

CW3E Atmospheric River Outlook: 19 February 2025

Atmospheric River Forecast to Bring Heavy Precipitation to Pacific Northwest

AR Summary:

- An atmospheric river (AR) is forecast to make landfall over the Pacific Northwest early on Sat 22 Feb and continue through Sun 23 Feb.
- This is currently forecast to be an AR3-4 on the Ralph et al. (2019) AR Scale across the Oregon and Washington coasts and AR1-2 in Vancouver Island and Northern California.
- CW3E's AR Recon field campaign continues to forecast and plan atmospheric sampling flights over the Northeast Pacific, with flights from Honolulu, HI and Sacramento, CA planned for 00Z 21 February to improve observations of initial atmospheric conditions in the global forecast models

Precipitation Forecasts:

- ECMWF precipitation is slightly higher over Southeastern Oregon than the GFS, as the ECMWF is stronger further south than the GFS.
- The NWS Weather Prediction Center (WPC) is forecasting 4+ inches of precipitation over the Olympic Peninsula, Washington and Oregon Coast Ranges and Cascades during this event.
- Freezing levels are forecast to rise to >6,000 feet ahead of this event, resulting in the majority of precipitation being forecast to fall as rain, even at higher elevations.

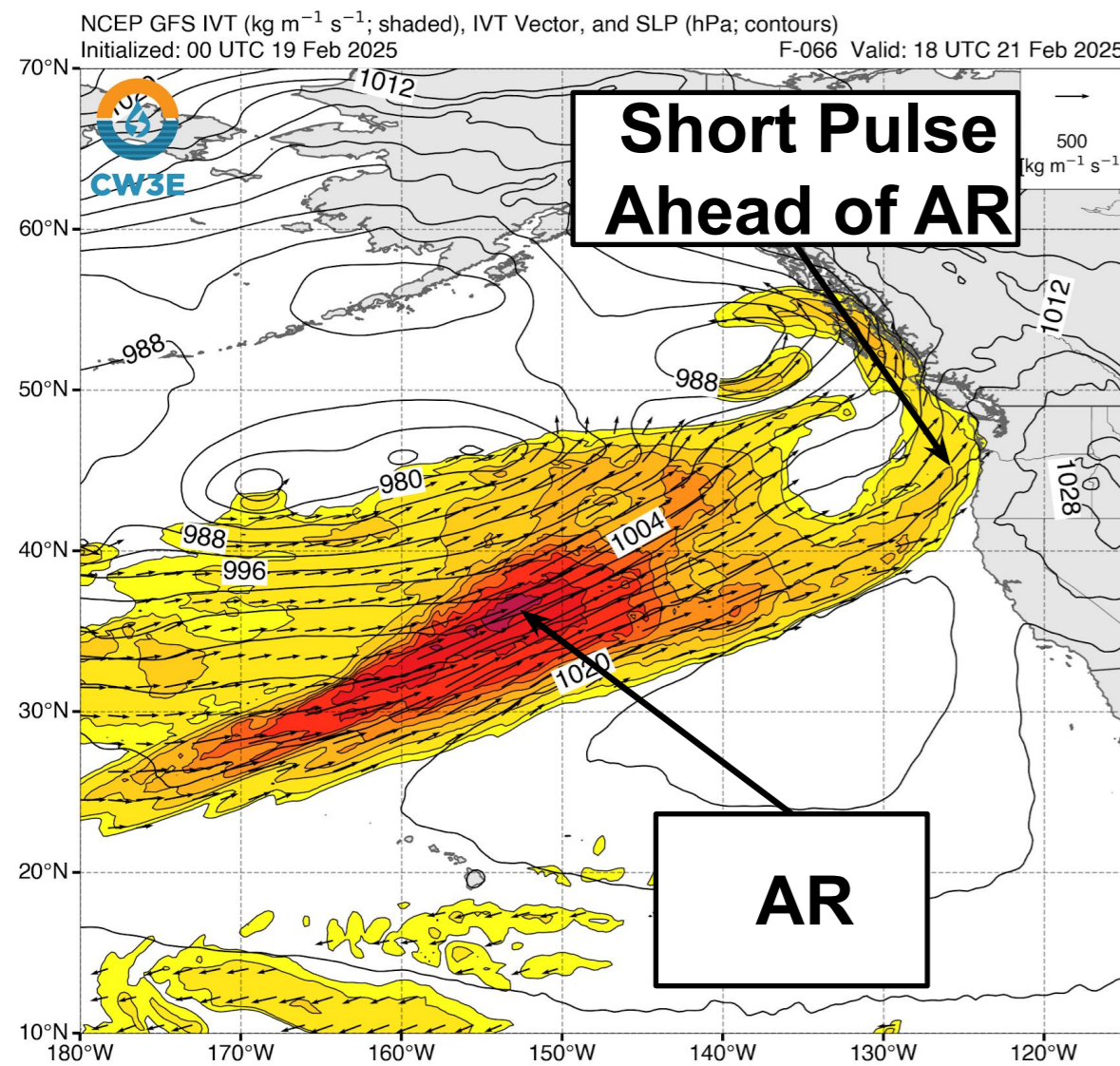
Flooding and Streamflow:

- The NWS WPC has issued a marginal risk Excessive Rainfall Outlook (level 1 of 4; 5% chance of flooding) over the Olympic Peninsula, Washington and Oregon Coast Ranges on days 4 and 5 (24-hr periods ending 4 AM PST Sun 23 and Mon 24 Feb).
- Stream levels are forecast to rise at multiple locations in Washington and Oregon. The Northwest River Forecast Center currently forecasts one station in Eastern Washington to exceed minor flood stage and 14 stations, primarily in Western Washington, to exceed action/bankfull stage.

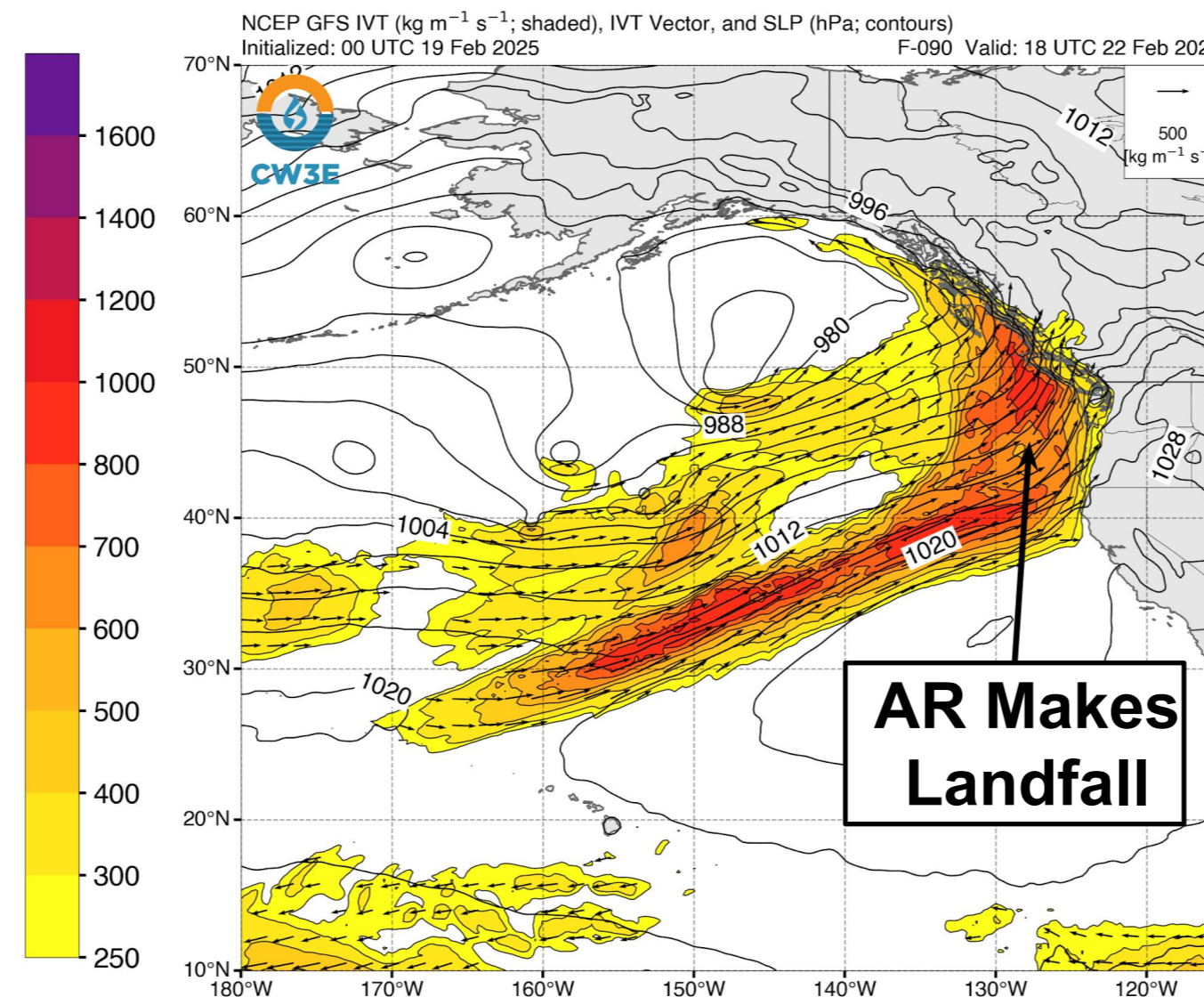
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GFS IVT & SLP Forecasts

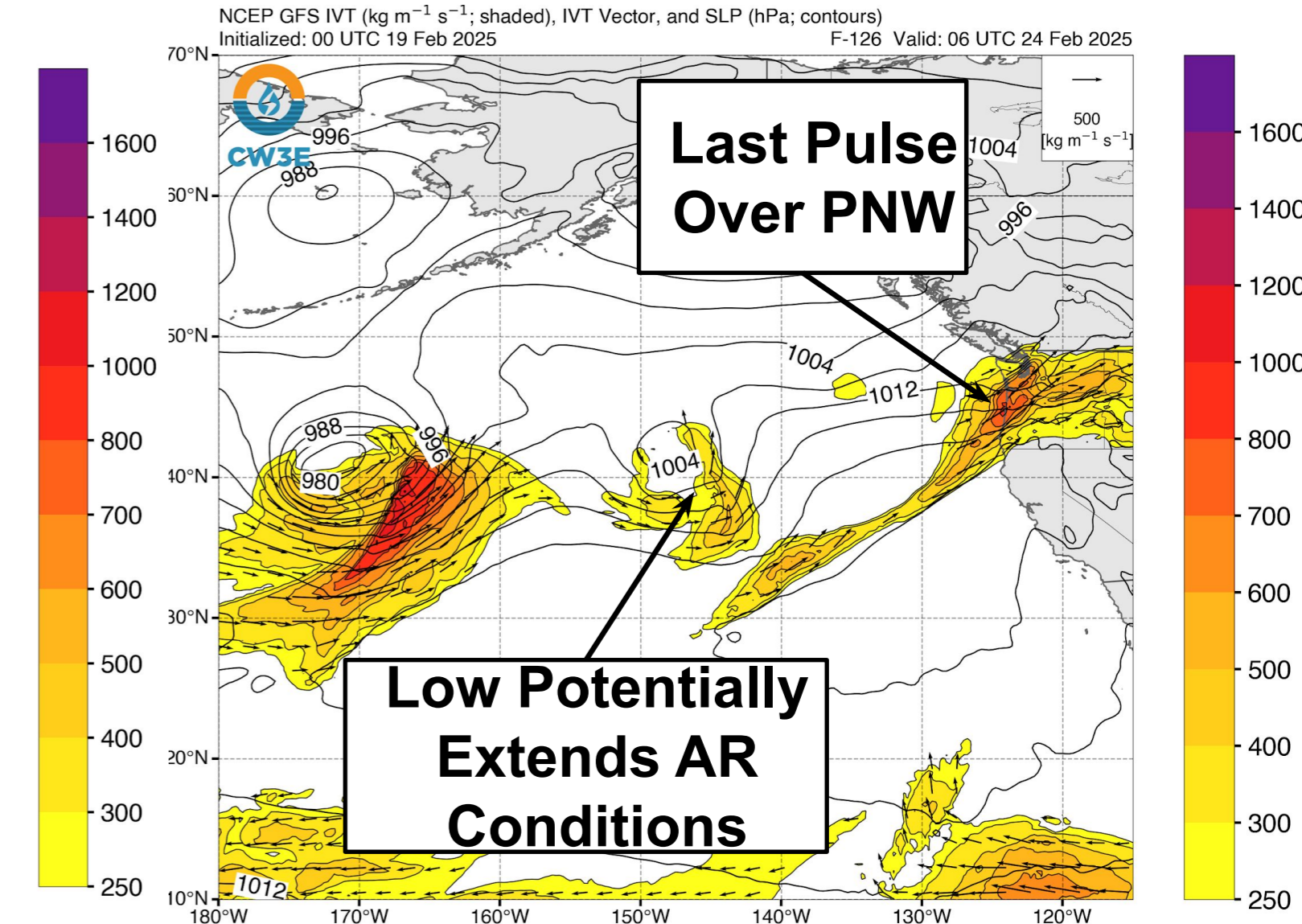
Valid: 10 AM PST 21 Feb (F-066)



Valid: 10 AM PST 22 Feb (F-090)



Valid: 10 PM PST 23 Feb (F-126)

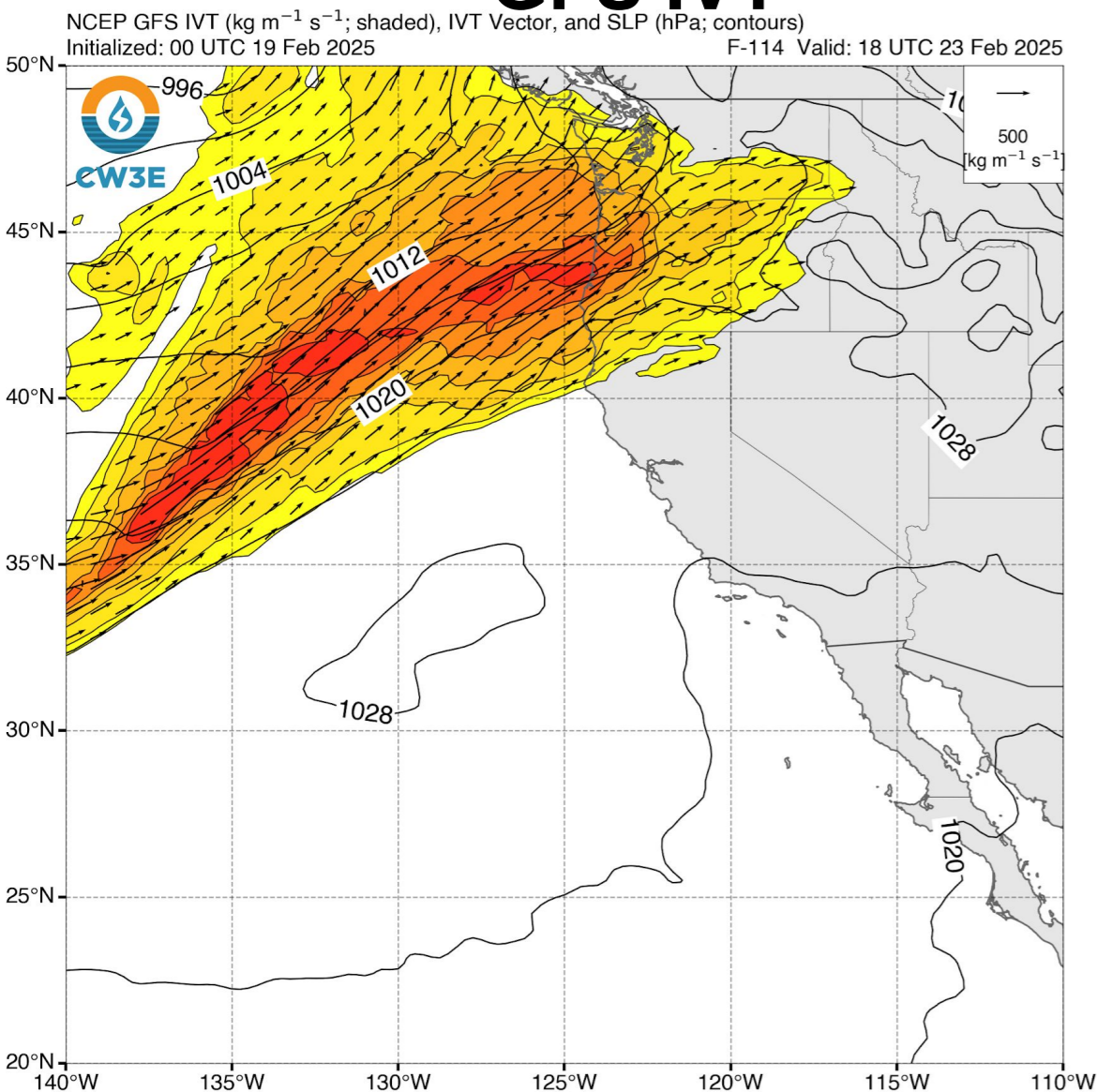


- The next atmospheric river (AR) is forecast to develop out of the Western Pacific and propagate toward the US West Coast over the next couple of days.
- There will be an initial short moisture pulse into the Pacific Northwest (PNW) ahead the AR on Fri 21 Feb.
- The AR will follow shortly behind, making landfall over the PNW early on Sat 22 Feb and continue through Sun 23 Feb.
- A low-pressure system is forecast to form behind the AR and has the potential to prolong AR conditions over the PNW as it interacts with remnant moisture in NE Pacific.

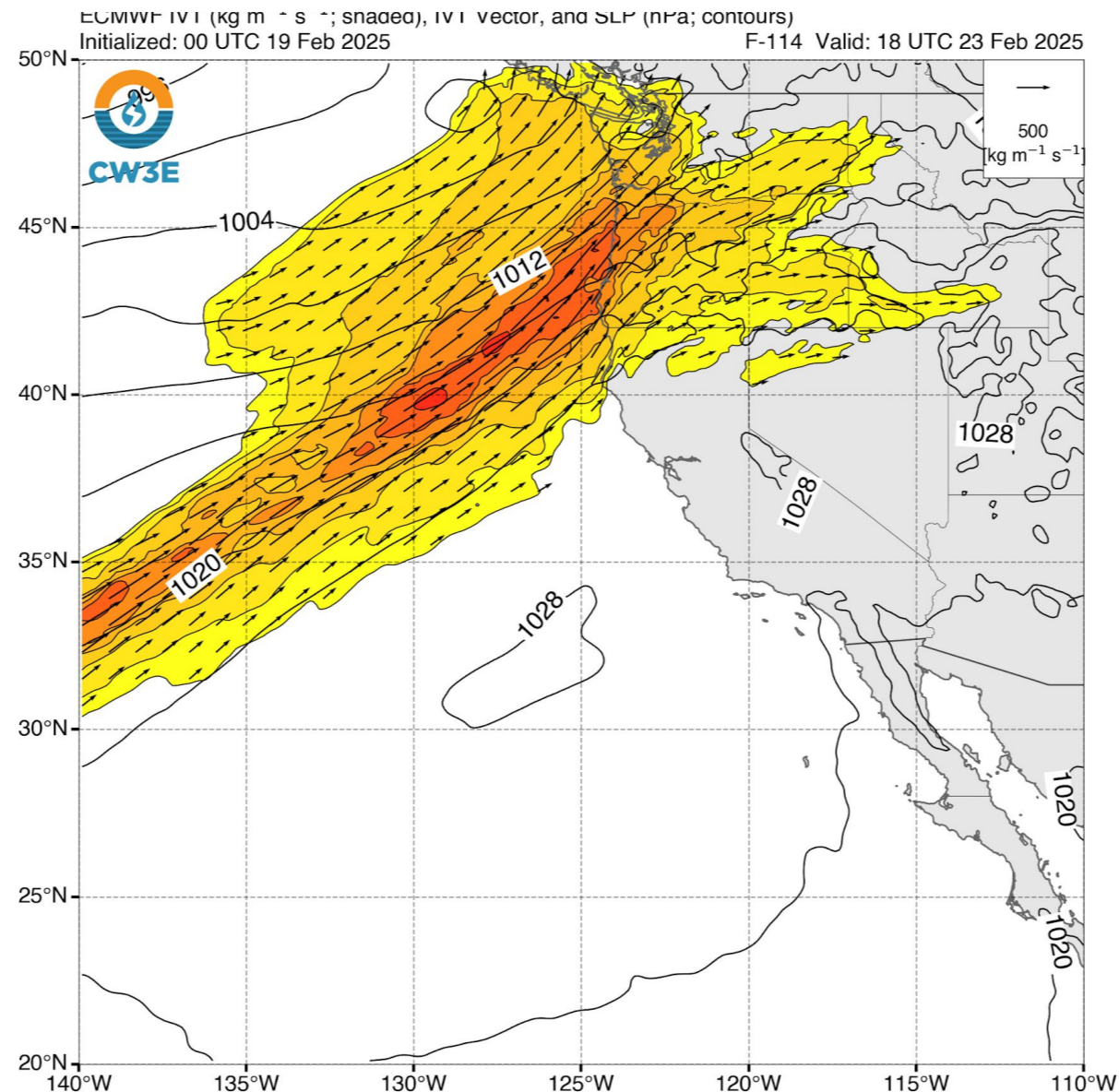
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GFS and ECMWF IVT Forecast Comparison Valid : 18 UTC 23 Feb (F-114)

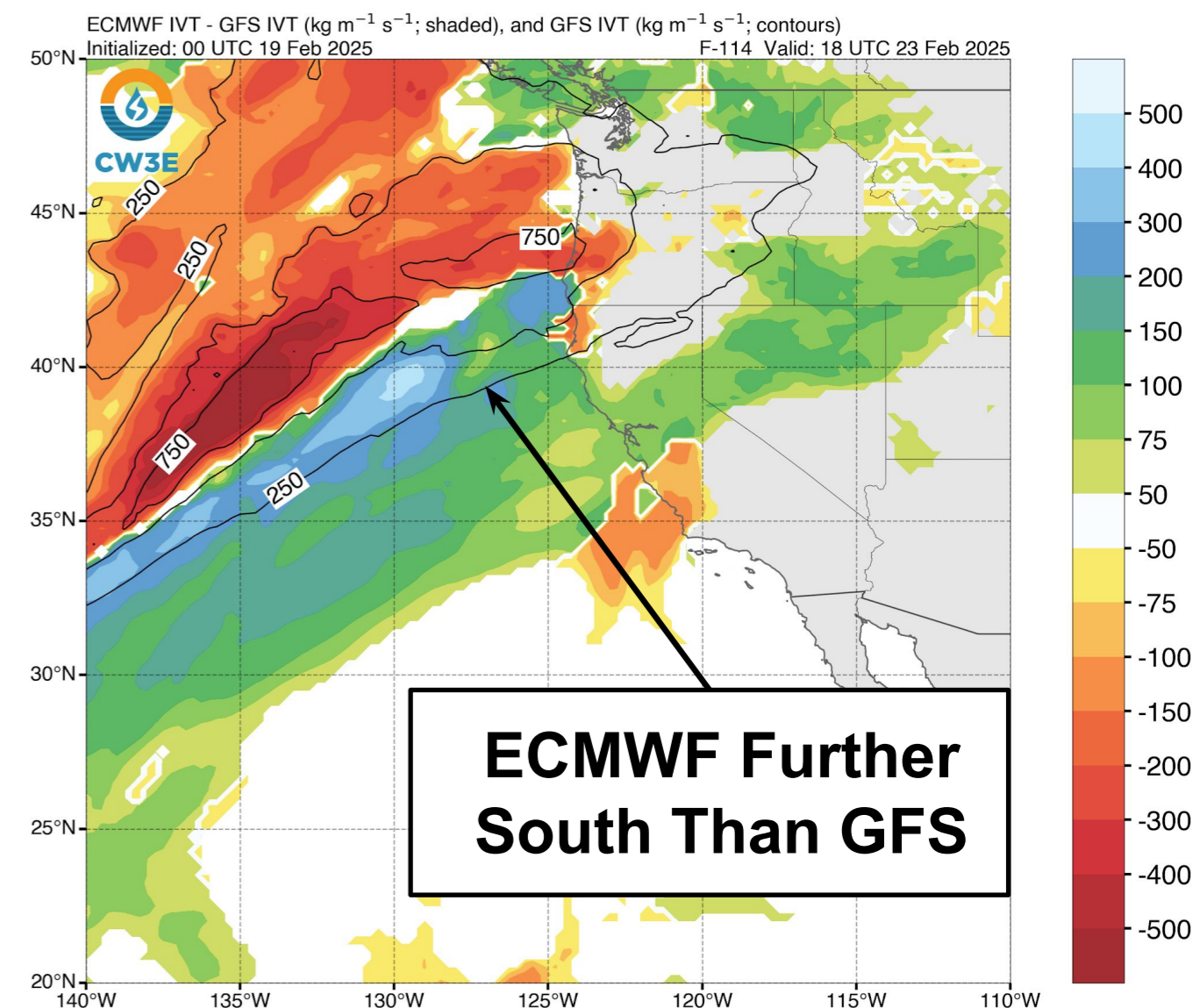
GFS IVT



ECMWF IVT



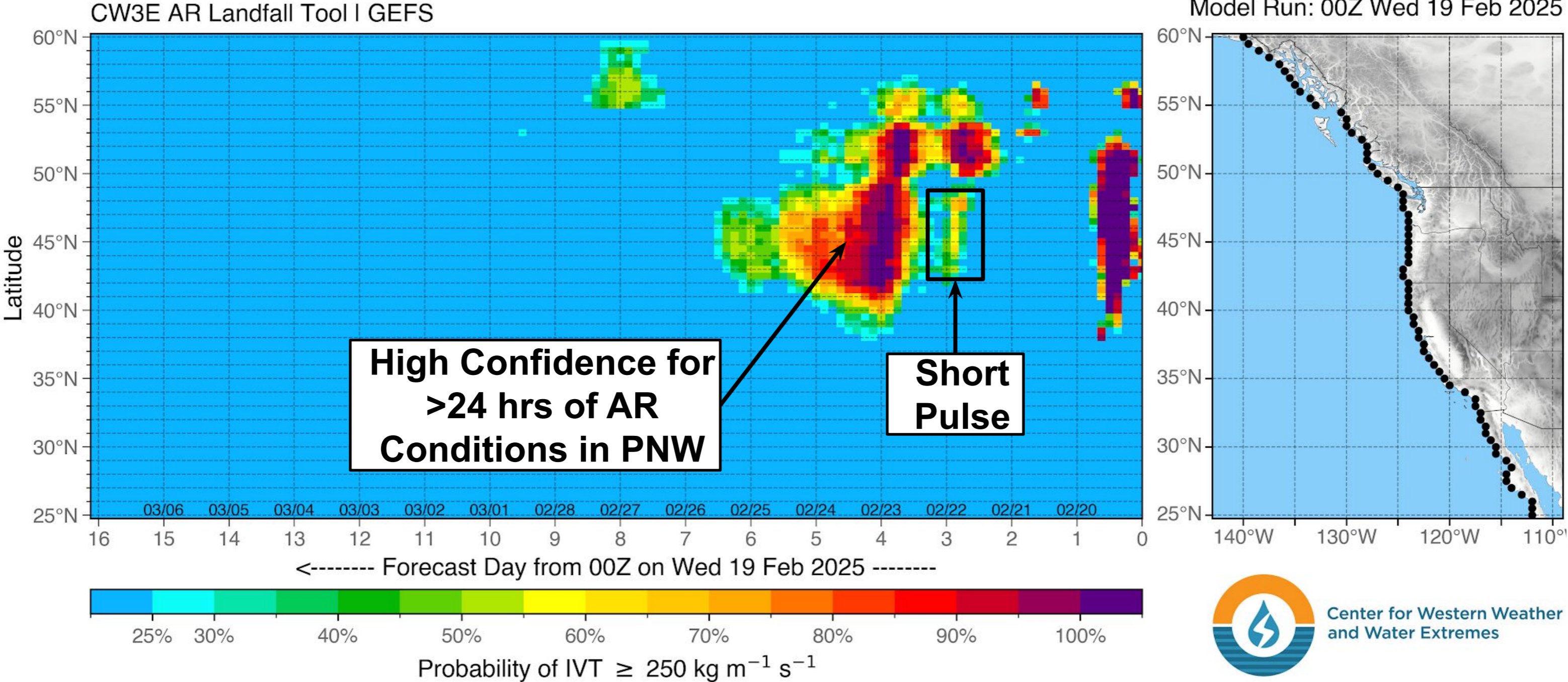
ECMWF IVT - GFS IVT



- The GFS and ECMWF landfall timing are aligned while the location of highest IVT and orientation of IVT in the core of the AR still differ.
- The GFS is stronger further to the north and is more northwesterly while the ECMWF is stronger further south and more southerly as the AR makes landfall.

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CW3E AR Landfall Tool: GEFS



Forecasts support FIRO/CA-AR Program and NSF #2052972 | Intended for research purposes only

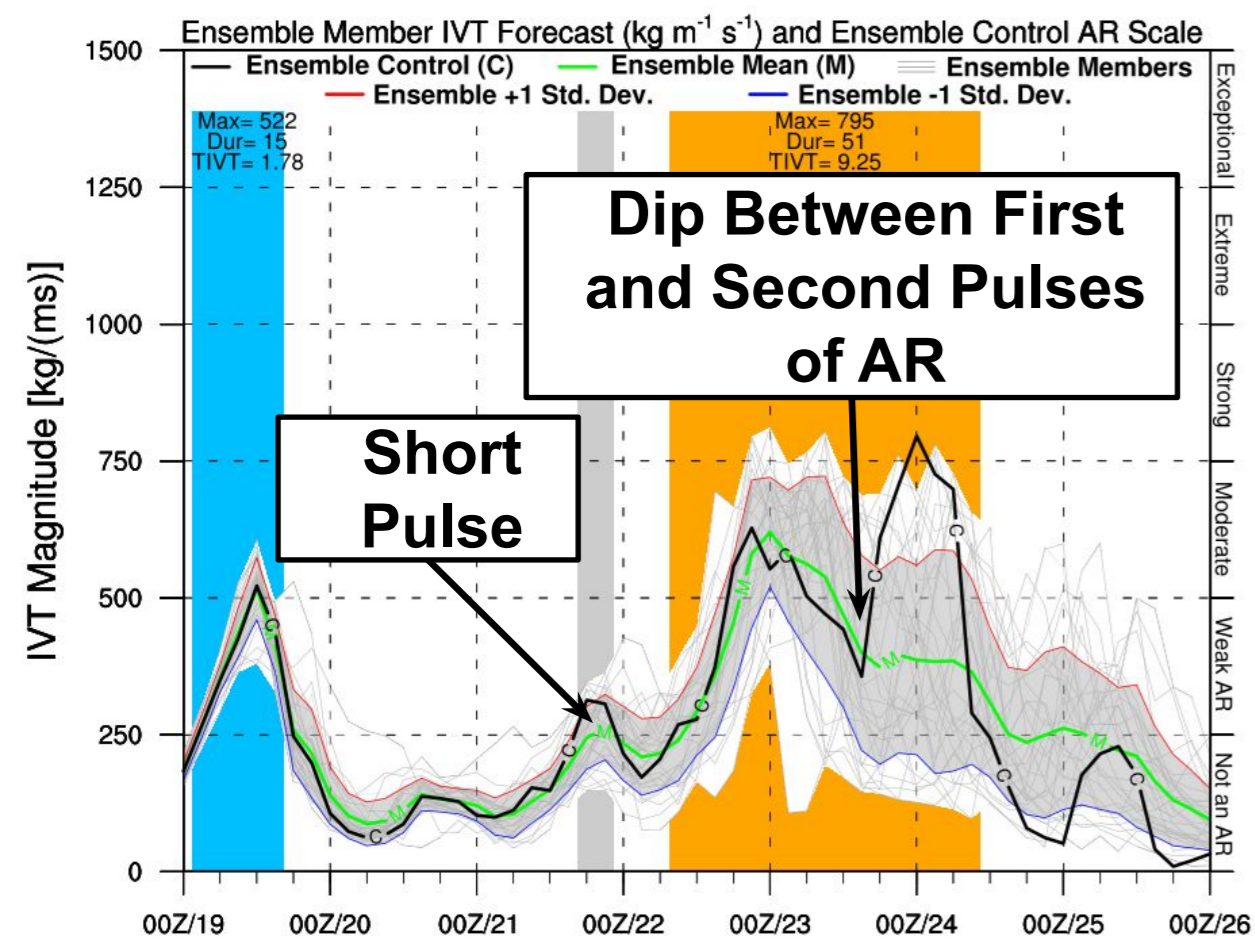
- CW3E’s AR Landfall Tool based on the GEFS shows high confidence in AR conditions ($IVT \geq 250 \text{ kg m}^{-1} \text{ s}^{-1}$) beginning over the Pacific Northwest on Sat 22 Feb and continuing through Sun 23 Feb.
- There is a short pulse of IVT forecast to reach the PNW coast late on Fri 21 Feb which, should it last longer, could help to extend AR conditions over the region and enhance the AR scale.

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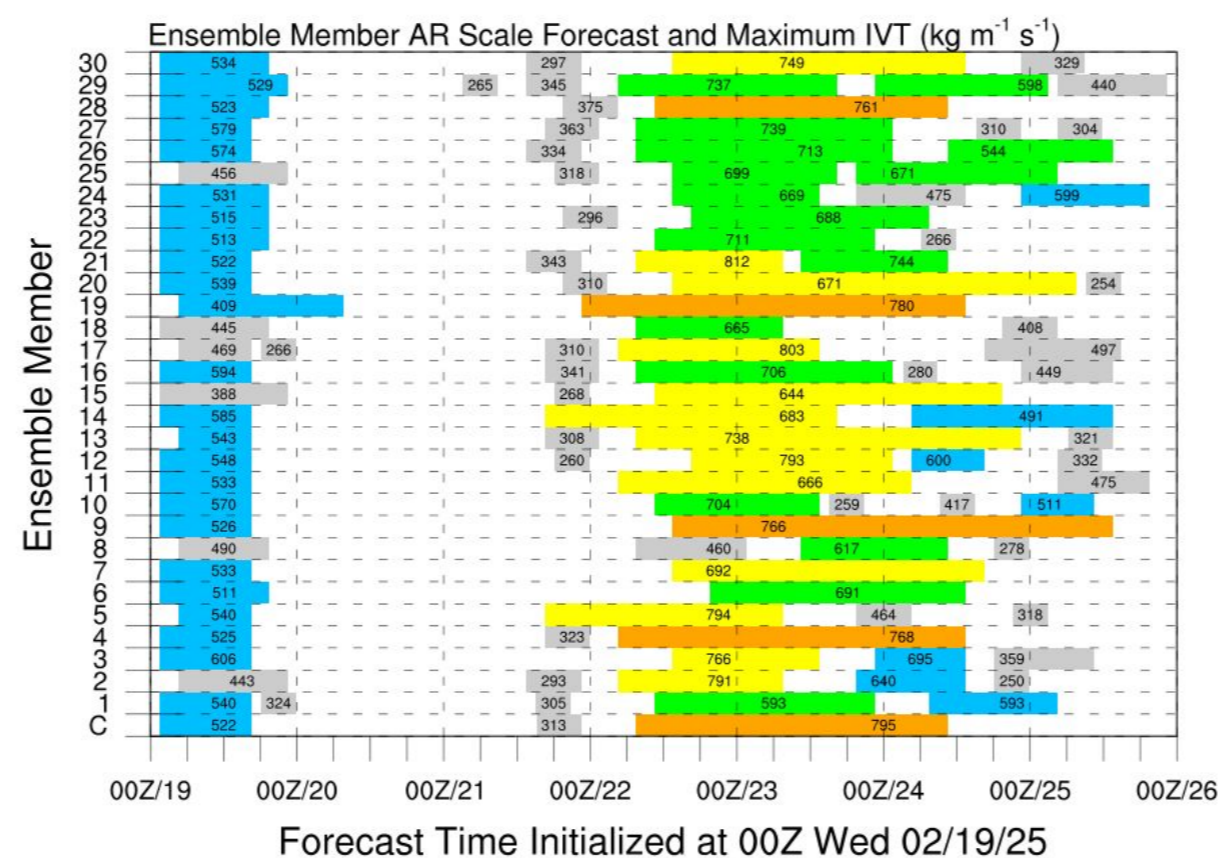
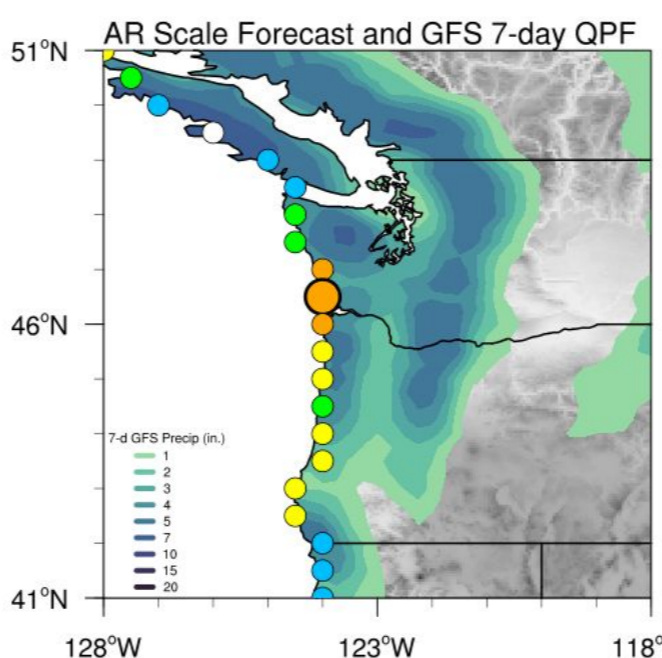
GEFS AR Scale and IVT Forecasts

GFS Ensemble Initialized: 00Z Wed 02/19/25

Location: 46.5°N 124°W



Categorical AR Strength by Ralph/CW3E



- The 00Z GEFS control member is forecasting **AR2-AR4 conditions** (based on the Ralph et al. 2019 AR Scale) over coastal Washington and Oregon and **AR1-AR2 conditions** over Vancouver Island and Northern California for this event.
- 18/31 GEFS members are forecasting at least AR3 conditions for a coastal point at 46.5°N, 124°W (near Willapa Bay, WA).
- There is uncertainty amongst the GEFS members with the timing of onset of AR conditions and maximum IVT as well as whether or not there will be a break in AR conditions between the first and second pulses of the AR.



AR 1 AR 2 AR 3 AR 4 AR 5

Image created: 05 UTC 02/19/2025

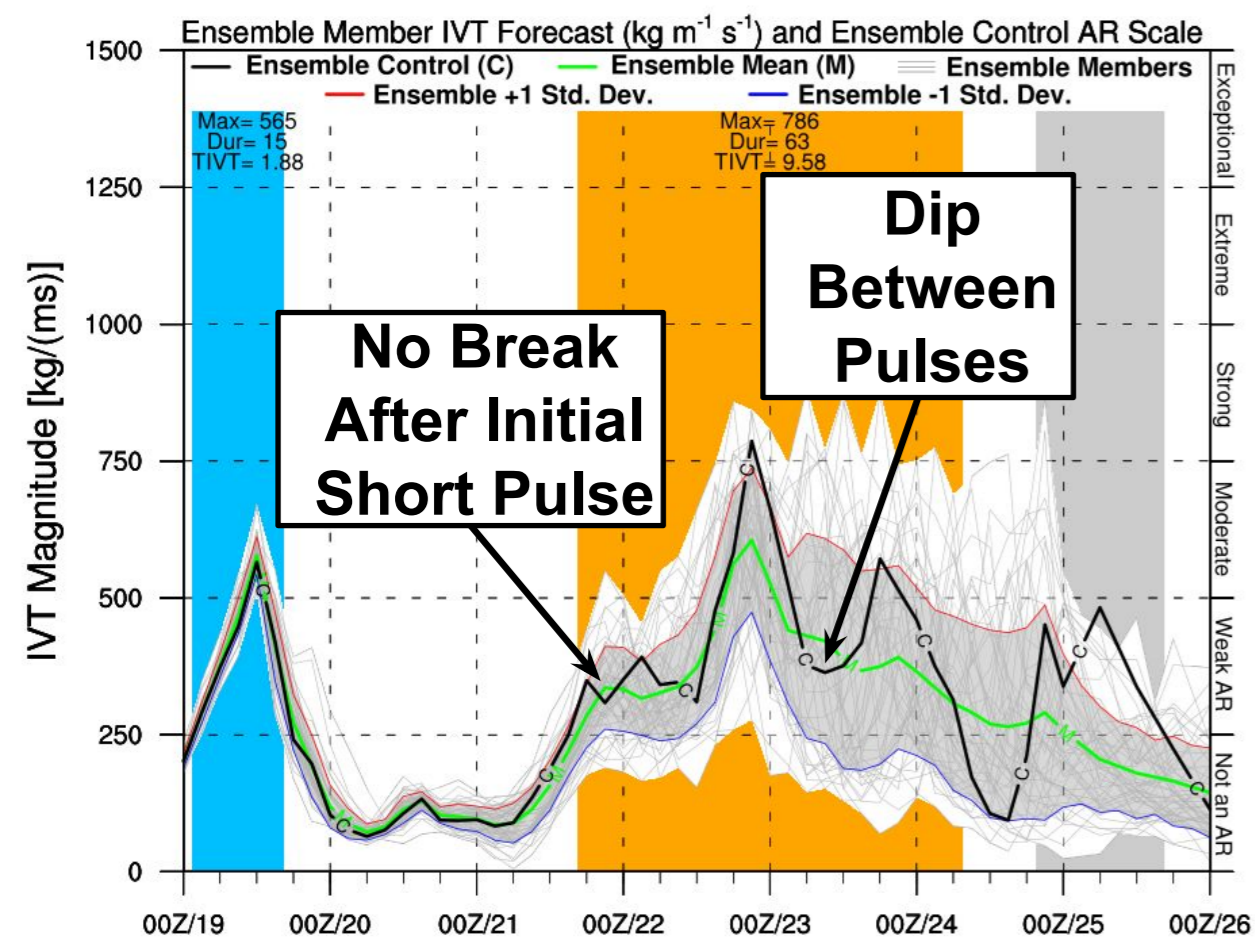
More information: <http://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

AR Outlook: 19 February 2025

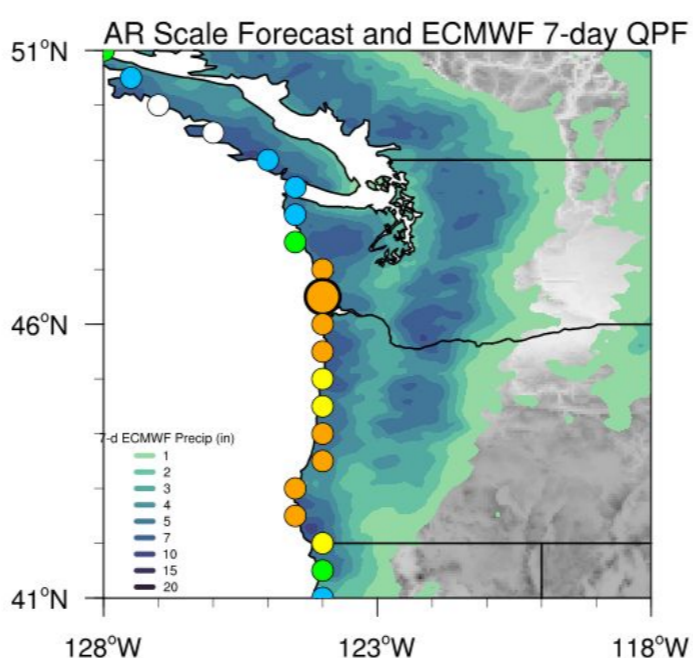
ECMWF EPS AR Scale and IVT Forecasts

ECMWF Ensemble Initialized: 00Z Wed 02/19/25

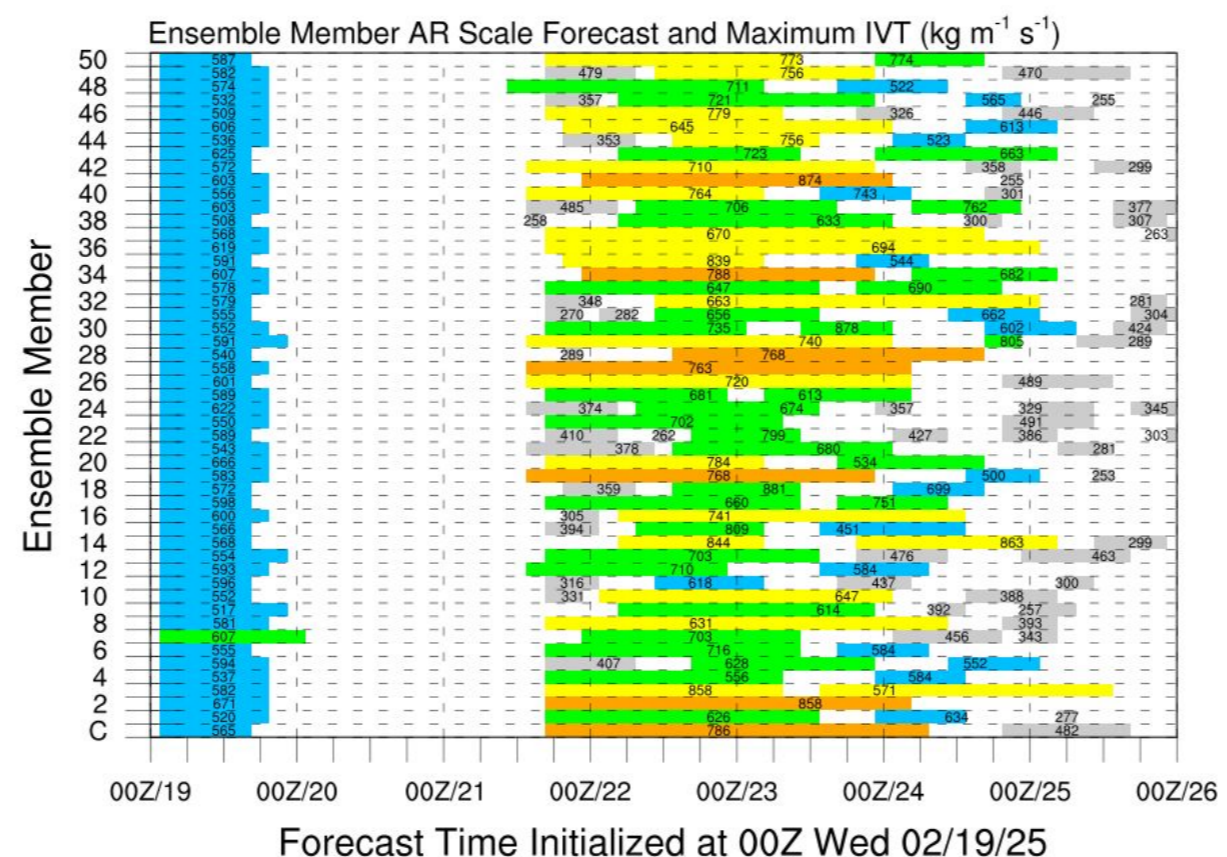
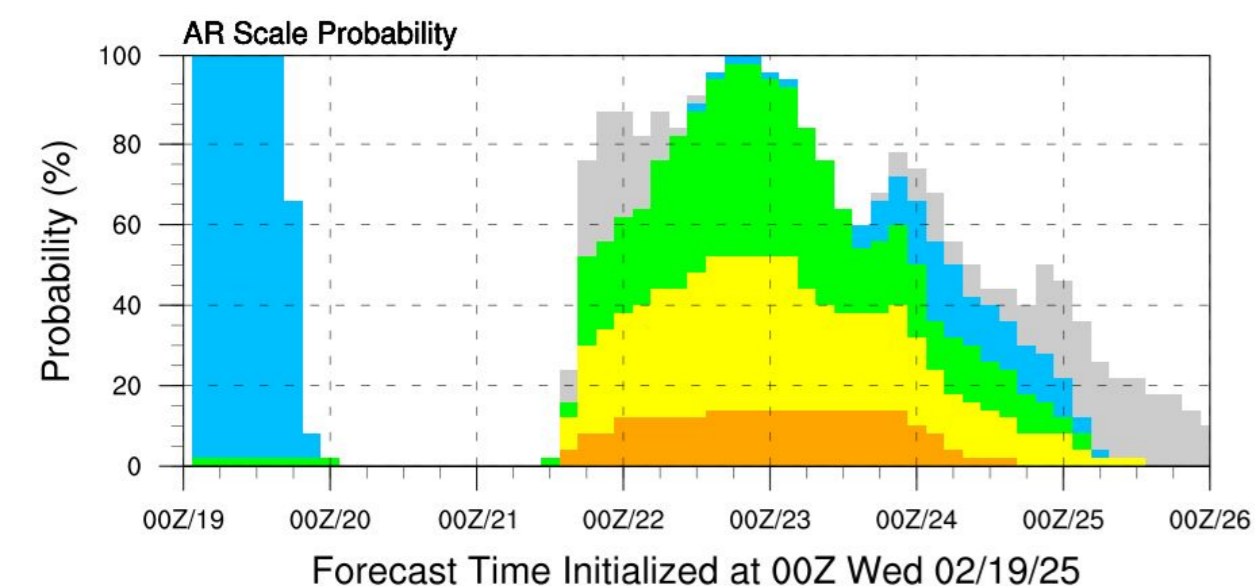
Location: 46.5°N 124°W



Categorical AR Strength by Ralph/CW3E



- The 00Z EPS control member is forecasting **AR3-AR4 conditions** (based on the Ralph et al. 2019 AR Scale) over much of the coastal Pacific Northwest, except for points along the Olympic Peninsula where it is forecasting **AR1 and AR2 conditions**.



- 26/51 EPS members are forecasting at least AR3 conditions for a coastal point at 46.5°N, 124°W (near Willapa Bay, WA) for the second pulse.
- Much like the GEFs, there is variability amongst the ensemble members in the timing of onset and dissipation with the potential break in AR conditions between the first and second pulse of IVT in the AR.



AR 1 AR 2 AR 3 AR 4 AR 5

Image created: 08 UTC 02/19/2025

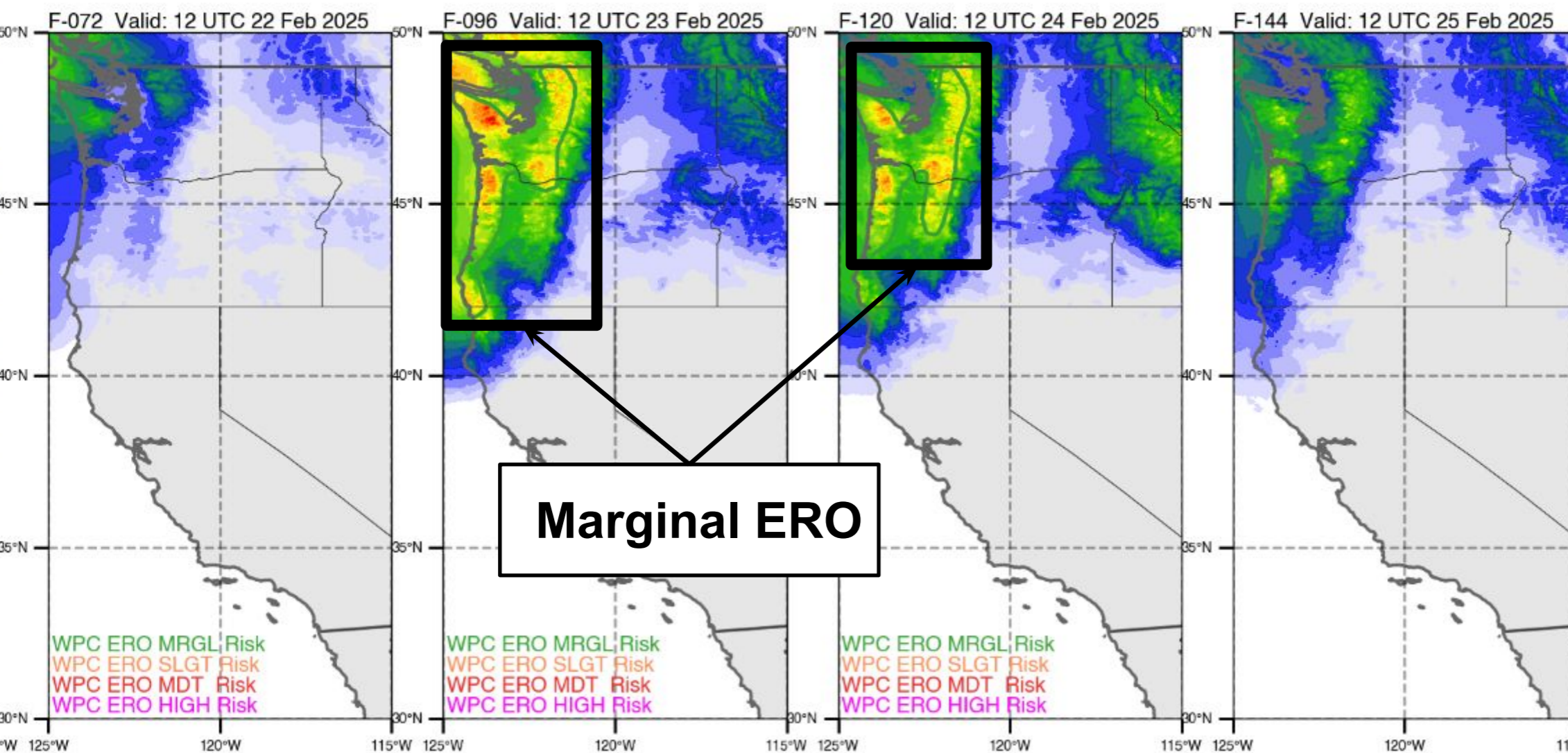
More information: <http://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

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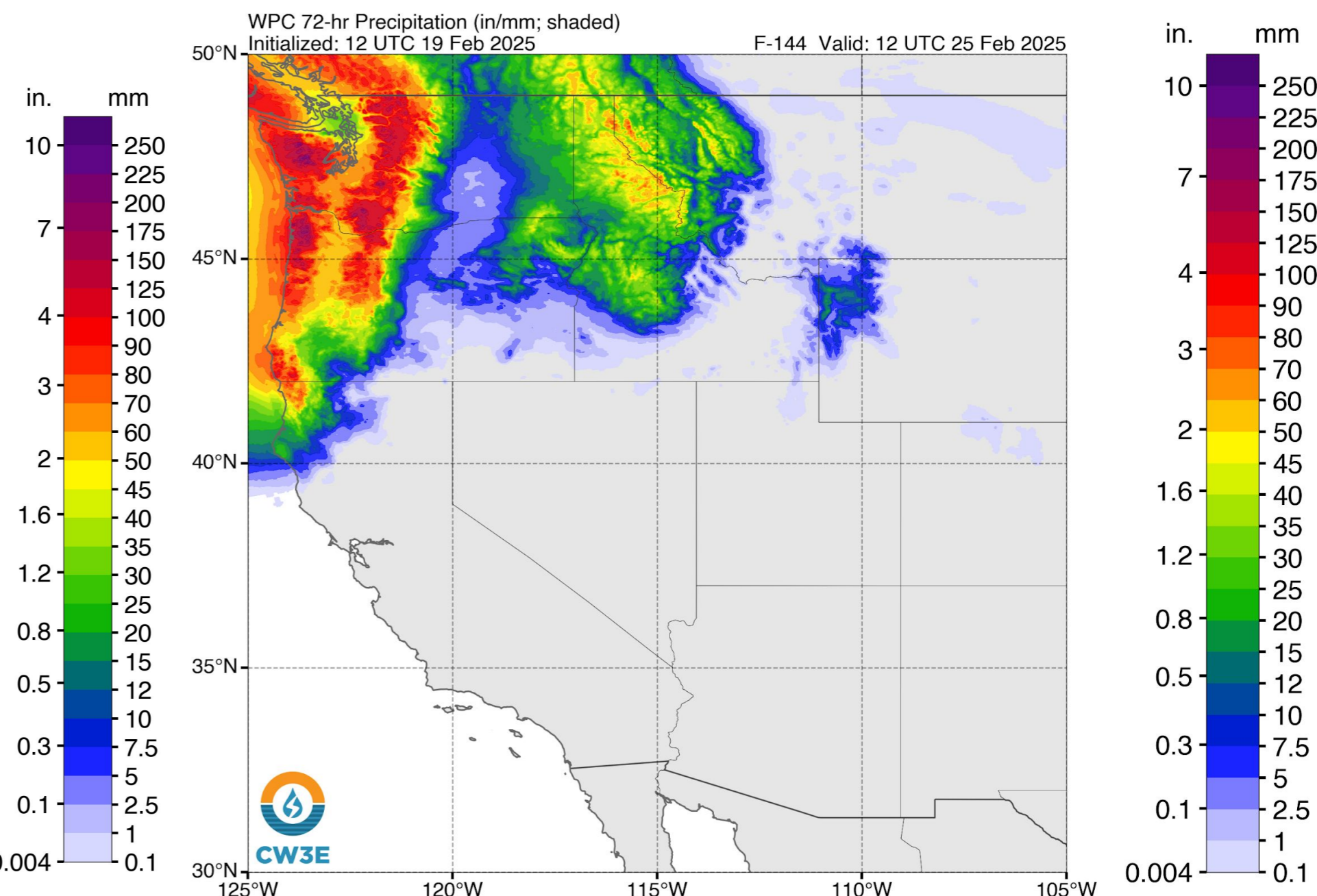
WPC Precipitation Forecasts

WPC 24-h Forecasts for Days 3-6

Valid: 4 AM PT 22-25 Feb



WPC 72-h QPF Valid: 4 AM PT 25 Feb

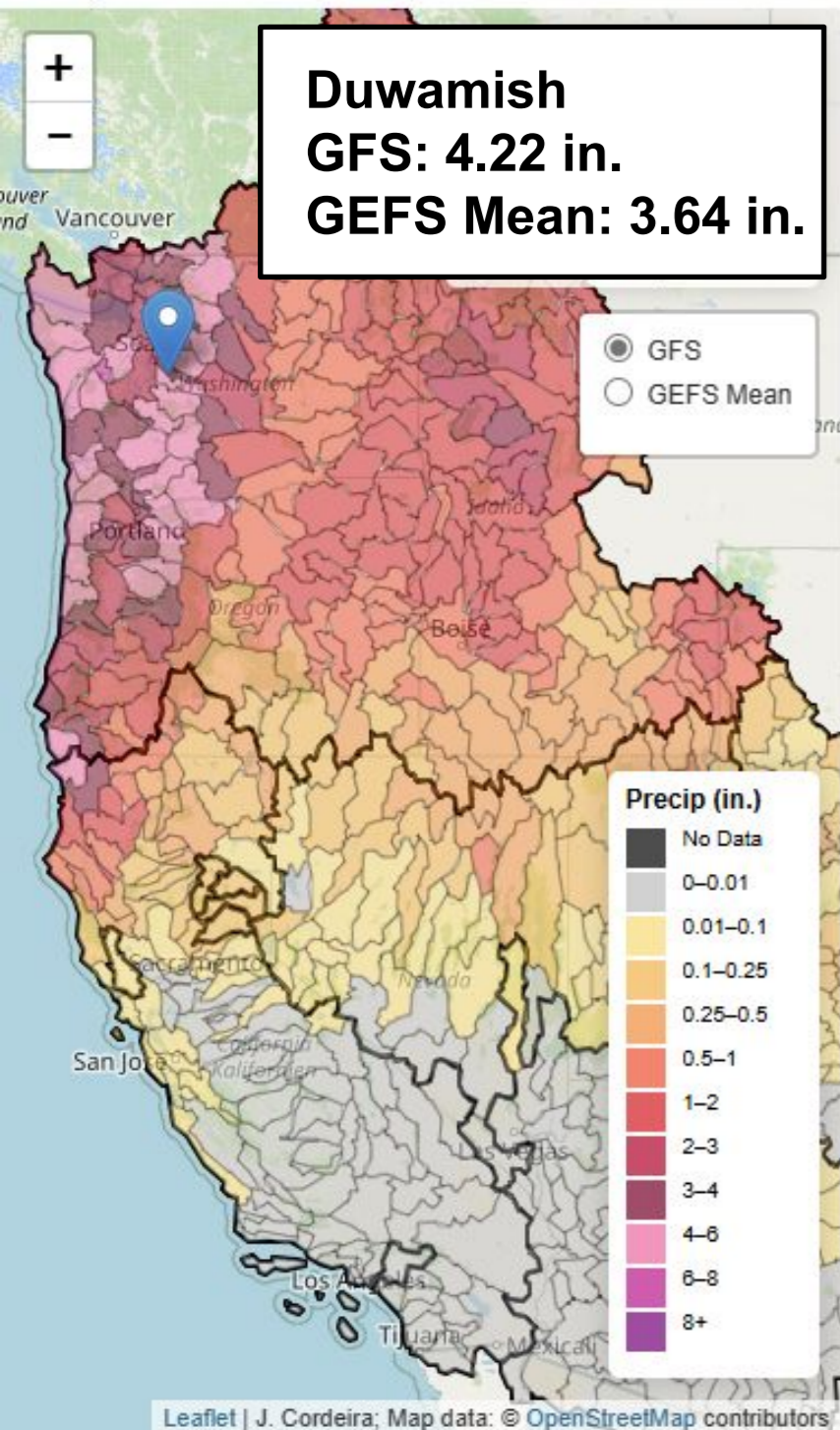


- The highest 3-day precipitation totals are expected over the Olympic Peninsula, Washington and Oregon Coast Ranges and Cascades where 4+ inches are forecast.
- A marginal risk Excessive Rainfall Outlook (ERO) (level 1 of 4, 5% chance of flooding) has been issued over the Olympic Peninsula, Washington and Oregon Coast Ranges and Cascades on days 4 and 5(24-h period ending 4 AM PT Sun 23 and Mon 24 Feb).

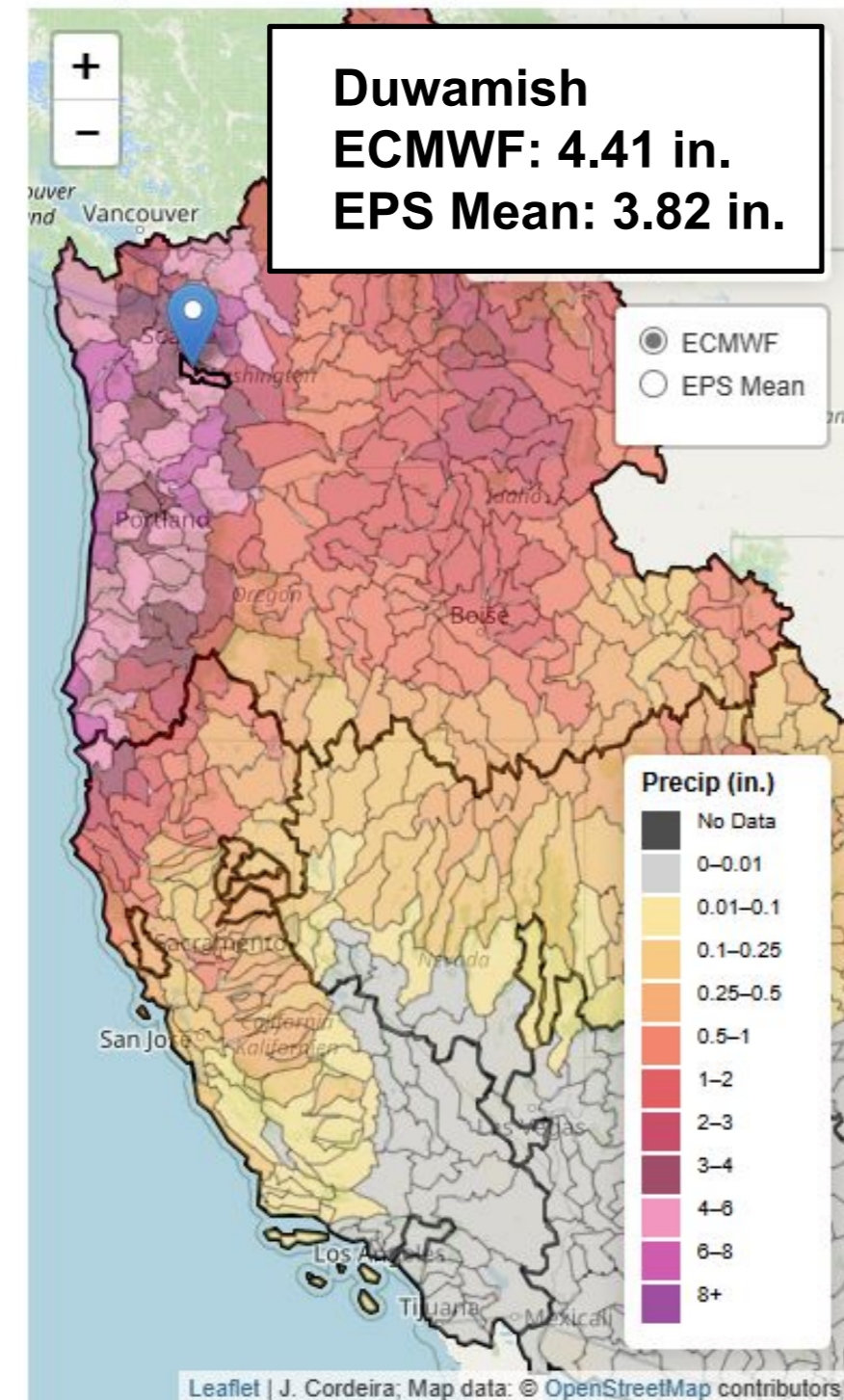
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Watershed Precipitation Forecasts - Duwamish

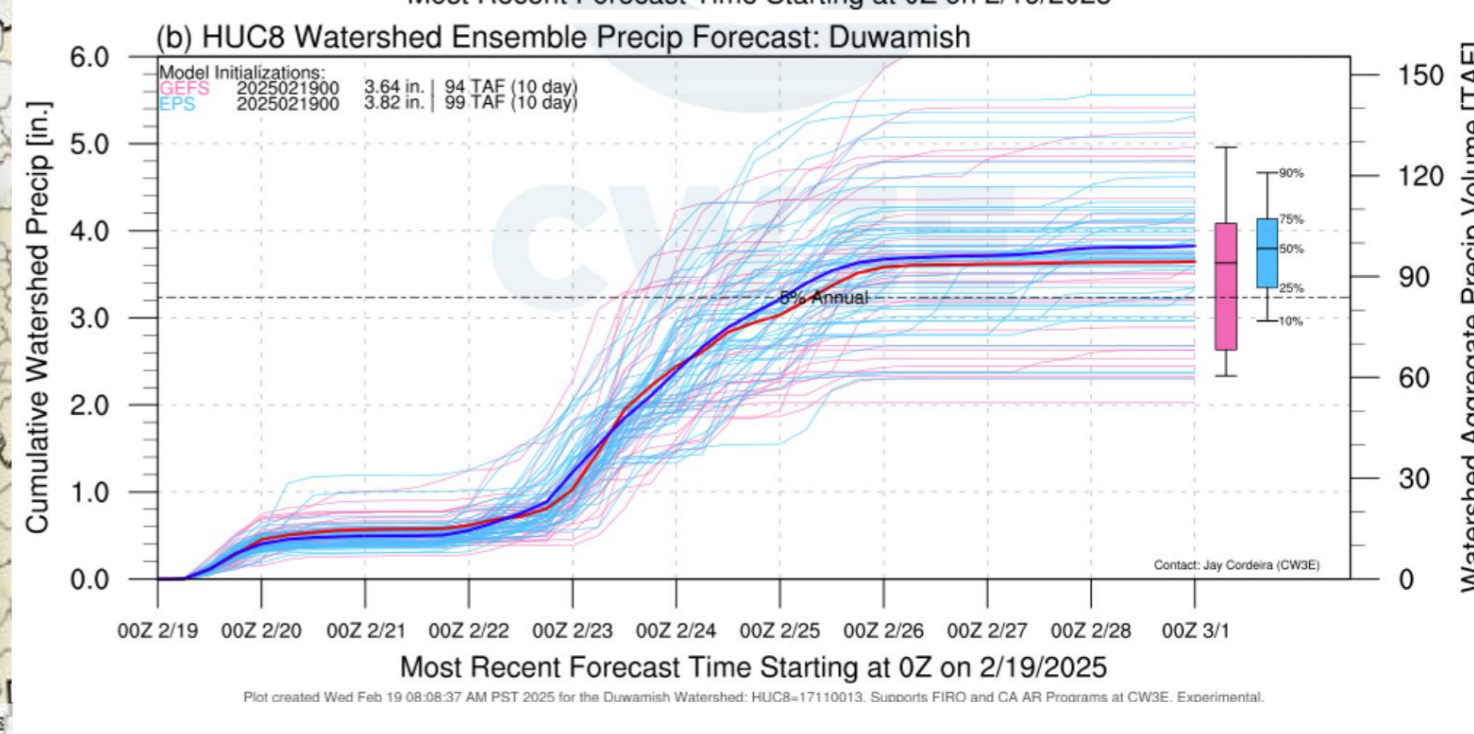
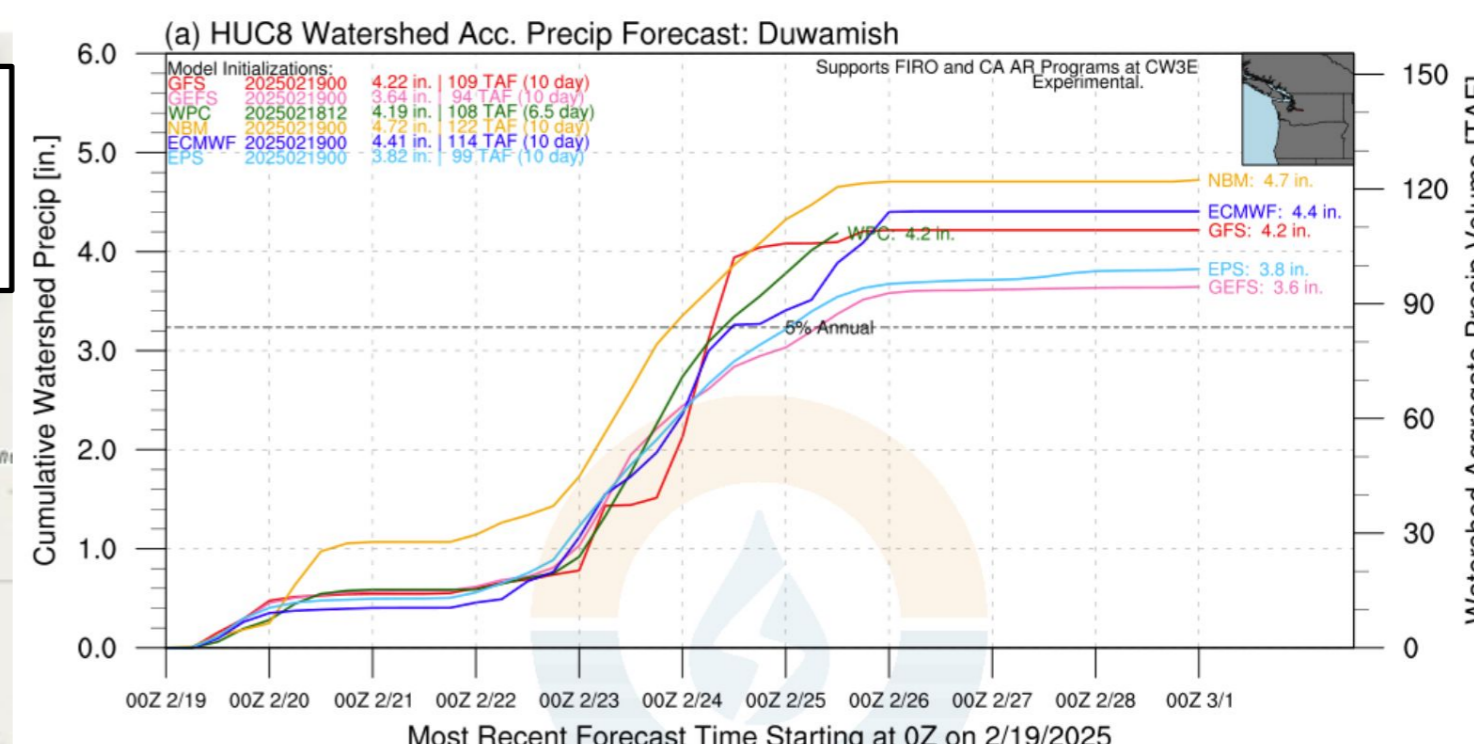
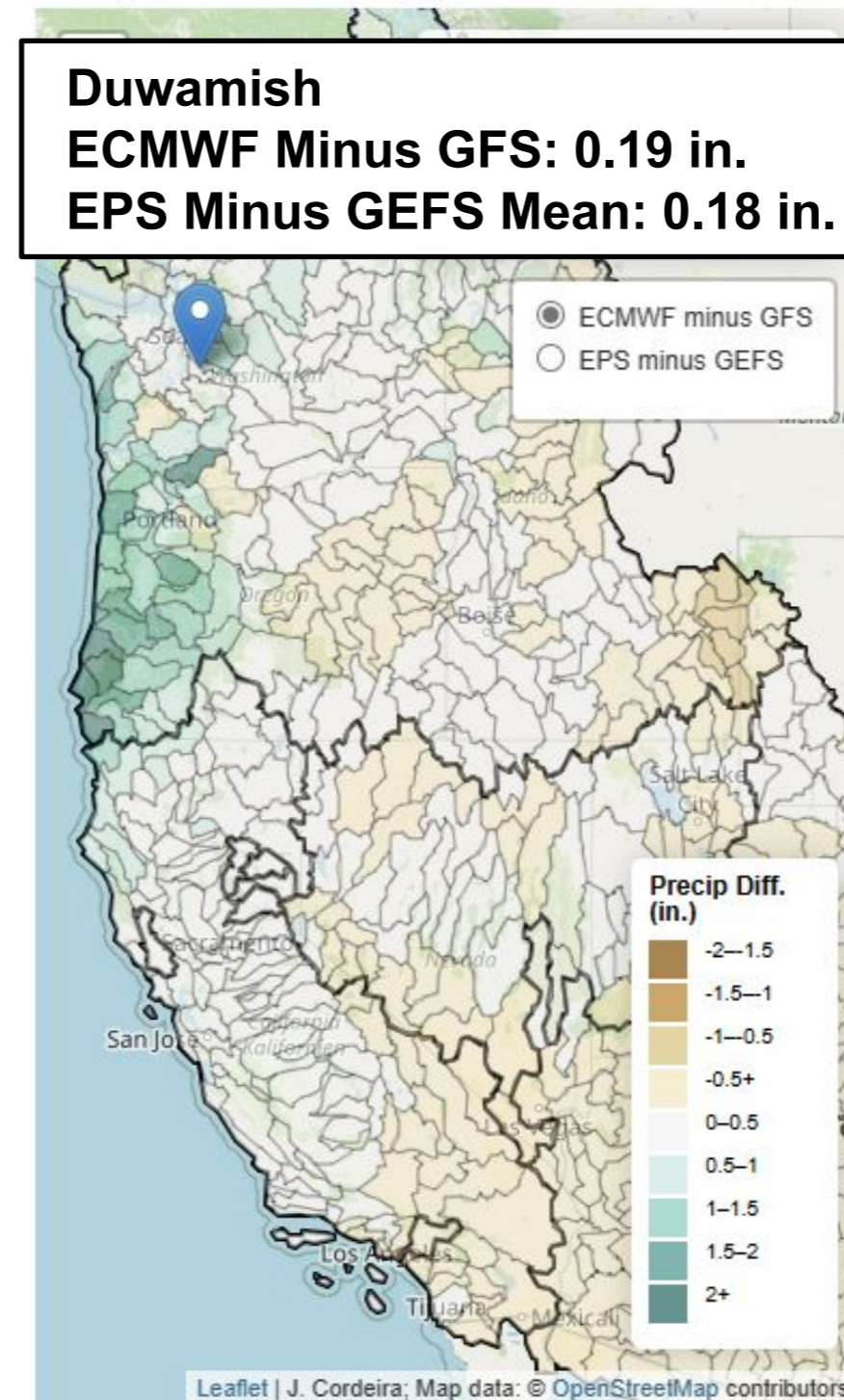
10-day GFS/GEFS Precipitation Forecasts



10-day ECMWF/EFS Precipitation Forecast



10-day Difference Precipitation Forecast

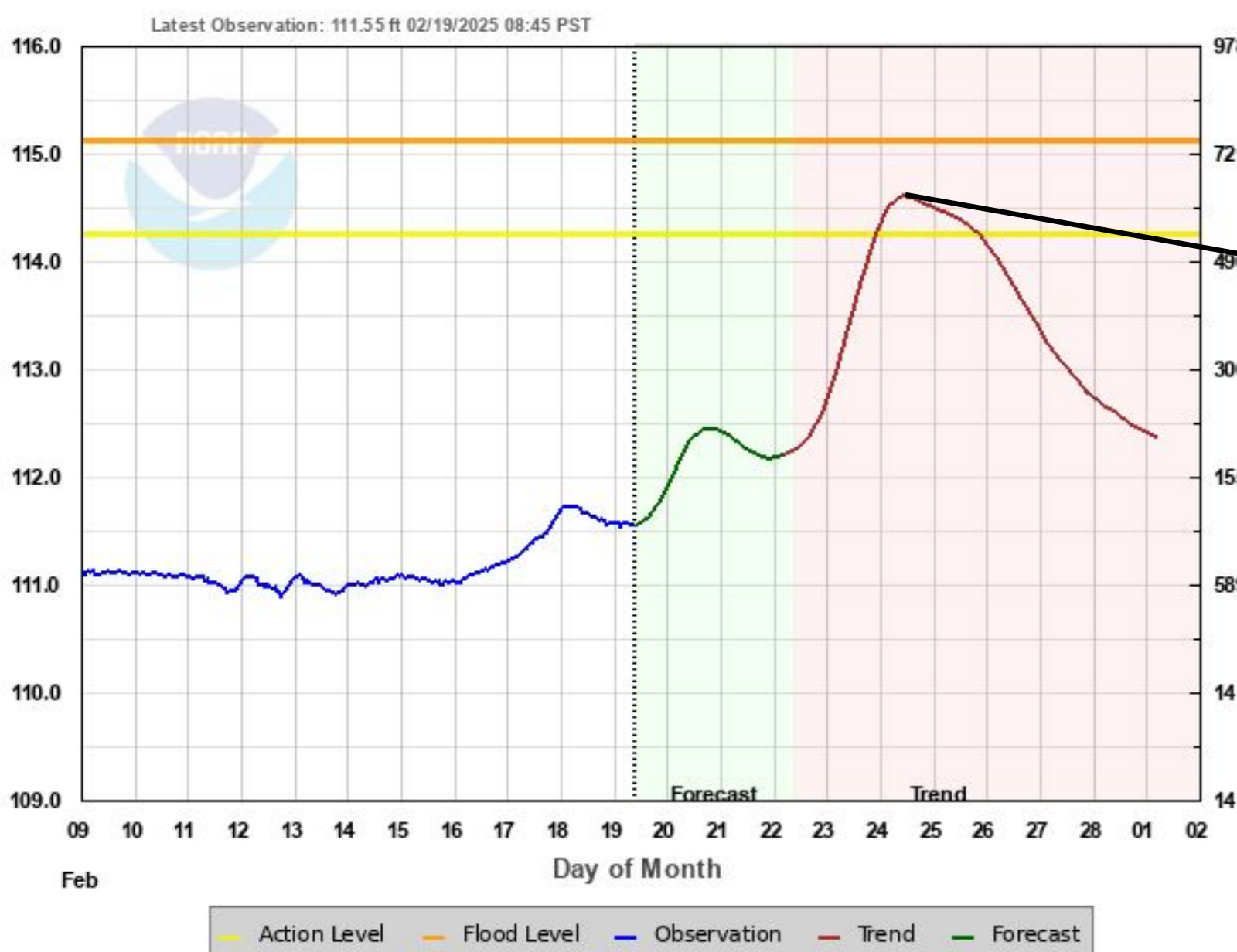


- All ensemble means and models are forecasting at least 3 inches of precipitation in the Duwamish watershed over the next 10 days (*upper right*).
- 3+ inches of precipitation in the Duwamish watershed is greater than **5% of normal annual precipitation**.
- >70% of GEFS and >80% of EPS members are forecasting 10-day precipitation totals to exceed **5% of normal annual precipitation** over this watershed.

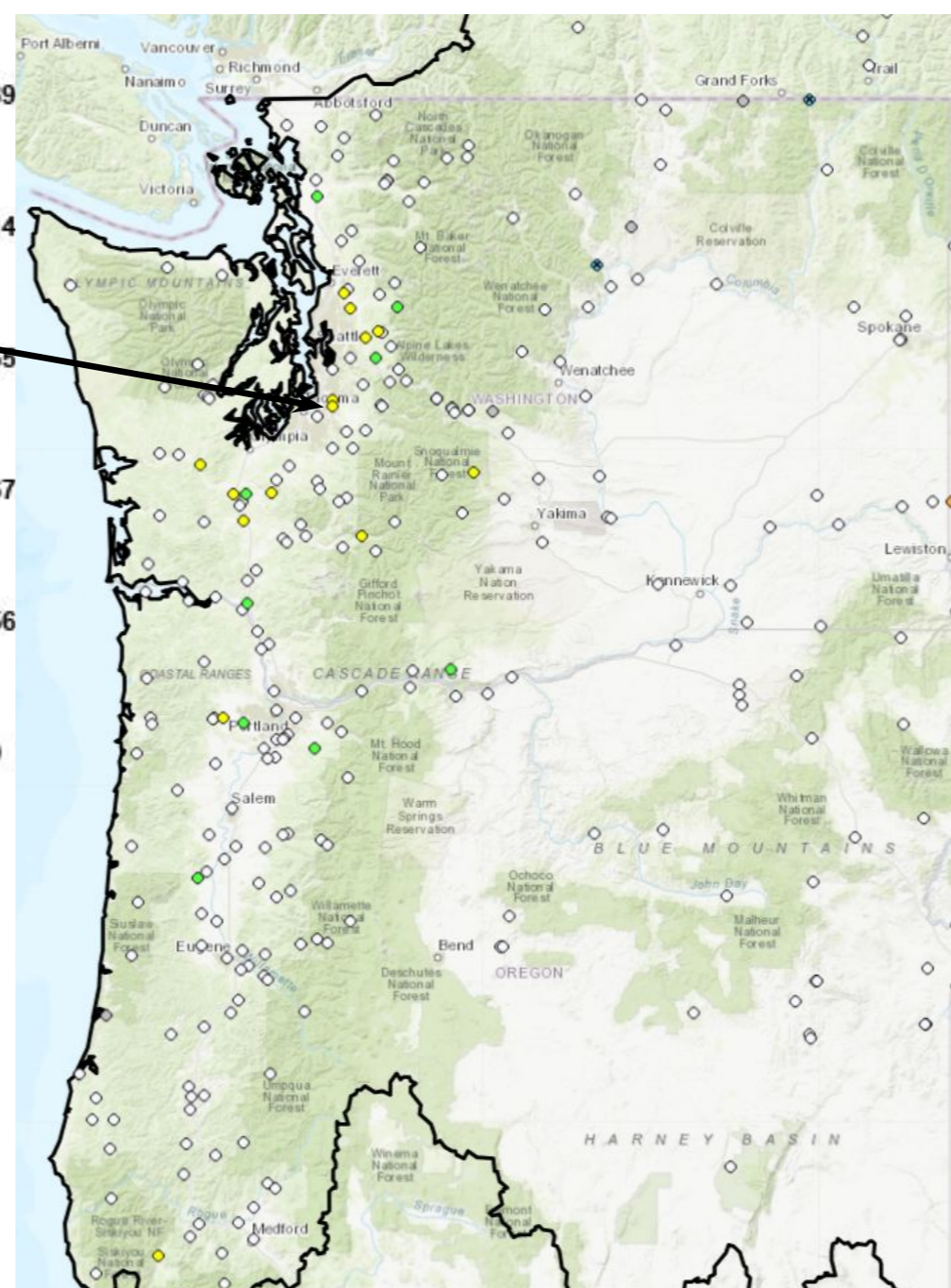
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Hydrologic Forecasts: Pacific Northwest

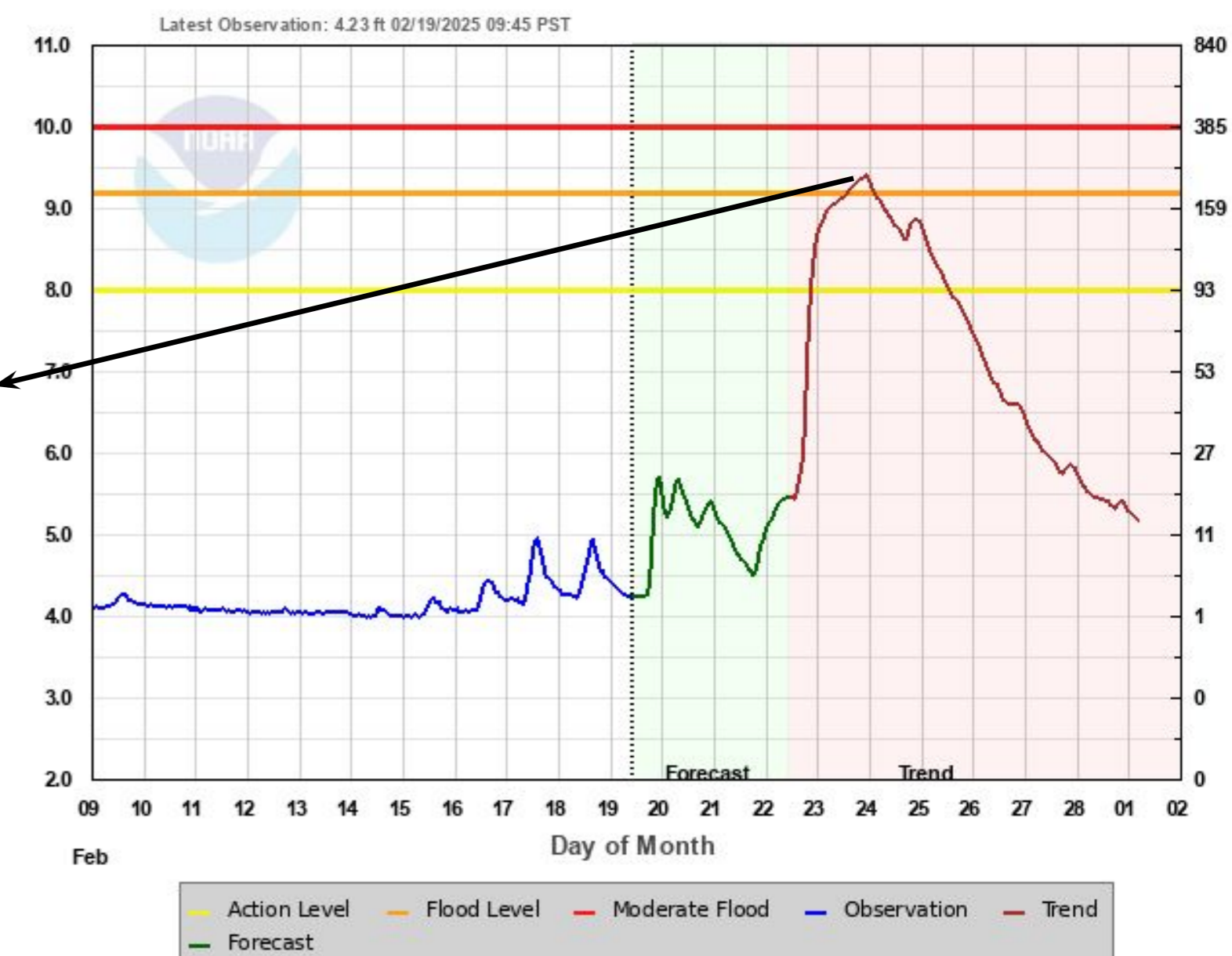
WHITE - AT R STREET (WRAW1)



Forecast Created: 02/19/2025 08:27 PST
Plot Created: 02/19/2025 09:57 PST



PARADISE CREEK - AT UNIVERSITY OF IDAHO AT MOSCOW (PAC11)

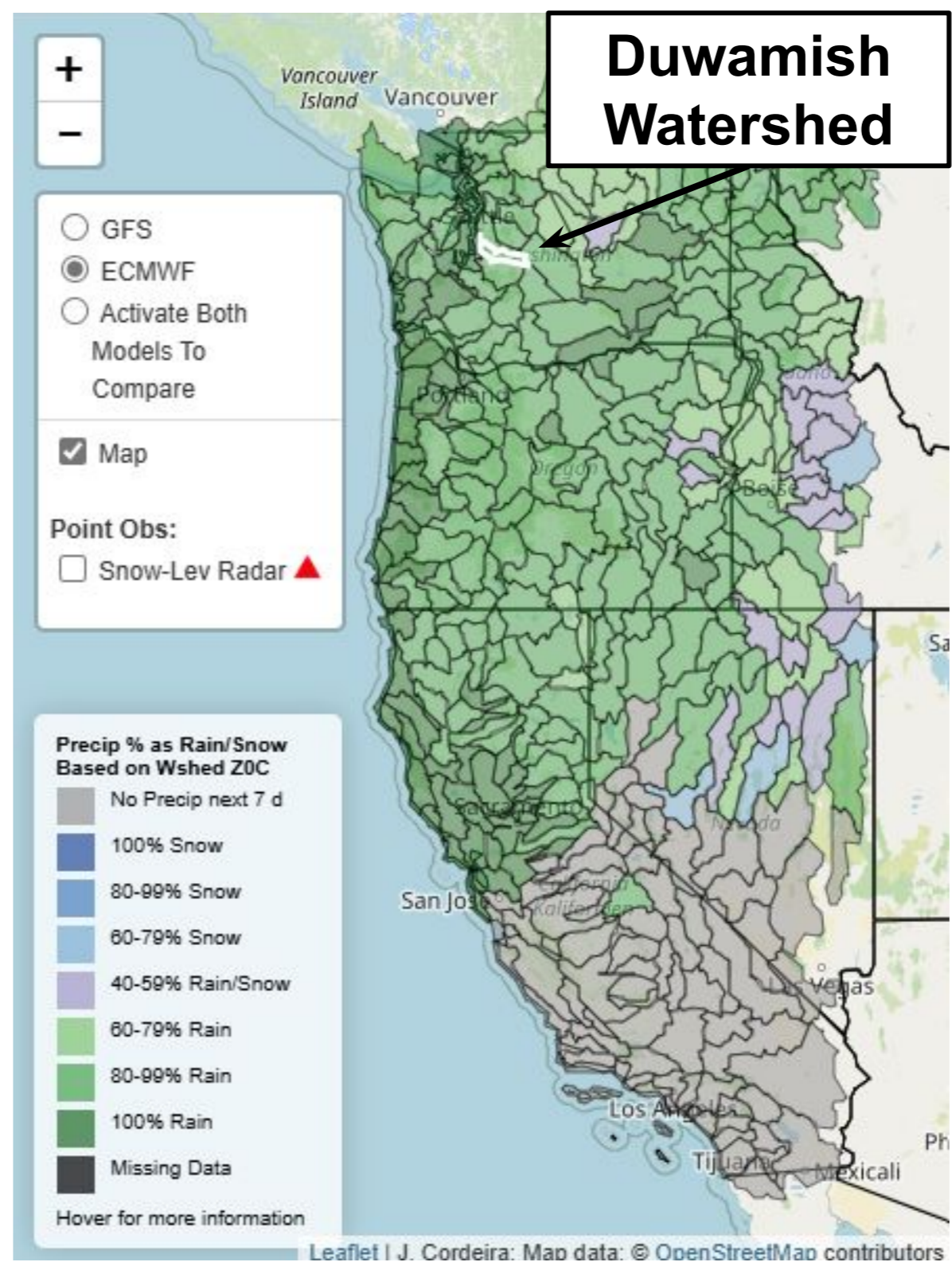
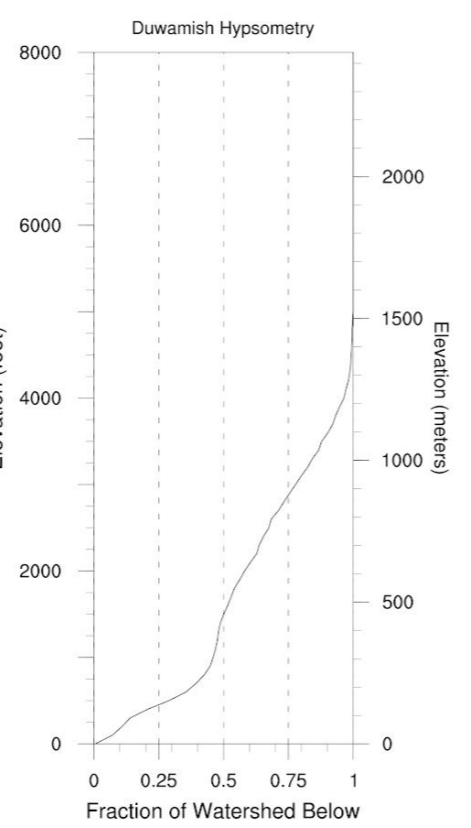
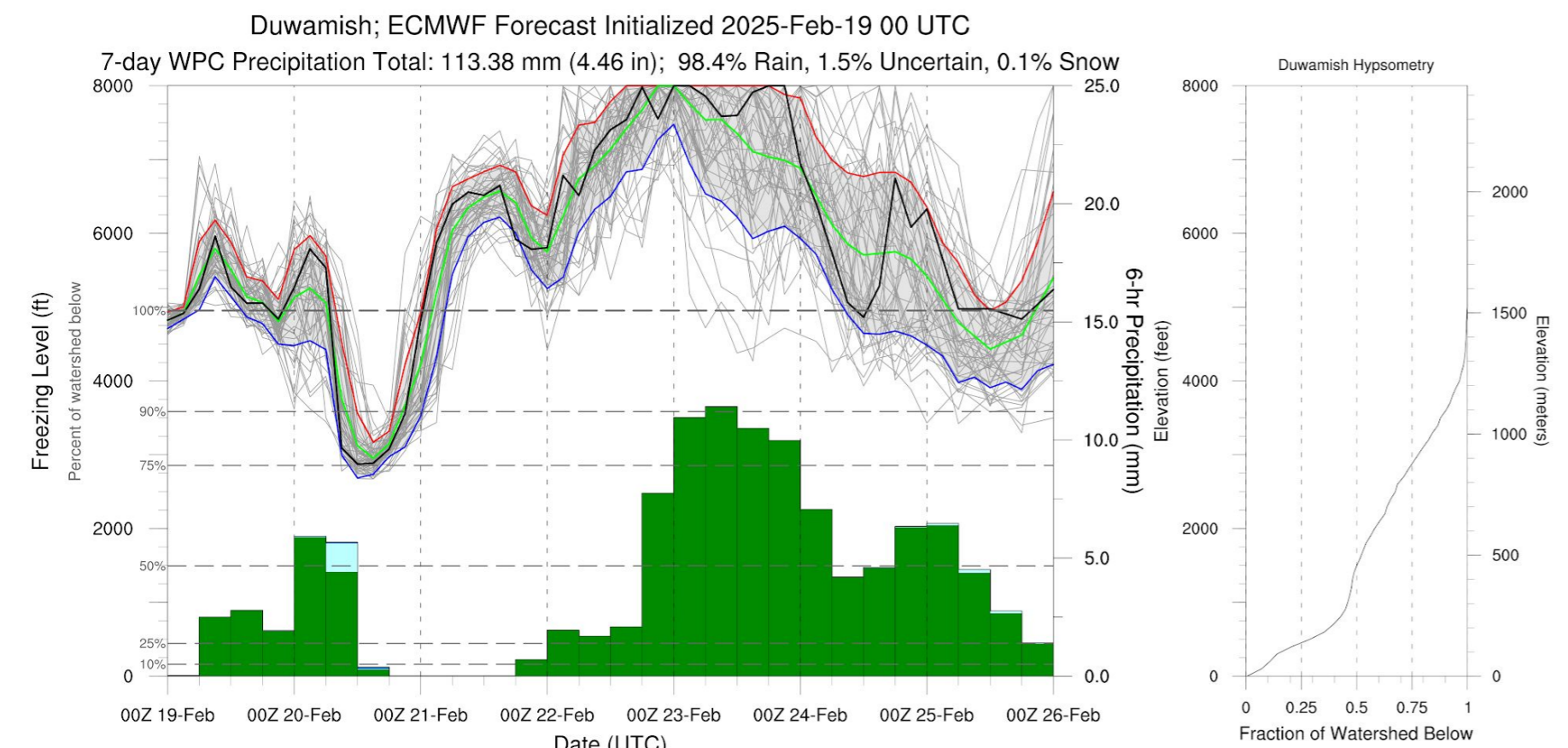
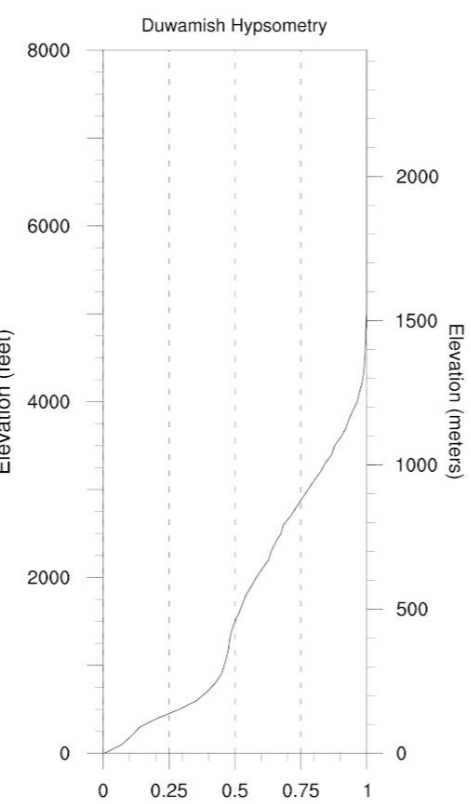
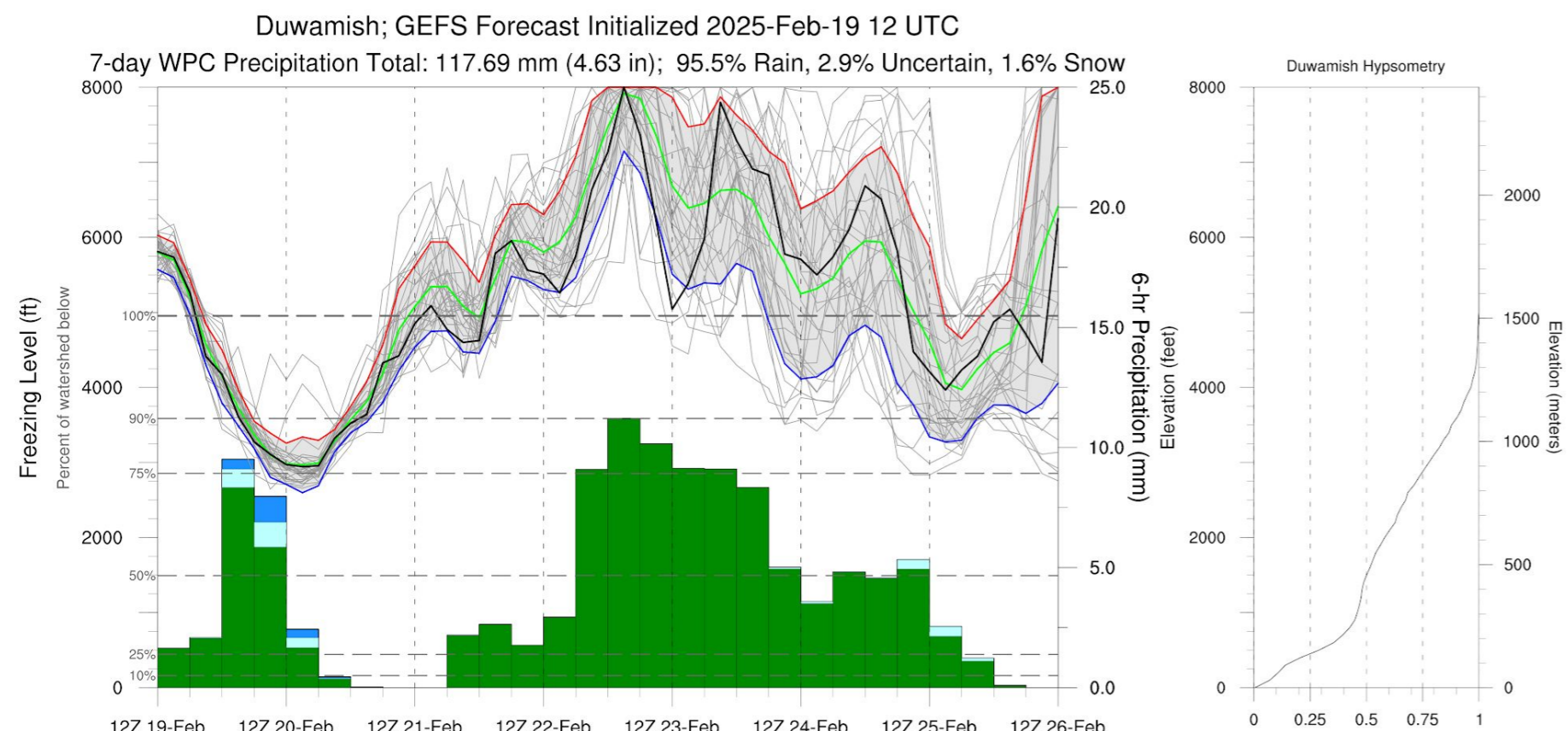


Forecast Created: 02/19/2025 08:07 PST
Plot Created: 02/19/2025 10:02 PST

- The NWS Northwest River Forecast Center (NWRFC) is forecasting one station in Eastern Washington to rise above minor flood stage (Paradise Creek at University of Idaho at Moscow, right) and 14 stations, primarily in Western Washington, to rise above action/bankfull stage (White River at R Street, left) between 23-25 Feb with the incoming AR.

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Watershed Freezing Level Forecast Comparison



- Freezing levels are forecast to rise from ~3000 feet following the AR that makes landfall over the PNW today to >6000 feet as this next AR makes landfall on 22 Feb.

- The higher freezing levels will lead to the majority of the precipitation in this event falling as rain, even at higher elevations.

- Precipitation falling mostly as rain increases the potential for runoff, especially as rain-on-snow following the recent snowfall events.

— Ensemble Control — Ensemble +1 Std. Dev. — Ensemble Members ■ Rain Within Ensemble Uncertainty ■ Snow
— Ensemble Mean — Ensemble -1 Std. Dev.

