CW3E Atmospheric River Outlook: 9 December 2024

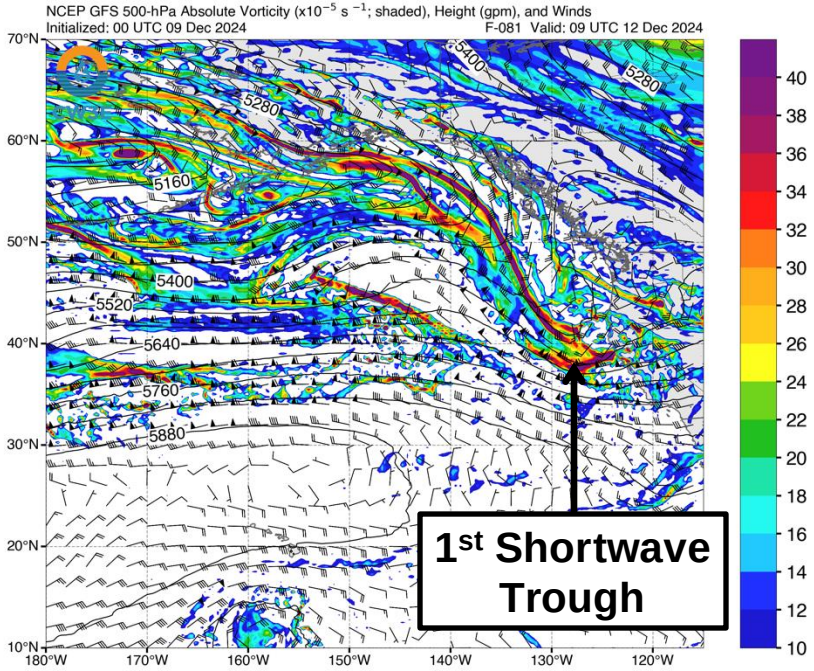
Unsettled Weather Pattern Likely to Return to US West Coast This Week

- A series of mid-level shortwave troughs and atmospheric rivers (ARs) are forecast to impact the US West Coast starting around mid-week and potentially continuing into next week.
- The first AR is forecast to bring a brief period of weak AR conditions (IVT < 500 kg m^{-1} s^{-1}) to California late Wed 11 Dec into Thu 12 Dec.
- A second and stronger AR is forecast to make landfall over Northern California Fri 13 Dec into Sat 14 Dec, but there is still some uncertainty regarding the timing, location, and magnitude of AR conditions.
- Looking further ahead, deterministic and ensemble models are showing potential for additional landfalling AR activity next week.
- The 00Z GEFS and EPS control members are forecasting an AR 2 (based on the Ralph et al. 2019 AR Scale) over most of coastal Northern California in association with the second AR.
- The 12Z National Blend of Models (NBM) is forecasting at least 2–5 inches of total precipitation in portions of Northern California, western Oregon, and western Washington during the next 7 days.
- Uncertainty in the forecast evolution of these ARs and shortwave troughs is driving uncertainty in forecast precipitation. In general, GEFS is forecasting higher precipitation totals across Northern California, western Oregon, and western Washington during the next 10 days compared to EPS.

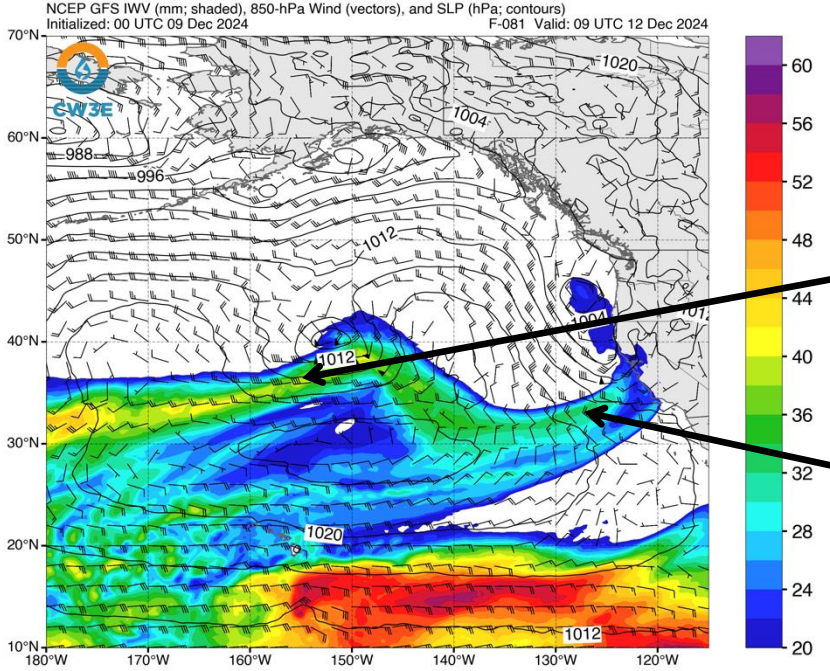
AR Outlook: 9 December 2024

GFS Model Forecasts: Valid 1 AM PT 12 Dec (F-81)

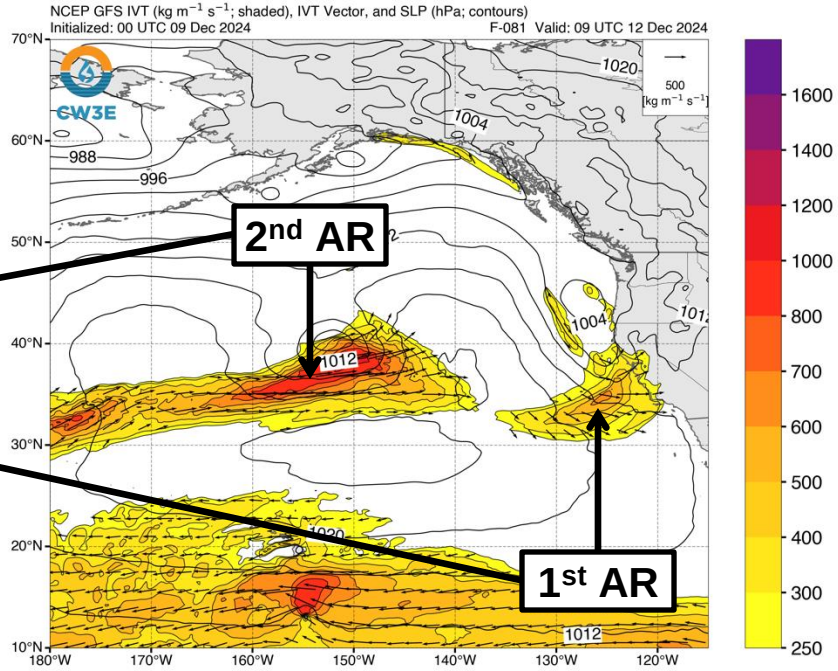
500-hPa Geopotential Height & Vorticity



IWV & SLP



IVT & SLP



- A series of mid-level shortwave troughs and atmospheric rivers (ARs) are forecast to propagate across the Northeast Pacific and bring unsettled weather to the US West Coast this week.
- The first shortwave trough is forecast to approach the US West Coast late Wed 11 Dec into Thu 12 Dec.
- South of the shortwave trough, a weak AR associated with a plume of moisture (IWV > 30 mm) is forecast to bring a brief period of weak AR conditions (IVT < 500 kg m^{-1} s^{-1}) to California.
- As the first AR approaches California, a second stronger AR is forecast to develop to the west in association with more robust subtropical moisture plume (IWV > 40 mm).

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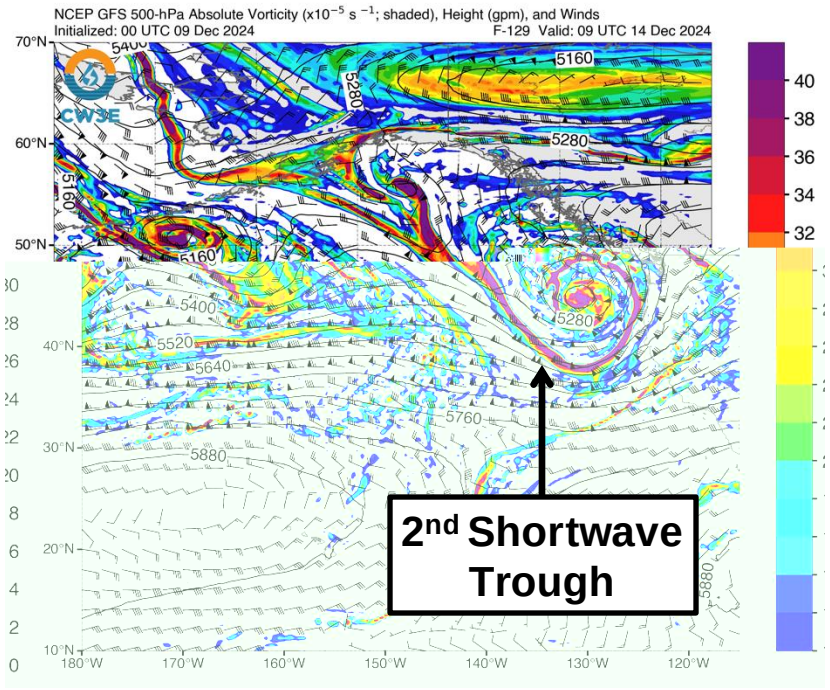
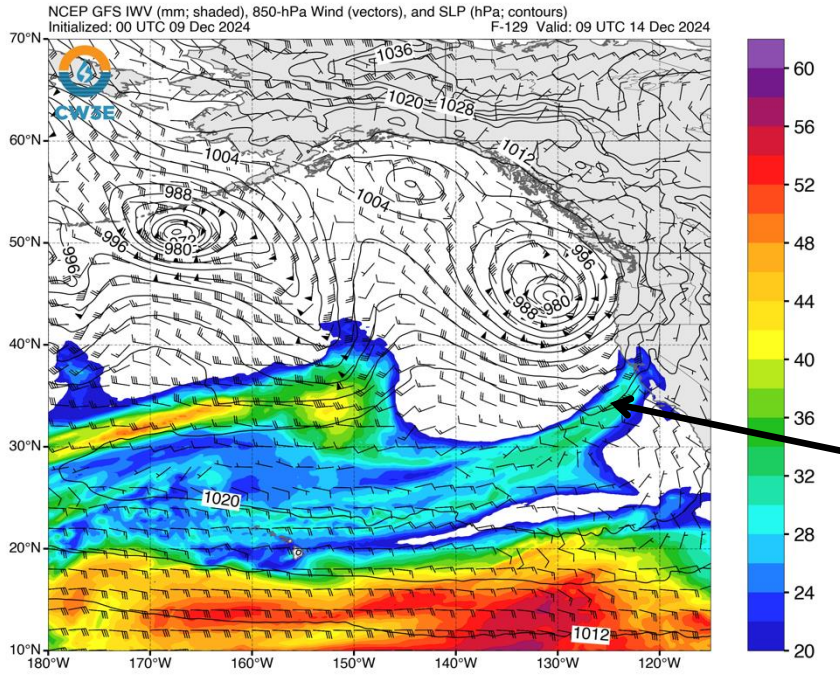
GFS Model Forecasts: Valid 1 AM PT 14 Dec (F-129)

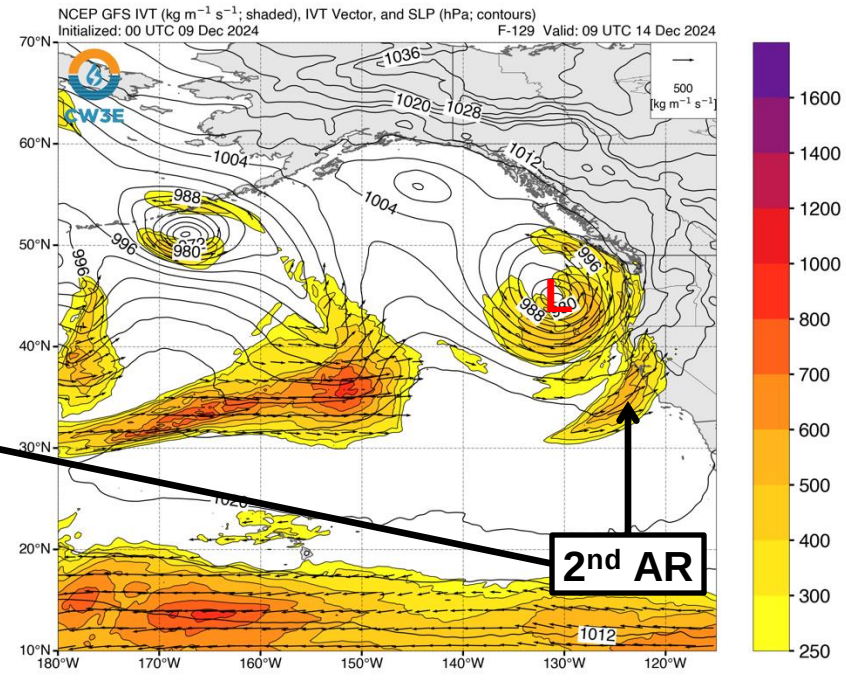
500-hPa Geopotential Height & Vorticity



IWV & SLP



IVT & SLP



- After the first shortwave trough moves onshore, a second and more amplified shortwave trough is forecast to develop and propagate southeastward.
- As the second shortwave trough approaches the US West Coast, the second AR is forecast to make landfall late Fri 13 Dec and bring moderate AR conditions (IVT ≥ 500 kg m^{-1} s^{-1}) to Northern California.
- The presence of the second AR may also fuel the development of a strong surface cyclone on the poleward side of the AR.
- There is still considerable uncertainty in the evolution of the second AR as it approaches the US West Coast.

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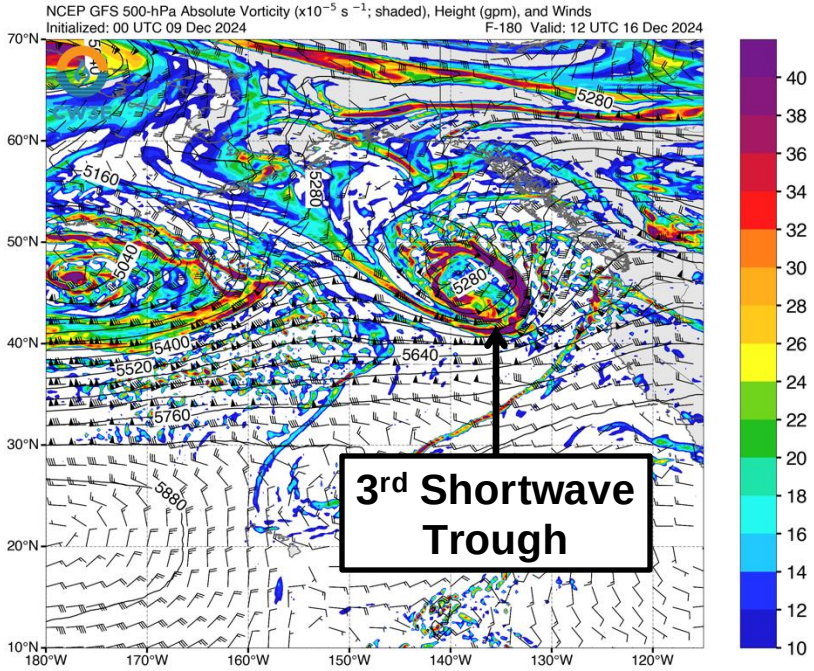
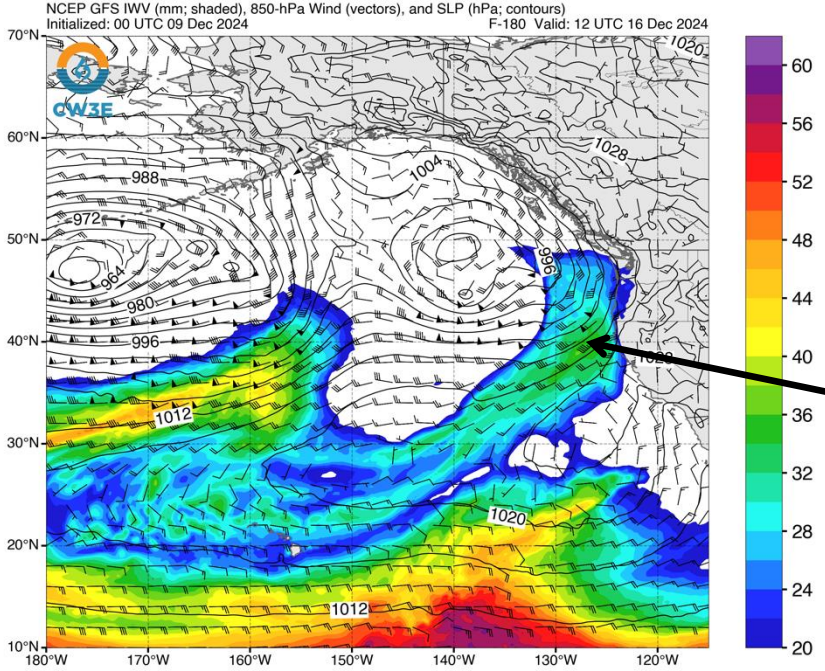
GFS Model Forecasts: Valid 4 AM PT 16 Dec (F-180)

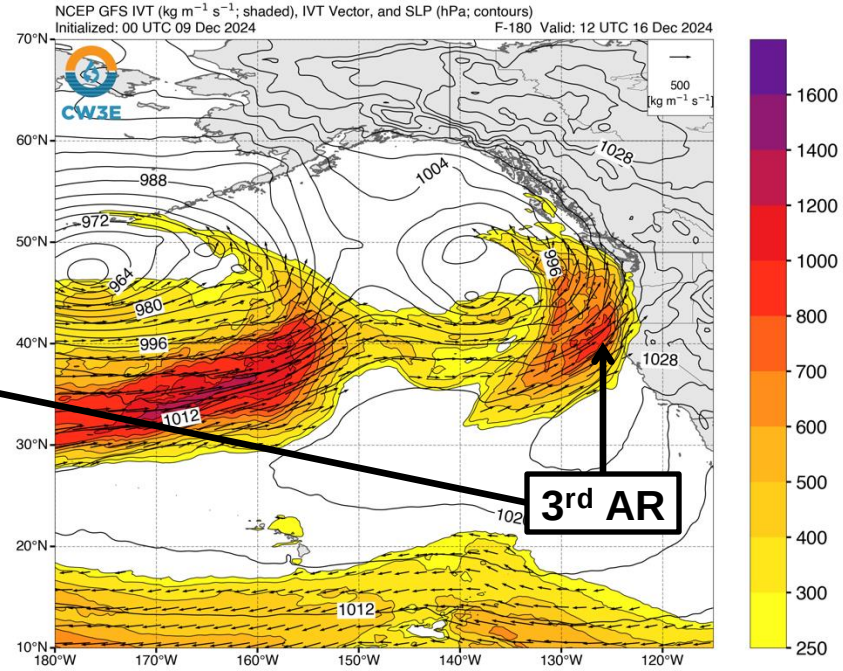
500-hPa Geopotential Height & Vorticity



IWV & SLP



IVT & SLP



- A third AR is forecast to develop behind the second AR and potentially make landfall over the Pacific Northwest early next week downstream of yet another shortwave trough.
- Given the long lead time (~7 days), there is even more uncertainty surrounding the evolution of the third shortwave trough and AR.

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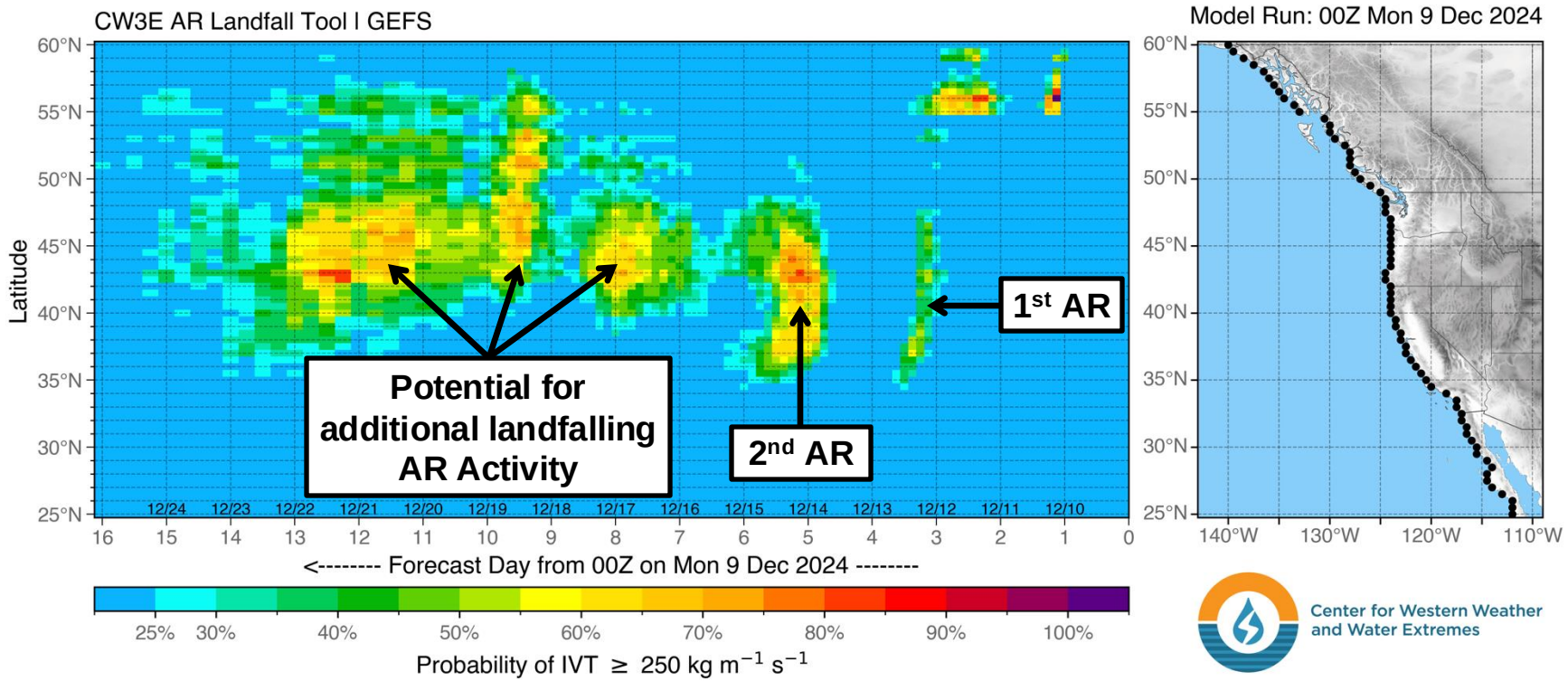
GEFS Probability of AR Conditions Along Coast



Center for Western Weather and Water Extremes

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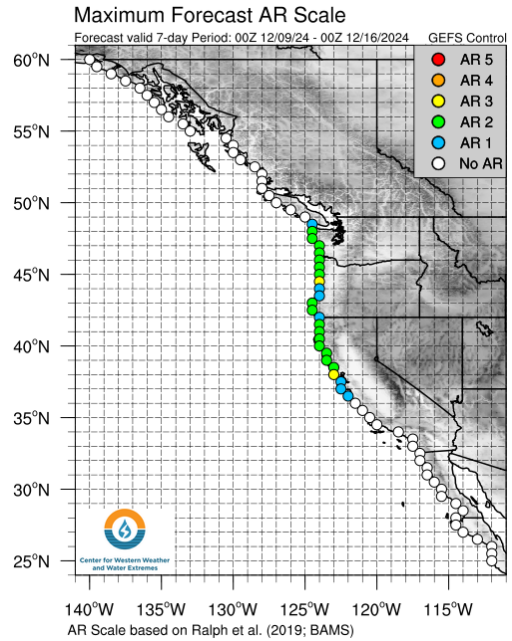
GEFS Control AR Scale

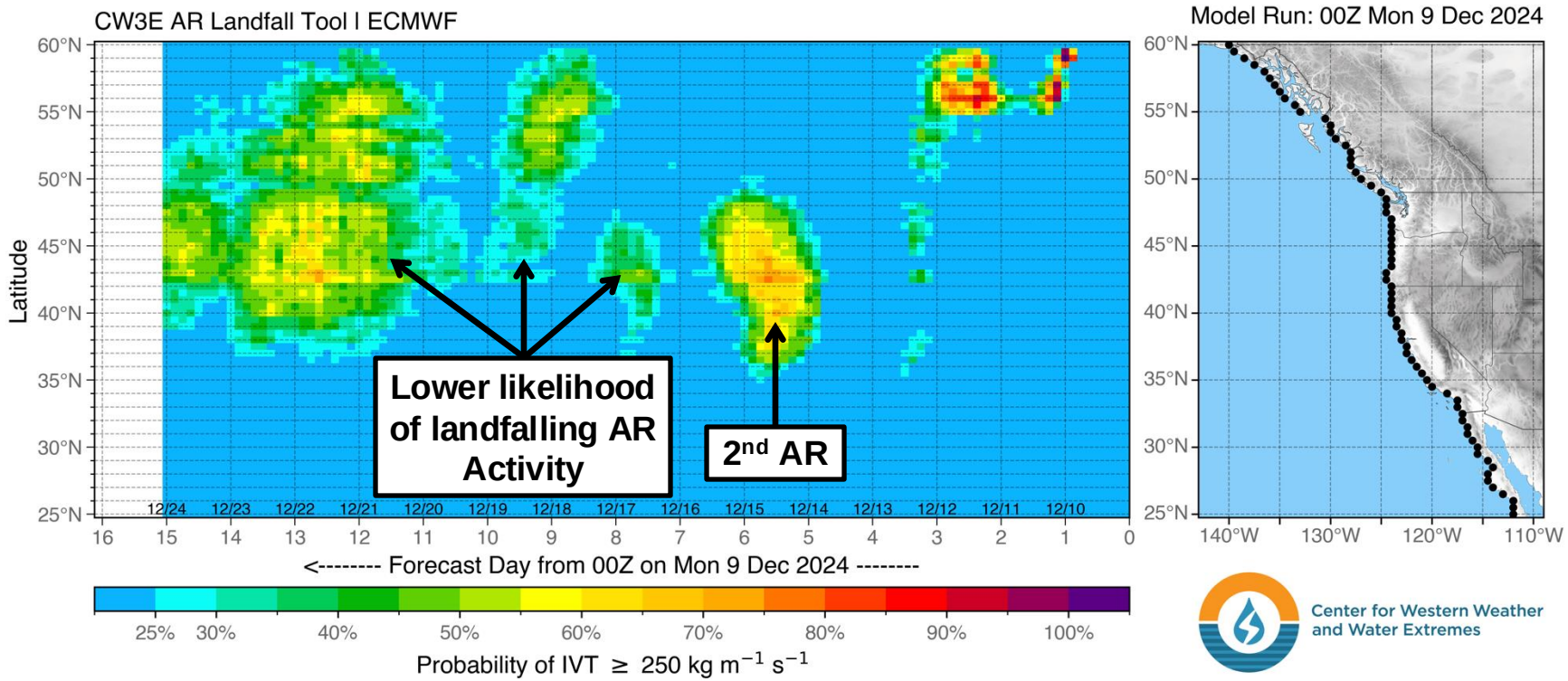


*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 00Z GEFS is showing moderate confidence (60–80% probability) in a period of AR conditions (IVT ≥ 250 kg m^{-1} s^{-1}) over coastal Northern California and Oregon on 13–14 Dec in association with the second AR.
- The 00Z GEFS control member is forecasting an AR 2 (based on the Ralph et al. 2019 AR Scale) over much of the US West Coast between the Bay Area and Olympic Peninsula during the next 7 days, with an AR 3 forecast near Point Reyes in Marin County, CA.
- GEFS is also showing potential for additional landfalling AR activity over the US West Coast throughout next week (16–21 Dec), with the highest likelihood over Oregon and Washington.

AR Outlook: 9 December 2024

EPS Probability of AR Conditions Along Coast



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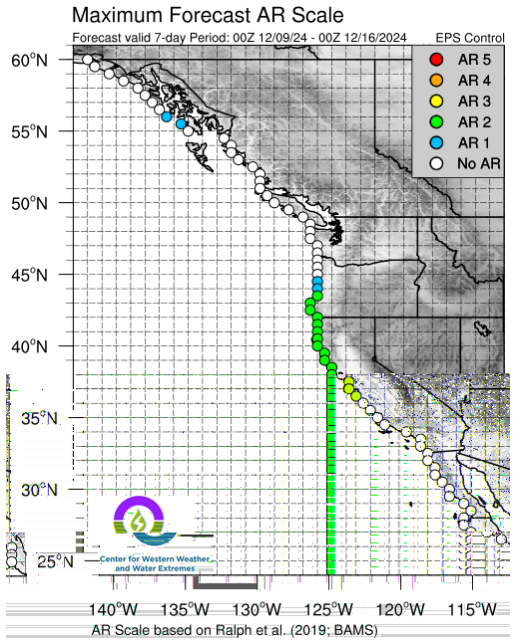
Center for Western Weather and Water Extremes

EPS Control AR Scale

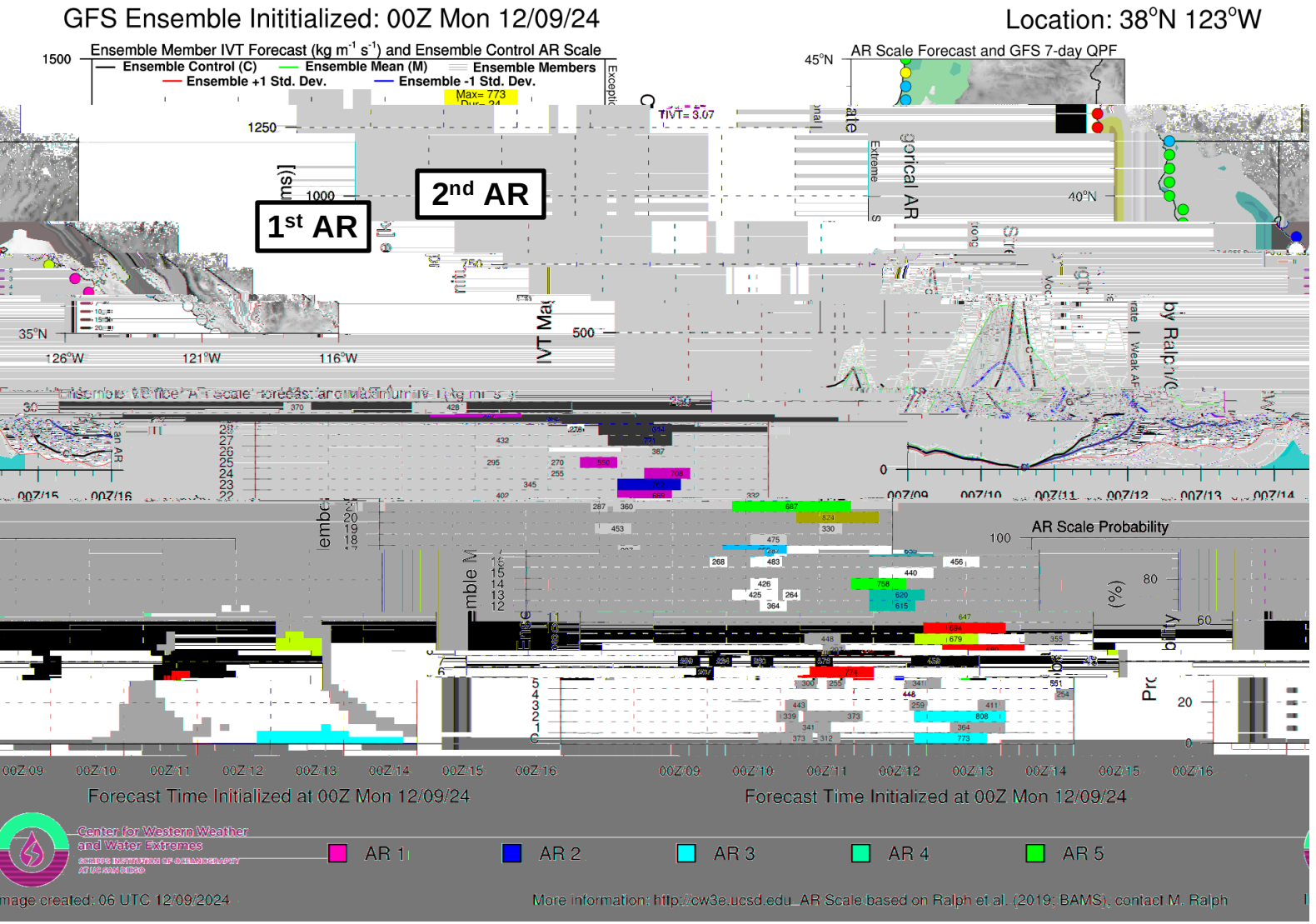


*EPS = ECMWF **E**nsemble **P**rediction **S**ystem (Europe)

- The 00Z EPS is also showing moderate confidence (60–80% probability) in a period of AR conditions over coastal Northern California and Oregon on 13–14 Dec.
- Compared to GEFS, the EPS is showing a slightly later AR landfall on 13 Dec, as well as a lower likelihood of landfalling AR activity during much of next week.
- The 00Z EPS control member is forecasting an AR 2 over coastal Northern California and southern Oregon during the next 7 days.
- Compared to the GEFS control, the EPS control is forecasting weaker AR Scale conditions over northern Oregon and Washington.

AR Outlook: 9 December 2024

GEFS AR Scale and IVT Forecasts



- The 00Z GEFS control is forecasting an AR 3 at 38°N, 123°W (Marin County, CA), and an AR 2 over the rest of coastal Northern California in association with the second AR.
- There is considerable uncertainty in the timing, magnitude, and duration of the second AR at this location.
- Only 3/31 (10%) ensemble members are predicting an AR 3, and 9/31 (29%) members are predicting less than an AR 1 over the next 7 days.

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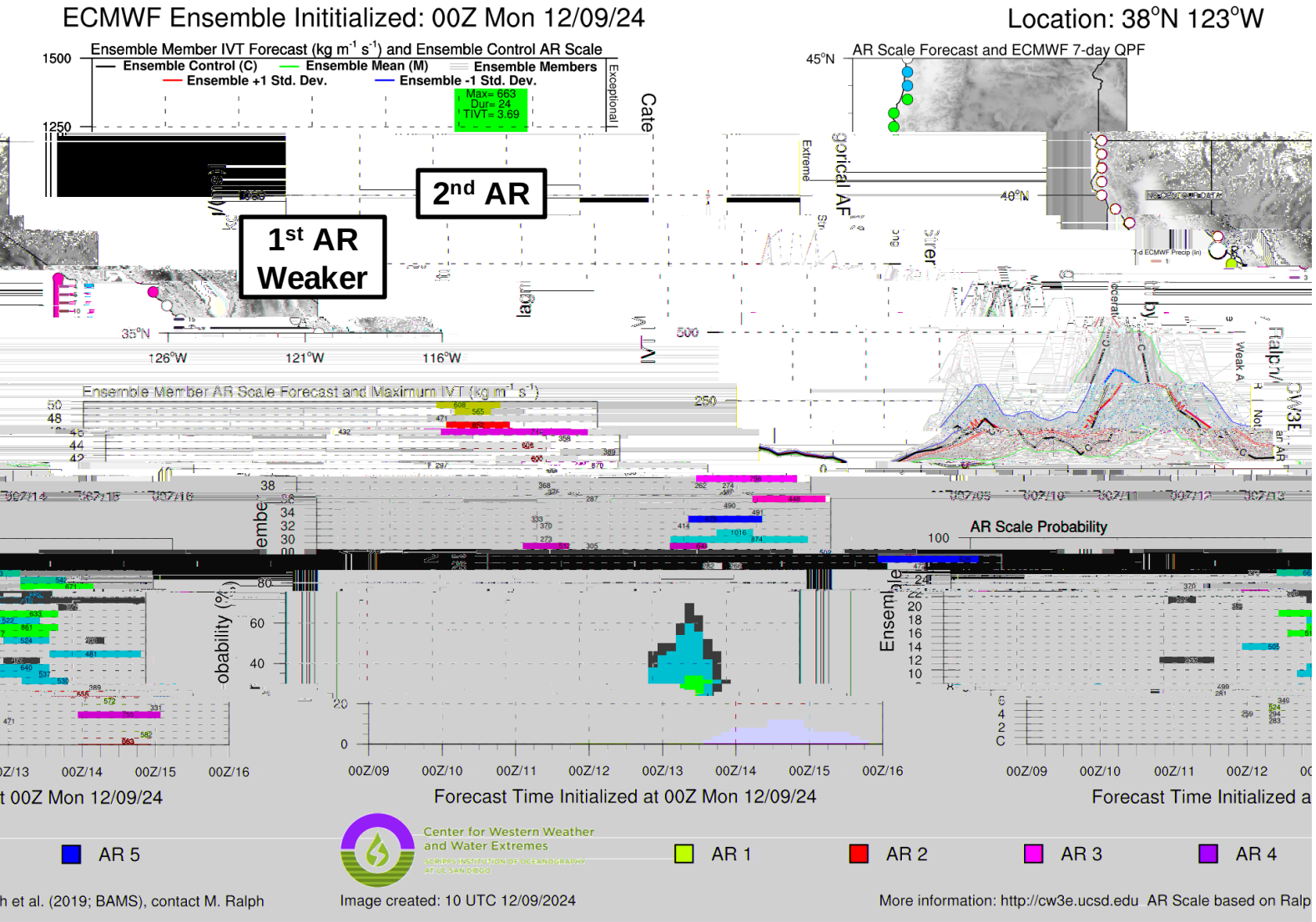
EPS AR Scale and IVT Forecasts



- The 00Z EPS control member is forecasting an AR 2 over coastal Northern California in association with the second AR.
- Similar to GEFS, only 12% (6/51) of EPS members are forecasting an AR 3, and 29% (15/51) of members are forecasting less than an AR 1 at 38°N, 123°W (Marin County, CA) over the next 7 days.
- Compared to GEFS, EPS is also showing a lower probability of AR conditions at this location in association with the first AR.

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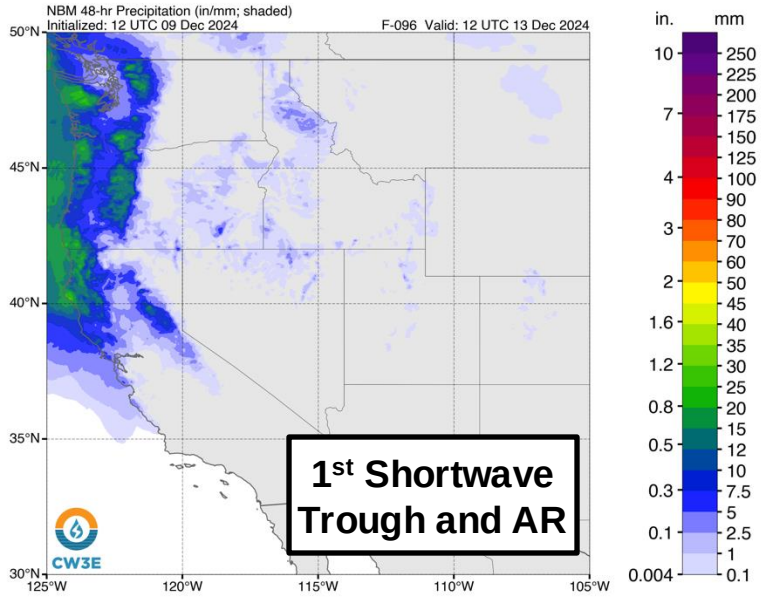
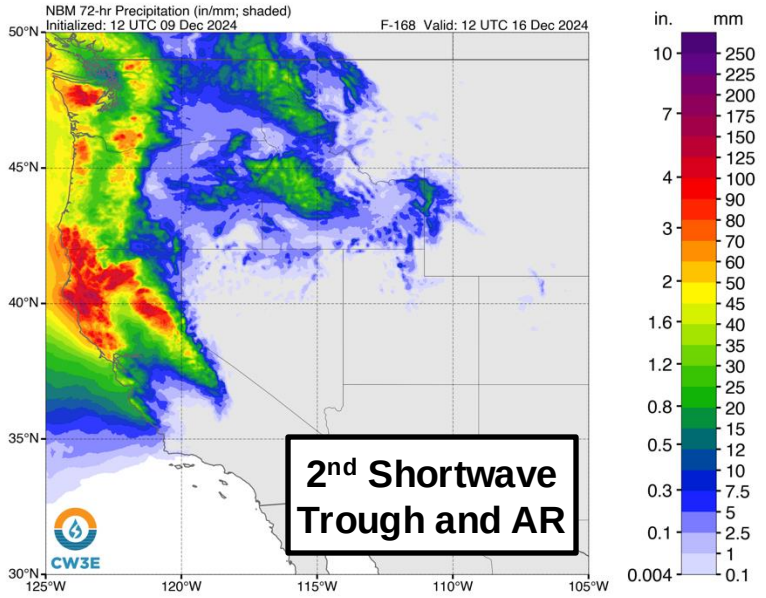
Precipitation Forecasts

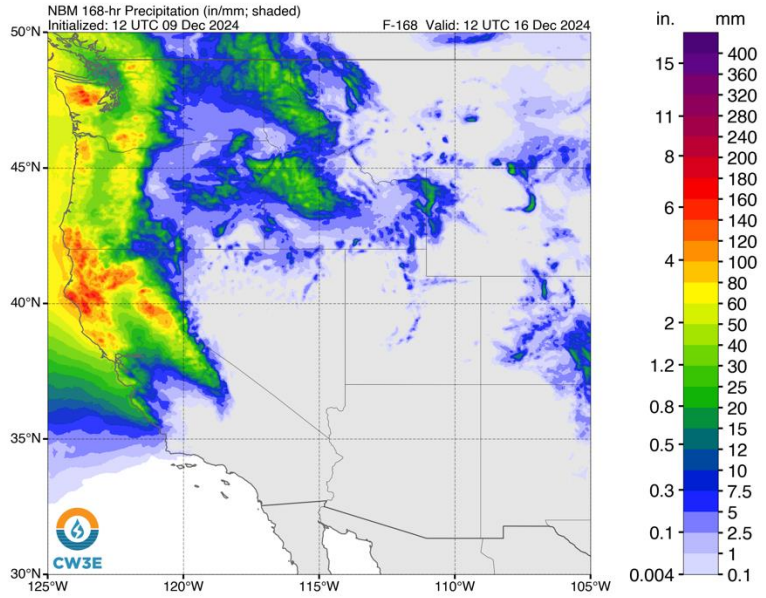
NBM 48-h QPF
Valid: 4 AM PT 13 Dec



NBM 72-h QPF
Valid: 4 AM PT 16 Dec



NBM 168-h QPF
Valid: 4 AM PT 16 Dec



- The first shortwave trough and AR are forecast to bring light precipitation to the Pacific Coast Ranges and Cascades.
- The second shortwave trough and AR are forecast to bring heavier precipitation to the region.
- The 12Z National Blend of Model (NBM) is forecasting at least 2–5 inches of total precipitation in portions of Northern California, western Oregon, and western Washington over the next 7 days, with the highest amounts in the Northern California Coast Ranges.

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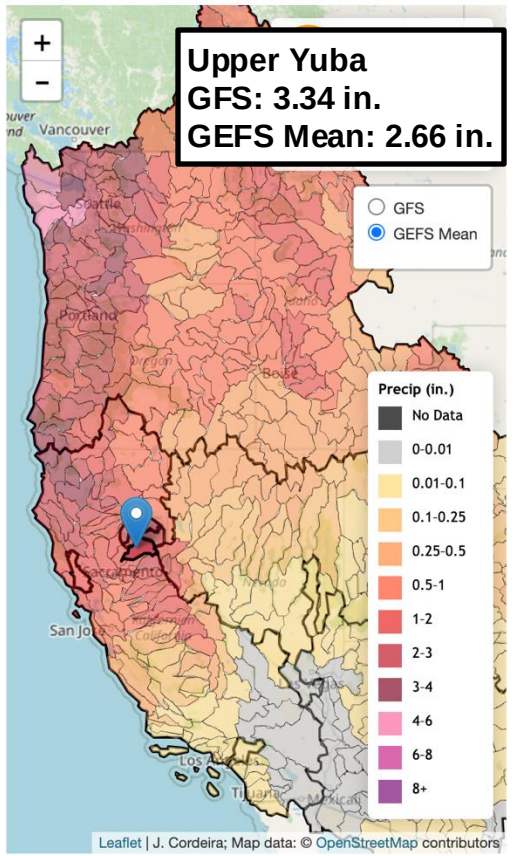
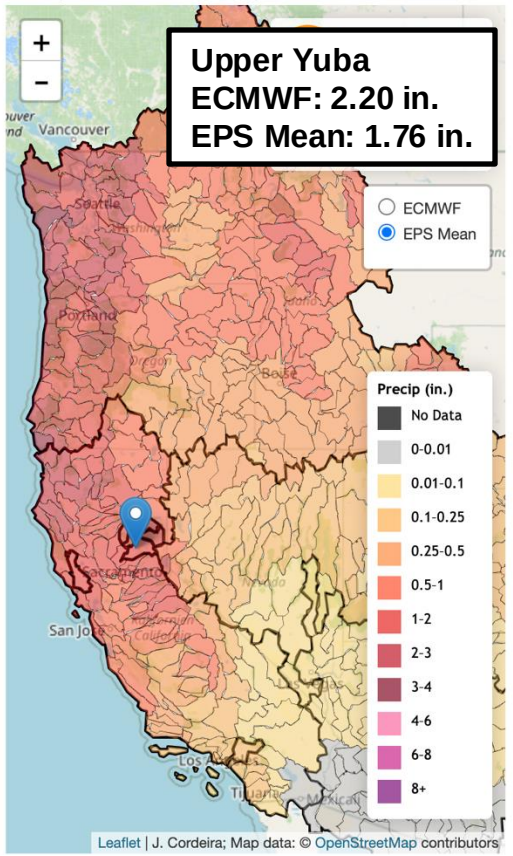
Watershed Precipitation Forecasts

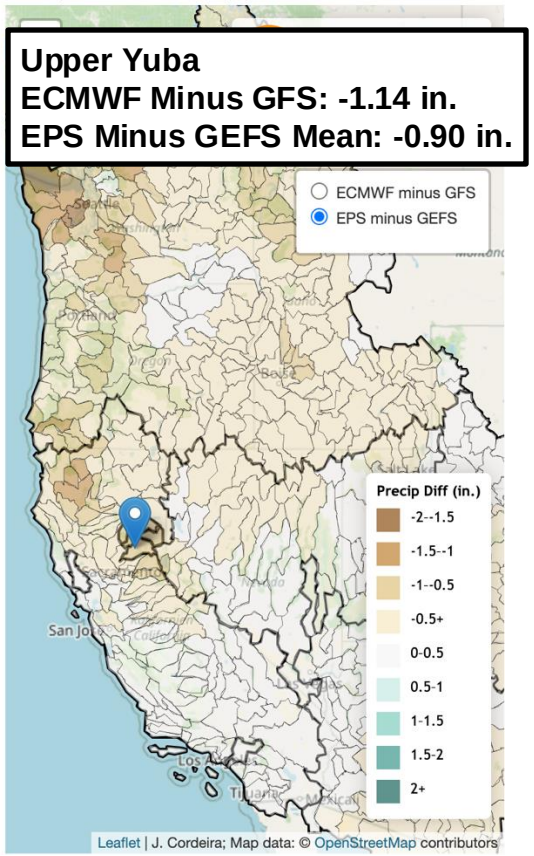
10-day GFS/GEFS Precipitation Forecasts

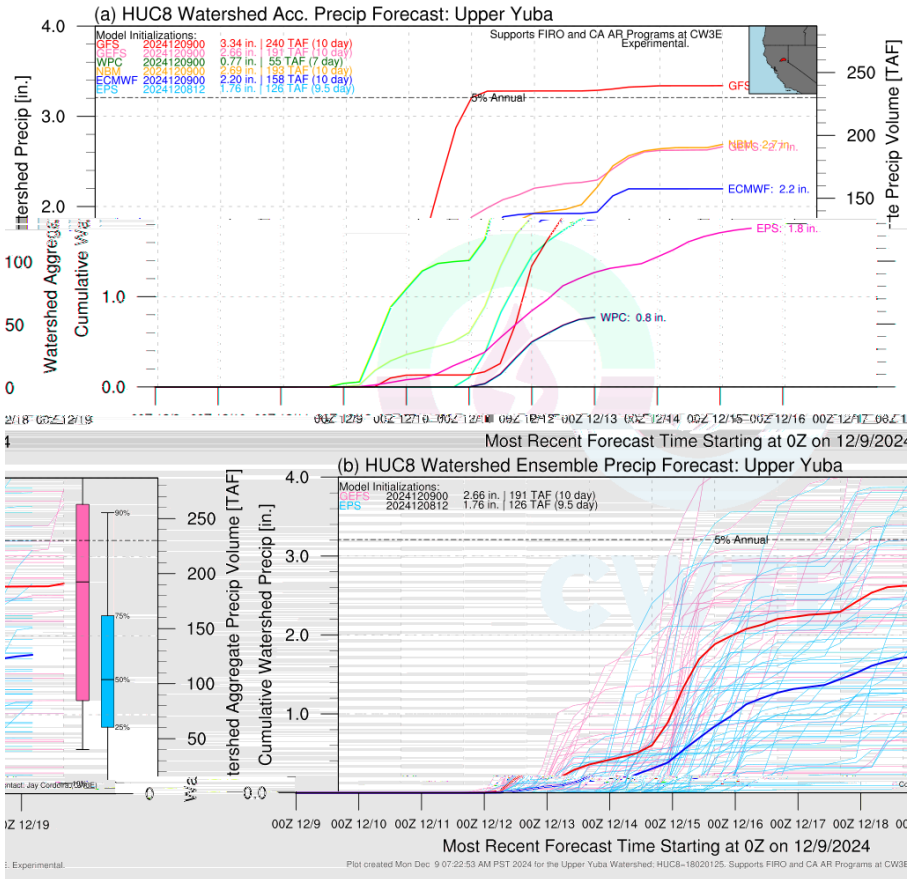


10-day ECMWF/EFS Precipitation Forecast



10-day Difference Precipitation Forecast





- Uncertainty in forecast evolution of these ARs is contributing to uncertainty in precipitation forecasts over the US West Coast.
- Overall, the 00Z GEFS is forecasting higher precipitation totals over much of western Washington, western Oregon, and Northern California during the next 10 days compared to the 00Z EPS.
- In the Upper Yuba, ~50% of GEFS members are forecasting 2.5+ inches of mean areal precipitation, and ~25% are forecasting 3.5+ inches.
- Only ~25% of EPS members are forecasting 2.5+ inches of mean areal precipitation in the Upper Yuba.

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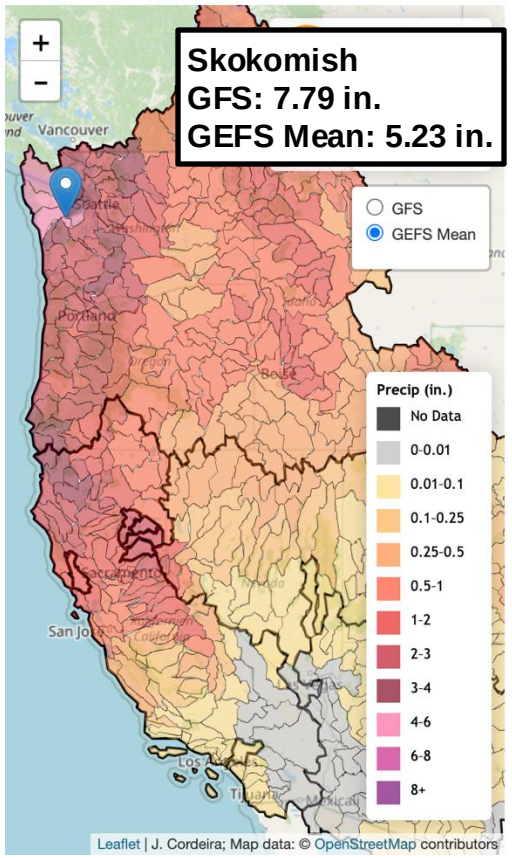
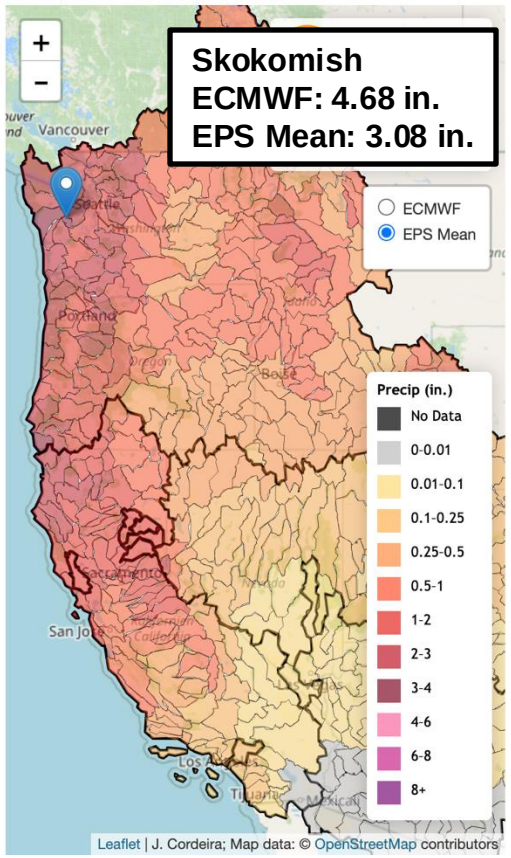
Watershed Precipitation Forecasts

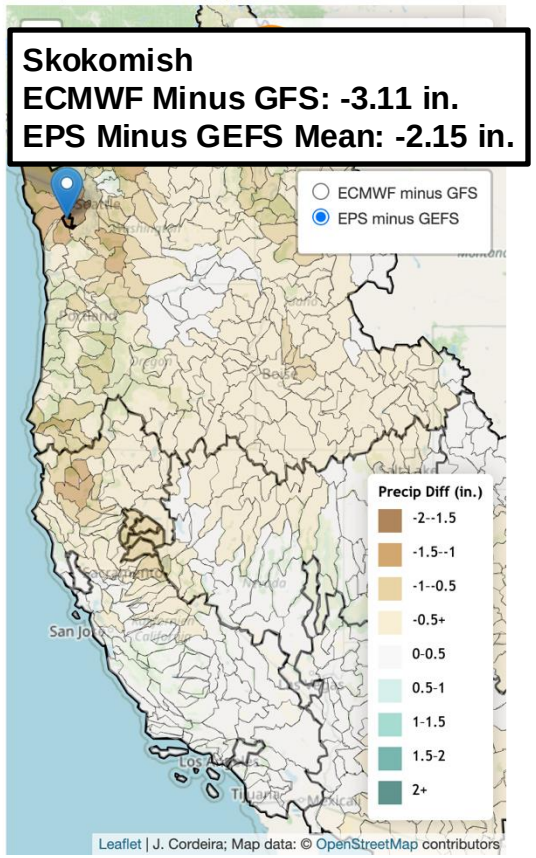
10-day GFS/GEFS Precipitation Forecasts

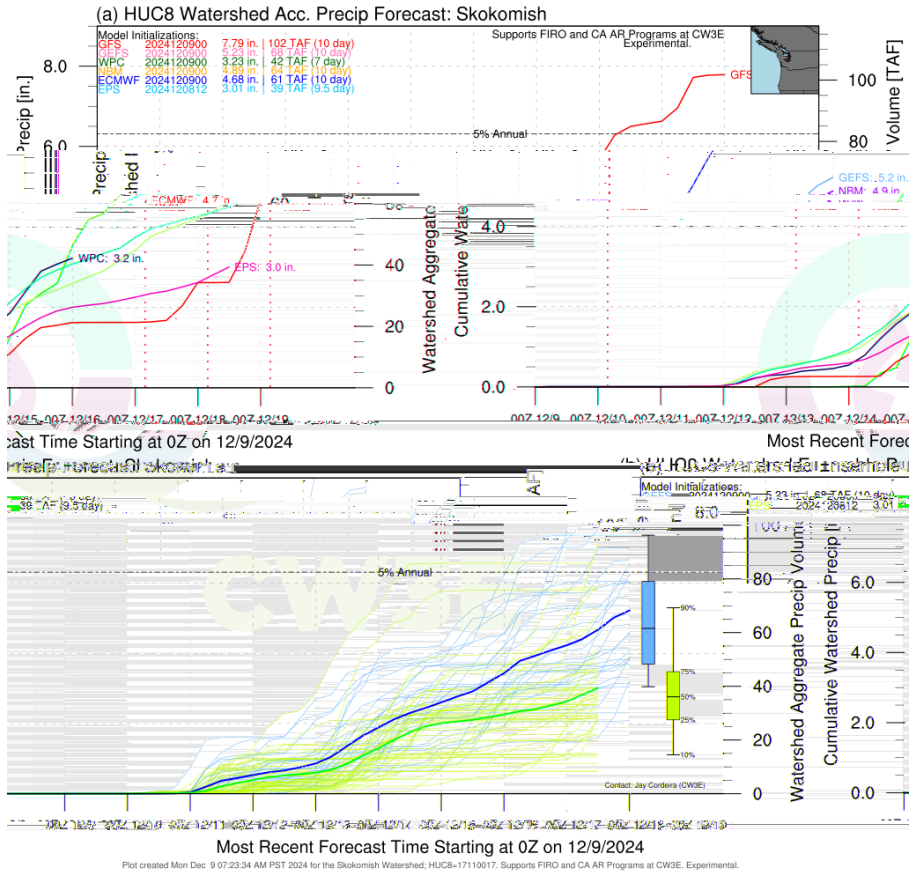


10-day ECMWF/EFS Precipitation Forecast



10-day Difference Precipitation Forecast





- In the Skokomish, ~50% of GEFS members are forecasting 5+ inches of mean areal precipitation, and ~25% are forecasting 6+ inches.
- About 50% of EPS members are forecasting < 3 inches of mean areal precipitation in the Skokomish.