Image Link: portland-winter.jpg (612×407)

From La Niña to ENSO Neutral: What It Could Mean for Portland Snow?

By April Elliott

Overview

- 2024-2025 PDX winter weather forecast review.
- ENSO/SOI phase for winter 2025-2026.
- Broader climate drivers and their impact on winter weather.
- Past winters with similar ENSO/SOI phases and broader climate drivers.
- Forecast for winter 2025-2026 at PDX.

2024-2025 PDX Winter Weather Forecast Review

Image Link: PSE3YWVSVBAKZEON2KMI77R4AY.jpg (1280×960)

2024-2025 PDX Winter Weather Forecast Review

“Grades” for last years forecast

(Shout out to Tanis Leach. He technically started the “report card”)

A – Excellent: Forecast was spot-on; the event unfolded exactly as predicted.
B – Strong: Forecast was not perfect, but the key elements were accurately anticipated.
C – Fair: The event was correctly identified, though there were notable errors or omissions.
D – Weak: Something occurred, but the forecast missed the mark in significant ways.
F – Poor: The forecast was so inaccurate that it should not have been issued.

2024-2025 PDX Winter Weather Forecast Review

Event	Forecast	What Actually Happened	Grade
Cold Snap	**Chances are high that we'll experience cold snap (or serries of cold snaps).** **Timing:** December and January are the prime months, but a February cold snap remains possible.	No Cold Snap. • Overnight lows between 20˚F-30˚F January 21-29, 2025, and February 10-14, 2025.	F
Ice Event	**An ice event is likely.** **Timing:** December and January hold the highest likelihood for this event. Still, early to mid-February remains in the cards for an ice occurrence.	We did have freezing rain • February 13 (about 0.10”).	B

High Wind Event:	**A high wind event possible late winter.**
	Timing: February to March.
	• I'm inclined to target the March time frame.
	• Strong easterly event earlier in the season is possible (associated with a cold snap).
		We did have a 3 notable high wind events:
		• November 19, 2024 (Bomb Cyclone):
		  • Windspeeds 33 mph
		  • Gust: 45 mph
		• December 13 and 26 2024:
		  • Windspeeds 29 mph for both events.
		  • Gusts of 44 mph on 12/26/24.
			C

Historic Data Link: ClimateBookPortland

2024-2025 PDX Winter Weather Forecast Review

Event	Forecast	What Actually Happened	Grade
Snowstorm	**Chances are high that we'll experience a snowstorm this winter.** **Timing:** January to February hold the highest likelihood, but a snowstorm in December is also quite probable	No snowstorm!	F
Seasonal Snow Total	7”-17” (leaning in the middle of this range).	Total snow for 2024-2025: 3” (All in February, with the bulk of this occurring 2/13/25-2/14/25)	D

What happened last winter to cause this forecast to be so far off?

2024-2025 PDX Winter Weather Forecast Review

	NDJ ONI	DJF ONI	JFM ONI	FMA ONI
Forecast	-0.620 °C	-0.656 °C	-0.601 °C	-0.478 °C
Actual	**-0.5**	**-0.6**	**-0.4**	**-0.2**

SOI	Nov	Dec	Jan	Feb	Mar	Apr
Actual		6.5	10.8	3.7	7.7	10	3.6

Actual ONI values were fairly accurate to model predictions.
SOI was forecasted to be positive.
This was likely not the issue.

2024-2025 PDX Winter Weather Forecast Review

Pacific Decadal Oscillation (PDO)

	Nov	Dec	Jan	Feb	Mar	Apr
Actual	-3.13	-2.03	-1.28	-1.4	-1.12	-1.15

2024-2025 PDO Forecast: Negative

PDO was negative through the winter, so this was likely not the issue

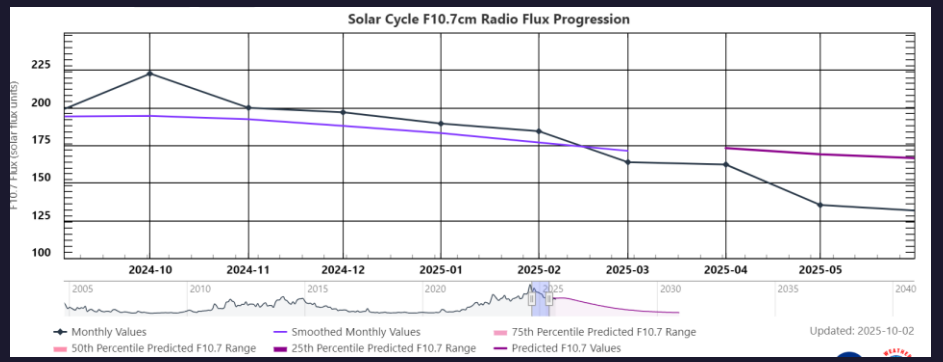
2024-2025 PDX Winter Weather Forecast Review

Image Link: https://i.imgflip.com/3mm024.jpg

2024-2025 PDX Winter Weather Forecast Review

Solar Cycles:

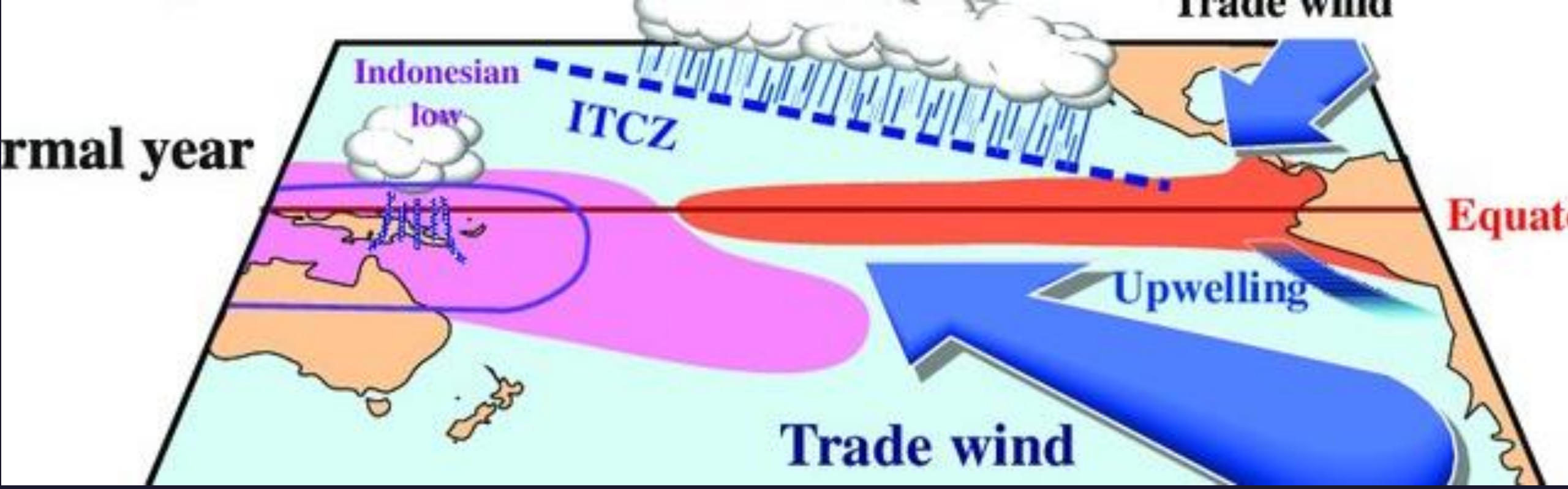
- **10.7cm Solar Flux:**
  - **Solar maximum through much of the winter months.**



	Nov	Dec	Jan	Feb	Mar	Apr
2024-2025	199.95 sfu	196.9 sfu	189.39 sfu	184.31 sfu	163.78 sfu	162.21 sfu

***sfu= Solar Flux Units:**

1 sfu= $10^{-22} W/m^2 Hz$



Winter 2025-2026; La Niña or ENSO Neutral?

Image Link: Schematic-diagram-of-ENSO-cycle-in-the-equatorial-Pacific-modified-from-The-Open.png (801×921)

ENSO Neutral or Weak La Niña

Strength	La Niña	El Niño
Weak	(-0.5)°C to (-0.9)°C	0.5°C to 0.9°C
Moderate	(-0.5)°C to (-0.9)°C	0.5°C to 0.9°C.
Strong	≤(-1.5)°C.	≥1.5°C.

ENSO Neutral: (+/- 0.4°C)

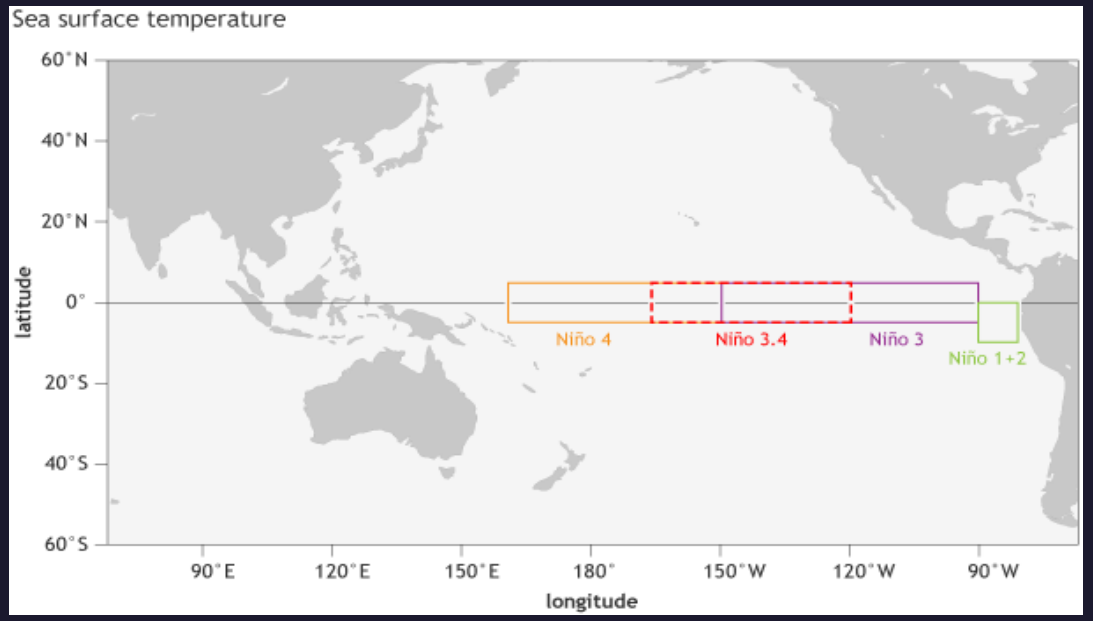
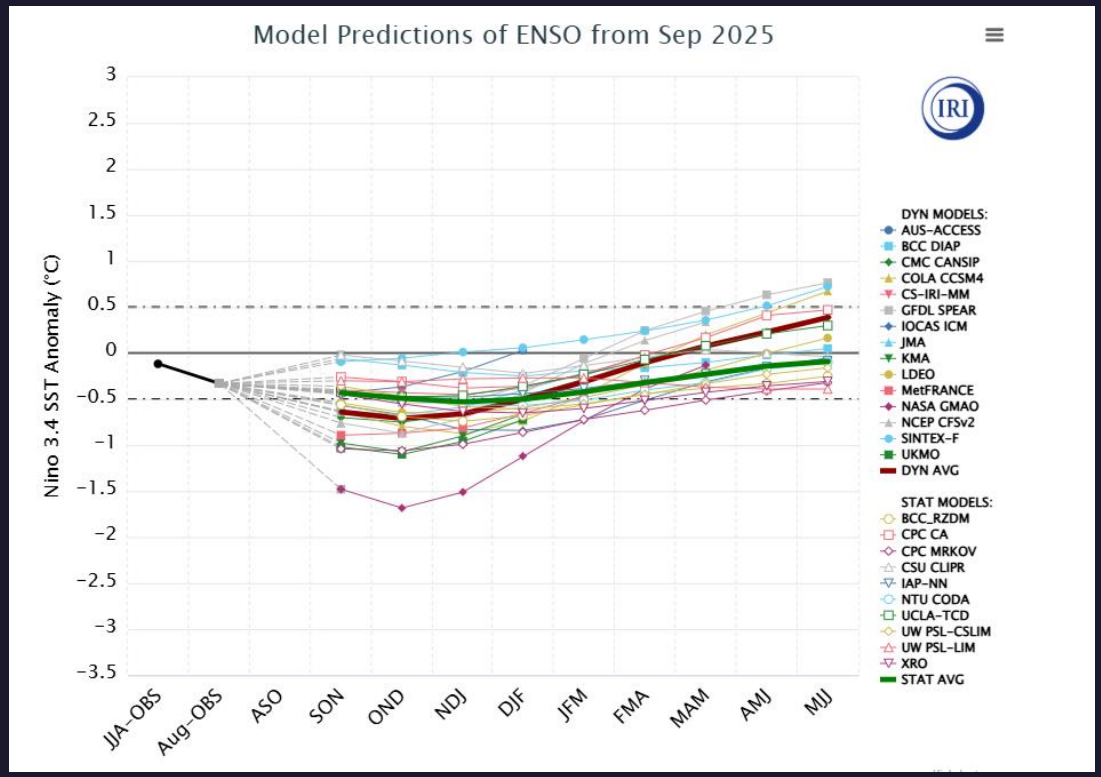


Image Link: https://www.climate.gov/sites/default/files/styles/full_width_620_alternate_image/public/Fig3_ENSOindices_SST_610.png?itok=IgBUyod_

ENSO Neutral or Weak La Niña

Model	OND	NDJ	DJF	JFM	FMA
Average, Dynamical models	-0.710	-0.659	-0.501	-0.314	-0.103
Average, Statistical models	-0.493	-0.526	-0.502	-0.420	-0.318
Average, All models	**-0.623**	**-0.606**	**-0.501**	**-0.362**	**-0.210**

2025-2026 Winter: Transitioning from a Weak La Niña to ENSO Neutral.



Data Link: IRI – International Research Institute for Climate and Society | September 2025 Quick Look

Southern Oscillation Index (SOI)

The SOI measures the difference in average atmospheric pressure between Tahiti and Darwin, Australia.

- Positive SOI (≥ 7): Indicates a La Niña phase, characterized by higher-than-average pressure over Tahiti and lower-than-average pressure over Darwin, Australia.
- Negative SOI (≤ -7): Indicates an El Niño phase, characterized by lower-than-average pressure over Tahiti and higher-than-average pressure over Darwin, Australia.
- Average SOI (between (-7) and 7): Indicates an ENSO Neutral Phase, characterized by average pressure over both Tahiti and Darwin, Australia.

SOI significantly influences global weather patterns, particularly during the winter months.

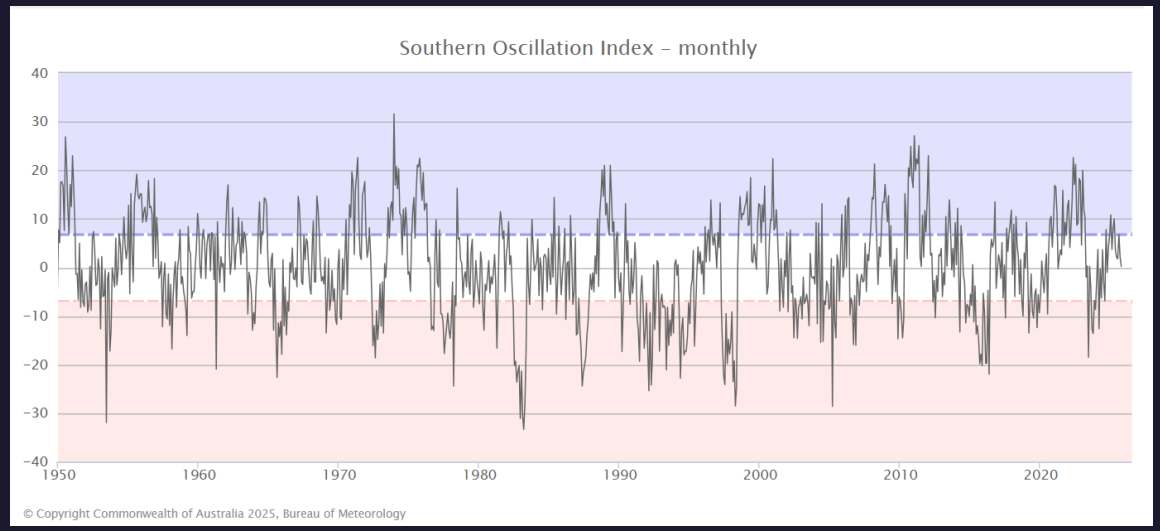


Image Link: Southern Oscillation Index (SOI) history

We expect to be in the positive to average range through winter 2025-2026.

Broader Climate Drivers

Image Link: https://geography-revision.co.uk/wp-content/uploads/2011/12/Atmospheric-Circulation-2.png

Pacific Decadal Oscillation (PDO)

- PDO is a long-term climate pattern involving shifts in sea surface temperatures (SSTs) in the North Pacific Ocean (north of 20°N latitude).

Two Phases:

- **Positive (Warm):** Warmer SSTs near the U.S. West Coast and cooler SSTs in the central Pacific.
- **Negative (Cool):** Cooler SSTs near the U.S. West Coast and warmer SSTs in the central Pacific.

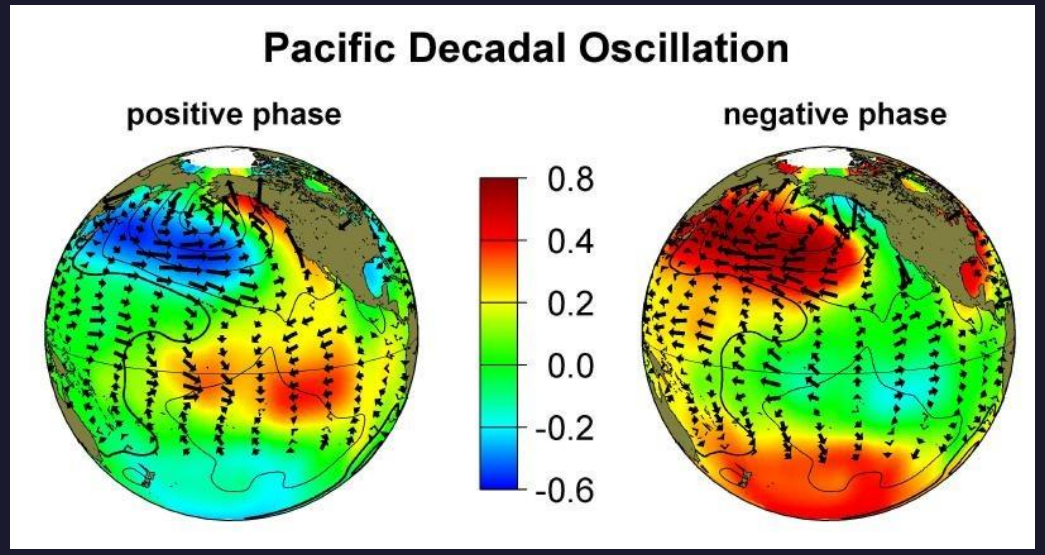


Image Link: https://iri.columbia.edu/wp-content/uploads/2015/09/pdo_warm_cool.jpg

Pacific Decadal Oscillation (PDO)

- **Negative PDO:** Weakens and shifts the jet stream northward, leading to cooler, drier winters in the Pacific Northwest.
- **Positive PDO:** Strengthens and shifts the jet stream southward, bringing wetter, stormier winters to the Pacific Northwest.
- According to the NCEI, as of September 2025, PDO was at **-2.38.**
  - This means we are in a **negative (cool) phase**.

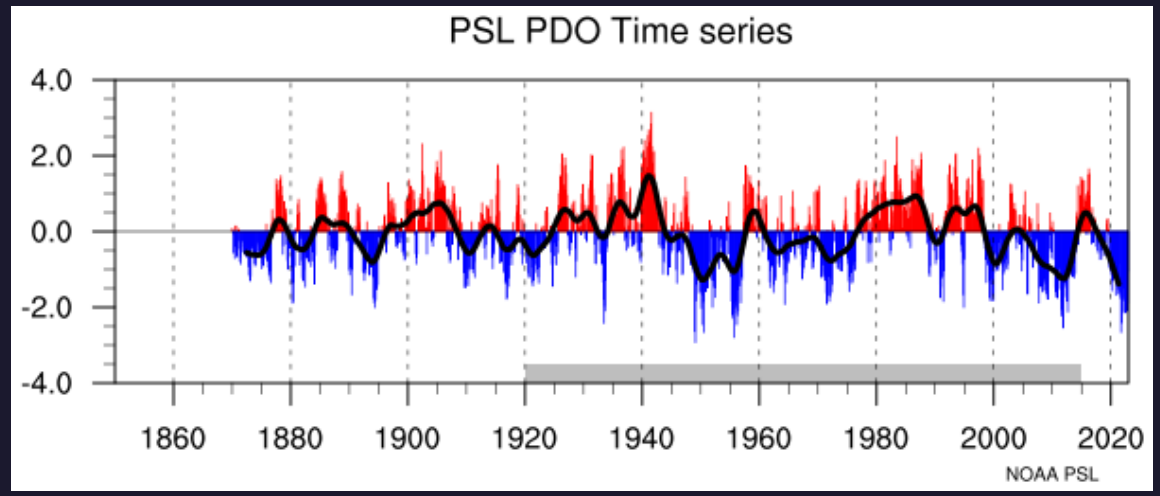


Image Link: pdo.timeseries.sstens.png (604×256)

We are expected to remain in a negative phase through 2025-2026 winter.

Solar Cycles - 10.7cm Solar Flux

- **10.7cm Solar Flux (F10.7):** A measure of solar radio emissions at a wavelength of 10.7 cm (2800 MHz). It serves as a proxy for overall solar activity. This includes sunspots, UV/EUV emissions, and magnetic energy.
  - Higher F10.7 flux = More solar radiation (thermosphere/ionosphere).
  - Low F10.7 flux = Less solar radiation (thermosphere/ionosphere).

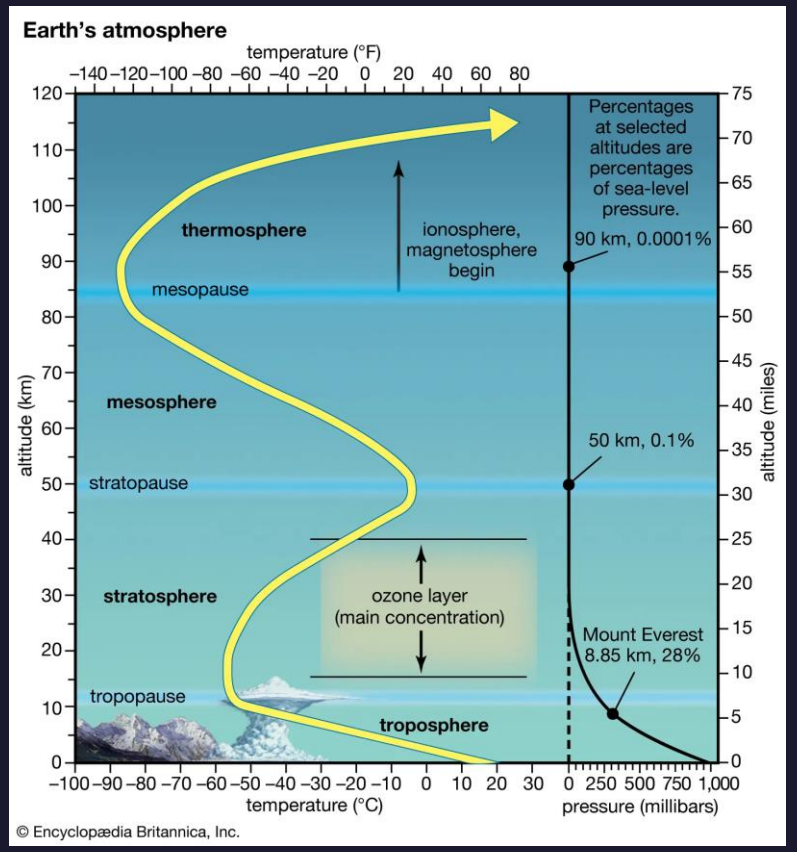


Image Link: https://cdn.britannica.com/56/97256-050-C79BB432/layers-atmosphere-Earth-yellow-line-height-response.jpg

Solar Cycles - 10.7cm Solar Flux

Major impacts the F10.7 Solar Flux Has on Winter Weather:

<u>Stratospheric–Tropospheric Coupling</u>

- Solar UV variations (which correlate with F10.7 flux) affect stratospheric temperature gradients, especially near the poles.
- This alters the stratospheric polar vortex and planetary wave propagation.
  - Higher solar flux: A strong stratospheric polar vortex.
  - Lower solar flux: A weak stratospheric polar vortex.

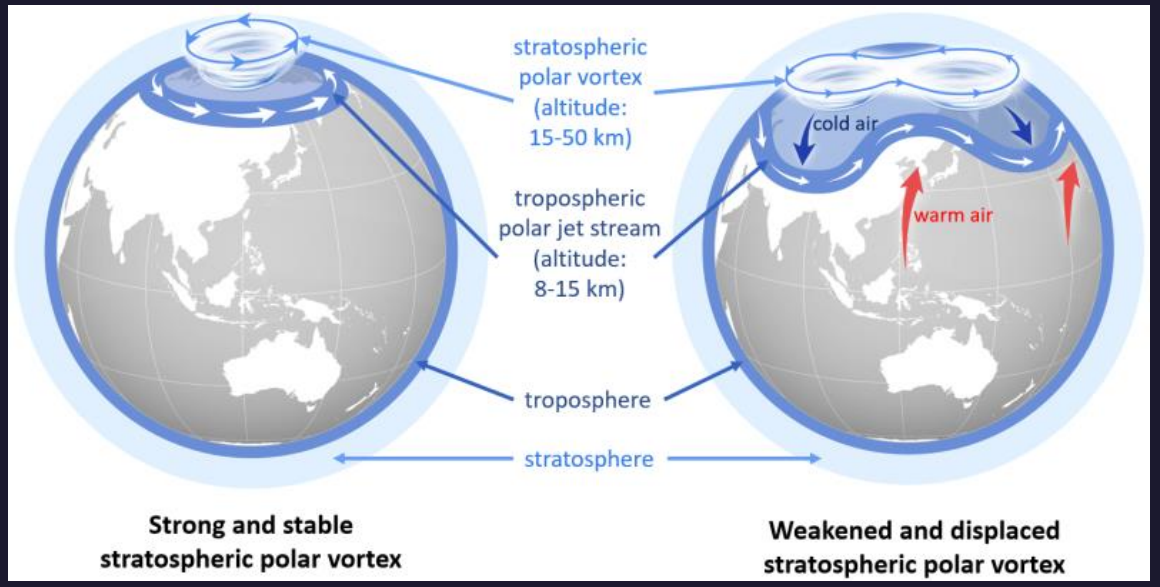


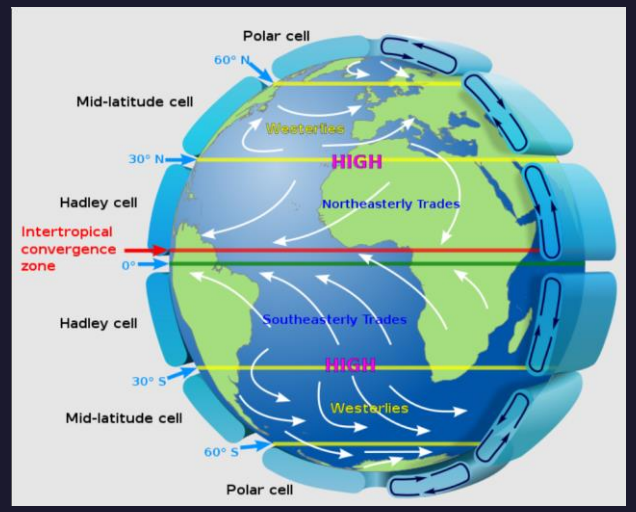
Image Link: https://my.weather.gov.hk/en/education/climate/general-climatology/images/735_fig1_polarVortex_e.png

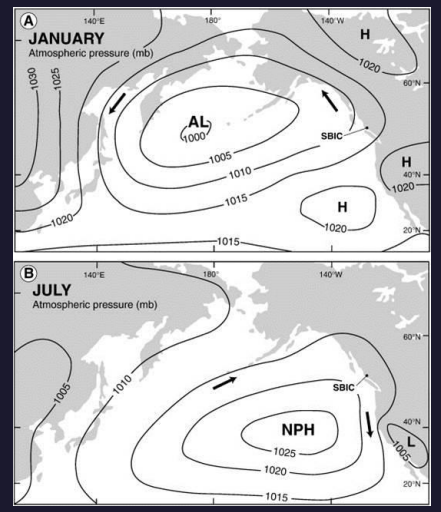
Solar Cycles - 10.7cm Solar Flux

Major impacts the F10.7 Solar Flux Has on Winter Weather:

Interaction with ENSO and PDO:

- Solar activity DOES NOT directly cause ENSO/PDO phase shifts. It can, however, enhance or suppress their atmospheric expression, especially through influences on:
  - Hadley cell strength
  - Aleutian Low (and the North Pacific High)
  - Blocking frequency over the North Pacific



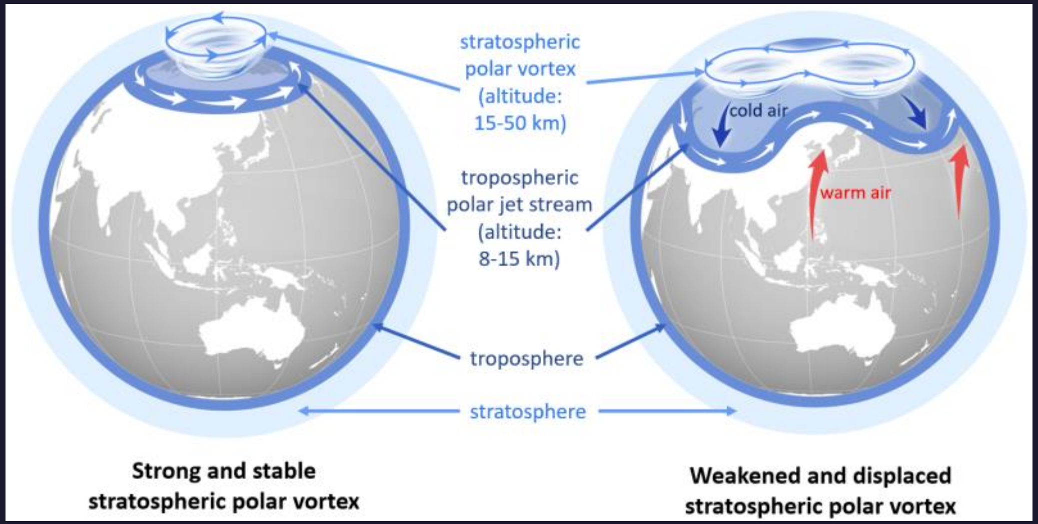


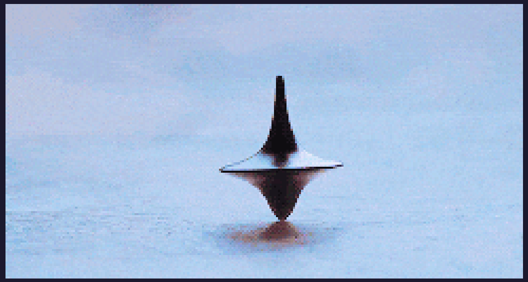
Left Image Link: https://geography-revision.co.uk/wp-content/uploads/2011/12/Atmospheric-Circulation-2.png
Right Image Link: https://response.restoration.noaa.gov/sites/default/files/north-pacific-pressure-systems_galloway-2010_favorite-1976.jpg

Solar Cycles - 10.7cm Solar Flux

Solar Activity (F10.7) and Pacific Northwest Snow:

- **High Flux (Solar Max):** Stronger stratospheric polar vortex, stronger polar jet stream.
  - Mild and wetter condition. This results in less snow (on average).
- **Low Flux (Solar Min):** Weaker stratospheric polar vortex, weaker polar jet stream.
  - More cold air intrusions. This results in more snow (on average).





Top Image:: https://my.weather.gov.hk/en/education/climate/general-climatology/images/735_fig1_polarVortex_e.png
Bottom Left GIF: https://media2.giphy.com/media/v1.Y2lkPTc5MGI3NjExbGoydDh3MzJjajl4ODcybGRuaGFscDYybzFzdnM4bHdrYW81Zmp6NSZlcD12MV9pbnRlcm5hbF9naWZfYnlfaWQmY3Q9Zw/bUkXxGkGYb5bq/giphy.gif
Bottom Right GIF: https://media0.giphy.com/media/v1.Y2lkPTc5MGI3NjExemtxZjljZG10MmlwOHlxMXFybzMzaml2Mjh1cjY0enNxODRmem1jciZlcD12MV9pbnRlcm5hbF9naWZfYnlfaWQmY3Q9Zw/to7v5lN21ELy3ui50w/giphy.gif

Solar Cycles - 10.7cm Solar Flux

Forecast for Winter 2025-2026 (in sfu)

	Nov	Dec	Jan	Feb	Mar	Apr
Forecast	**160.0**	**160.8**	**160.6**	**159.7**	**158.2**	**156**
25th Percentile	156.6-165.9	157.1-166.1	156.7-165.8	155.7-164.7	154.4-163.1	152.5-161
50th Percentile	154.1-170.1	154.4-170.5	154-170	153-169.2	151.6-167.8	149.2-165.5
75th Percentile	150.6-174.2	157.1-166.1	150.5-175.6	149.6-172.1	148.1-170.3	145.6-168.1

Solar Activity State	Approximate F10.7 Range
Deep Solar Minimum	**~65 to 75 sfu**
Solar Average (Moderate Activity)	**~100 to 150 sfu**
Solar Maximum (High Activity)	**~180 to 220+ sfu**
Extreme Peaks (rare)	**Sometimes above 250 sfu**

***sfu= Solar Flux Units:**

1 sfu= $10^{-22}\,W/m^2\,Hz$

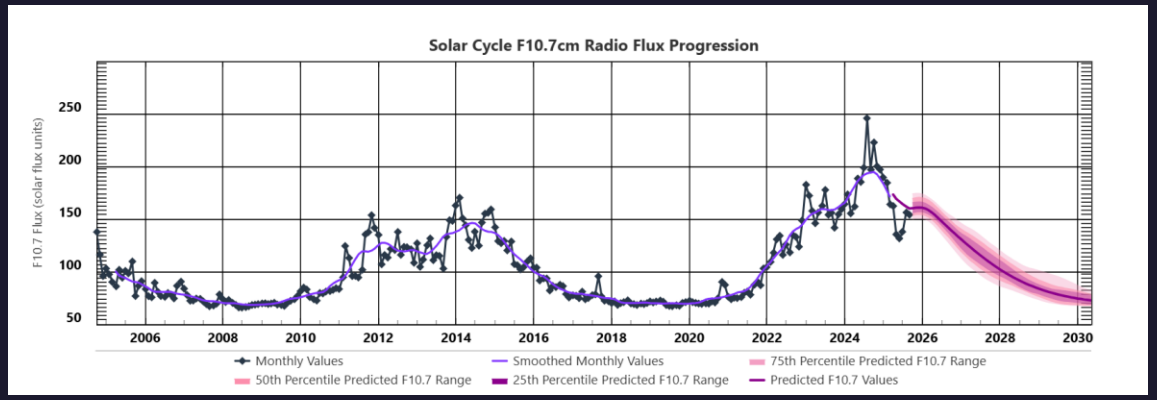


Image Link: . https://www.swpc.noaa.gov/products/solar-cycle-progression

- **This forecast suggest that we look to be on the upper end of the Solar Average (Moderate Activity).**

Historical Winter Patterns at PDX With Comparable ENSO Phases and Broader Climate Influences

Image Link: https://th.bing.com/th/id/R.0d0f35829d02e8471d00ff83e3b40fb0?rik=z8ltfHI2xbSI%2fg&pid=ImgRaw&r=0

Years With Similar ENSO Patterns

The following credentials were used to identify years with similar ENSO Phases based on model predictions for winter 2025-2026.

1. NDJ: (-1.0)˚C - (-0.5)˚C
2. DJF: (-1.0)˚C - 0˚C
3. JFM: (-0.60)˚C - 0˚C
4. FMA: (-0.40)˚C - 0.40˚C

Model	NDJ	DJF	JFM	FMA
Average, Dynamical models	-0.659	-0.501	-0.314	-0.103
Average, Statistical models	-0.526	-0.502	-0.420	-0.318
Average, All models	**-0.606**	**-0.501**	**-0.362**	**-0.210**

Years With Similar ENSO Phase Patterns Since 1950

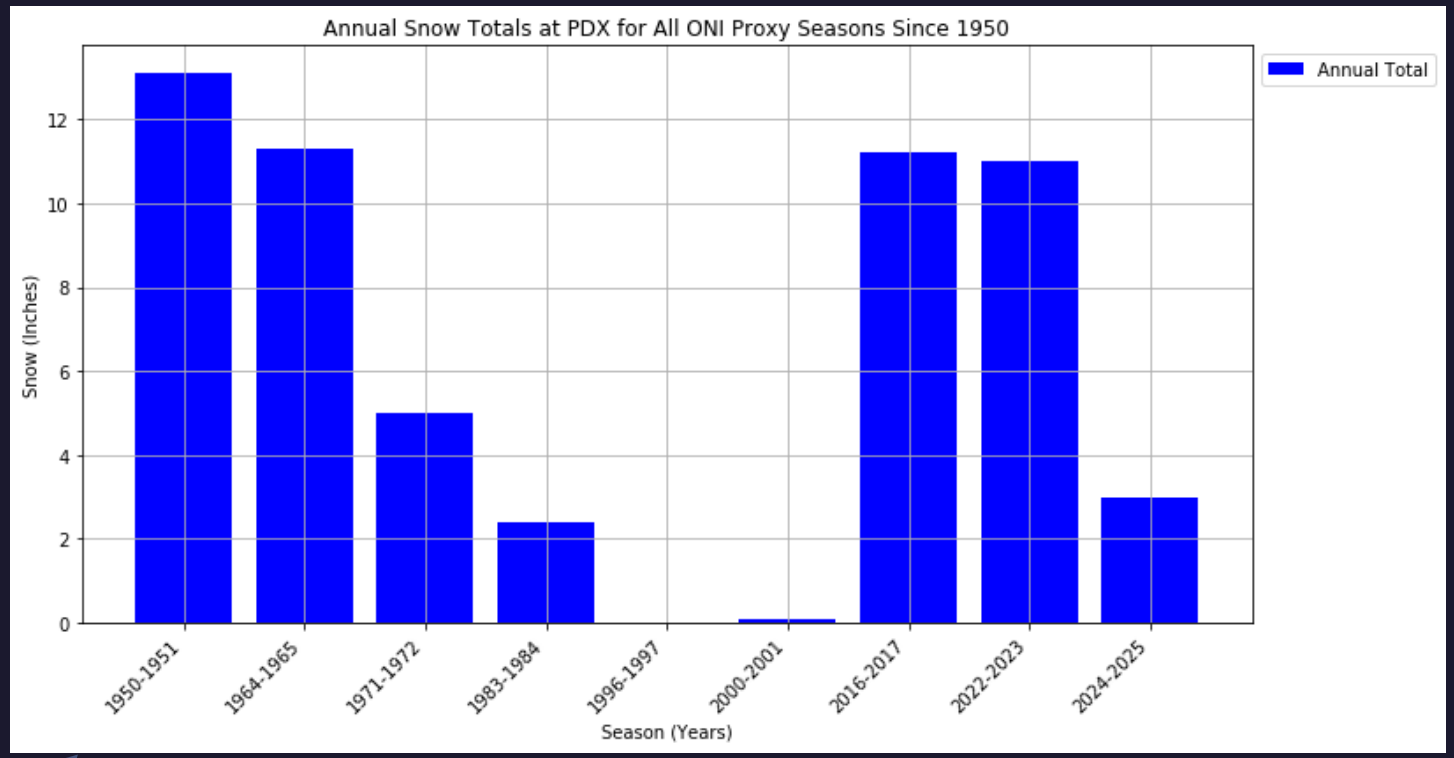
Season	NDJ ONI	DJF ONI	JFM ONI	FMA ONI
1950-1951	-0.8	-0.8	-0.5	-0.2
1964-1965	-0.8	-0.6	-0.3	-0.1
1971-1972	-0.9	-0.7	-0.4	0.1
1983-1984	-0.9	-0.6	-0.4	-0.3
1996-1997	-0.5	-0.5	-0.4	-0.1
2000-2001	-0.7	-0.7	-0.5	-0.4
2016-2017	-0.6	-0.3	-0.2	0.1
2022-2023	-0.8	-0.7	-0.4	-0.1
2024-2025	-0.5	-0.6	-0.4	-0.2
Forecast for 2025-2026 (Average, All models)	**-0.606**	**-0.501**	**-0.362**	**-0.210**

Years With Similar ENSO Phase Patterns Since 1950- SOI

Season	Nov	Dec	Jan	Feb	Mar	Apr
1950-1951	12.5	23.0	16.5	9.6	-1.4	-1.3
1964-1965	2.6	-3.0	-4.0	1.6	2.9	-12.9
1971-1972	7.2	2.1	3.7	8.2	2.4	-5.5
1983-1984	-0.7	0.1	1.3	5.8	-5.8	2.0
1996-1997	-0.1	7.2	4.1	13.3	-8.5	-16.2
2000-2001	22.4	7.7	8.4	11.9	6.7	0.3
2016-2017	11.8	-1.4	8.9	-6.0	10.5	4.5
2022-2023	4.6	20.0	11.8	10.5	-2.0	0.3
2024-2025	6.5	10.8	3.7	7.7	10	3.6

- **Positive SOI (≥ 7):** La Niña phase.
- **Negative SOI (≤ -7):** El Niño phase.
- **Average SOI (between (-7) and 7):** ENSO Neutral Phase

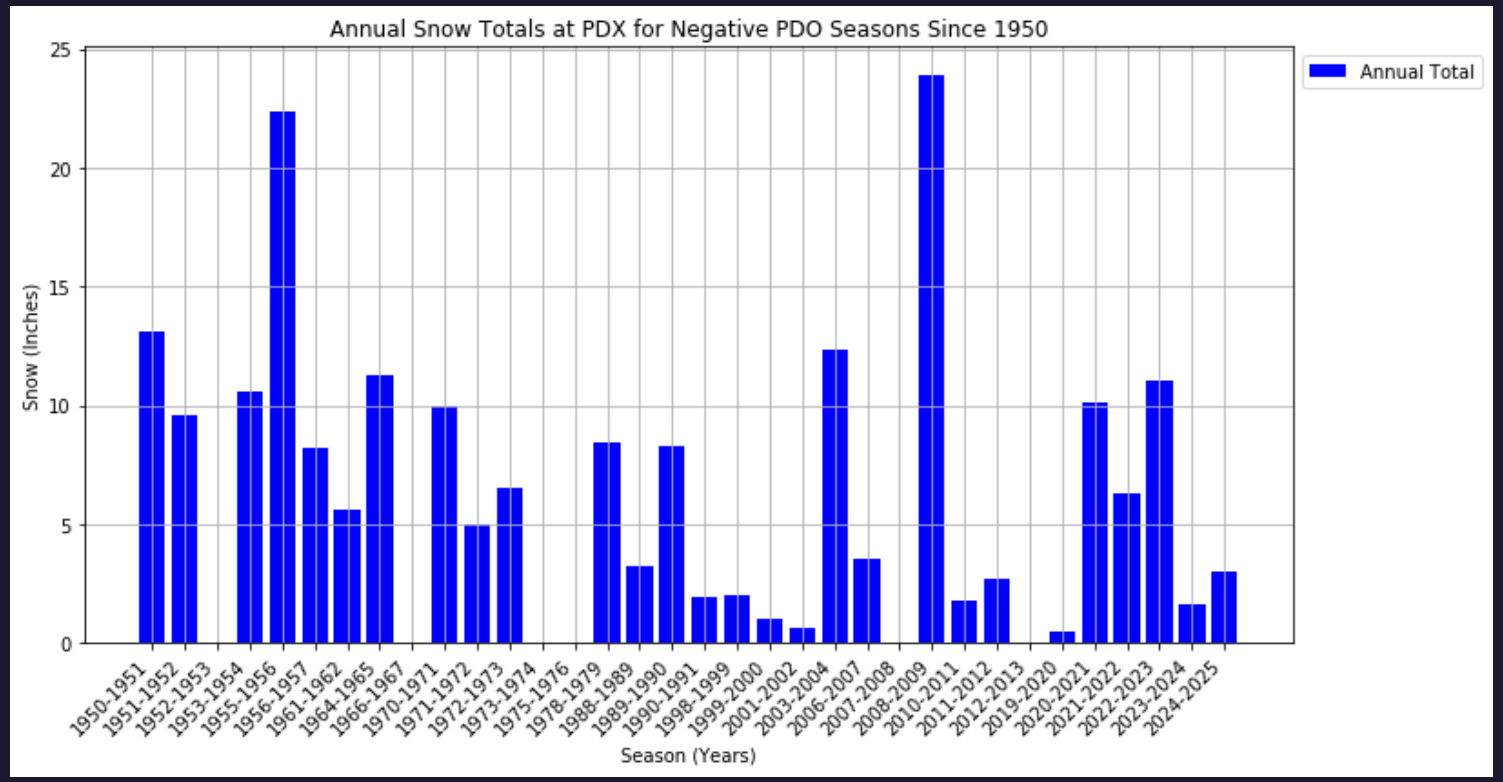
Years With Similar ENSO Phase Patterns Since 1950



- Average annual snow total at PDX for all ONI years since 1950: **6.34”**

- Seasons with the most snow:
  - 1950-1951: 13.1”
  - 1964-1965: 11.3”
- Seasons with the least snow:
  - 1996-1997: 0”
  - 2000-2001: 0.1”

Years With Negative PDO Since 1950



- Average annual snow total at PDX for all negative PDO years since 1950: **6.01”**

- Seasons with the most snow:
  - 2008-2009: 23.9”
  - 1955-1956: 22.4”
- Seasons with the least snow:
  - 1952-1953: 0”
  - 1966-1967: 0”
  - 1973-1974: 0”
  - 1975-1976: 0”
  - 2007-2008: 0”
  - 2012-2013: 0”

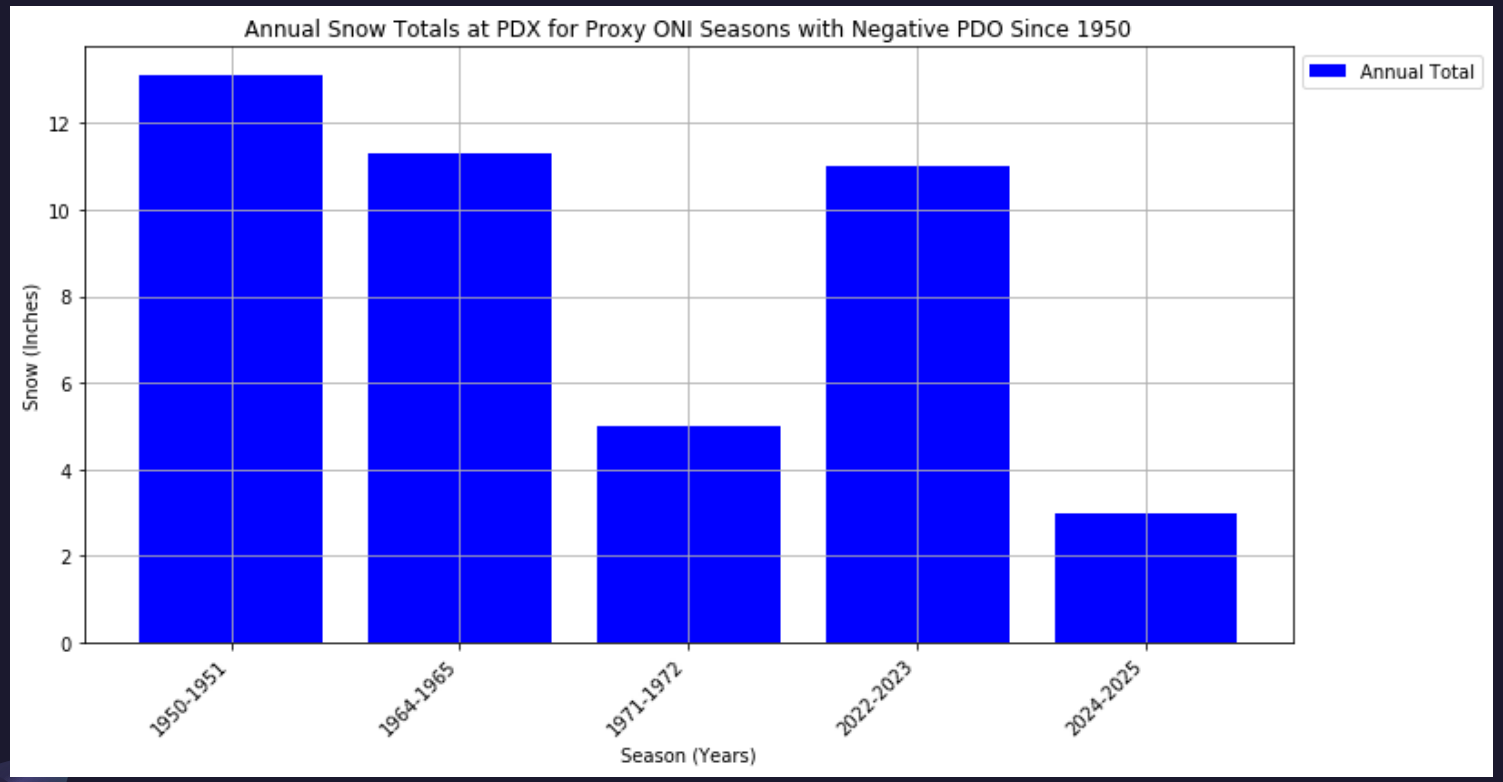
ONI Proxy Years With Negative PDO Since 1950

Season (Years)	Nov	Dec	Jan	Feb	Mar	Apr
1950-1951	-1.45	-1.06	-1.19	-1.52	-1.72	-1.35
1964-1965	-0.68	-0.62	-0.95	-0.61	-0.17	-0.01
1971-1972	-1.28	-1.77	-2.12	-1.95	-1.53	-1.7
2022-2023	-2.41	-2.21	-1.24	-1.65	-2.45	-3.07
2024-2025	-3.13	-2.03	-1.28	-1.4	-1.12	-1.15

The following ONI proxy years did not have negative PDO through the entire winter:

- 1983-1984
- 1996-1997
- 2000-2001
- 2016-2017

ONI Proxy Years With Negative PDO Since 1950



- Average annual snow total at PDX for ONI proxy years with negative PDO since 1950: **8.68”**
  - 1950-1951: 13.1”
  - 1964-1965: 11.3”
  - 1971-1972: 5.0”
  - 2022-2023: 11.0”
  - 2024-2025: 3.0”

Solar Cycles - 10.7cm Solar Flux

Close Proxy Years:

- Monthly mean sfu ranged between 145-185 for November through April (table below).

Season	Nov	Dec	Jan	Feb	Mar	Apr
2000-2001	178.82	173.62	166.62	146.66	177.69	178.07
2023-2024	154.36	159.28	163.99	173.28	155.19	161.7

Proxy Years:

- Monthly mean sfu ranged between 125-195 for November through April (table below).

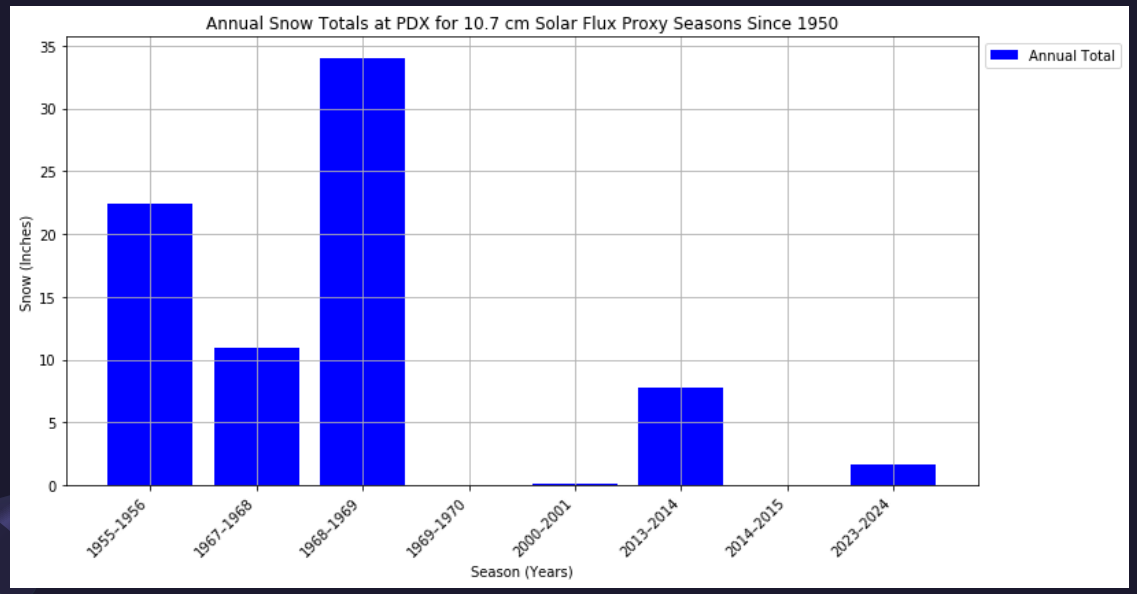
Season	Nov	Dec	Jan	Feb	Mar	Apr
1955-1956	130.01	134.56	141.16	167.23	160.6	165.95
1967-1968	145.3	163.04	189.12	173.18	142.63	129.48
1968-1969	138.54	148.44	152.75	155.21	172.25	155.5
1969-1970	156.69	143.64	158.27	175.44	158.36	161.99
2000-2001	178.82	173.62	166.62	146.66	177.69	178.07
2013-2014	148.78	148.1	162.69	170.13	150.5	143.94
2014-2015	155.74	159.02	142	128.92	126.89	129.05
2023-2024	154.36	159.28	163.99	173.28	155.19	161.7

***sfu= Solar Flux Units:**

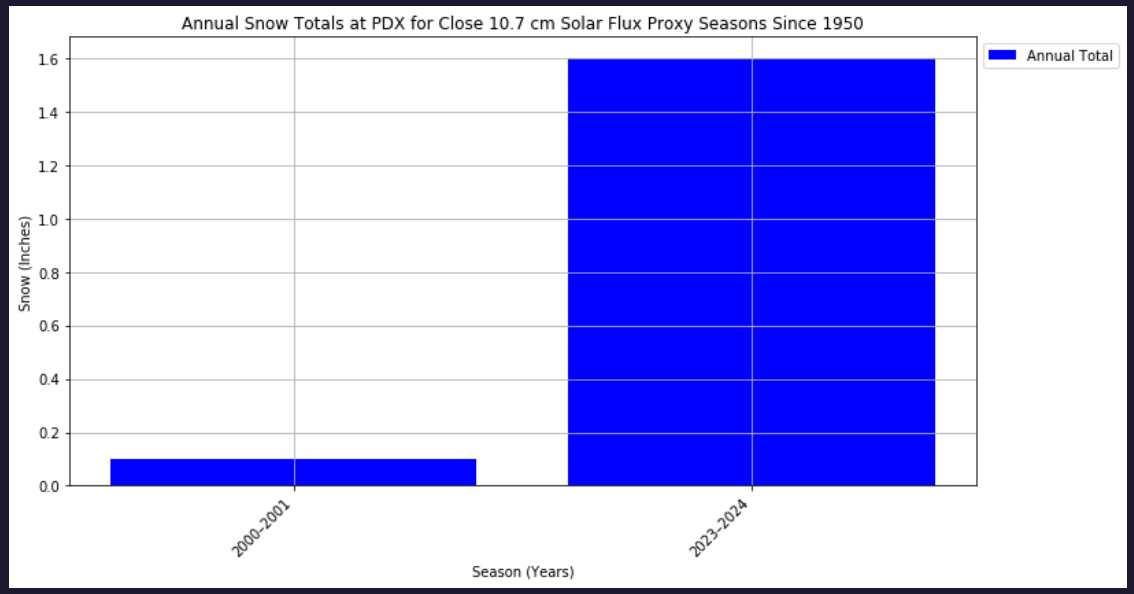
1 sfu= $10^{-22}\, W/m^2\, Hz$

Solar Cycles - 10.7cm Solar Flux

Annual snow values at PDX for proxy winter seasons (November and April) where monthly mean sfu ranged between 125-195.
Average: 9.6”



Annual snow values at PDX for proxy winter seasons (November and April) where monthly mean sfu ranged between 145-185:
Average: 0.85”



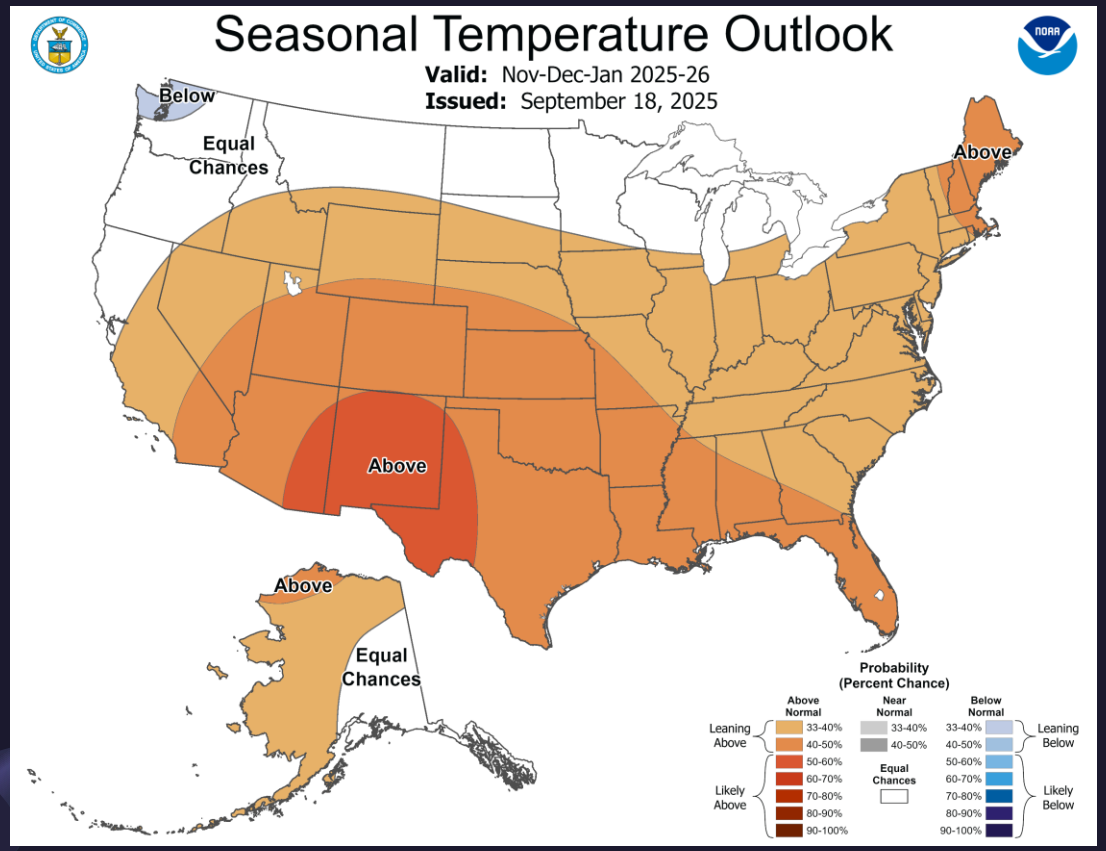
***sfu= Solar Flux Units:**
1 sfu= $10^{-22}\,W/m^2\,Hz$

Solar Cycles - 10.7cm Solar Flux

- One of the proxy 10.7 Solar Flux years fell with in ONI proxy years.
  - 2000-2001
- 10.7cm Solar Flux values for the proxy ONI Years can be seen in the table to the left.

Season	Nov	Dec	Jan	Feb	Mar	Apr
1950-1951	101.9	101.11	107.93	101.84	102.47	127.06
1964-1965	73.69	78.78	78.55	75.16	74.08	71.98
1971-1972	114.02	124.54	114.78	141.79	128.48	112.89
1983-1984	92.45	93.44	116.11	140.56	122.03	128.67
1996-1997	78.72	77.77	73.99	73.75	73.47	74.5
2000-2001	**178.82**	**173.62**	**166.62**	**146.66**	**177.69**	**178.07**
2016-2017	78.58	75.29	77.37	76.95	74.69	80.91
2022-2023	123.56	148.46	182.47	172.09	157.53	145.86
2024-2025	199.95	196.9	189.39	184.31	163.78	162.21

Climate Prediction Center-NOAA Seasonal Outlook



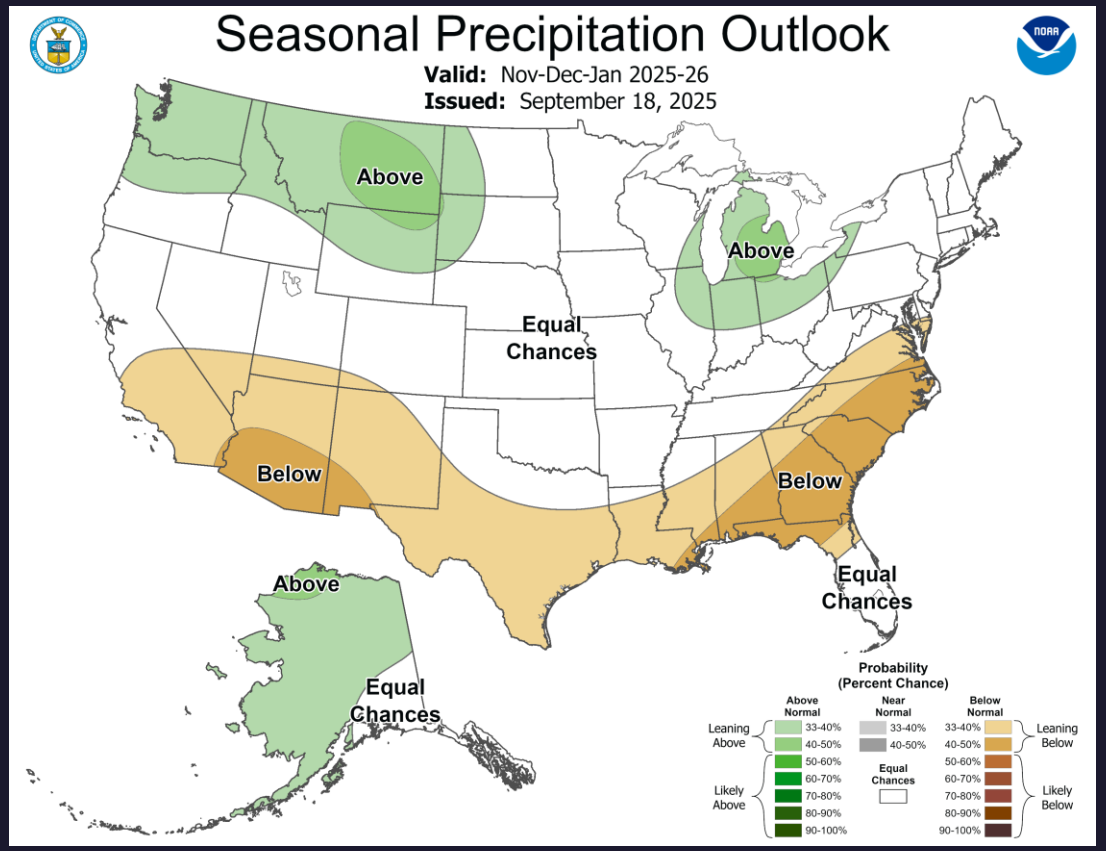
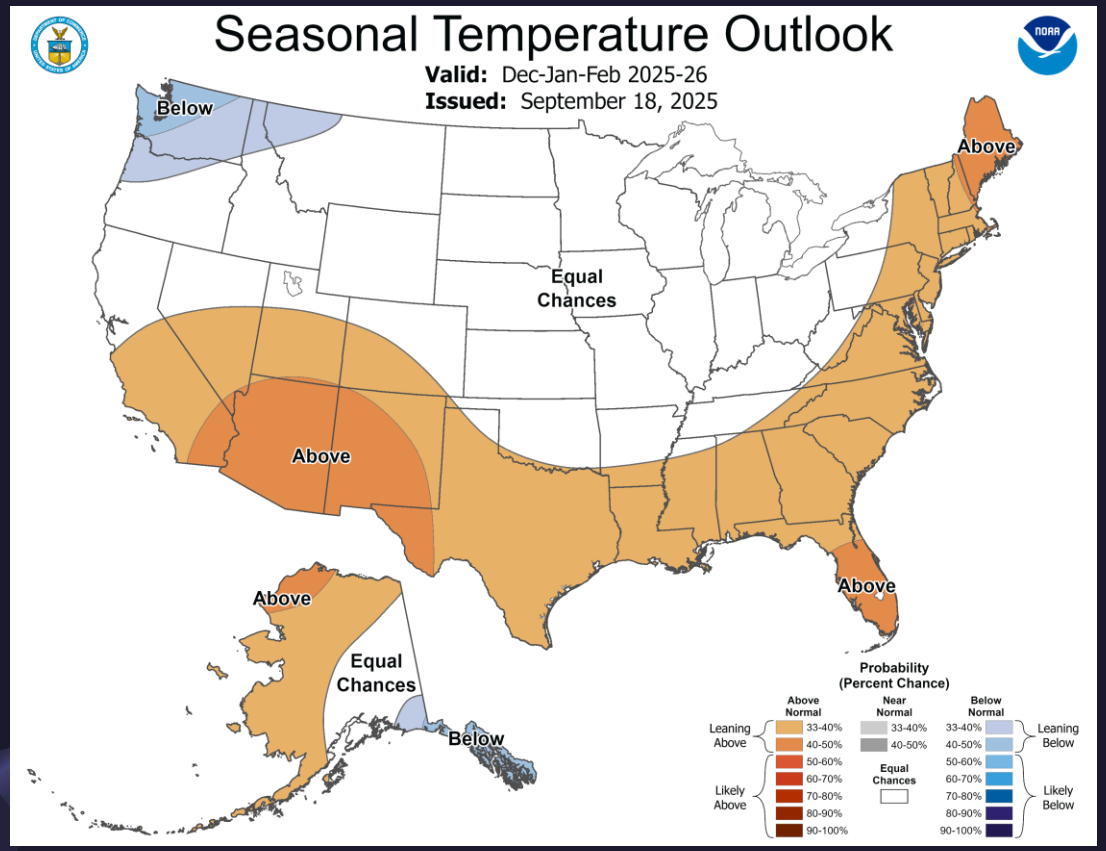
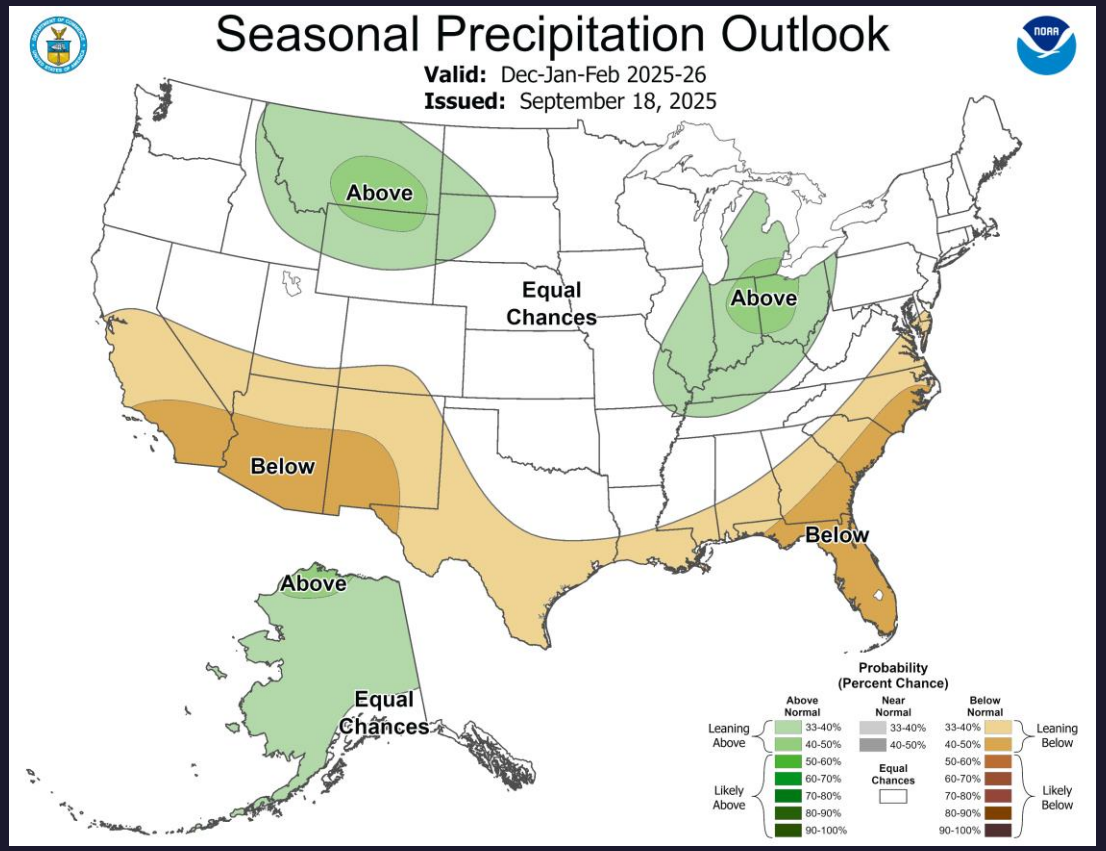


Image Link: https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=4

Climate Prediction Center-NOAA Seasonal Outlook





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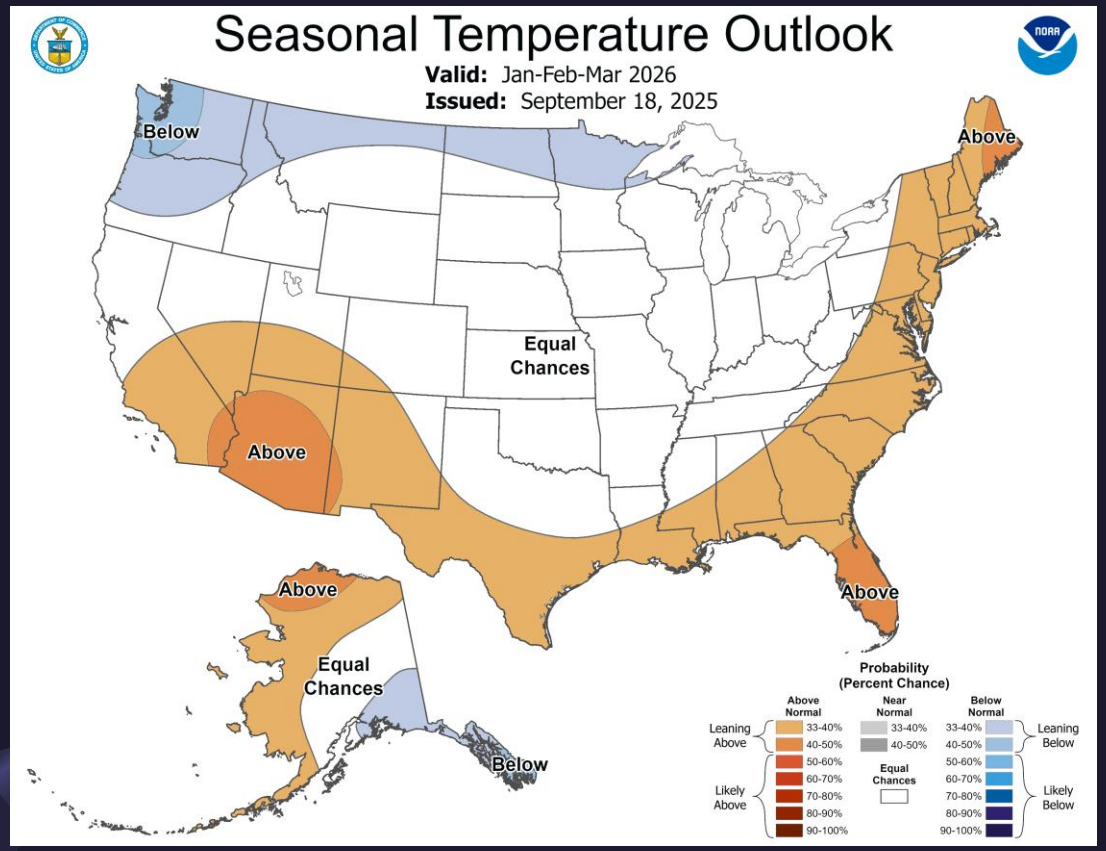
Climate Prediction Center-NOAA Seasonal Outlook



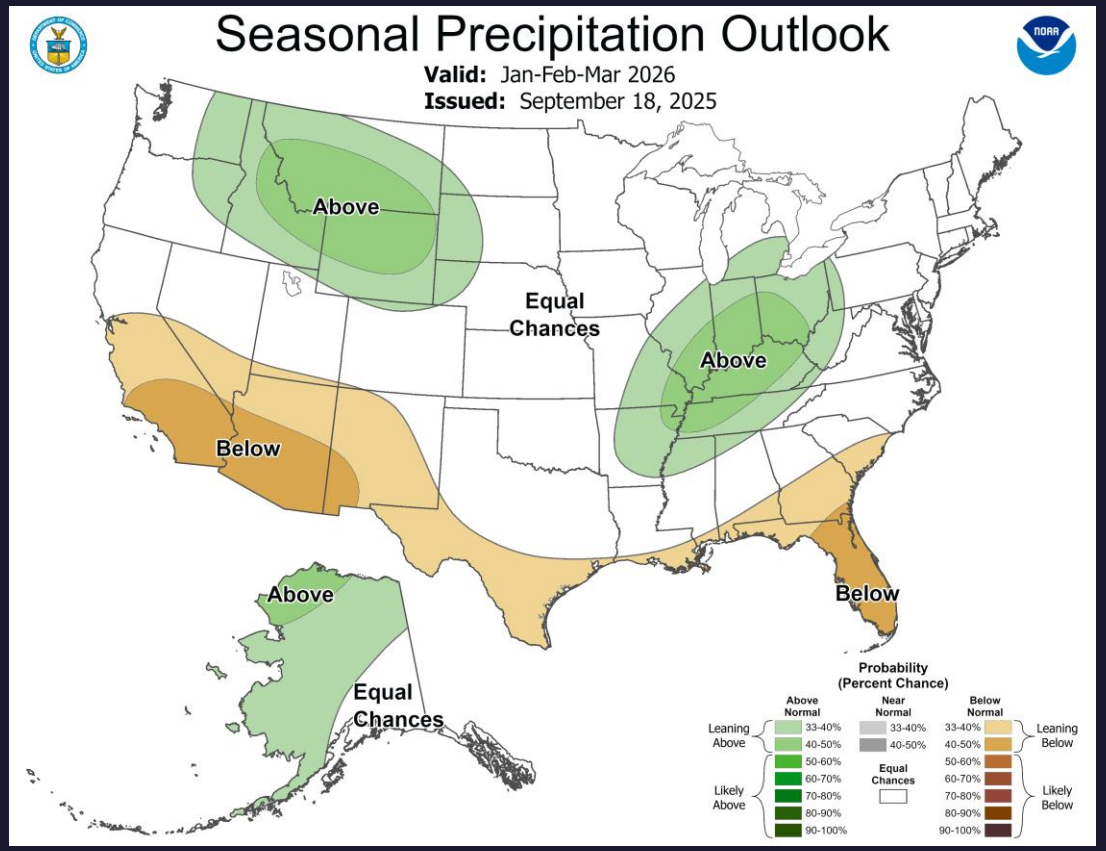
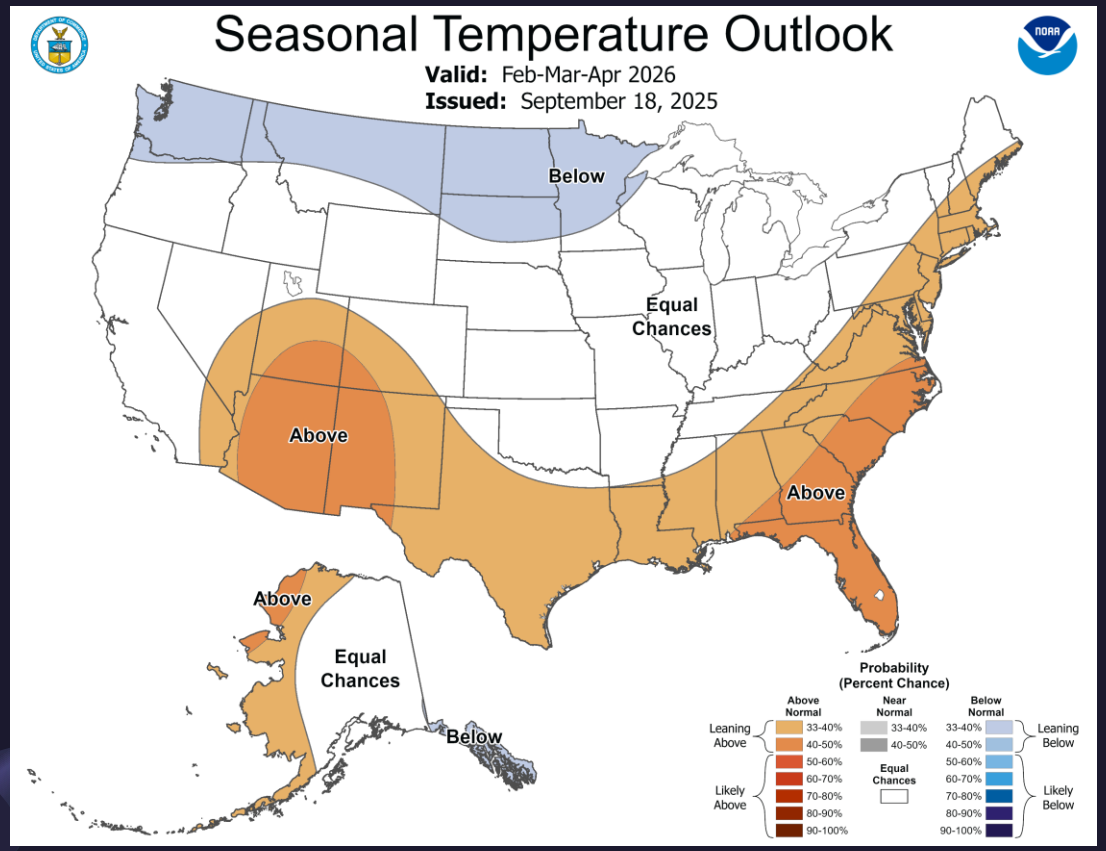
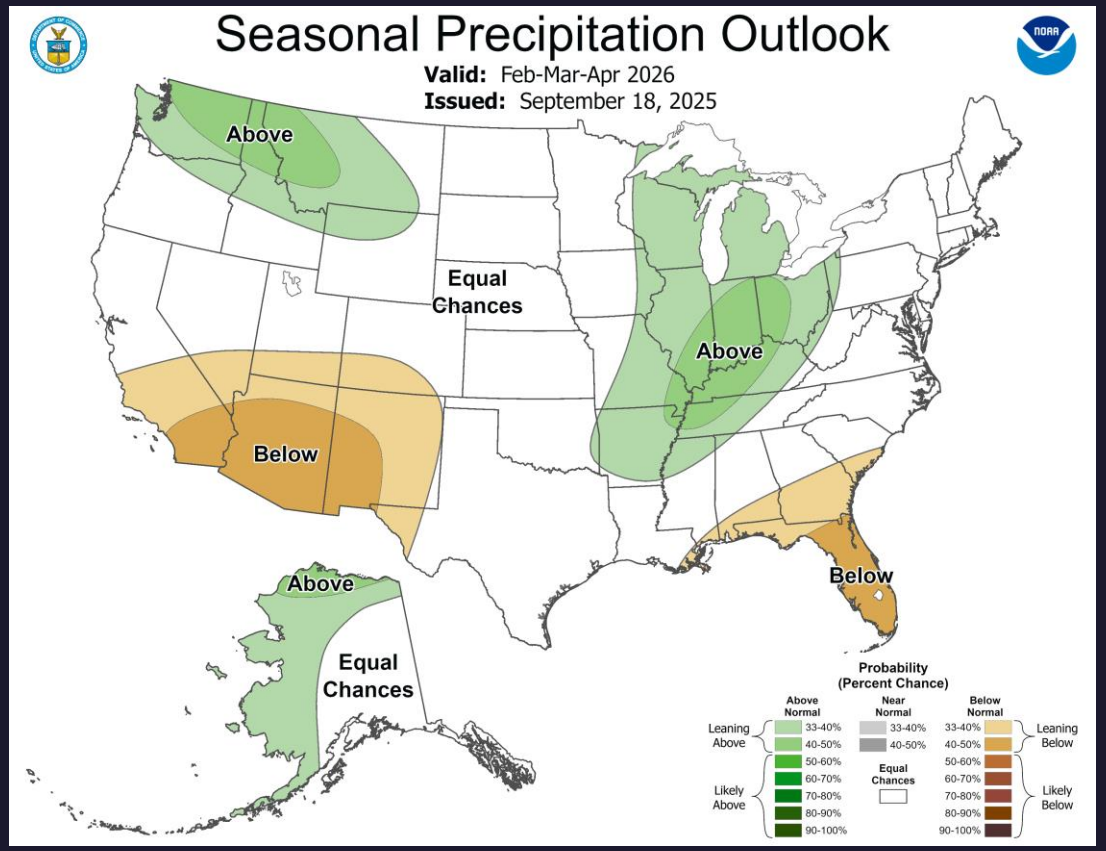


Image Link: https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=4

Climate Prediction Center-NOAA Seasonal Outlook





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2025-2026 PDX Winter Forecast

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PDX Winter Weather Forecast

Weather Event	Timing	Other Details
Hydrological Event (localized flooding or widespread flooding).	Early Season and Late Season	We may see some sort of flooding event. I am leaning towards localized flooding. I also think early season (November and December) is more likely than late season.
High wind event	November through January	I don't expect any notable windstorms, but a high wind event is possible (at least wind advisory for the Portland metro area).
Cold Air Event	January and February	A cold spell likely January – February. I don't expect any arctic blast or record-breaking cold air event (mostly likely from an easterly event).
Icing Event	Late December through Mid-February	We will likely see some sort of icing event. Minor event is most likely but can't rule out a significant event.

2025-2026 Snow Forecast: 3.76"
Range: 0" - 6"

Bulk of PDX Snow is likely January through February.

Thank you

Image Link: https://i.pinimg.com/originals/f4/f0/e6/f4f0e6b95f56418eedd025360dbdeb12.jpg

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