

CW3E AR Outlook: 15 December 2025

Two Atmospheric Rivers to Bring Heavy Precipitation to the Pacific Northwest This Week

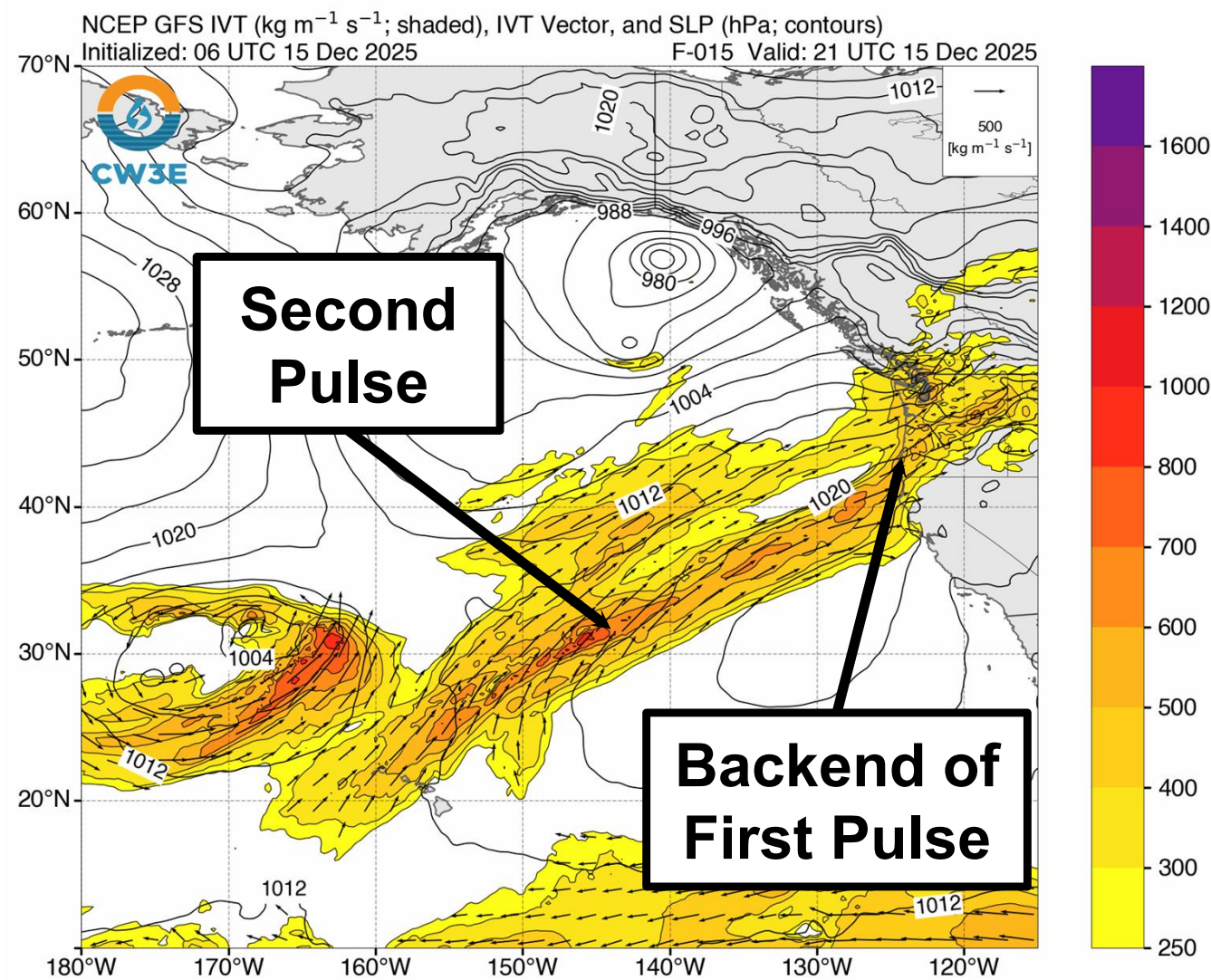
- Two atmospheric rivers (ARs) are forecast to impact the Pacific Northwest and northern California from Mon 15 Dec into early Sat 20 Dec, bringing heavy precipitation (5–10+ in.) to western Washington and Oregon.
- The first AR made landfall yesterday, with a second moisture pulse forecast to make landfall Tue 16 Dec. There is potential for ≥ 48 hours of continuous AR conditions in Oregon and northern California.
- A second AR is forecast to make landfall late Wed 17 Dec and impact the US West Coast through Fri 19 Dec.
- The largest precipitation totals from the first AR are forecast over the Olympic Peninsula and Washington Cascades, where the Weather Prediction Center (WPC) is forecasting 4–6 in. of precipitation for the 72-hour period ending 4 AM PT 18 Dec.
- Precipitation from the second AR is forecast to be heavier than the first, with the highest totals over the Oregon Coast Ranges and Oregon Cascades. The WPC forecasting 4–8 in. of precipitation in the 48-hr period ending 4 AM PT 20 Dec in these areas.
- GFS forecast 7-day precipitation accumulations over the northern Oregon Cascades are $>190\%$ of normal monthly precipitation and 30–45% of normal water year precipitation.
- The WPC has issued slight risk ($\geq 15\%$ chance for flash flooding) Excessive Rainfall Outlooks (ERO) for the 24-hour period ending 4 AM Tue 16 Dec (first pulse of first AR) in western Washington and northern coastal Oregon, as well as the 24-hour period ending 4 AM Fri 19 Dec (second AR) in western Oregon.
- The first AR is forecast to produce >24 inches of snow above 5,000 feet in the Olympic Mountains and Washington Cascades, with higher amounts possible in the North Cascades.
- Numerous stream gages in Washington and Oregon are forecast to rise above flood stage due to heavy precipitation from the first and second ARs.
- Active weather is forecast to continue over the US West Coast next week, with heavy rain and snow potentially shifting southward into California.

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GFS IVT Forecast of First AR

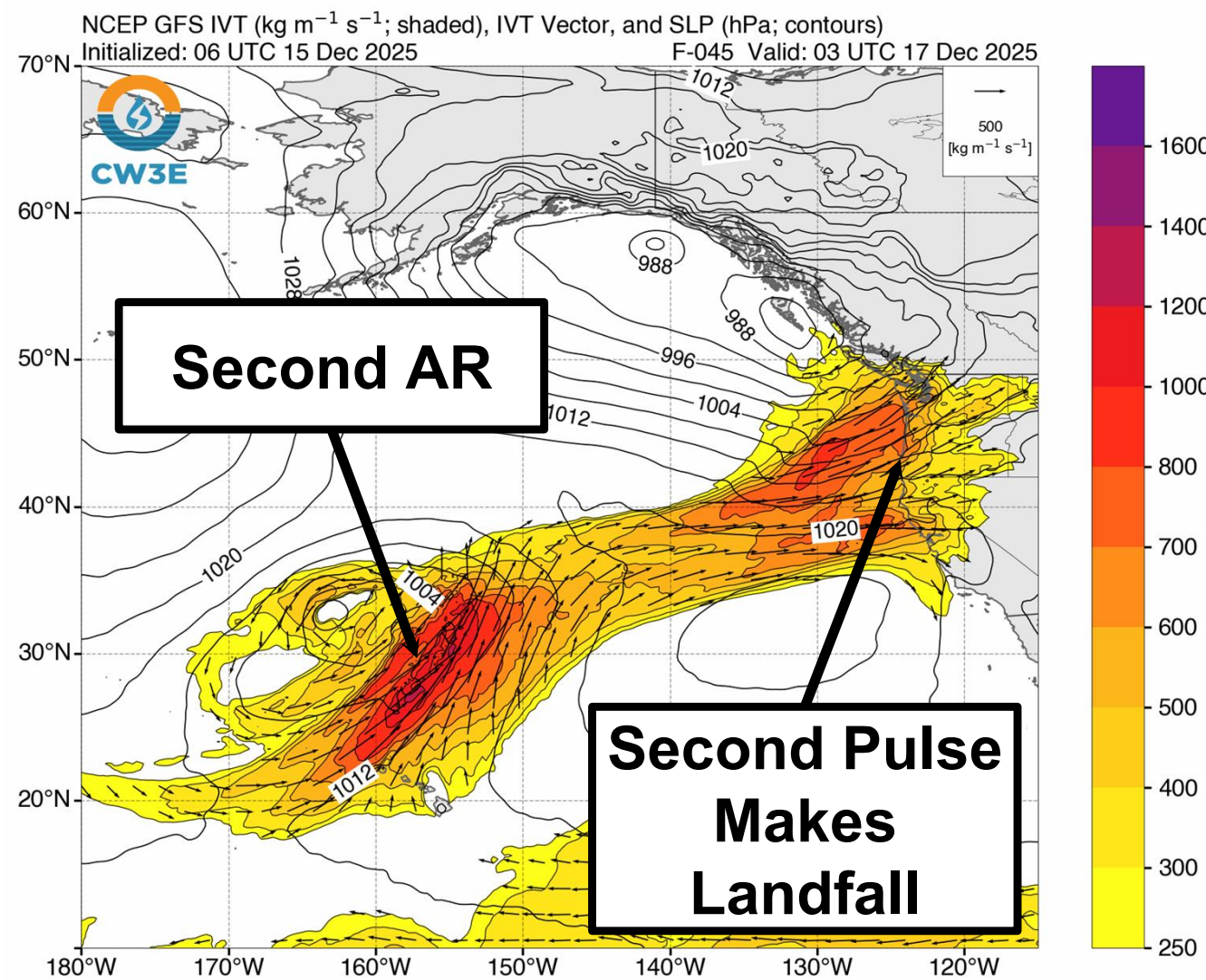
IVT and SLP

Valid: 1 PM PDT Mon 15 Dec



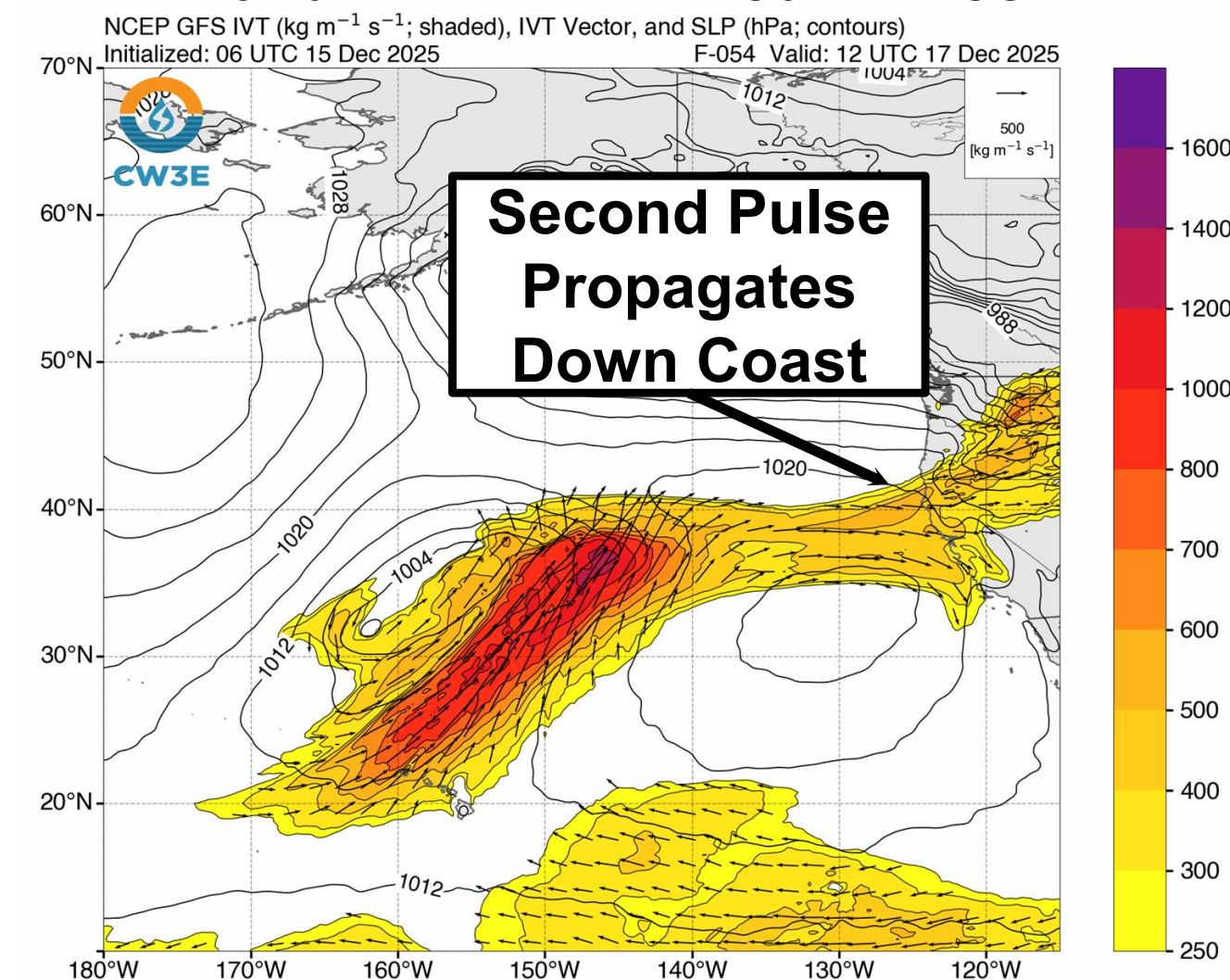
IVT and SLP

Valid: 7 PM PDT Tue 16 Dec



IVT and SLP

Valid: 4 AM PDT Wed 17 Dec



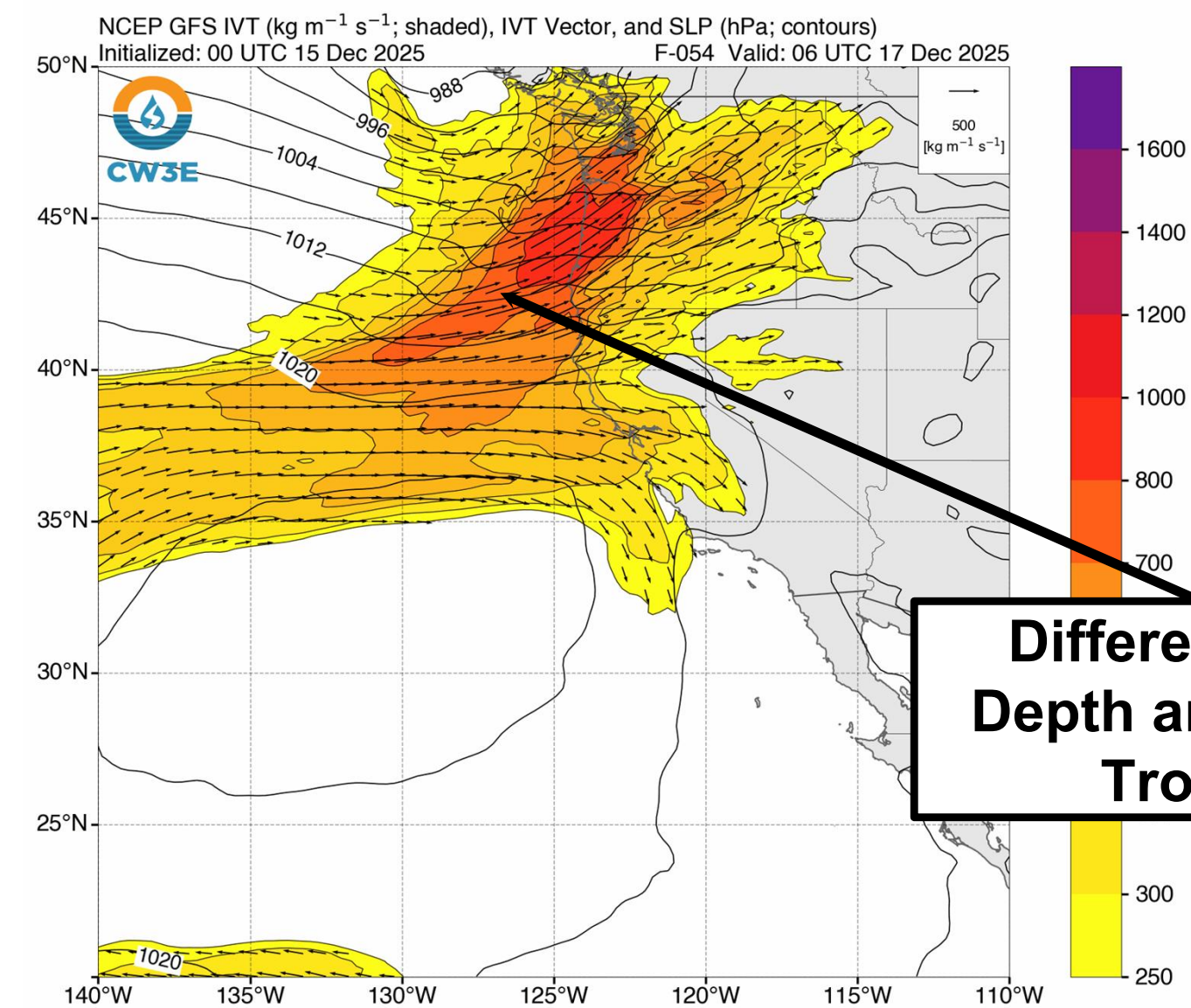
- The first moisture transport pulse in the first AR made landfall earlier today, Mon 15 Dec and is forecast to impact the Pacific Northwest (PNW) and Northern California through this evening (*Left*).
- The second pulse is forecast to be driven northeast toward the US West Coast by a shortwave trough, strengthening as it approaches the PNW coast tomorrow (*Center*), Tue 16 Dec, with the formation of the secondary low off the coast of Southern Alaska.
- The southern extent of the second pulse is forecast to propagate down the California coast through the Bay Area late Tue 16 Dec through midday Wed 17 Dec (*Right*).

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GFS and ECMWF IVT Forecast Comparison: First AR

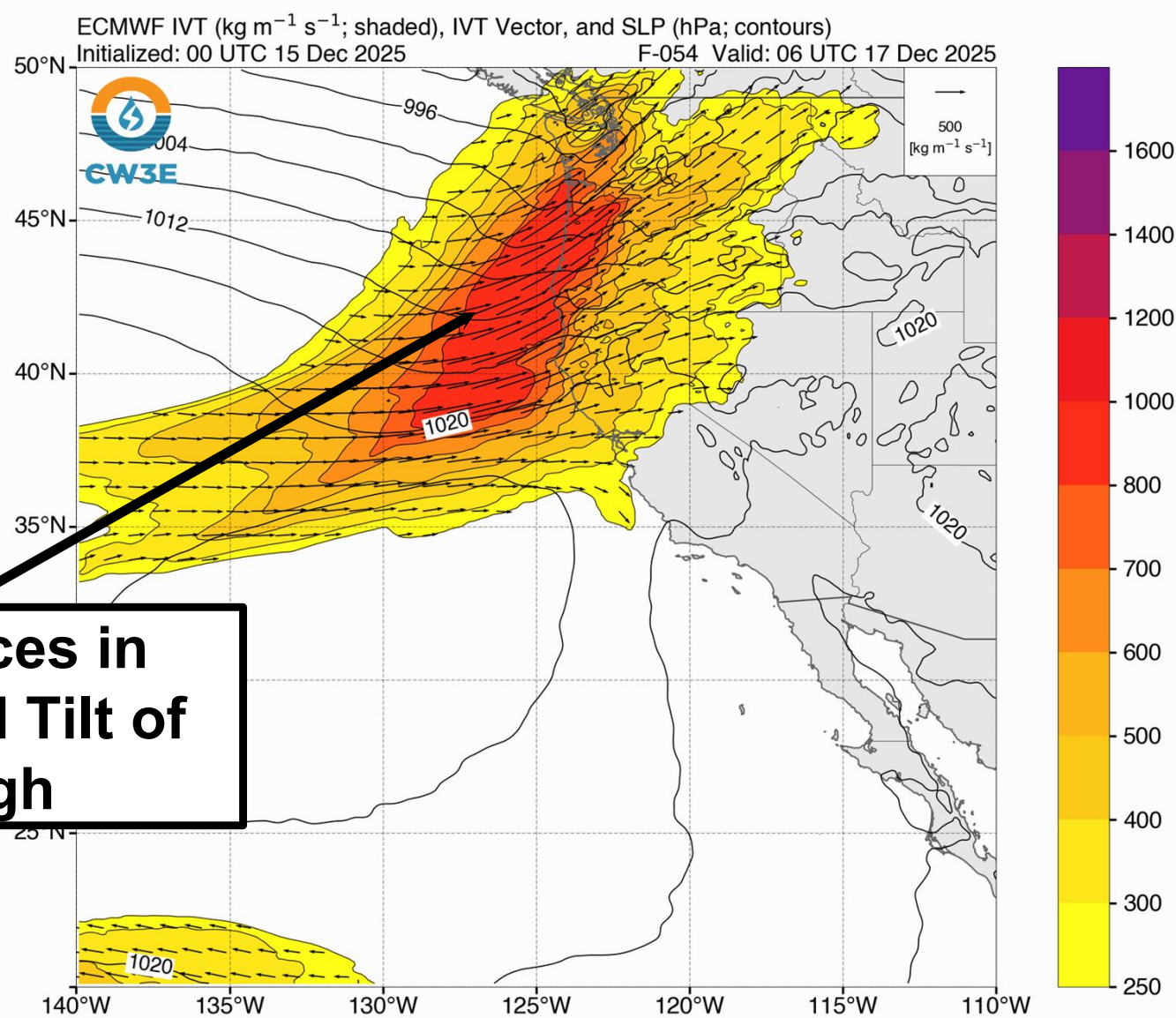
GFS IVT and SLP

Valid: 10 PM PDT Tue 16 Dec



ECMWF IVT and SLP

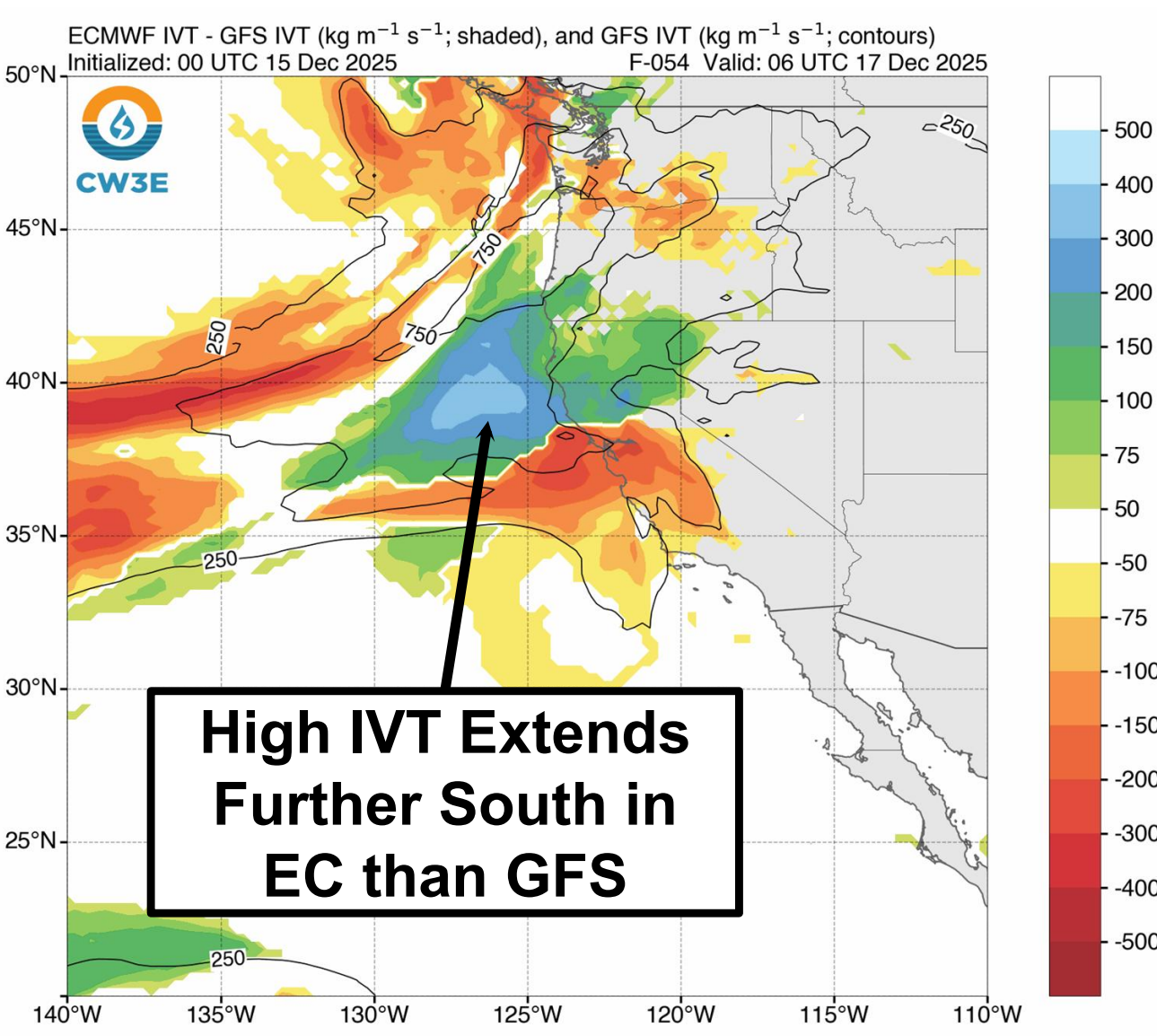
Valid: 10 PM PDT Tue 16 Dec



Differences in
Depth and Tilt of
Trough

ECMWF IVT - GFS IVT

Valid: 10 PM PDT Tue 16 Dec



High IVT Extends
Further South in
EC than GFS

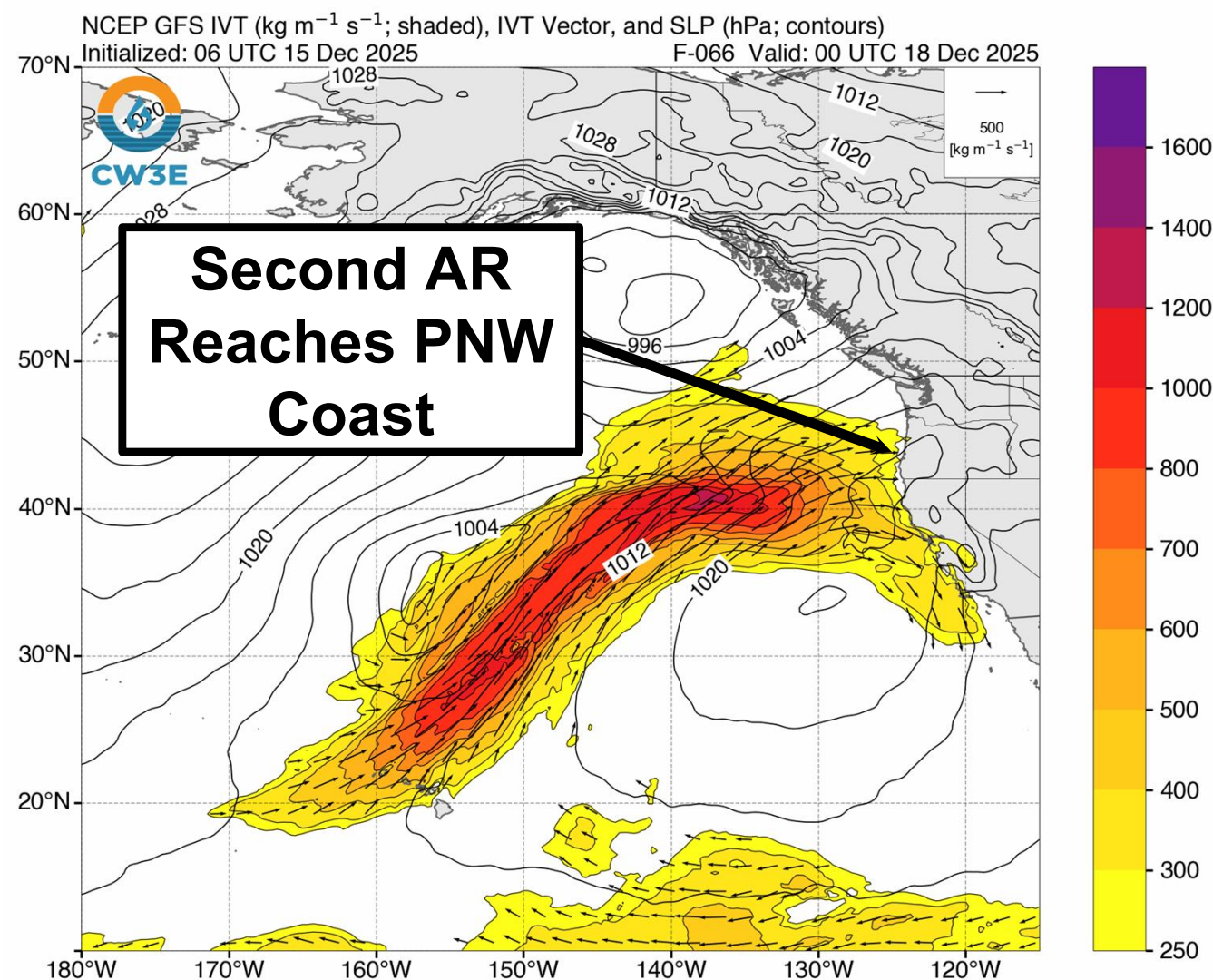
- There are model-to-model differences in the forecast of the AR and shortwave as the core of the second pulse makes landfall over the Pacific Northwest coast late Tue 16 Dec.
- The ECMWF (*Center*) is forecasting a stronger IVT plume and greater southerly extent of the plumes core than the GFS (*Left*).
- Differences in the forecast of the second plume's strength and depth can be tied to the depth and tilt of the shortwave and forecast volume of atmospheric water vapor (*not shown*). In the ECMWF the shortwave trough is deeper and is more neutral as opposed to the sharp, positive tile of the trough in the GFS.

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GFS IVT Forecast of the Second AR

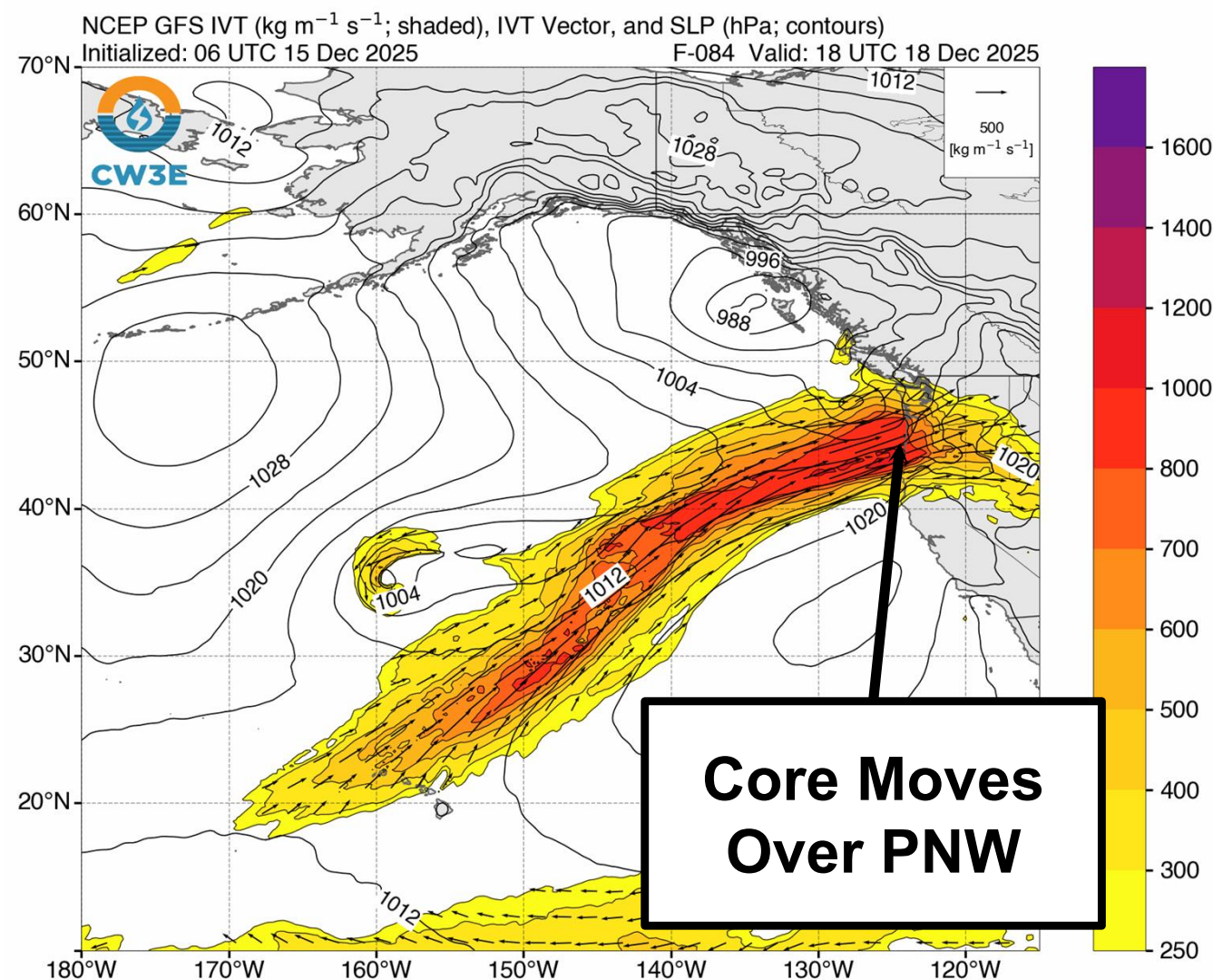
IVT and SLP

Valid: 4 PM PDT Wed 17 Dec



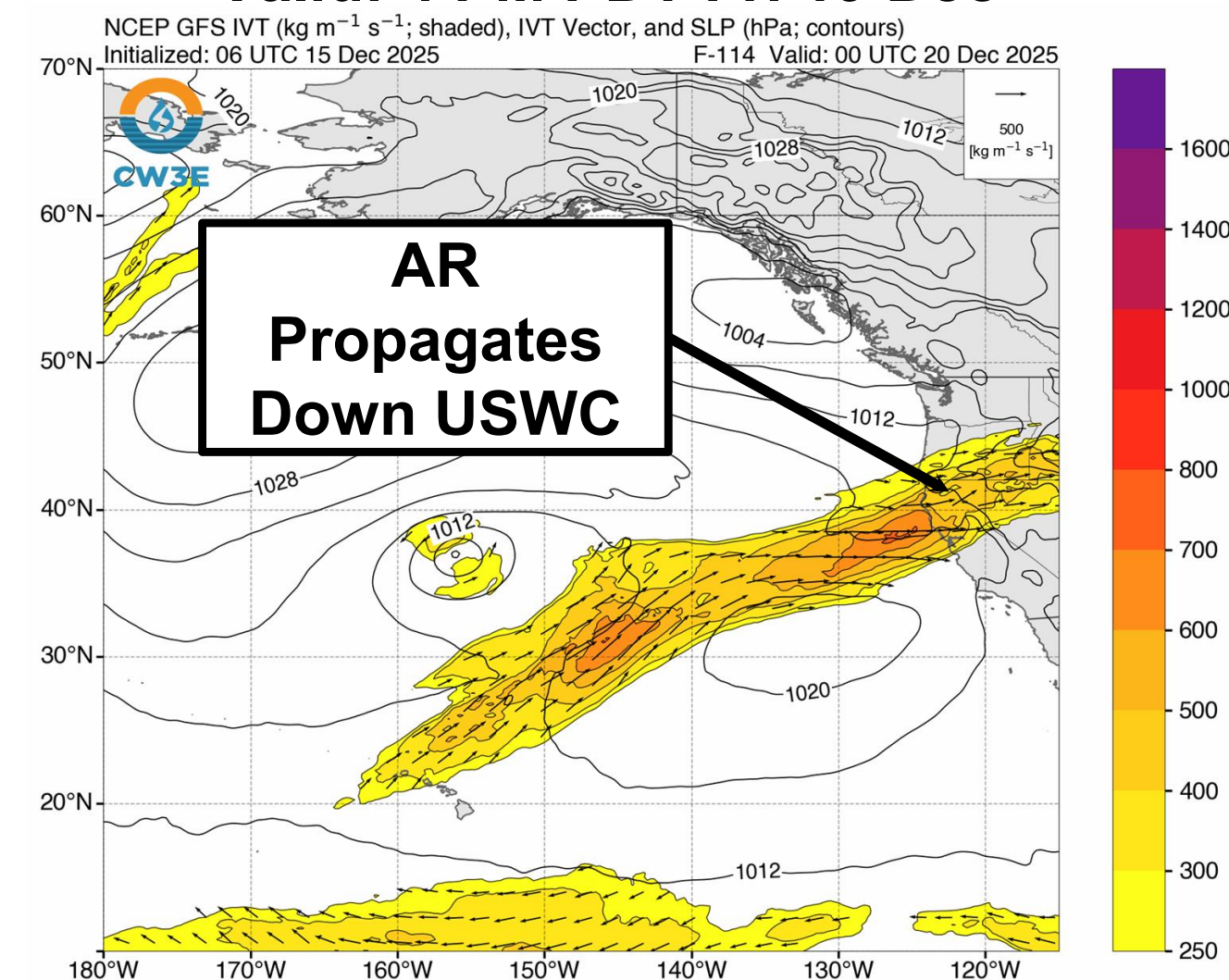
IVT and SLP

Valid: 10 AM PDT Thu 18 Dec



IVT and SLP

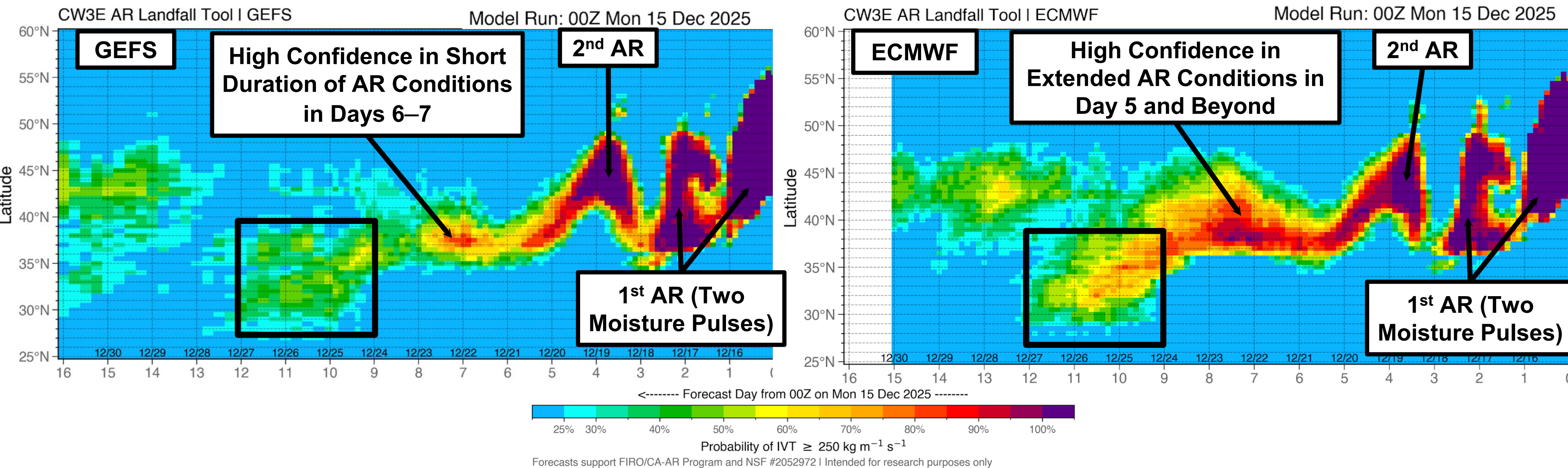
Valid: 4 PM PDT Fri 19 Dec



- The second AR is forecast to reach the Pacific Northwest coast late on Wed 17 Dec as remnants of the first AR remain off the California coast.
- The core of the AR is forecast to reach the Pacific Northwest coast early Thu 18 Dec and slowly propagate down the US West Coast through Fri 19 Dec.

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GEFS vs. ECMWF Coastal AR Landfall Tool



- The 00Z GEFS and EPS are both showing very high confidence ($>90\%$ probability) in AR conditions ($\text{IVT} \geq 250 \text{ kg m}^{-1} \text{ s}^{-1}$) along the Pacific Northwest and California coasts with the first (15–16 Dec), second (16–17 Dec) and third (18–20 Dec) ARs.
- The GEFS is indicating a higher probability of the .
- Both ensembles are showing very high confidence ($>80\%$ probability) in AR conditions on days 5–8 along the PNW coast with the potential third AR. The EPS is showing higher confidence in AR conditions continuing through Day 8 than the GEFS.
- The GEFS and EPS ensembles are both highlighting the potential for additional AR activity over Central and Southern California for the period between Wed 24 Dec–Fri 26 Dec.

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AR Scale Forecasts - Coastal Washington

GEFS

EPS

GEFS Ensemble Initialized 00 UTC 15 Dec 2025

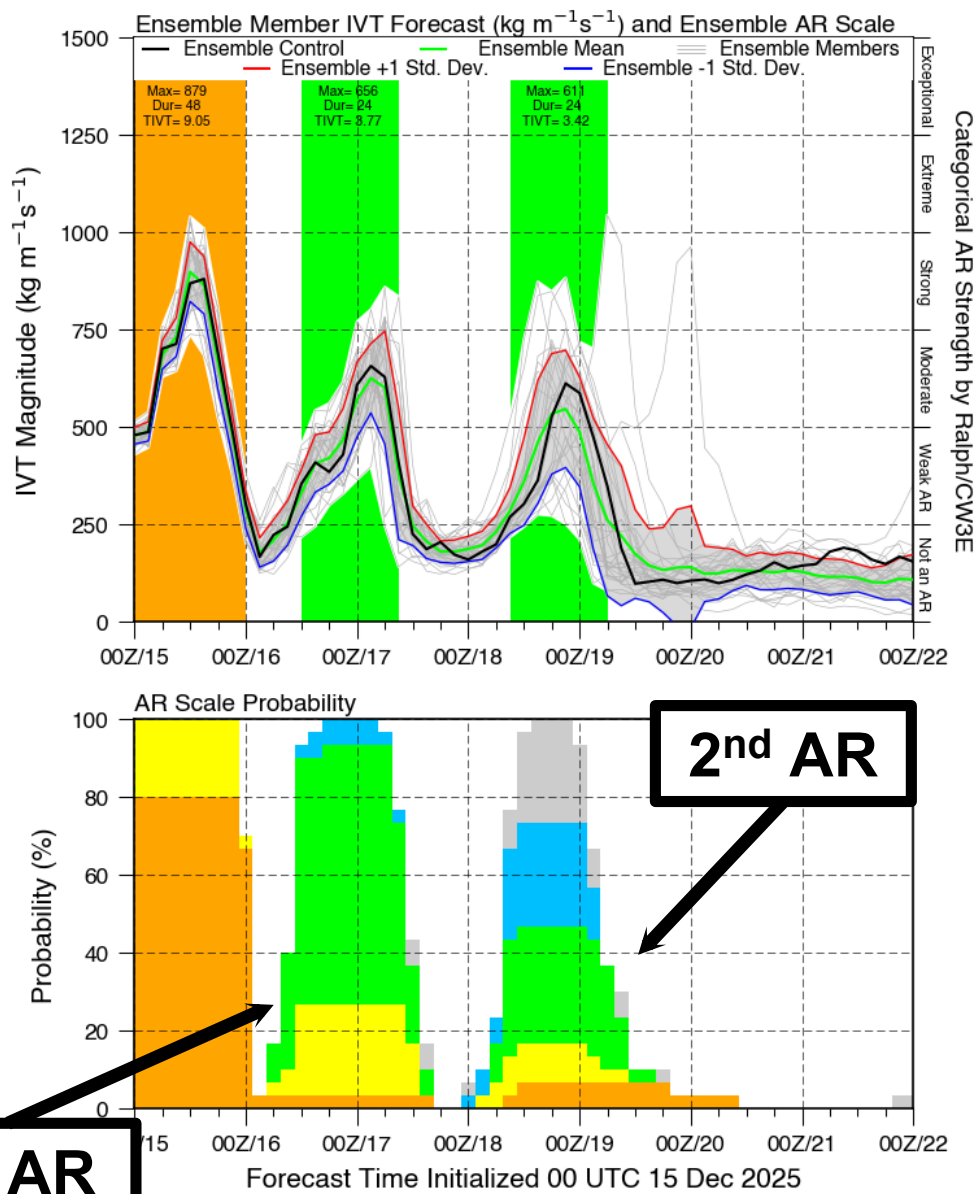
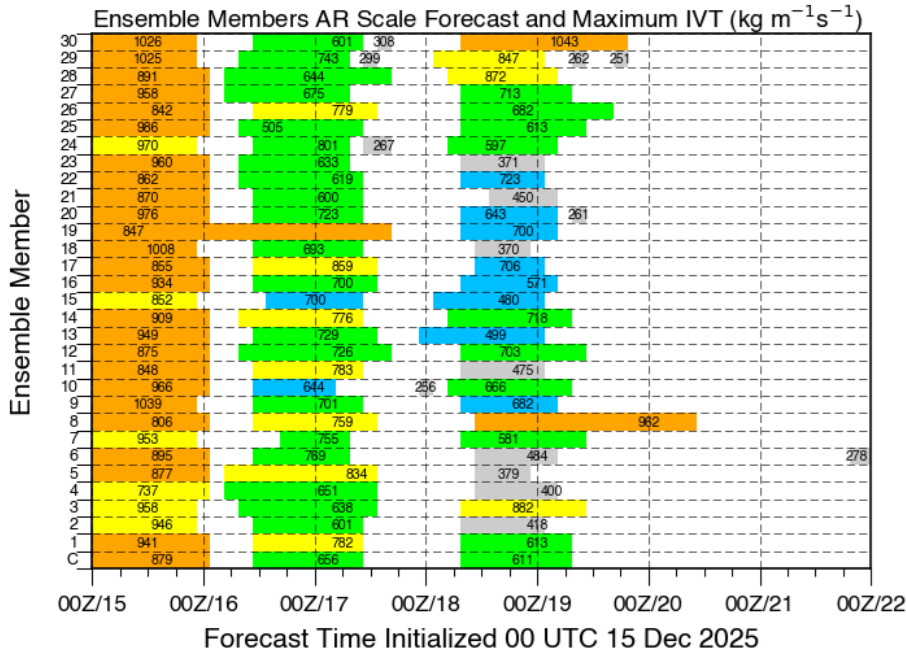


Image created 05 UTC 15 Dec 2025



More information: <https://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS)

ECMWF Ensemble Initialized 00 UTC 15 Dec 2025

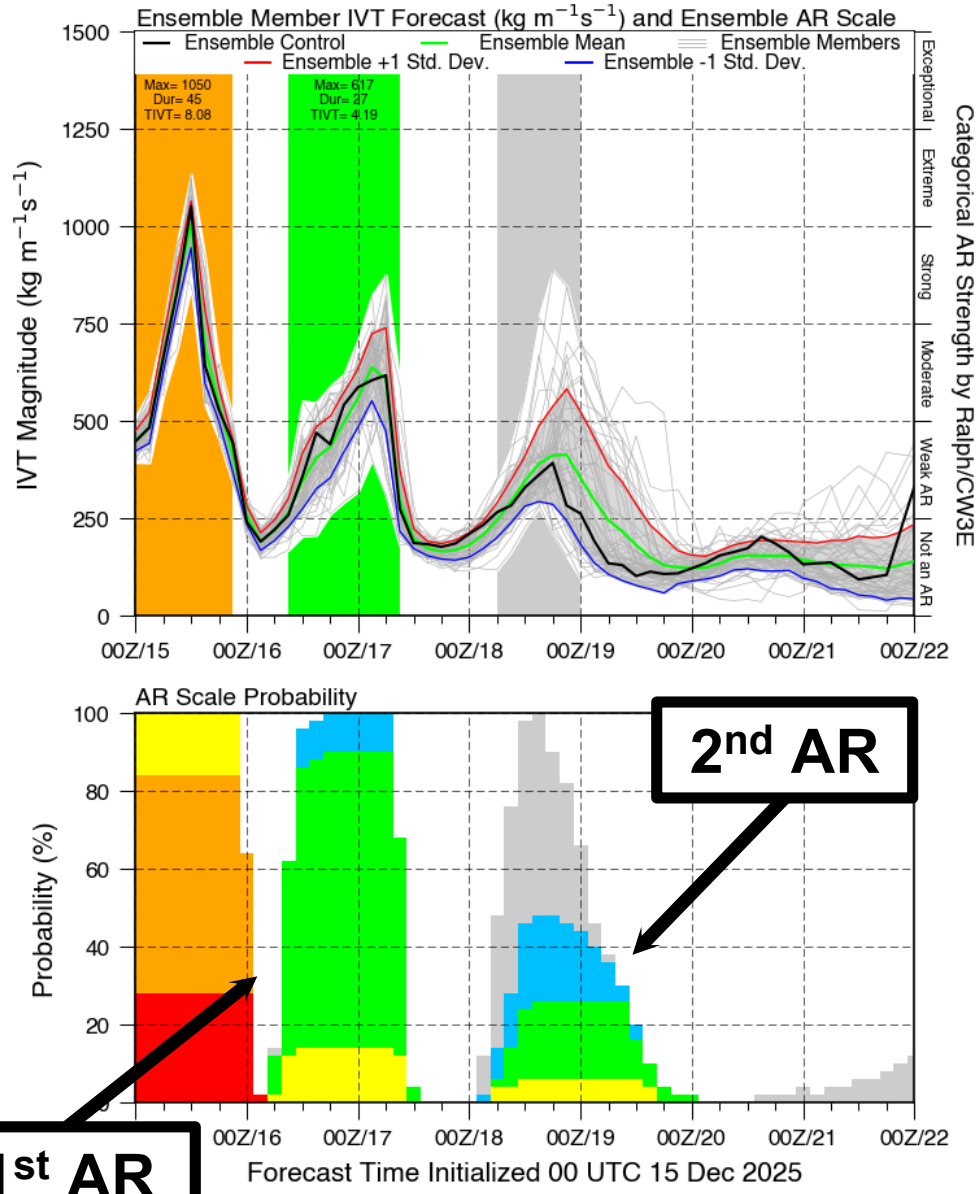
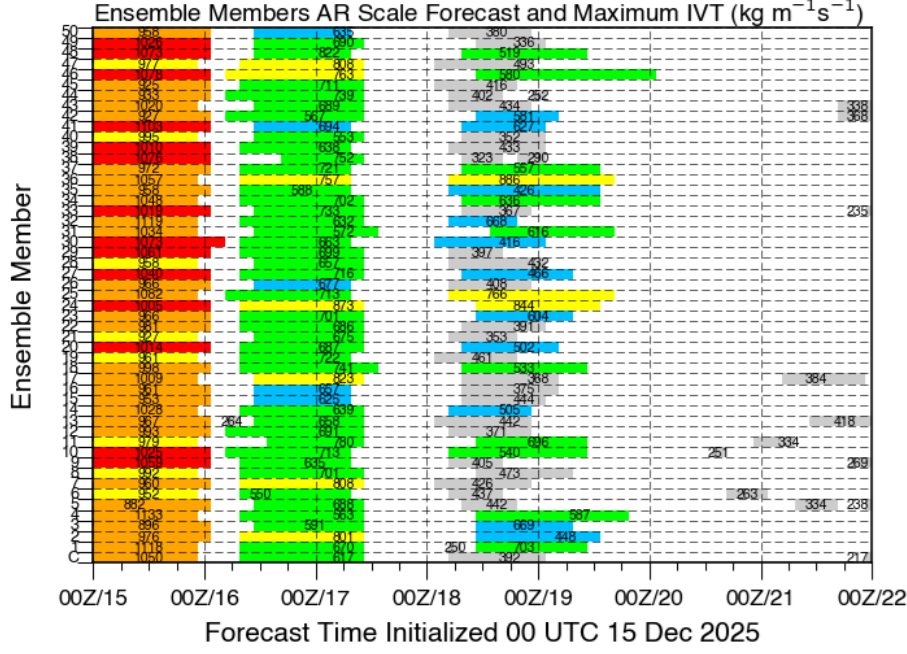


Image created 09 UTC 15 Dec 2025



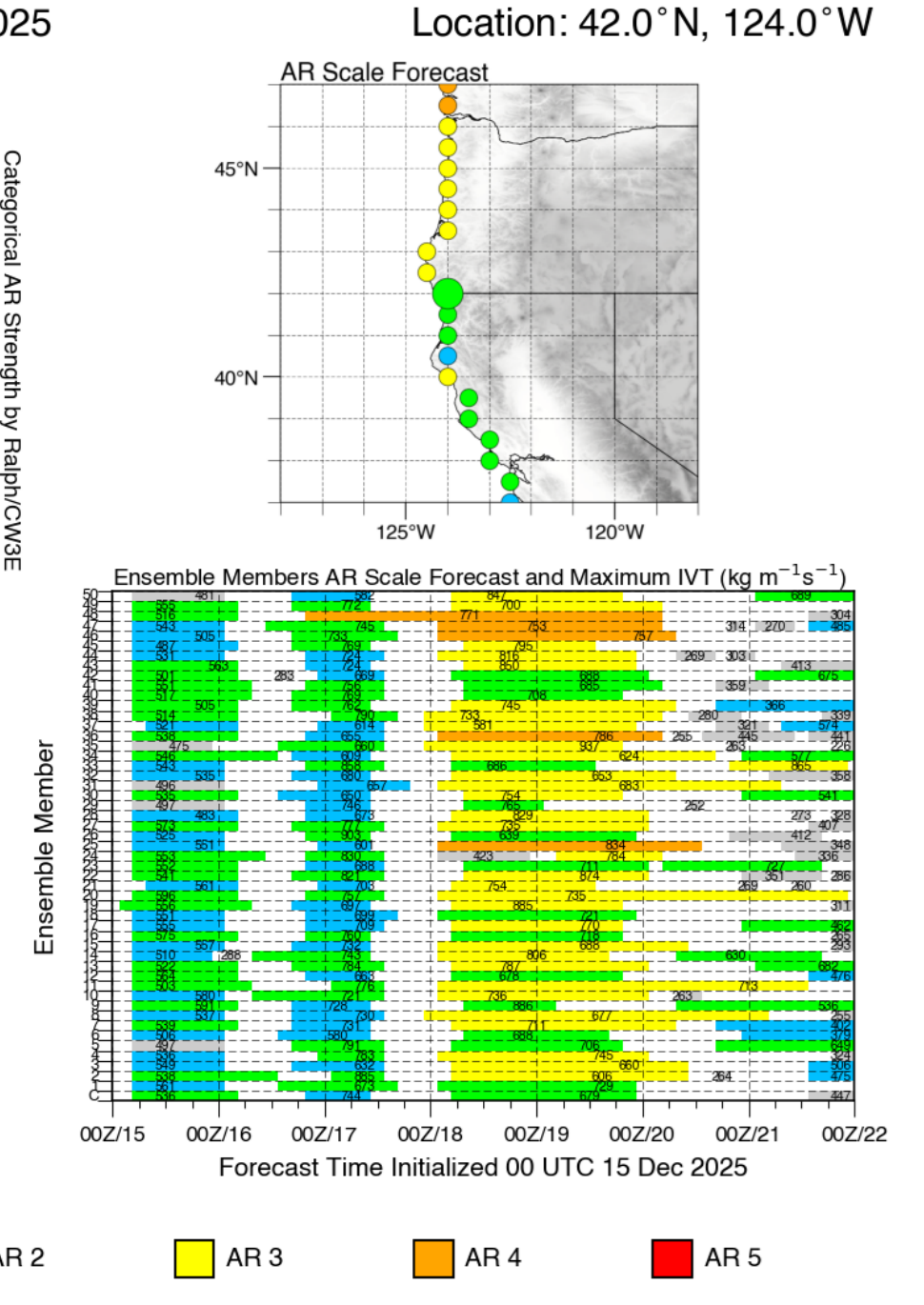
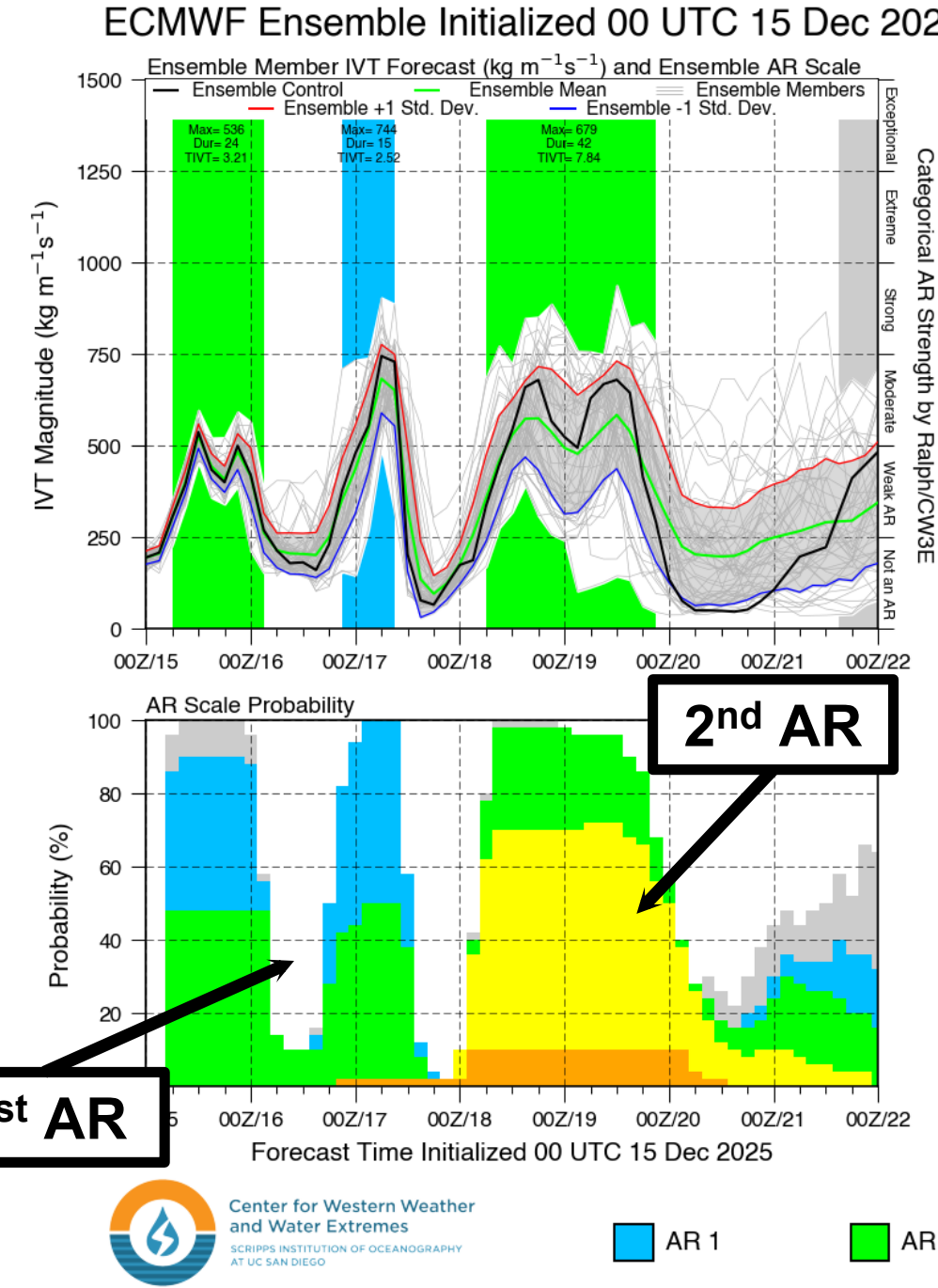
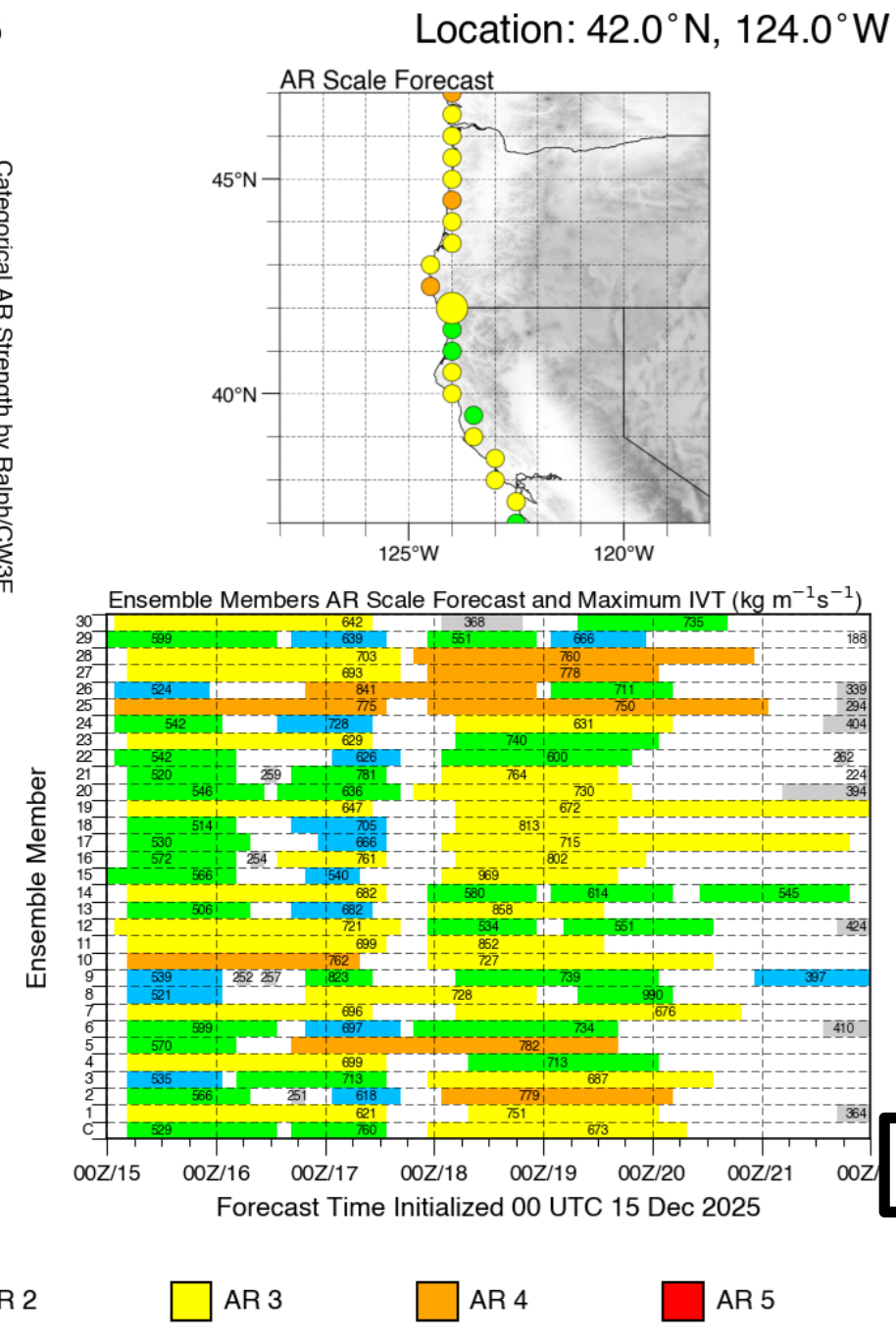
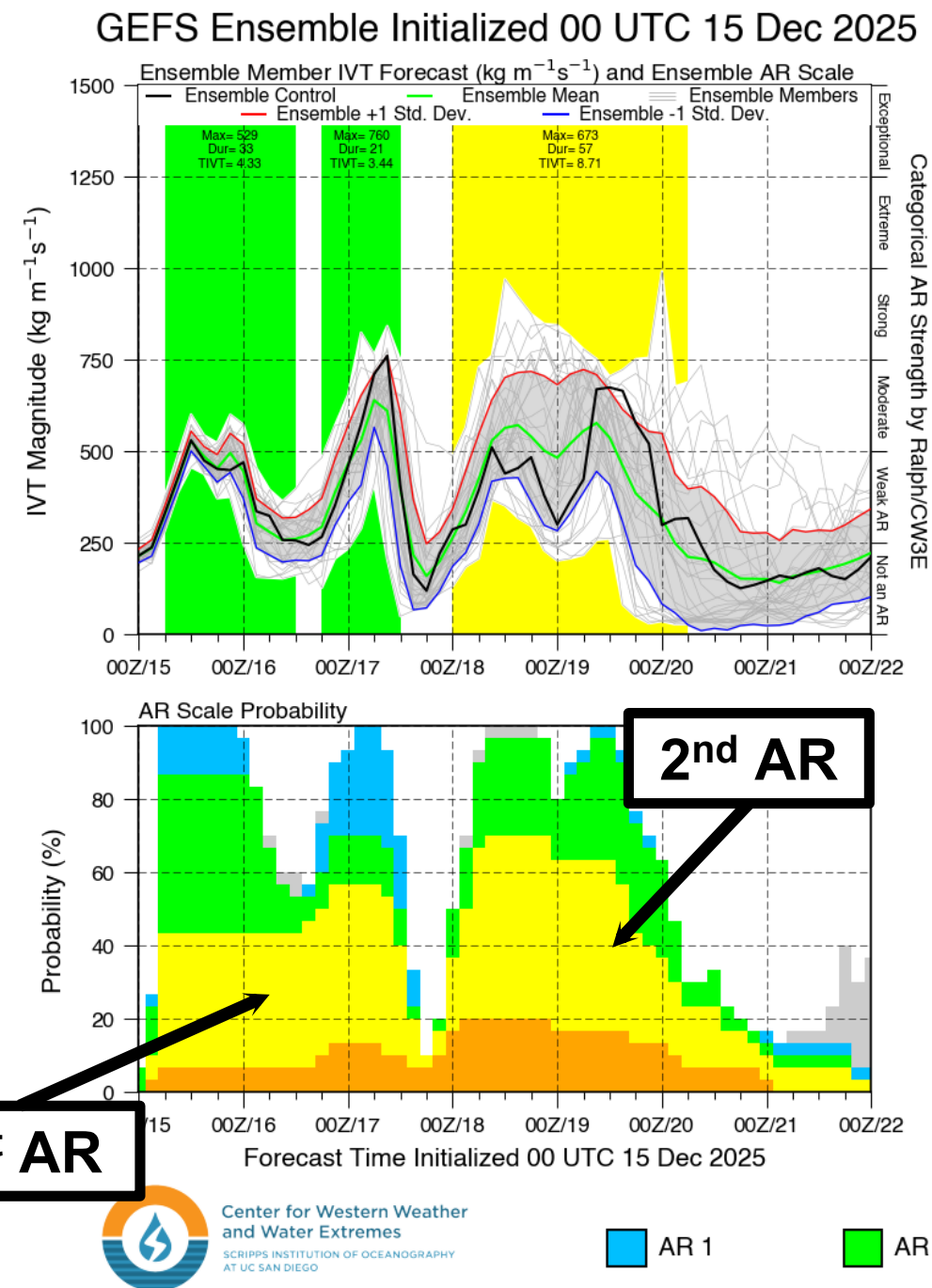
More information: <https://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS)

- The GEFS and EPS are showing good agreement in the IVT magnitude and duration of the two moisture pulses in the first AR over coastal Washington.
- There is greater uncertainty in both ensembles in the AR duration and timing and magnitude of maximum IVT in the second AR.

AR Scale Forecasts - Coastal Oregon-California Border

GEFS

EPS

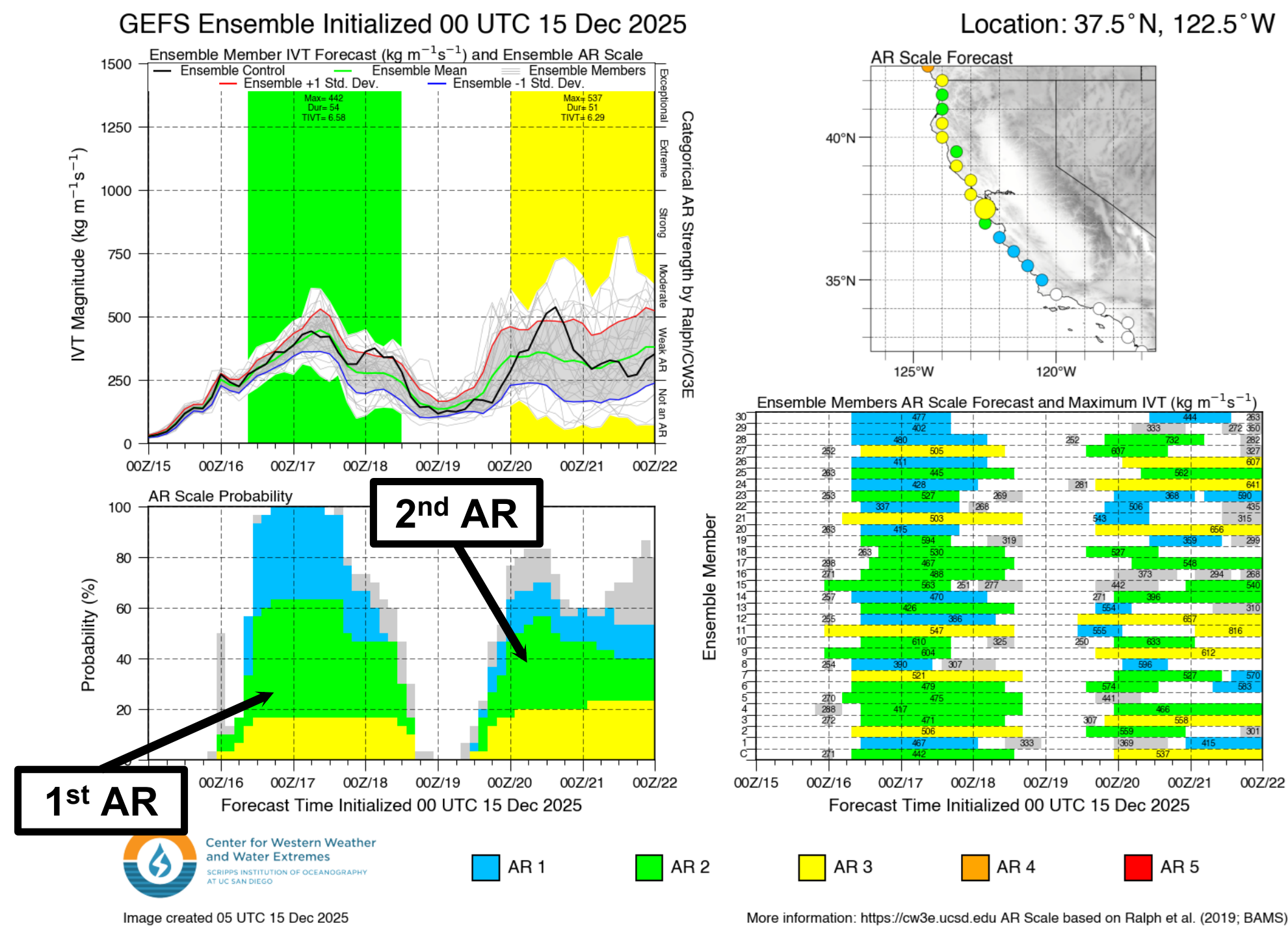


- The GEFS has more ensemble members forecasting continuous AR conditions in Northern California between the two pulses of the first AR, while every EPS ensemble members is forecasting a break in AR conditions.
- Additionally, both ensembles show significant uncertainty in the duration of AR conditions as well as the timing of AR onset and the timing and magnitude of maximum IVT in the second AR after 4 PM PT Wed 17 Nov.

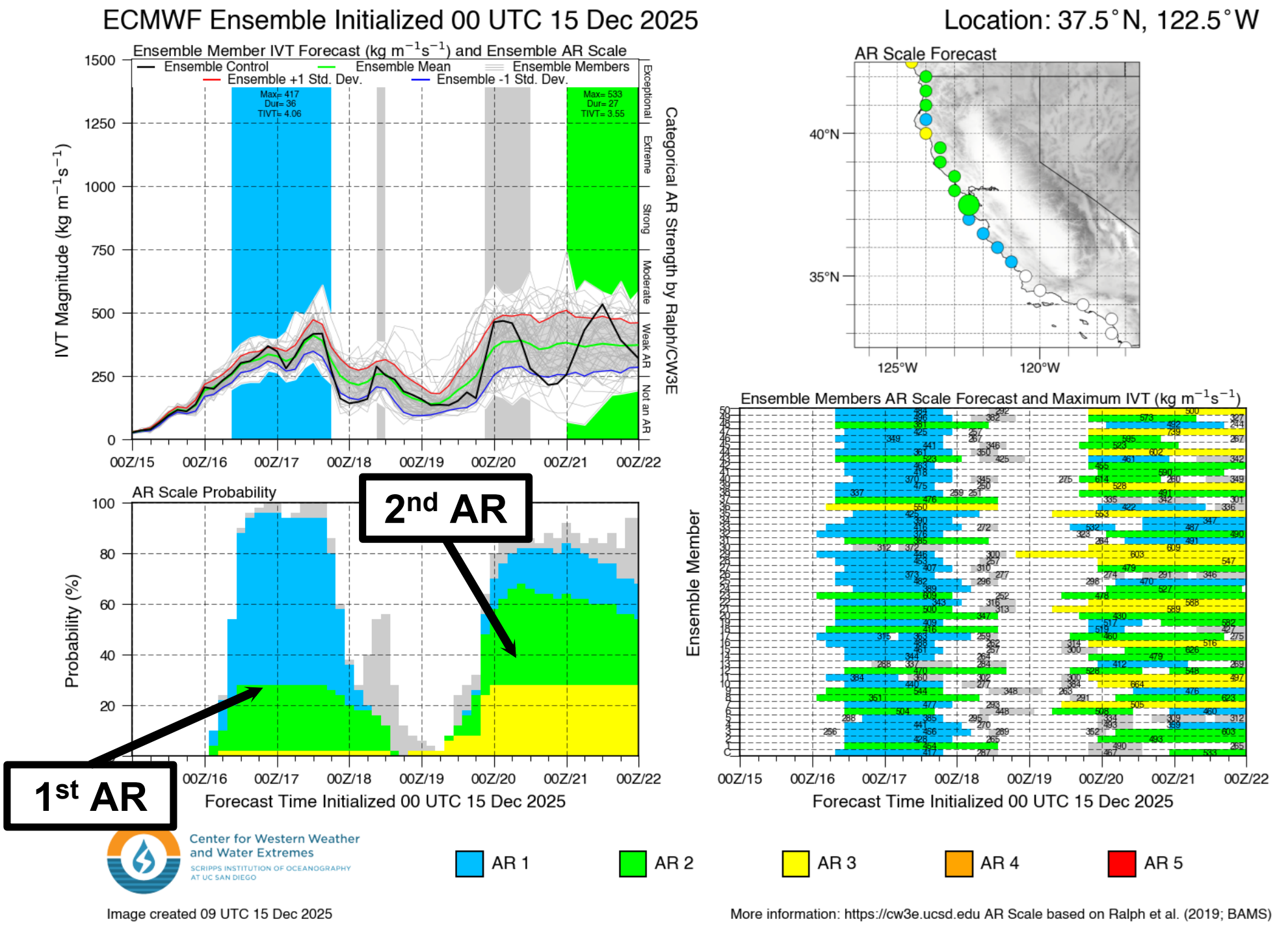
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AR Scale Forecasts - Coastal Central California

GEFS



EPS



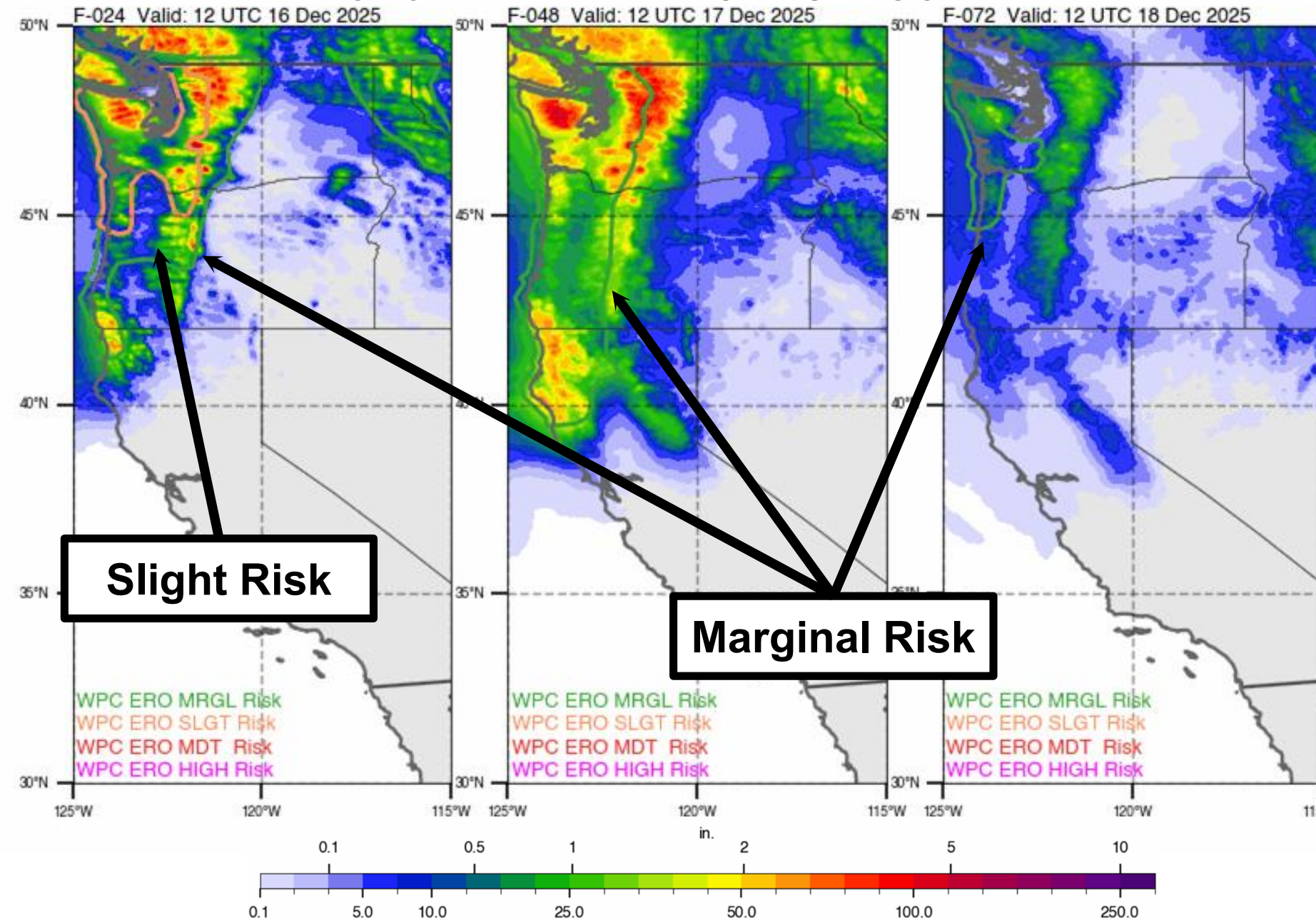
- Both the GEFS and EPS are forecasting two periods of AR conditions in central California in the next 7 days. A higher percentage of GEFS members are forecasting AR2 conditions (~60%) with the first AR as compared to the EPS (~20%).
- There is greater uncertainty in the timing, duration and magnitude of AR conditions after 4 PM PT Thu 18 Nov.

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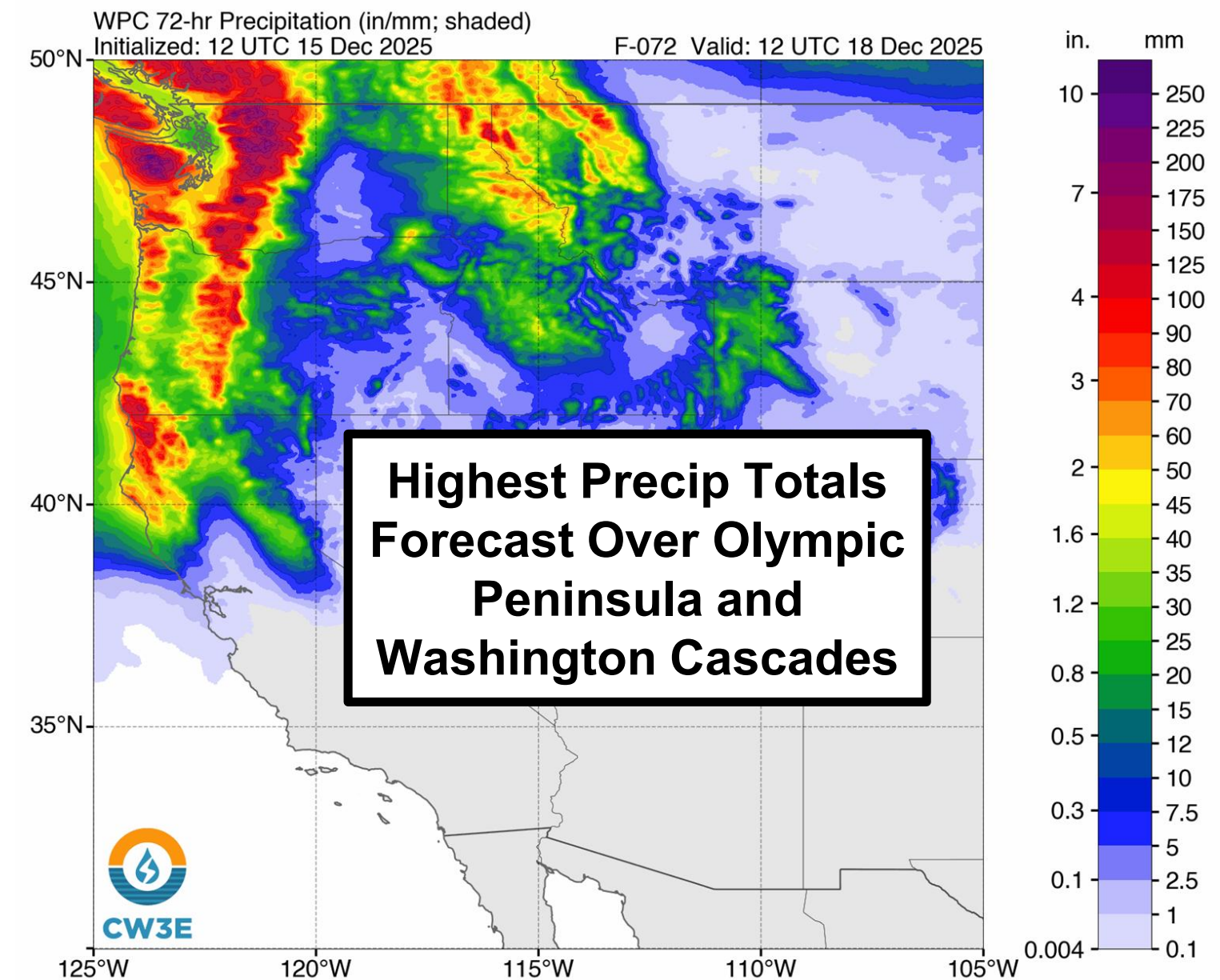
WPC Precipitation Forecast: First AR

WPC Days 1-3 QPF

Valid: 4 AM PT 16–18 Dec



WPC 72-h Total QPF
Valid: 4 AM PT 18 Dec



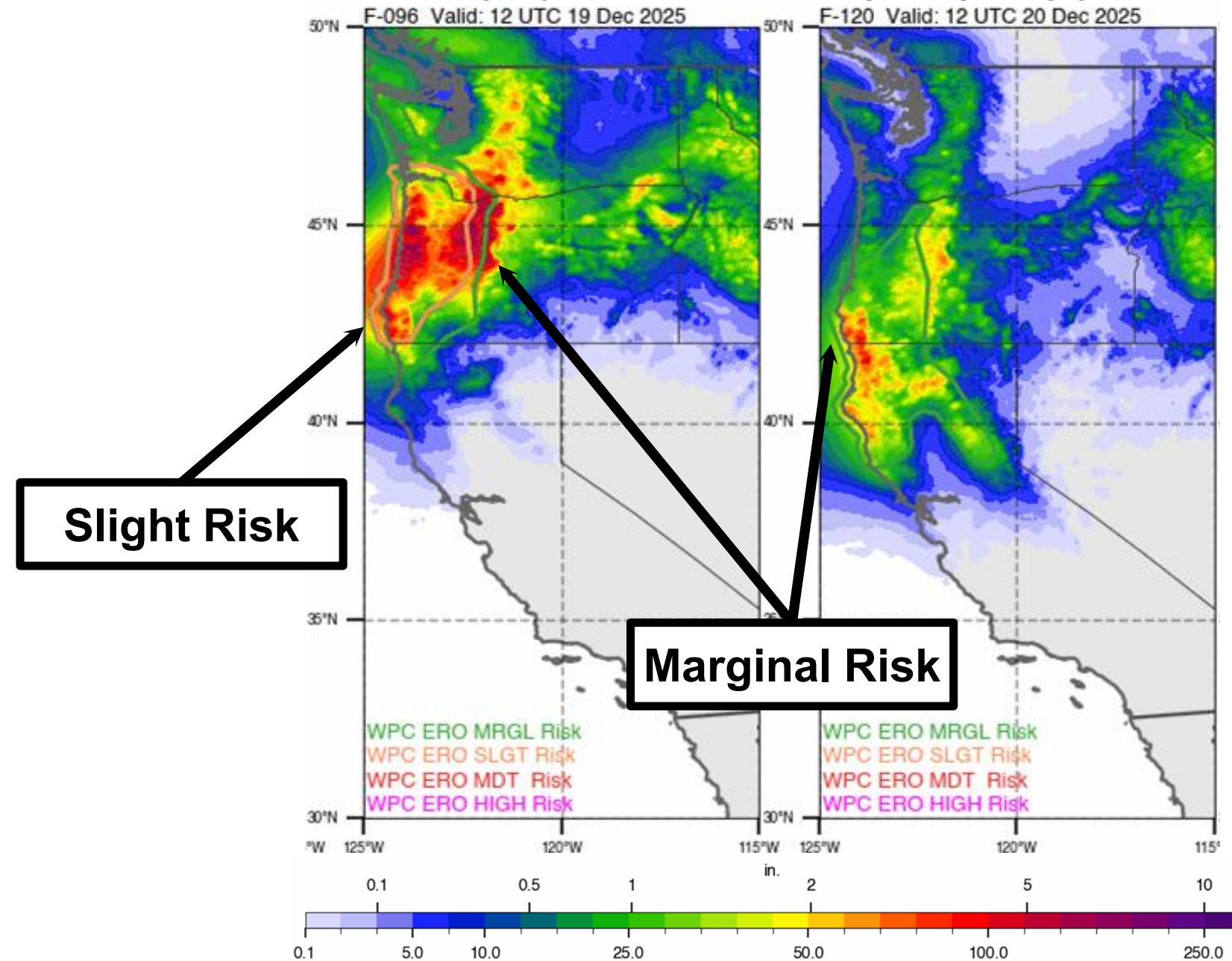
- The heaviest precipitation from the first AR is forecast over the Washington Cascades and Olympic Peninsula, where the Weather Prediction Center (WPC) is forecasting 4–6 in. of precipitation for the 72-hour period ending 4 AM PT 18 Dec.
- The heaviest single day precipitation is forecast for 4 AM PT 16–17 Dec associated with the second pulse.
- The WPC has issued a **slight risk** ($\geq 15\%$ chance of flash flooding) Excessive Rainfall Outlook (ERO) over coastal Washington and the foothills of the Washington Cascades for the 24-hour period ending 4 AM PT 16 Dec associated with the first pulse. **Marginal risk** EROs were also issued across the PNW west of the Cascades for both the first and second pulses on Days 1 through 3.

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WPC Precipitation Forecast: Second AR

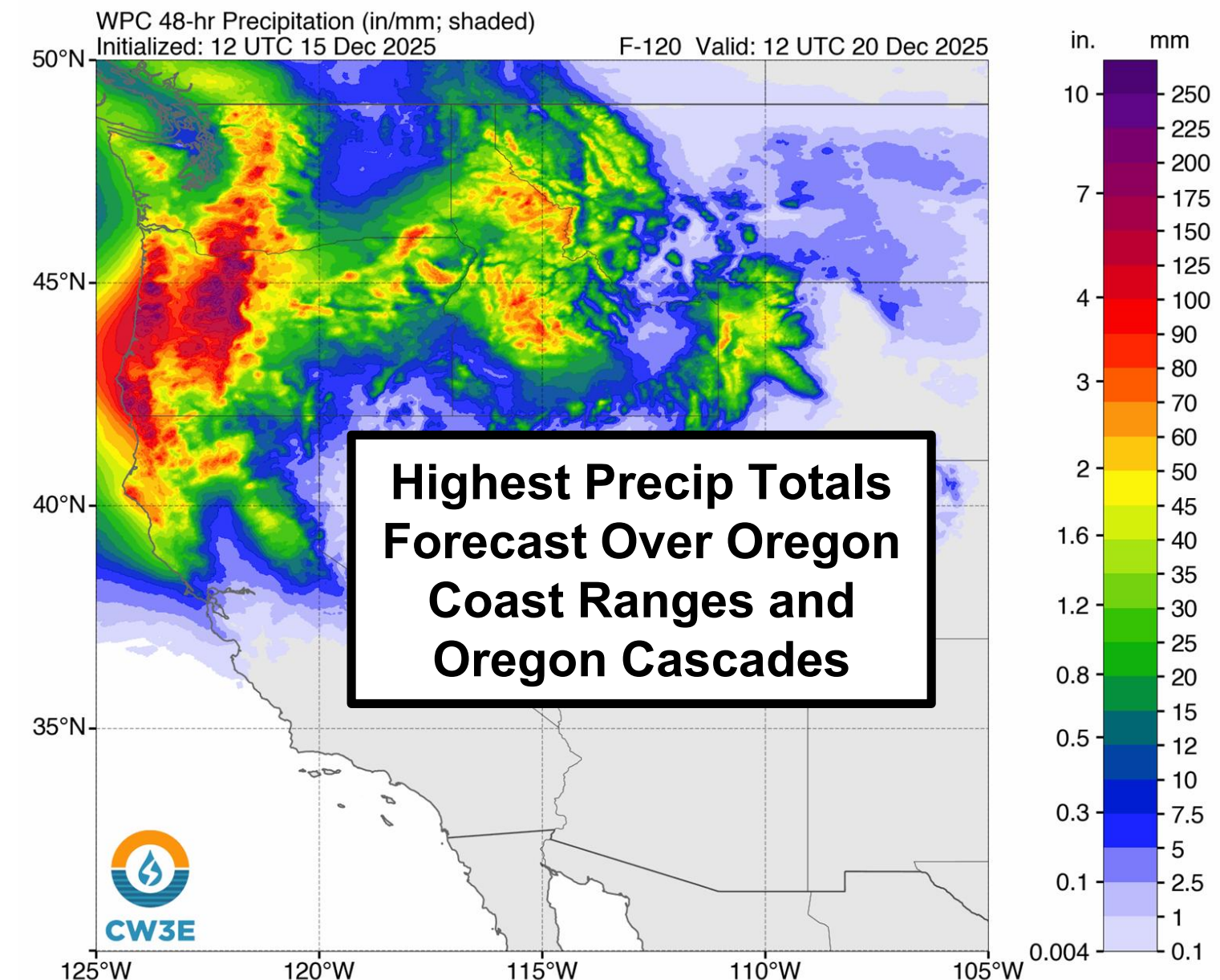
WPC Days 4-5 QPF

Valid: 4 AM PT 19–20 Dec



WPC 48-h Total QPF

Valid: 4 AM PT 20 Dec



- The heaviest precipitation from the second AR is forecast over the Oregon Coast Ranges and Oregon Cascades, where the Weather Prediction Center (WPC) is forecasting 4–8 in. of precipitation for the 48-hour period ending 4 AM PT 20 Dec.
- The WPC has issued a **slight risk** ($\geq 15\%$ chance of flash flooding) Excessive Rainfall Outlook (ERO) over coastal Oregon and the foothills of the Oregon Cascades for the 24-hour period ending 4 AM PT 19 Dec associated with the first pulse. **Marginal risk** EROs were also issued over a larger region in Oregon on Day 4 and over Western Oregon and Northern California on Day 5.

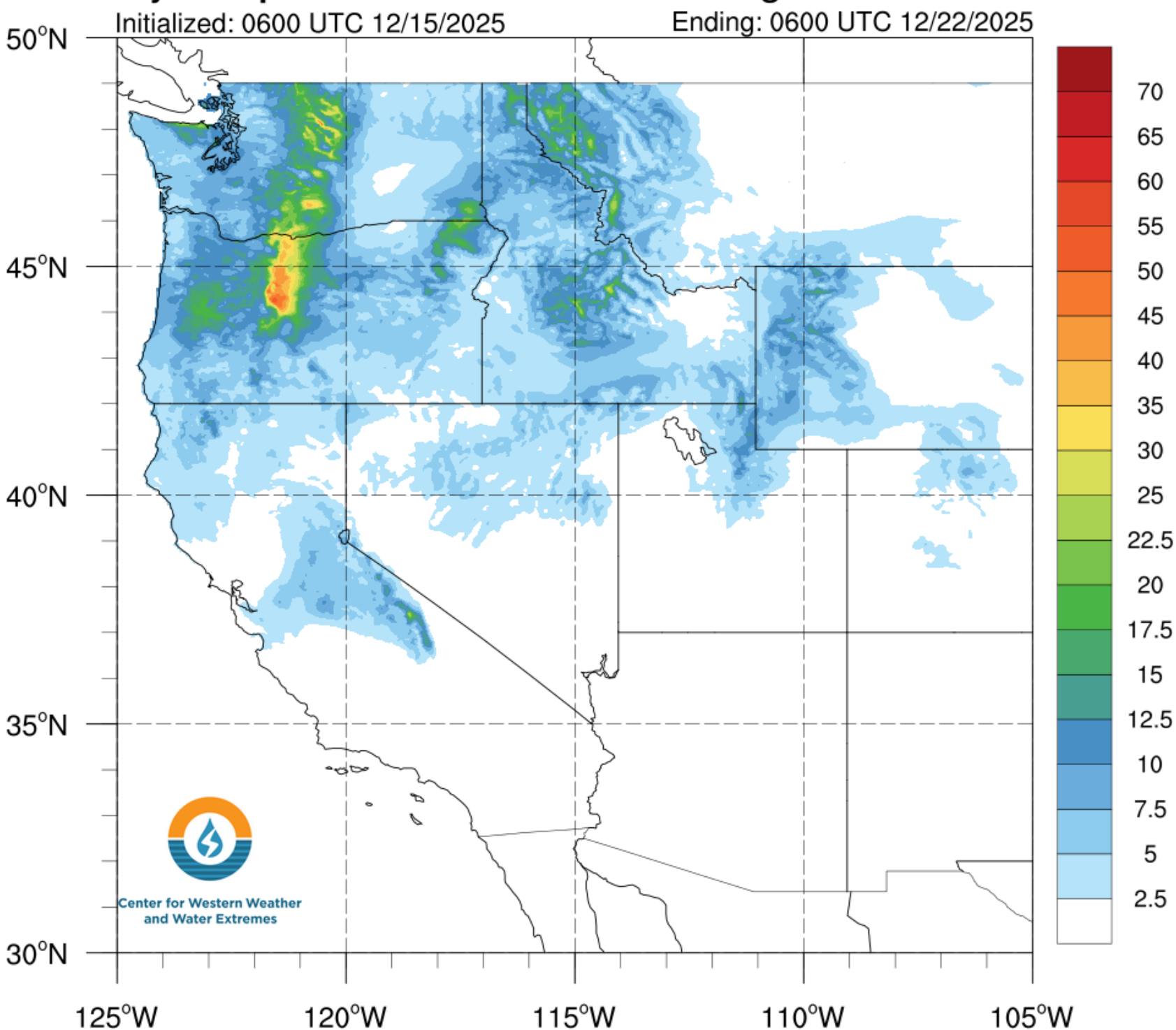
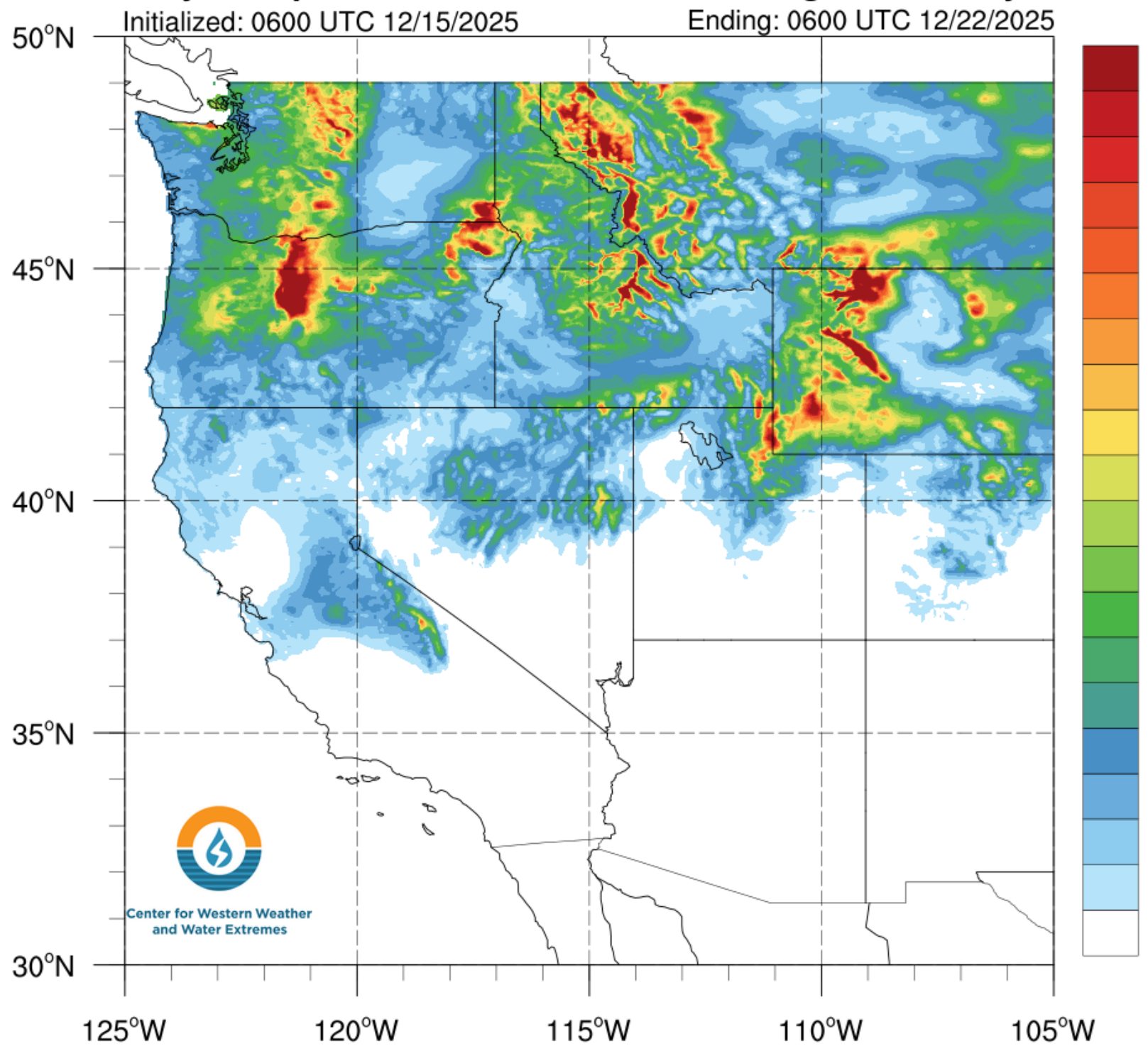
GFS Precipitation Forecasts as Percentages of Normal

GFS 7-Day Accumulation
Percentage of Monthly Normal

GFS 7-Day Accumulation
Percentage of Water Year Normal

GFS 7-day Precipitation Accumulation Percentage of Monthly Normal

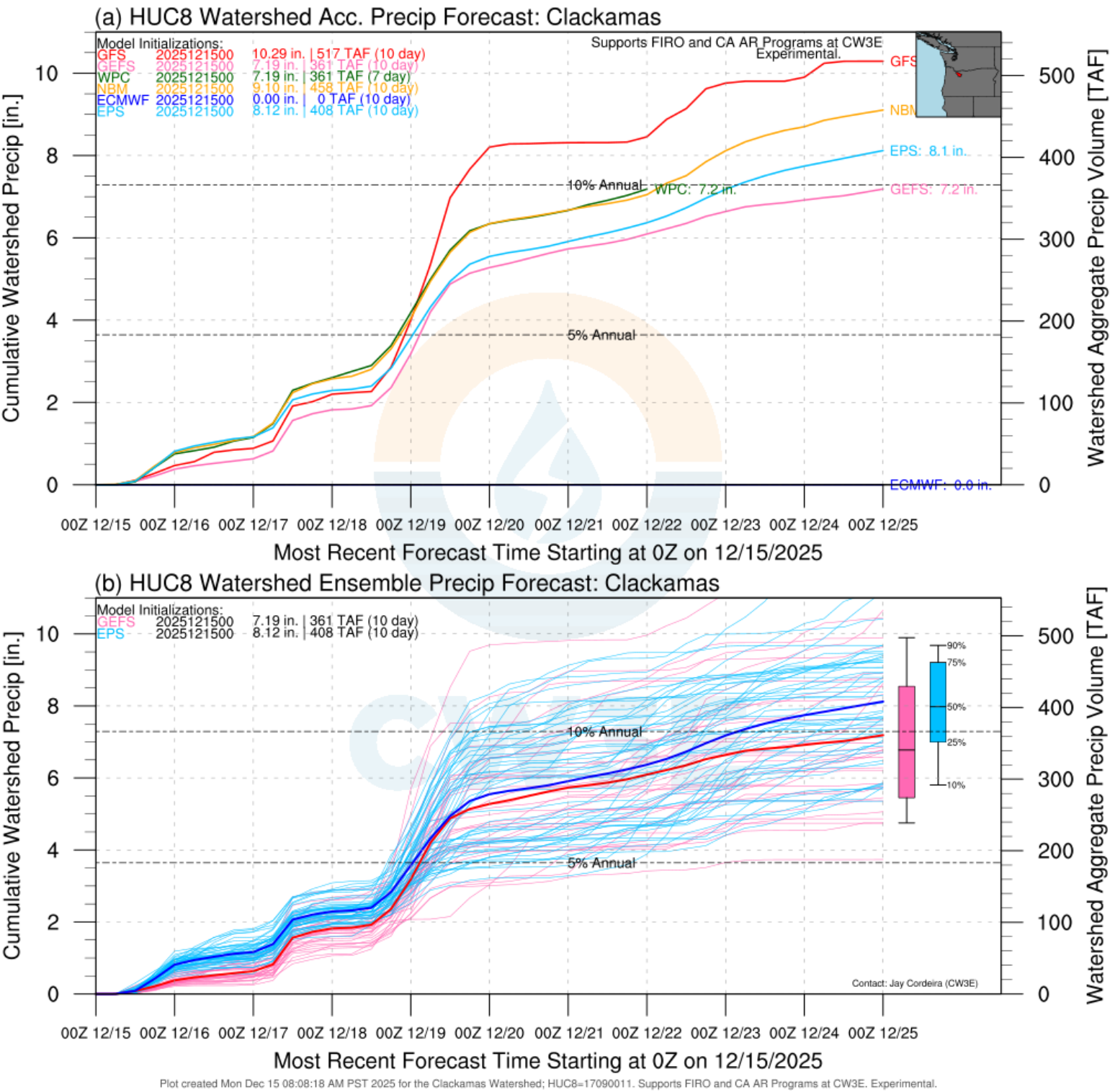
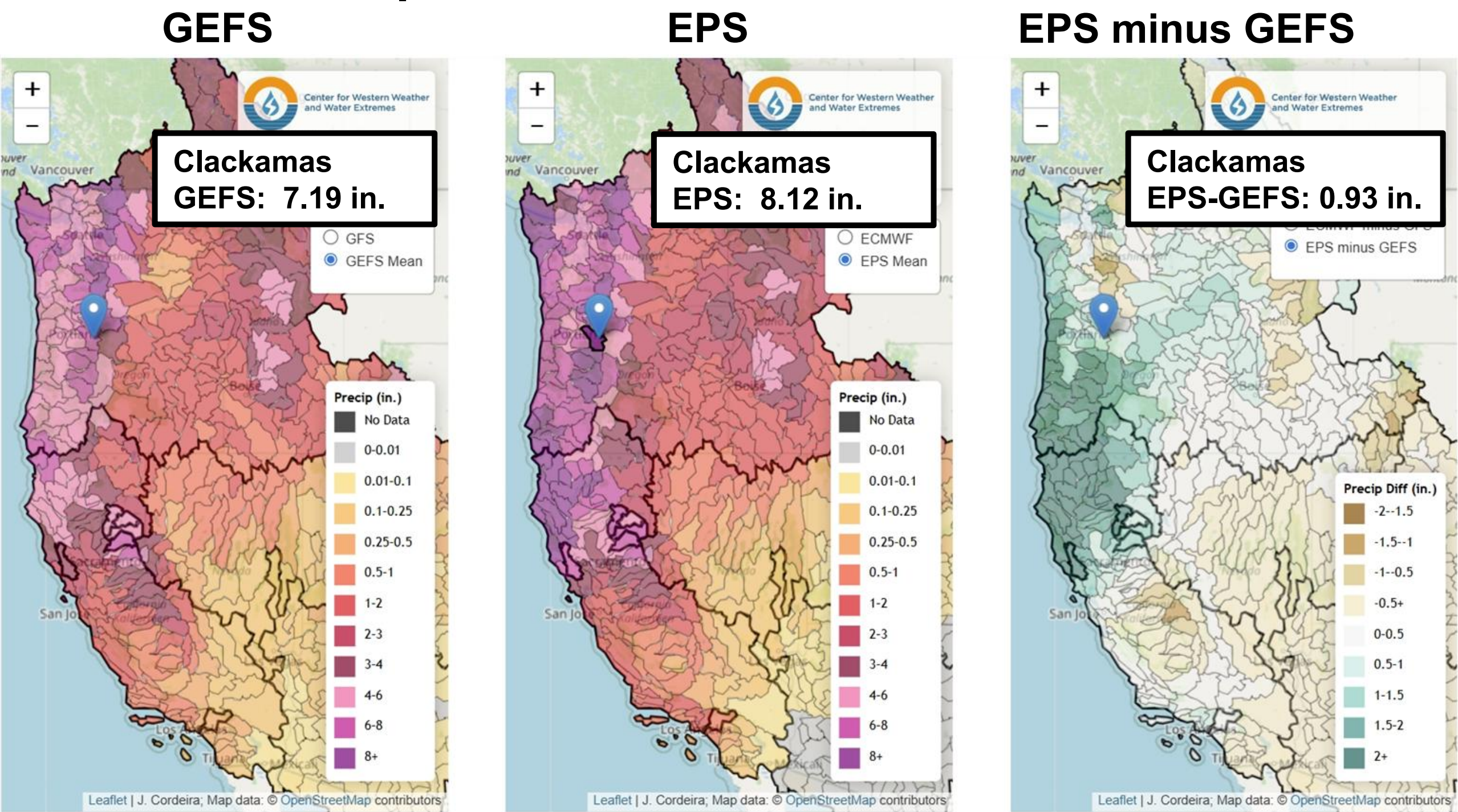
GFS 7-day Precipitation Accumulation Percentage of Water Year Normal



- The GFS 7-day forecast precipitation (period ending 10 PM Mon 22 Dec), which captures precipitation from both the first and second ARs, represents a significant percentage of monthly and water year normals.
- Precipitation over the northern Oregon Cascades is forecast to be >190% of normal monthly precipitation and 30–45% of normal water year precipitation.

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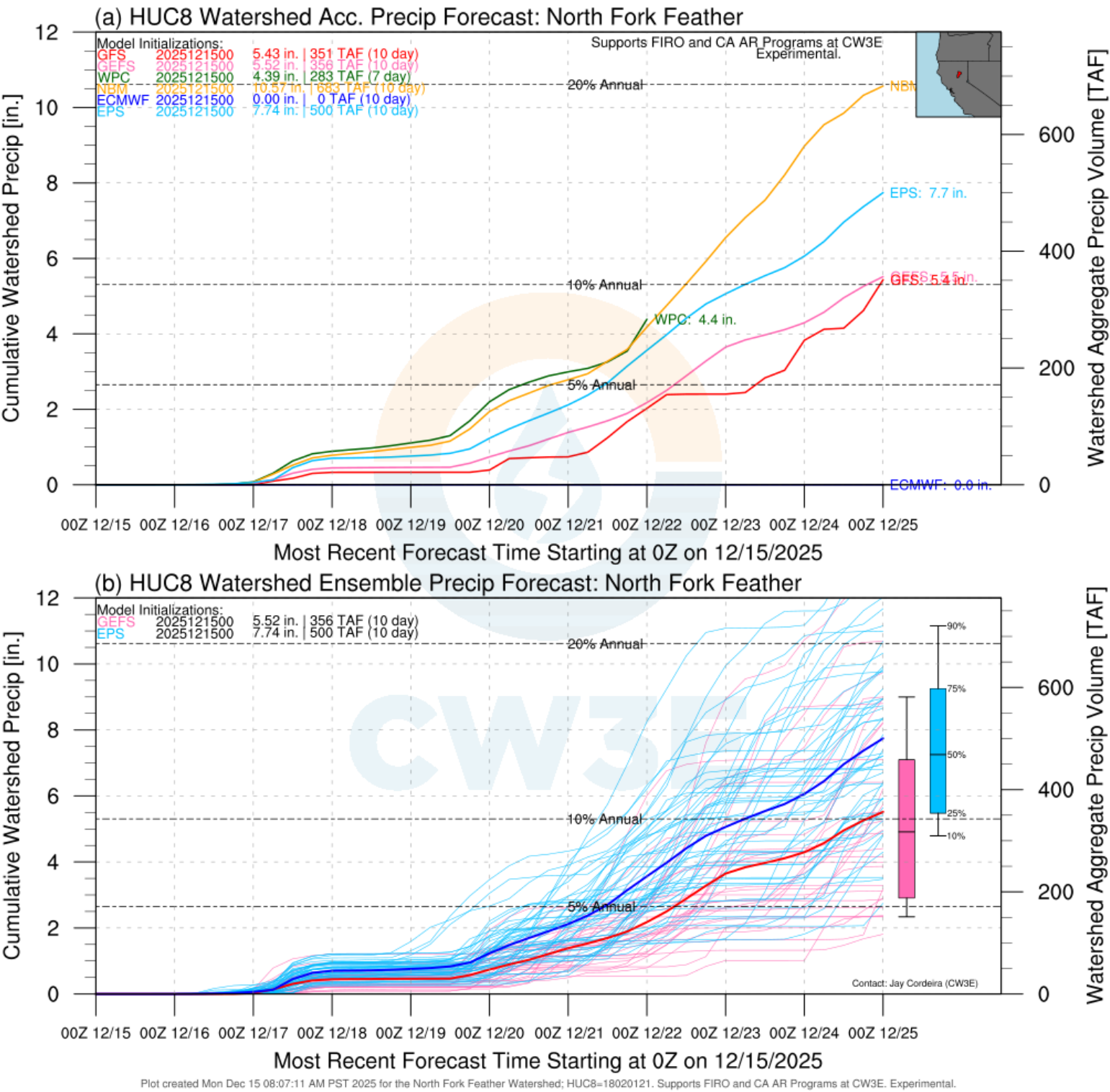
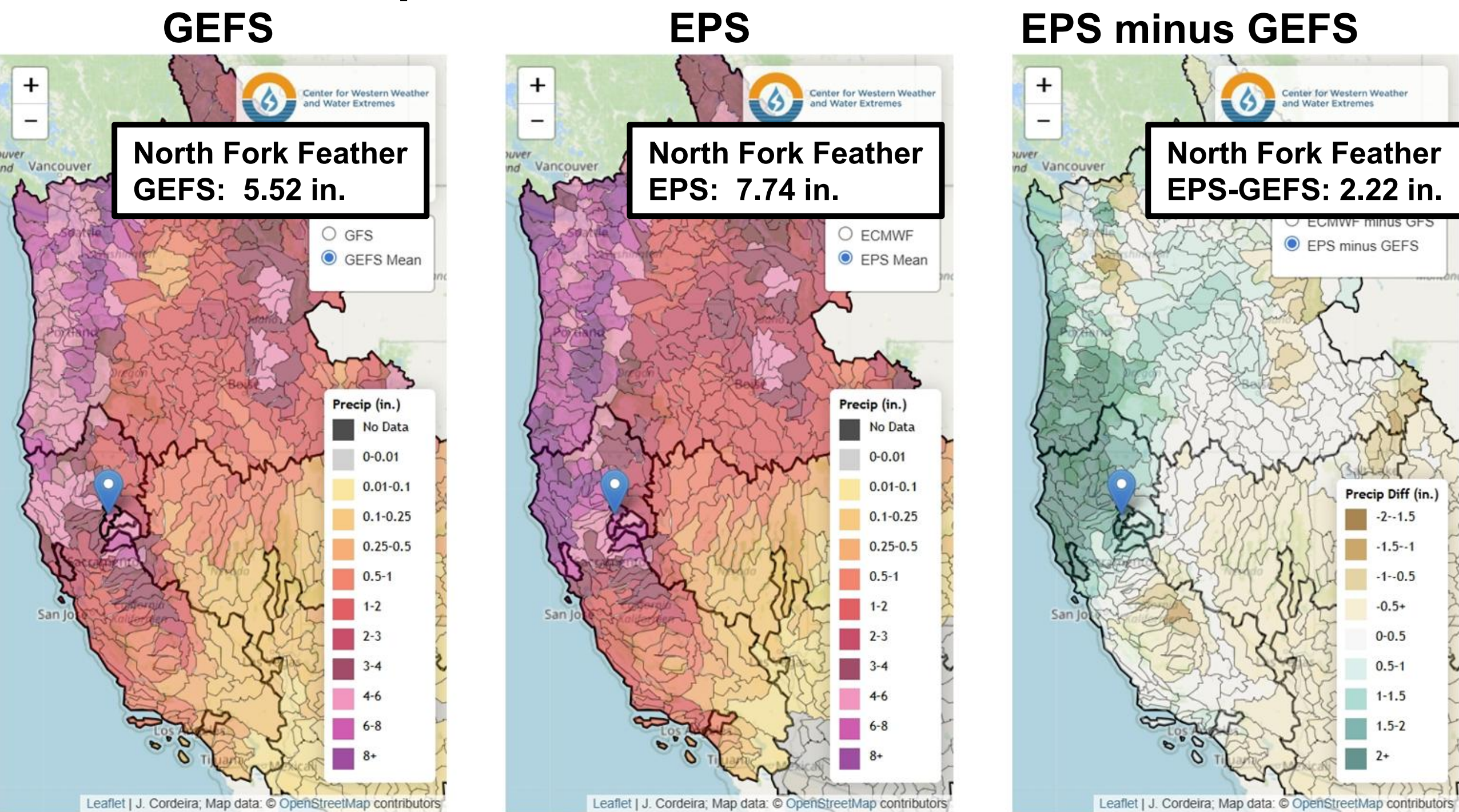
Watershed Precipitation Forecasts: Clackamas



- Every ECMWF ensemble (EPS) and GEFS member are forecasting 10-day precipitation totals exceeding 5% of normal annual precipitation (~3.5 in.) over the Clackamas watershed, including ~70% of EPS and ~40% of GEFS members exceeding 10% of normal annual precipitation (~7.25 in.).
- Both ensembles are showing the potential for the heaviest precipitation with the second AR between 4 AM PT Thu 18 Dec and 4 PM PT Fri 19 Dec.

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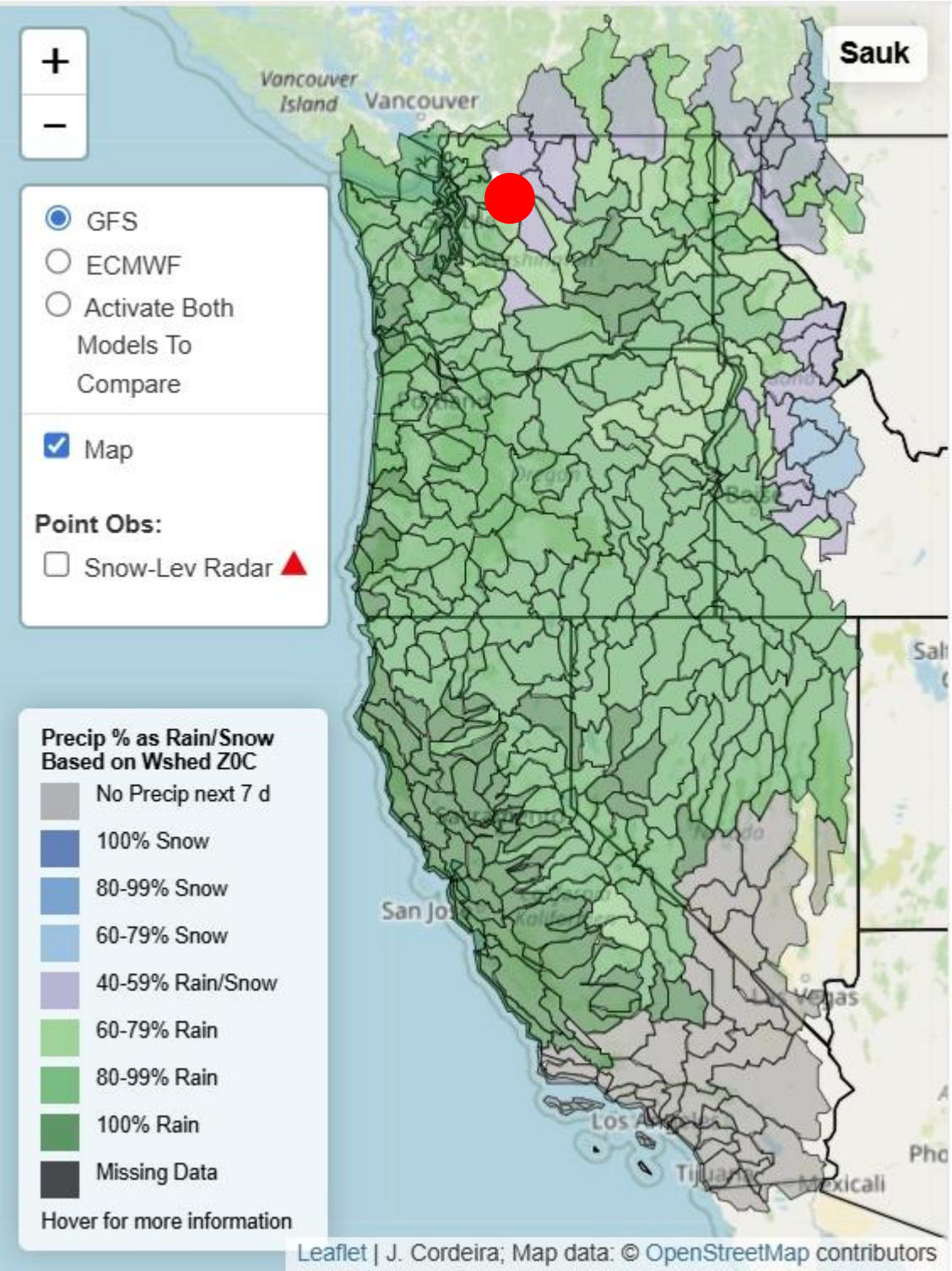
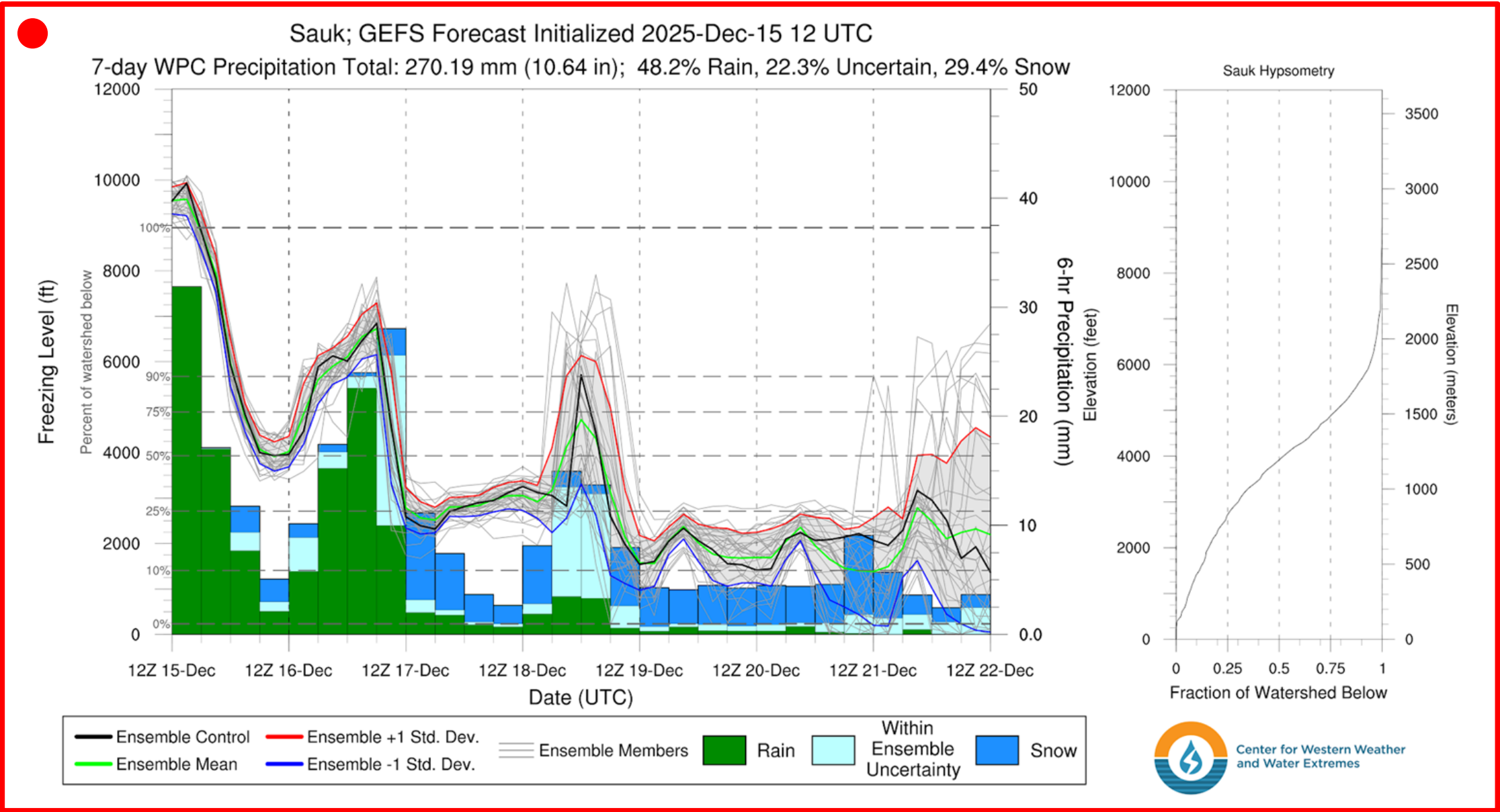
Watershed Precipitation Forecasts: North Fork Feather



- Watershed precipitation forecasts for the North Fork Feather watershed indicate the potential for heavy precipitation accumulations beginning on Sat 20 Dec.
- ~80% of EPS members and ~40 of GEFS members are forecasting 10-day precipitation totals >10% normal annual precipitation (~5.5 in.), including 8 EPS and 2 GEFS members exceeding 20% of normal annual precipitation (~10.5 in.).

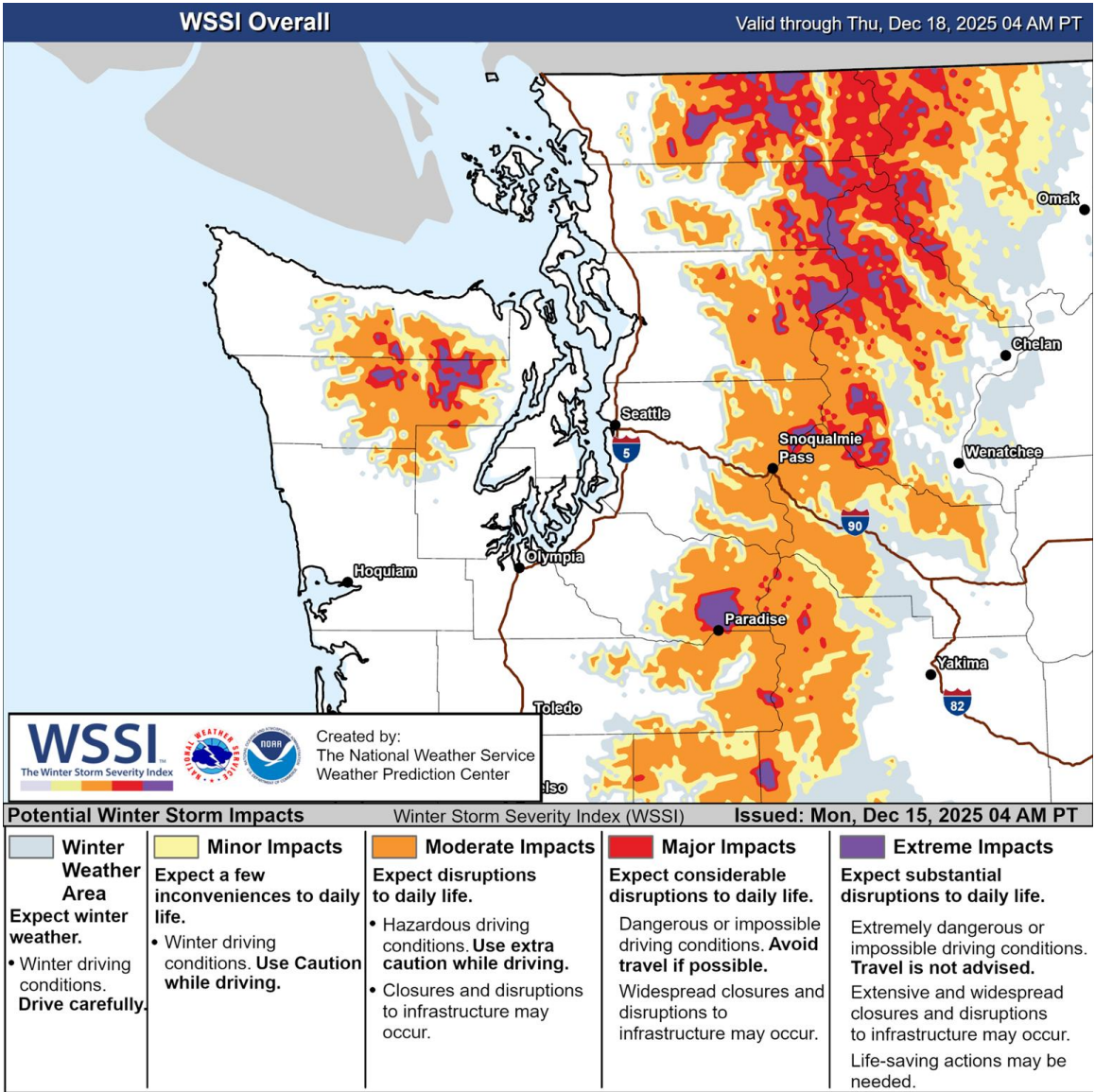
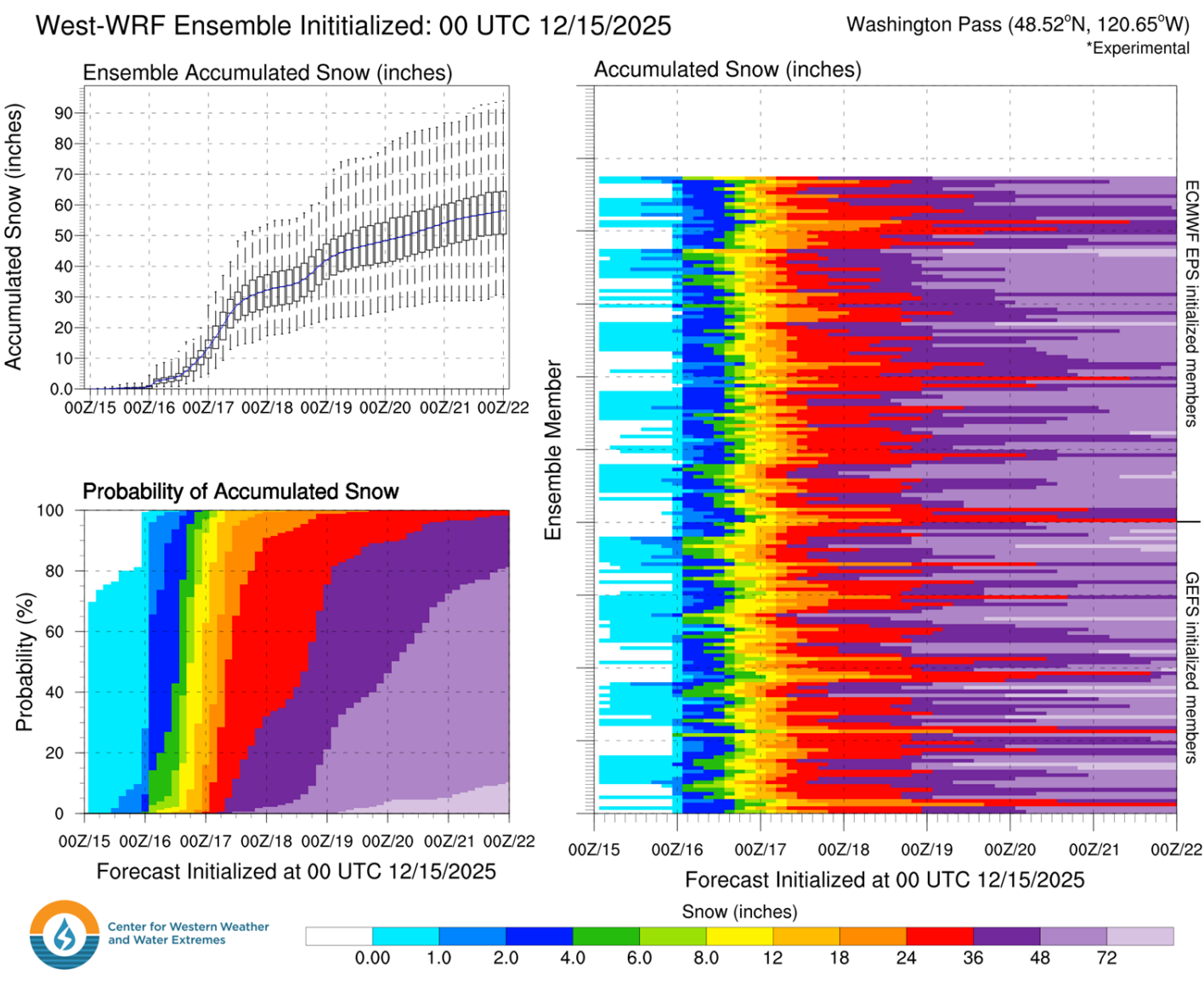
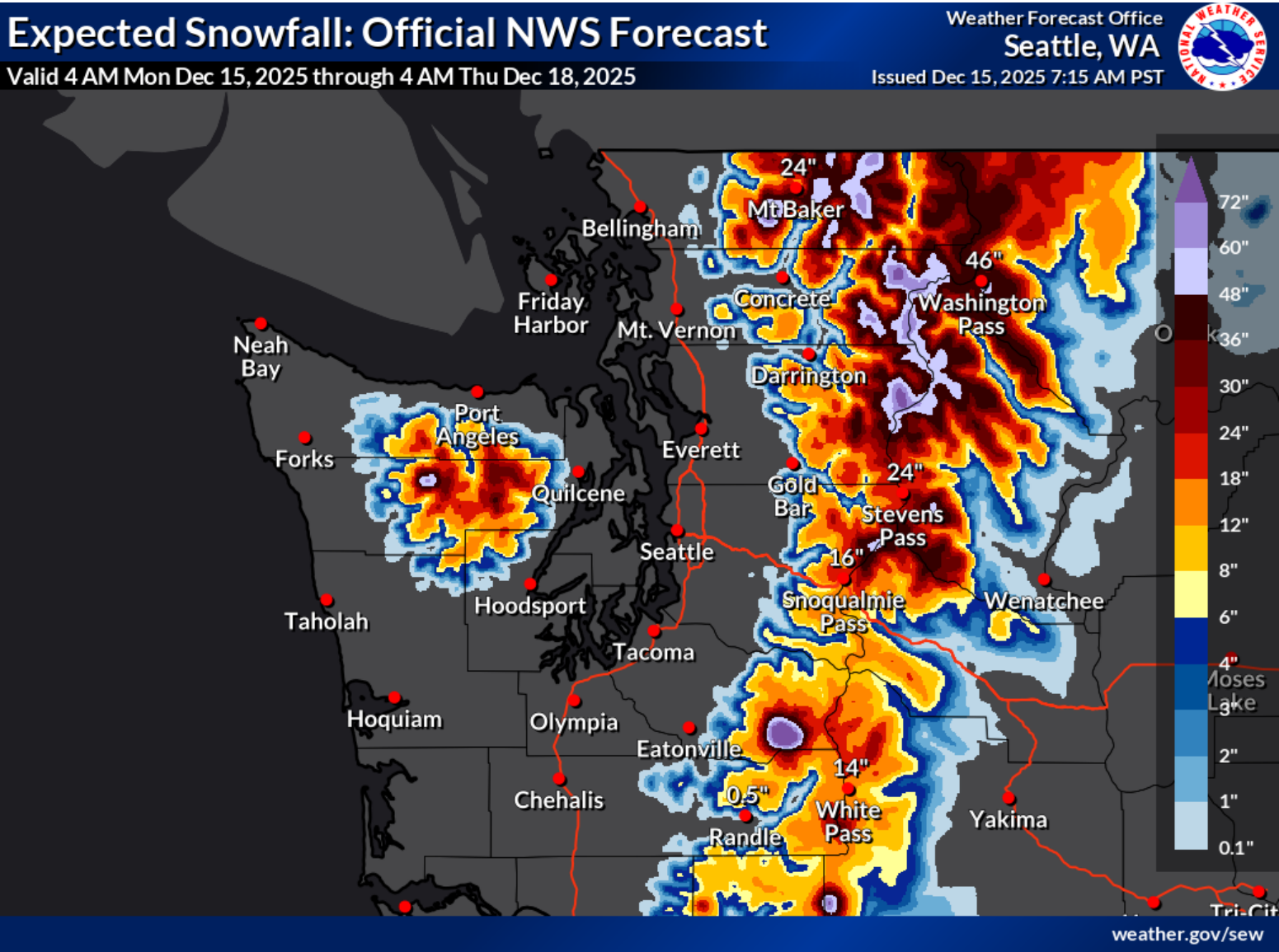
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Watershed Freezing Level Forecast: Snoqualmie



- Freezing levels are forecast to plummet to ~4000 feet in the northern Washington Cascades as the first pulse of the first AR weakens. As the second pulse moves into the region, freezing levels are forecast to rise again to ~6500 feet before sharply plummeting again to ~3000 feet by early Wed 17 Dec.
- The low freezing levels forecast in each moisture pulse of the first AR are likely to help contribute to heavy snowfall over the Washington Cascades.

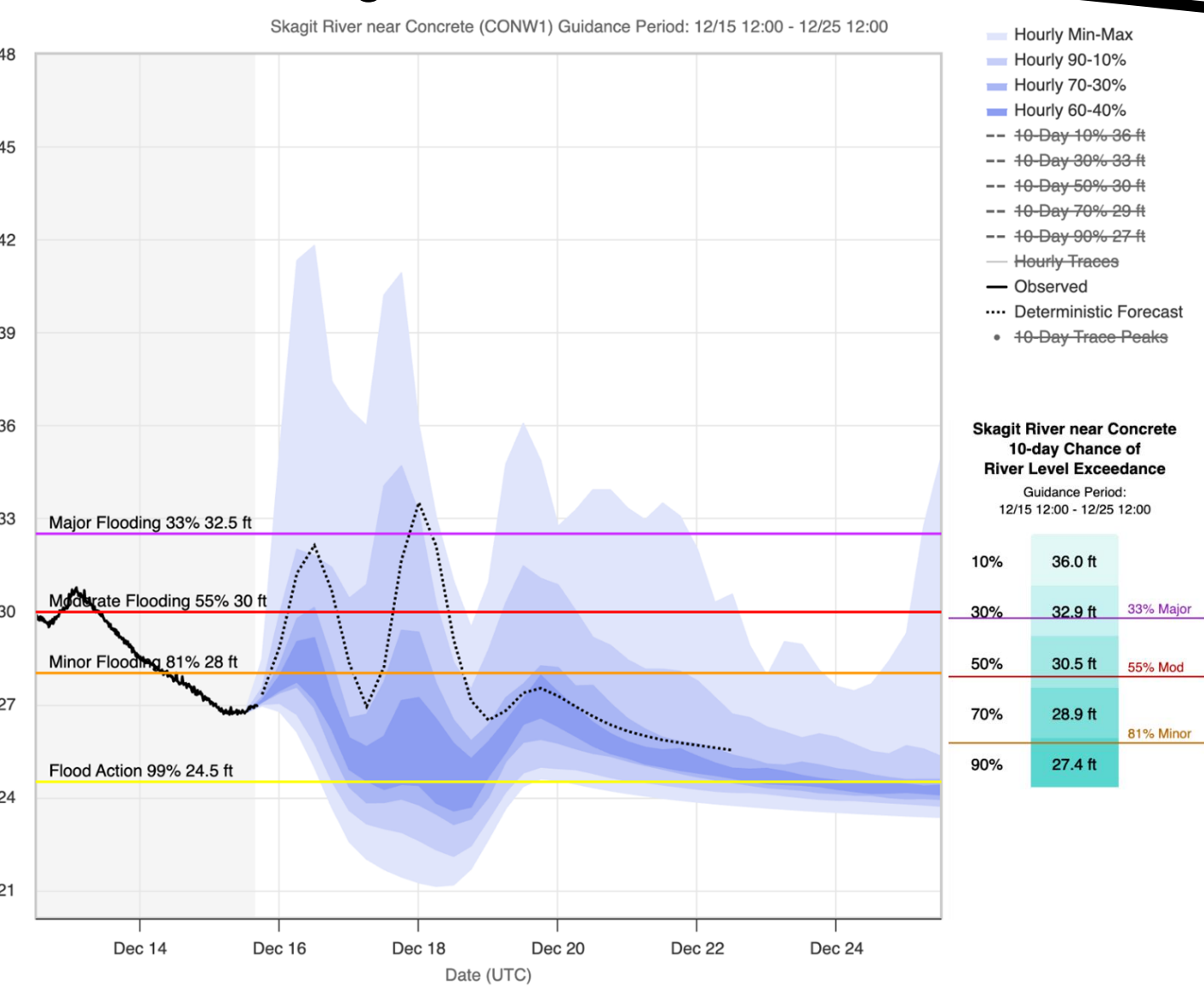
Winter Weather Impacts



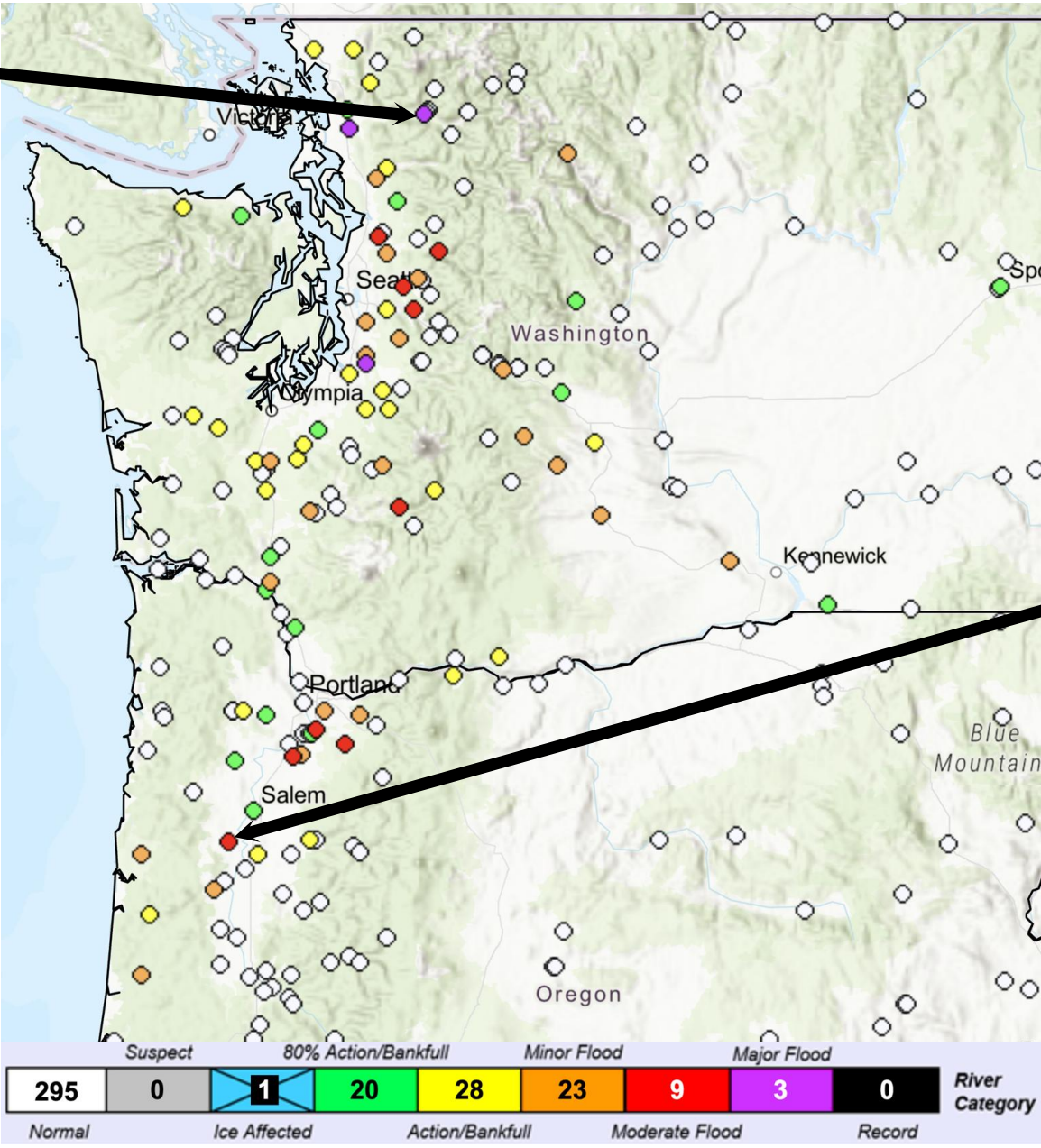
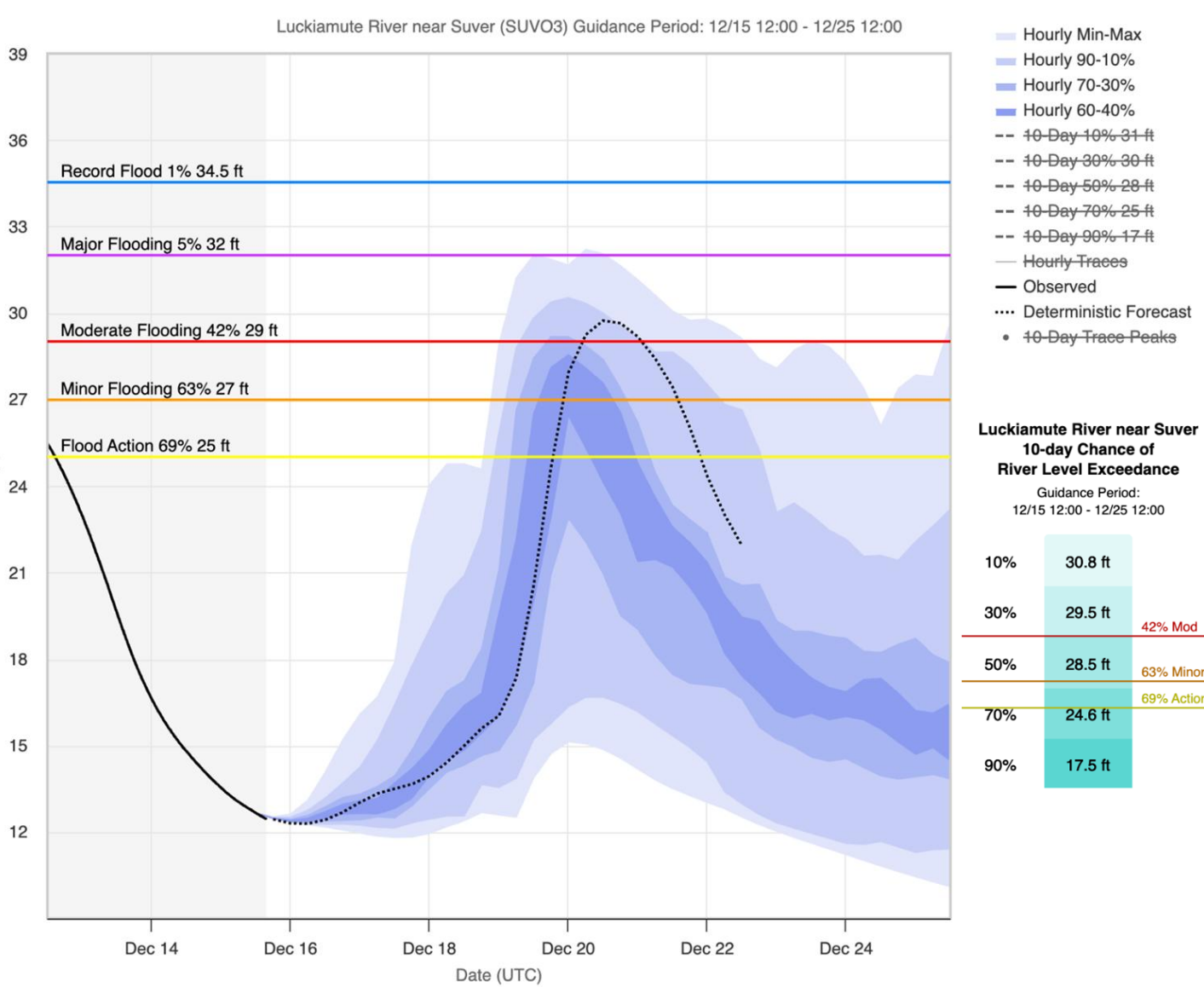
- The first AR is forecast to produce heavy snow in the Olympic Mountains and Washington Cascades, particularly during the second pulse of moisture transport late Tue 16 Dec into Wed 17 Dec.
- The NWS is forecasting at least 24–48 inches of total snowfall above 5,000 feet during the 72-hour period ending 4 AM PT Thu 18 Dec (*left*). CW3E’s West-WRF ensemble is showing ~40% probability of >36 inches of snow at Washington Pass (*center*).
- Major-to-extreme winter storm impacts are expected above 5,000 feet, primarily in the North Cascades (*right*). Moderate winter storm impacts are expected between 3,000 and 5,000 feet, where 12–24 inches of snowfall are forecast.
- Additional snowfall in the Olympic Mountains and Cascades is likely during the second AR late this week. Snowfall from these storms will be beneficial given that current snowpack is running well-below normal.

NWRFC Streamflow Forecasts

Skagit River near Concrete

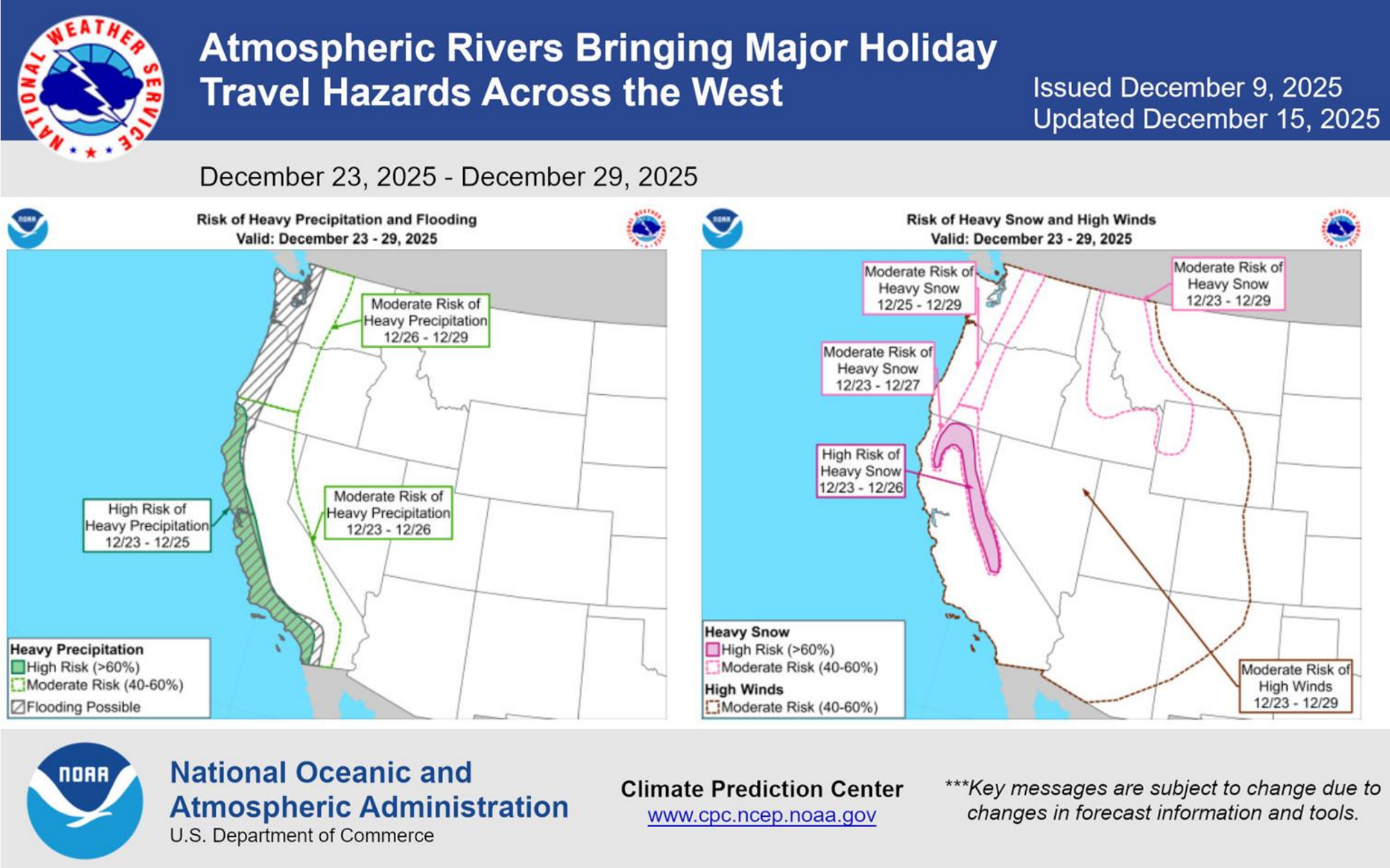
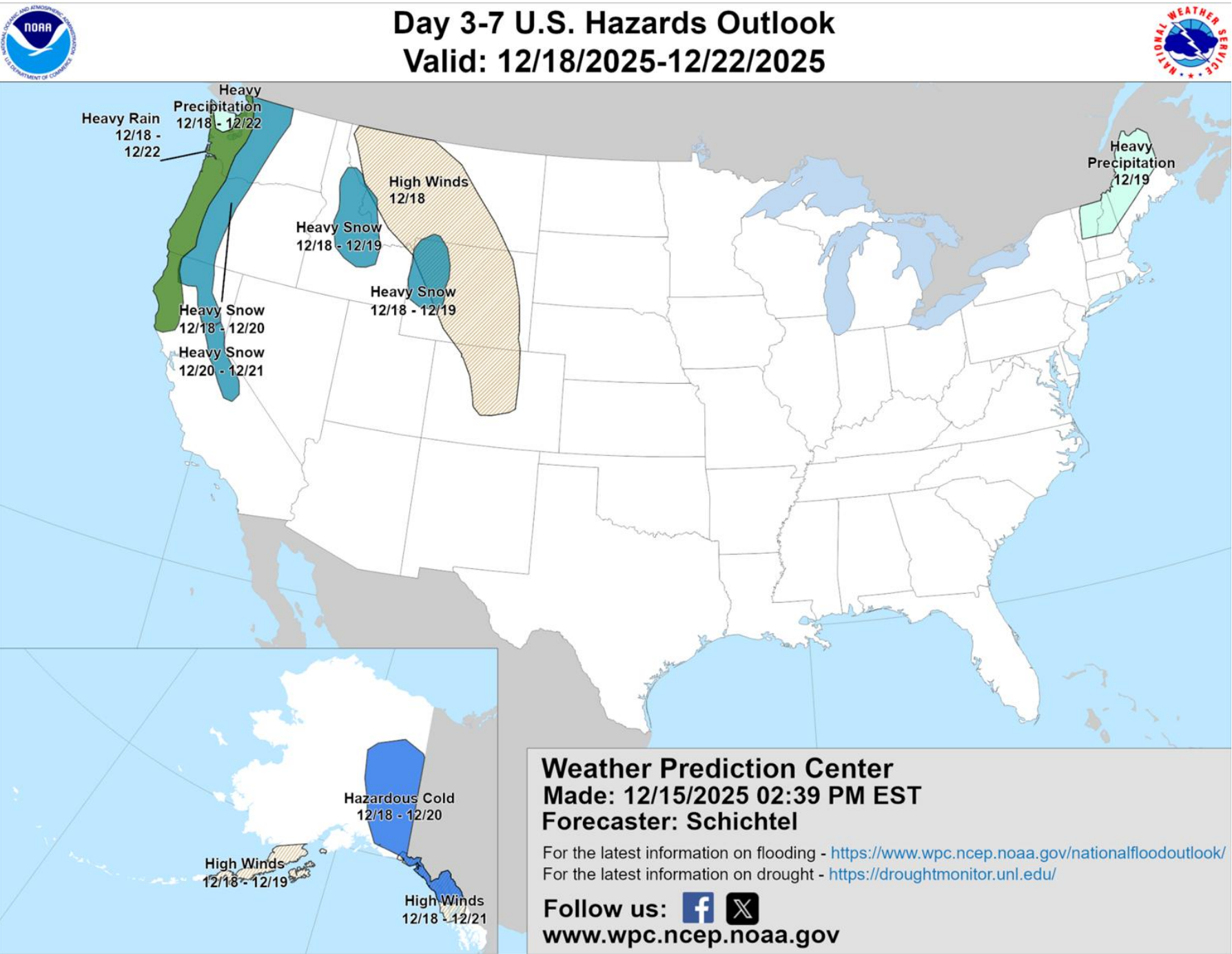


Luckiamute River near Suver



- With soils saturated and river/stream levels already elevated from last week's AR, heavy precipitation this week is forecast to result in widespread riverine flooding in Washington and Oregon.
- The Skagit River near Concrete is forecast to rise above **moderate flood stage** tonight and then crest above **major flood stage** on Wed 17 Dec following the second pulse of moisture transport during the first AR. Ensemble forecasts indicate a 33% probability of this gage exceeding major flood stage.
- Further south, the Luckiamute River near Suver is forecast to rise above **moderate flood stage** early Sat 20 Dec due to heavy rainfall from the second AR. Ensemble forecasts indicate a 42% probability of this gage exceeding moderate flood stage.

WPC Days 3–7 & CPC Days 8–14 Hazards Outlooks



- The WPC Days 3–7 Hazards Outlook is highlighting the likelihood of heavy rain in western Washington, western Oregon, and northwestern California, as well as heavy snow in the Cascades and Sierra Nevada during Thu 18 Dec – Mon 22 Dec.
- The Climate Prediction Center (CPC) is also indicating a high risk of heavy precipitation in coastal California and heavy snow in the Klamath Mountains and Sierra Nevada next week, as well as a moderate risk of heavy precipitation and heavy mountain snow elsewhere over the US West Coast. Flooding will be possible over western Washington, western Oregon, and coastal California.