# Winter 2023-2024 Weather Forecast

*31st Winter Weather Forecast Meeting, OMSI and Oregon AMS, Portland*

TMT Year-End-Review meeting, CRITFC Celilo Room

**Kyle Dittmer, P.H.** **(AIH 07-1699)**

*Hydrologist-Meteorologist*

Columbia River Inter-Tribal Fish Commission
Portland, Oregon

*Professor of Natural Sciences*

Multnomah University, Portland, Oregon

December 6th, 2023

# Columbia River Inter-Tribal Fish Commission - **CRITFC**



CRITFC website, http://www.critfc.org

# 2022-2023 Portland Climate Forecast Performance

| Month: | Temperature (mean monthly): | Avg. (n=20) | Observed | Precipitation (% normal): | Avg. (n=20) | Observed |
|---|---|---|---|---|---|---|
| November | Near Normal (-1.8 to + 1.8 degF) | 0.9 | **-1.6** | Above Normal (110 - 130%) | 110% | **93%** |
| December | Near Normal (-1.8 to + 1.8 degF) | 0.3 | **-1.8** | Near Normal (90 - 110%) | 98% | **140%** |
| January | Near Normal (-1.8 to + 1.8 degF) | -0.8 | **2.2** | Above Normal (110 - 130%) | 122% | **72%** |
| February | Near Normal (-1.8 to + 1.8 degF) | -0.8 | **-2.8** | Near Normal (90 - 110%) | 99% | **62%** |
| March | Near Normal (-1.8 to + 1.8 degF) | -1.6 | **-3** | Above Normal (110 - 130%) | 111% | **122%** |
| | average: | -0.4 | -1.4 | average: | 108% | 98% |

## ...but what about *Snow events*?!

Forecasted five events: two moderate and three minor
(8.5-inch seasonal total), December to March.

Observed three snow events: Dec. 4, 22; Feb. 22...
an **11-inch** seasonal total.

# 2022-2023 Government Camp Climate Forecast Performance

| Month: | | Temperature: | Observed | | Precipitation: | Observed | | Snowfall | Observed | Forecast | Observed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| November | | 0.8 | -4.6 | | 113% | 114% | | 32 | 45 | 125% | 147% |
| December | | -0.9 | -2 | | 126% | 87% | | 64 | 78 | 145% | 151% |
| January | | 0.2 | -0.9 | | 134% | 40% | | 72 | 24 | 142% | 49% |
| February | | -1.2 | -3.2 | | 121% | 54% | | 55 | 30 | 137% | 75% |
| March | | -2 | -5.2 | | 122% | 80% | | 55 | 58 | 142% | 163% |
| April | | -1.2 | -2.1 | | 96% | 133% | | 25 | 60 | 118% | 338% |
| May | | -0.5 | 3.7 | | 96% | 15% | | 6 | 0 | 168% | 0% |
| average: | | -0.7 | -2.0 | | 115% | 75% | | 309 | 295 | 140% | 132% |

Water Supply Forecast (MEI method): Columbia R. at The Dalles, Jan.-July:
123 MAF (issued Oct. 2022), 122%.  Observed: 80 MAF.  Error ±54%.
111 MAF (issued April 2023), 103%.  Observed: 80 MAF.  Error ±39%.

# NOAA/CPC and Columbia U. IRI ENSO 2023-2024 Winter Forecast



Model Predictions of ENSO from Nov 2023
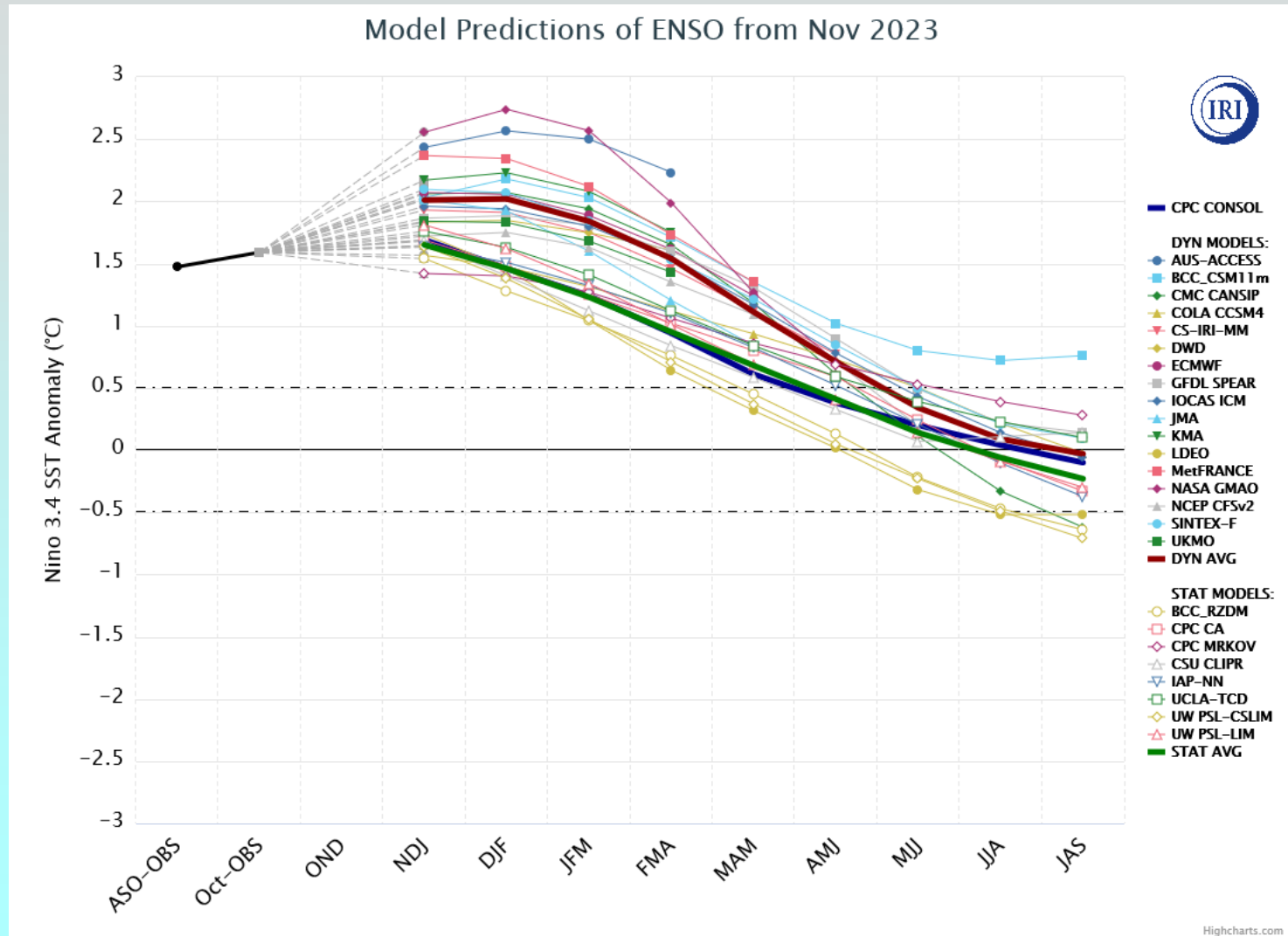
# SEA SURFACE TEMPERATURE OCEANIC NINO INDEX - CATEGORIES
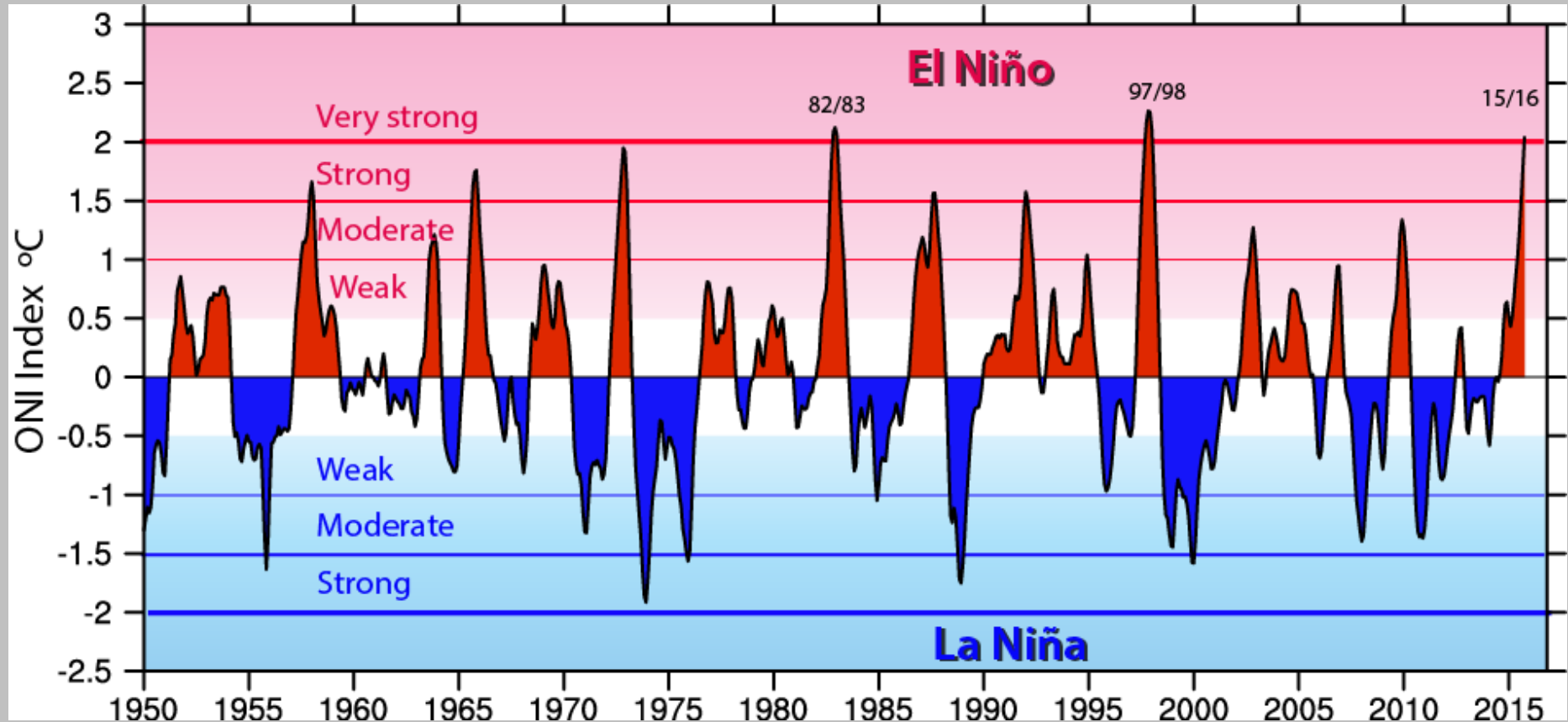
# WHAT TYPE OF *El Niño* WINTER EVENT CAN WE EXPECT?



STRONG-TO-VERY STRONG

NOAA guidance: 55% Moderate-to-Strong (January-March)

WEAK (AS A KITTEN)
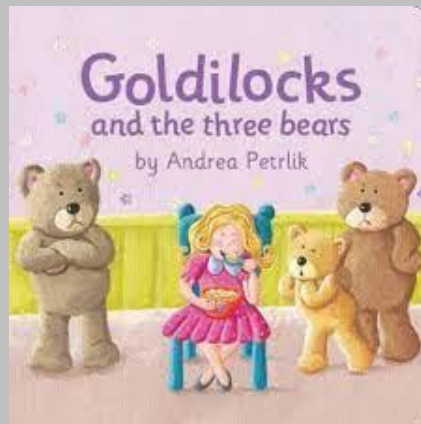
"NOT TOO STRONG...
NOT TOO WEAK...
BUT JUST RIGHT"

# THE SCIENCE OF *El Niño* WINTER PATTERNS
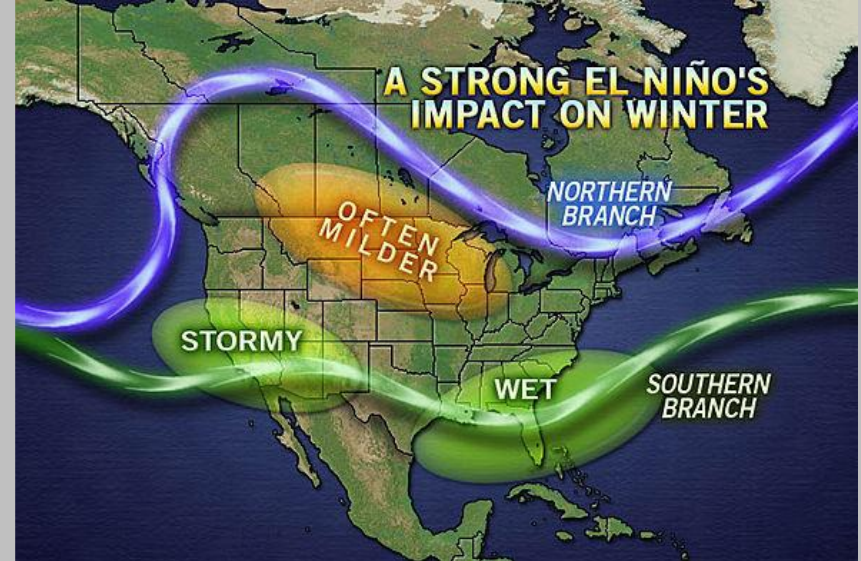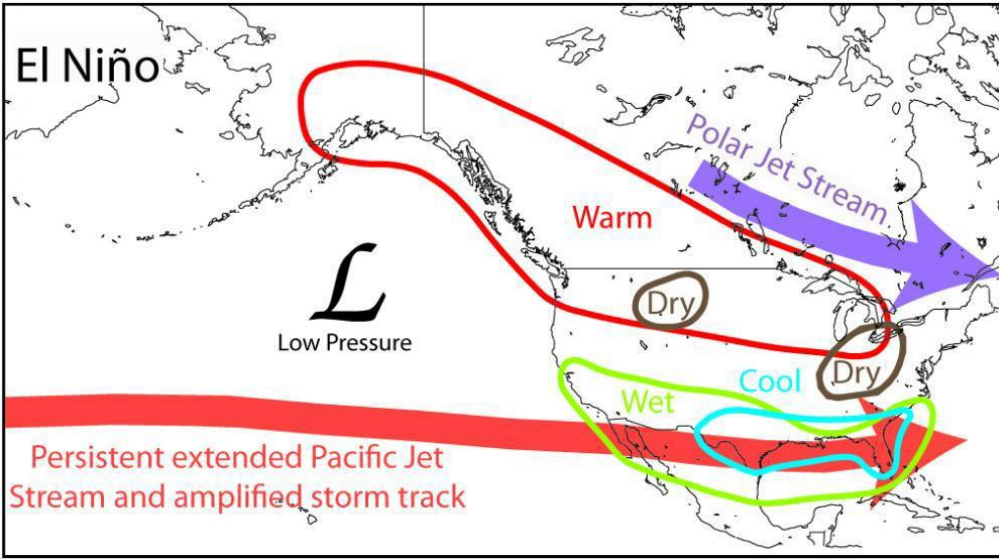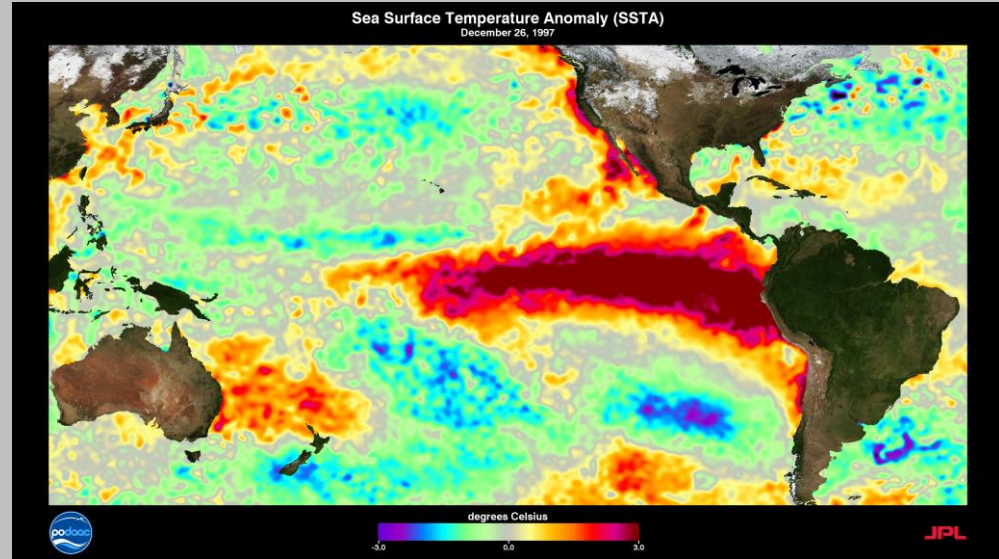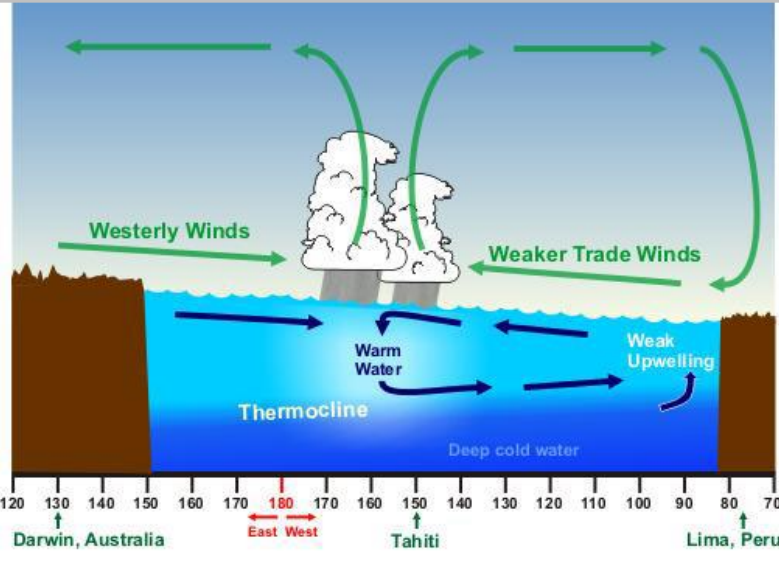
...BUT WHAT ARE THE FORECASTED SST PATTERNS?

# NOAA SEA SURFACE TEMPERATURES - "*El Niño* winter"



https://www.cpc.ncep.noaa.gov/products/CFSv2/htmls/glbSSTe3MonMask.html
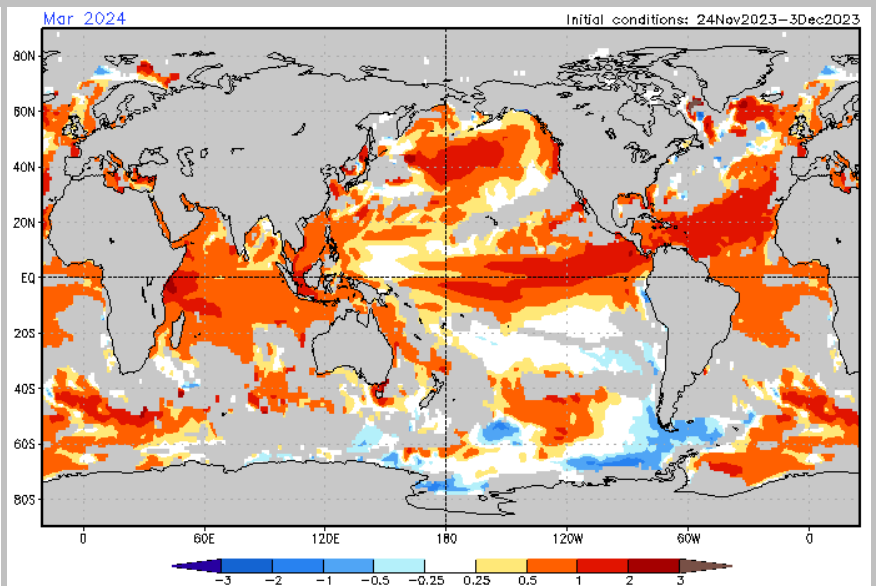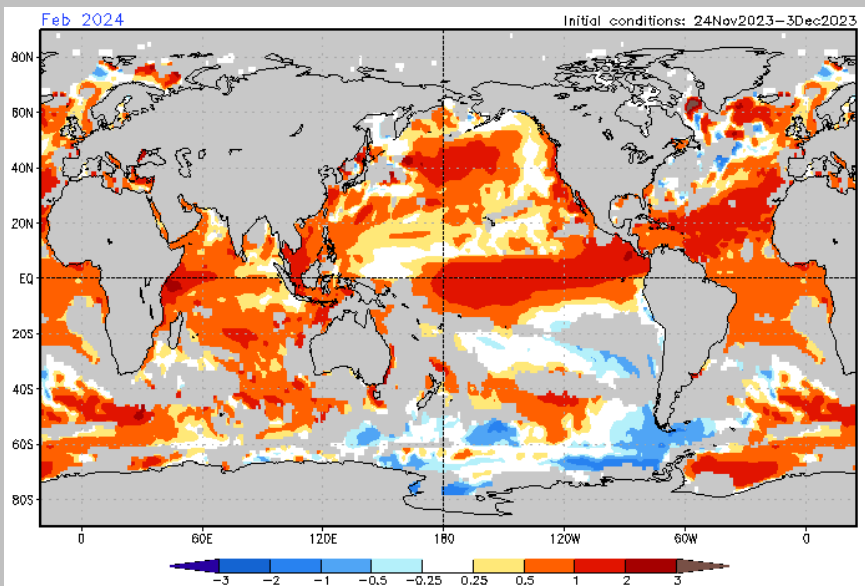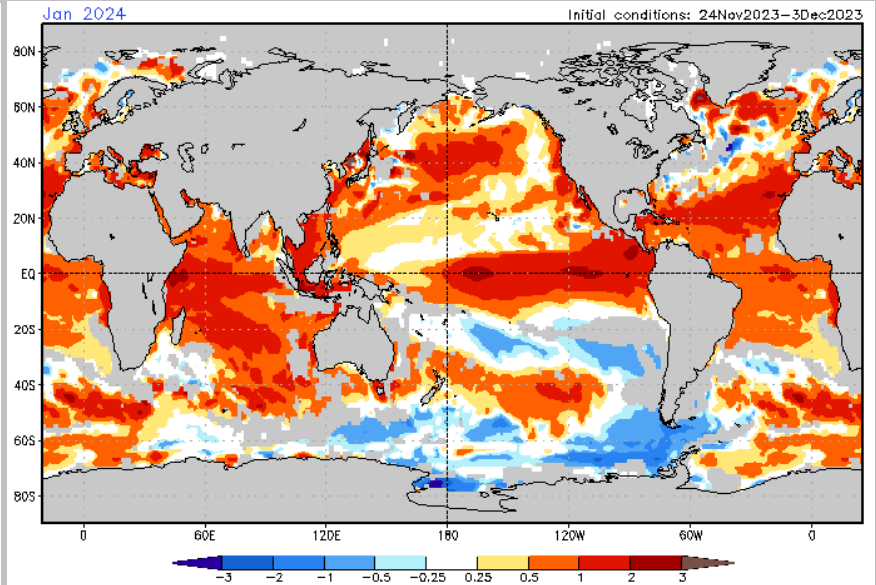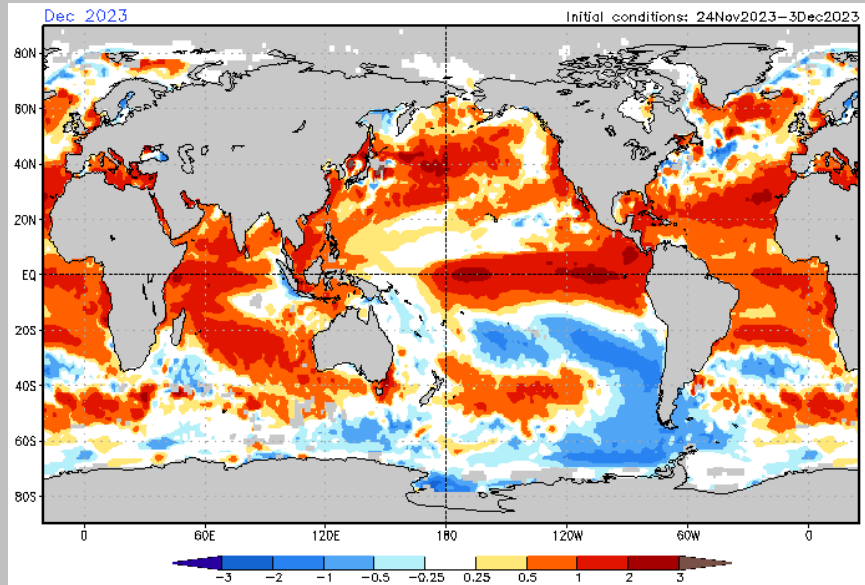
# NOAA/CPC Winter Forecast

# NOAA/NWS Portland Forecast

- Current ENSO Status: **El Niño**

- 75-85% chance of a strong El Niño through this winter

- Historically, strong El Niños tend to bring **warmer than normal temperatures** to the Pacific Northwest. **Precipitation trends are less clear.**

- NWS Climate Prediction Center Outlook for PNW winter 2023-24:
    - **Likely above normal temperatures** (50-60% chance)
    - **Equal chances for above, below, or near-normal precipitation** (~33% chance each)

- Potential for drought relief in western OR/WA

Source: https://oregonams.files.wordpress.com/2023/10/noahalviz.pptx

# OSU/Tanis Leach

- THE BASICS…

- Rain: Near Median water year favored: **31-39" (87-109% of median)**
  - Winter: 13-16.5".
  - Best Estimate: 34"

- Temperature Departure: Near Normal favored: **Within 1.5°F of average**
  - Best estimate: Right at average

- Windstorm(s): Nothing too crazy: Peak gust **45-55 mph.**

- Lowest Temperature: **Above 20°F**
  - Best Estimate: 22°F

- Most likely to be Active: **December**

- SNOWFALL FORECAST…

- Mountain Snow Depth on April 1$^{st}$ between **75-110%** of normal above 4500 feet.
  - 60-100% from 3500-4500 feet.

- Valley Snowfall:
  - Below Normal Favored Portland: **0-3"**
    - Best estimate: T
  - Central/South Valley Normal Snowfall Favored: 1-5"
    - Central/South Valley: 3"
  - Chance of 2 inch snowstorm: 40%
  - Chance of 5 inch snowstorm: 20%
  - Chance of 8 inch *snowpocalypse*: 5%
  - Chance of bust winter: 50%

Method: Analogue (21 years), Oceanic Nino Index (ONI), PDO, AMO, Sunspots
https://oregonams.files.wordpress.com/2023/10/tanisleach.pptx

# OREGON DEPT. AGRICULTURE



Method (Pete Parsons, ODA): Analogue, 3-year average (WY 1952, 1966, 1973)

Source: https://www.oregon.gov/ODA/programs/NaturalResources/Pages/Weather.aspx

# Introduction – CRITFC Method

- ➢ CRITFC forecast uses a holistic, integrated big picture view.

- ➢ Big-picture: **Solar Forcing** (e.g., sunspot cycles) <u>does</u> influence our global weather patterns over the long term (decades). *In memoriam:* Dr. Landscheidt, of Germany (1922 – 2004).

- ➢ Track ENSO with the Multi-variable ENSO Index: **MEI**.

- ➢ NOAA's Sea-Surface Temperature Departure Forecasts.

- ➢ Hydro-Climate approach: Use a regression: Multi-variable ENSO Index (1950-2023) vs. historic runoff for the Columbia River at The Dalles, then compute a 2024 Water Supply Forecast.

- ➢ Select the "right" mixture of 20 past Water Years (next slide).

- ➢ Pattern recognition is key: *El Niño* years.

# Introduction – CRITFC Method



Ensemble forecasting – 20 past water years:

| WY2024 | TDA runoff | PDO-warm | PDO-cold | El Nino | E-neutral | La Nina |
|---|---|---|---|---|---|---|
| 1952 | 113.5 | | x | X | | |
| **1958** | 107.6 | | x | X | | |
| 1964 | 107.3 | | x | X | | |
| 1970 | 97.01 | | x | X | | |
| 1978 | 104.7 | x | | X | | |
| 1980 | 97.84 | x | | X | | |
| 1987 | 79.23 | x | | X | | |
| 1988 | 76.01 | x | | X | | |
| 1995 | 104 | x | | X | | |
| **1998** | 104.1 | x | | X | | |
| 2003 | 87.7 | | x | X | | |
| 2004 | 83 | | x | X | | |
| 2007 | 95.7 | | x | | X | |
| **2010** | 84.7 | | x | X | | |
| 2013 | 97.7 | | x | | X | |
| 2014 | 108.1 | | x | | X | |
| 2015 | 83.5 | | x | X | | |
| **2016** | 97.4 | | x | X | | |
| 2019 | 90.1 | | x | X | | |
| 2020 | 101.3 | | x | X | | |
| | (MAF) | | | | | |
| Average: | **96.0** | | El-Nino: | | | 17 |
| STDEV: | 10.5 | | Strong El-Nino: | | | 4 |
| | | | ENSO-neutral: | | | 3 |

# SUNSPOT COUNTS – "*El Niño* winter"



https://www.swpc.noaa.gov/products/solar-cycle-progression
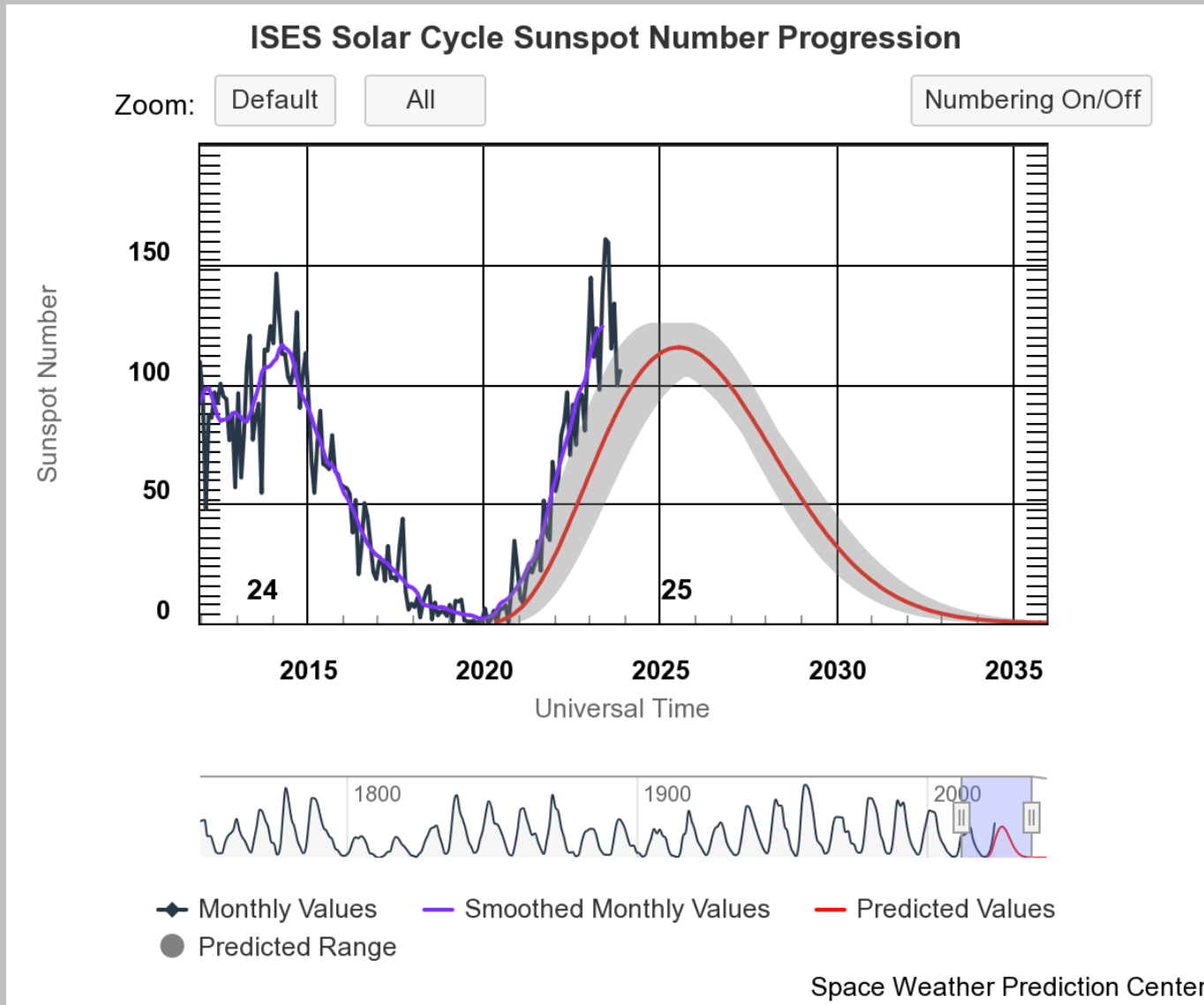
# MEI SIGNAL SUGGESTS "*El Niño* winter"



**MEI.v2 Evolution of Current ENSO Event in Historical Context**

— 1983 — 1987 — 1992 — 1998 — 2016
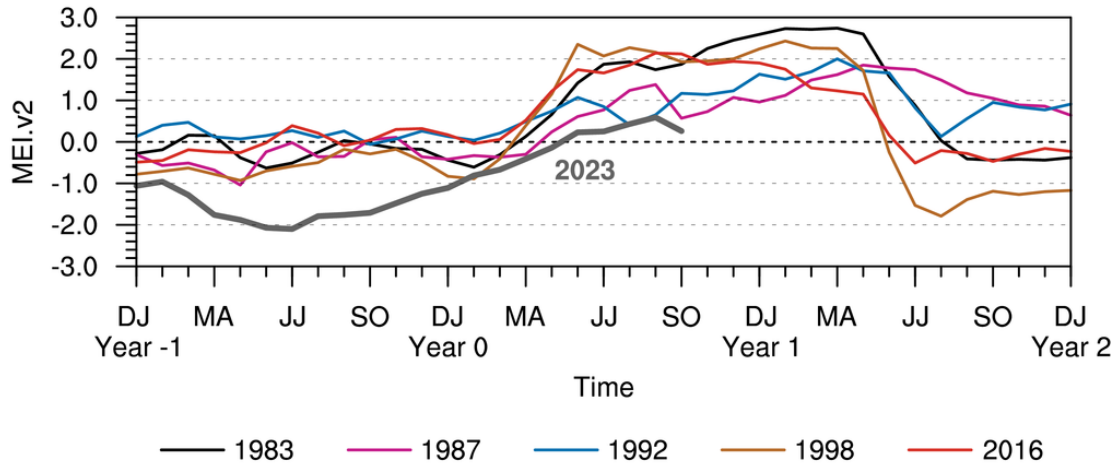
**MEI** – one index that tracks:

➢ Sea-Level Pressure

➢ Surface winds (2D)

➢ Sea-surface Temperature

➢ Surface Air Temperature

➢ Fraction of Cloud cover



**Multivariate ENSO Index Version 2**



ENSO indexes

Source: https://www.esrl.noaa.gov/psd/enso/mei
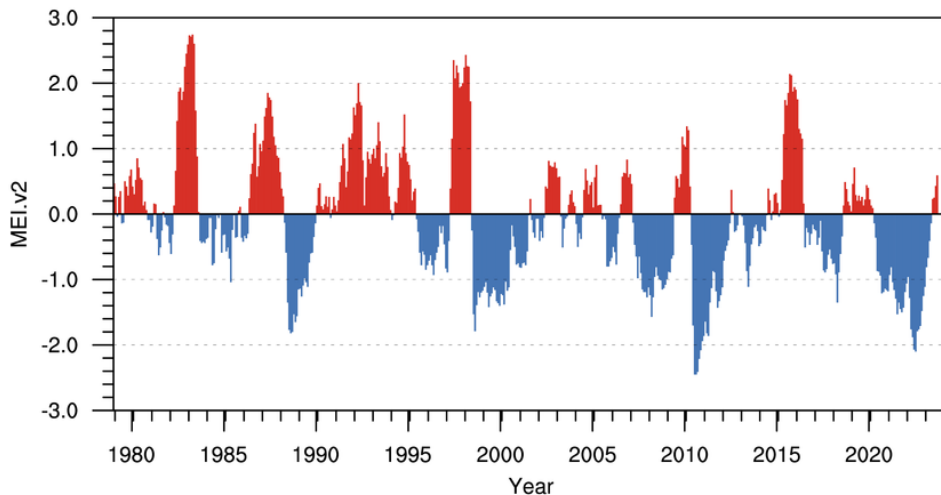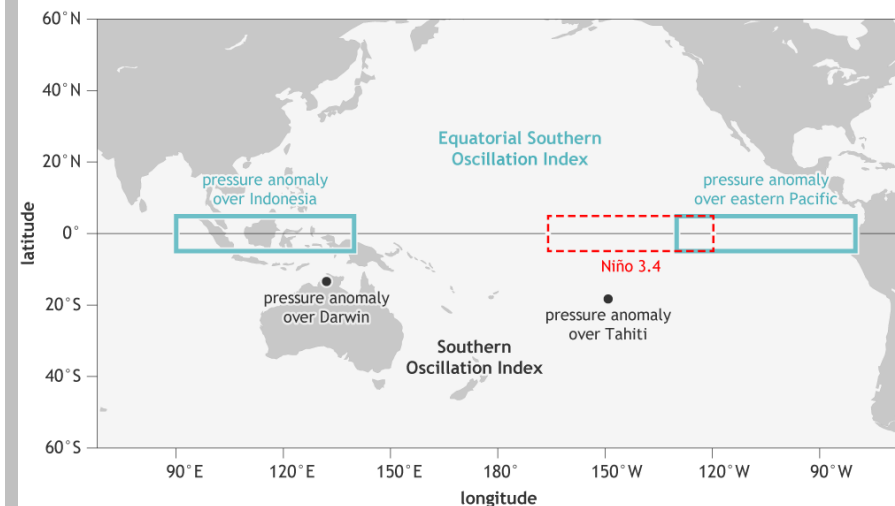
# PDO SIGNAL: COLD PHASE...STILL NEGATIVE

**PACIFIC DECADAL OSCILLATION (PDO), v.5**

Source: Dr. Nate Mantua, NOAA (formerly UW-Climate Impacts Group)

# ENSEMBLE STREAMFLOW FORECAST – Water Year 2024



**Columbia River at The Dalles (red line WY 2024)**

Blue line = long-term average (WY 1929-2023)

# Summary: the mountains

## Government Camp, Oregon

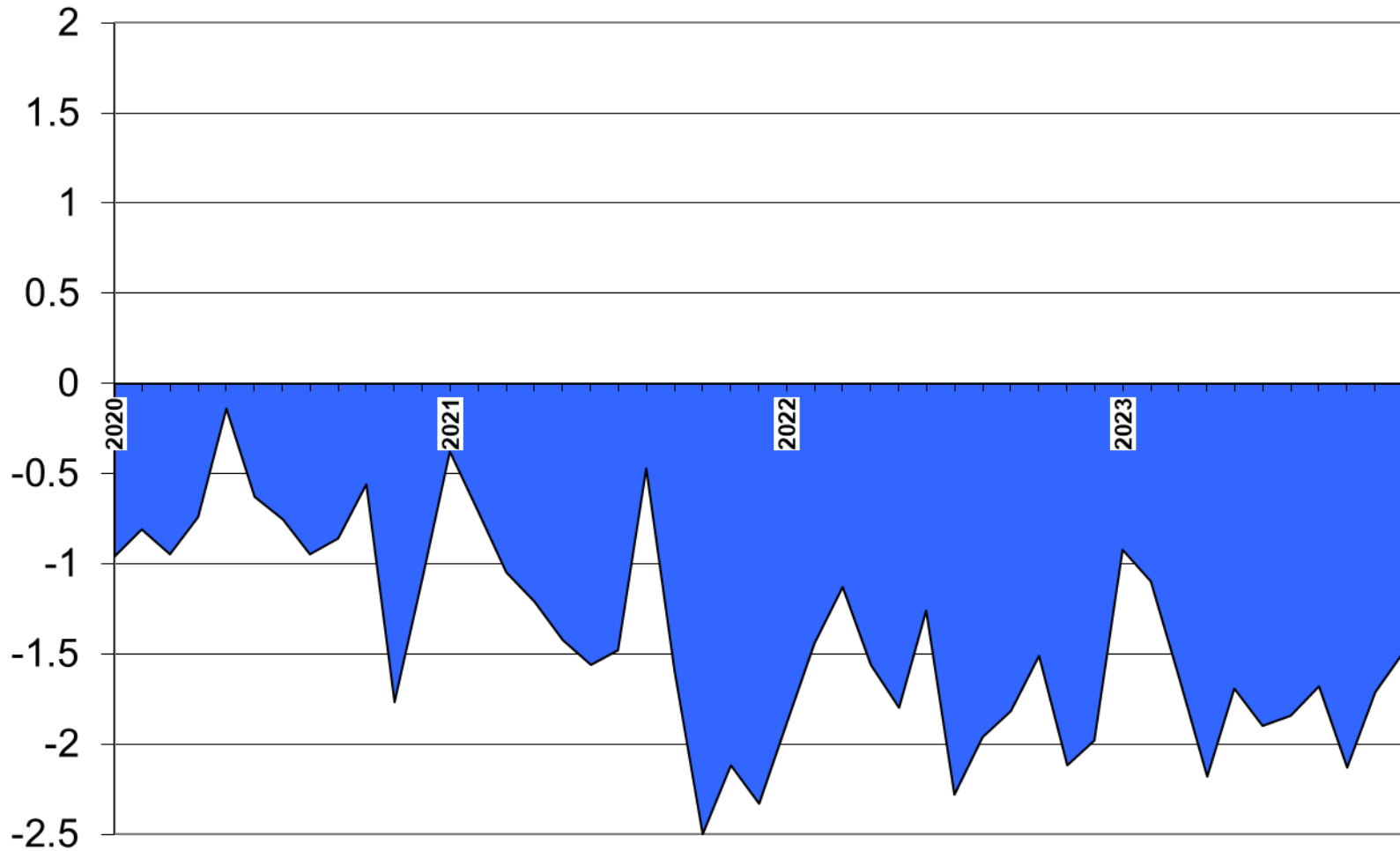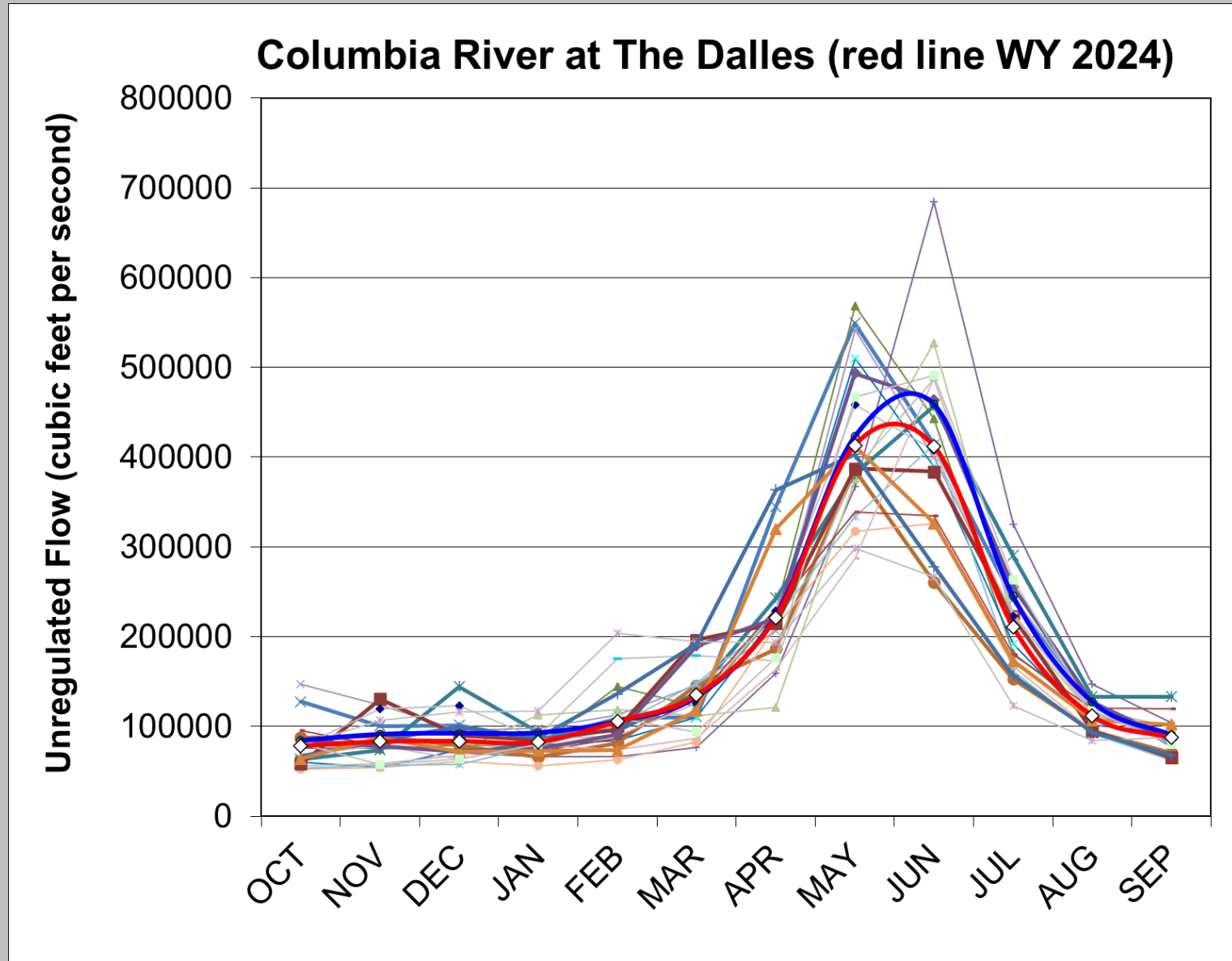| Month: | Temperature (mean monthly): | Avg. (n=20) | Precipitation (% normal): | Avg. (n=20) | Snowfall | % Normal |
|---|---|---|---|---|---|---|
| November | Near Normal (-1.8 to + 1.8 degF) | -0.1 | Near Normal (90 - 110%) | 96% | 30 | 113% |
| December | Near Normal (-1.8 to + 1.8 degF) | -0.1 | Near Normal (90 - 110%) | 96% | 43 | 97% |
| January | Above Normal (> + 1.8 degF) | 2.1 | Near Normal (90 - 110%) | 104% | 50 | 97% |
| February | Near Normal (-1.8 to + 1.8 degF) | 1 | Near Normal (90 - 110%) | 90% | 35 | 89% |
| March | Near Normal (-1.8 to + 1.8 degF) | 0.7 | Near Normal (90 - 110%) | 94% | 35 | 86% |
| April | Near Normal (-1.8 to + 1.8 degF) | 0.7 | Near Normal (90 - 110%) | 100% | 21 | 97% |
| May | Near Normal (-1.8 to + 1.8 degF) | 0.7 | Near Normal (90 - 110%) | 97% | 3 | 60% |

Expect a seasonal snow total: **216**-inches or **91%** of normal (NOV-MAY).

© Gary J. Weathers

TIMBERLINE

# Summary: the Portland Forecast

| Month: | Temperature (mean monthly): | Avg. (n=20) | Precipitation (% normal): | Avg. (n=20) |
|---|---|---|---|---|
| November | Near Normal (-1.8 to + 1.8 degF) | 0.7 | Below Normal (70 - 90%) | 82% |
| December | Near Normal (-1.8 to + 1.8 degF) | 0.5 | Near Normal (90 - 110%) | 104% |
| January | Near Normal (-1.8 to + 1.8 degF) | 1.3 | Above Normal (110 - 130%) | 111% |
| February | Near Normal (-1.8 to + 1.8 degF) | 1.2 | Below Normal (70 - 90%) | 80% |
| March | Near Normal (-1.8 to + 1.8 degF) | 0.9 | Near Normal (90 - 110%) | 92% |

EXPECT LOW VARIABILITY – HARD RAIN EVENTS, MORE/LONGER DRY-SPELLS, FOG, FEW GORGE WIND EVENTS, etc.

WATER SUPPLY FORECAST: **96 MAF** (**±**10 MAF) or **94%**, COLUMBIA RIVER AT THE DALLES, JANUARY - JULY.

## *...but what about Snow events?!*

Expect **TWO** events: 1 moderate (2 inch), 1 minor (1 inch or less).

NOV 0.5-inch, DEC 0.75-inch (up to 2), JAN 2.5-inch (up to 7), FEB 0.5-inch (up to 2), and MAR 0.25-inch (up to 0.75).

(35% - 70% likely) Season: **4.5**-inches