

CW3E Atmospheric River Outlook: 26 Feb 2024

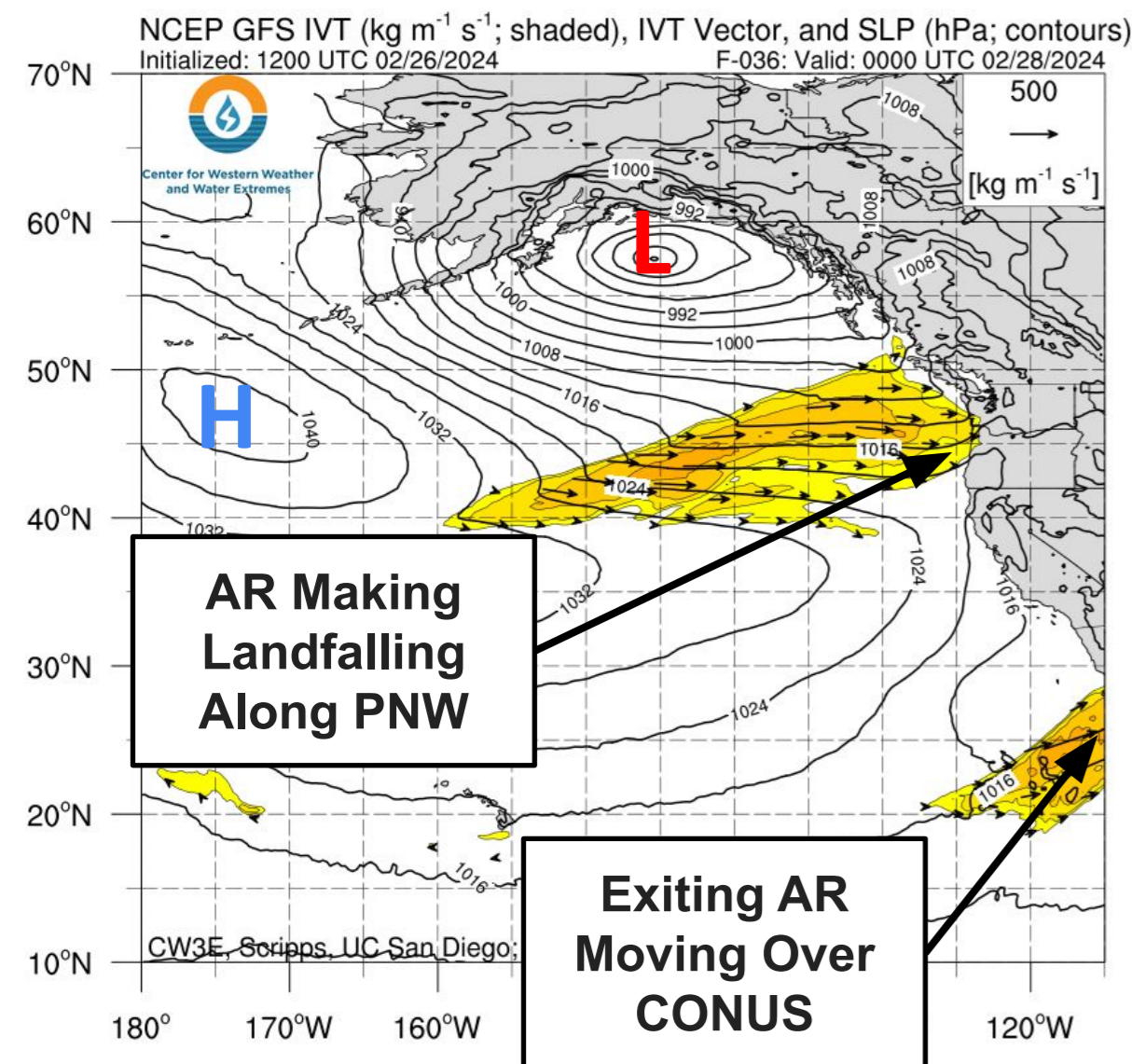
AR and Low Pressure System Fuel Precipitation Event Over USWC

- An atmospheric river (AR) and low pressure system forecast to make landfall over the USWC will help fuel a multi-day precipitation event that is likely to bring heavy snowfall to the Cascades and Sierra Nevada.
- The AR makes landfall over the PNW late on Tue 27 Feb and moves down the USWC through Fri 1 Mar.
- There is potential for a pulse of IVT from the central Pacific to reach the USWC and extend AR conditions over northern and central CA when it interacts with AR.
- Behind this AR, the associated low pressure system and a mid-level trough will help continue this precipitation event over CA through Sun 3 Mar.
- The NWS Weather Prediction Center (WPC) is forecasting significant precipitation over the next 7 days along the WA/OR coasts and OR/CA border and over the Cascades and Sierra Nevada.
- The National Blend of Models (NBM) showing very high probabilities (>90%) of snowfall exceeding 36+ in. for portions of the Cascades and Sierra Nevada.
- West-WRF Ensemble Meteograms are also showing very high probabilities of significant snowfall (totals > 24 in.) in the Sierra Nevada.
- The WPC Excessive Rainfall Outlooks include a Marginal Risk (level 1 of 4, or at least 5% chance) for flooding for the WA/OR/N. CA coasts and the N. Sierra Nevada with the the AR as it moves down the coast.
- Stay alert to official NWS forecasts, watches, and warnings at [weather.gov](https://www.weather.gov) and follow guidance from local emergency management officials.

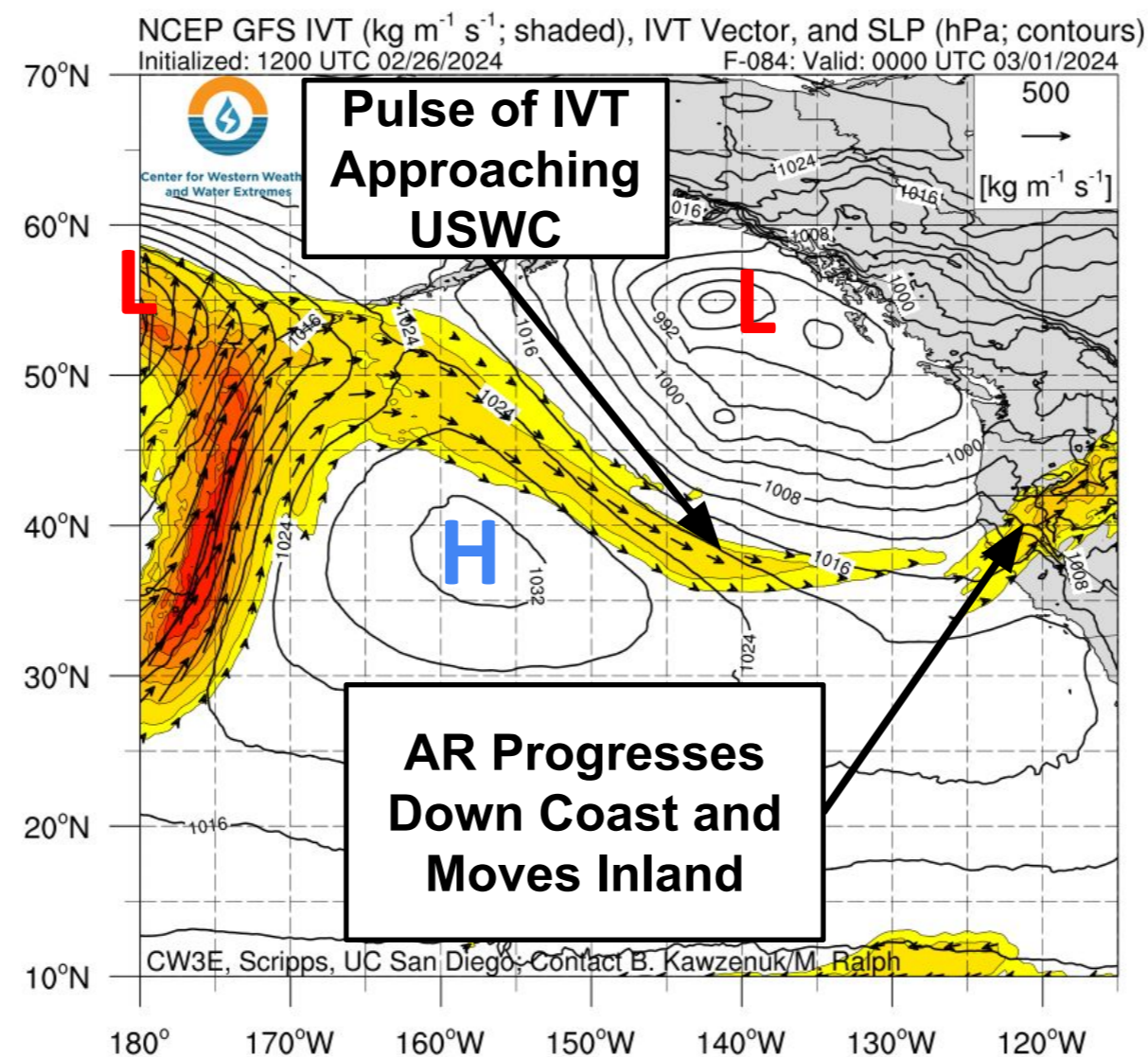
CW3E AR Outlook: 26 Feb 2024

GFS Initialized: 12Z Mon 26 Feb 2024

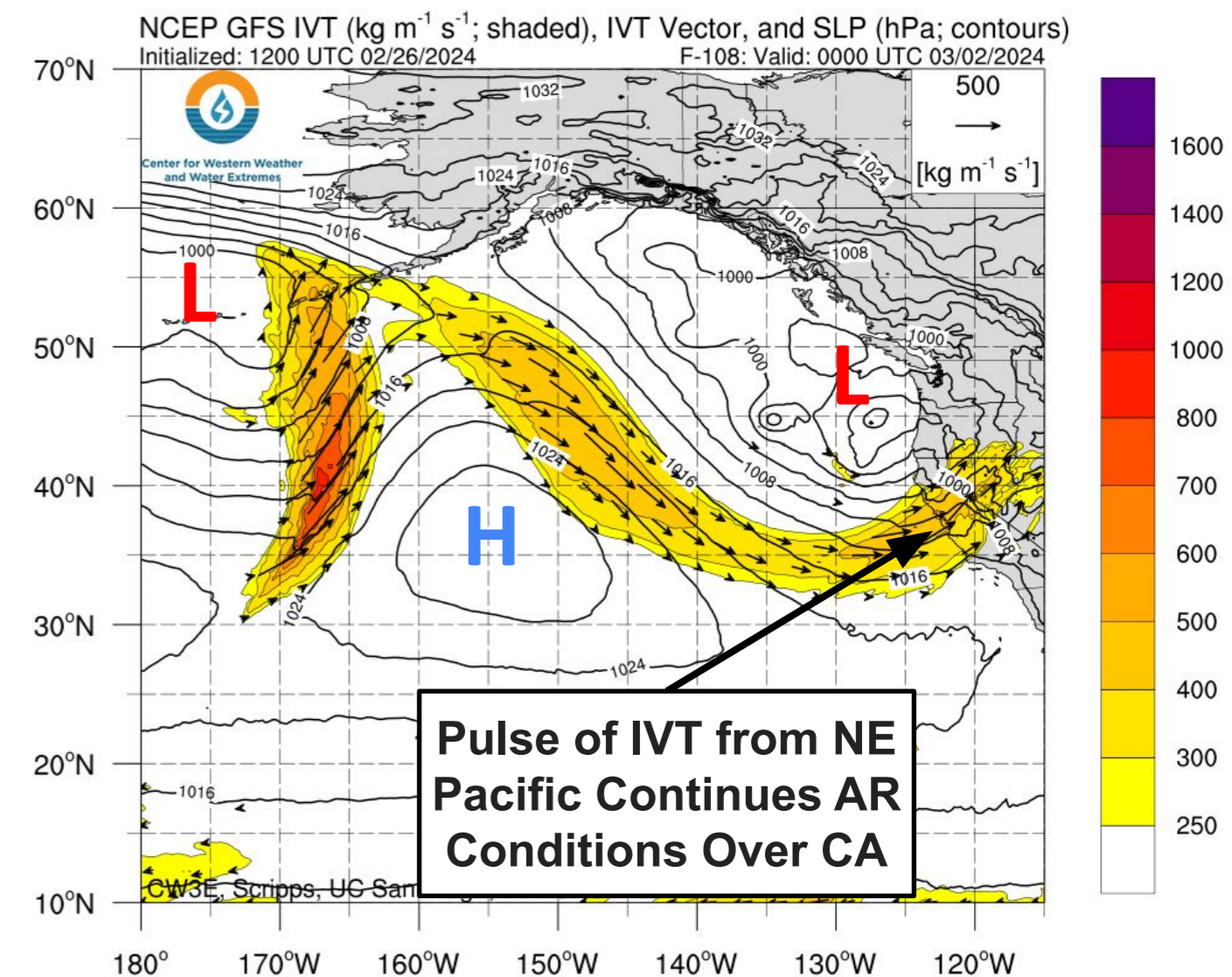
4PM PT Tue 27 Feb 2024



4PM PT Thu 29 Feb 2024



4PM PT Fri 1 Mar 2024

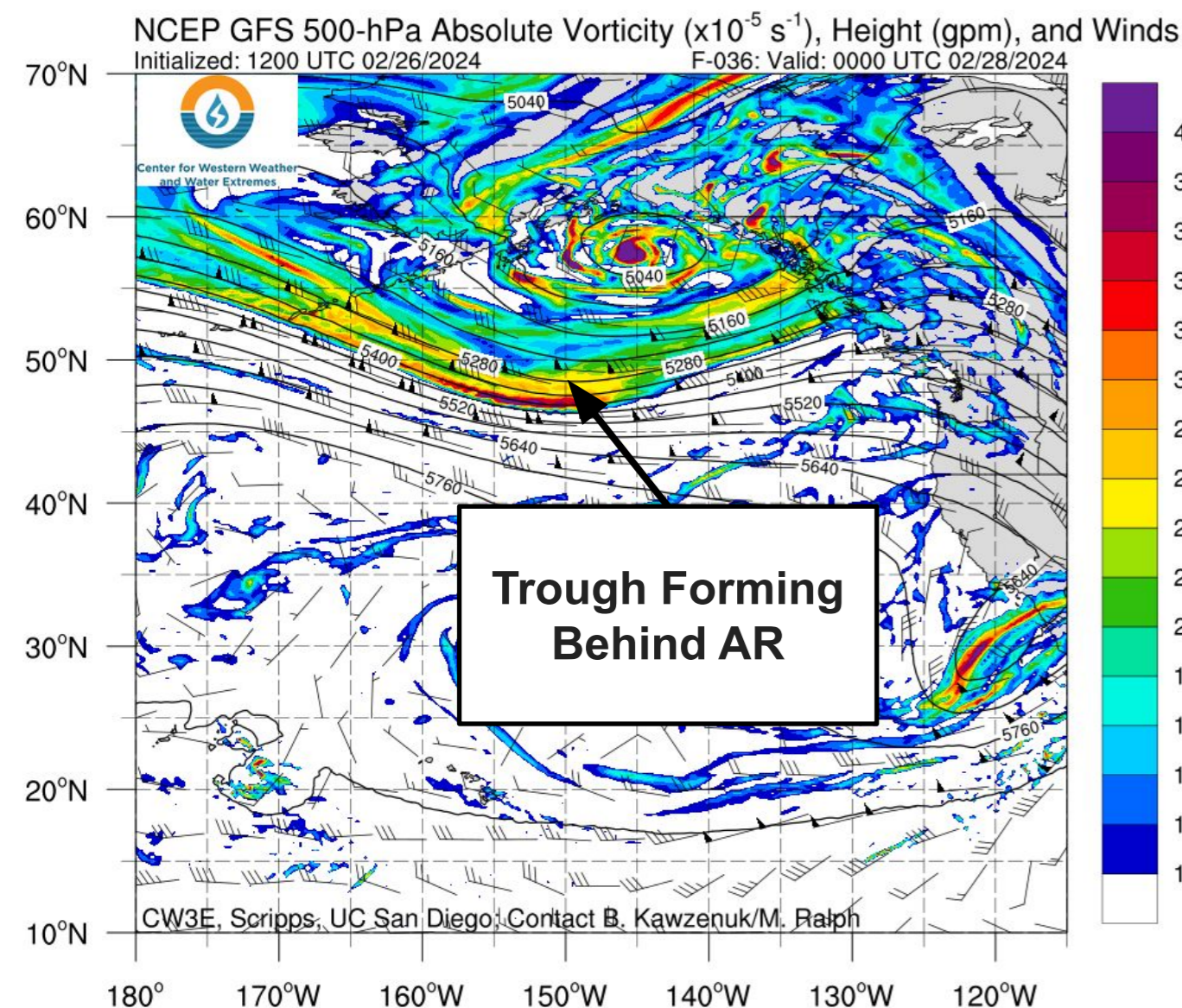


- The AR making landfall over the North American West Coast alongside a low pressure system is likely to fuel a long duration precipitation event over the US West Coast.
- The AR is forecast to make landfall over the PNW late Tue 27 Feb and progress down the USWC through Thu 29 Feb.
- A pulse of IVT from the central Pacific extends toward the USWC Thu 29 Feb before reaching the USWC Fri 1 Mar. This pulse merges with the AR over CA to potentially continue AR conditions over north and central CA through Sat 2 Mar.

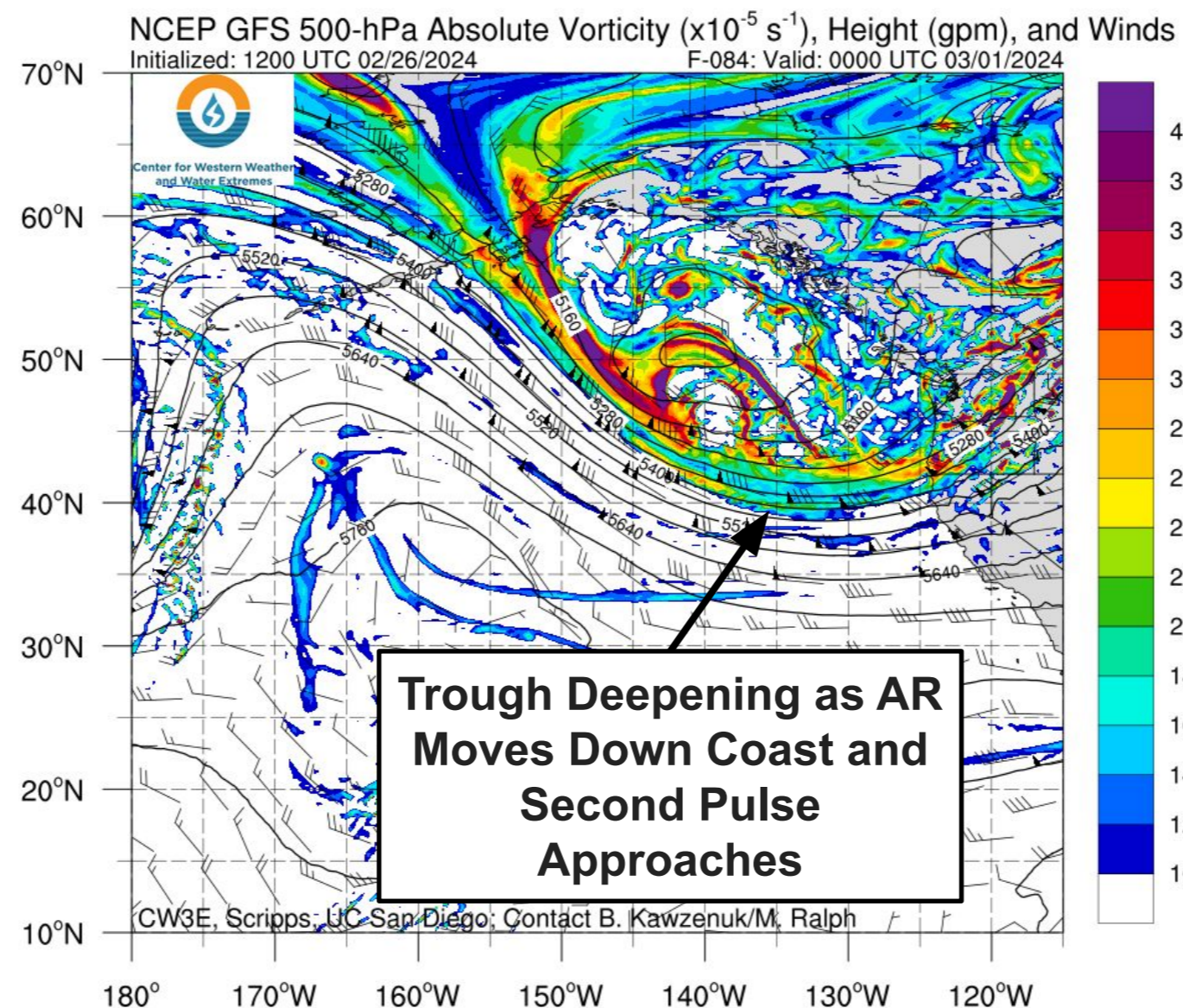
CW3E AR Outlook: 26 Feb 2024

GFS Init 12Z Mon 26 Feb 2024

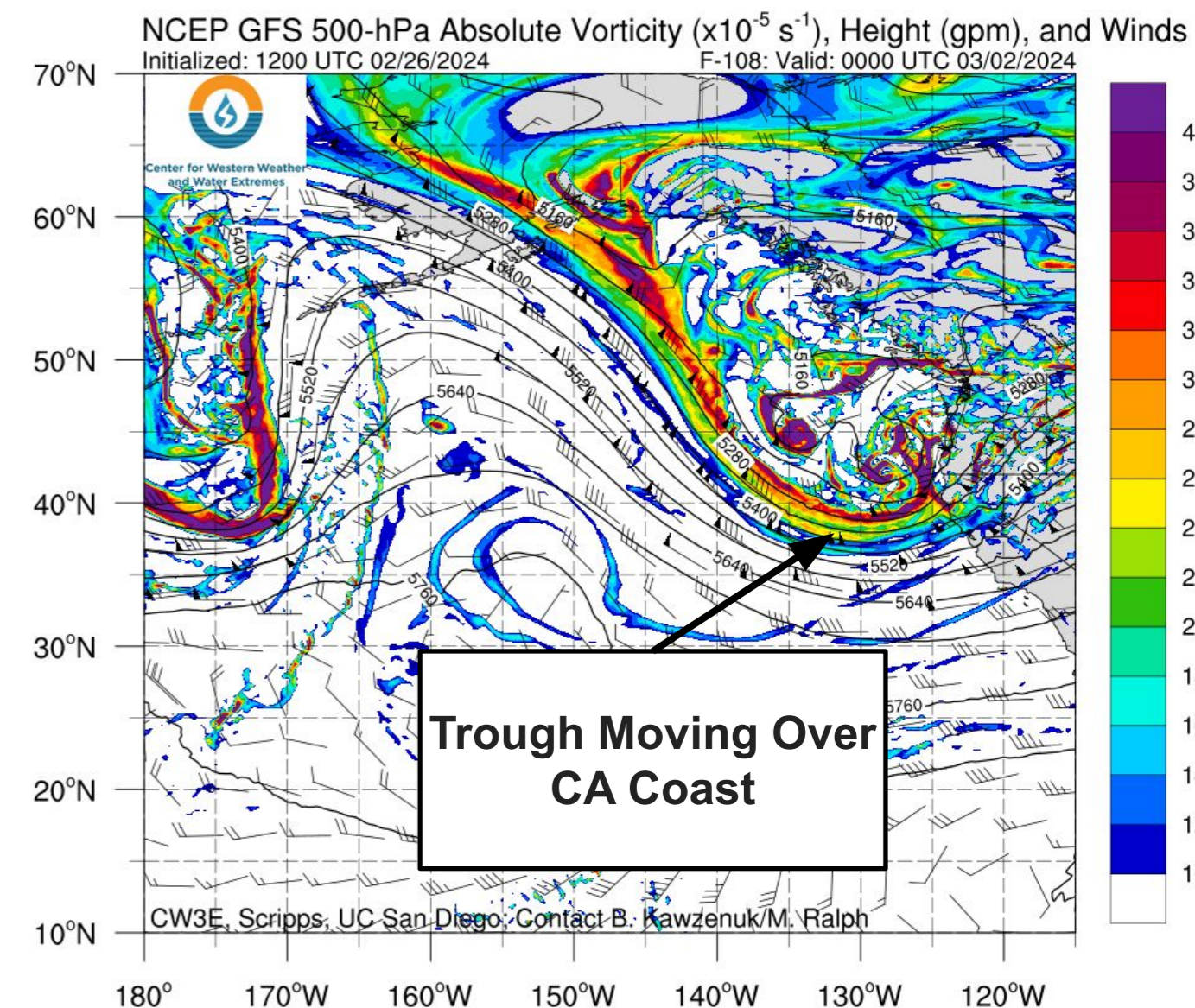
4PM PT Tue 27 Feb 2024



4PM PT Thu 29 Feb 2024

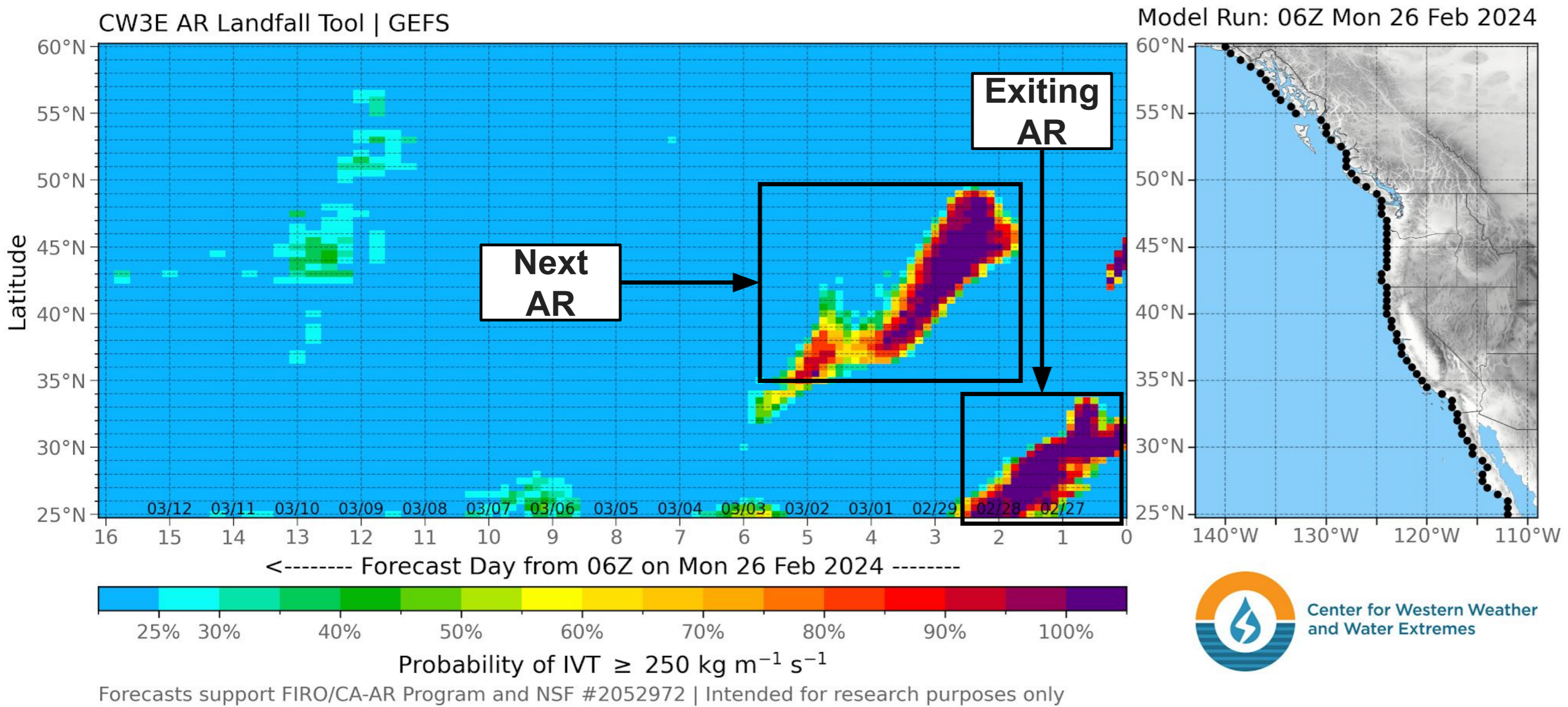


4PM PT Fri 1 Mar 2024



- A mid-level trough is forecast to develop over the Aleutian Islands, eventually shifting to the east and deepening over the Gulf of Alaska.
- This trough progresses toward the USWC along with the pulse of IVT on Thu 29 Feb before moving over the USWC Fri 1 Mar. This trough alongside the low pressure system are likely to help extend the precipitation event over CA.

CW3E AR Outlook: 26 Feb 2024



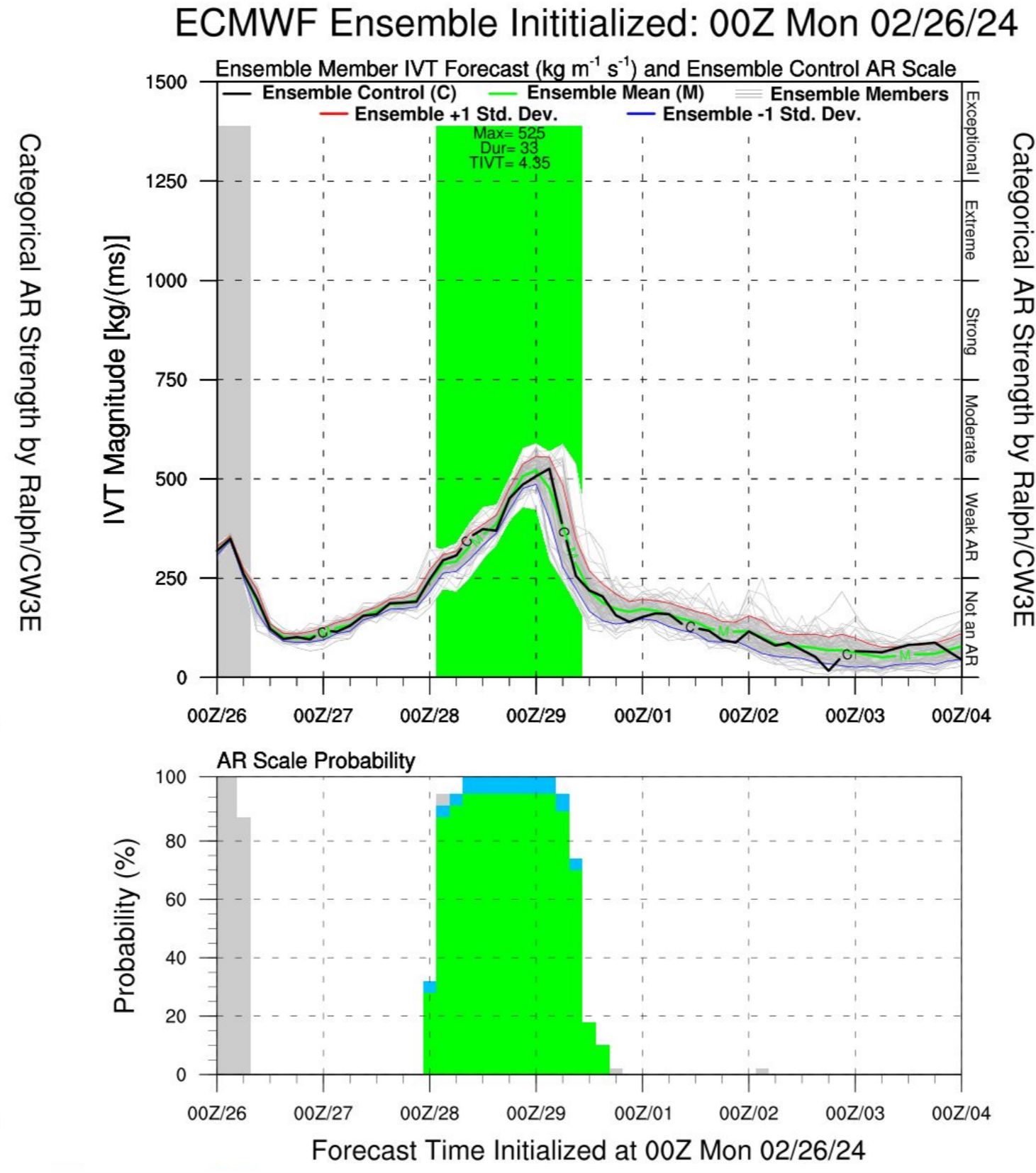
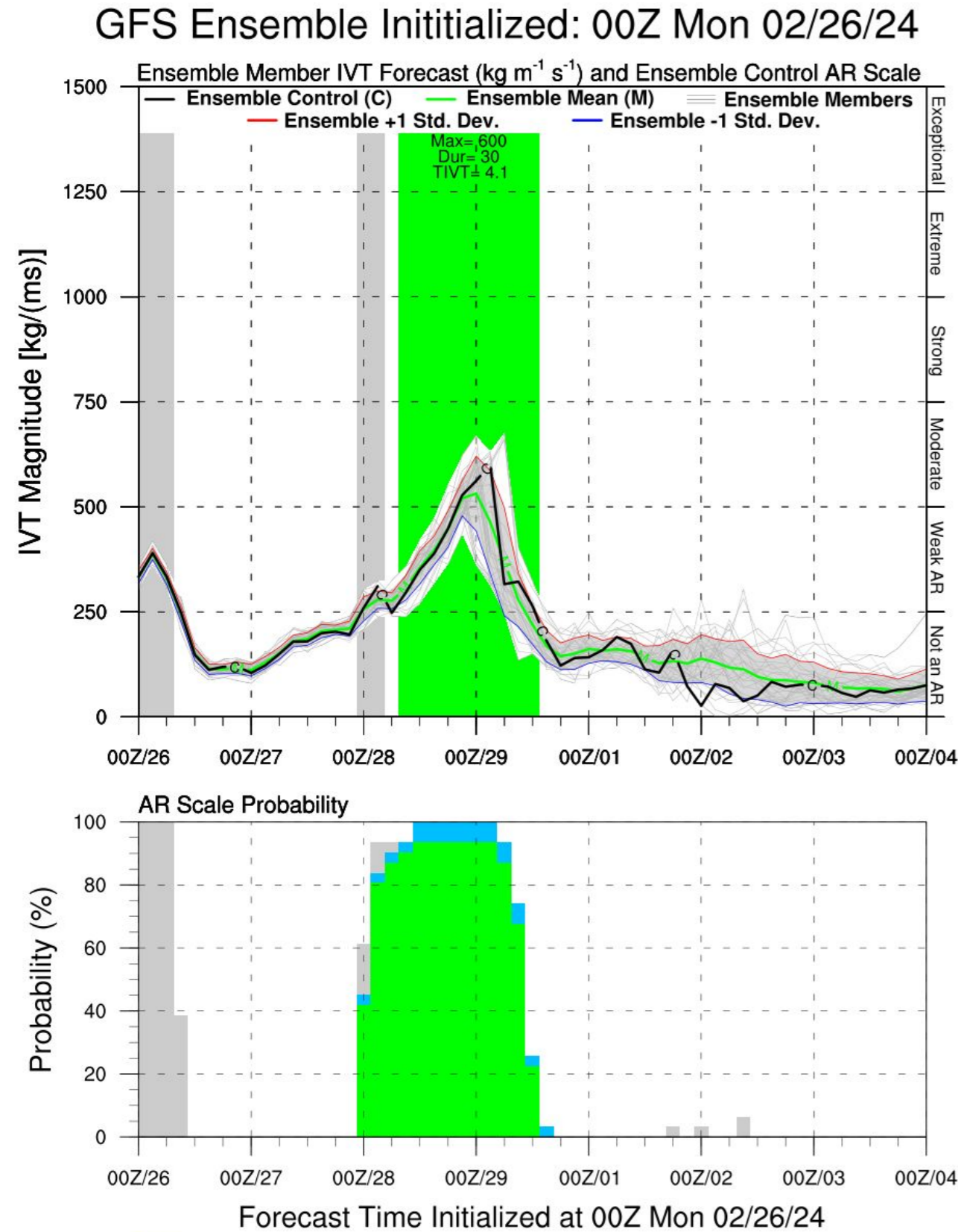
- CW3E's ensemble AR Landfall tool illustrates the timing and location of the IVT associated with both storms as they move onshore and shift to the south along the west coast into California.
- All GEFS members (31, 100%) show IVT $> 250 \text{ kg m}^{-1} \text{ s}^{-1}$ making landfall over from the PNW to C. CA with the second storm for 28 Feb through 1 Mar.

CW3E AR Outlook: 26 Feb 2024

7-day GEFS and EPS AR Scale and IVT Forecast

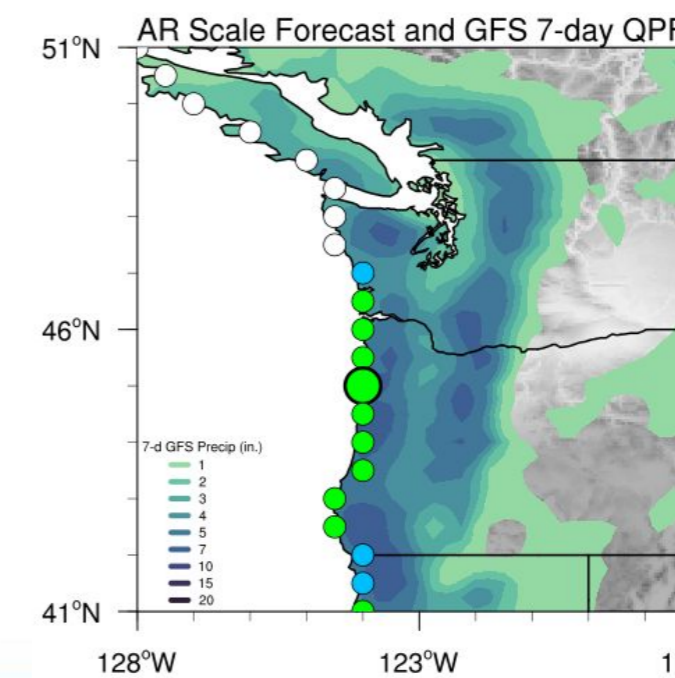
Landfall Point: 45° N, 124° W

- 30/31 (97%) **GEFS ensemble members** are forecasting **AR2** conditions at this location.
- 48/51 (94%) **EPS ensemble members** are forecasting **AR2** conditions at this location.
- Both ensembles are confident in AR2 conditions in the PNW.

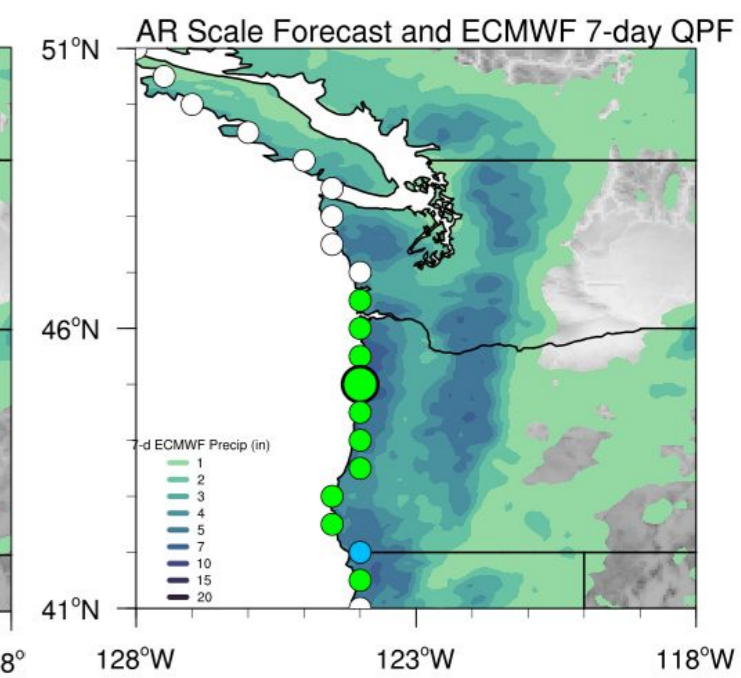


Category: Exceptional, Extreme, Strong, Moderate, Weak AR, Not an AR

GFS Ensemble



ECMWF Ensemble

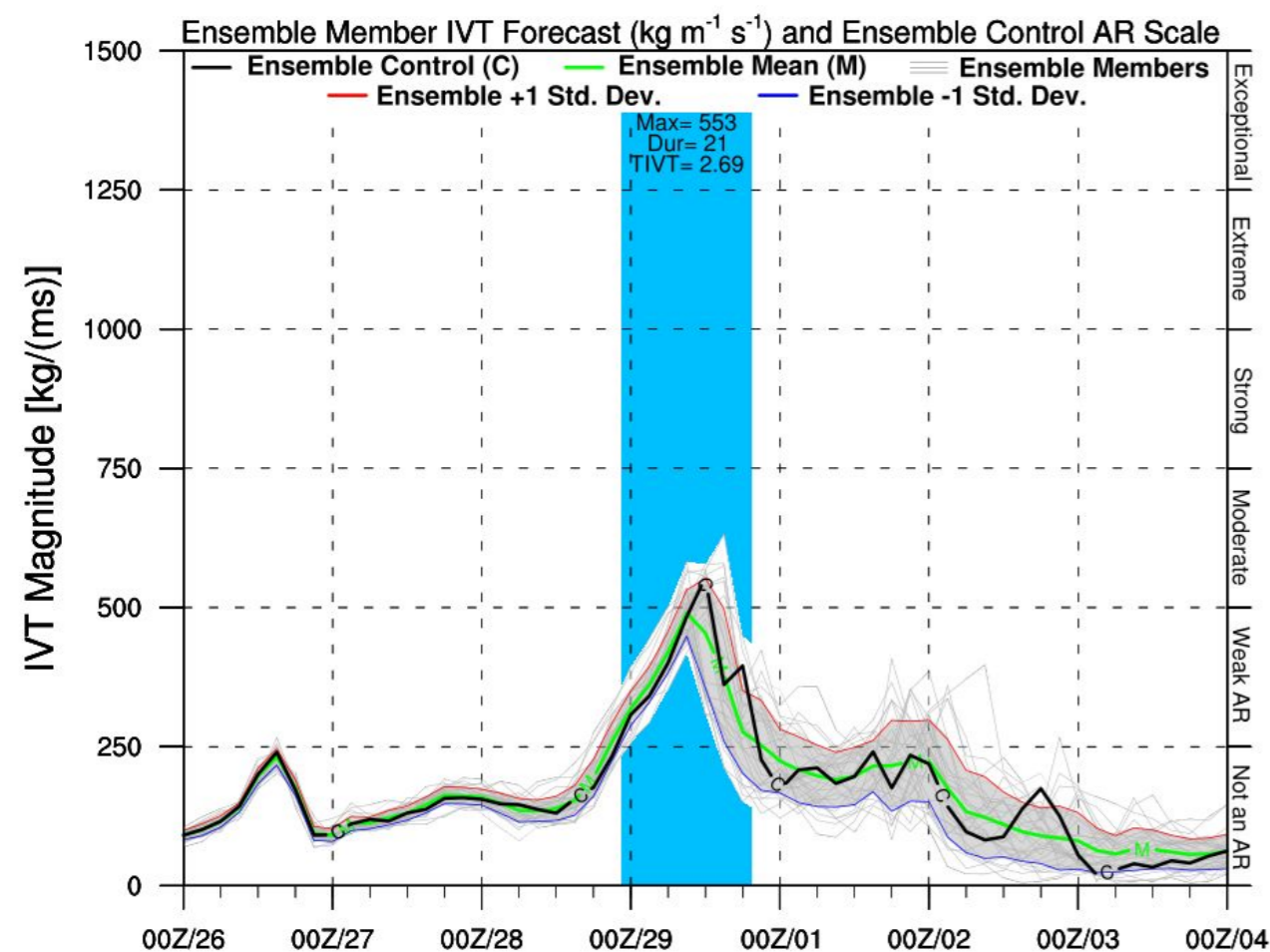


CW3E AR Outlook: 26 Feb 2024

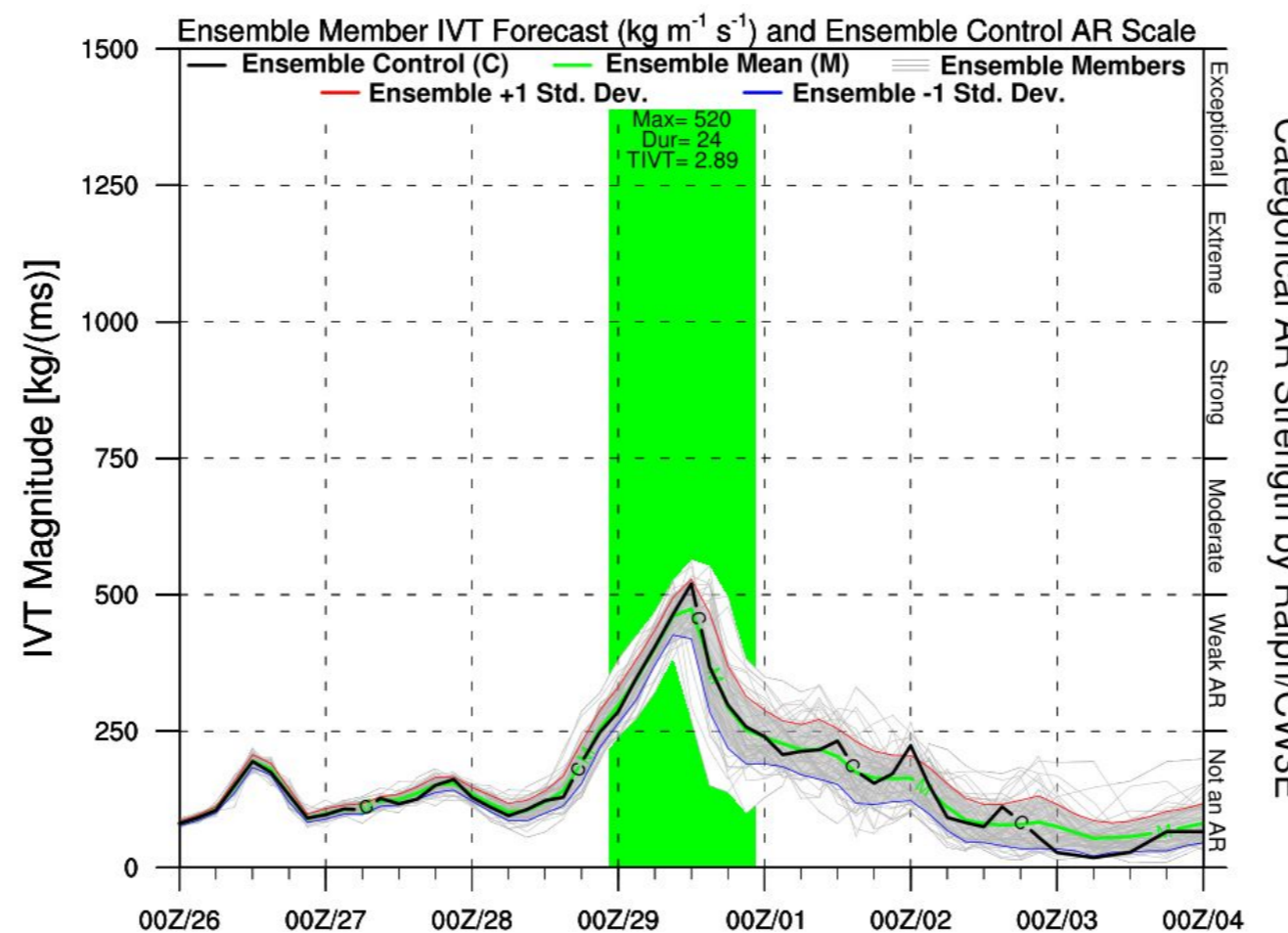
7-day GEFS and EPS AR Scale and IVT Forecast

Landfall Point: 41.5° N, 124° W

GFS Ensemble Initialized: 00Z Mon 02/26/24

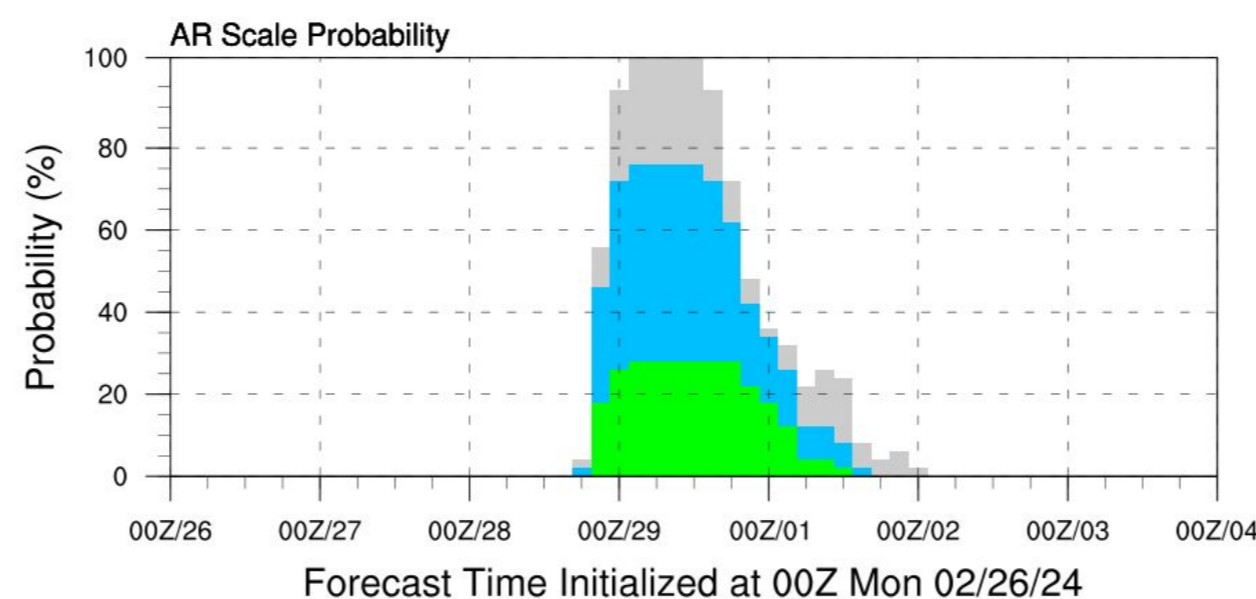
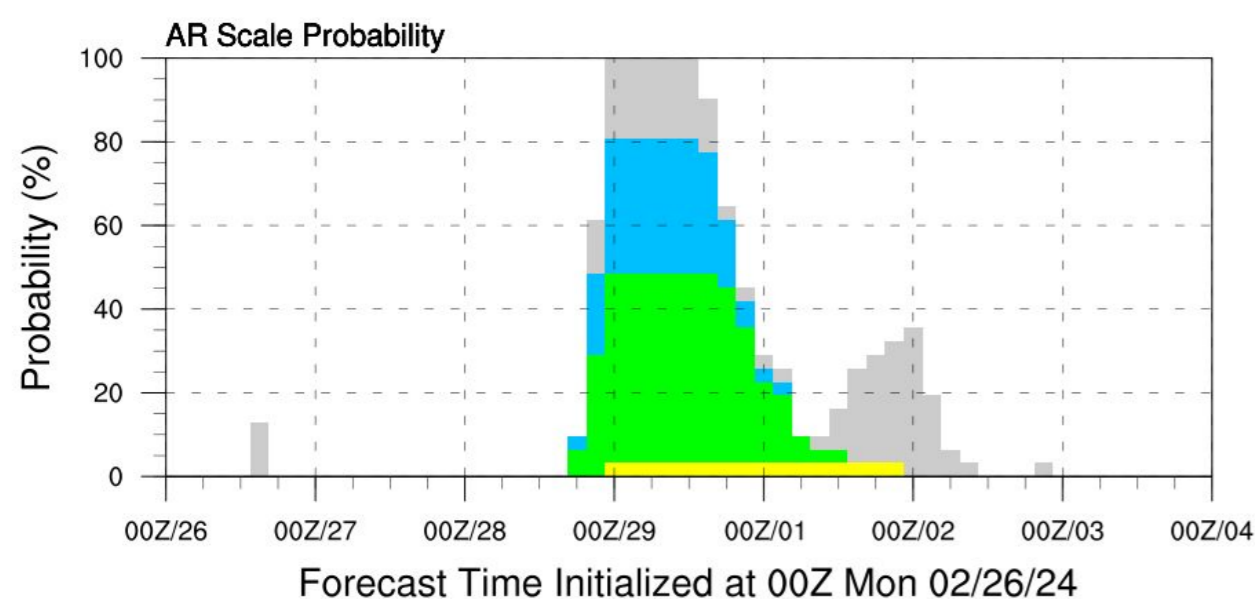


ECMWF Ensemble Initialized: 00Z Mon 02/26/24



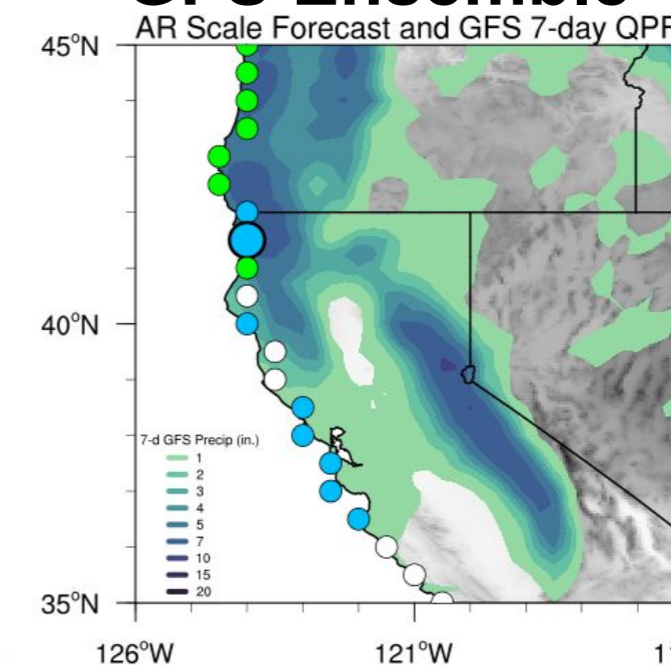
Categorical AR Strength by Ralph/CW3E

Categorical AR Strength by Ralph/CW3E

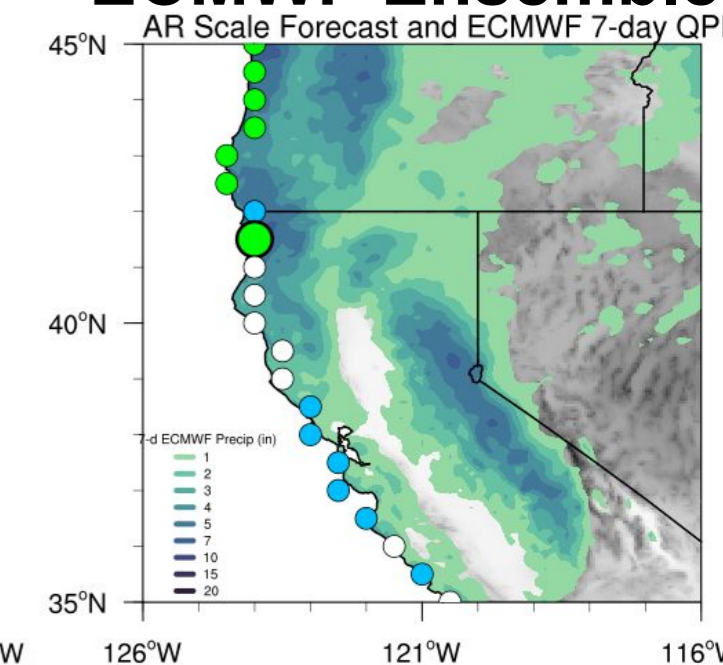


- 15/31 (48%) **GEFS ensemble members** are forecasting at least **AR2** conditions at this location.
- 14/51 (28%) **EPS ensemble members** are forecasting **AR2** conditions at this location.
- Both ensembles are less confident in the AR Scale in N. CA.

GFS Ensemble

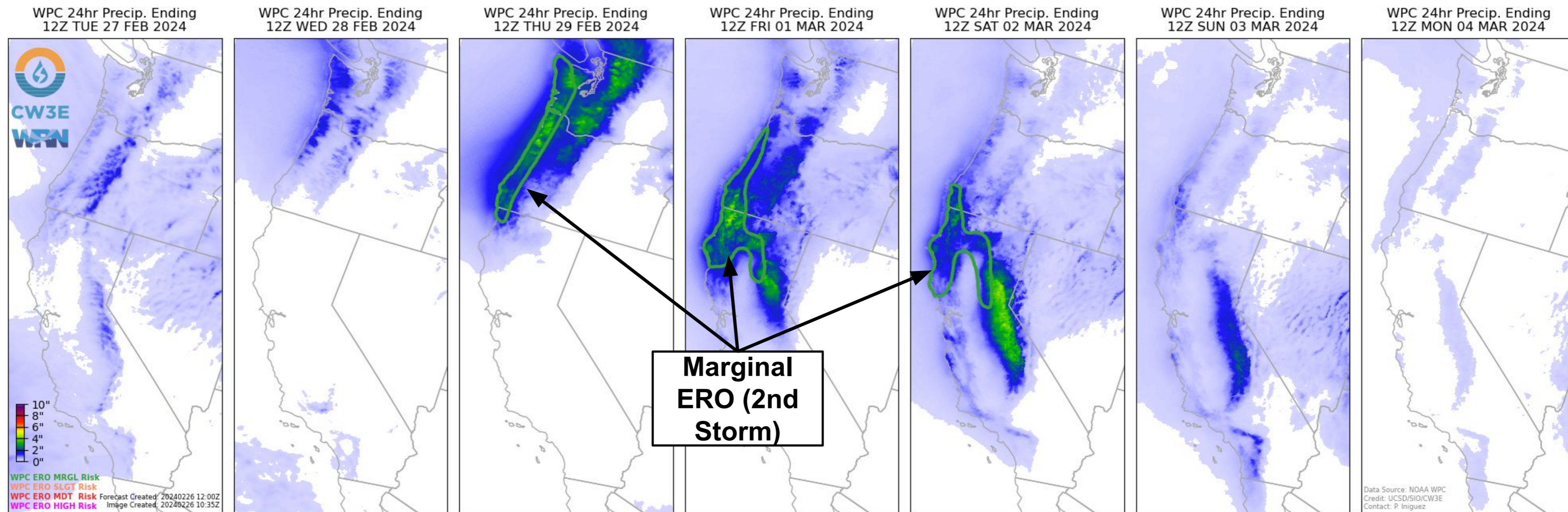


ECMWF Ensemble



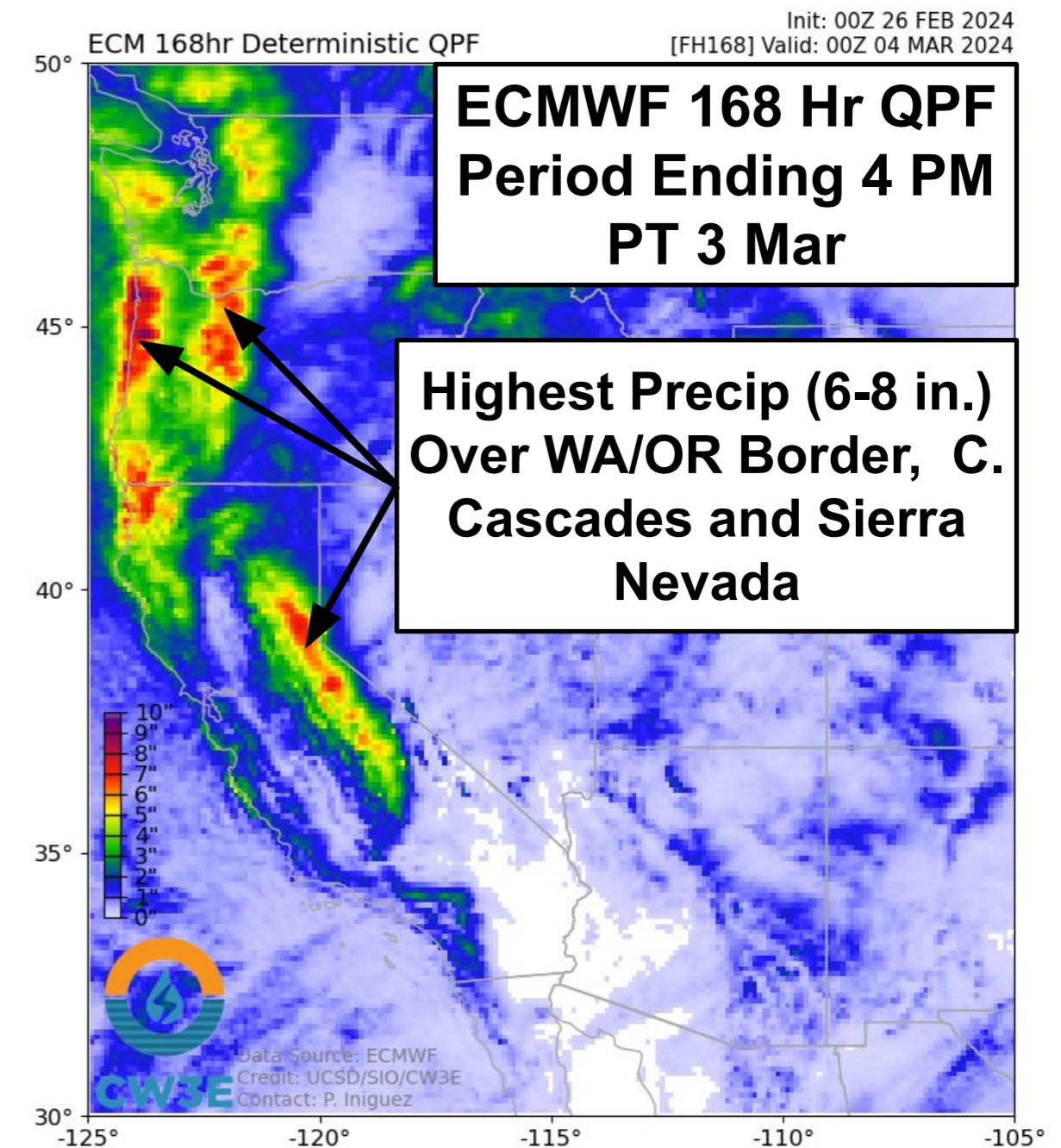
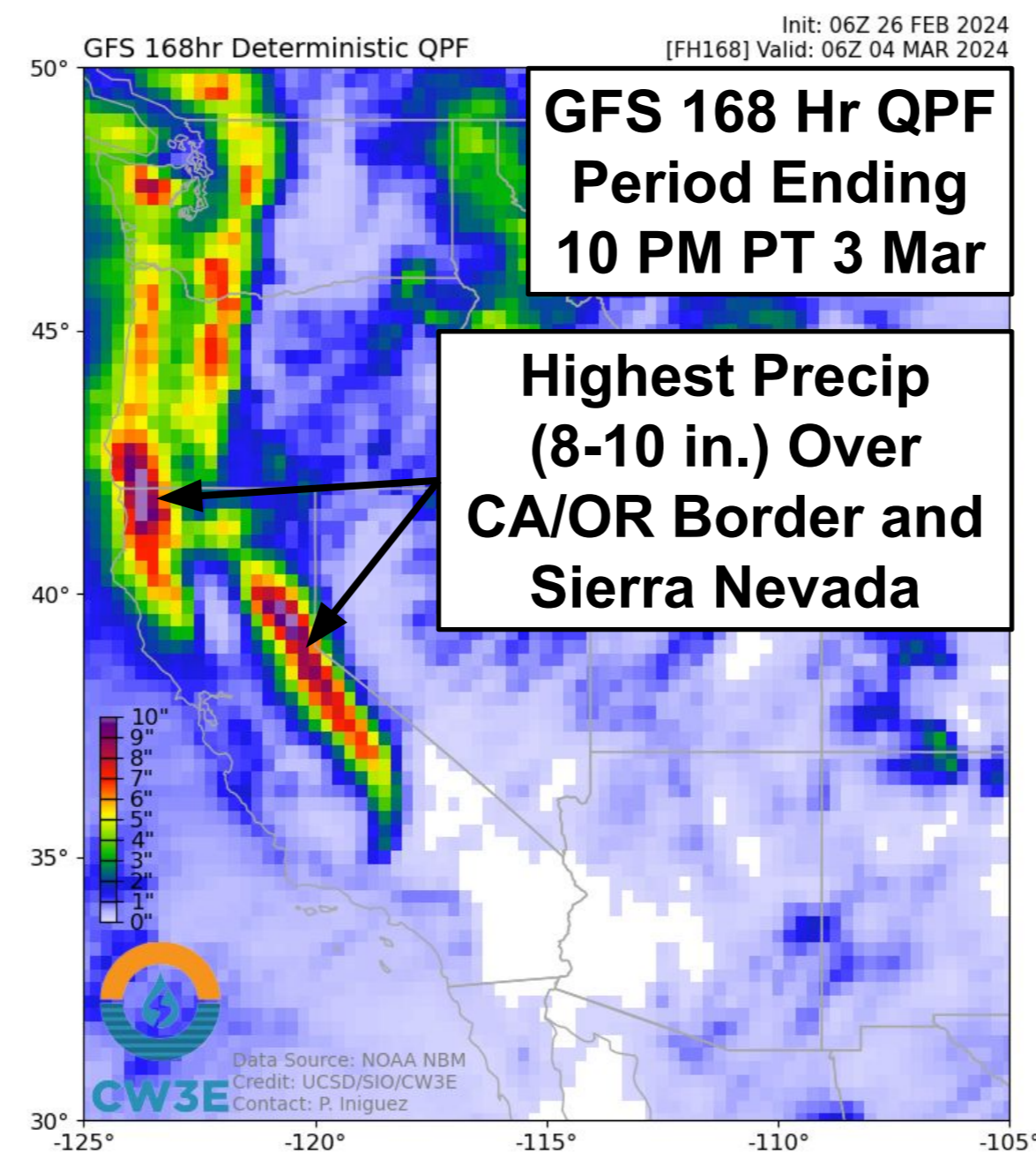
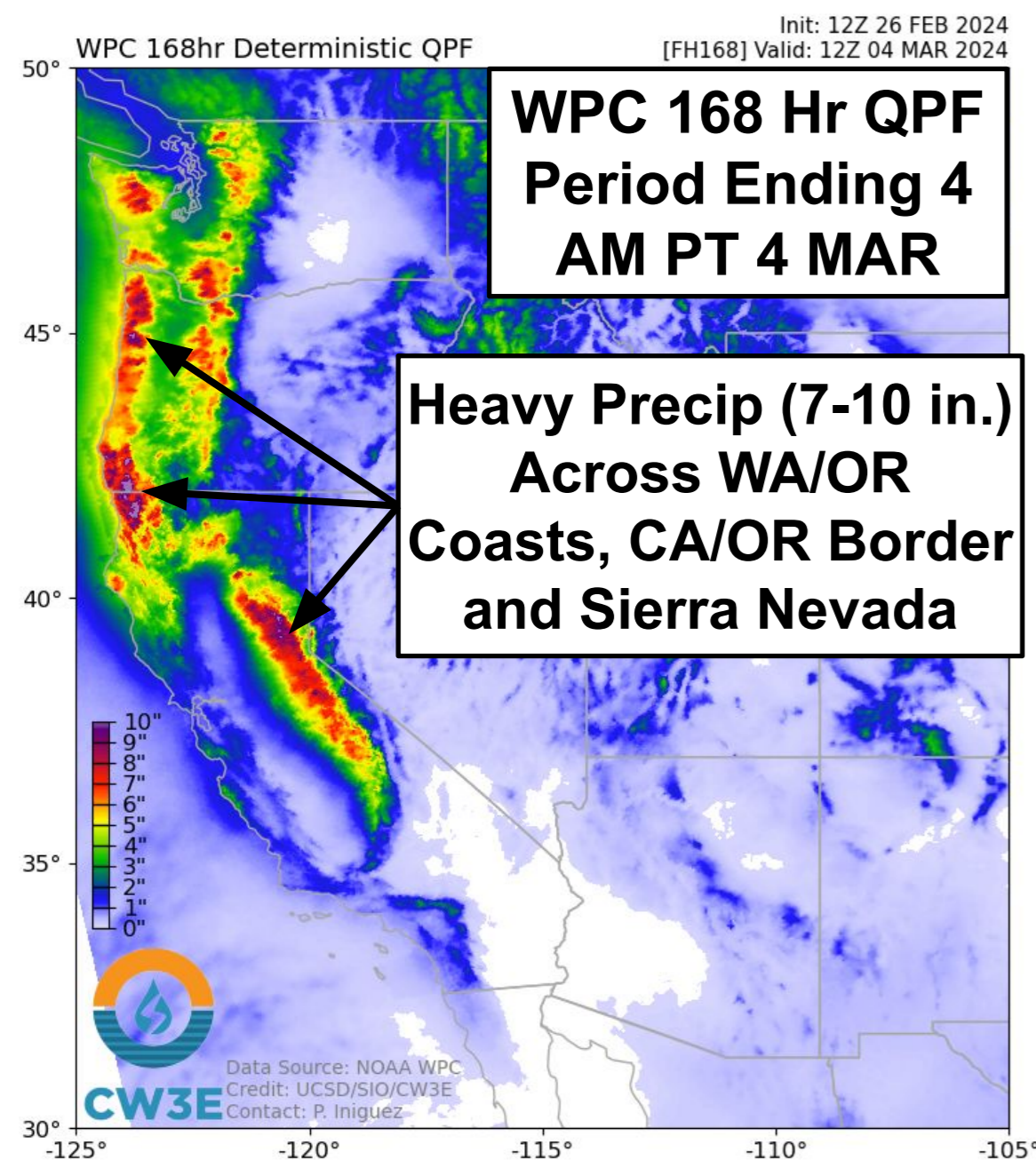
CW3E AR Outlook: 26 Feb 2024

*Excessive Rain Outlook (ERO)



- The WPC is forecasting the heaviest precipitation over the PNW, N. CA, and the Sierra Nevada (1-4 in. per day).
- A Marginal Risk (level 1 of 4, or at least 5% chance) for flash flooding is forecast by WPC for the WPC along the coastal mountains of Washington, Oregon, and Northern California and in the northern Sierra Nevada and the N. Sierra Nevada foothills at times from 4 AM PT Wed 28 Feb through 4 AM PT Sat 2 Mar.

CW3E AR Outlook: 26 Feb 2024

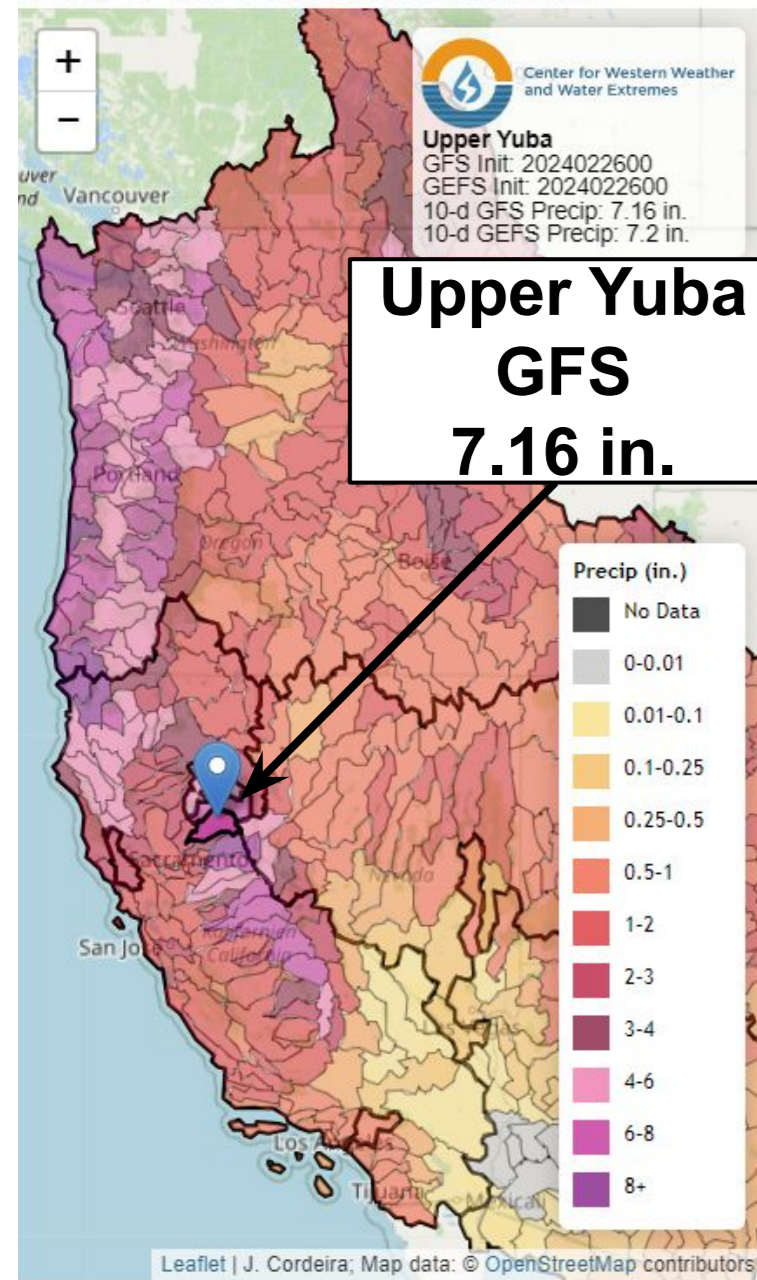


- WPC, GFS and ECMWF are forecasting significant precipitation in CA over the next 7 days, although there is uncertainty between forecast precipitation totals in the Sierra Nevada and along coastal WA/OR/N.CA.
- WPC and GFS are forecasting highest precipitation over the CA/OR border and Sierra Nevada, where both forecasts have regions of precipitation greater than 10 inches over the next 7 days.
- The ECMWF is forecasting the highest 7-day precipitation accumulations over the WA/OR border. ECMWF's forecast precipitation totals over the CA/OR border and the Sierra Nevada are much less than that of the WPC and GFS.

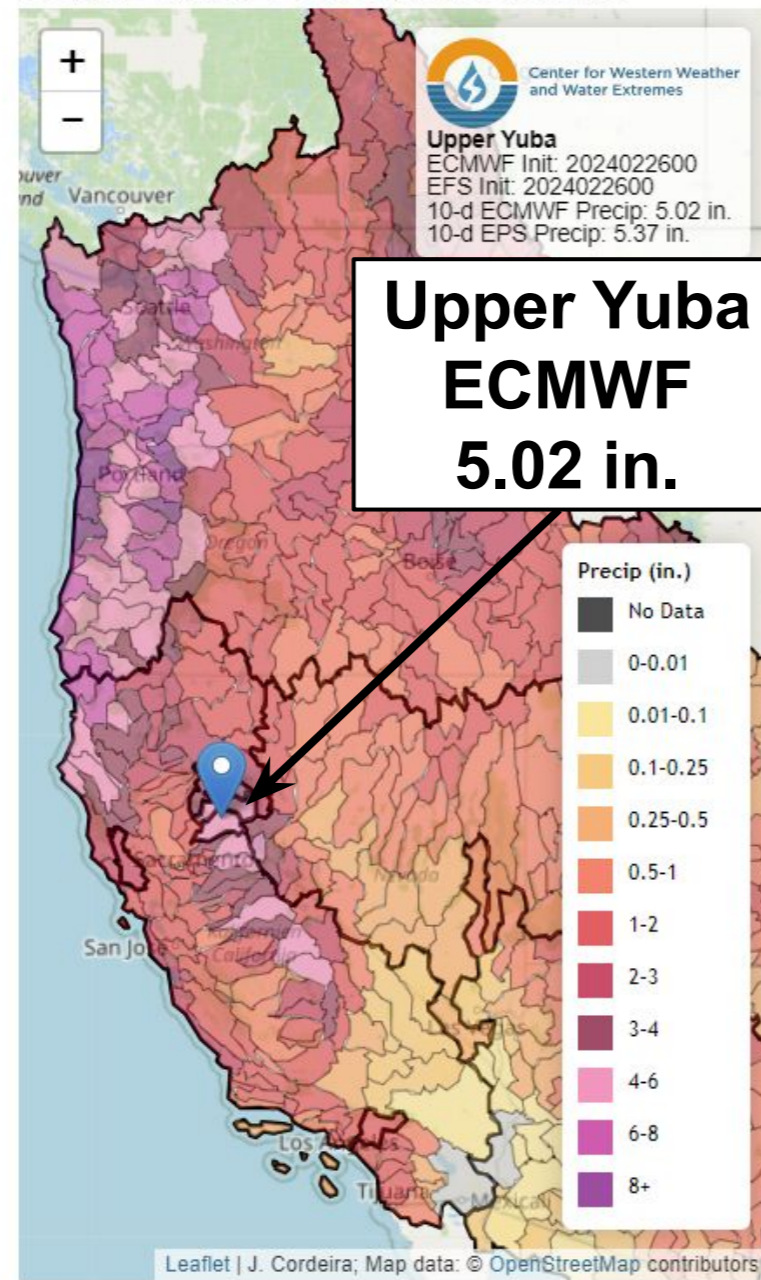
CW3E AR Outlook: 26 Feb 2024

10-day Watershed Precipitation Forecasts (Initialized 00Z 26 Feb)

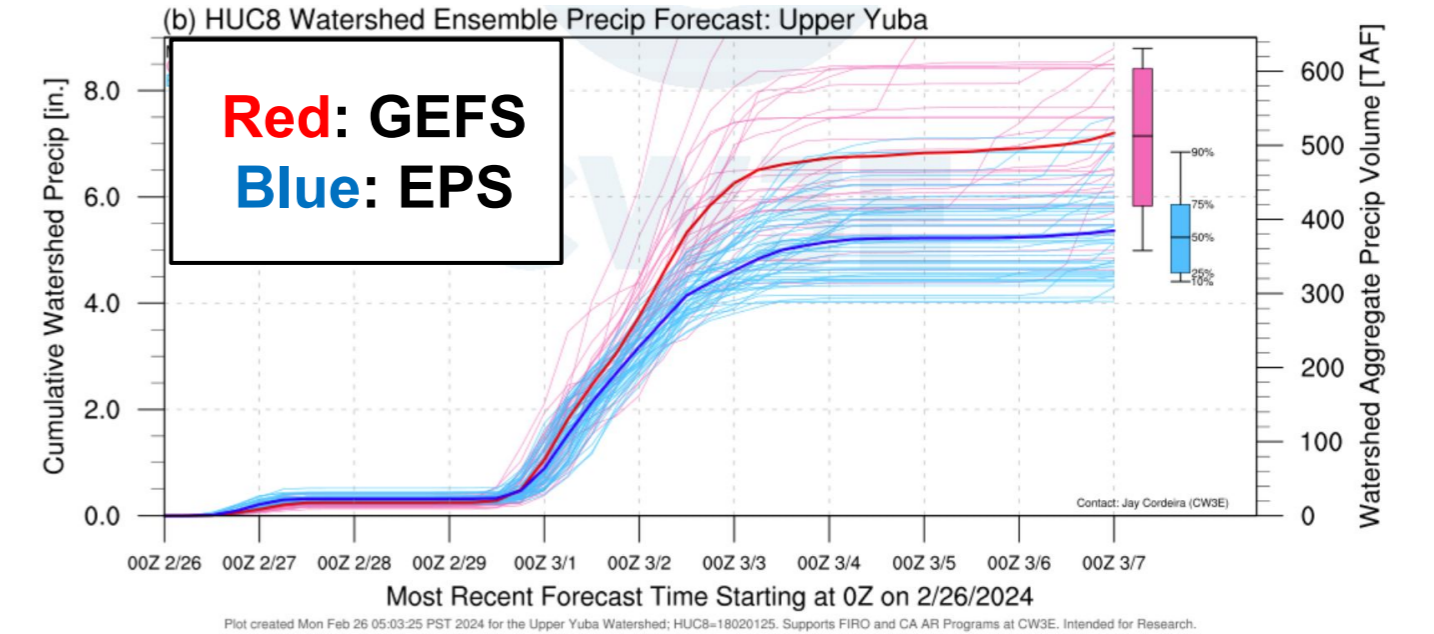
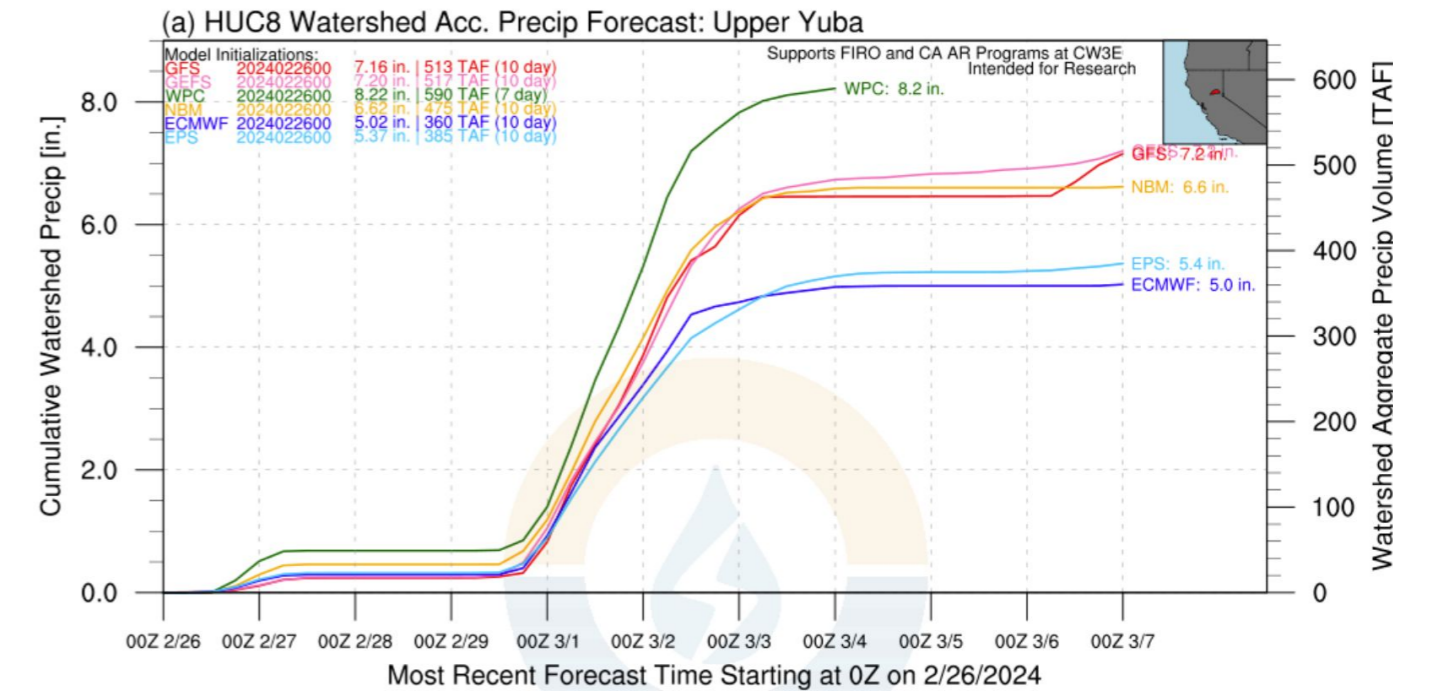
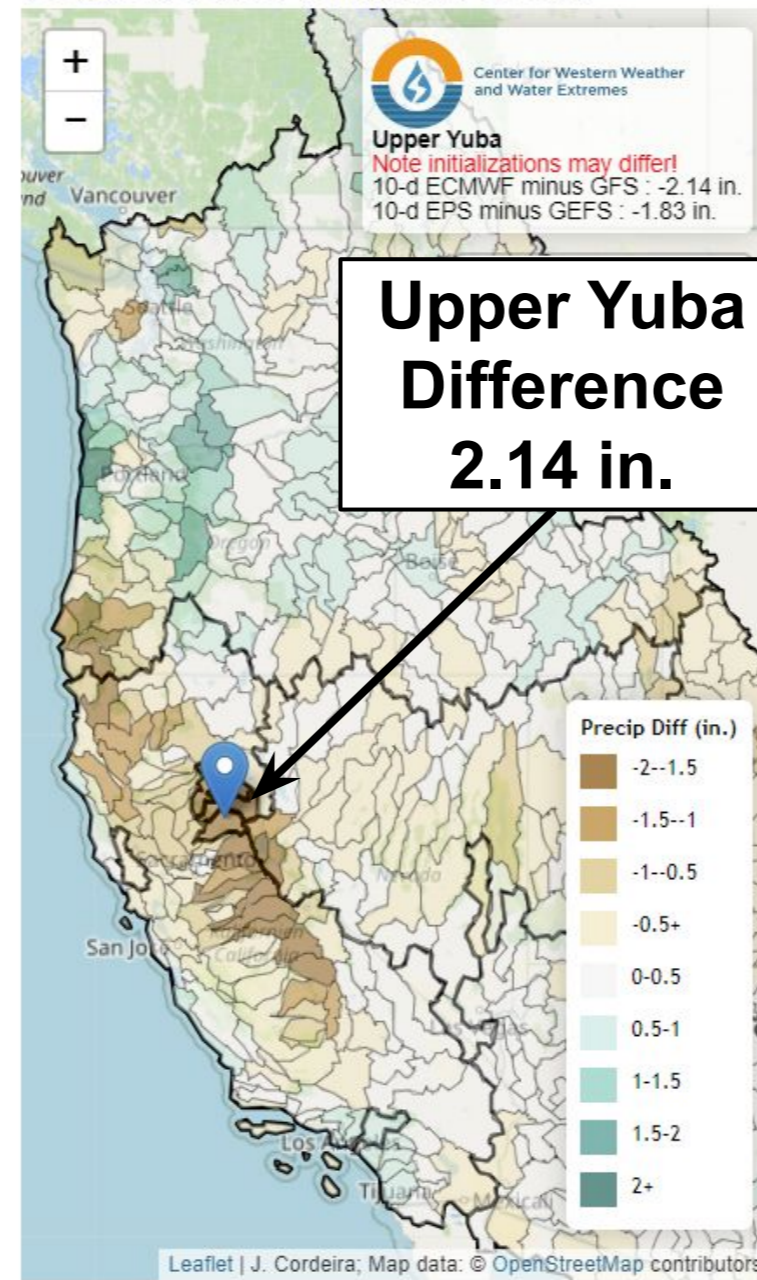
10-day GFS/GEFS Precipitation Forecasts



10-day ECMWF/EFS Precipitation Forecast



10-day Difference Precipitation Forecast

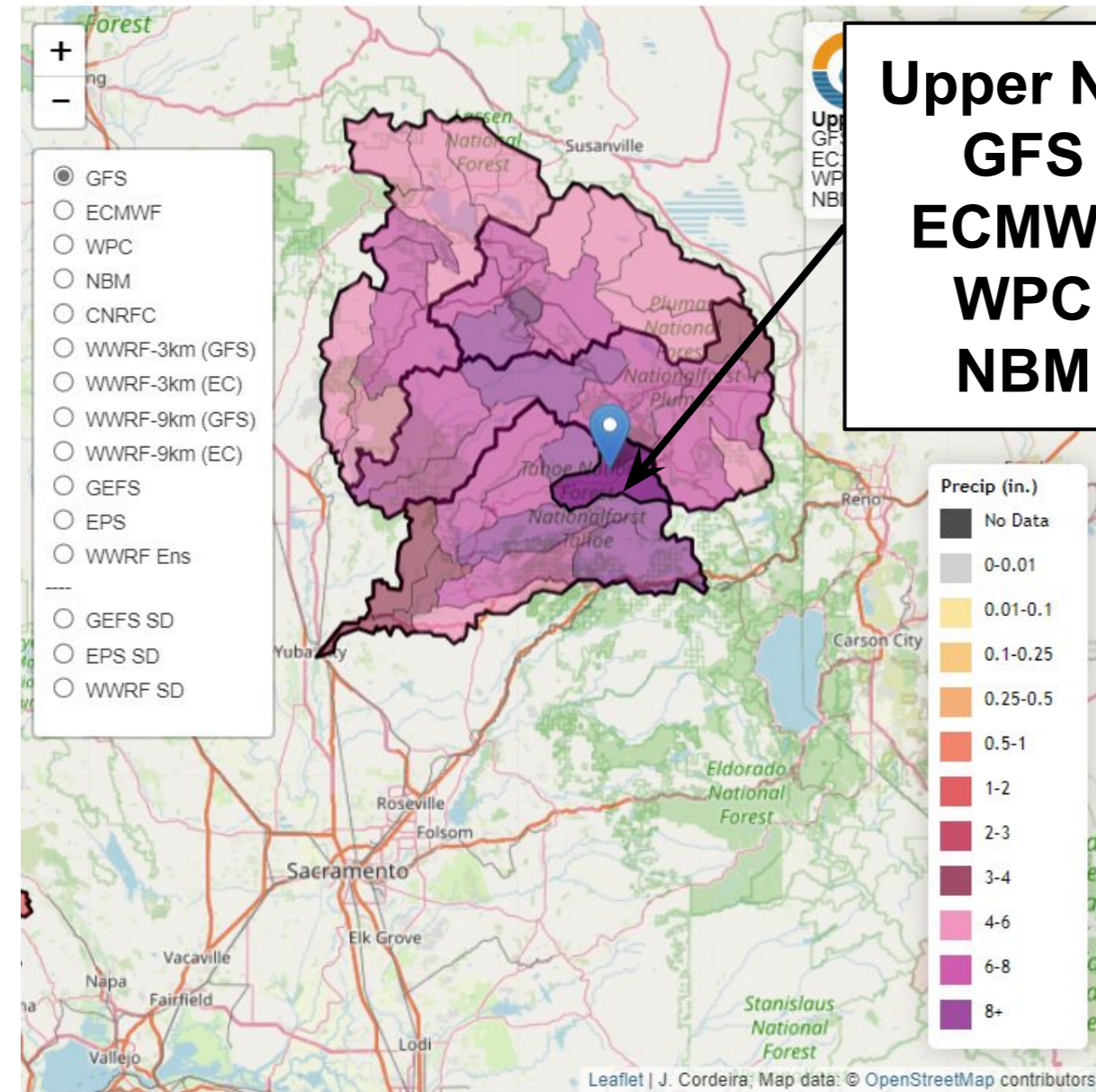


- The 00Z GFS and 00Z ECMWF 10-day watershed precipitation totals vary for CA, where the GFS is forecasting greater precipitation in the Sierra Nevada and N. CA watersheds and the ECMWF is greater for Cascade and WA/OR border watersheds.
- The 00Z GFS is forecasting 7.16 in. of mean areal precipitation in the Upper Yuba River watershed over the next 10 days, while the 00Z ECMWF is forecasting 5.02 in.. The GEFS is showing more uncertainty in 10 day totals than the EPS.

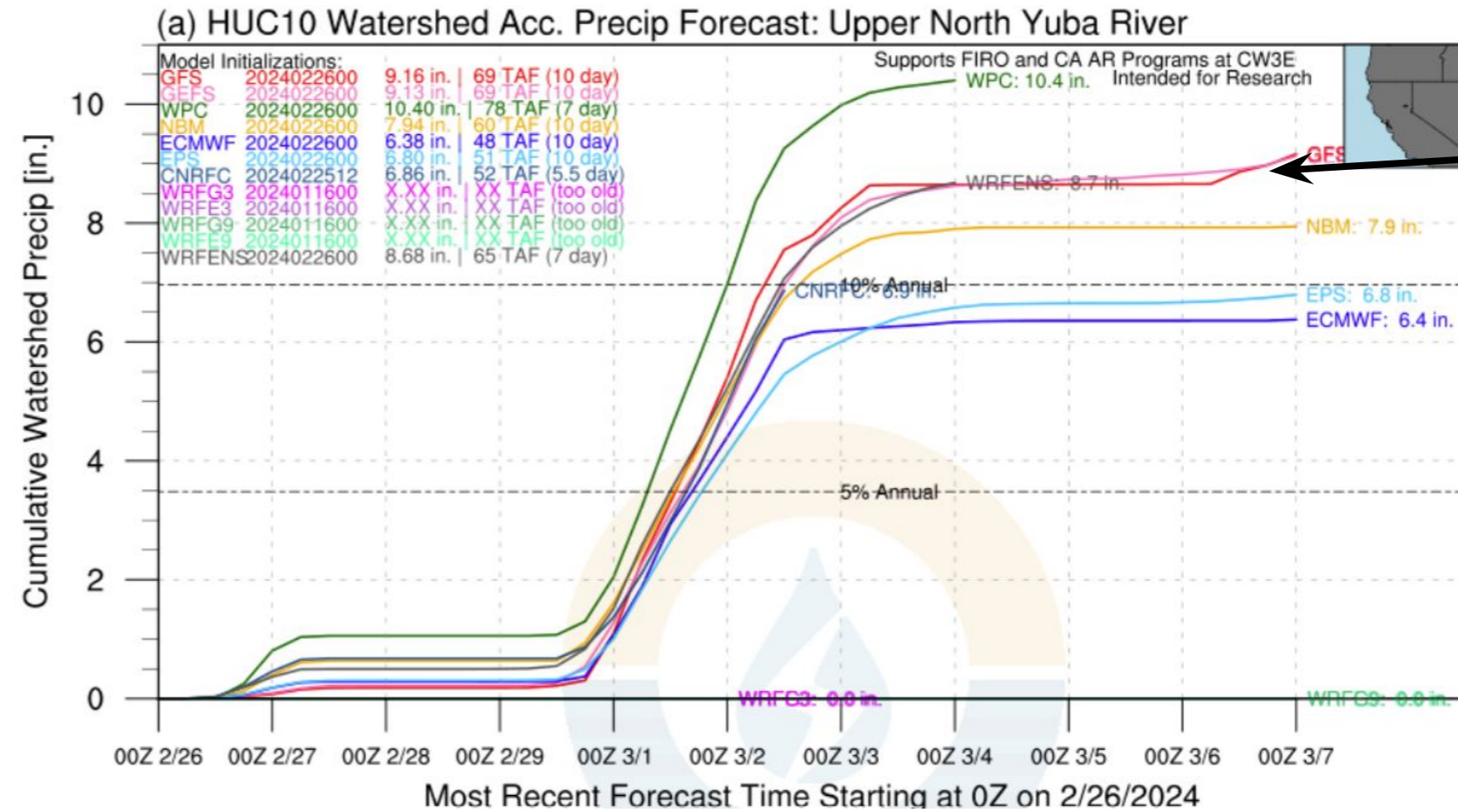
CW3E AR Outlook: 26 Feb 2024

10-day Watershed Precipitation Forecasts (Initialized 00Z 26 Feb)

10-day Model Precipitation Forecasts



Upper North Yuba
GFS 9.16 in.
ECMWF 6.36 in.
WPC 10.4 in.
NBM 7.94 in.

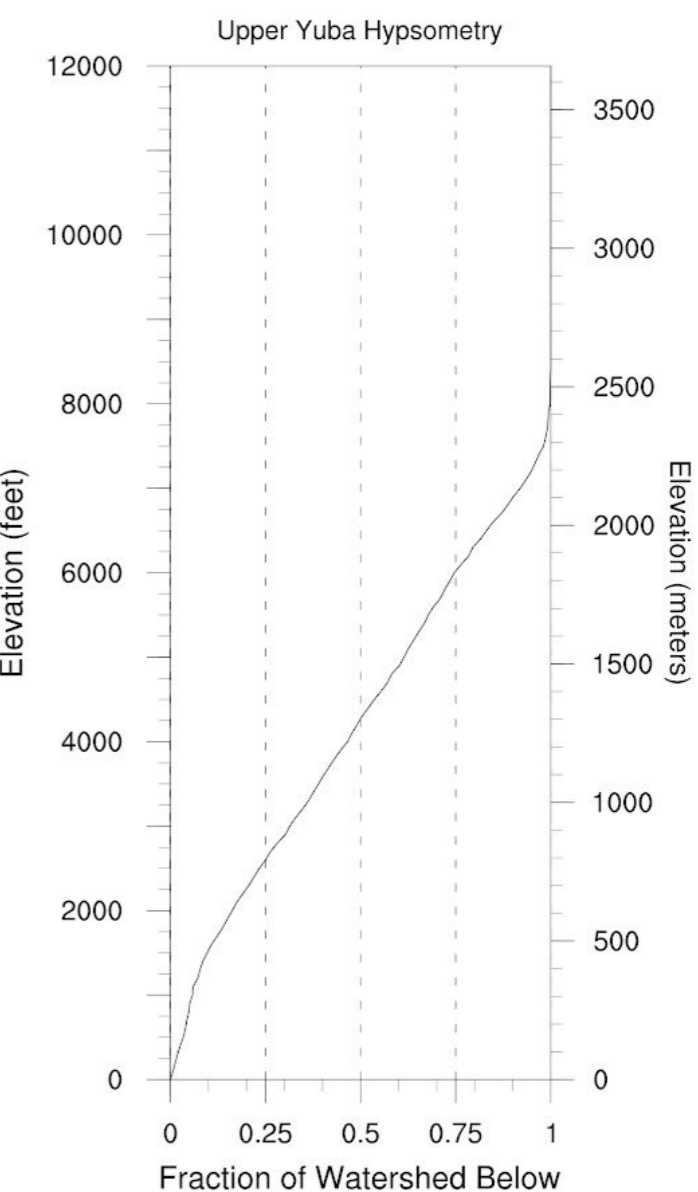
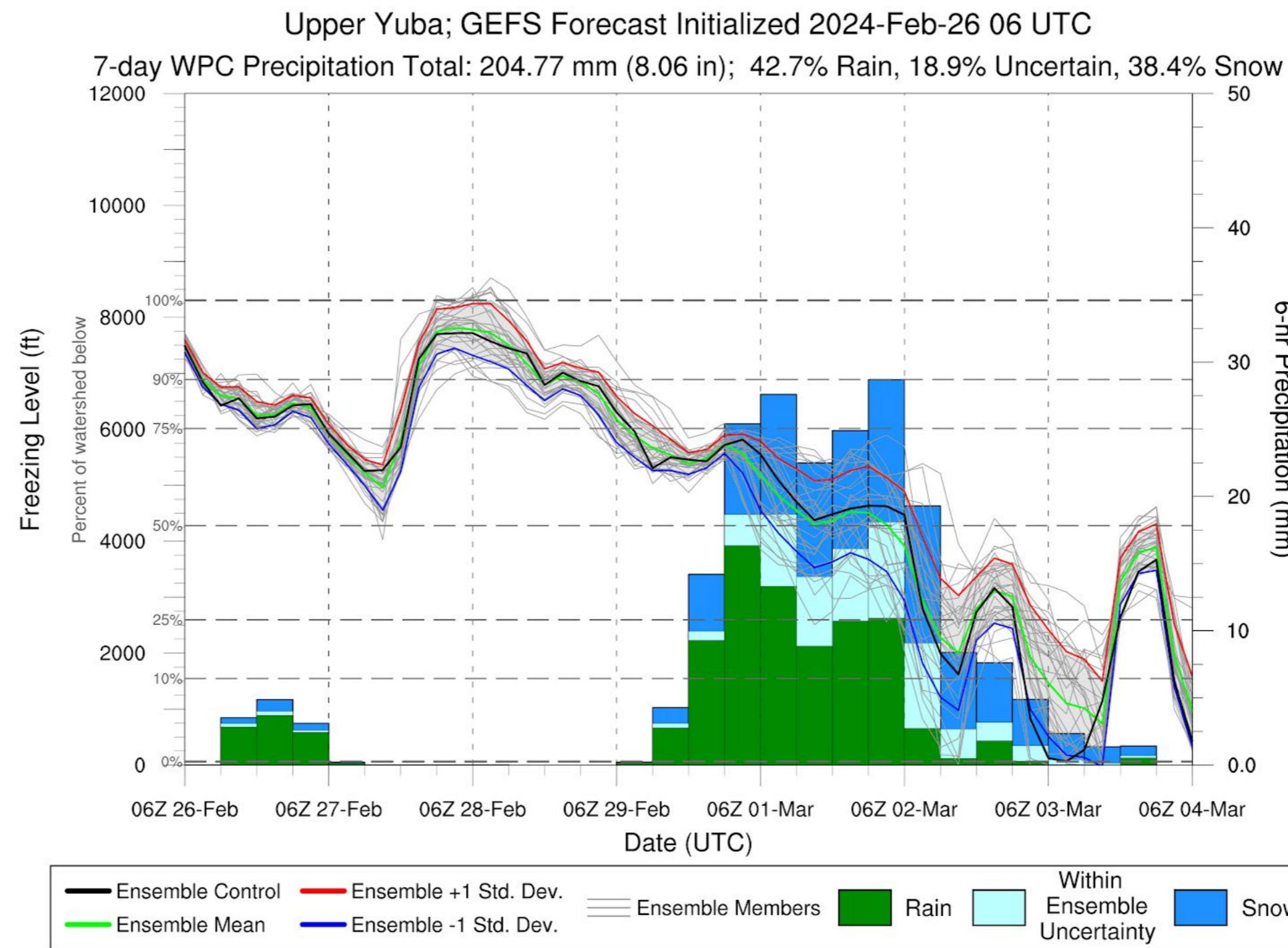
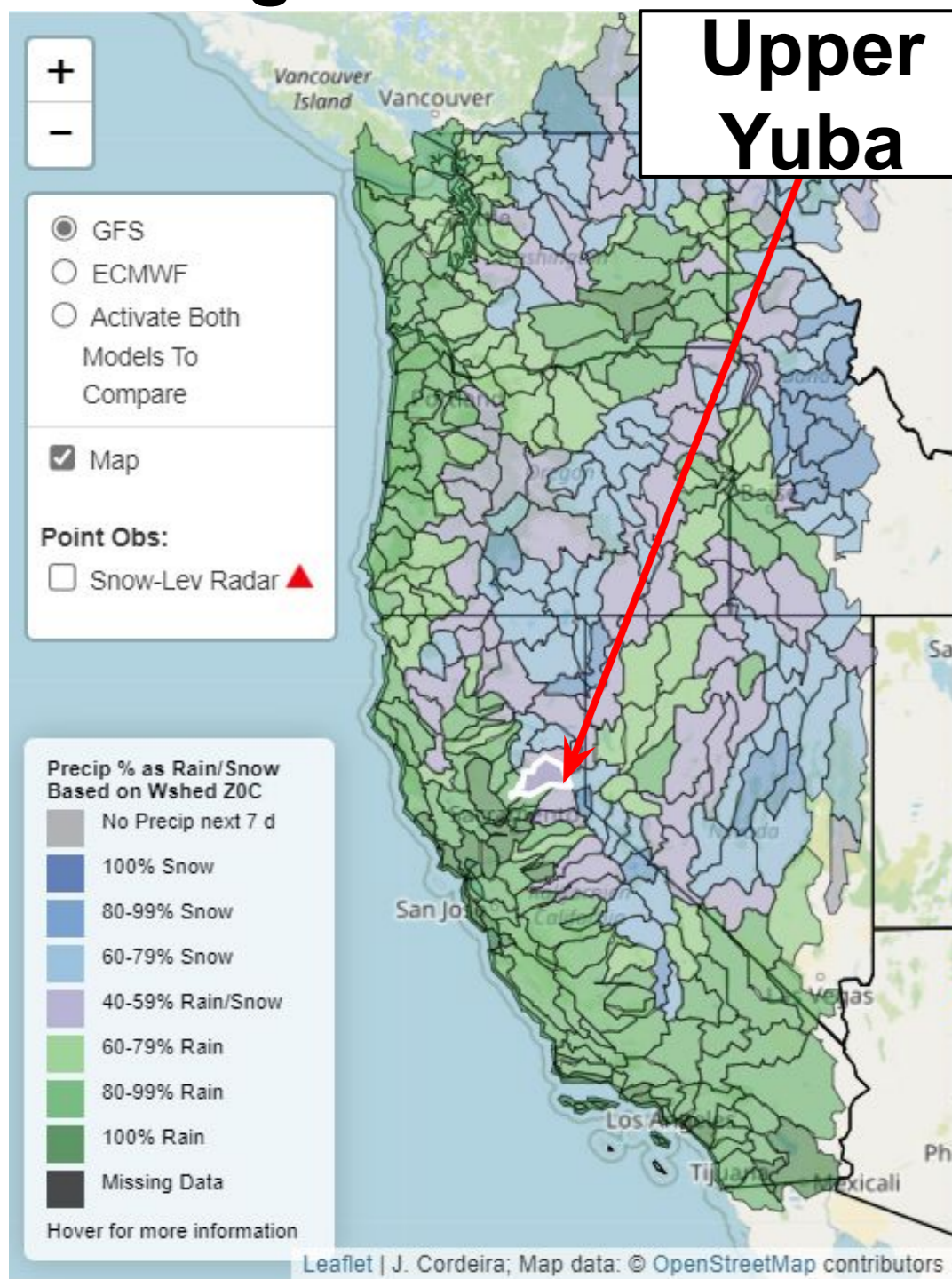


WPC, GFS, NBM, & WRFENS 10-Day Precipitation Above 10% of Annual Precip

- The forecast precipitation in the Upper North Yuba sub-basin is forecast to be significant in all models.
- The WPC (10.4 in.), GFS (9.16 in.), NBM (7.94 in.) and WRFENS (8.68 in.) 10-day precipitation forecasts are all above 10% of the annual precipitation in the Upper North Yuba sub-basin.

CW3E AR Outlook: 26 Feb 2024

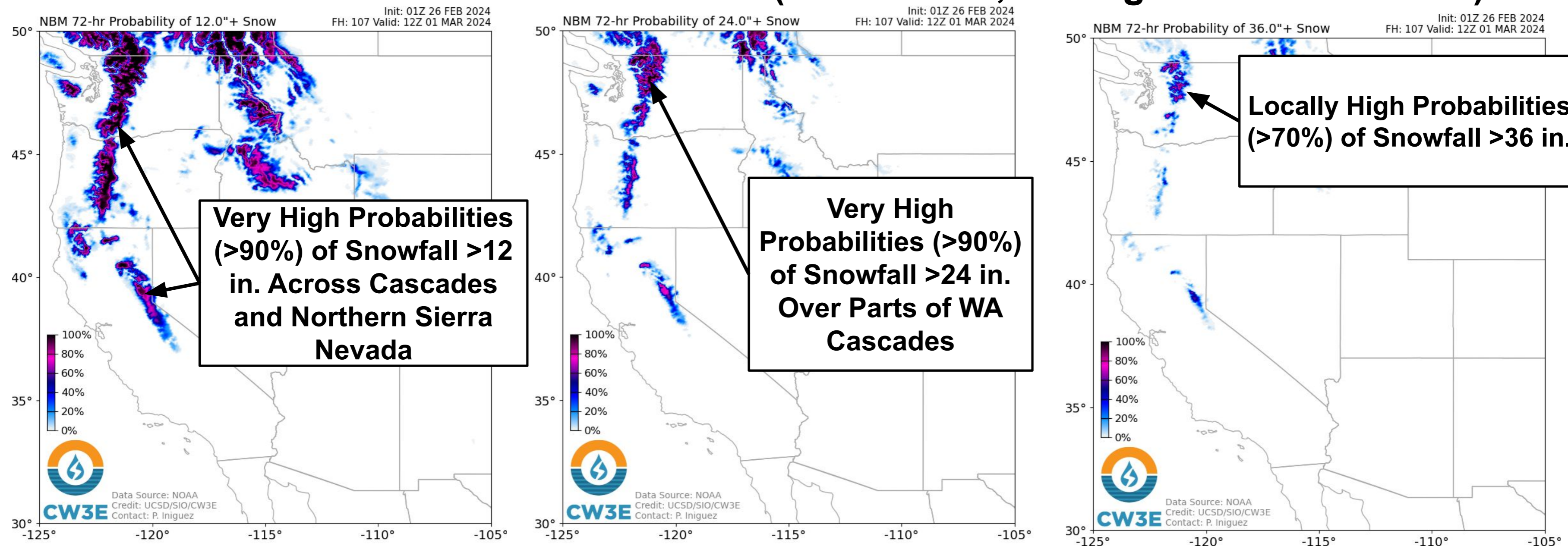
Freezing Level Forecast



- The freezing level is forecast to drop from ~8000 to ~0 feet above Mean Sea Level (MSL) in the Upper Yuba watershed.
- There is some uncertainty amongst GEFS ensemble members in the forecast precipitation type; 42.7% of forecast precipitation forecast to fall as rain, with 38.4% forecast as snow.

CW3E AR Outlook: 26 Feb 2024

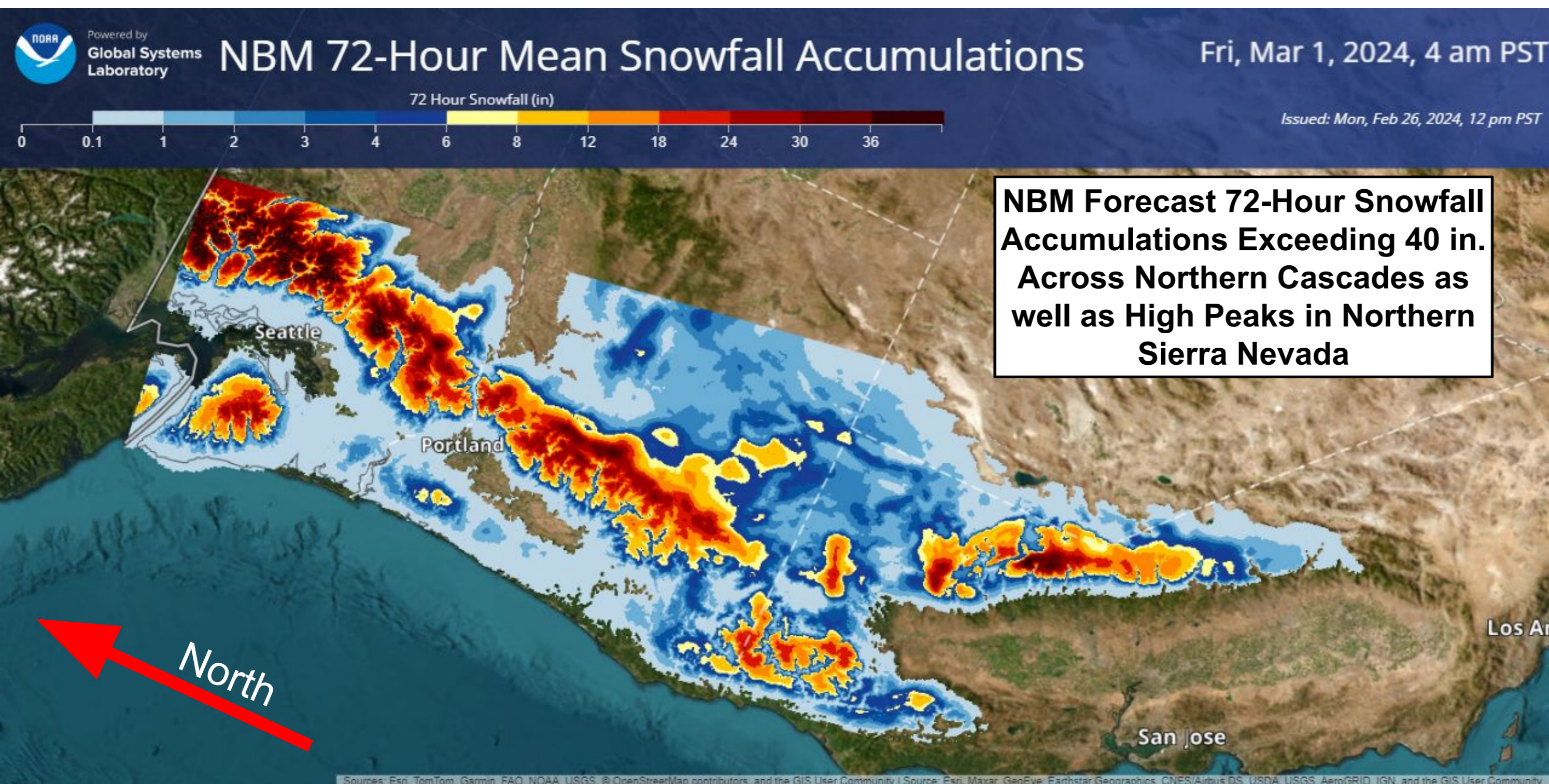
NBM AR Snowfall Accumulation Probabilities (First 72-Hrs, Ending 4 AM PT Fri 1 Mar)



- The first portion of this storm's snowfall with the AR is primarily over the Cascades.
- Currently, the NBM is forecasting very high probabilities (>90%) of 72 hour snowfall accumulations (for period ending 4 PM PT Fri 1 Mar) exceeding 12 in. across much of the Cascades and Northern Sierra Nevada and 24 in.+ for the WA Cascades.
- There are localized regions with high probabilities (>70%) of snowfall accumulations exceeding 36 + in. in the WA Cascades.

CW3E AR Outlook: 26 Feb 2024

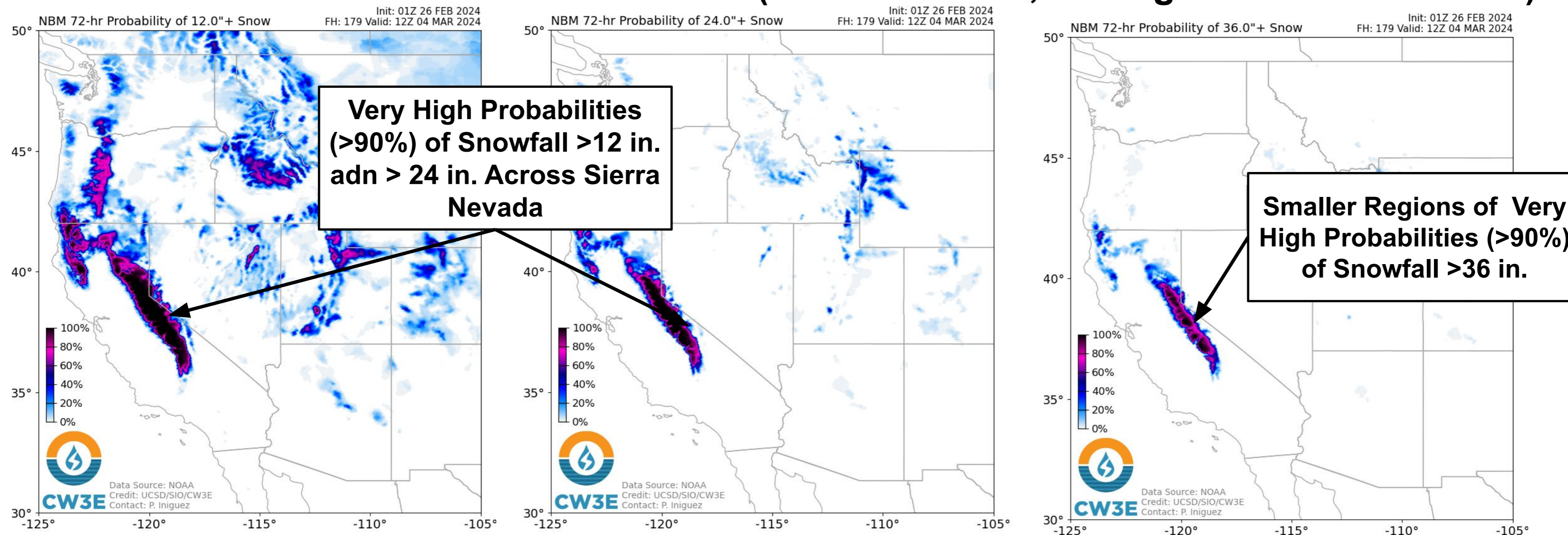
NBM AR Snowfall Accumulation Totals (First 72-Hrs, Ending 4 AM PT Fri 1 Mar)



- NBM forecast snowfall accumulations for the first 72 hours showcase wide spread snowfall and significant mountain snow with the AR.
- Mountain snow totals are forecast to exceed 36 inches in the Cascades and over the northern Sierra Nevada. Snowfall totals over 40 inches along the highest peaks are forecast in both the WA Cascades and Northern Sierra Nevada.
- With this period, there is also large regions of low-level snowfall, with regions of 1-6 inches throughout WA, OR and CA.

CW3E AR Outlook: 26 Feb 2024

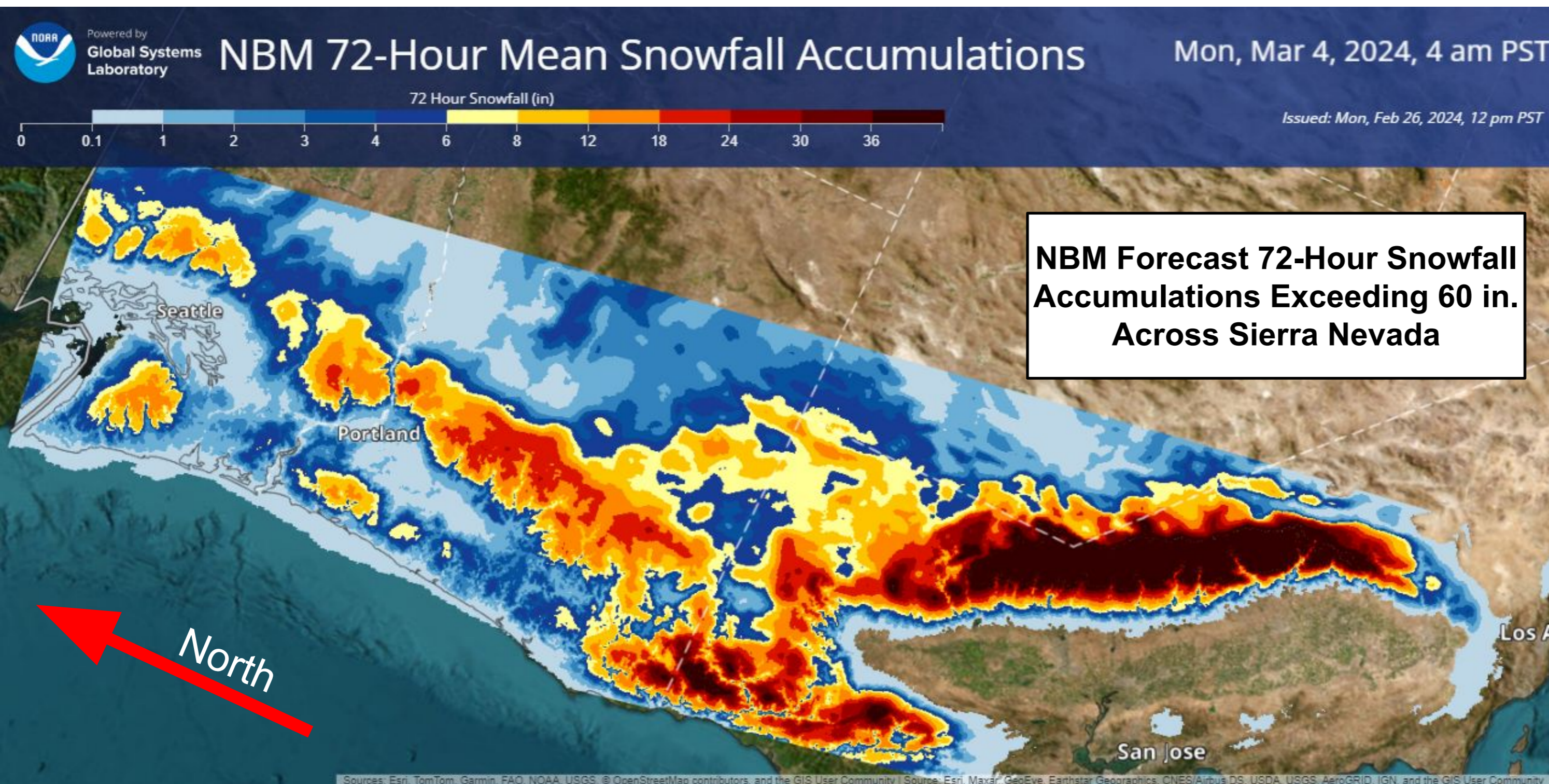
NBM AR Snowfall Accumulation Probabilities (Second 72-Hrs, Ending 4 AM PT Mon 4 Mar)



- The second portion of the storm's snowfall is associated with the second pulse of IVT, surface low pressure and mid-level trough over the USWC.
- Currently, the NBM is forecasting very high probabilities (>90%) of 72 hour snowfall accumulations (for period ending 4 PM PT Mon 4 Mar) exceeding 24 in. across much of the Sierra Nevada and 36 in.+ for smaller regions of the Sierra Nevada.
- The NBM is also high probabilities of snowfall exceeding 12 in. over the OR Cascades.

CW3E AR Outlook: 26 Feb 2024

NBM AR Snowfall Accumulation Totals (Second 72-Hrs, Ending 4 AM PT Mon 4 Mar)



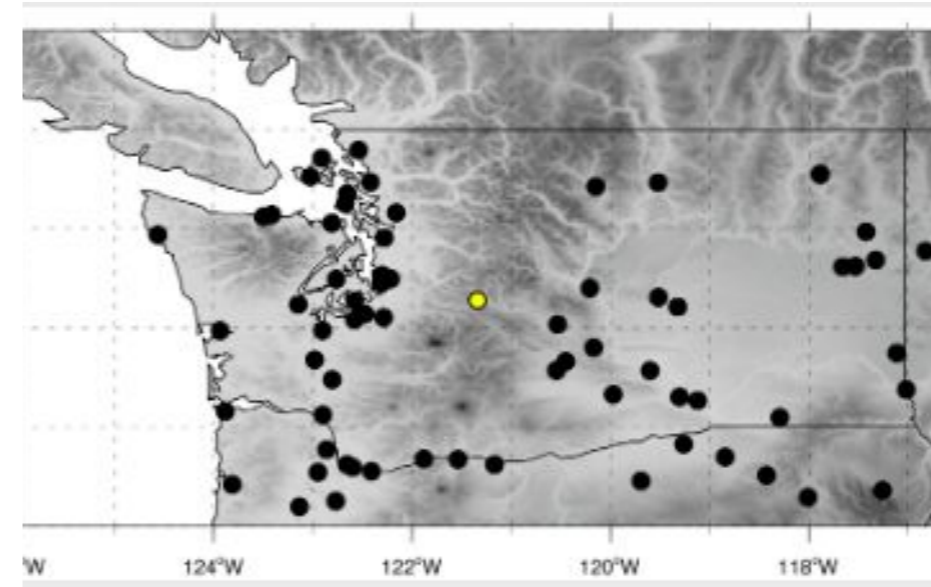
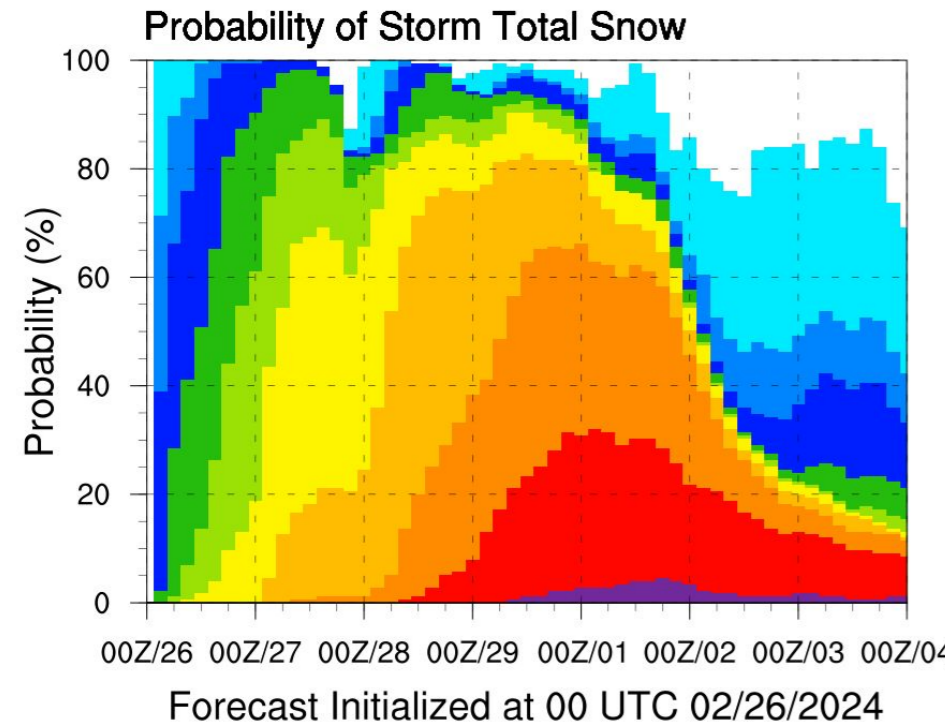
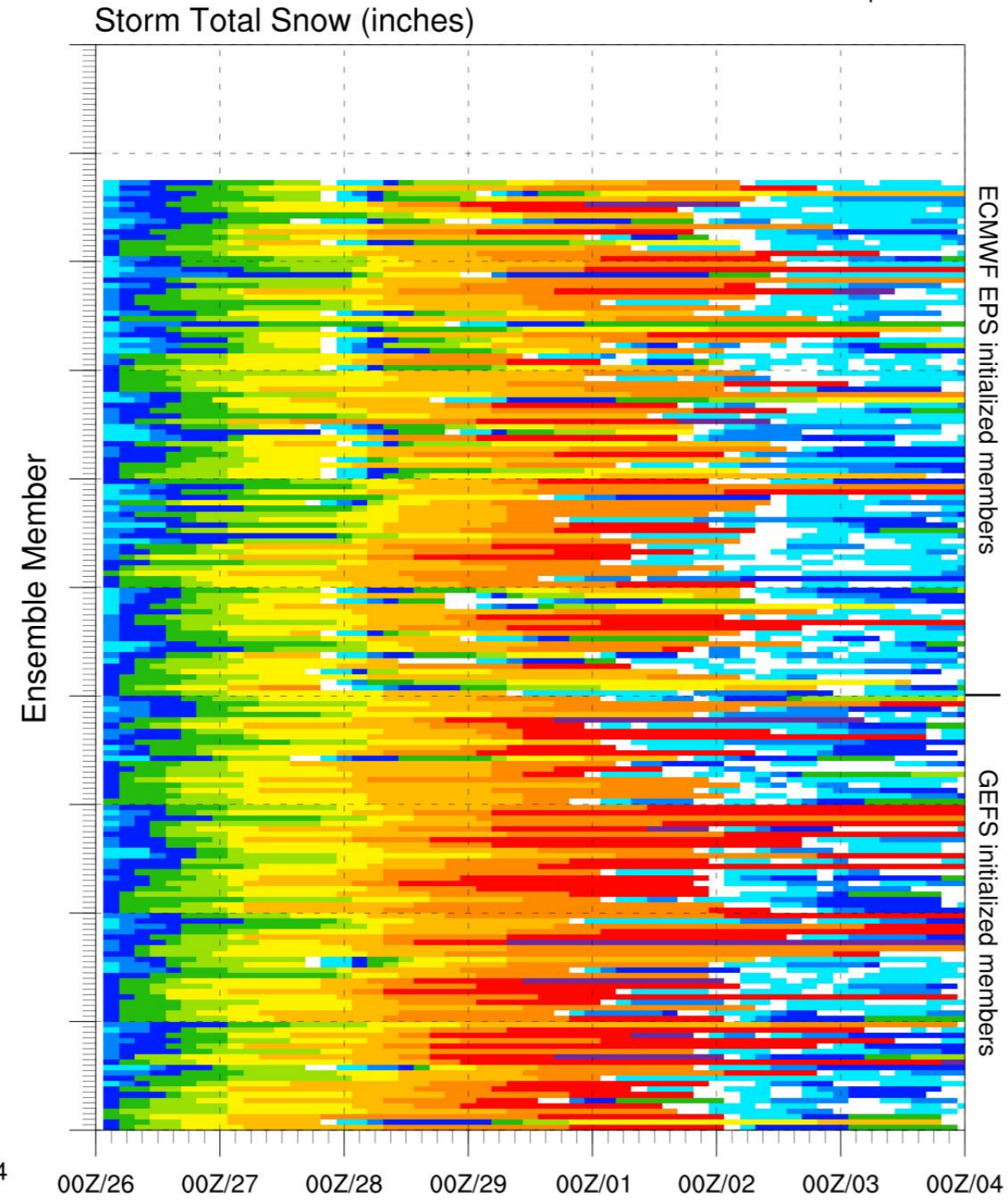
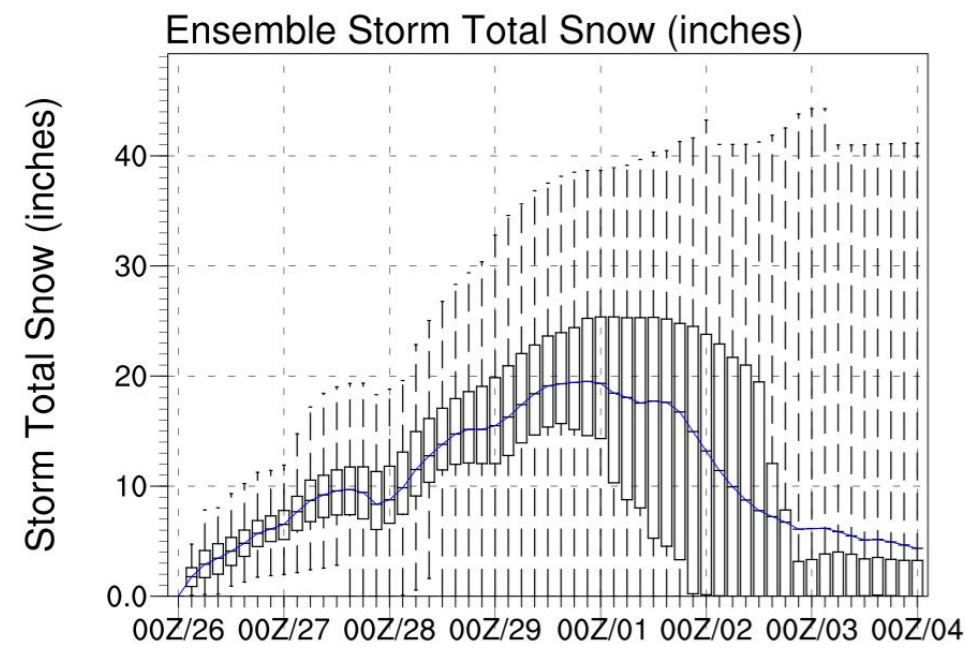
- The second 72-hour period also shows heavy snowfall forecast in the NBM.
- The heaviest snowfall in this period is over the Sierra Nevada, where there are large regions of forecast snowfall totals greater than 60 inches in the highest peaks of the Sierra Nevada, with possibility to exceed 80 inches.
- The OR Cascades are forecast to receive another 20+ in. at the highest elevations during this period.
- With this period, there is also again large regions of low-level snowfall, with regions of 1-6 inches throughout WA, OR and CA.

CW3E AR Outlook: 26 Feb 2024

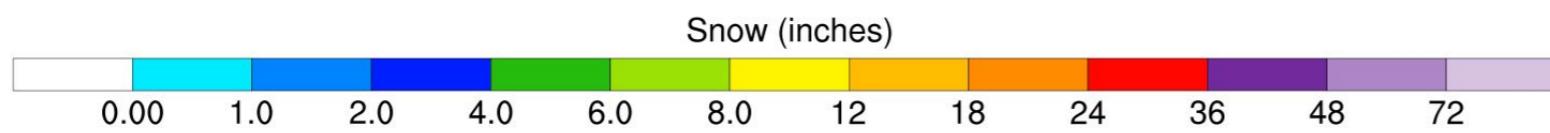
West-WRF Ensemble Meteogram

West-WRF Ensemble Initialized: 00 UTC 02/26/2024

Stampede Pass(Amos) (47.28°N, 121.34°W)
*Experimental



- The West-WRF ensemble produces meteograms showing accumulated precipitation at select locations across the West.
- For this location at Stampede Pass in the WA Cascades, the West-WRF ensemble members are forecasting a ~60% chance of 18"+ of snow. While there is high likelihood of large snowfall totals, large uncertainty remains in high snowfall totals.
- The majority of members (~90%) are forecasting at least 8" of snow, with several (~30%) members forecasting totals greater than 36".

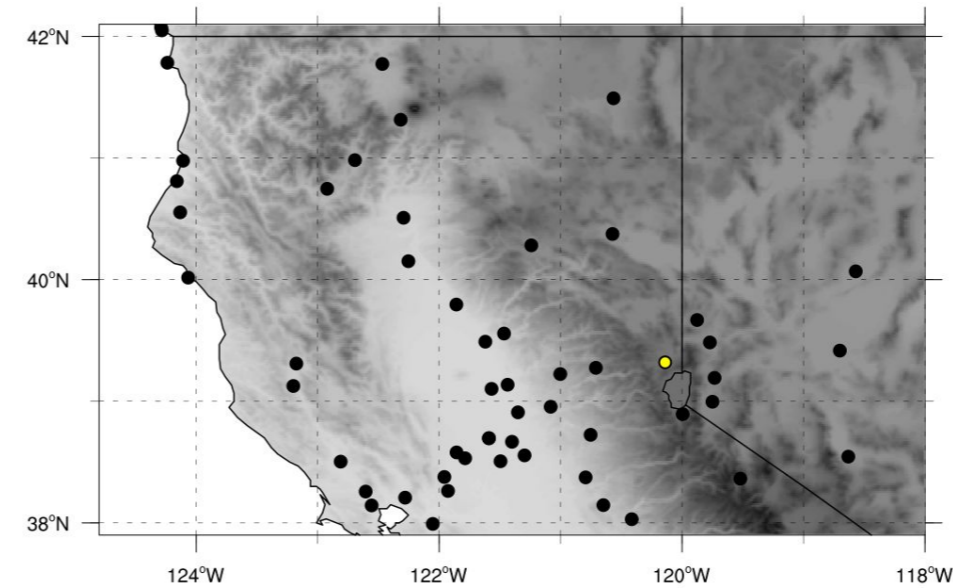
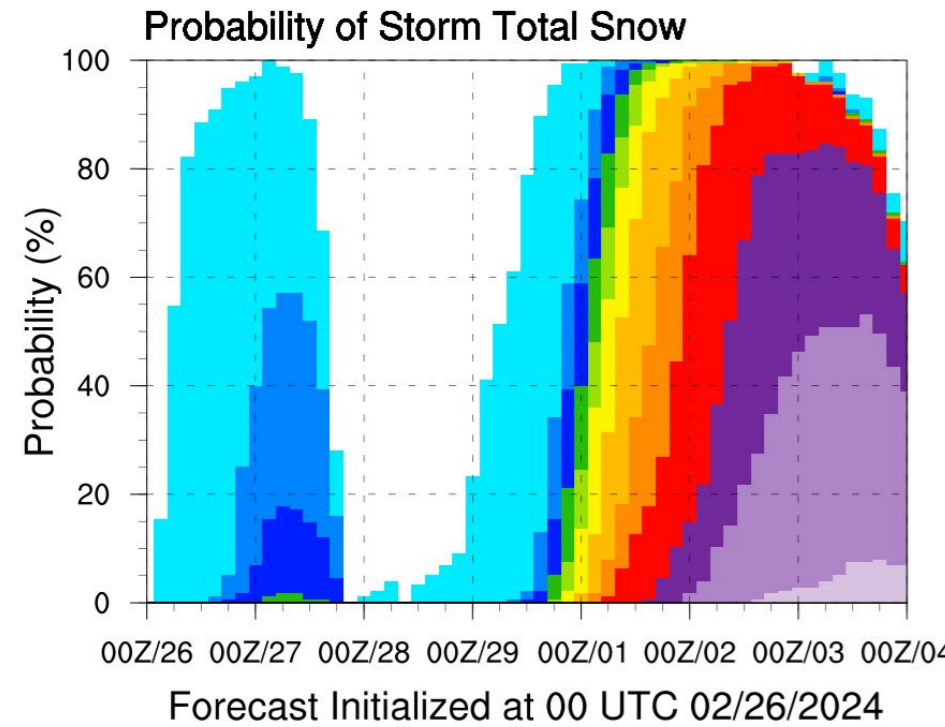
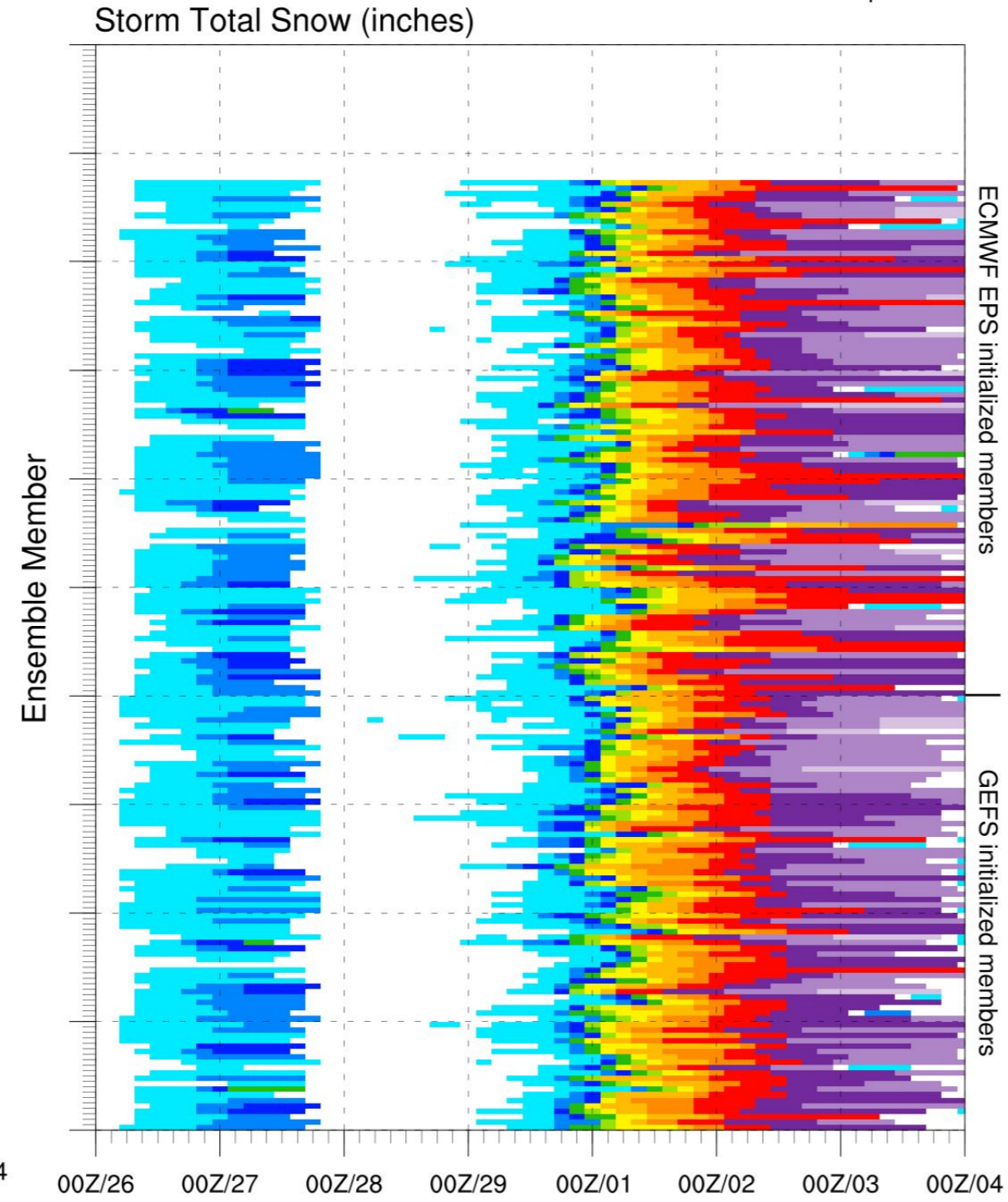
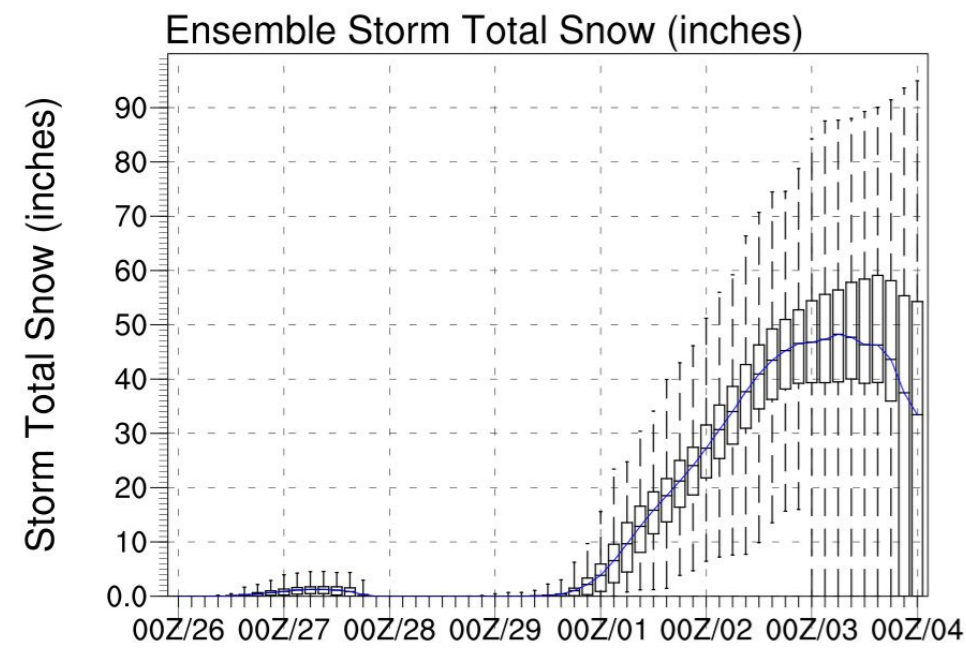


CW3E AR Outlook: 26 Feb 2024

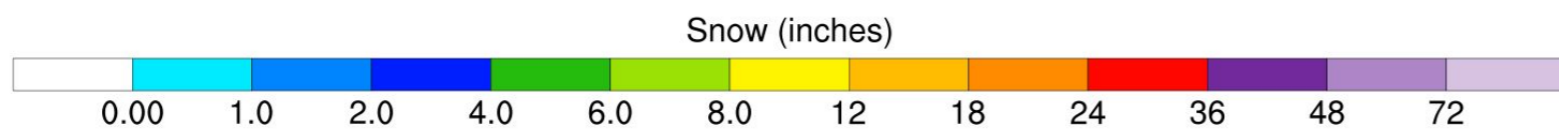
West-WRF Ensemble Meteogram

West-WRF Ensemble Initialized: 00 UTC 02/26/2024

Truckee-Tahoe (39.32°N, 120.14°W)
*Experimental



- For this location at Truckee-Tahoe in the Northern Sierra Nevada, the West-WRF ensemble members are forecasting an ~80% chance of 36"+ of snow. While there is high likelihood of large snowfall totals, large uncertainty remains in high snowfall totals.
- The majority of members are forecasting at least 24" of snow, with several members forecasting totals greater than 72".



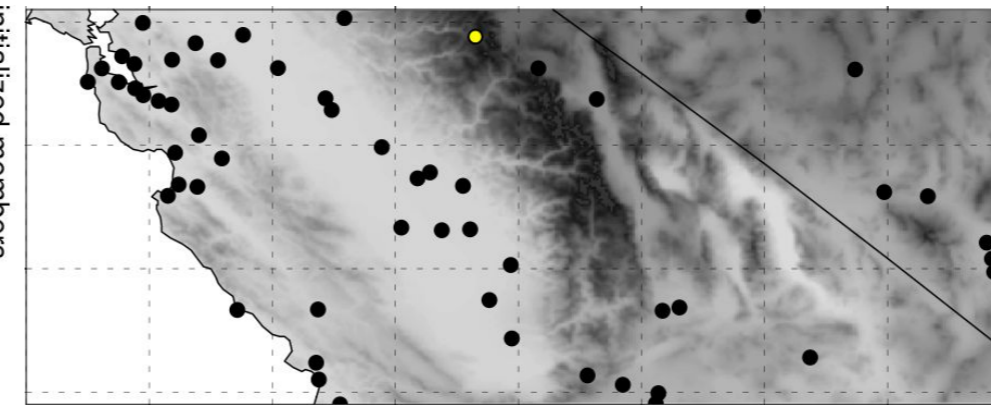
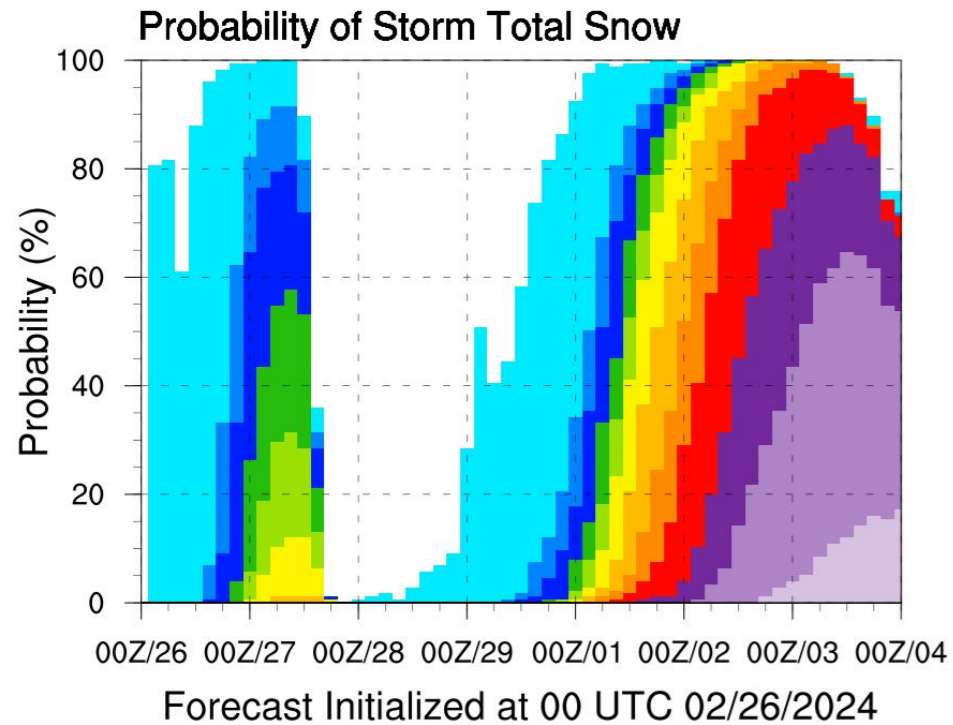
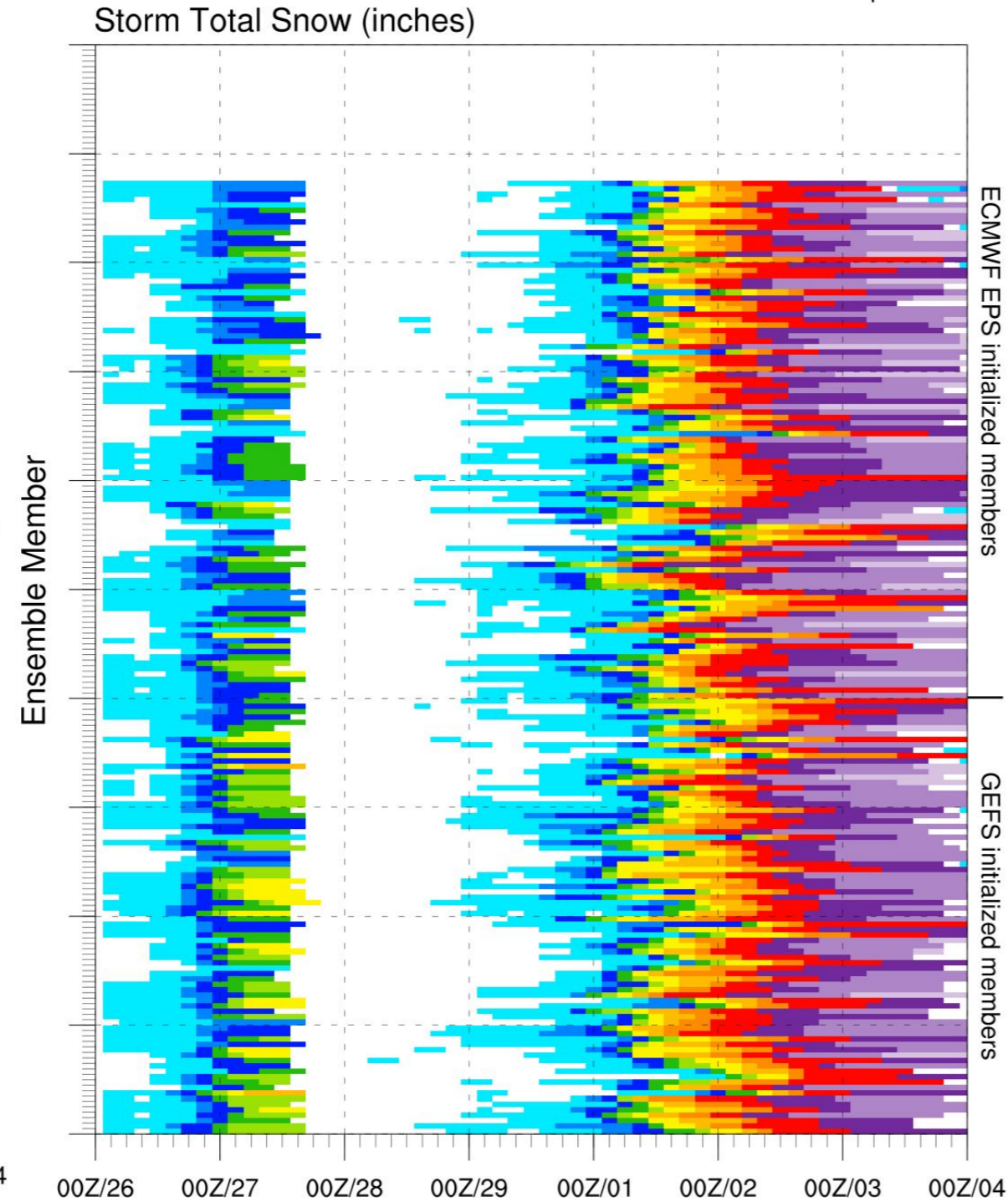
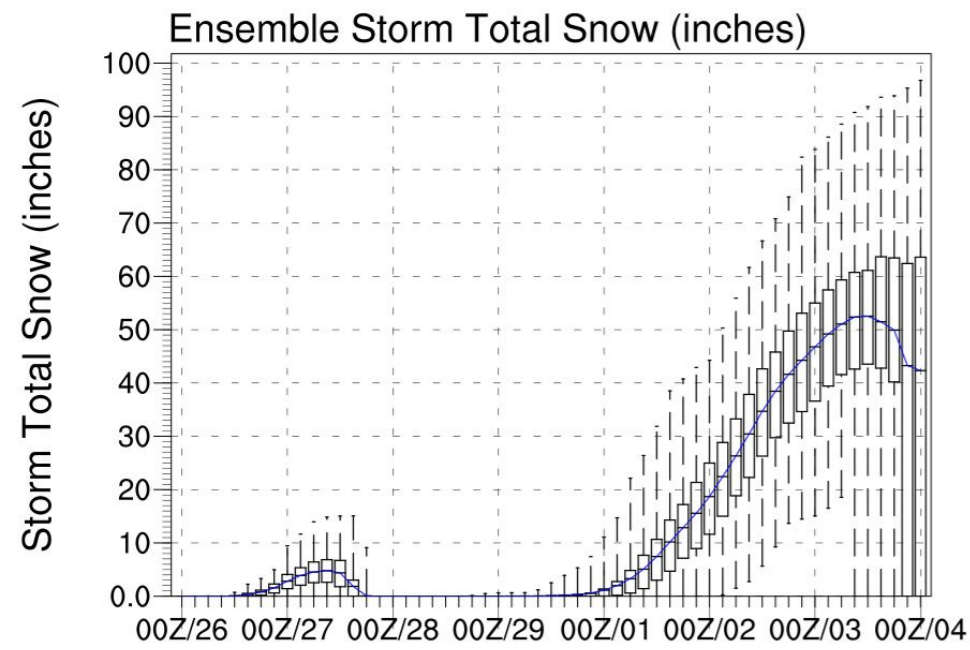
CW3E AR Outlook: 26 Feb 2024

West-WRF Ensemble Meteogram

West-WRF Ensemble Initialized: 00 UTC 02/26/2024

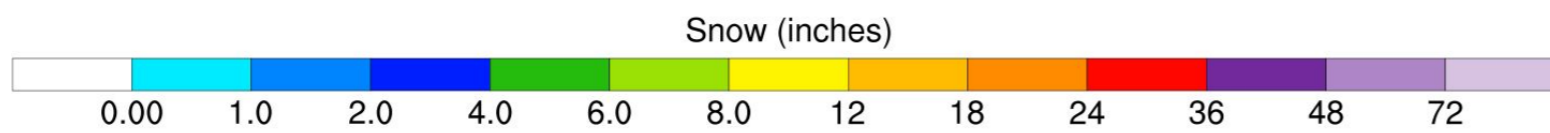
Tuolumne Meadows (37.88°N, 119.35°W)

*Experimental



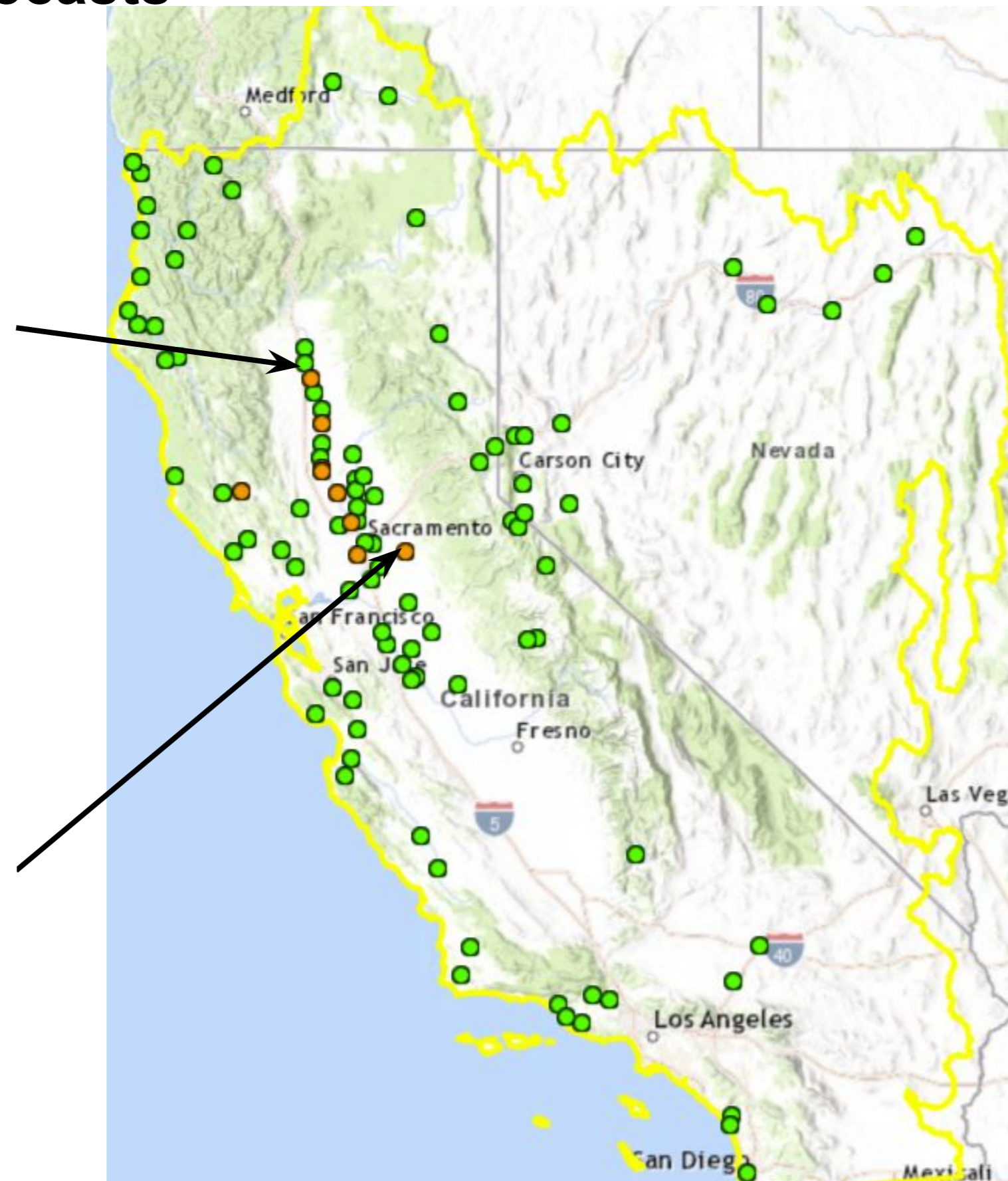
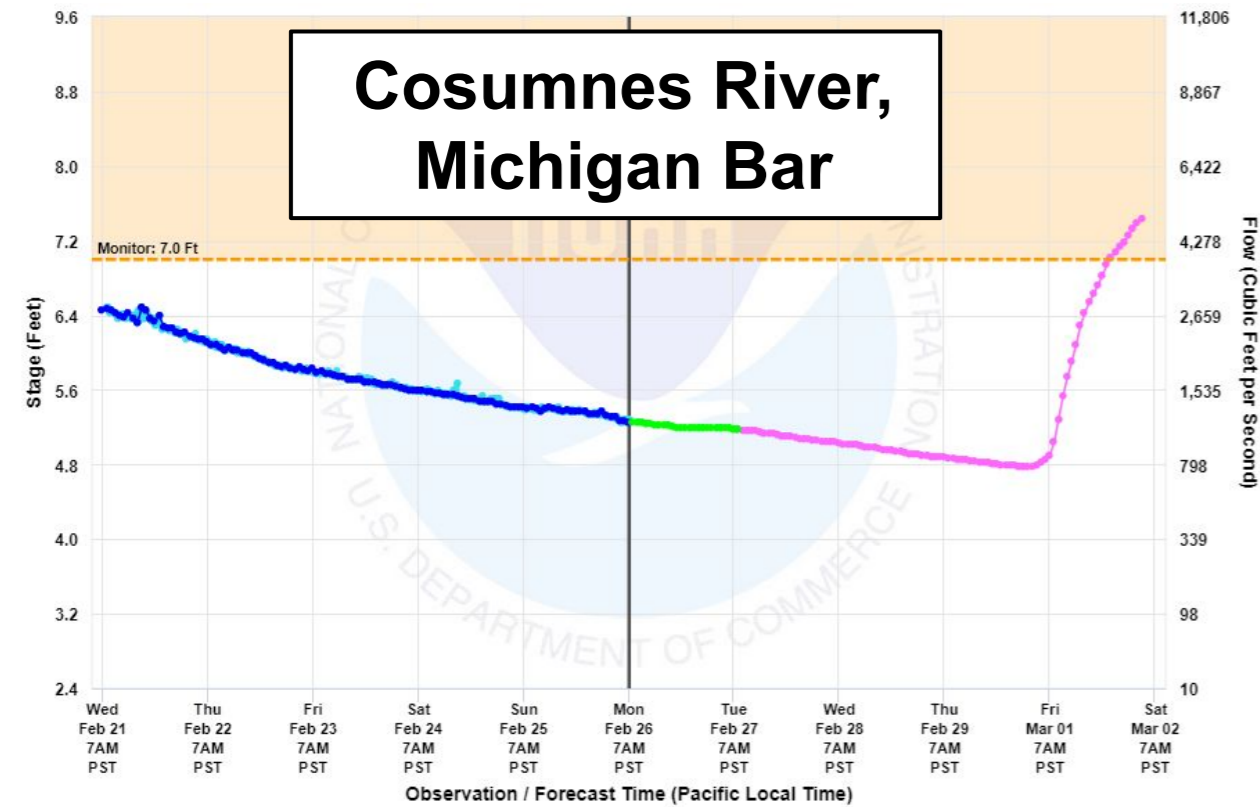
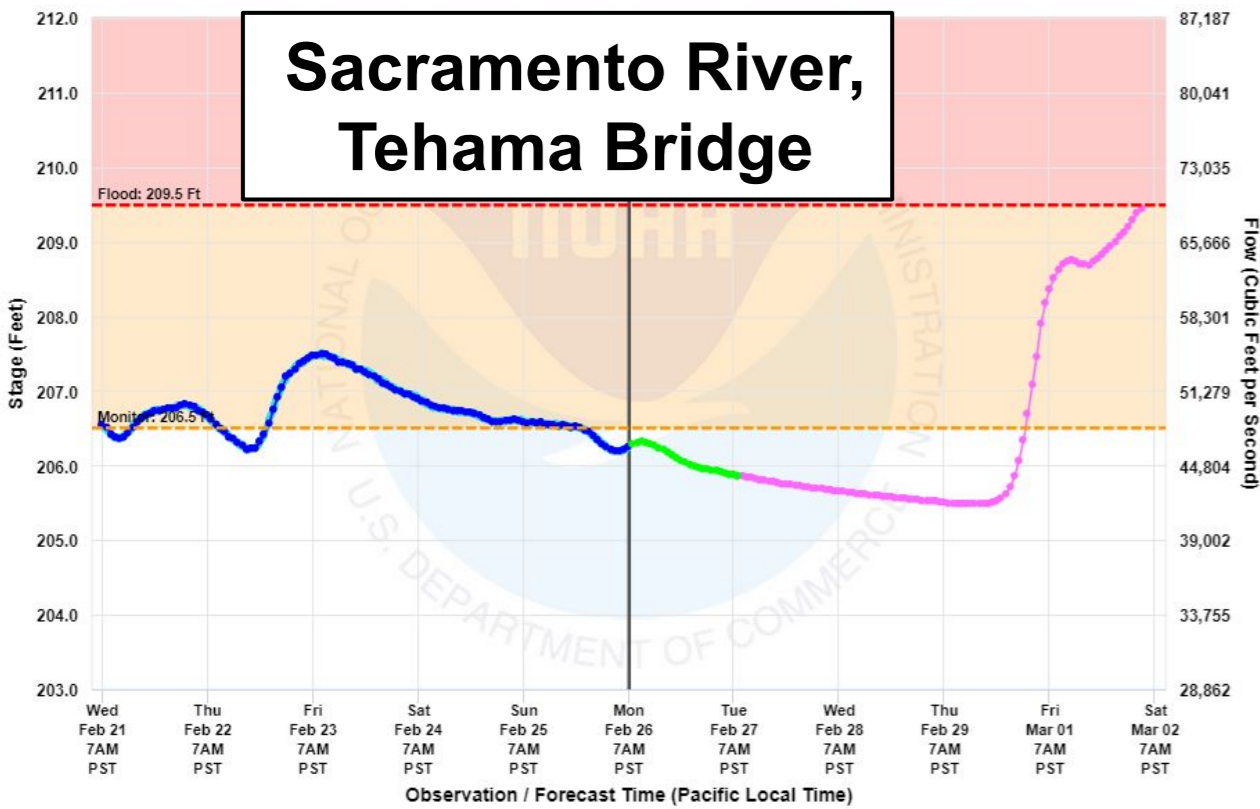
- For this location at Tuolumne Meadows in the Central Sierra Nevada, the West-WRF ensemble members are forecasting a ~85% chance of 36"+ of snow. While there is high likelihood of large snowfall totals, large uncertainty remains in high snowfall totals.

- The majority of members are forecasting at least 8" of snow with several members forecasting totals greater than 18".



CW3E AR Outlook: 26 Feb 2024

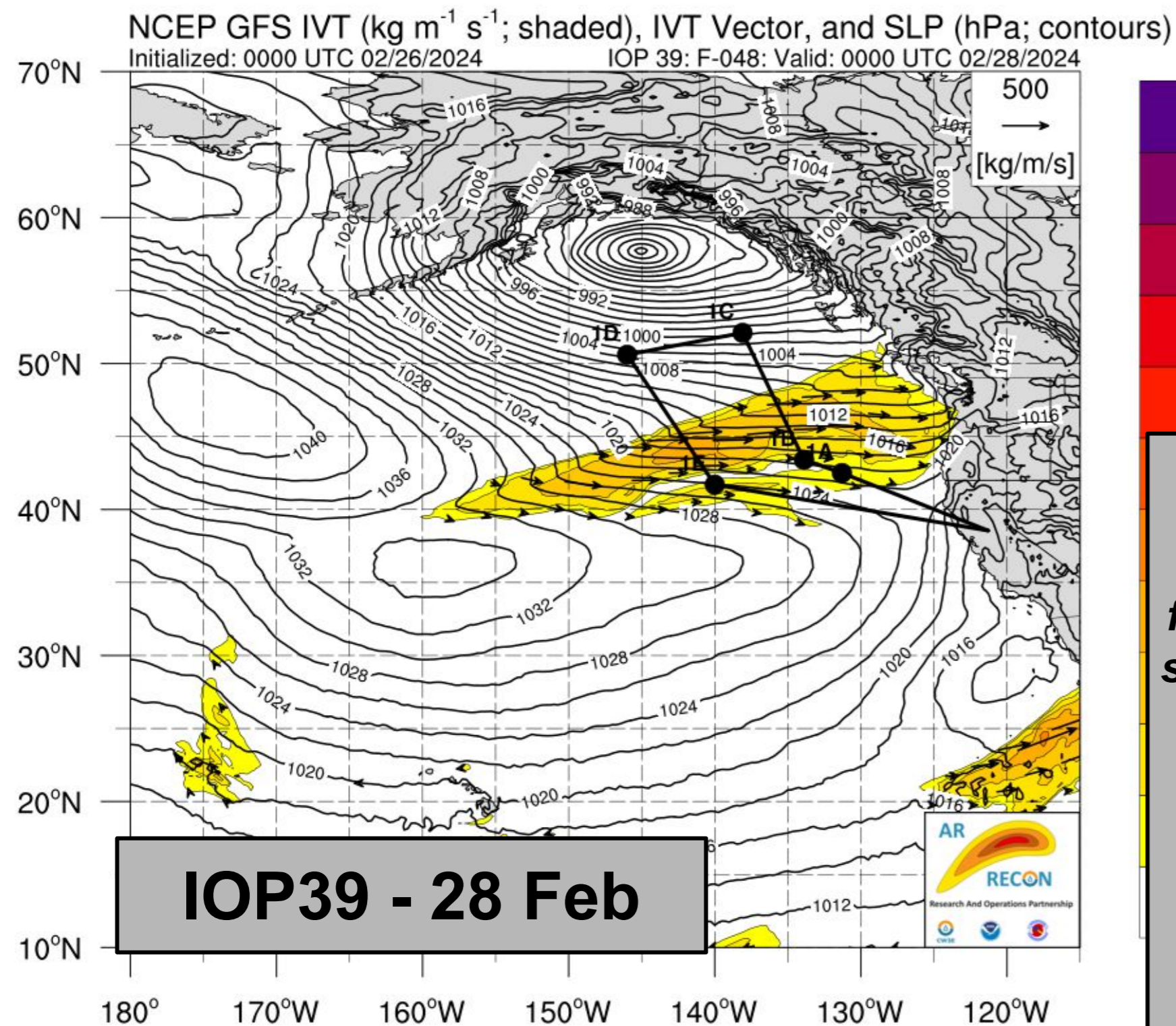
NWS CNRFC River Stage Forecasts



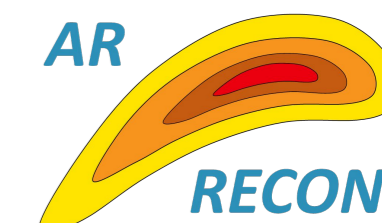
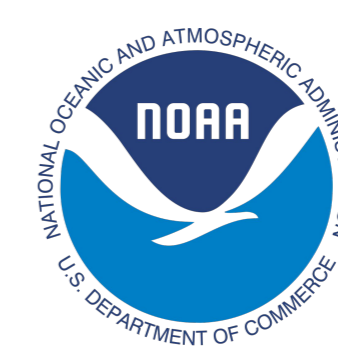
- River levels in northern CA are forecast to rise as a result of the precipitation.
- CNRFC is currently forecasting 9 gages to exceed monitor stage in the next 5 days.
- The Sacramento River at Tehama Bridge (top left) guidance shows the river reaching monitor stage late on Thu 29 Feb and approaching flood stage late on Fri 1 Mar.
- The Cosumnes River at Michigan Bar (bottom left) guidance shows the river exceeding monitor stage late on Fri 1 Mar.

CW3E AR Outlook: 26 Feb 2024

Current AR Recon Planned Flight Sequence



The AR Recon team has planned the first flight of this sequence sampling the incoming event for a potential flight tomorrow. The team will continue to meet throughout the week to potentially continue to sample this incoming system



- CW3E's Atmospheric River Reconnaissance (AR Recon) field campaign continues in WY2024, with the most recent sequence of flights focusing on the development of the current sequence of storms.
- The AR Recon team planned the first flight in this sequence, departing from Sacramento, CA to fly over and around ARs in the eastern N. Pacific
- These sampling missions provide data in near real-time to the global forecast models to improve weather forecasts. Data from these missions are archived for future AR research.
- Flights sample the atmosphere and its essential atmospheric structures, in addition to regions of forecast sensitivity.