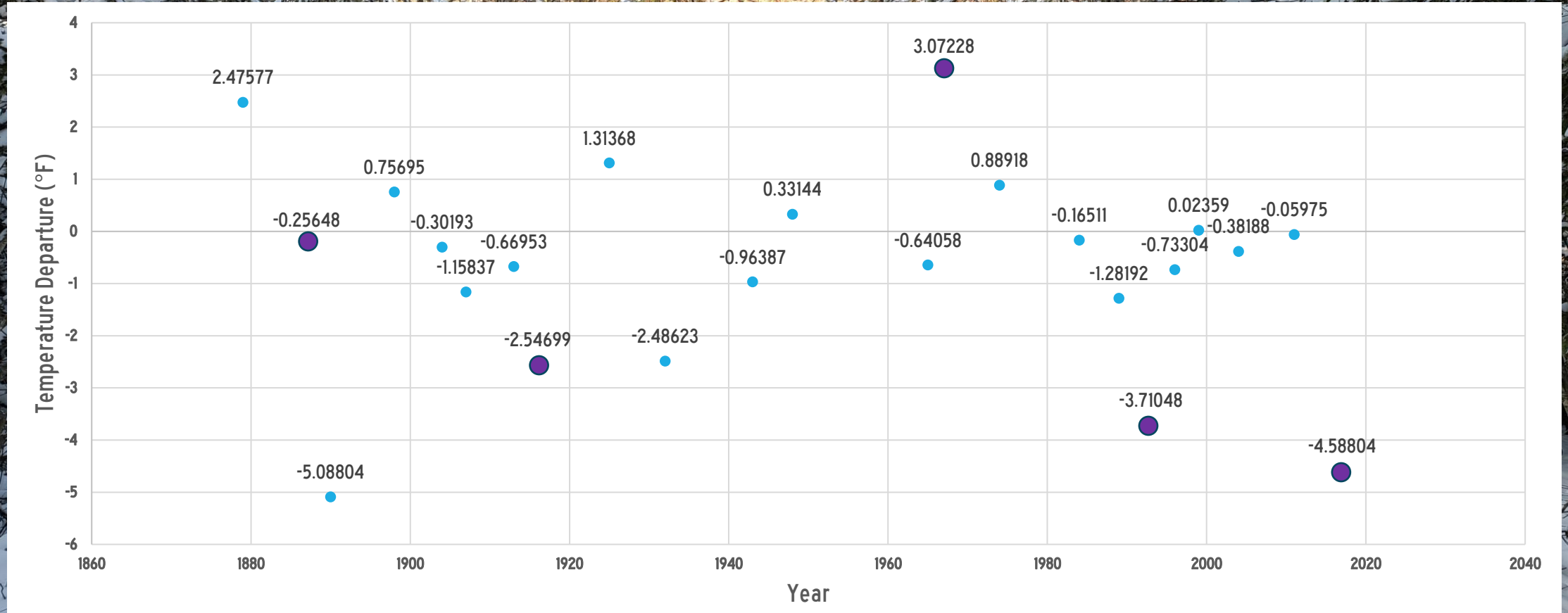


Median: 47.97”

Top Analog Median: 51.11”

Weighted Analog Median: 50.66”

Temperature Departure From Average (Trend Adjusted) PDX

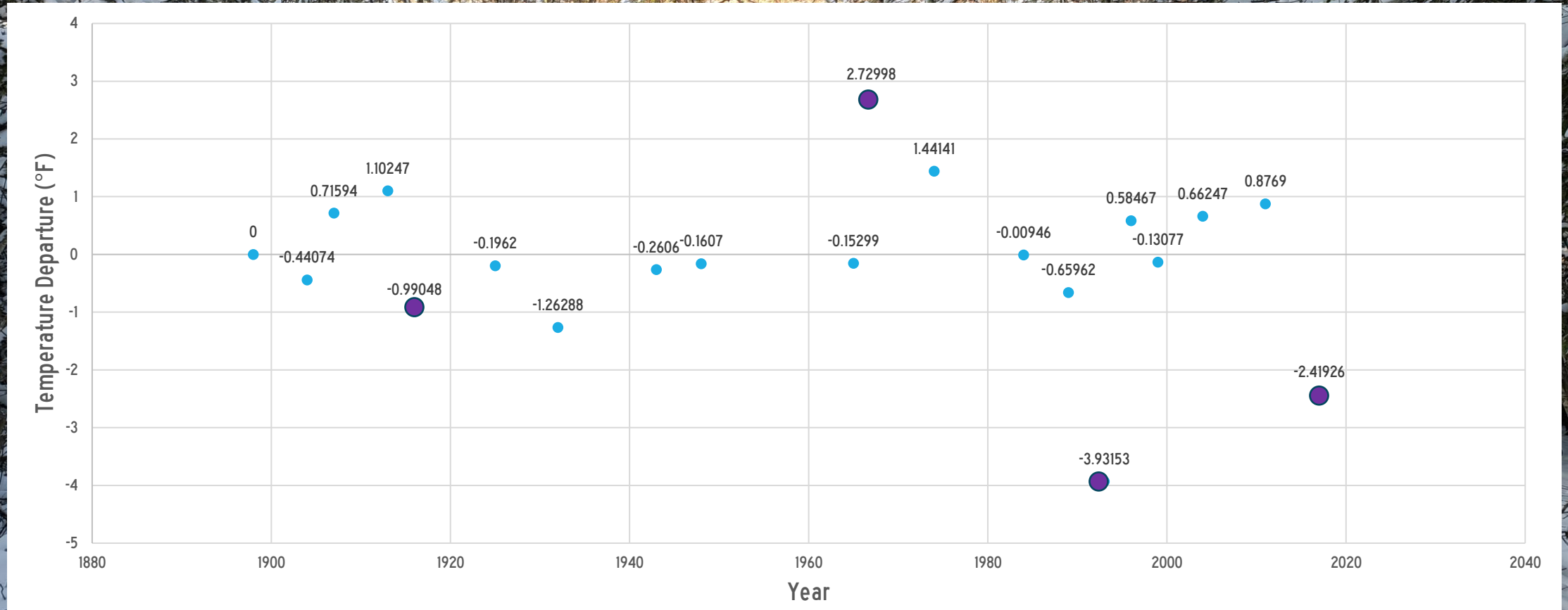


Median: -0.84°F

Top Analog Median: -2.55°F

Weighted Analog Median: -1.07°F

Temperature Departure From Average (Trend Adjusted) EUG

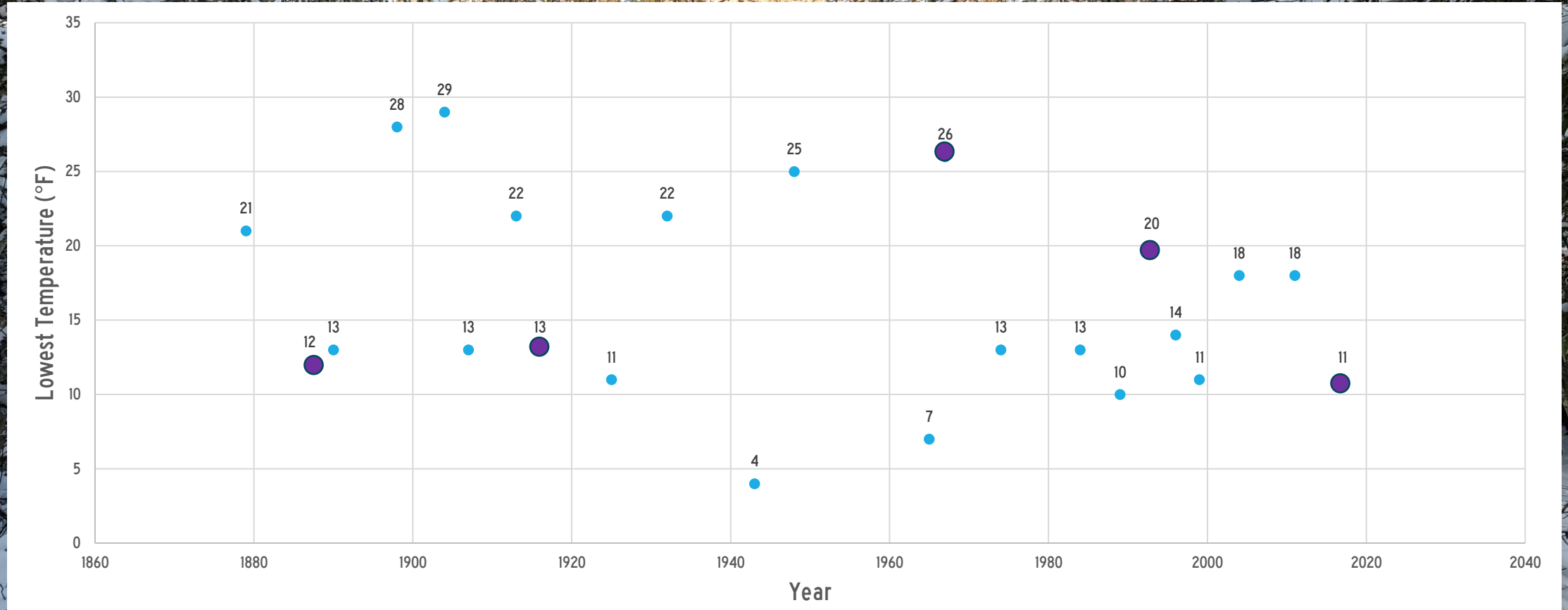


Median: -0.14°F

Top Analog Median: -1.71°F

Weighted Analog Median: -1.04°F

Lowest Winter Temperature (Trend Adjusted)
PDX

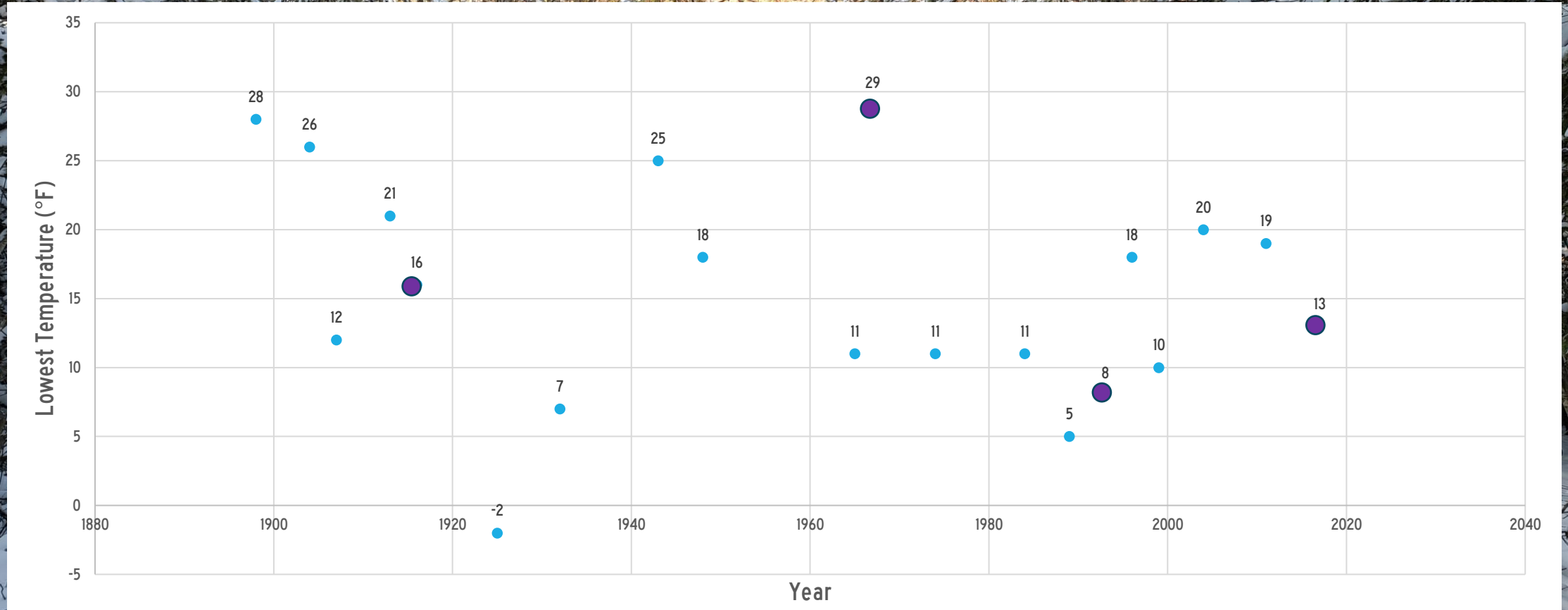


Median: 13°F

Top Analog Median: 13°F

Weighted Analog Median: 13°F

Lowest Winter Temperature (Trend Adjusted)
EUG

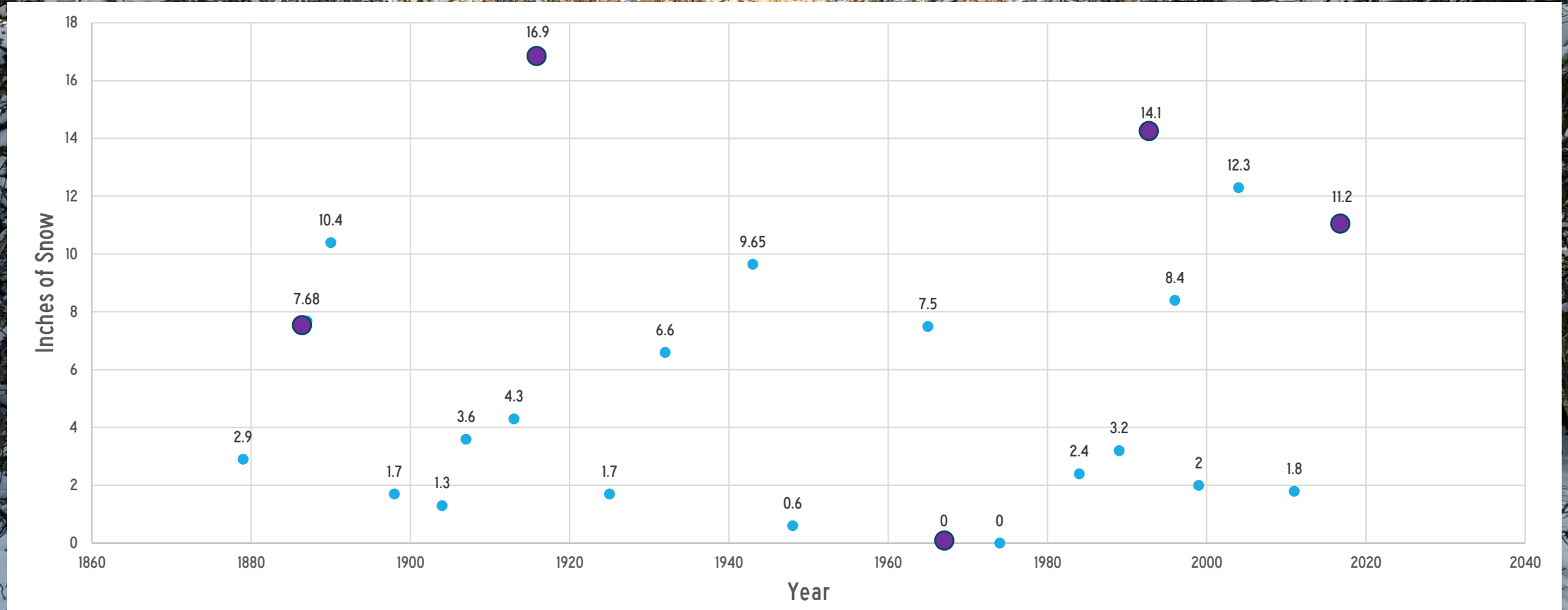


Median: 14.5°F

Top Analog Median: 14.5°F

Weighted Analog Median: 14.5°F

Adjusted Snowfall PDX

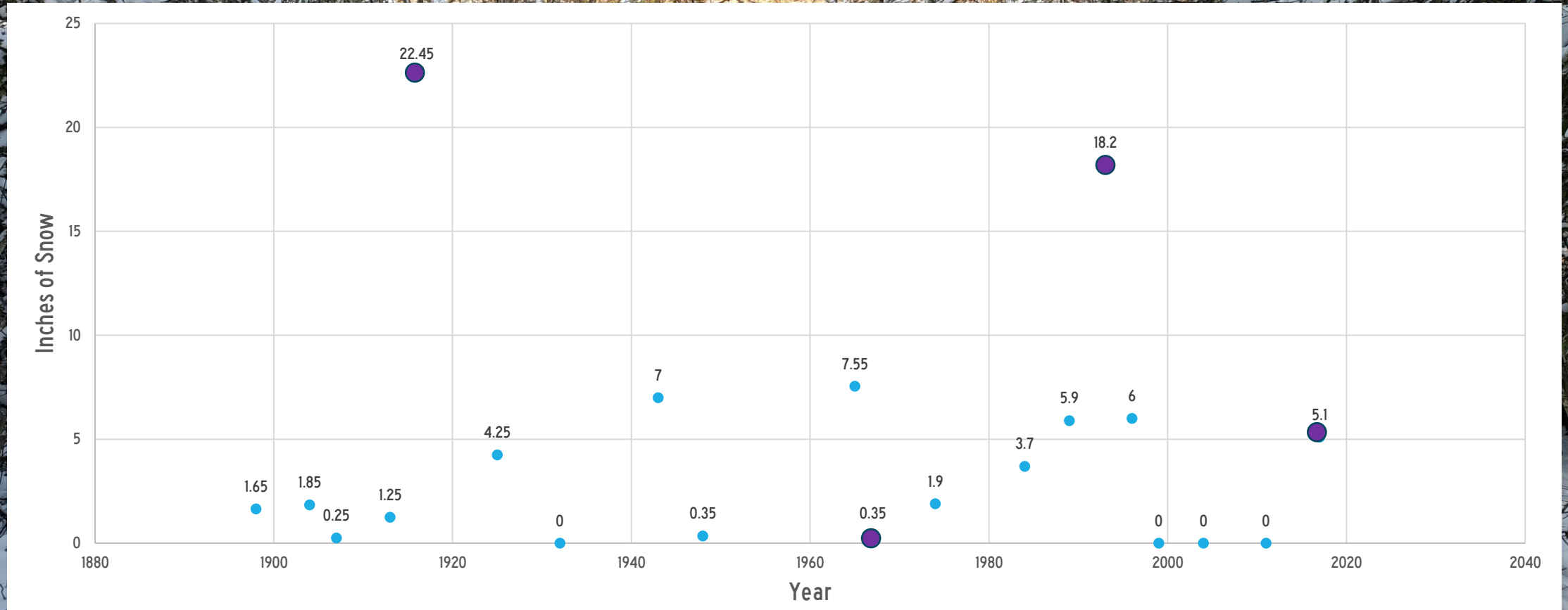


Median: 3.6”

Top Analog Median: 11.2”

Weighted Analog Median: 9.6”

Adjusted Snowfall EUG



Median: 3.7”

Top Analog Median: 11.7”

Weighted Analog Median: 11.5”

Historically Significant Trends:

- 9 consecutive winters have had measurable snowfall. (record high)
  - Chance of a 10th occurring (unadjusted): 3% chance
  - Possibly overridden by La Ninas almost always having snowfall.
- Only 3 winters (1941-42, 1973-74, 1976-77) have produced a temperature under 20°F with less than 1.5 inches of snow (all with 0).
- All but 1 of the 15 Moderate or Strong El Nino to La Ninas produced an arctic blast (93.3% occurrence rate).
- All but 1 of the 15 Moderate or Strong El Nino to La Ninas had the La Nina water year wetter than the El Nino water year (93.3% occurrence rate).
  - 39.9" was our water year.


The Predictions

The Basics

- Rain: Above average. Hyperactive year possible:
  - PDX: **39.9**" or more, with a best estimate of **46**"
  - S. Valley: **44.2**" or more, with a best estimate of **51**"
- Temperature Departure: Below Normal favored: **0.6°F+ below average**
  - PDX Best estimate: **2°F below average**
  - S. Valley Best estimate: **1.5°F below average**
- Windstorm(s): A decent windstorm: **53 mph+**
  - Or somewhere in the PNW gets a big windstorm and the Willamette Valley dodges it (ex: Inauguration Day windstorm)
- Lowest Temperature: **Below 20°F**
  - Best Estimate: **13°F**
- Most likely to be Active: Latter Half of Winter (Jan 1-Feb 15)

Snowfall

- Mountain Snow Depth on April 1st greater than 125% of normal
  - 115% or better above 5000 feet.
- Valley Snowfall: Possibly Hyperactive: **6" or more**
  - PDX Best Estimate: 9"
  - S. Valley Best Estimate: 11"
  - Chance of No Snow Winter: 20%

Things Winter Will Never Do

- Never going to give you up,
- Never going to let you down,
- Never going to run around, and desert you.
- Never going to make you cry,
- Never going to say goodbye,
- Never going to tell a lie, and hurt you.


Thank You.

Links

- Full report: https://docs.google.com/document/d/1izkmIx3aEFwQqbqaZf1oI4wZsK6rdQYs/edit?usp=drive_link&ouid=102355074394437759895&rtpof=true&sd=true
- YouTube Channel: https://www.youtube.com/@weatherandtravelwithtanis4589/videos