

CW3E Atmospheric River Outlook: 12 December 2025

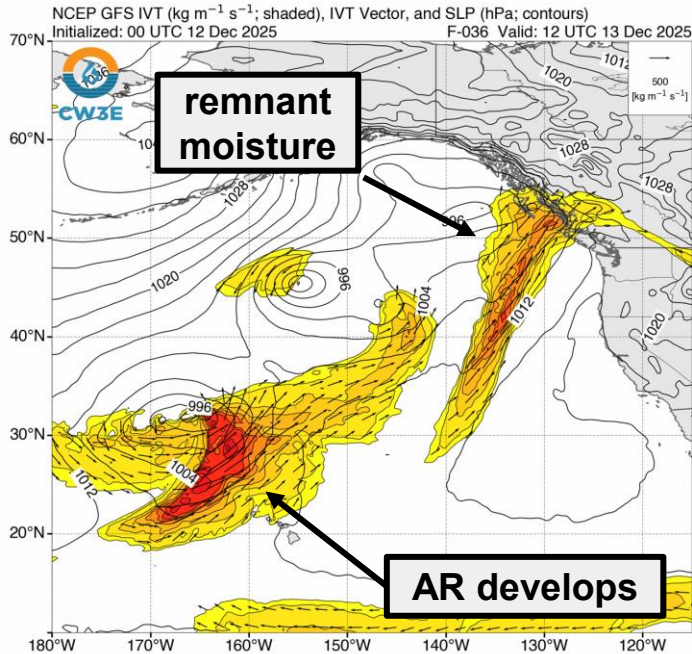
Atmospheric River Forecast to Bring Precipitation to Pacific Northwest and Northern California

- A strong atmospheric river (AR) is forecast to develop over the N. Pacific and merge with an area of remnant moisture from the prior AR that is currently dissipating, eventually moving onshore over British Columbia & the Pacific Northwest on Sun 14 Dec.
- This AR is forecast to bring another long-duration period (>48 hrs) of AR conditions to the Pacific Northwest with strong southwesterly IVT $>750 \text{ kg m}^{-1} \text{ s}^{-1}$ forecast over the region between Mon 15 Dec–Tue 16 Dec. The AR is forecast to then shift south along the US West Coast and bring AR conditions to Northern California between Tue 16 Dec–Wed 17 Dec.
- There are still model-to-model uncertainties during the first AR, with the ECMWF ensemble forecasting a brief break in AR conditions on 16 Dec, while the GEFS keep continuous AR conditions in coastal Oregon.
- The GEFS and ECMWF ensemble control members are forecasting AR3/AR4 conditions along coastal Washington & Oregon and AR2/AR3 conditions in coastal northern California, but there is still uncertainty in the forecast AR duration and intensity.
- The GEFS (50–70% prob.) and ECMWF (70–90% prob.) ensembles are both forecasting high probabilities for AR conditions over coastal Oregon and Northern California for the period beginning on 18 Dec, although some forecast uncertainty remains.
- The NWS Weather Prediction Center (WPC) is forecasting 72-hour precipitation totals of 3–6 in. from this AR along the Coast Ranges in WA, OR, & N. CA, and in the Cascades and northern Sierra Nevada for the period ending at 10 AM on Wed 17 Dec.
- The NWS WPC has issued a **marginal risk** (level 1 of 4; $\geq 5\%$ probability of flash flooding) excessive rainfall outlook (ERO) over northern WA for Sun 14 Dec–Mon 15 Dec, **marginal risk** and **slight risk** (level 2 of 4; $\geq 15\%$ probability) EROs over WA, OR, and far northern CA for Mon 15 Dec–Tue 16 Dec, and a **marginal risk** ERO over WA, OR, and CA for Tue 16 Dec–Wed 17 Dec.
- The NWS Northwest River Forecast Center (NWRFC) is forecasting stream levels to rise in western Washington and Oregon beginning on Mon 15 Dec and continuing for multiple days with this next round of AR activity.
- Freezing levels are forecast to begin relatively high over the Pacific Northwest, eventually lowering as the AR moves through, creating the potential for significant snowfall along terrain the Cascades after Tue 16 Dec.

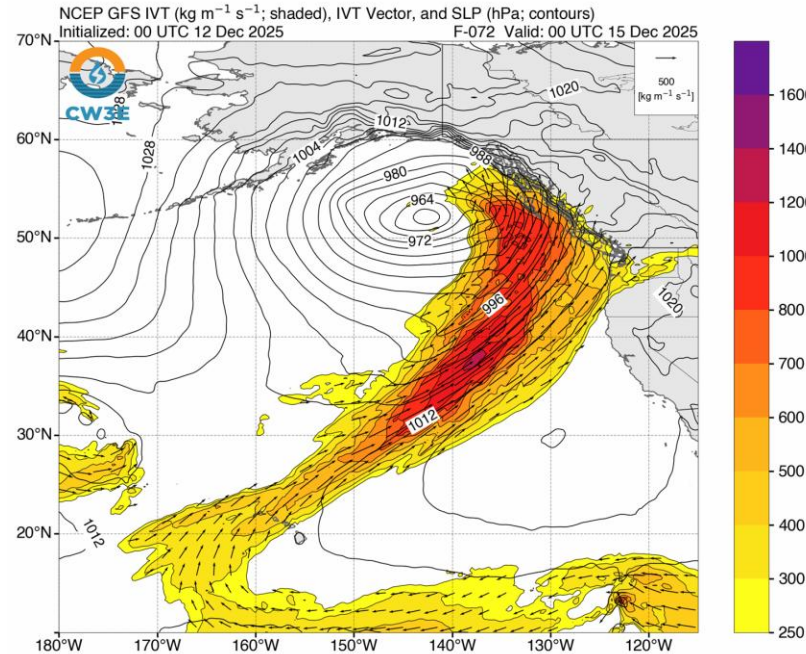
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GFS Model Forecast: Initialized 00 UTC 12 Dec 2025

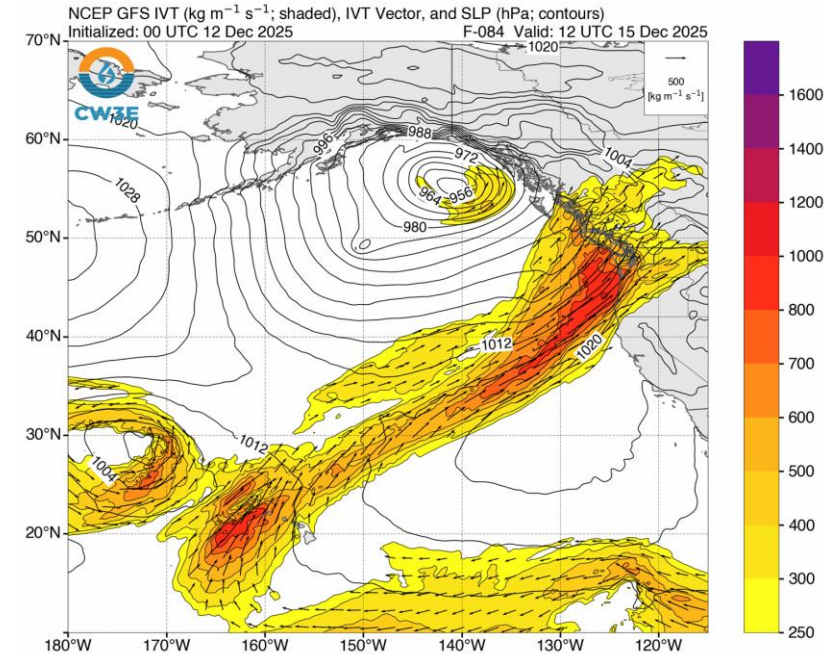
4 AM PT Sat 13 Dec



4 PM PT Sun 14 Dec



4 AM PT Mon 15 Dec

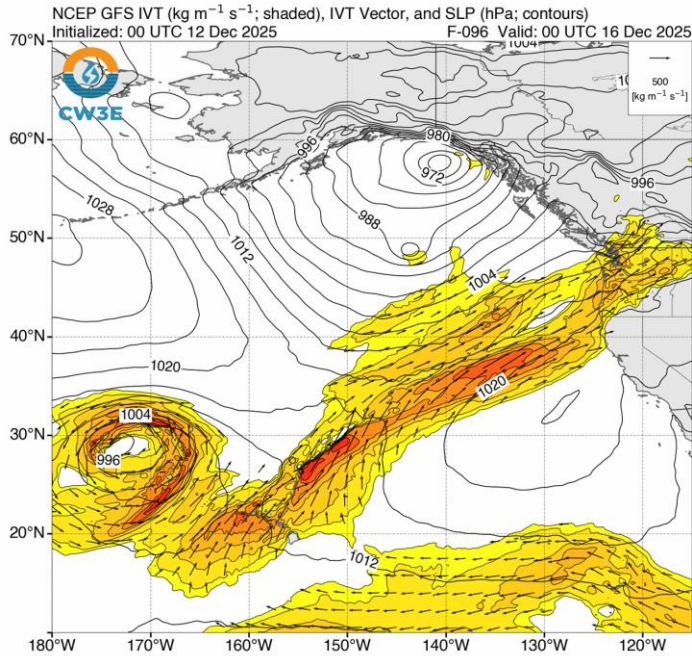


- An atmospheric river is forecast to develop just north of Hawai'i in association with a strong surface low-pressure system, resulting in strong northward moisture transport into an area of remnant tropical moisture from the previous AR this week (left).
- This AR is forecast to develop a broad corridor of southwesterly IVT $>800 \text{ kg m}^{-1} \text{s}^{-1}$ within the core of the system, with the highest IVT moving onshore over British Columbia and the Pacific Northwest on Sun 14 Dec (center).
- The AR is forecast to shift southward along the US West COast, with the corridor of highest IVT over the Pacific Northwest on Mon 15 Dec (right).

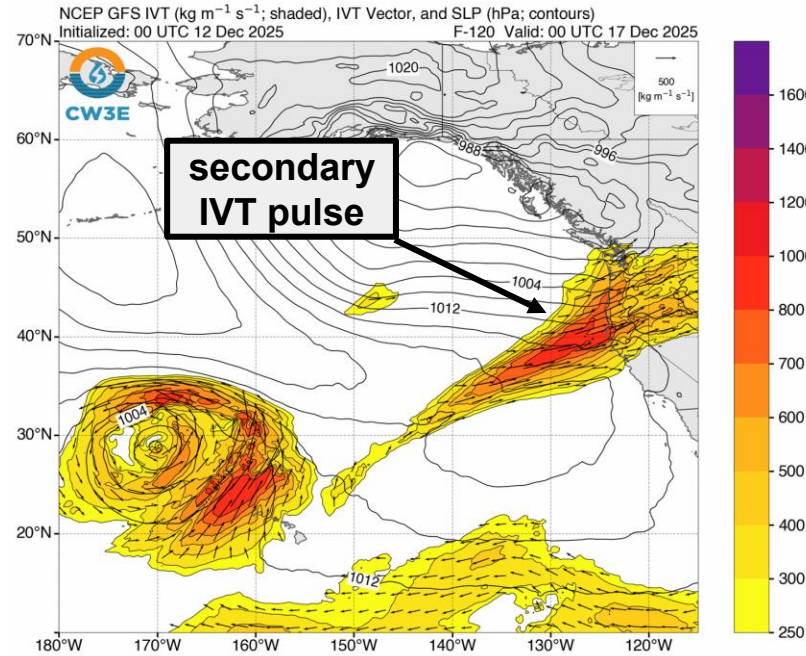
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GFS Model Forecast: Initialized 00 UTC 12 Dec 2025

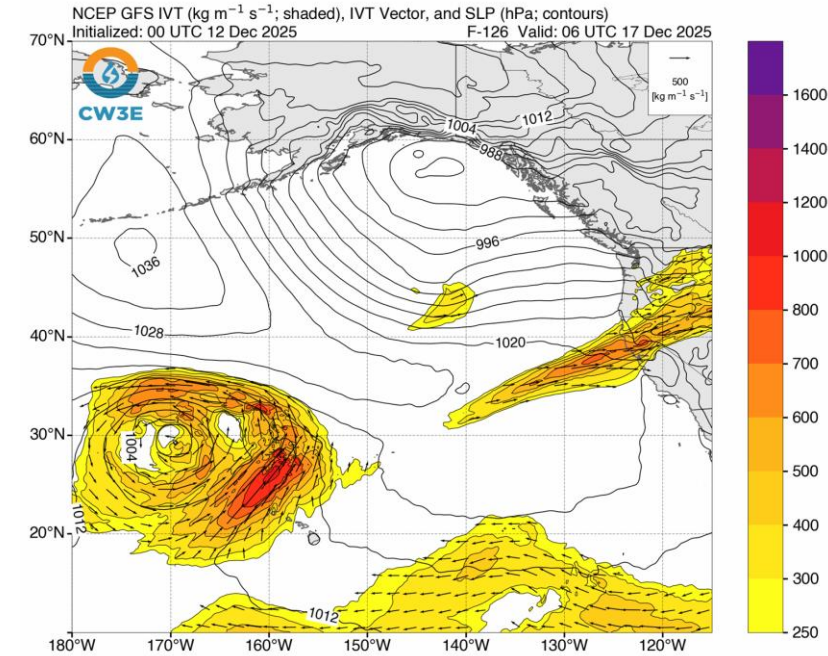
4 PM PT Mon 15 Dec



4 PM PT Tue 16 Dec



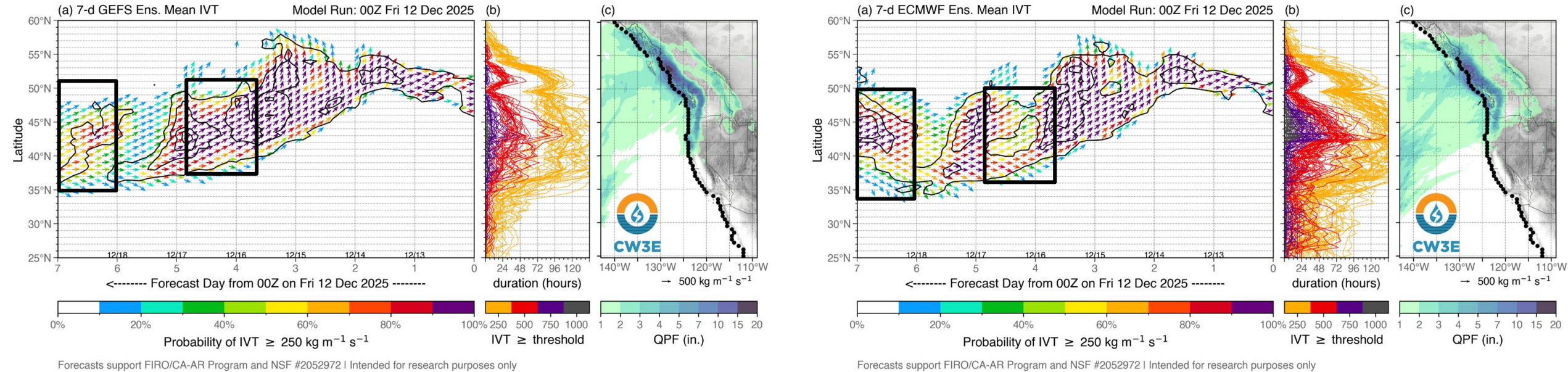
10 PM PT Tue 16 Dec



- As the AR shifts southward along the coast, a secondary pulse of elevated moisture transport is forecast to develop, extending the duration of AR conditions over the Pacific Northwest (left and center).
- This second pulse of IVT $>600 \text{ kg m}^{-1} \text{s}^{-1}$ is forecast over coastal Oregon and Northern California on Tue 16 Dec (center).
- The AR is then forecast to shift southward along the US West Coast, bringing AR conditions to coastal Northern and Central California, although there significant model-to-model differences at to the exact magnitude and duration of AR conditions.

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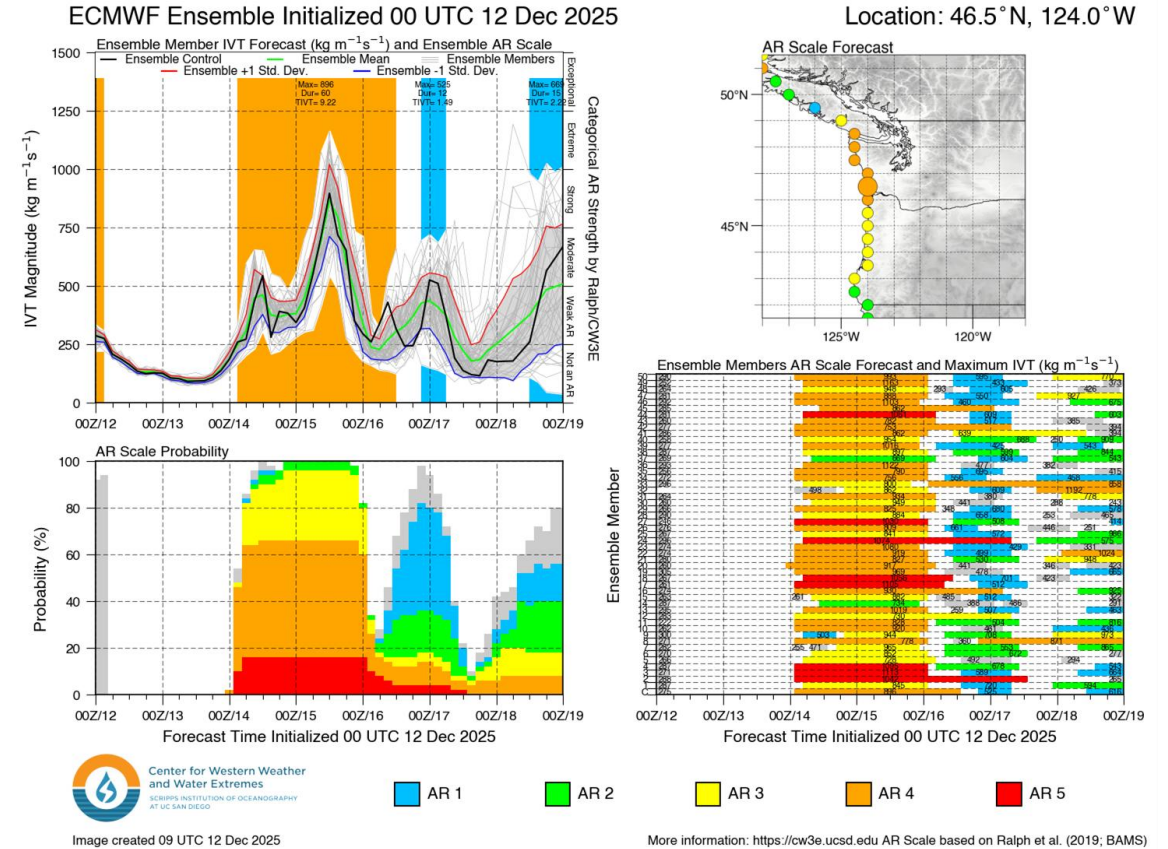
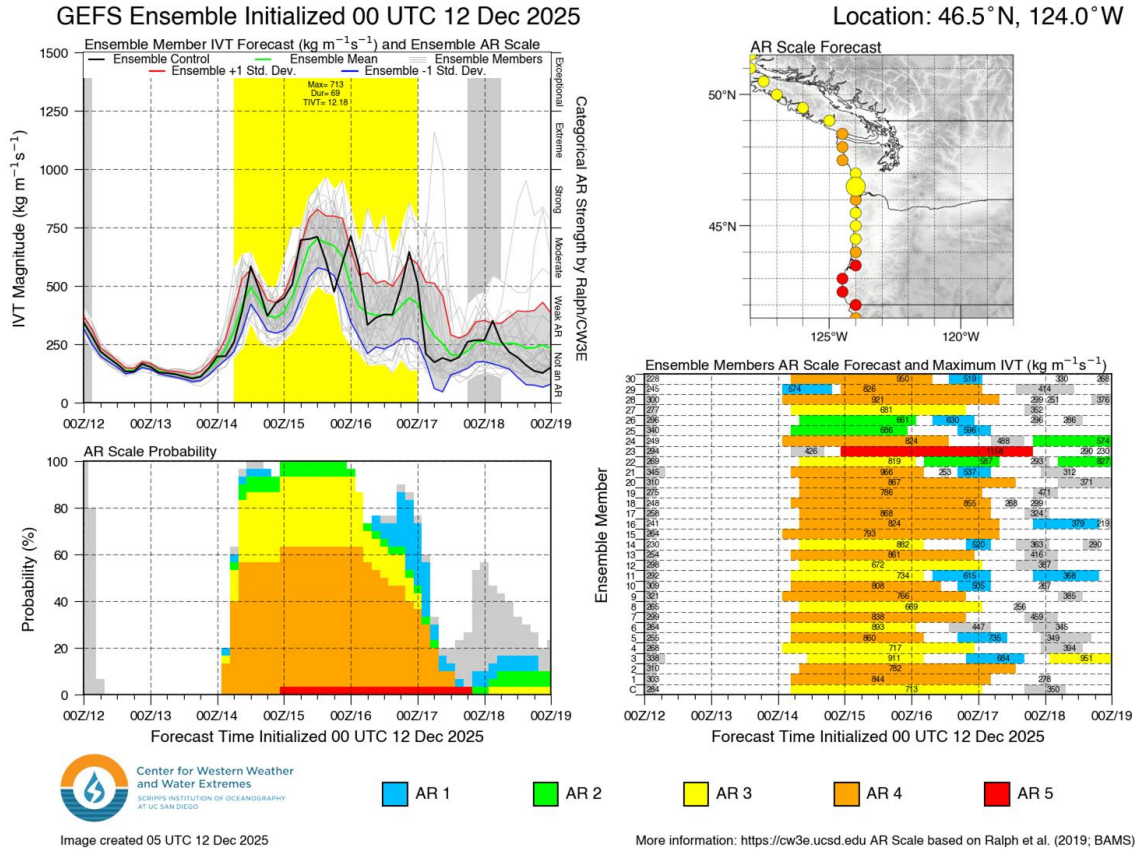
Model Differences: GEFS and EPS IVT Probability & Vectors



- This AR is forecast to bring primarily southwesterly IVT to coastal locations in the Pacific Northwest and Northern California
- There is model-to-model uncertainty in the persistence of AR conditions over the Pacific Northwest in association with the second pulse of IVT during this AR, with the GEFS (left) illustrating no break in AR conditions while the ECMWF ensemble favors a distinct gap in AR conditions along the coast around 12 UTC on 16 Dec.
- There is also uncertainty regarding the likelihood of additional AR activity beginning on 18 Dec over coastal Oregon and Northern California, with ~50–70% of GEFS members highlighting this potential as compared to a much higher 70–90% of ECMWF ensemble members highlighting this possibility.

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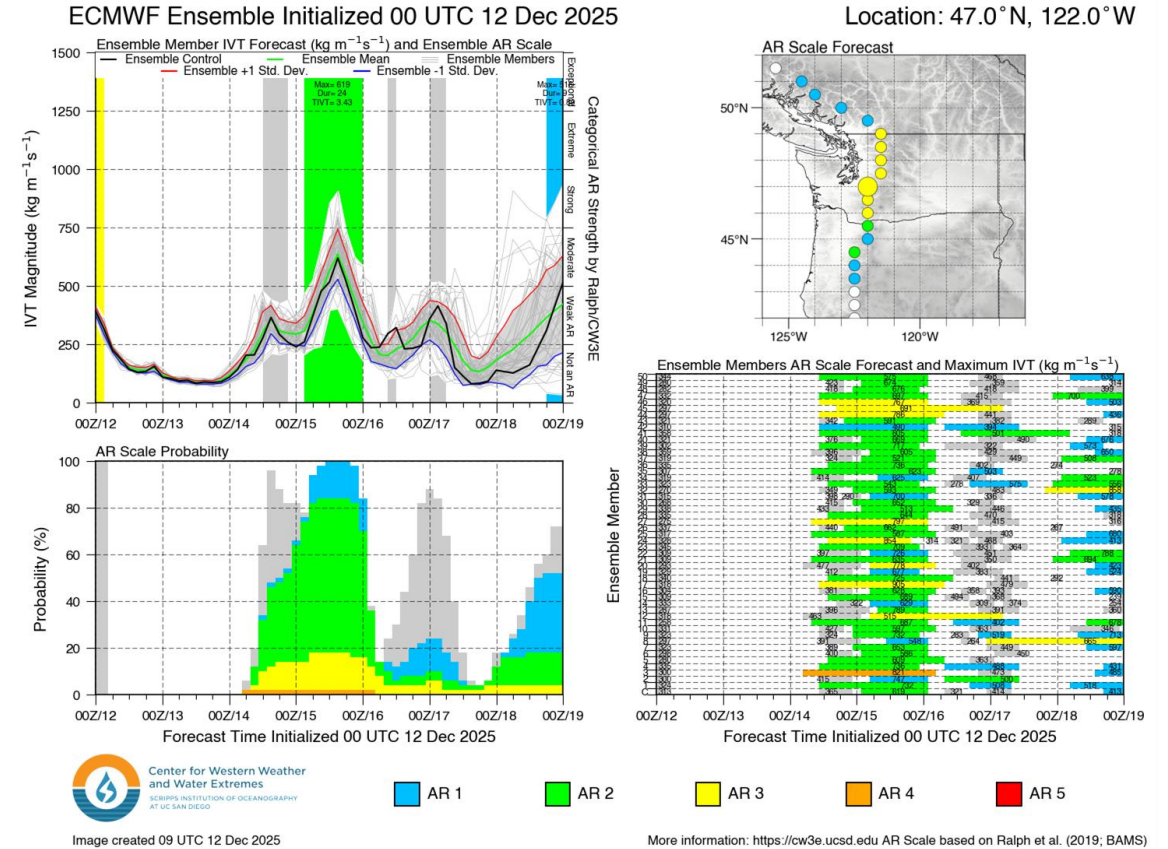
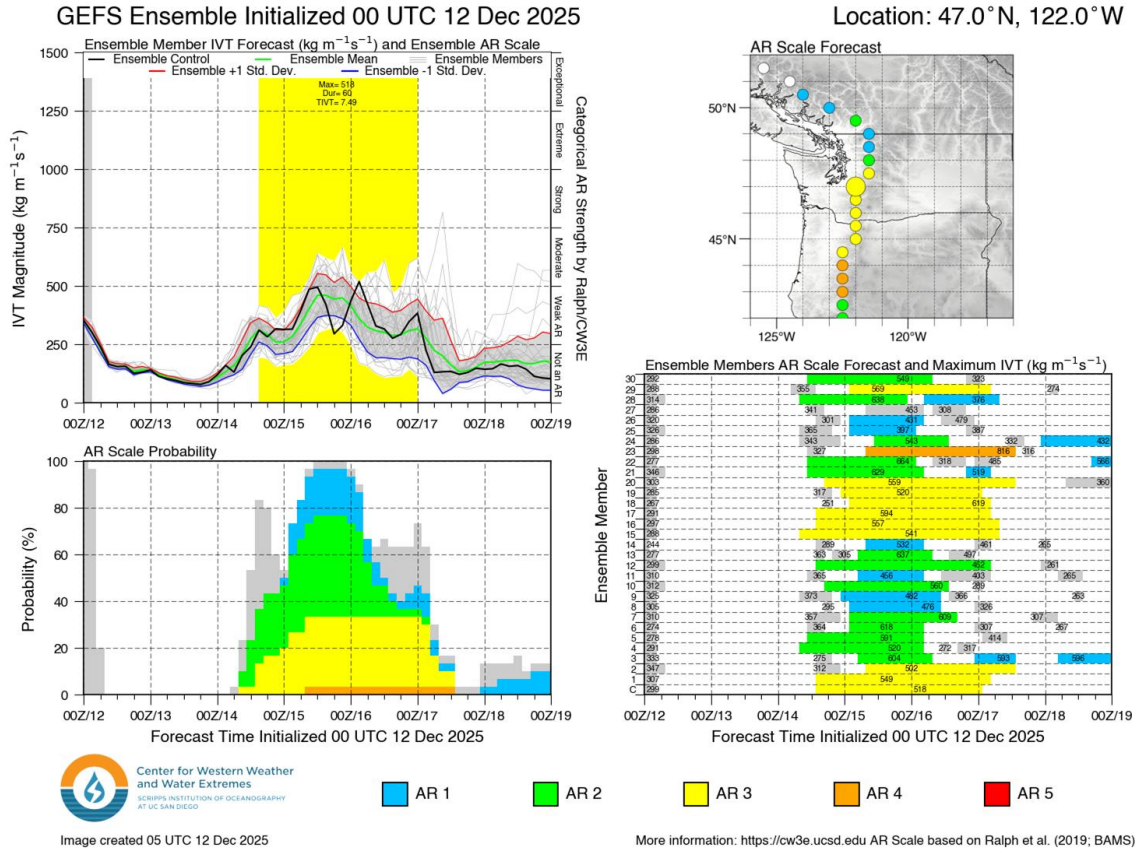
GEFS vs ECMWF AR Scale: Pacific Northwest - Coastal



- The 00Z GEFS control member is forecasting an AR3 while the ECMWF ensemble control member is forecasting an AR4 (based on the Ralph et al. 2019 AR Scale) for a coastal point in Pacific County, Washington, with the difference primarily due to a slightly lower maximum IVT forecast by the GEFS control member.
- Both the GEFS and EPS ensembles are forecasting ~60% probability of AR4 or greater at this coastal location.

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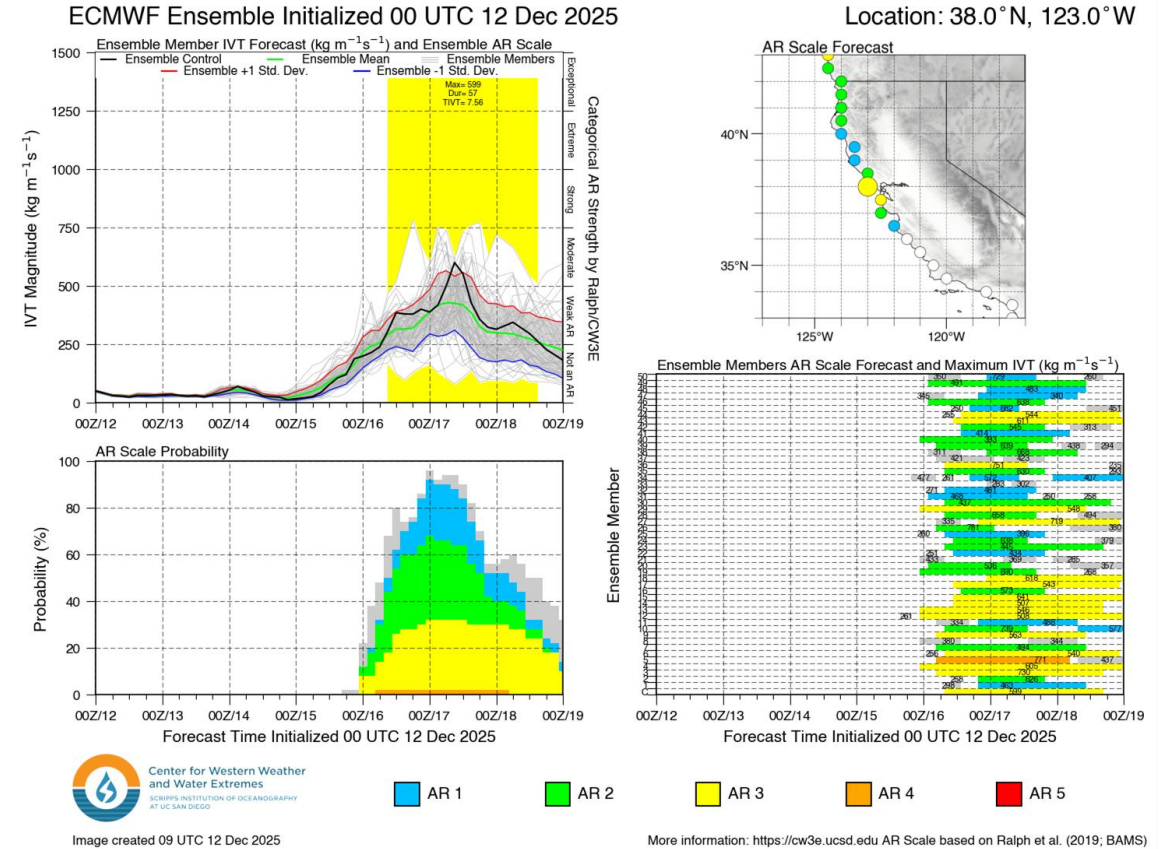
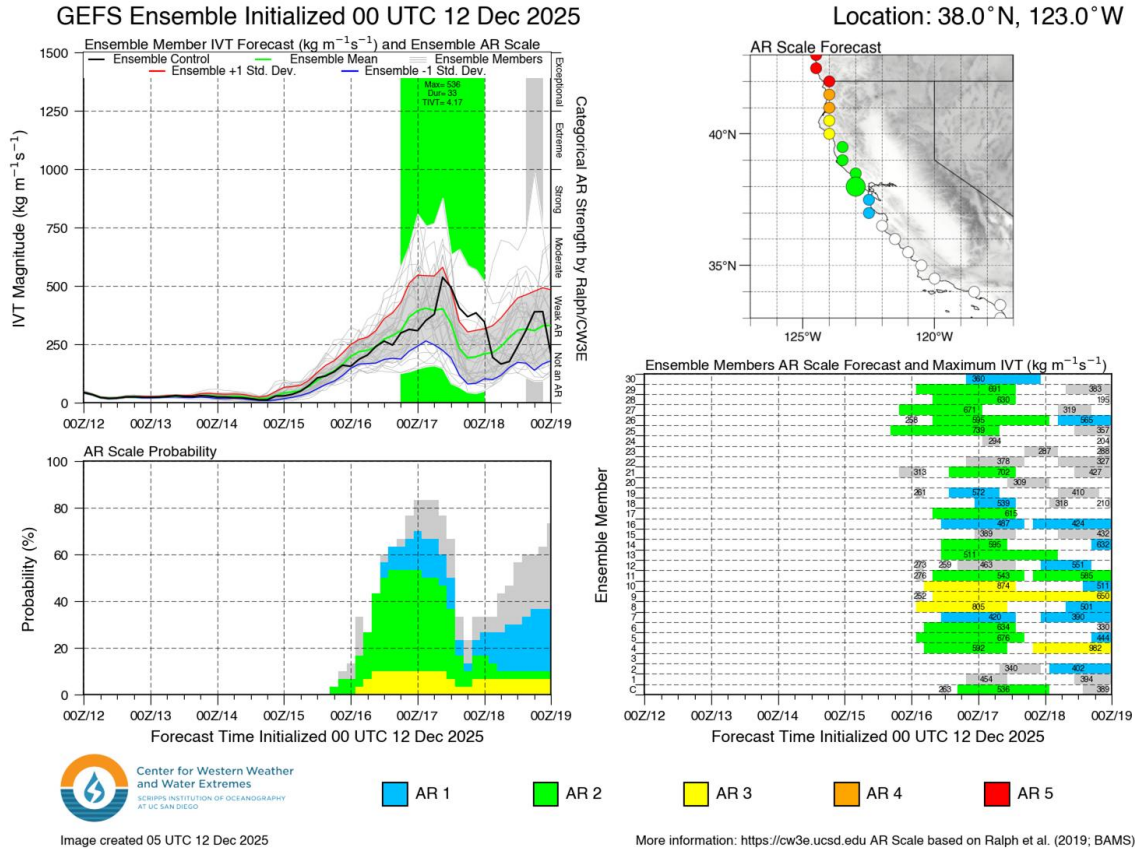
GEFS vs ECMWF AR Scale: Pacific Northwest - Foothills



- Prolonged AR conditions are forecast over the foothills of the Cascades due to the inland penetration of this AR. This is similar to the last AR, where significant precipitation in the foothills was also driven by inland penetration of a strong AR.
- The 00Z GEFS control member is forecasting AR3 (based on the Ralph et al. 2019 AR Scale) conditions, whereas the ECMWF ensemble control member is forecasting an AR2 at 47.0 N, 122.0 W (Near Howard Hanson dam), due to a short period of IVT less than $250 \text{ kg m}^{-1} \text{s}^{-1}$ at this location.

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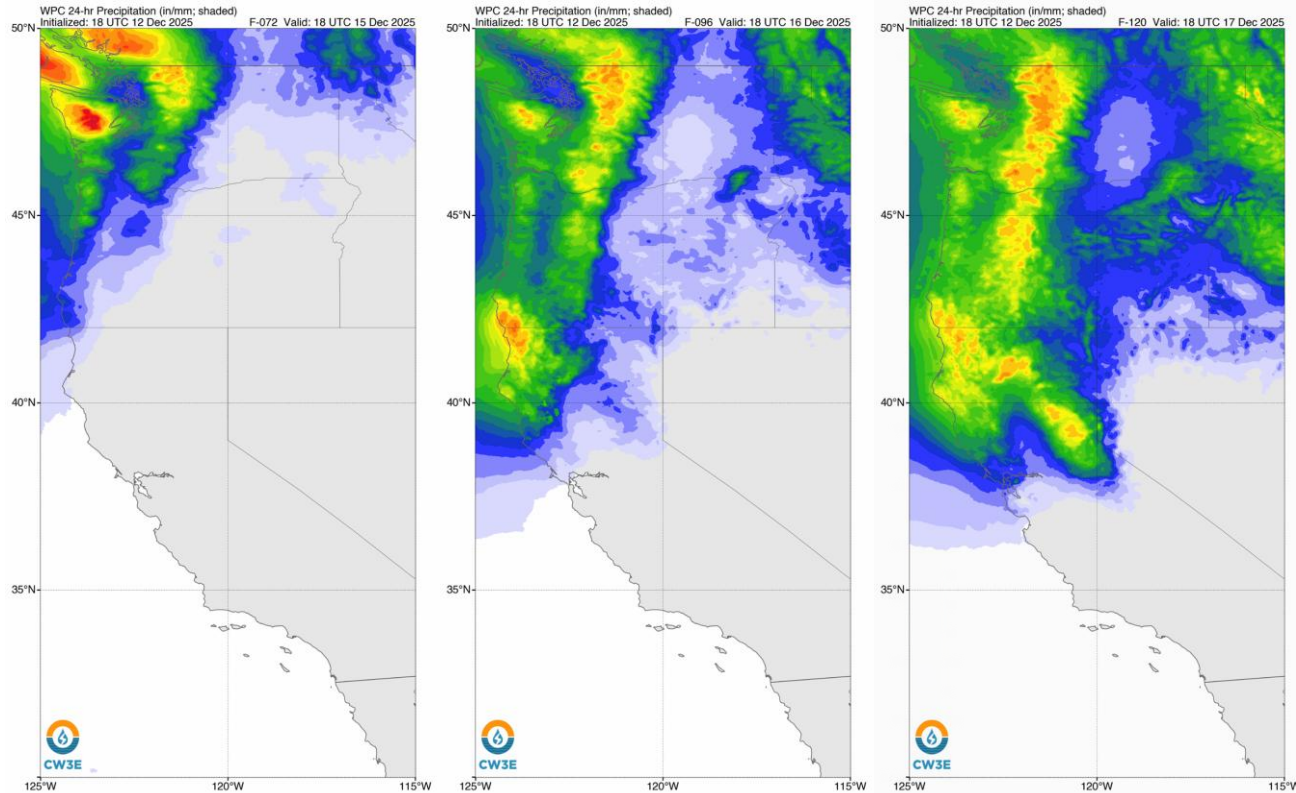
GEFS vs ECMWF AR Scale: Northern California - Coastal



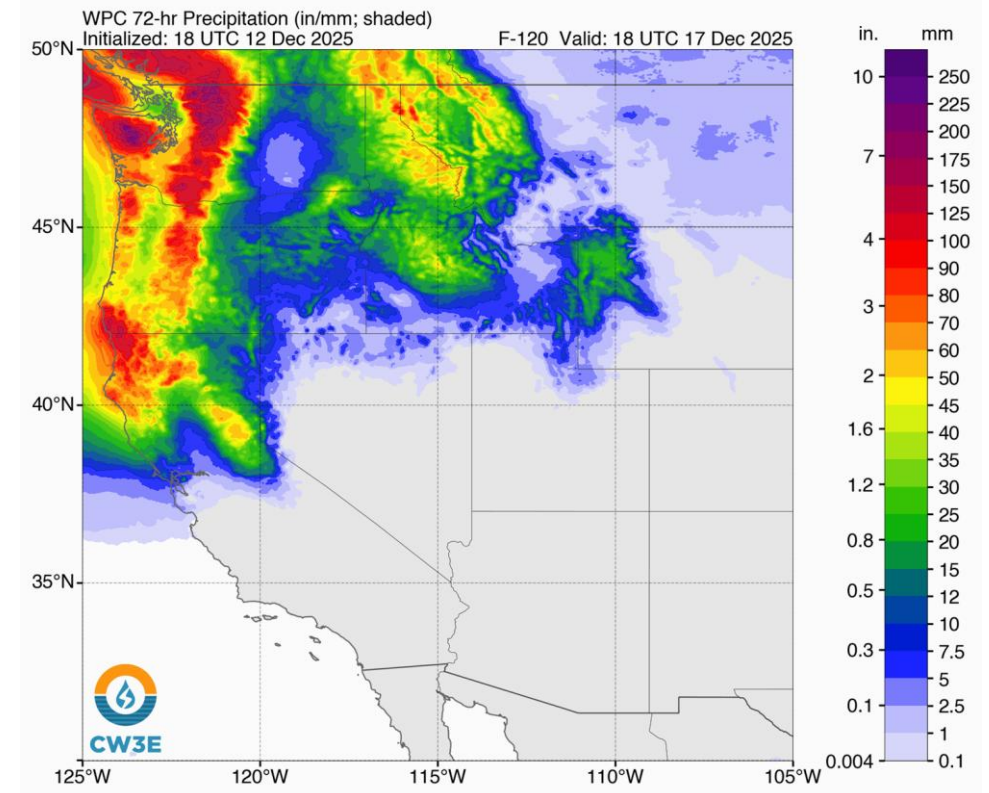
- The GEFS control member is forecasting an AR 2 over coastal Northern California while the ECMWF ensemble control member is forecasting an AR3 for a coastal point in Marin County, CA just north of the Bay Area.
- There are still significant model differences as to the exact duration and intensity of the AR at this location, but ~50 of GEFS members and ~65% of ECMWF members are forecasting at least AR2 conditions during the next 7 days.

WPC Quantitative Precipitation Forecasts

NWS WPC 24-hour QPF: Periods ending 10 AM Mon 15 Dec–10 AM Wed 17 Dec.



NWS WPC 72-hour QPF: 10 AM Wed 17 Dec



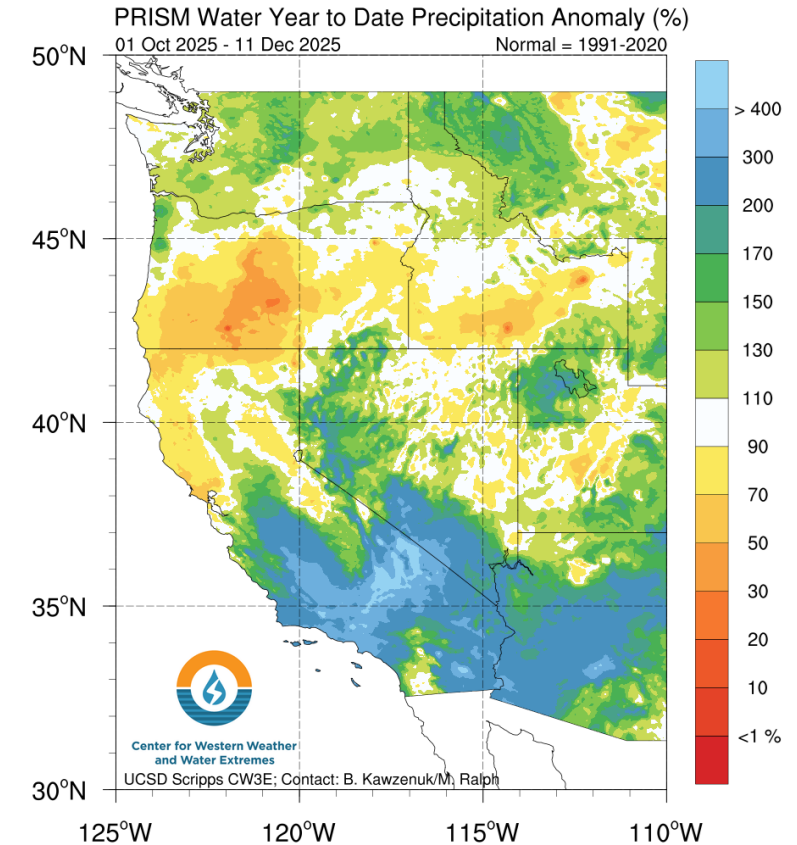
- The highest 24-hour precipitation amounts of 2–4 inches are forecast over the Olympic Peninsula and northern Cascades between 10 AM Sun 14 Dec–10 AM Mon 15 Dec, followed by two 24-hour periods each with an additional 1.5–2.5 inches in the Coast Ranges in WA, OR, & N. CA, and in the Cascades and northern Sierra Nevada between 10 AM Mon 15 Dec–10 AM Wed 17 Dec.
- The NWS WPC is forecasting 72-hour precipitation totals of 3–6 in. in the Coast Ranges in WA, OR, & N. CA, and in the Cascades and northern Sierra Nevada for the period ending at 10 AM on Wed 17 Dec.

NWS WPC Excessive Rainfall Outlooks & PRISM Water Year to Date Anomaly



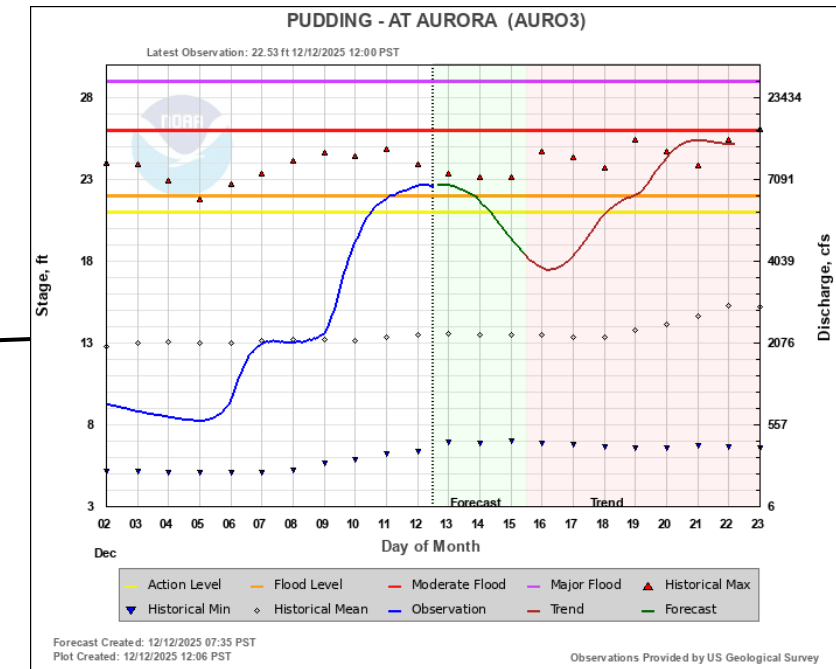
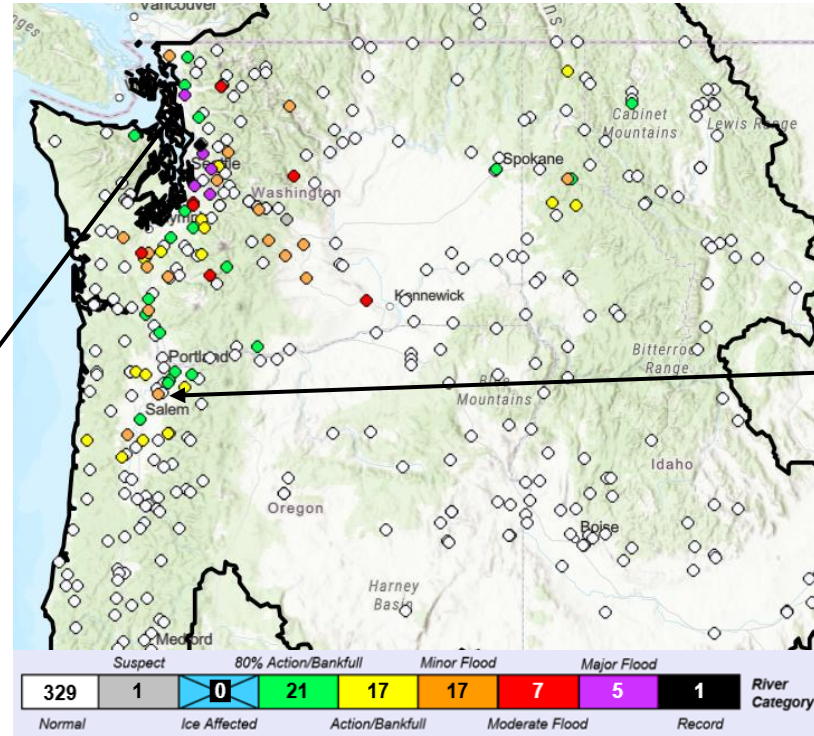
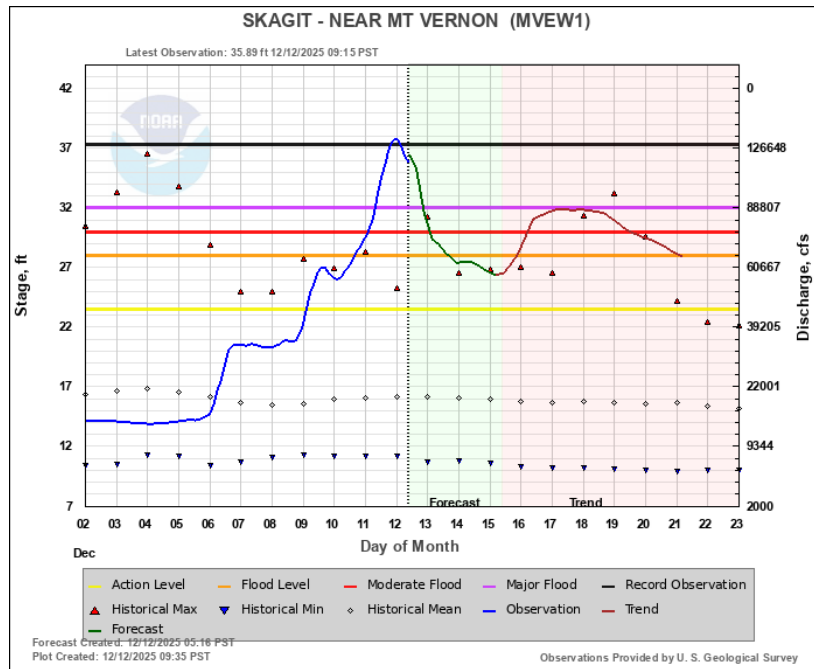
Risk of rainfall exceeding flash flood guidance within 25 miles of a point

HIGH: At Least 70%	SLGT: At Least 15%
MDT: At Least 40%	MRGL: At Least 5%



- The NWS WPC has issued a **marginal risk** (level 1 of 4; $\geq 5\%$ probability of flash flooding) excessive rainfall outlook (ERO) over northern WA for Sun 14 Dec–Mon 15 Dec, **marginal risk** and **slight risk** (level 2 of 4; $\geq 15\%$ probability) over eastern WA, OR, and far northern CA for Mon 15 Dec–Tue 16 Dec, and a **marginal risk** over much of western WA, OR, and northern CA for Tue 16 Dec–Wed 17 Dec.
- Significant precipitation is expected from this AR over portions of the Pacific Northwest that are currently sitting at $\sim 100\text{--}150\%$ for their water year to date precipitation anomaly after significant recent AR activity.

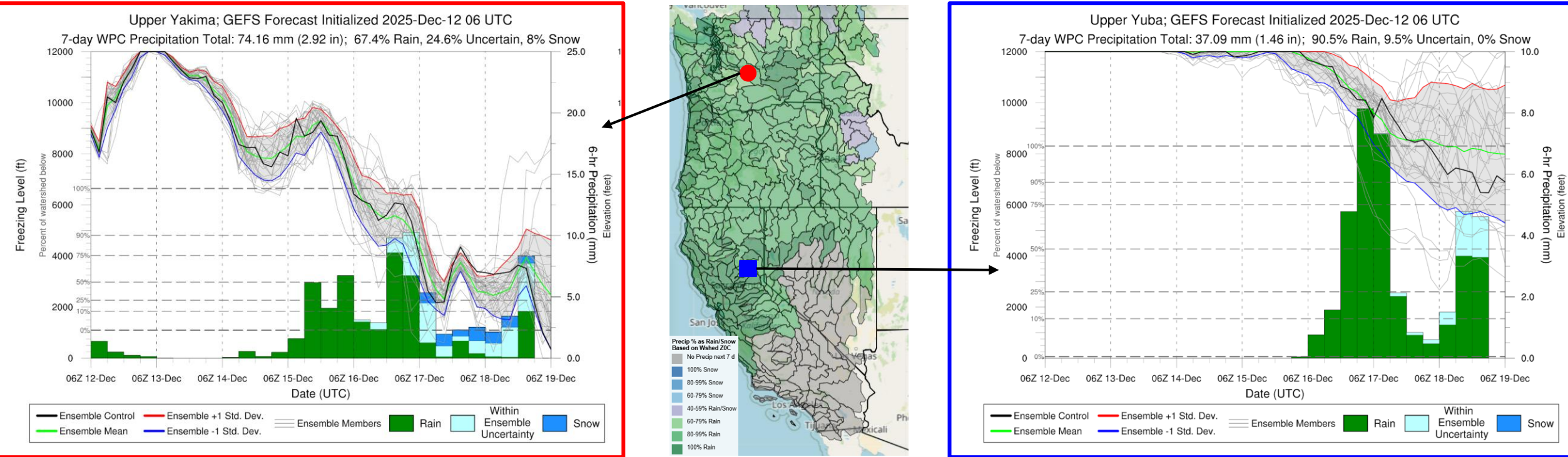
NWS Northwest River Forecast Center Streamflow Forecast



- The NWS Northwest River Forecast Center (NWRFC) is forecasting stream levels to rise in western Washington and Oregon beginning on Mon 15 Dec and continuing for multiple days with the next round of AR activity.
- These stream rises are forecast on the heels of significant rises that were observed in recent days with a prior AR. Some gauges are forecast to remain above action level, rising again with the next AR that is forecast to bring precipitation to the region.
- Minimal streamflow responses are currently forecast over Northern California due to dry antecedent conditions (not shown).

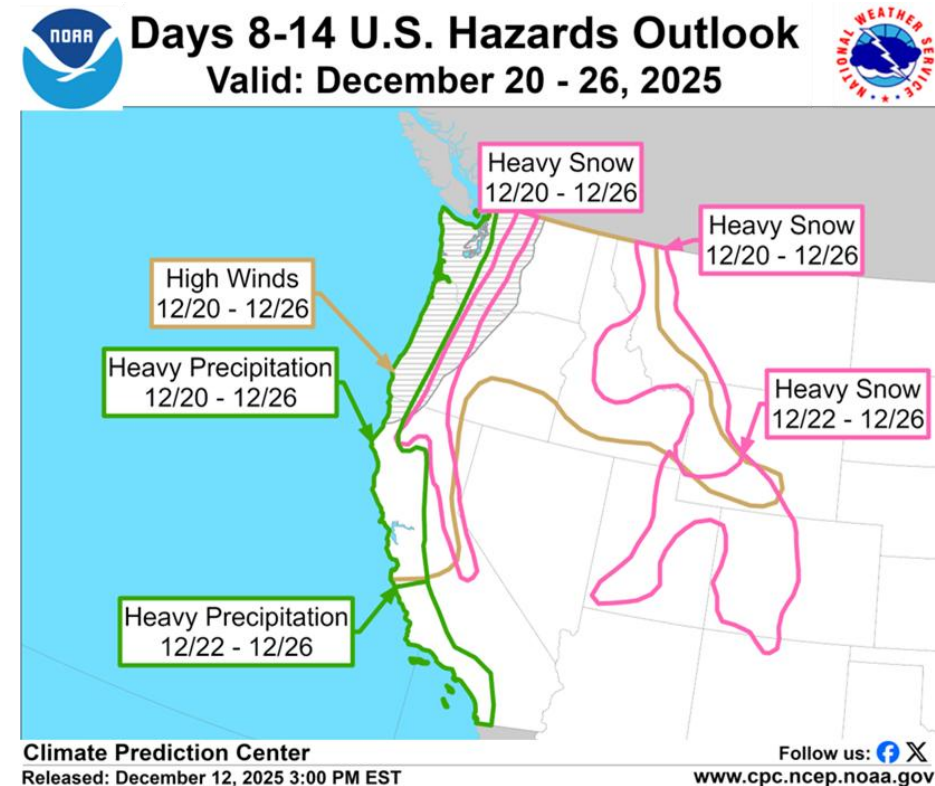
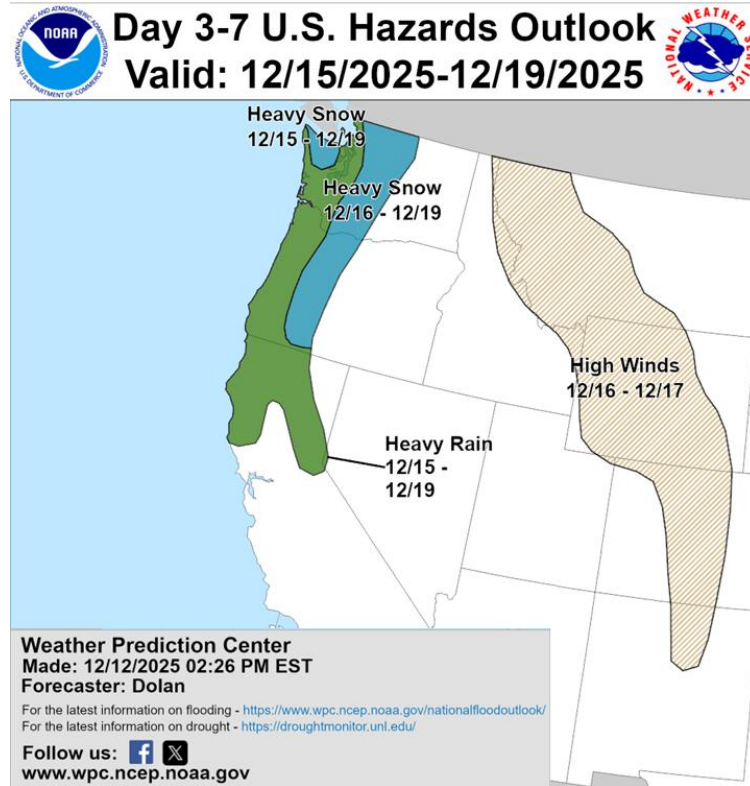
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GEFS Watershed Freezing Level Forecast Comparison



- Freezing levels over the Pacific Northwest are forecast to remain above 8,000 ahead of the approaching AR and gradually fall to below 4,000 feet, creating the potential for accumulating snowfall in the Cascades after 16 Dec as the AR moves over the region.
- In the northern Sierra Nevada, freezing levels are forecast to remain above 8,000 feet during the majority of the AR, eventually dipping to 4–6,000 feet later in the event, although there is more uncertainty later in the period.

NWS Weather Prediction Center and Climate Prediction Center Hazard Outlooks



- The NWS Weather Prediction Center has highlighted the risk of heavy rainfall in coastal Washington, Oregon, and northern California between Mon 15 Dec–Fri 19 Dec and the risk for heavy snow in the Olympics & Cascades for Mon 15 Dec–Fri 19 Dec.
- The NWS Climate Prediction Center has highlighted a moderate risk of heavy precipitation and heavy snow continuing over the Pacific Northwest and extending southward into California next weekend into the following week. Flooding is possible in western Washington and Oregon.