

CW3E Atmospheric River Outlook: 2 Feb 2024

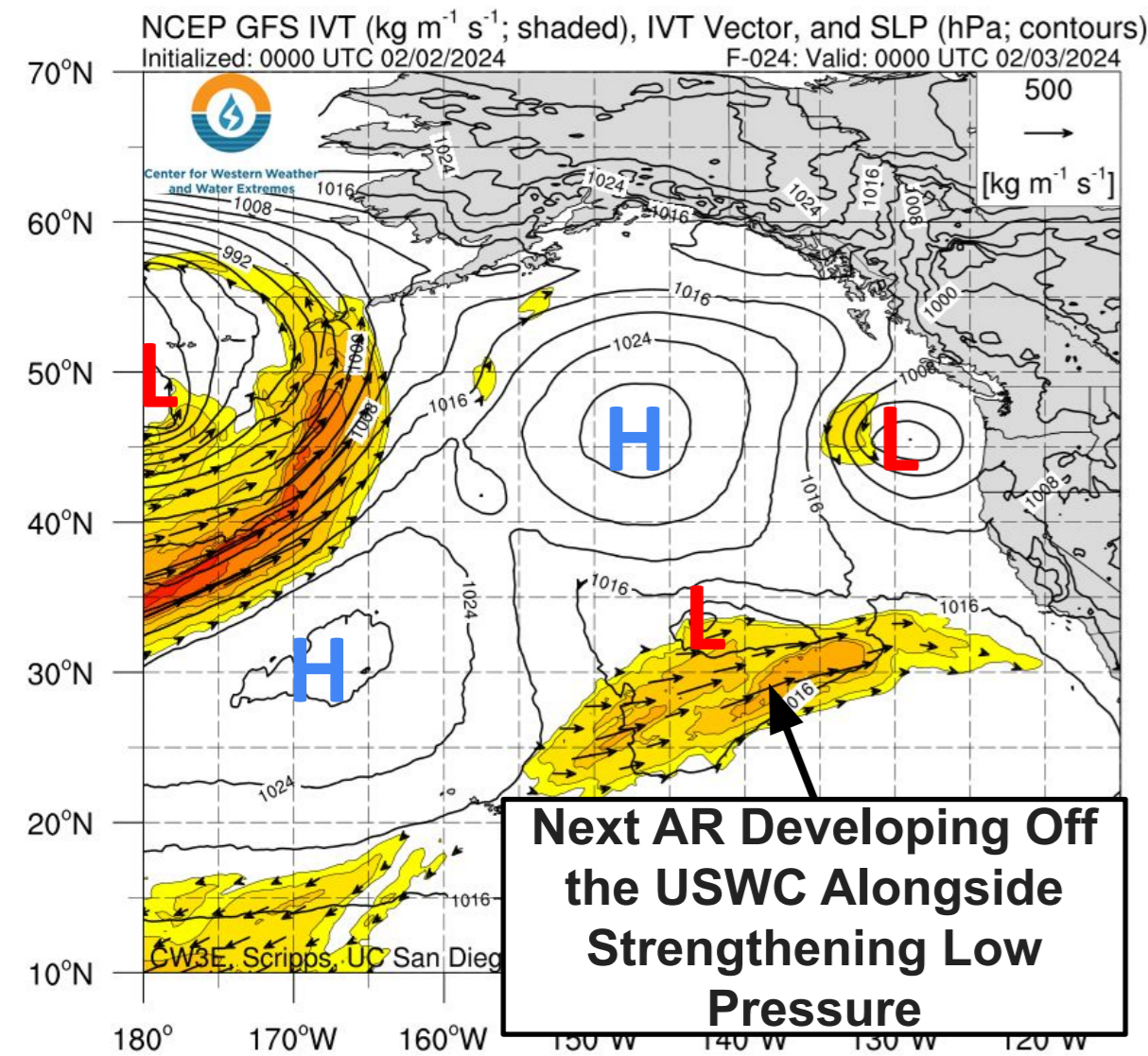
Strong Atmospheric River to Drive High-Impact Precipitation Event Over California

- A strong AR and low pressure system are forecast to make landfall over Central CA Sun 4 Feb and progress down the CA coast through Mon 5 Feb.
- There is uncertainty between the GFS and ECMWF deterministic models on the strength of the low pressure system and AR as well as the landfall location.
- The GFS is forecasting the low pressure and AR to be stronger than the ECMWF and make landfall further north in CA.
- The GEFS and West-WRF ensemble are forecasting AR3 conditions (based on Ralph et al. 2019 AR scale) over the central CA coast, with AR1/2 conditions in northern and southern CA.
- This AR is forecast to bring significant precipitation to much of CA, including heavy rainfall along the central and southern CA coasts and heavy snowfall in the Sierra Nevada.
- The WPC is forecasting greater than 6 inches of precipitation over the Sierra Nevada and Transverse Ranges over the next 7 days.
- The WPC Excessive Rainfall Outlook indicates a Moderate Risk (level 3 of 4, or at least 40% chance) for flash flooding in Central CA coast for the 24 hour period ending 4 AM PT Mon 5 Feb and Los Angeles Metro Area for the 24 hour period ending 4 AM PT Tue 6 Feb.

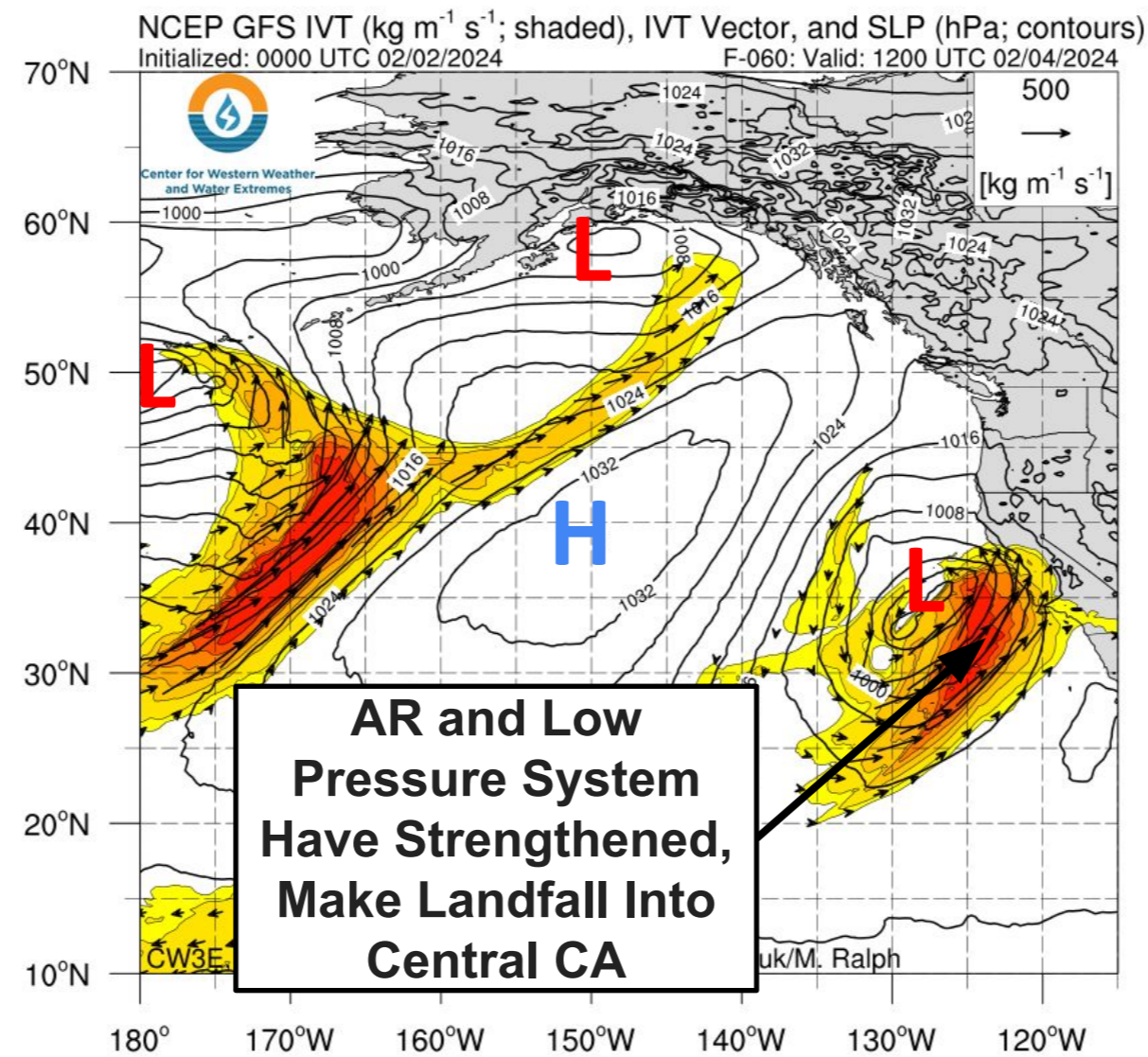
CW3E AR Outlook: 2 Feb 2024

GFS Init 0Z Fri 2 Feb 2024

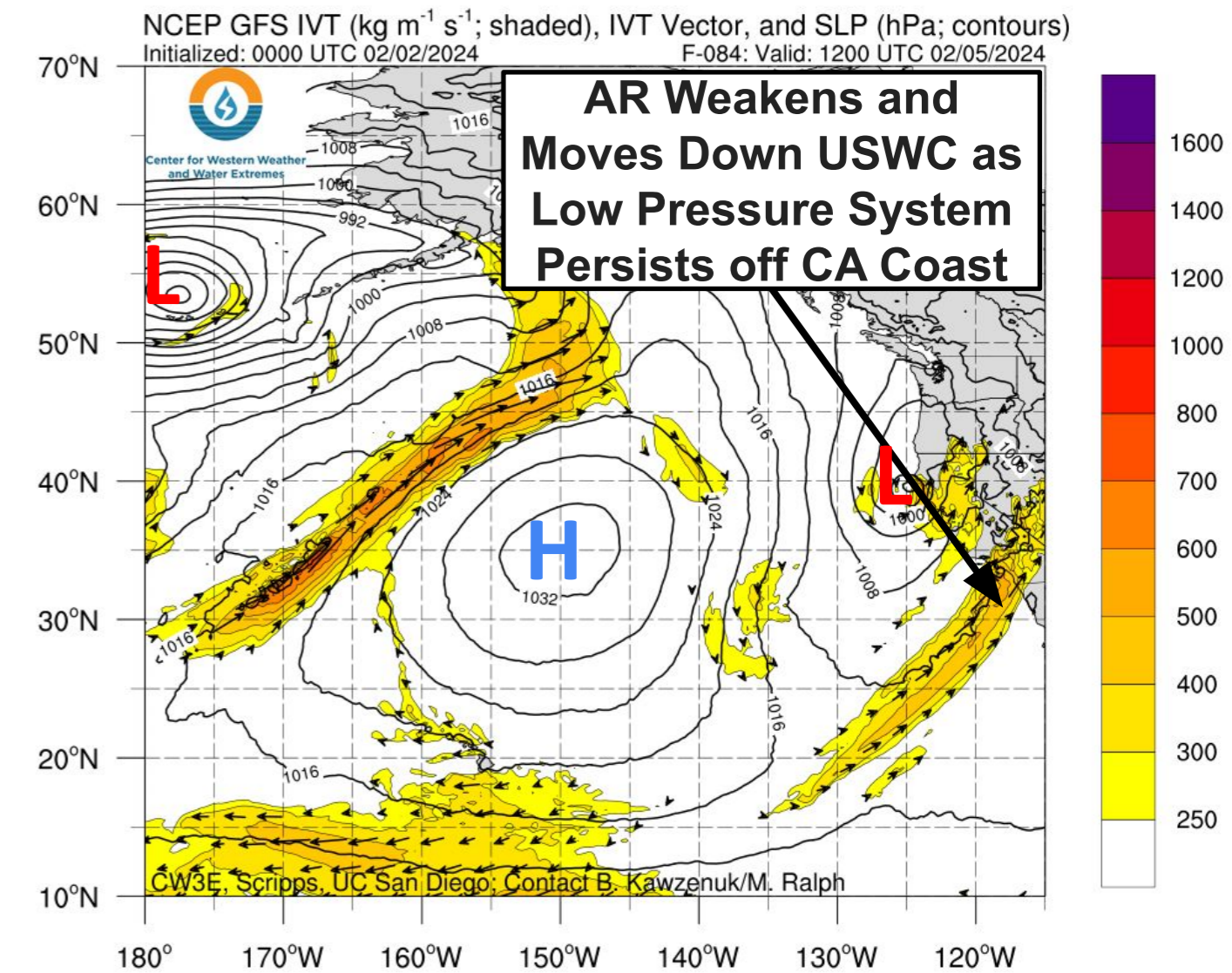
4PM PT Fri 2 Feb 2024



4AM PT Sun 4 Feb 2024



4AM PT Mon 5 Feb 2024



- The AR and low pressure system approaching the USWC strengthens on Fri 2 Feb.
- Both the low pressure system and AR continue strengthening until they approach the USWC, when the AR makes landfall over Central CA early Sun 4 Feb.
- The AR progresses down the CA coast through Sun 4 Feb into Mon 5 Feb.

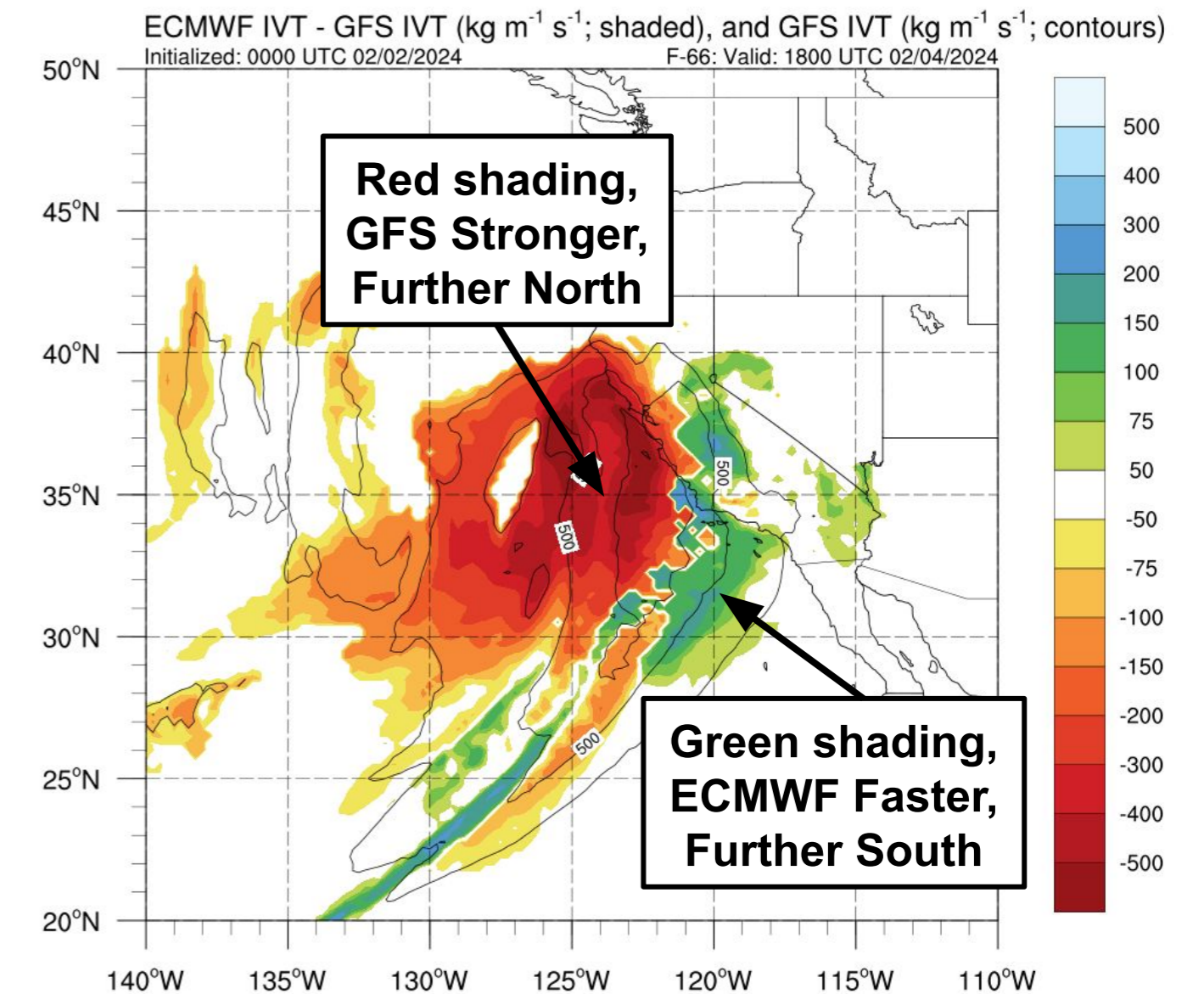
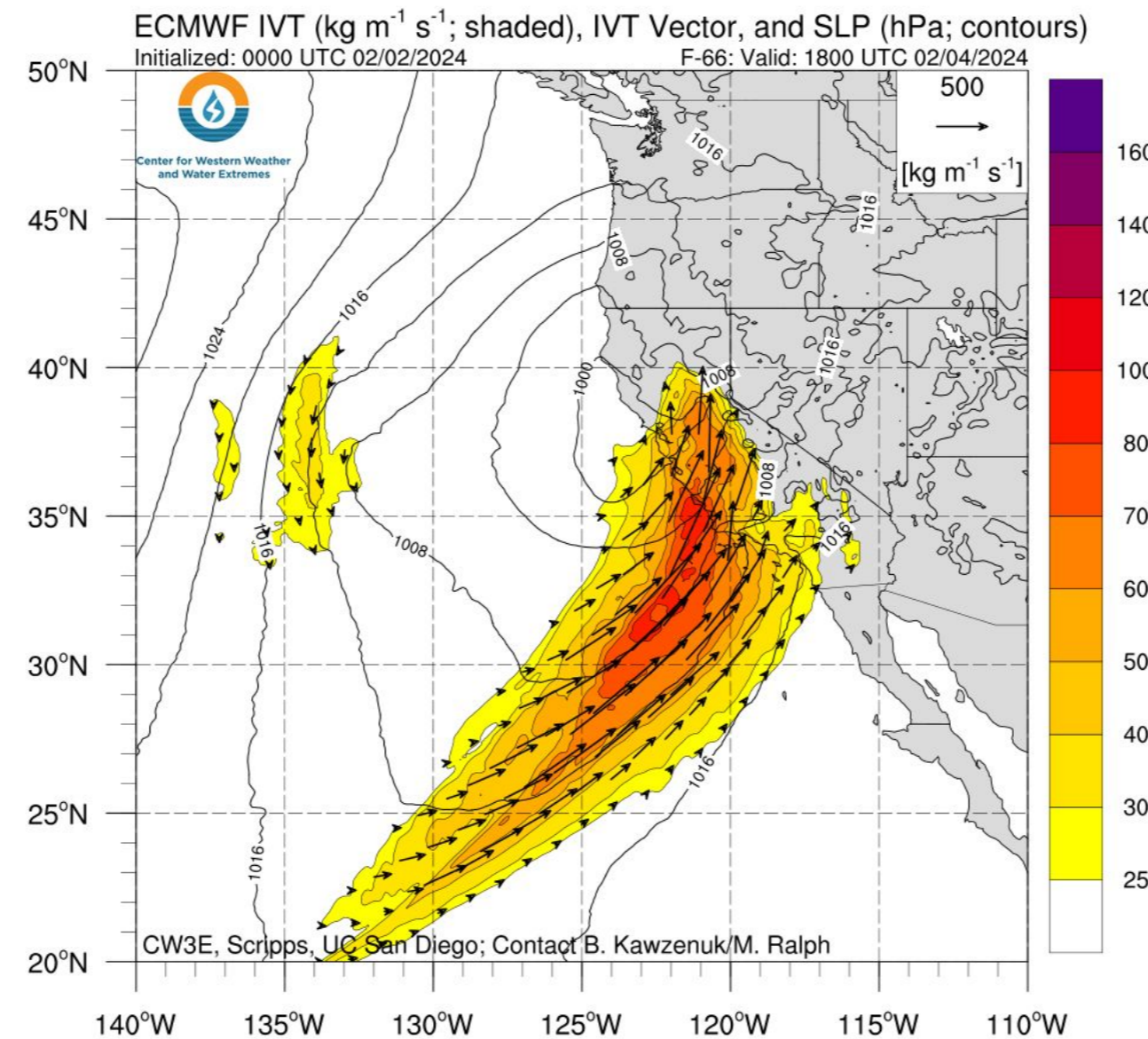
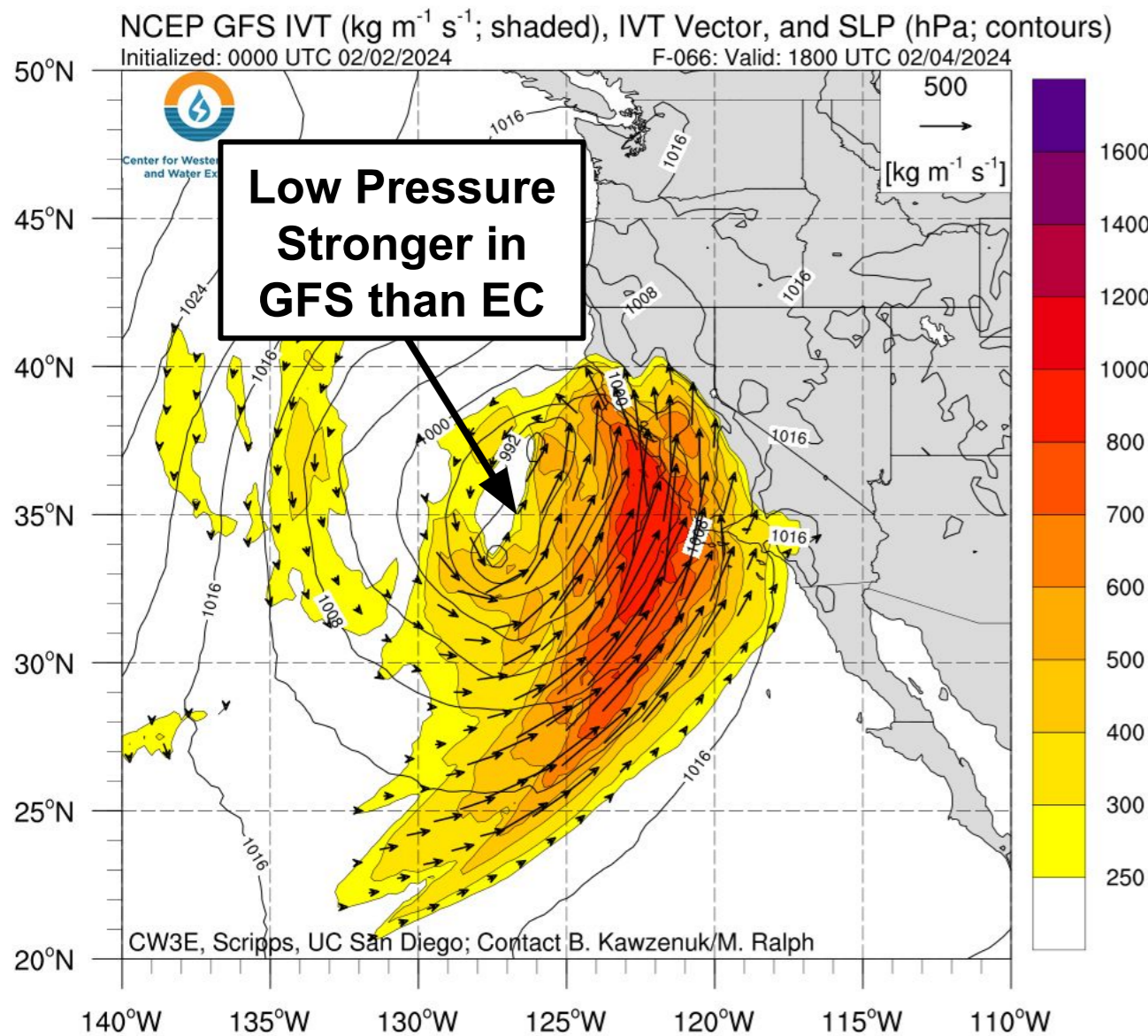
CW3E AR Outlook: 2 Feb 2024

Model Comparison; Valid 10 AM PT Sun Feb 4

00Z 4 Feb GFS IVT

00Z 4 Feb ECMWF IVT

ECMWF IVT minus GFS IVT

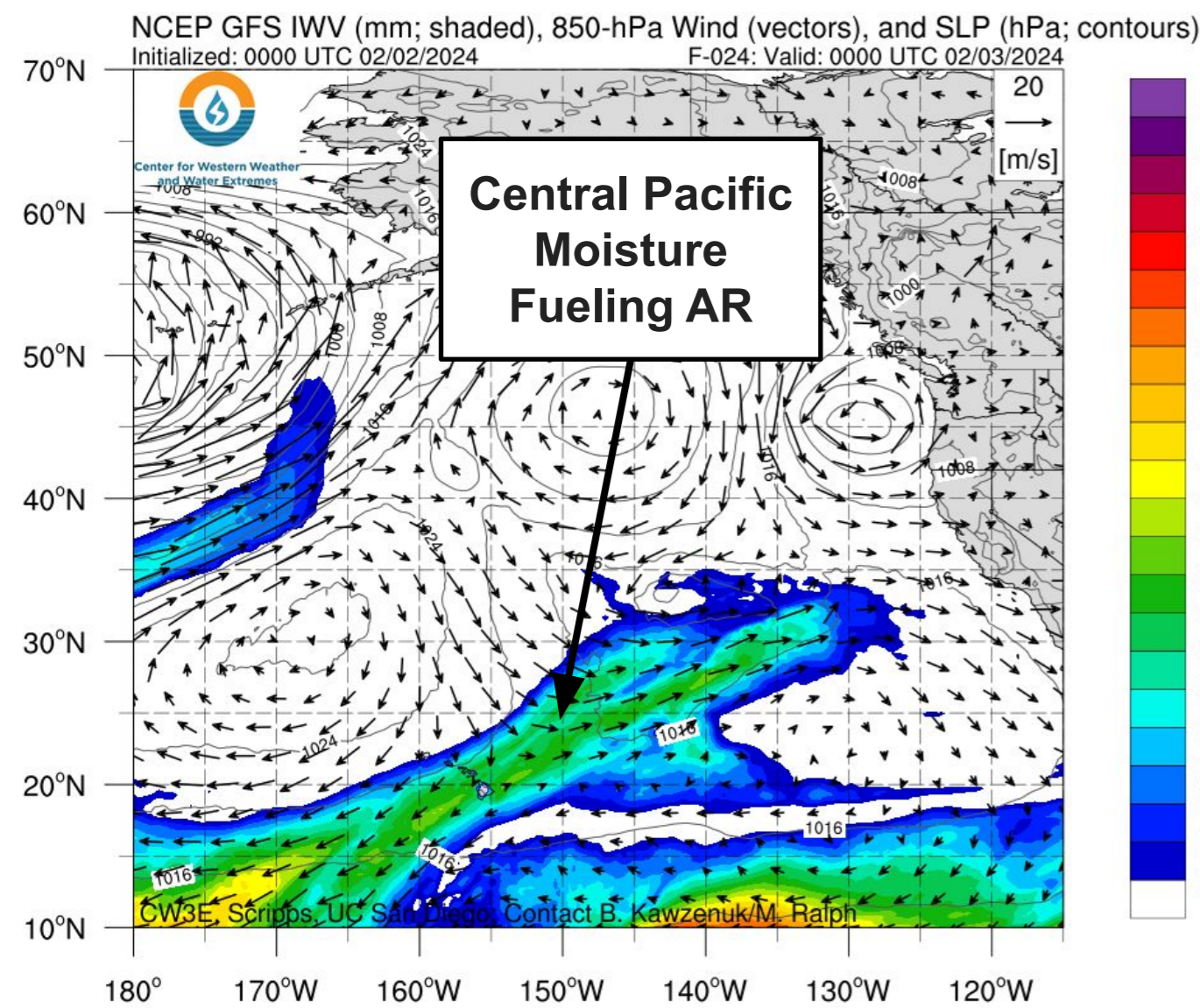


- The 00Z GFS (*left*) forecasts the AR and low pressure system to be stronger than the ECMWF (*center*) and make landfall further to the north.
- The increased strength and further north landfall leads to higher precipitation in northern CA and greater potential for precipitation through central and southern CA as the AR may take longer to progress down the CA coast.

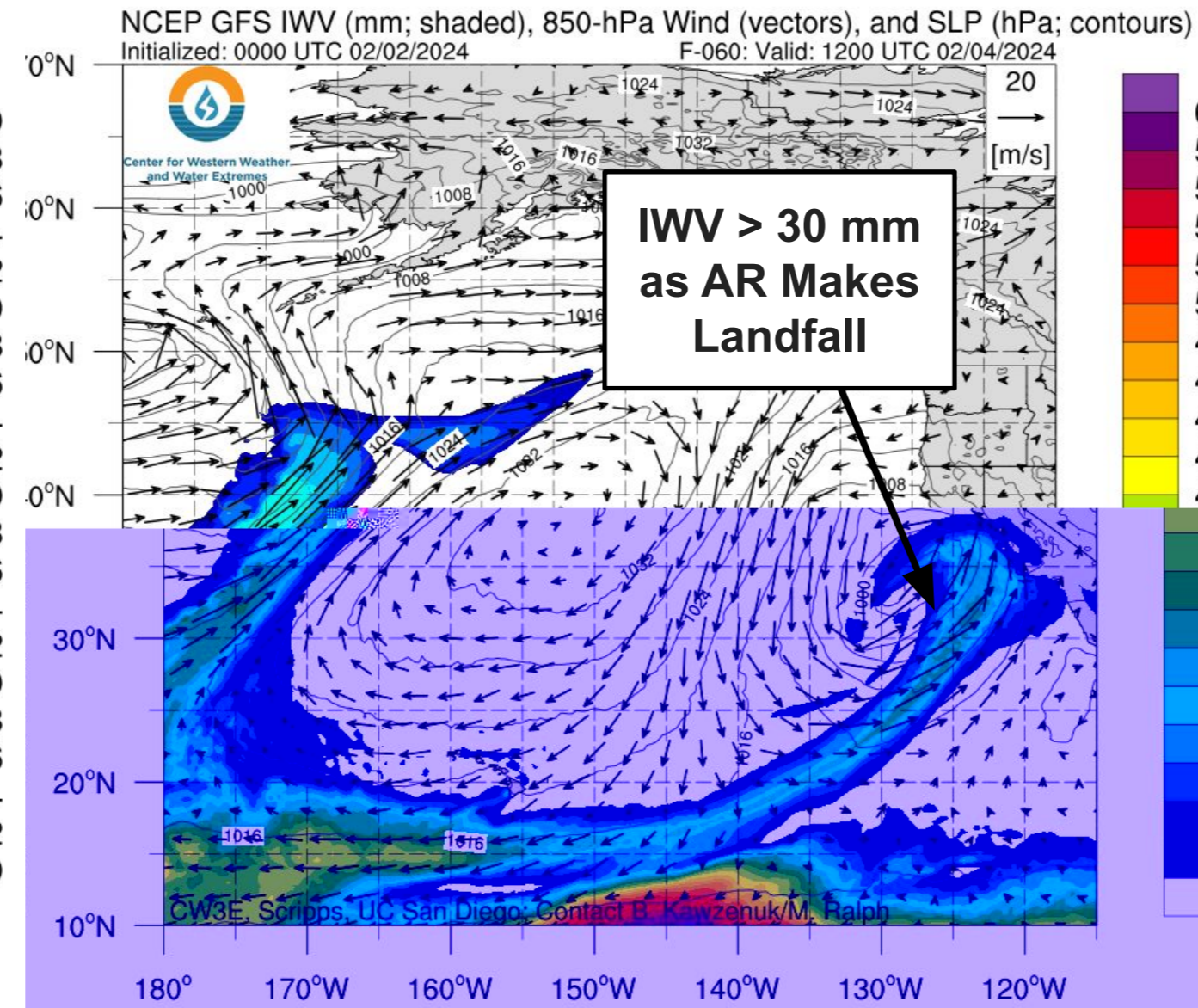
CW3E AR Outlook: 2 Feb 2024

GFS Init 0Z Fri 2 Feb 2024

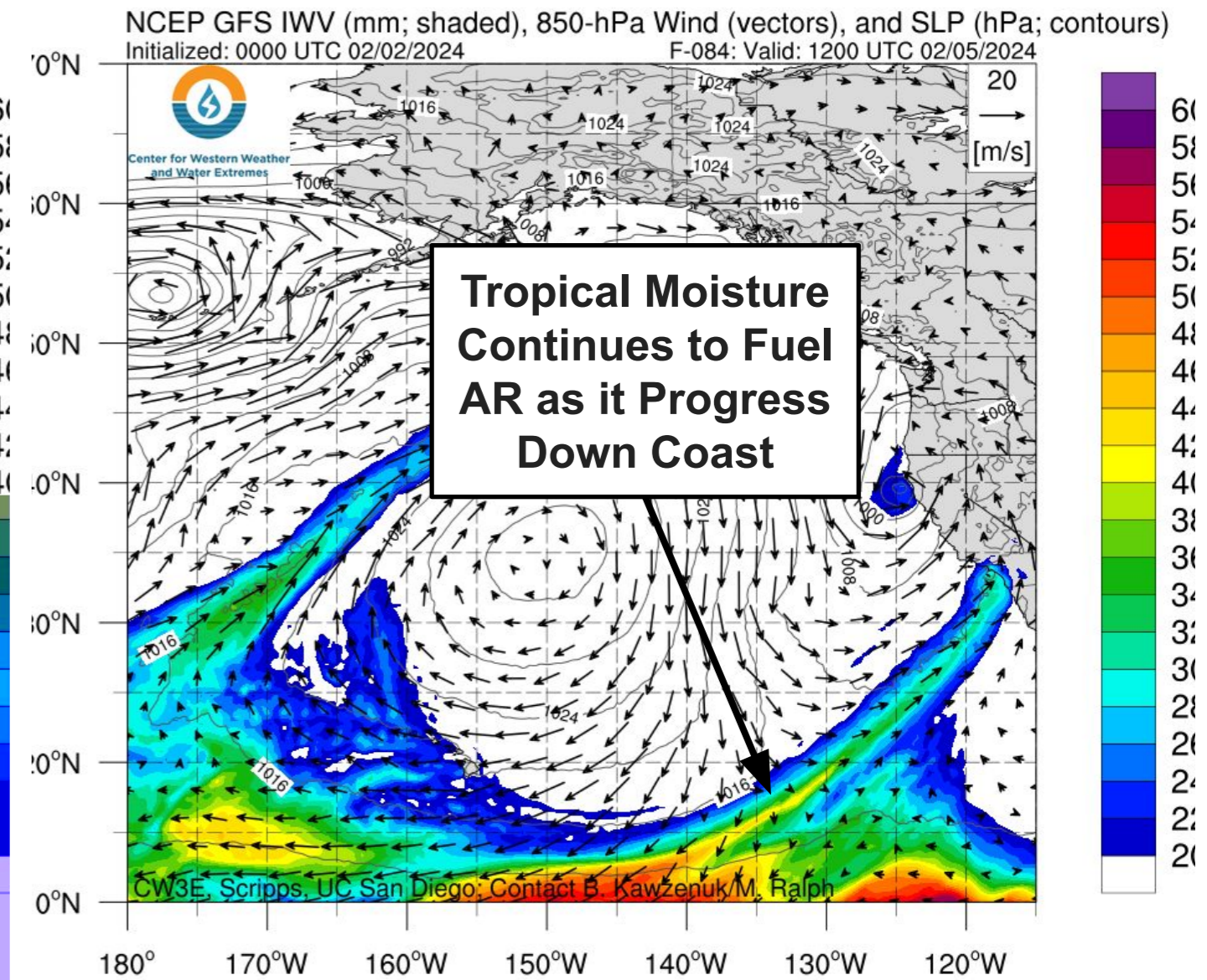
4PM PT Fri 2 Feb 2024



4AM PT Sun 4 Feb 2024

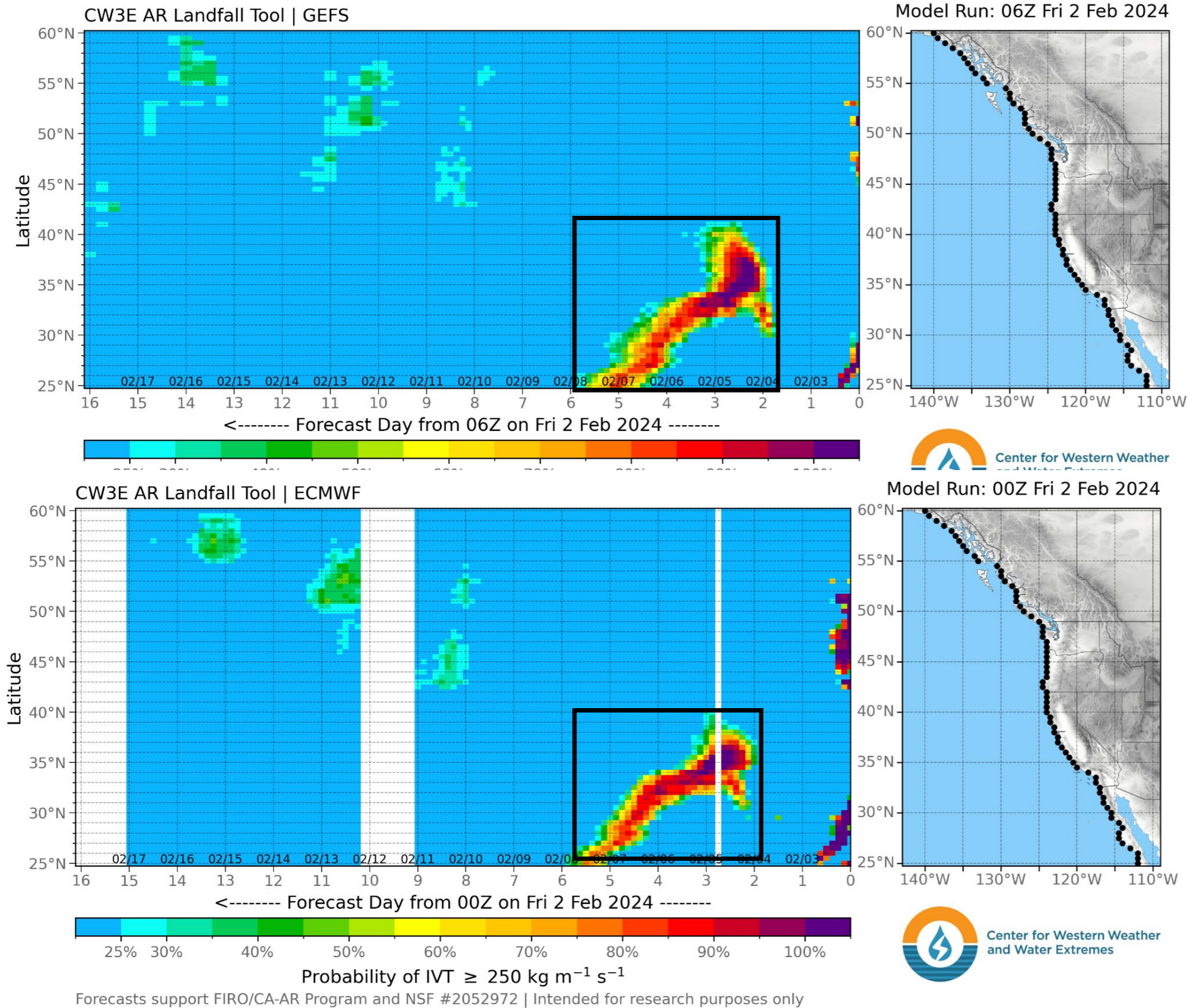


4AM PT Mon 5 Feb 2024



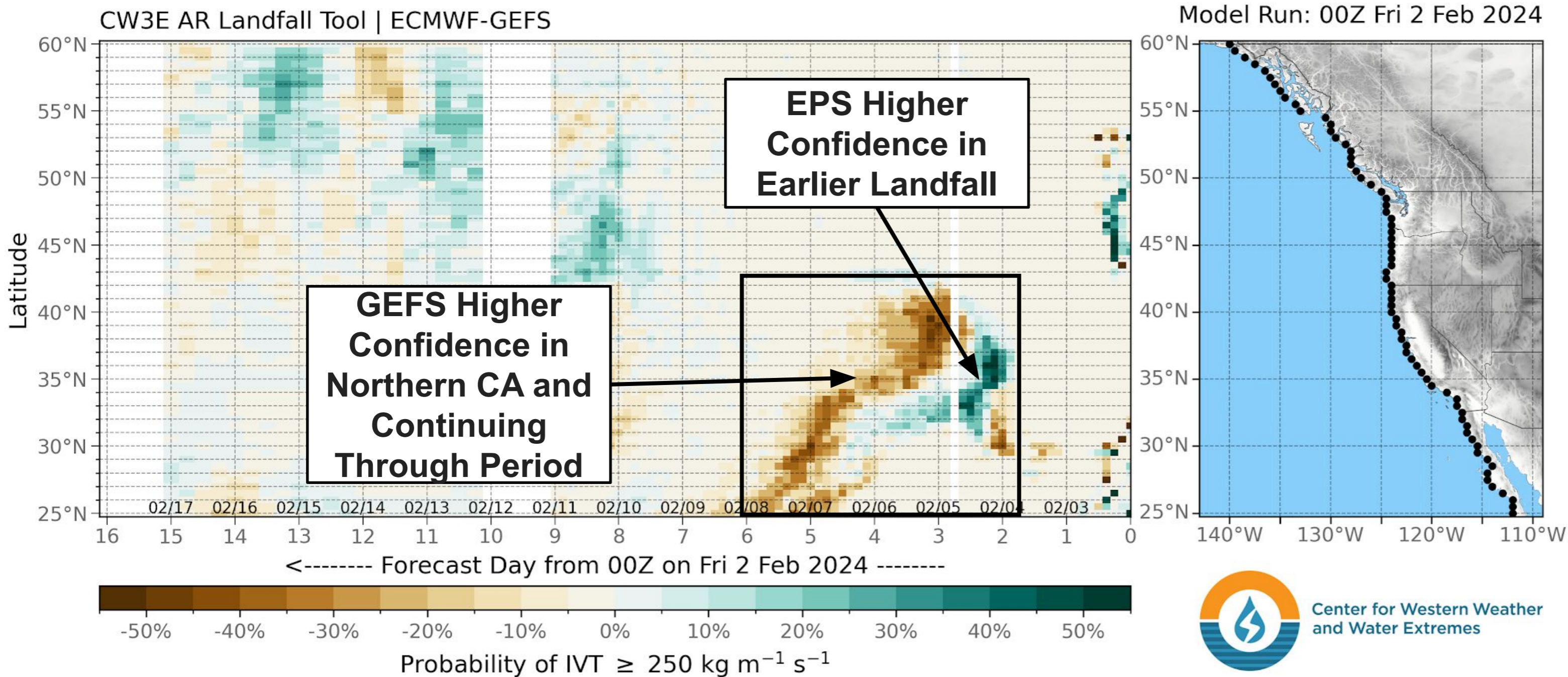
- The AR is forecast to develop over a preexisting plume of moisture positioned in the Central Pacific, to the north of Hawaii
- As the AR progresses down the CA coast it begins to tap into tropical moisture to the southeast of Hawaii.

CW3E AR Outlook: 2 Feb 2024



- Both the GEFS (top) and EPS (bottom) are showing very high confidence (>95%) in $IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$ making landfall over CA this weekend and propagating down the coast through Wed 7 Feb.

CW3E AR Outlook: 2 Feb 2024



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

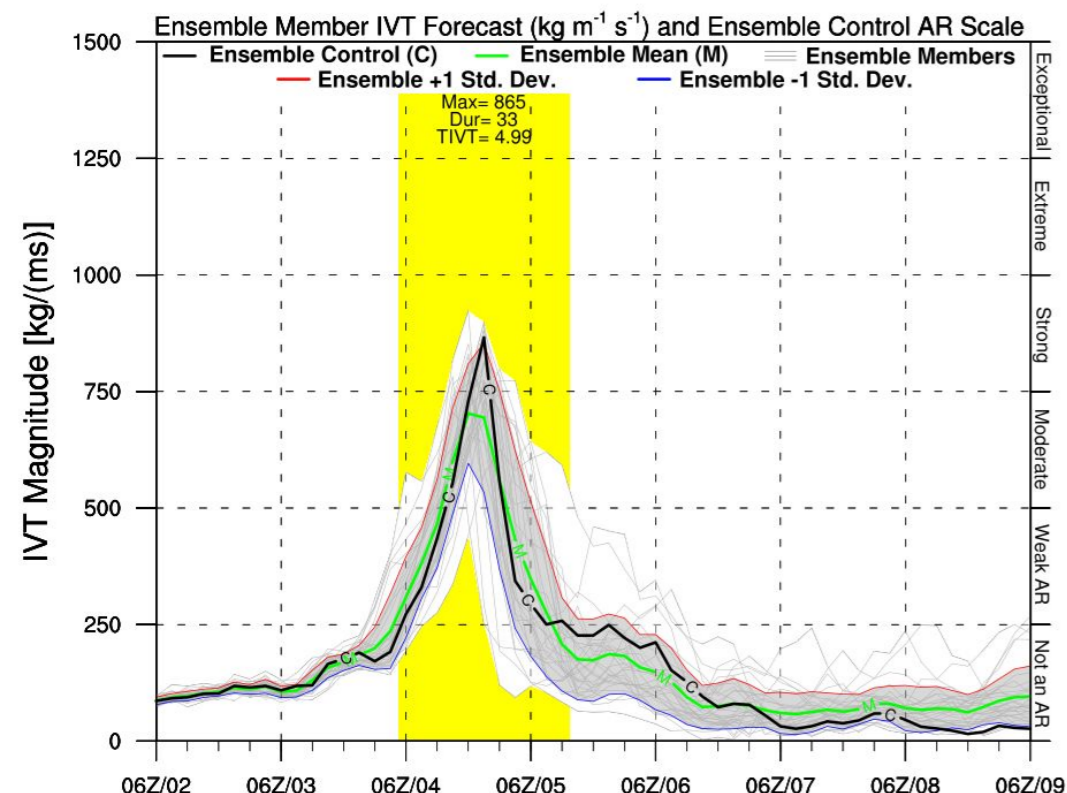
- The EPS is more confident in $IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$ making landfall earlier in the period with higher confidence early Sun 4 Feb.
- The GEFS is showing greater confidence in $IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$ making landfall in Northern CA and for AR conditions to persist later in CA.

CW3E AR Outlook: 2 Feb 2024

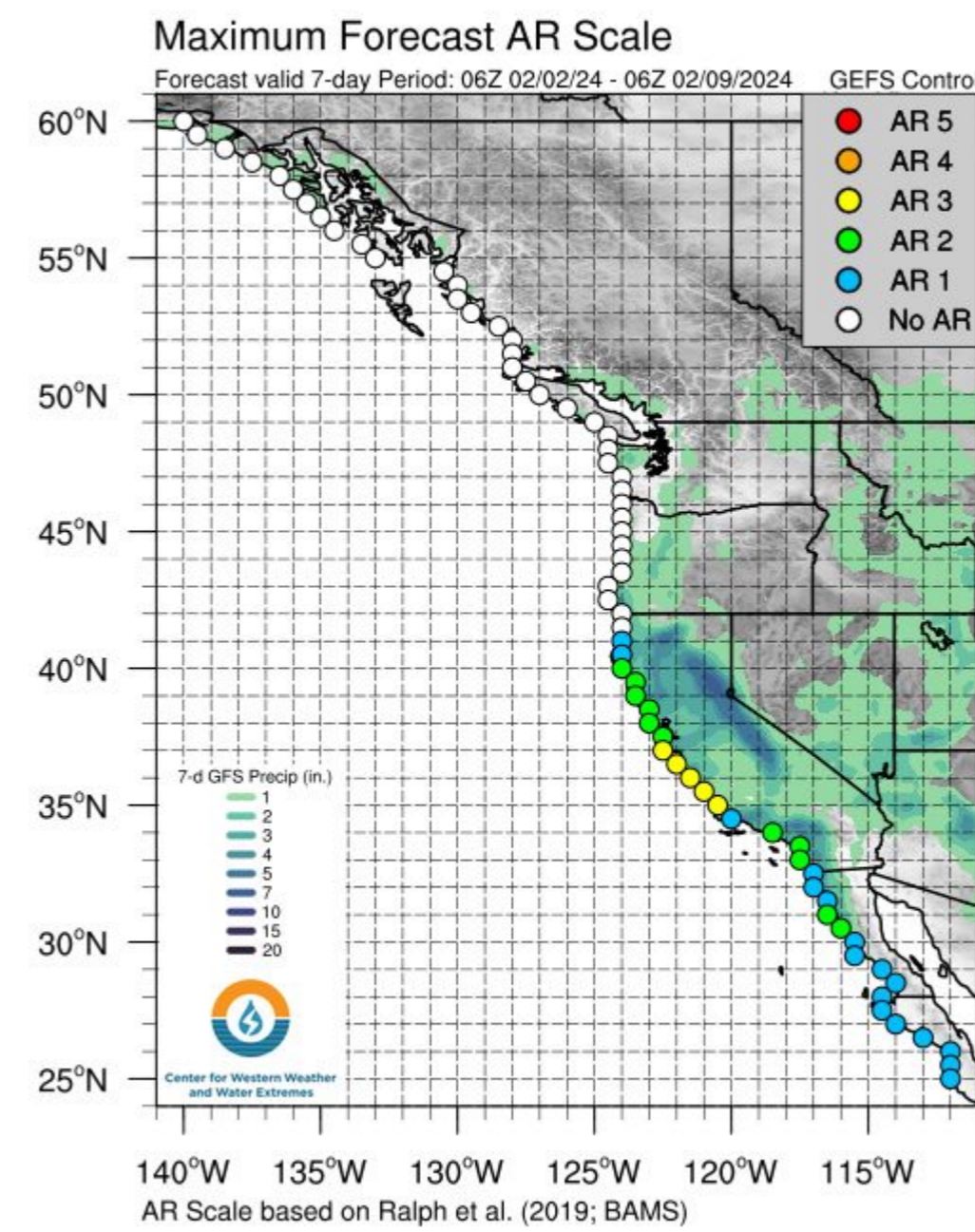
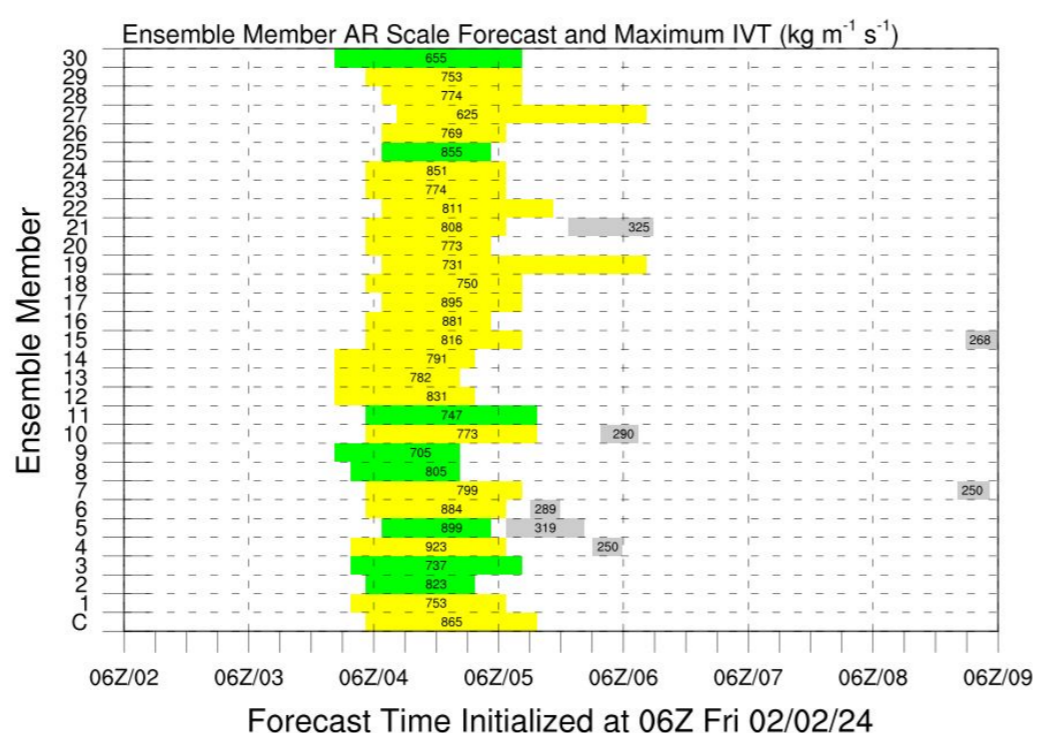
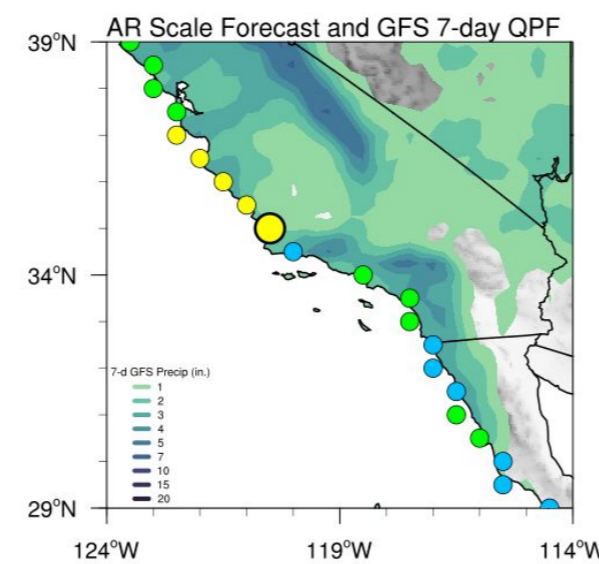
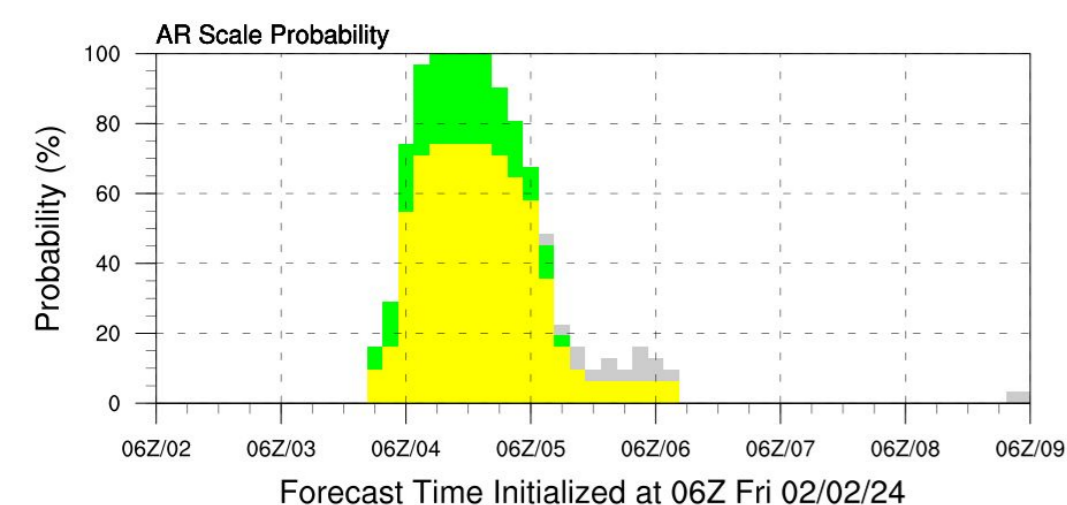
GEFS 7-day AR Scale and IVT Forecast

GFS Ensemble Initialized: 06Z Fri 02/02/24

Location: 35°N 120.5°W



Categorical AR Strength by Ralph/CW3E



- The GEFS control member is forecasting AR3 conditions at 35 at 35° N, 120.5° W (near San Luis Obispo CA) for 0Z Sun 4 Feb through 6Z Mon 5 Feb.
- 23/31 (74%) GEFS ensemble members are forecasting AR3 conditions during the upcoming AR.
- There is some uncertainty amongst GEFS ensemble members in the duration of AR conditions at this location.



AR 1 (blue) AR 2 (green) AR 3 (yellow) AR 4 (orange) AR 5 (red)

Image created: 11 UTC 02/02/2024

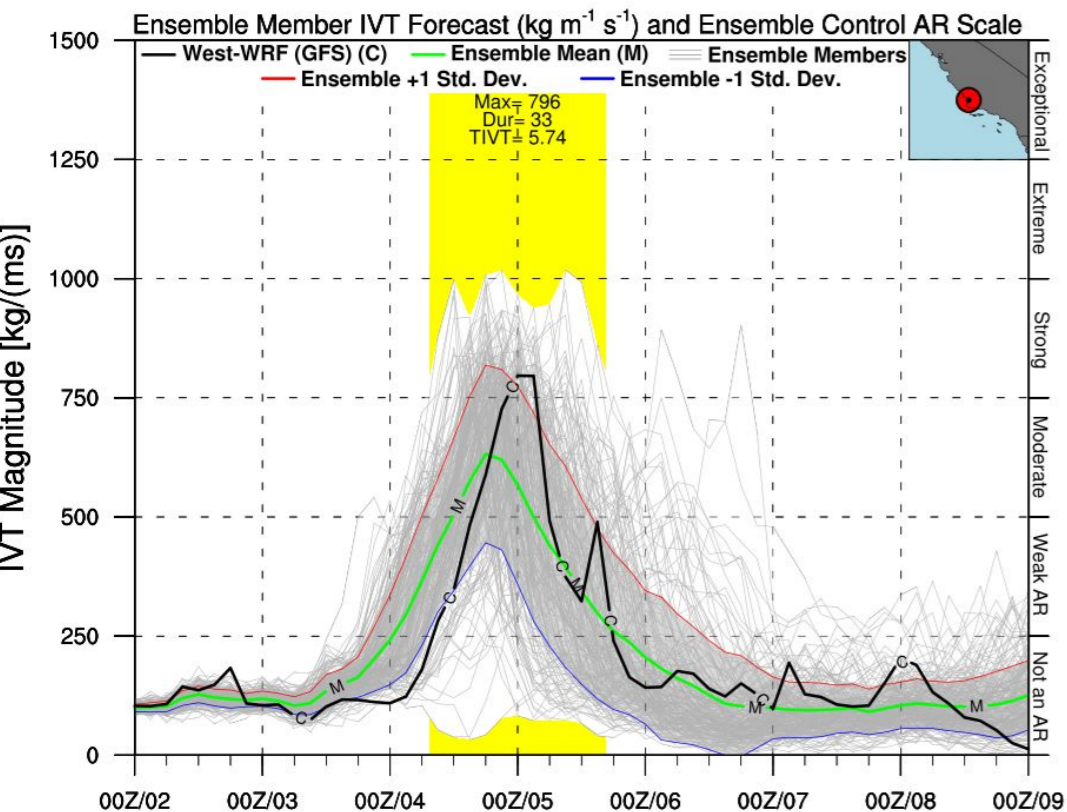
More information: <http://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

CW3E AR Outlook: 2 Feb 2024

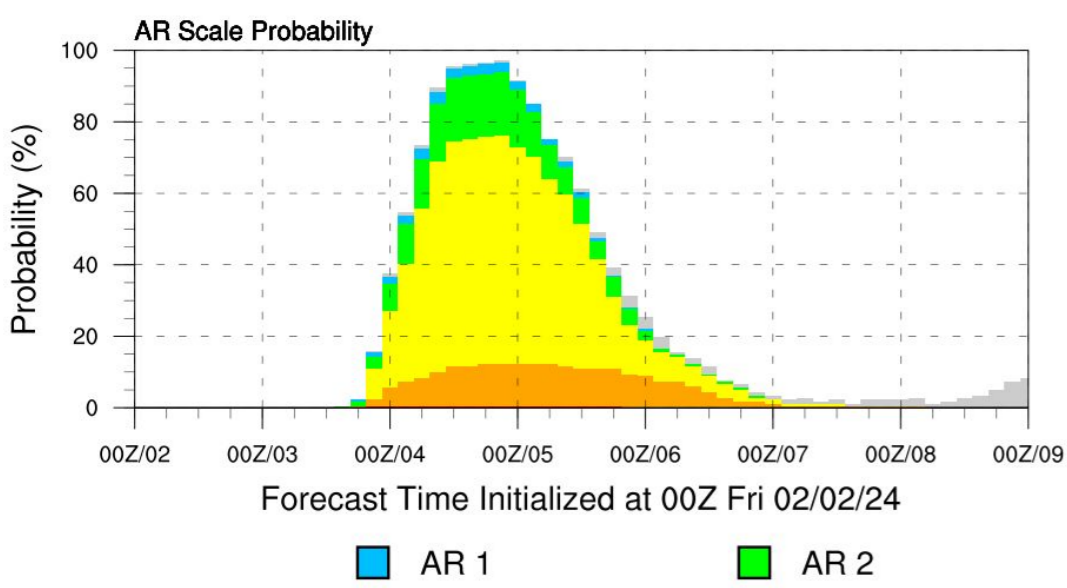
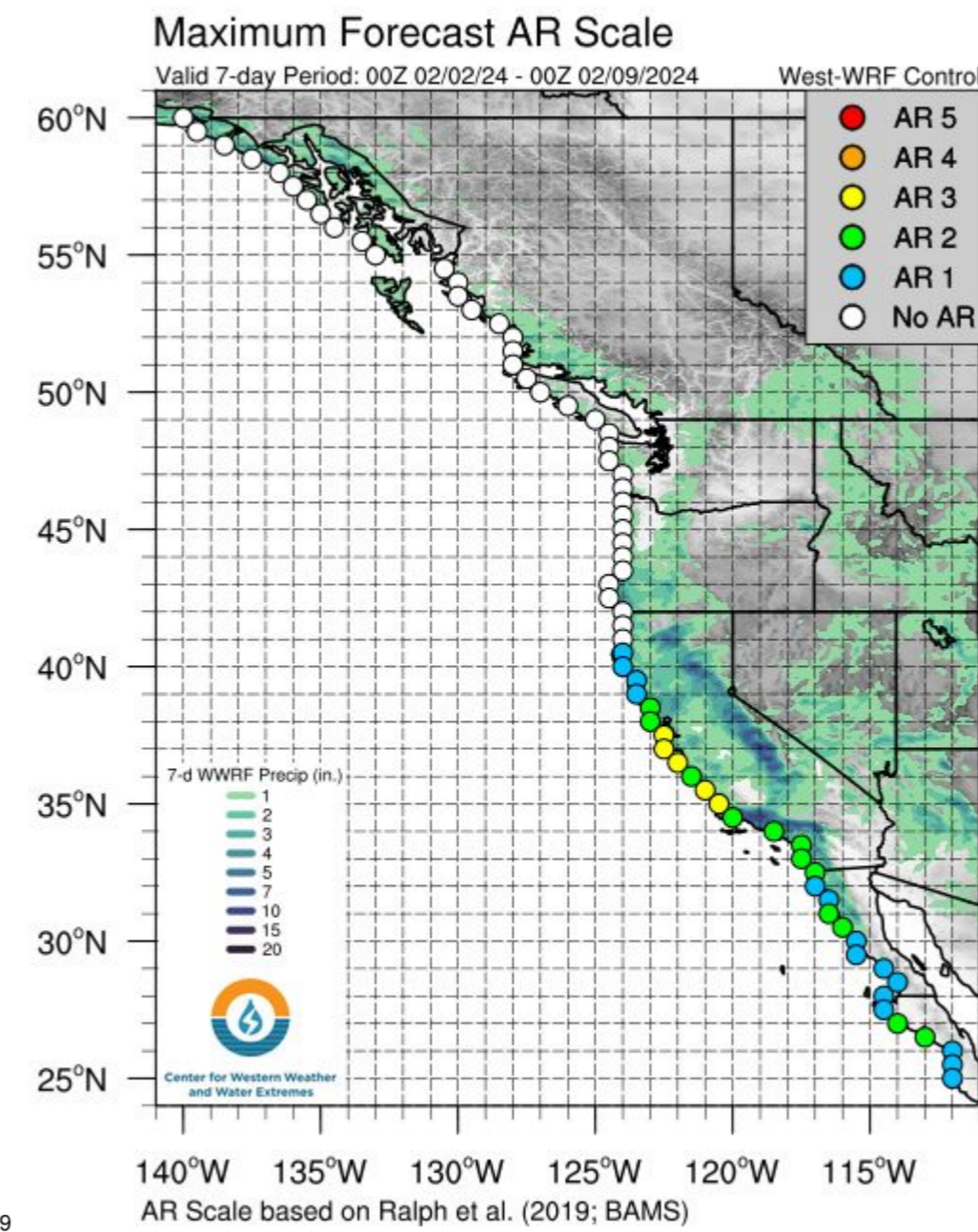
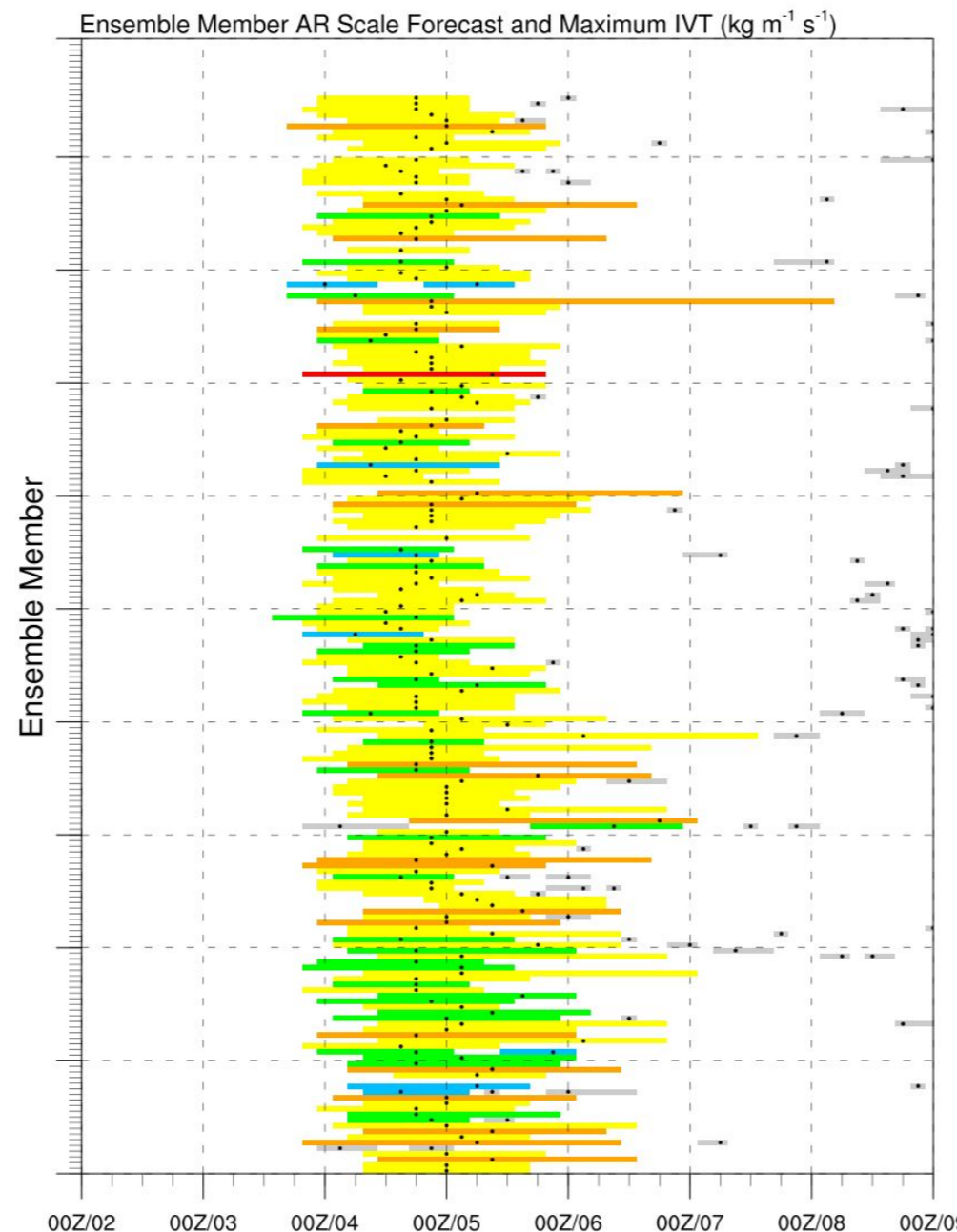
West-WRF Ensemble 7-day AR Scale and IVT Forecast

West-WRF Ensemble Initialized: 00Z Fri 02/02/24

Location: 35°N 120.5°W



Categorical AR Strength by Ralph/CW3E



- The West-WRF ensemble control member is also forecasting AR3 conditions at 35° N, 120.5° W (near San Luis Obispo CA) for 0Z Sun 4 Feb through 12Z Mon 5 Feb..

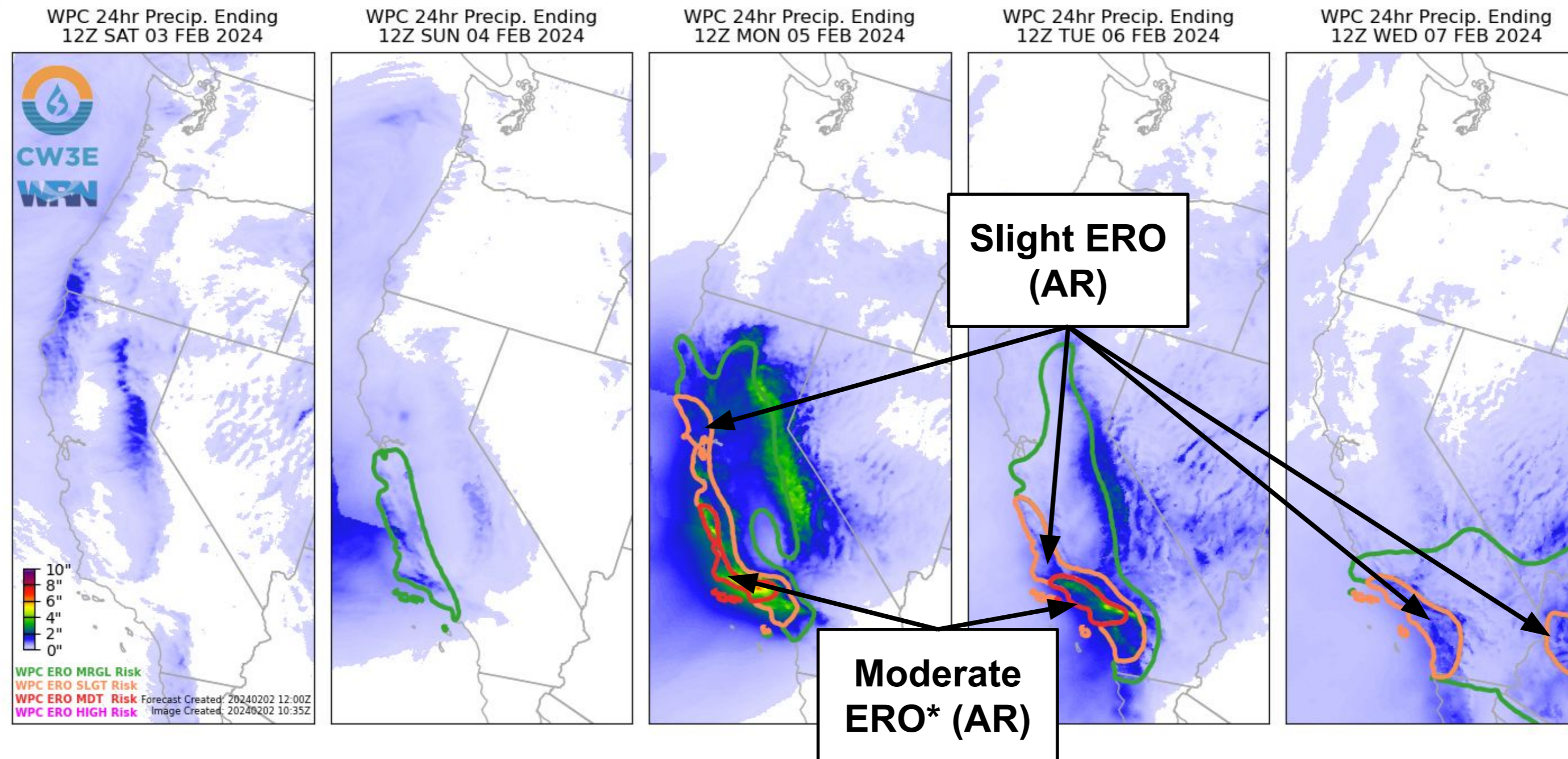
- The majority of ensemble members are forecasting AR3 or greater conditions at this location.

- There is uncertainty amongst the ensemble members regarding the duration of AR conditions at this location.

Image created: 14 UTC 02/02/2024

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

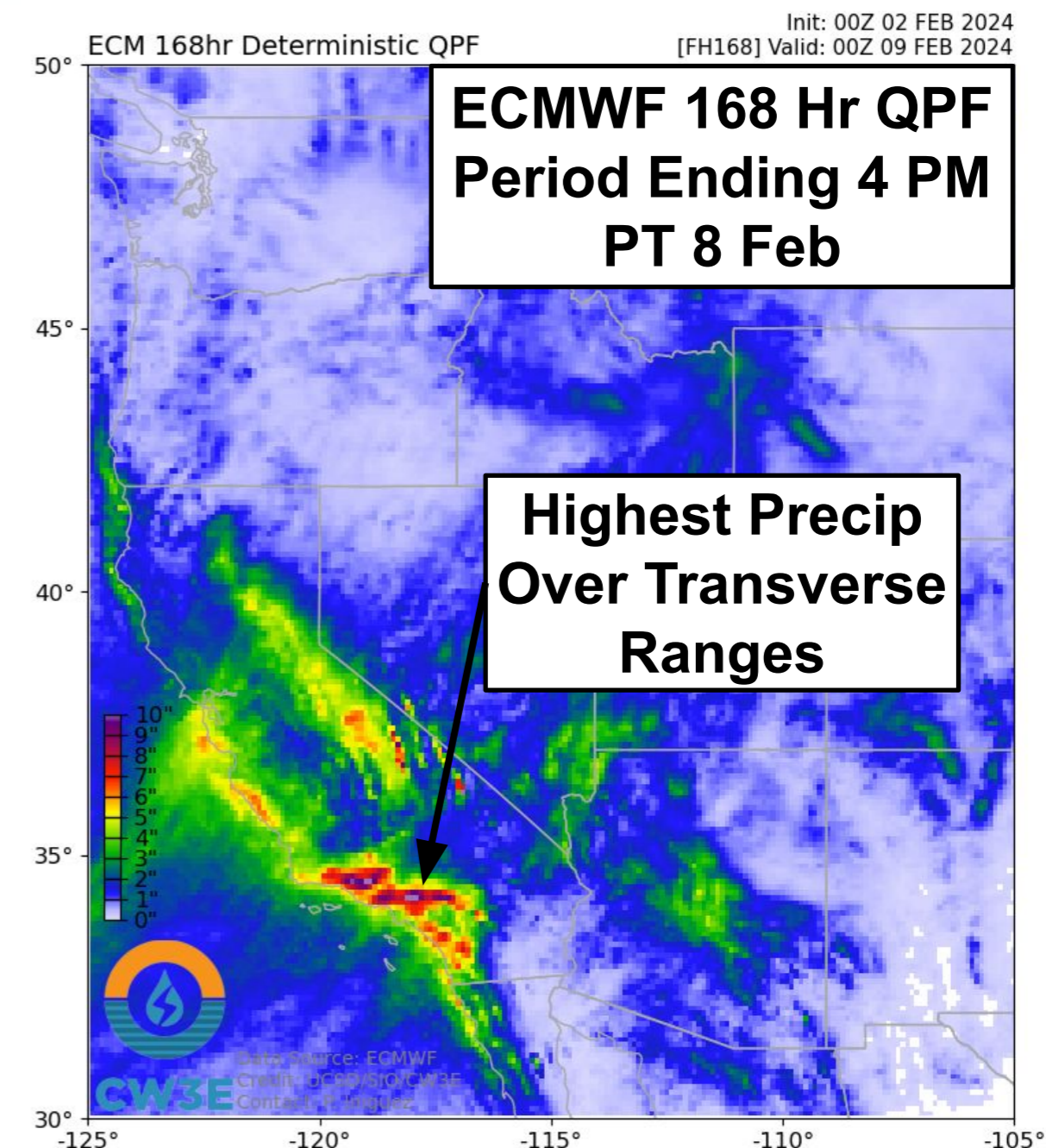
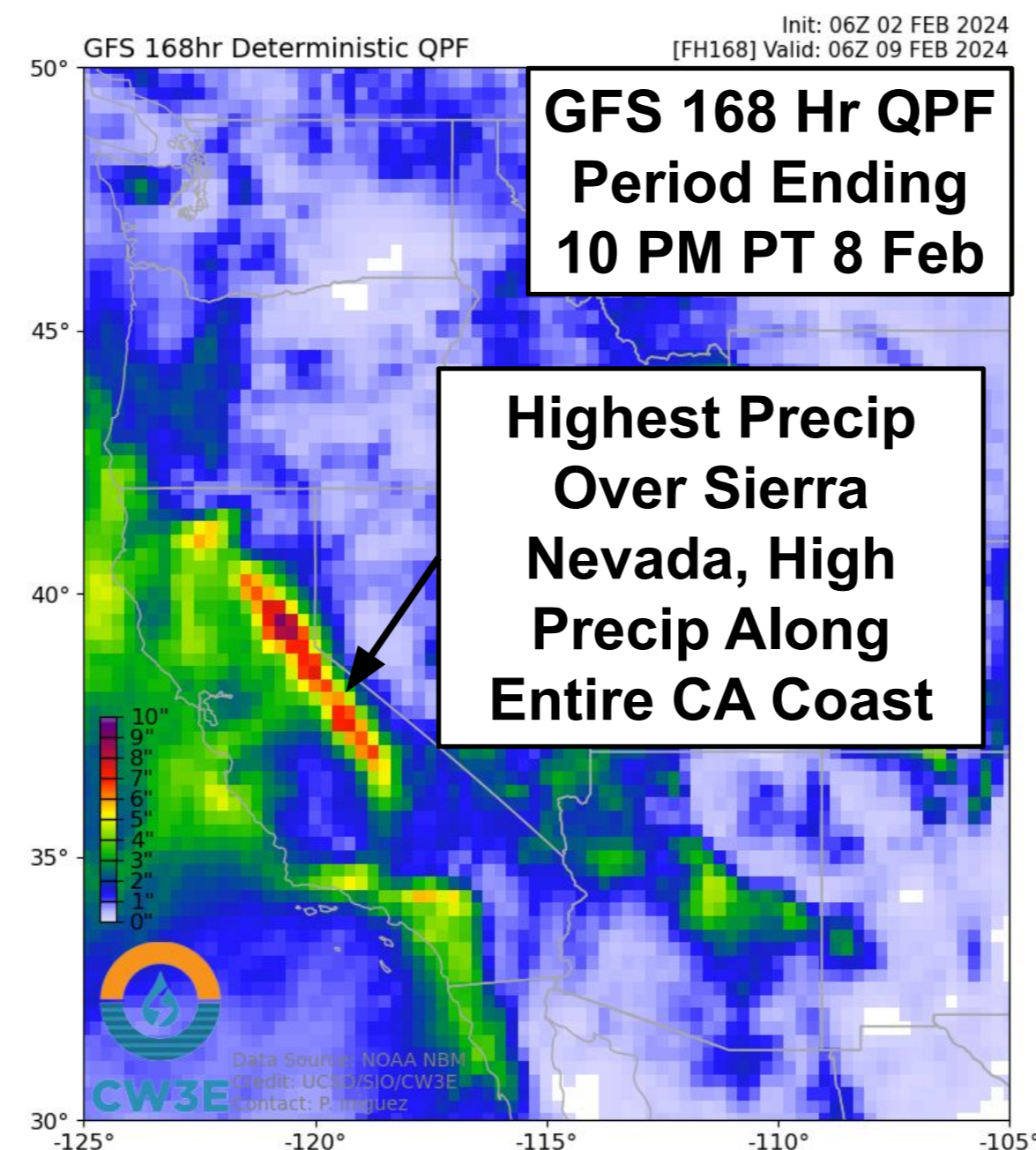
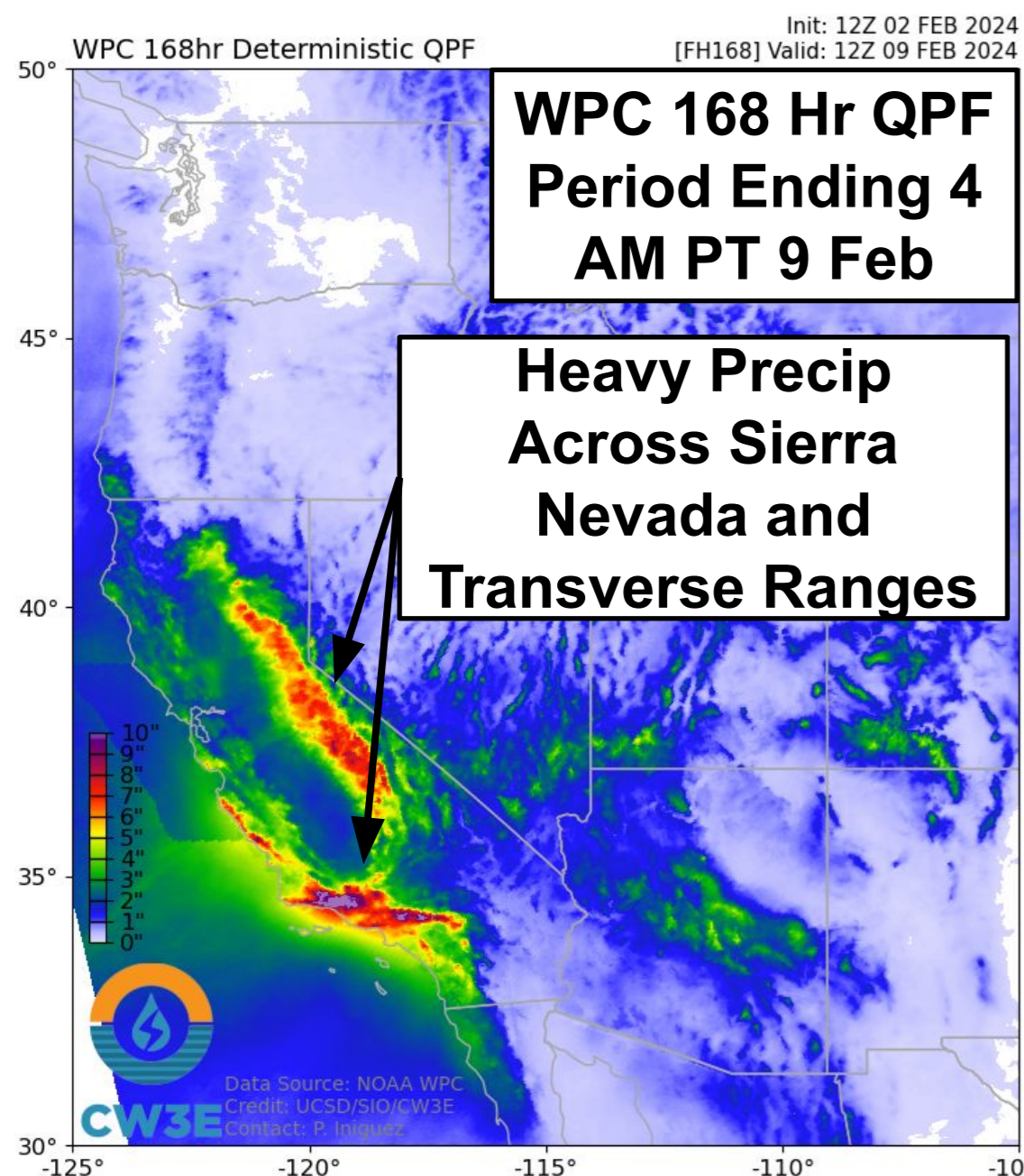
CW3E AR Outlook: 2 Feb 2024



- The NWS WPC is forecasting the heaviest precipitation over the Sierra Nevada and the Central CA coast on day 3 (24 hour period ending 4 AM PT Mon 5 Feb).
- A Moderate Risk (level 3 of 4, or at least 40% chance) for flash flooding has been issued along the Central CA coast for the 24 hour period ending 4 AM PT Mon 5 Feb and Los Angeles Metro Area for the 24 hour period ending 4 AM PT Tue 6 Feb.
- Slight Risks (level 2 of 4, or at least 15% chance) for flooding have been issued from north of the Bay Area down to the LA Metro Area for the 24-hour period ending 4 AM PT Mon 5 Feb, along the Central CA coast into Southern CA for the 24 hour period ending 4 AM PT Tue 6 Feb and along the Southern CA coast and in Western AZ for the 24-hour period ending 4 AM PT Wed 7 Feb.

*Excessive Rain Outlook (ERO)

CW3E AR Outlook: 2 Feb 2024

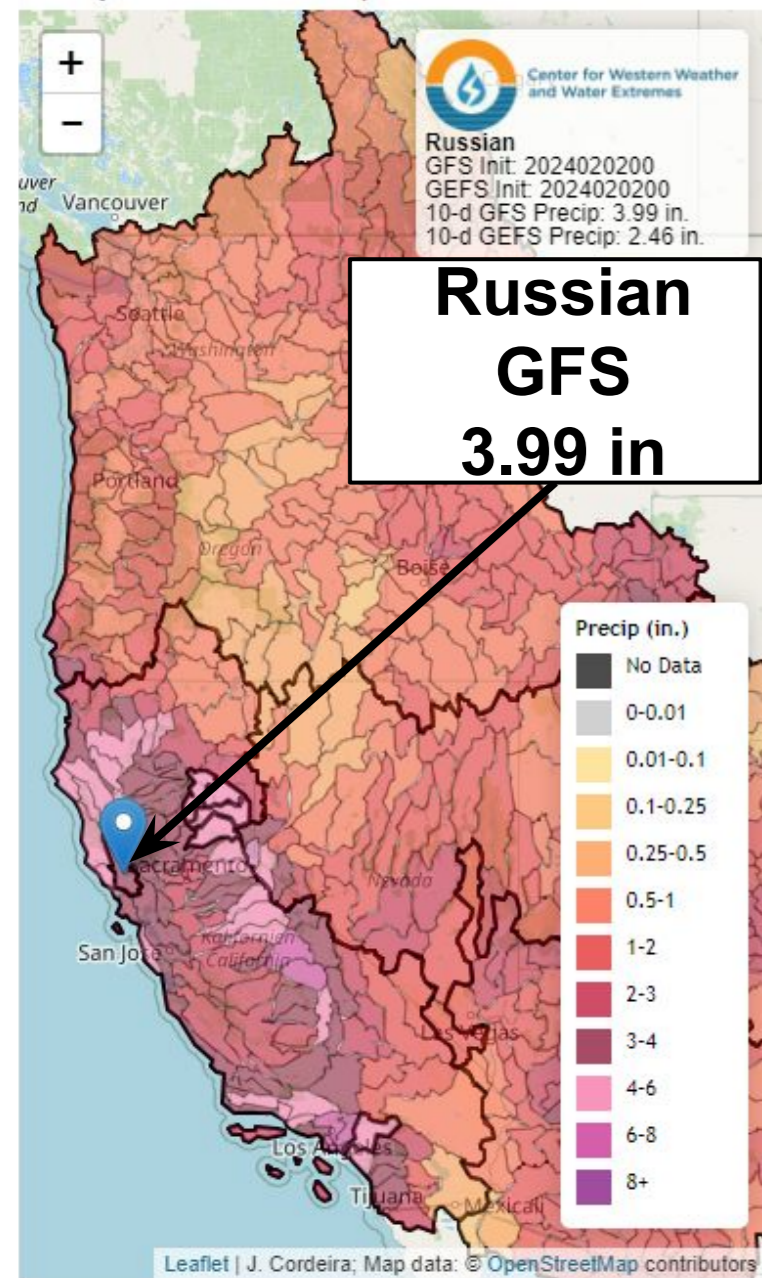


- WPC, GFS and ECMWF are forecasting significant precipitation in CA over the next 7 days, although there is uncertainty between forecast precipitation totals in the Sierra Nevada, Transverse Ranges, and along coastal Central California.
- The GFS is forecasting the highest precipitation over the Sierra Nevada while the ECMWF is forecasting the highest precipitation over the Transverse Ranges. The WPC is forecasting the highest precipitation totals in both the Sierra Nevada and Transverse Ranges.

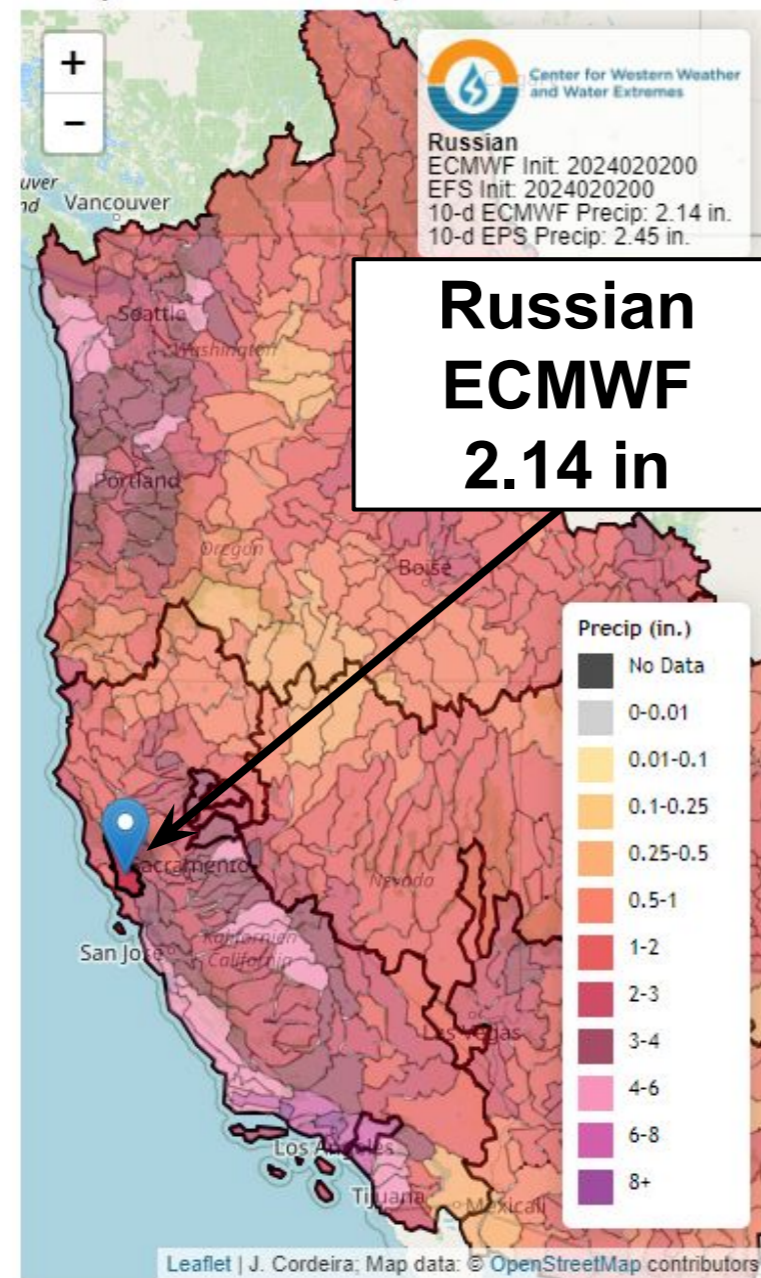
CW3E AR Outlook: 2 Feb 2024

10-day Watershed Precipitation Forecasts (Initialized 00Z 02 Feb)

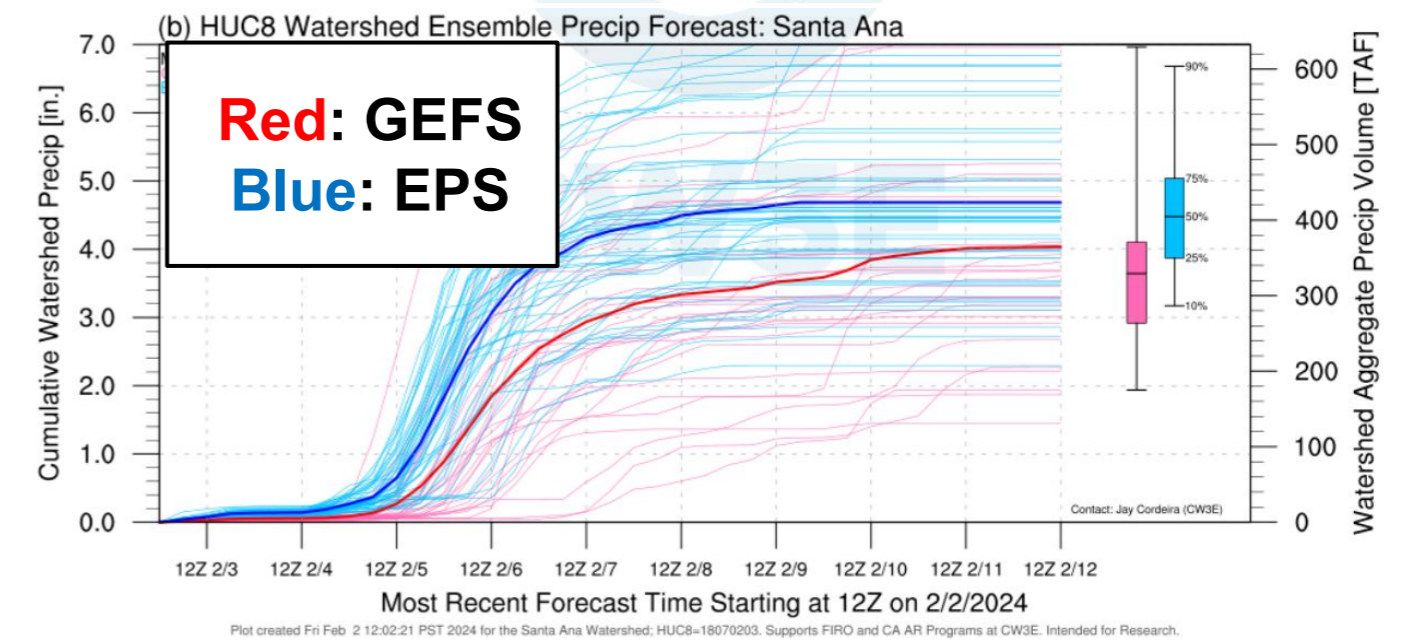
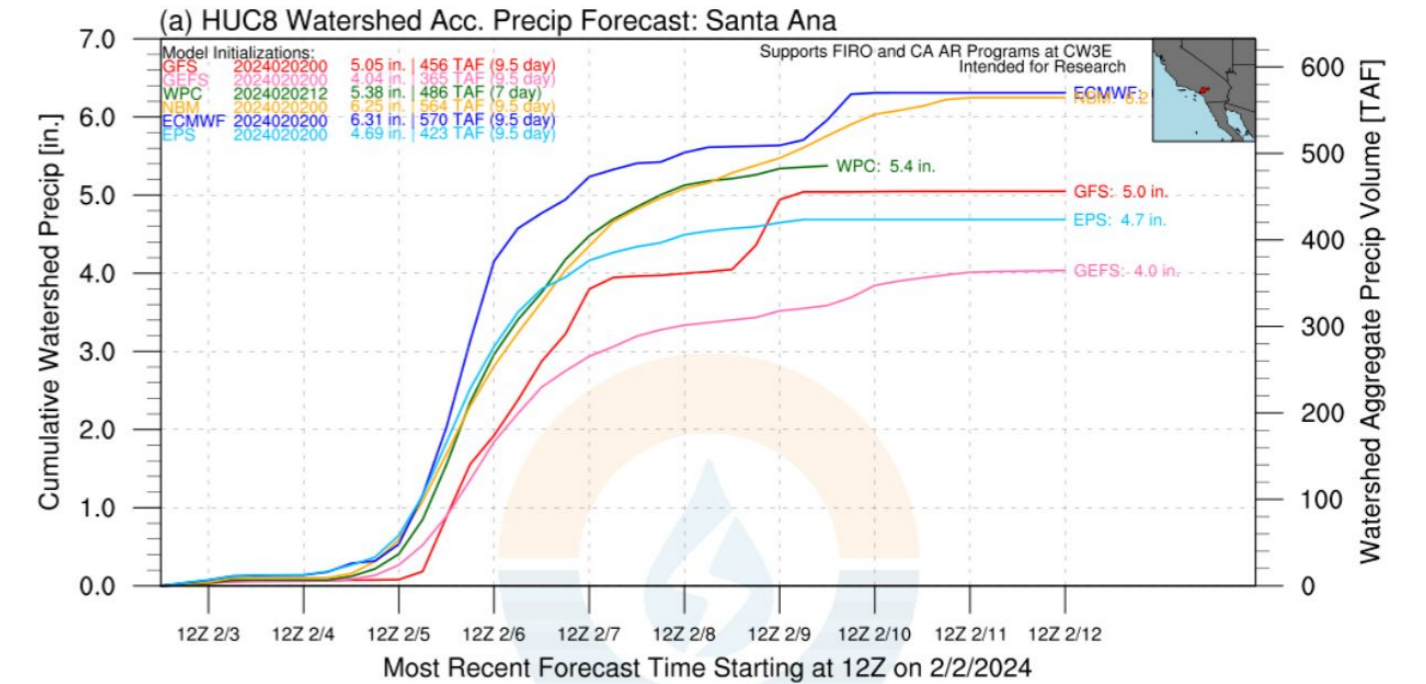
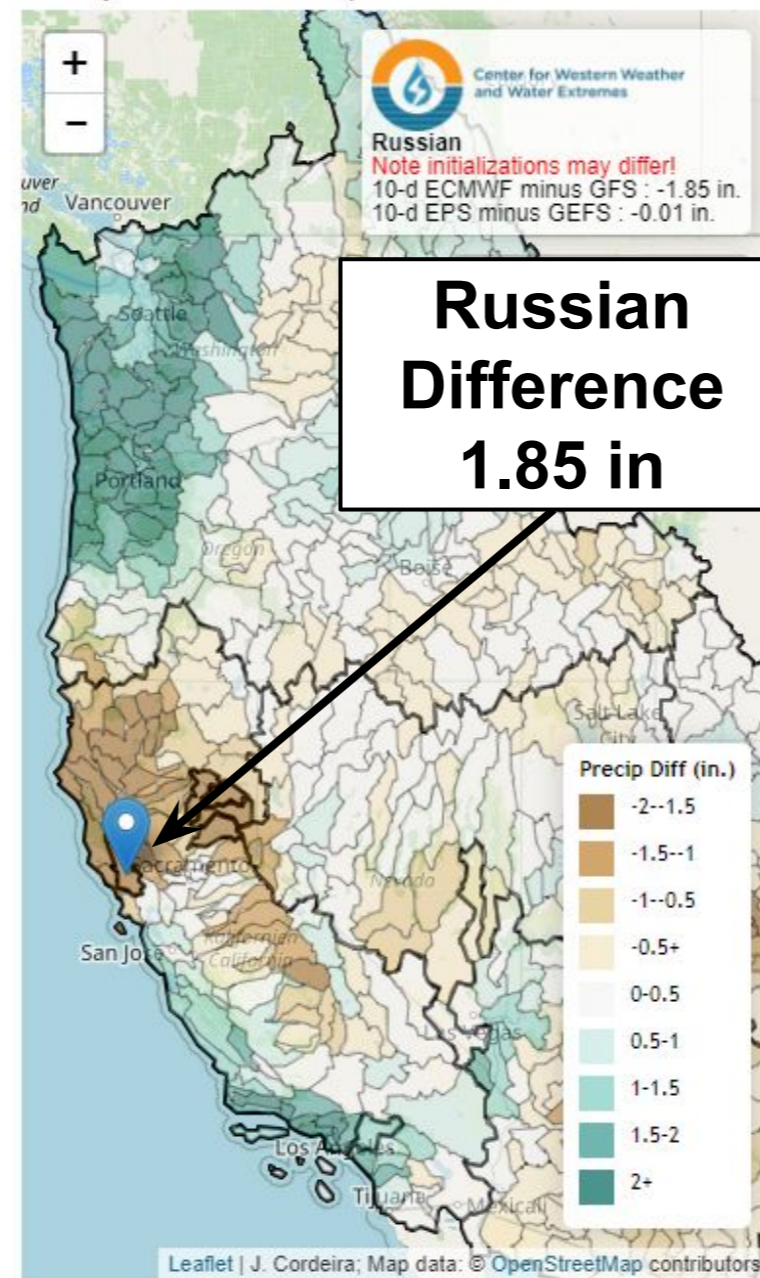
10-day GFS/GEFS Precipitation Forecasts



10-day ECMWF/EFS Precipitation Forecast



10-day Difference Precipitation Forecast

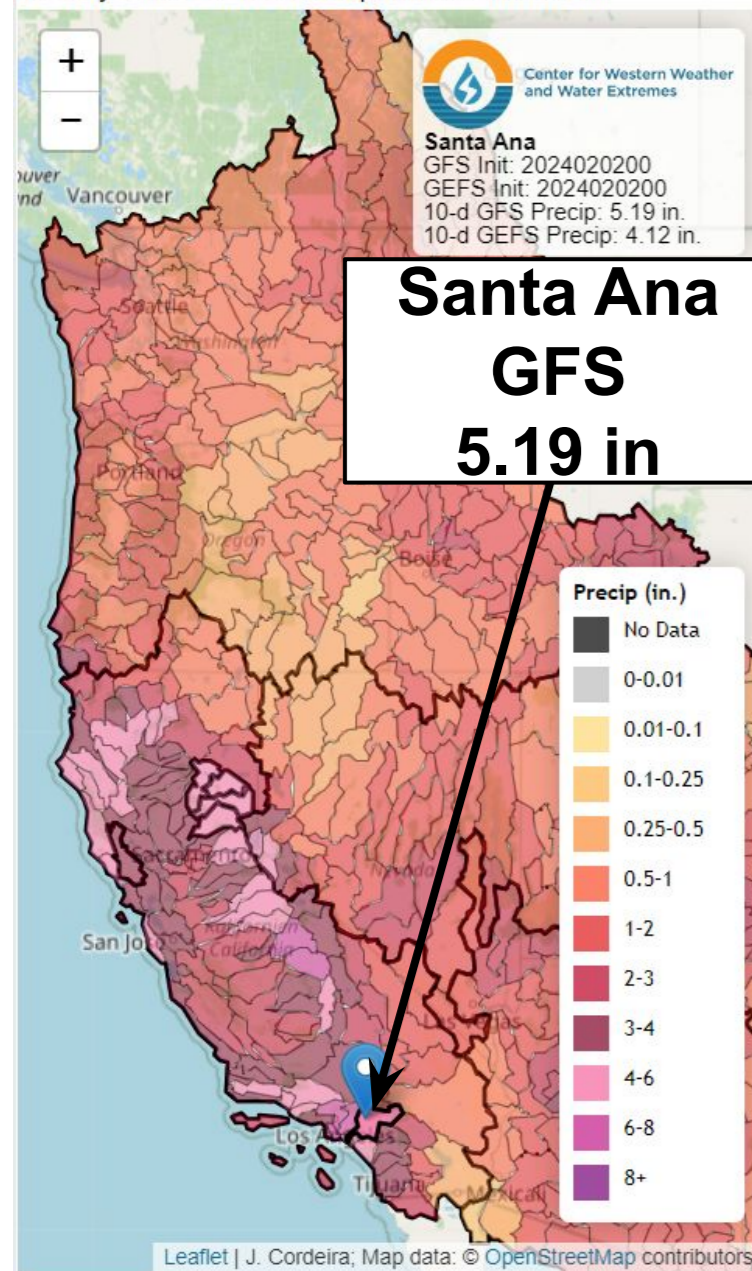


- The 00Z GFS and 00Z ECMWF 10-day watershed precipitation totals vary for CA during the period, where the GFS is forecasting greater precipitation in Northern CA and Sierra Nevada watersheds and the ECMWF is higher along the Central CA coast.
- The 00Z GFS is forecasting 3.99” of mean areal precipitation in the Russian River watershed over the next 10 days, while the 00Z ECMWF is forecasting 2.14” over the same watershed. Both ensembles’ members show large uncertainty in the 10-day totals.

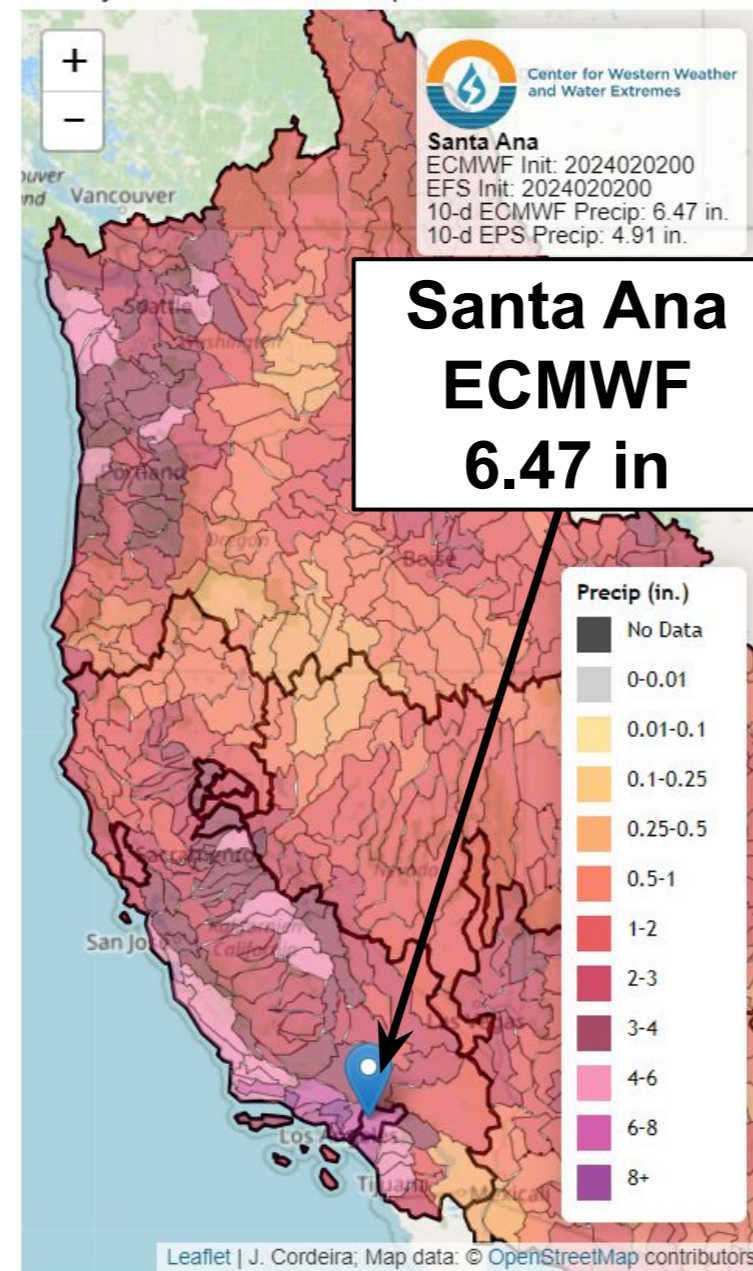
CW3E AR Outlook: 2 Feb 2024

10-day Watershed Precipitation Forecasts (Initialized 12Z 02 Feb)

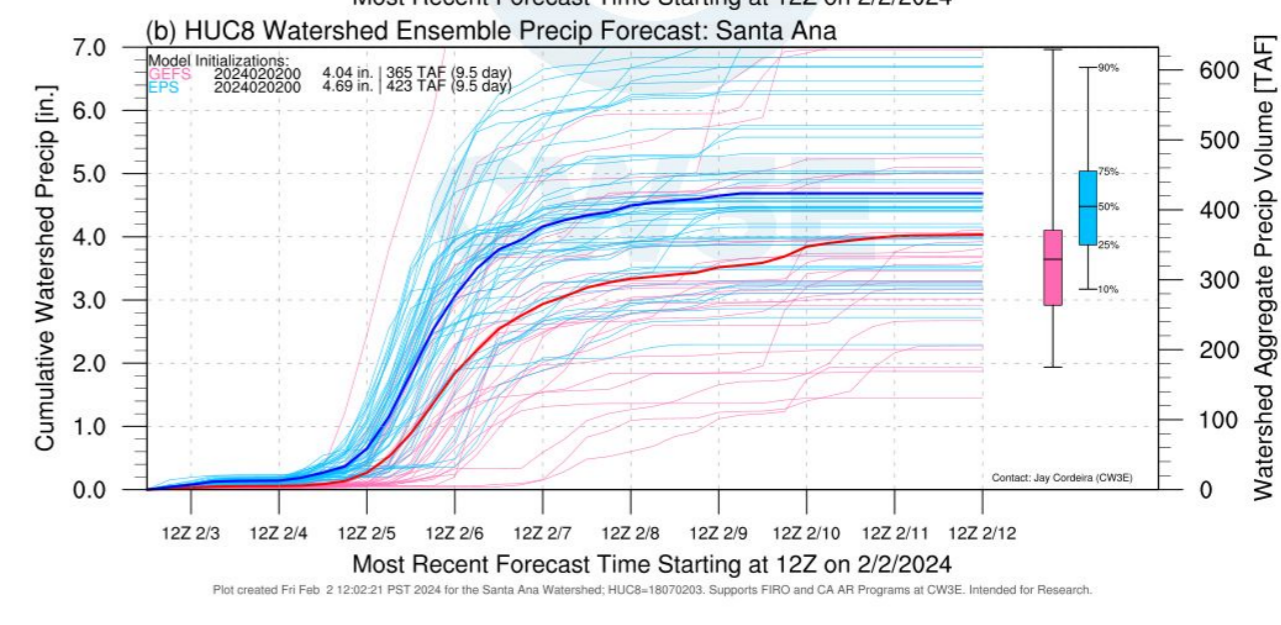
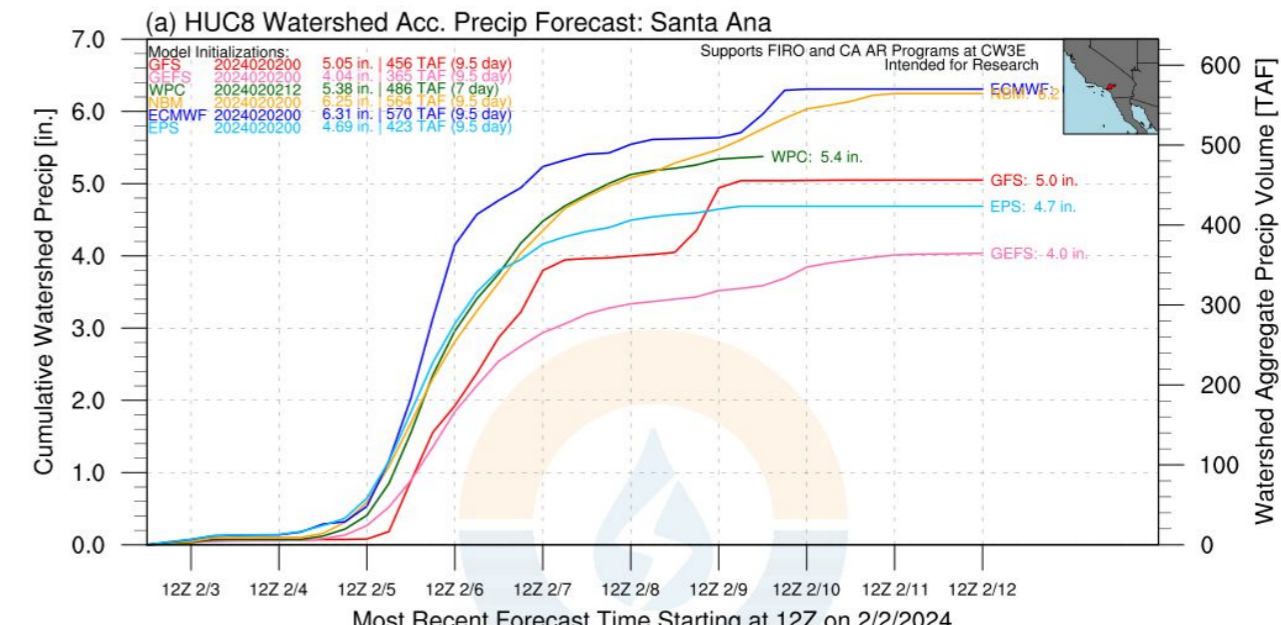
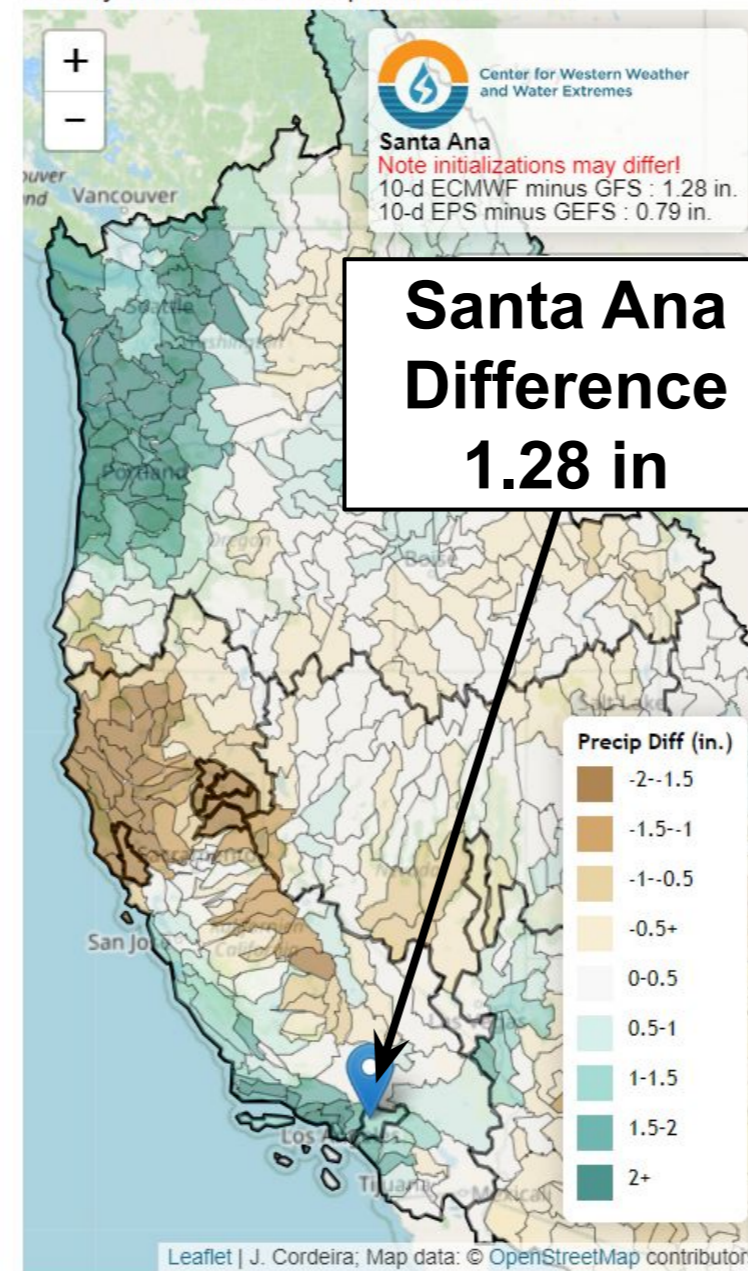
10-day GFS/GEFS Precipitation Forecasts



10-day ECMWF/EFS Precipitation Forecast

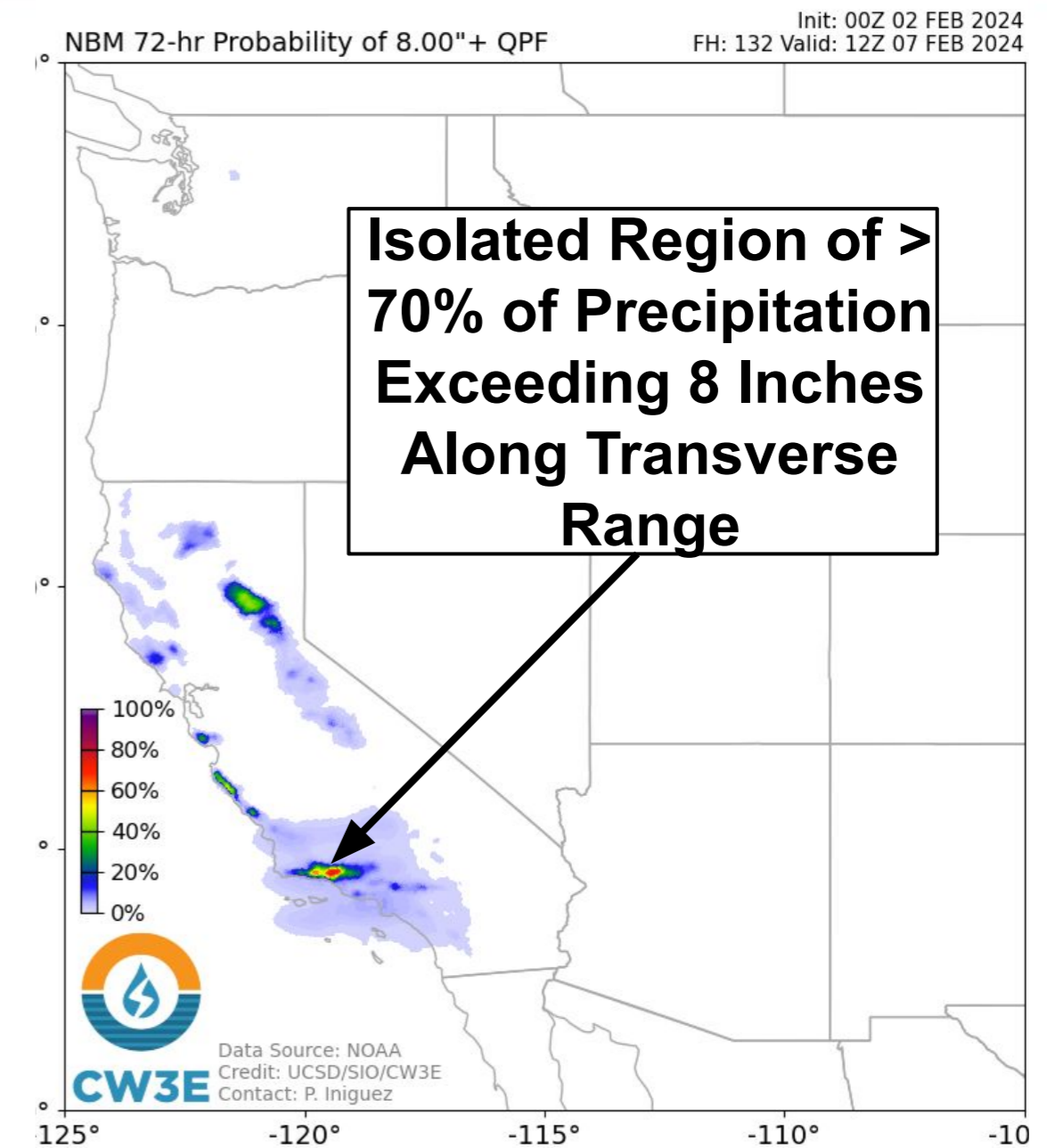
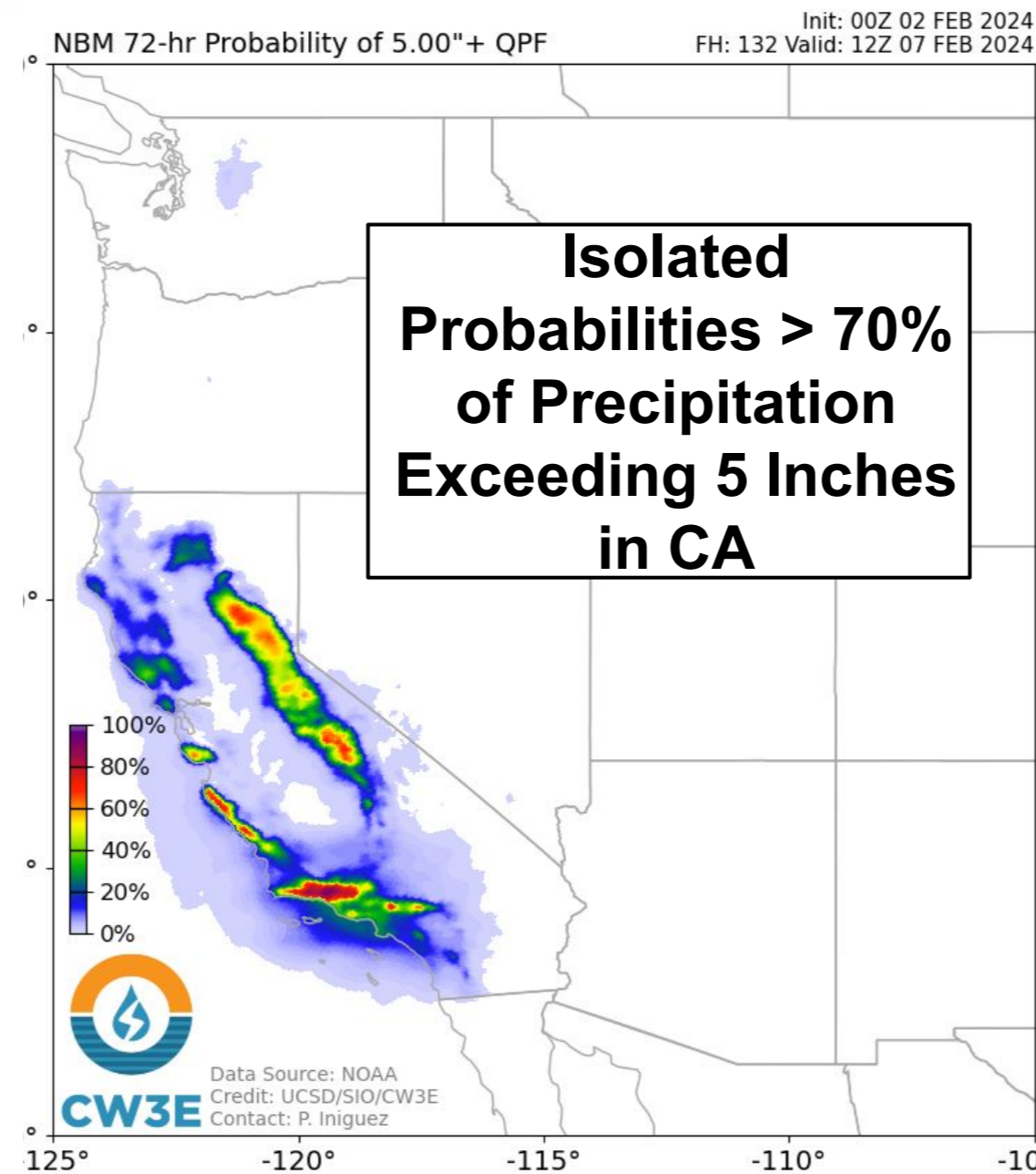
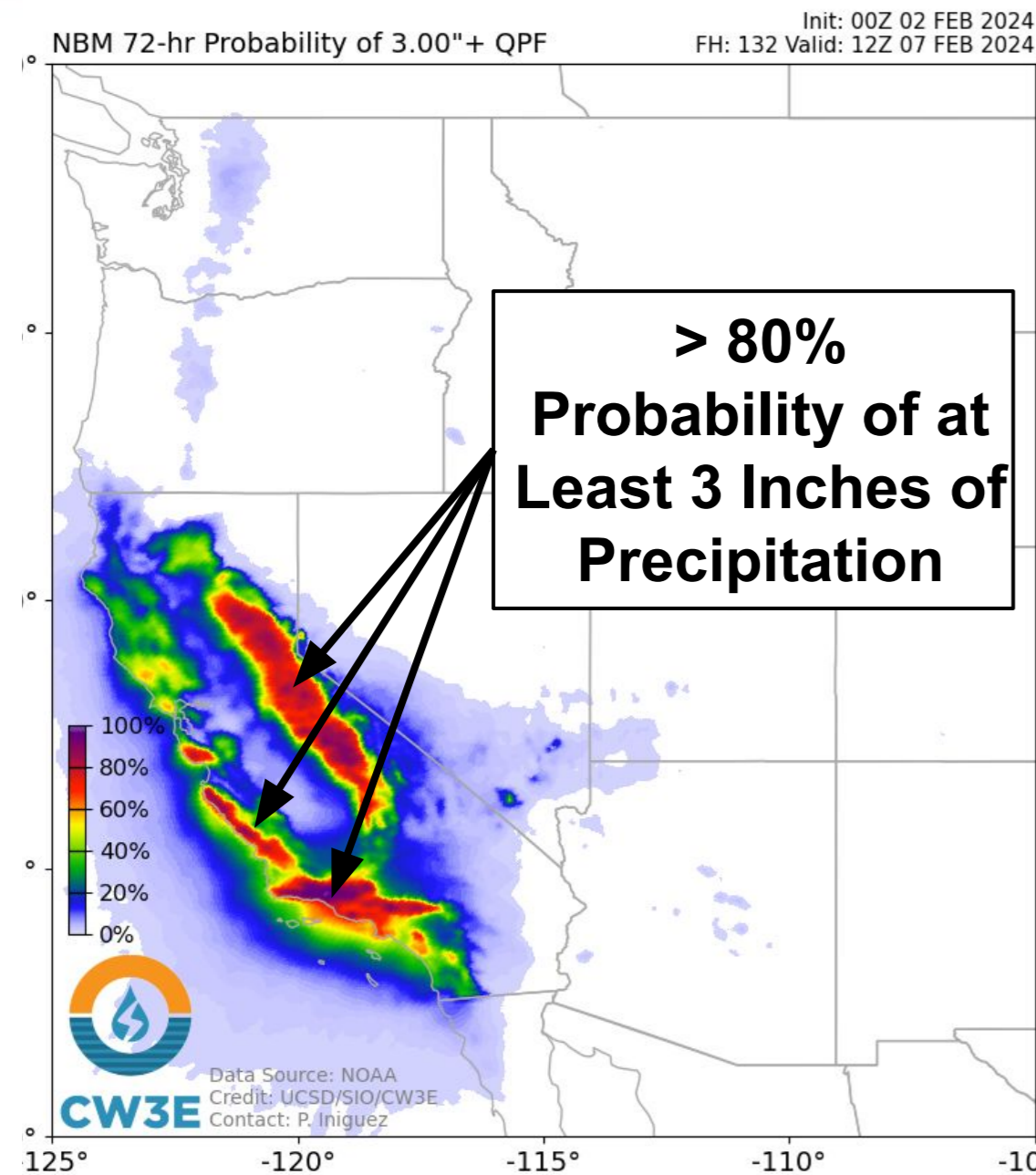


10-day Difference Precipitation Forecast



- The 12Z GFS is forecasting 5.19 in. of precipitation over the Santa Ana watershed, while the 12Z ECMWF is forecasting 6.47 in. over the next 10 days.
- The EPS ensemble mean is also forecasting higher precipitation totals during this period of 4.7 in. as compared to 4.0 in. forecast by the GEFS ensemble mean for Southern California.

CW3E AR Outlook: 2 Feb 2024

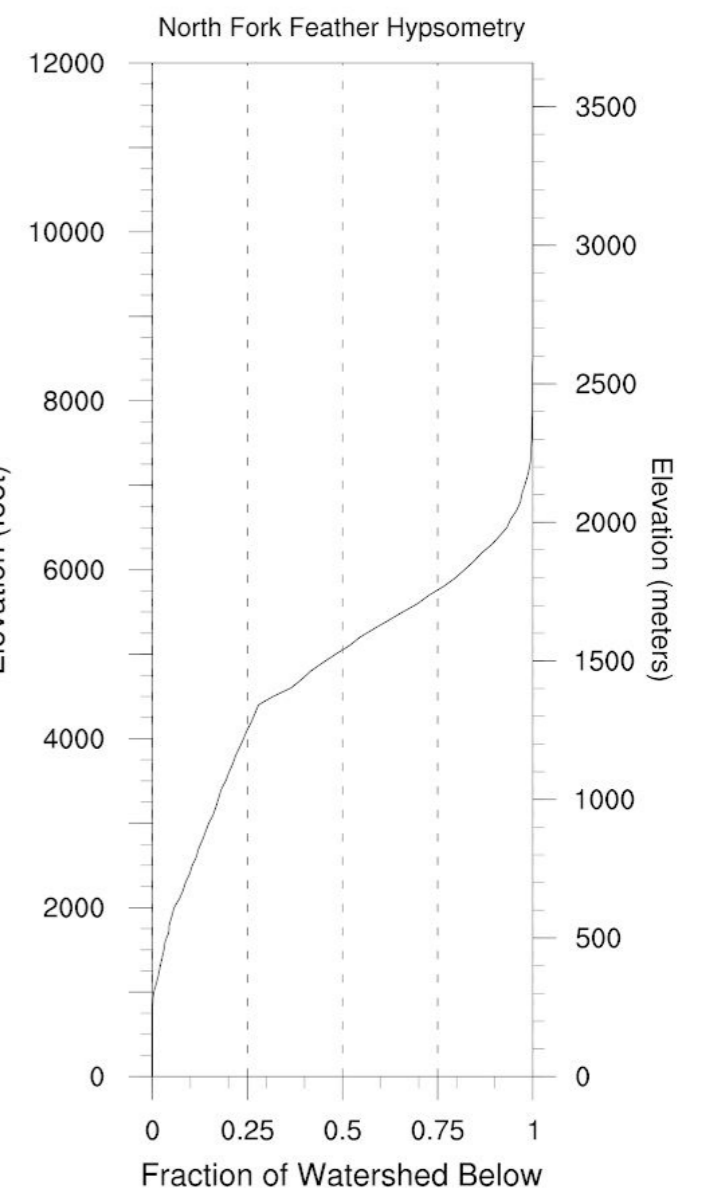
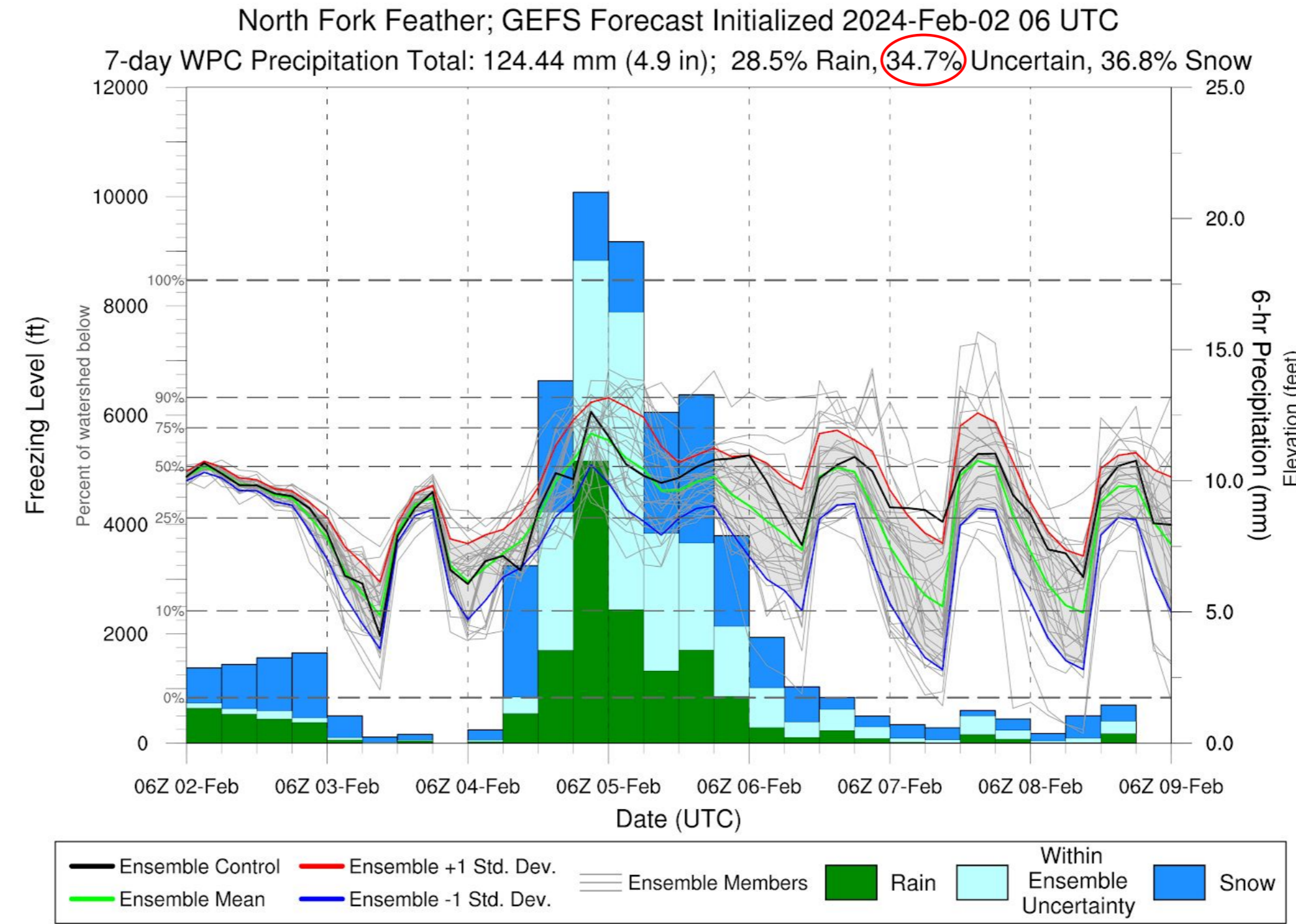
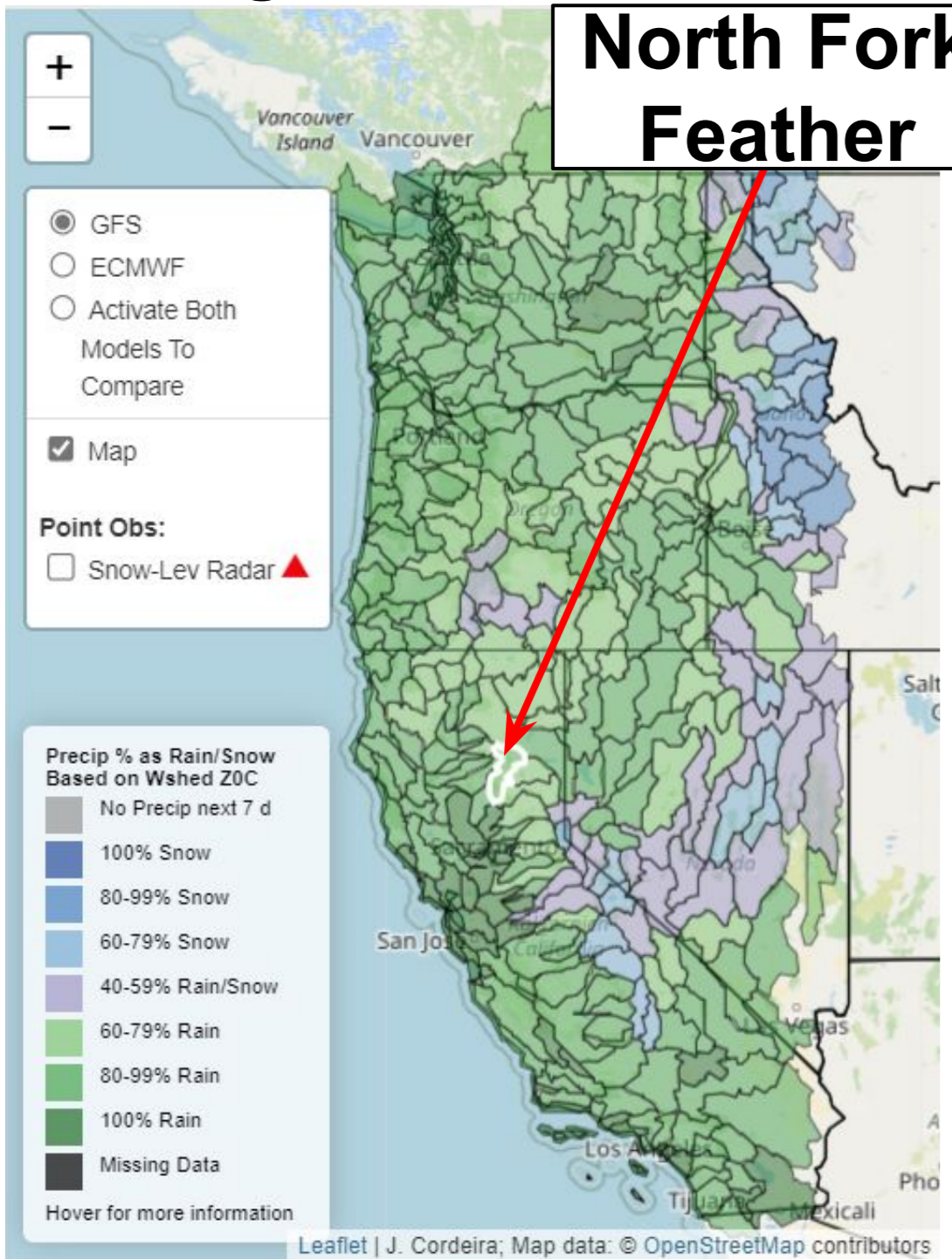


- For the 72-hour period ending at 4 AM PT Wed 7 Feb, the National Blend of Models (NBM) is showing high probabilities (> 80%) that the Sierra Nevada, Coast Ranges and Transverse Ranges receive at least 3 inches of precipitation.
- The NBM is also showing isolated regions of higher probabilities (>70%) of 72-h precipitation exceeding 5 inches in the Sierra Nevada, Coast Ranges and Transverse Ranges.
- There is also a singular isolated region of higher probabilities (>70%) of precipitation exceeding 8 inches in the Transverse Range.

CW3E AR Outlook: 2 Feb 2024

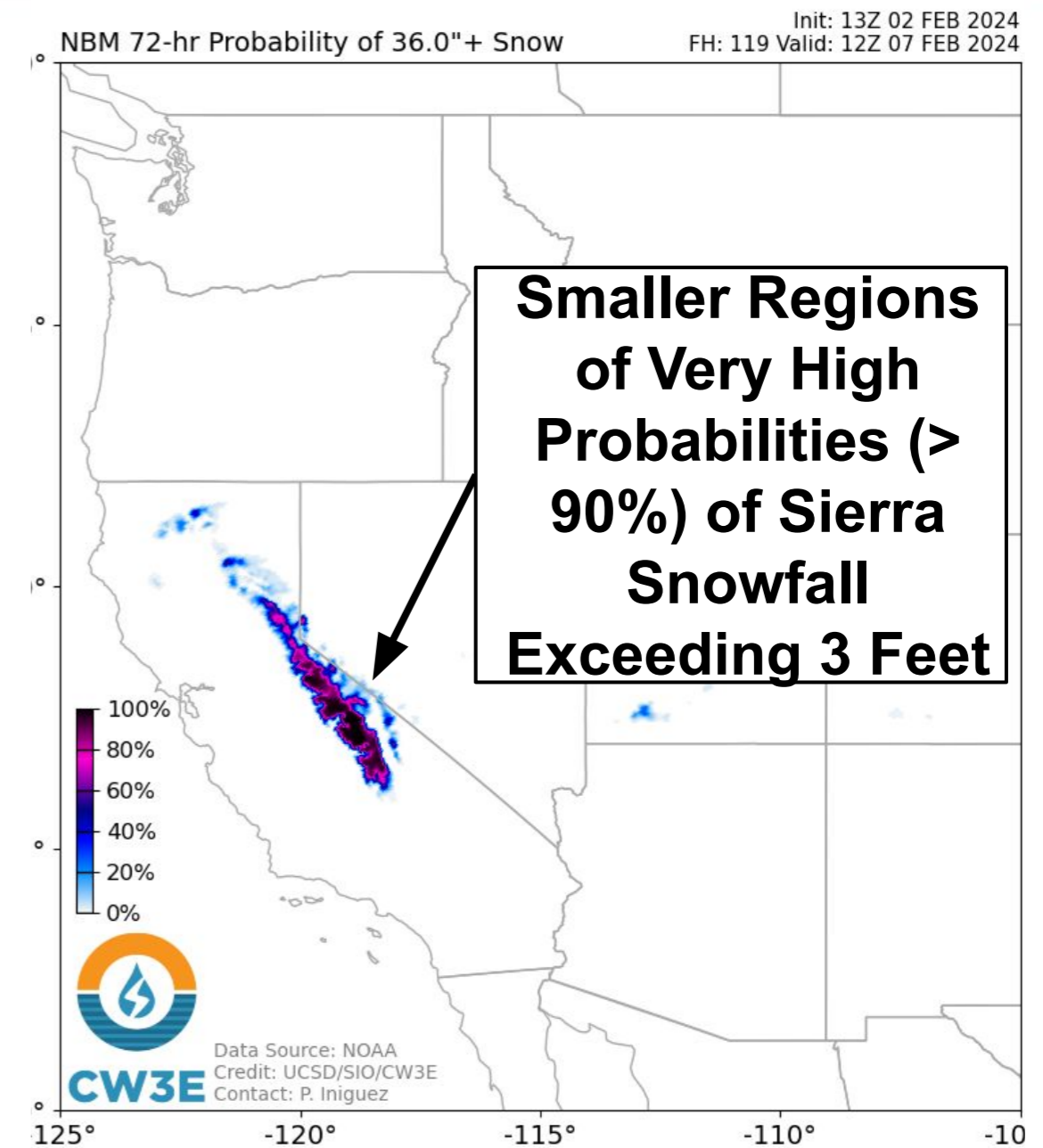
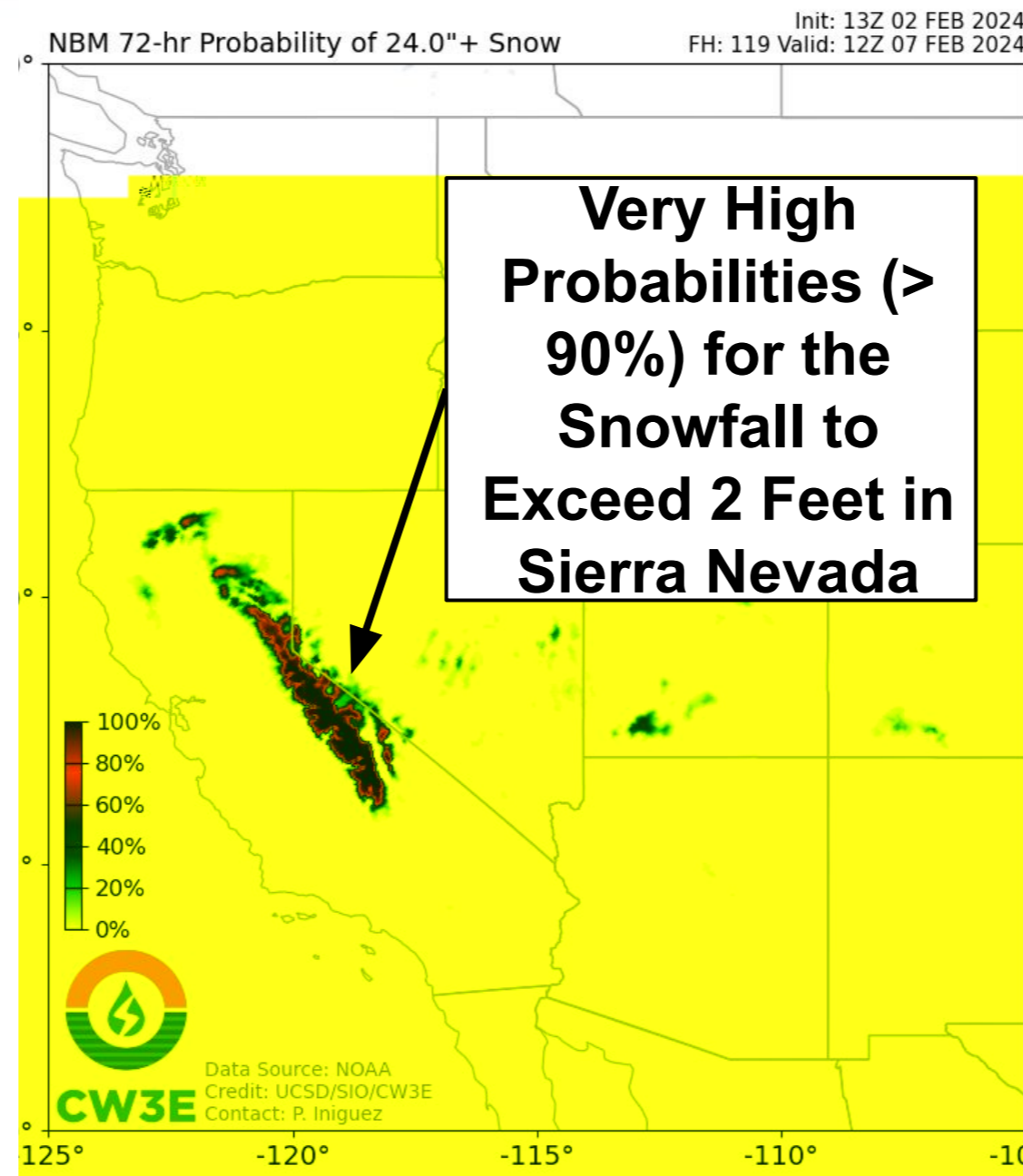
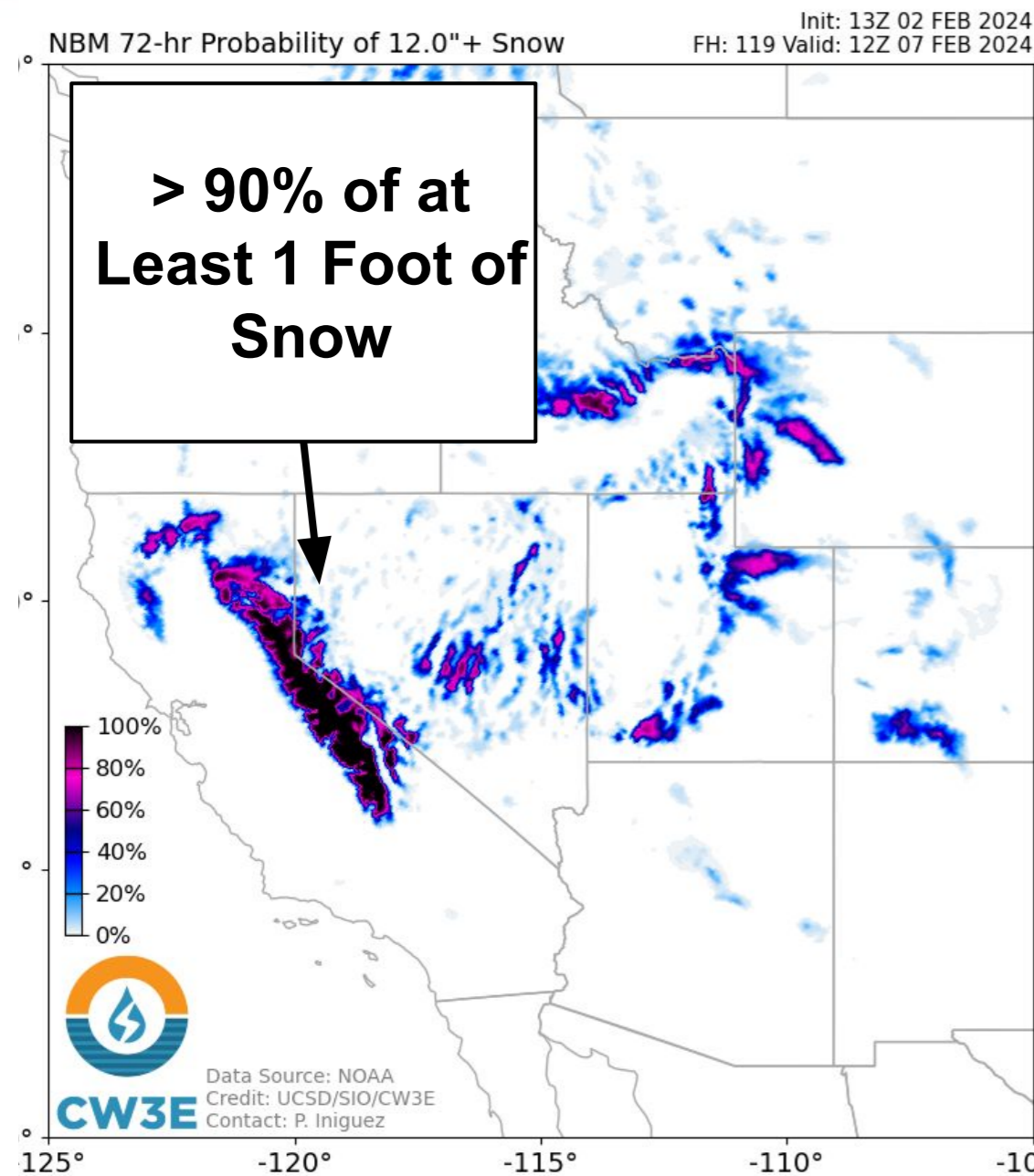
Freezing Level Forecast

North Fork Feather



- The freezing level is forecast to rise from ~3000 ft to ~ 6000 ft above Mean Sea Level (MSL) at the onset of AR conditions in the North Fork Feather watershed before slightly decreasing to ~5000 ft throughout the rest of the event.
- The freezing level in the North Fork Feather results in approximately 35% uncertainty in the precipitation type forecast, with the remainder of the ensemble members slightly favoring a forecast of snow (36.8%) to rain (28.5%).

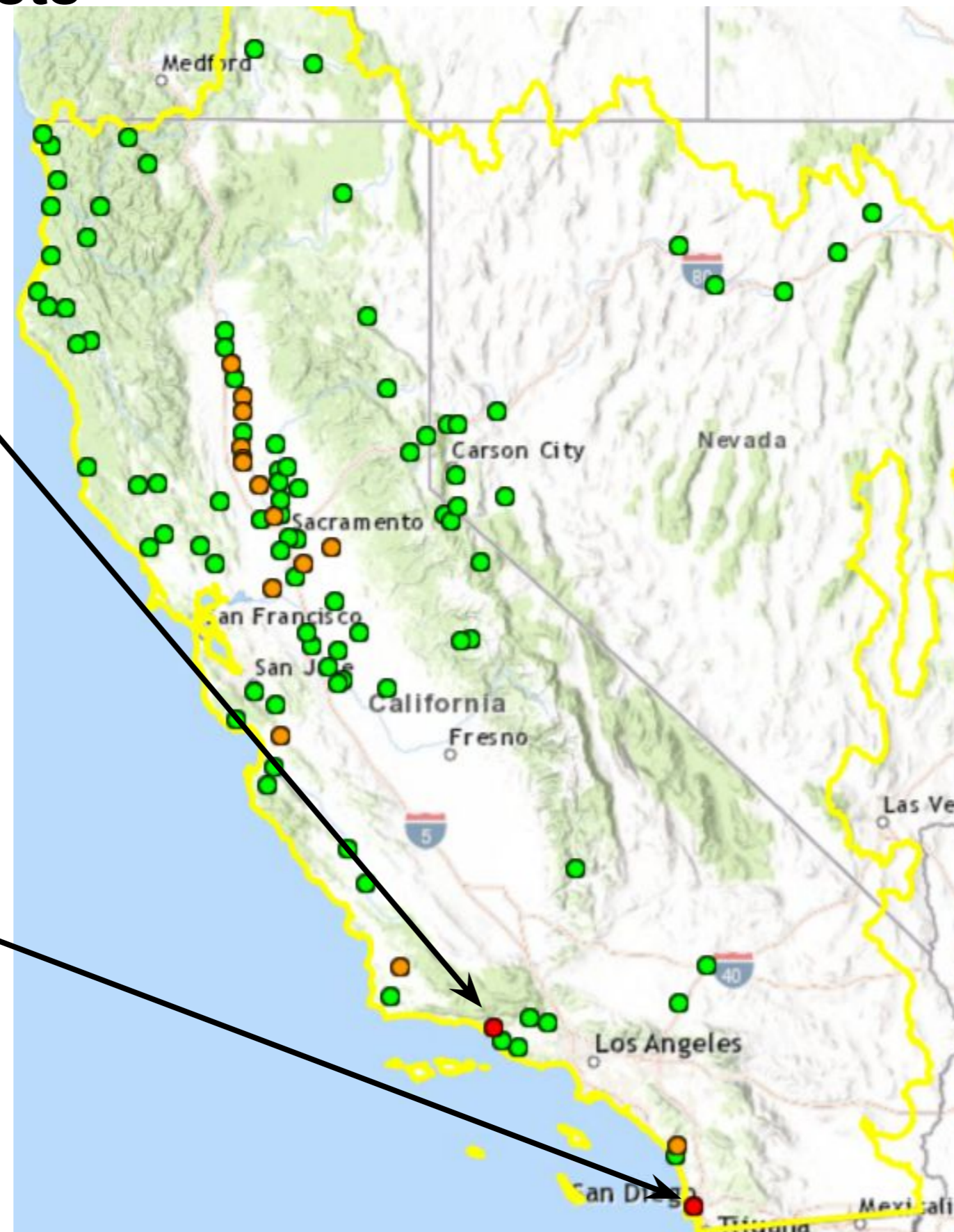
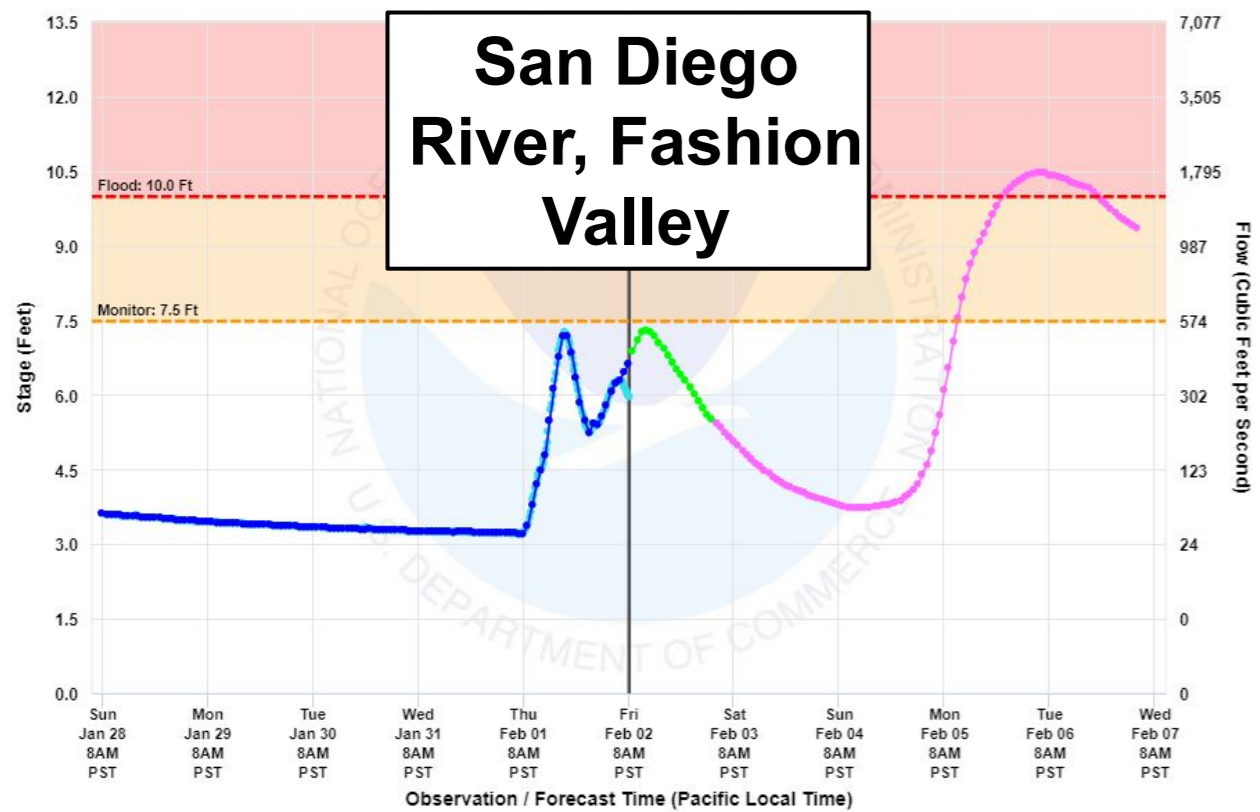
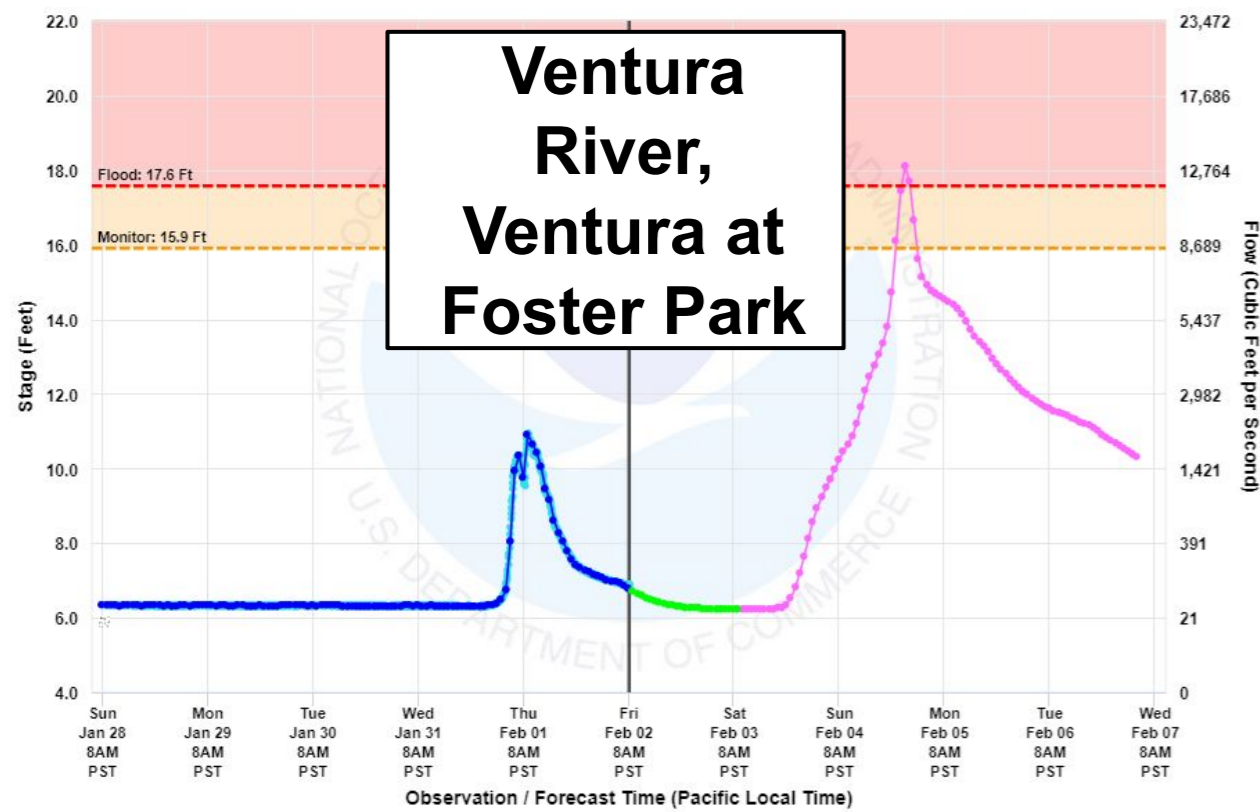
CW3E AR Outlook: 2 Feb 2024



- For the 72-hour period ending at 4 AM PT Wed 7 Feb, the NBM is showing very high probabilities (>90%) that the Sierra Nevada receives at least 12 inches of snowfall.
- The NBM is showing smaller regions of very high probabilities (>90%) of snowfall exceeding 2 feet and 3 feet in the Sierra Nevada.

CW3E AR Outlook: 2 Feb 2024

NWS CNRFC River Stage Forecasts



- River levels in CA are forecast to rise as a result of the precipitation from the approaching AR.
- CNRFC is currently forecasting 14 gages to exceed monitor stage and 2 gages to exceed flood stage in the next 5 days.
- The Ventura River at Ventura at Foster Park (top left) guidance shows the river reaching flood stage for short time late on Sun 4 Feb.
- The San Diego River at Fashion Valley (bottom left) guidance shows the river reaching flood stage late Mon 5 Feb as the AR moves down the coast.

NOAA / NWS / California Nevada River Forecast Center • California Department of Water Resources
 — Observed (Raw Gauge) — Observed (Simulated) — Forecast — Guidance

CW3E AR Outlook: 2 Feb 2024

Surface Winds

Hazardous Winds Sunday

What

- High Wind Warning: Strong southerly winds with gusts to 60 mph or greater
- Wind Advisory: Strong southerly winds with gusts up to 50 mph

Where

- Bay Area and Central Coast
- Strongest winds in higher terrain and along immediate coast

When

- 4 AM Sunday to 10 PM Sunday

Impacts

- Gusty winds could blow around unsecured objects.
- Downed trees could result in power outages.

Forecast Confidence

Low Medium High

Weather Forecast Office
San Francisco Bay Area
Friday, February 2

Damaging/Strong Wind Gusts Possible
Information as of Friday, February 2nd, 2024 at 10:00 AM PST

Potential Wind Gusts
Valid at 4 PM PST Sunday, February 4th, 2023

BOTTOM LINE

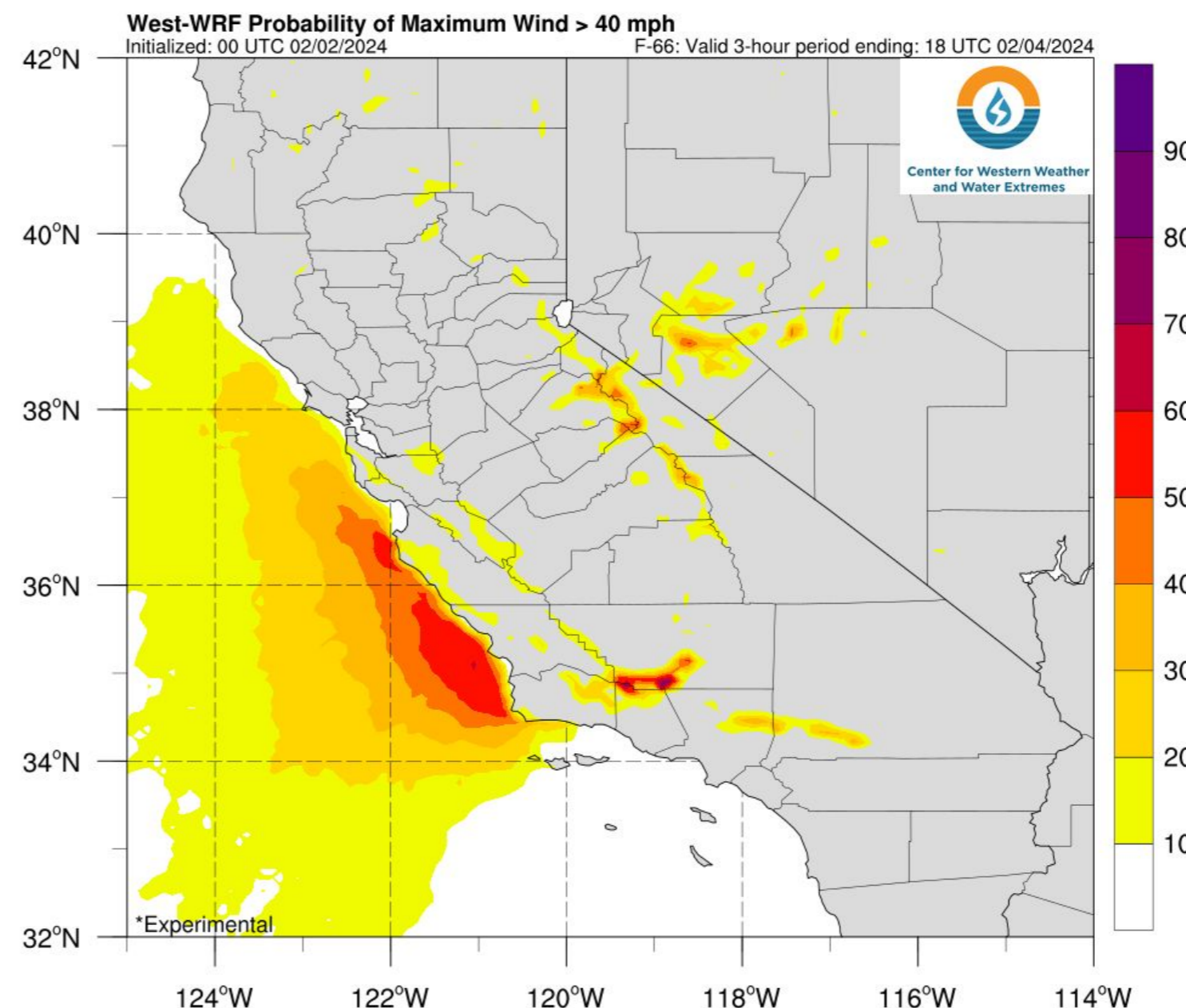
- Southeast to south wind gusts near 65 mph along the Interstate 5 corridor through the Grapevine
- Southeast to south wind gusts near 45 mph in the Coastal Range and San Joaquin Valley
- Sunday and Sunday night

WHAT TO DO

- Avoid large trucks and tractor trailers
- Hold on to the steering wheel firmly with both hands
- Slow down

Hanford, CA WEATHER FORECAST OFFICE
<http://www.weather.gov/hnx>
[facebook.com/NWSHanford](https://www.facebook.com/NWSHanford) @NWSHanford
 February 2, 2024

West-WRF Probability of Max Winds > 40mph Valid: 3-hour period ending 10AM PT Sunday 4 Feb

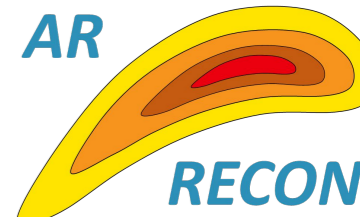


- West-WRF ensemble is forecasting high probabilities (>50%) of maximum wind > 40mph from Monterey to Point Conception

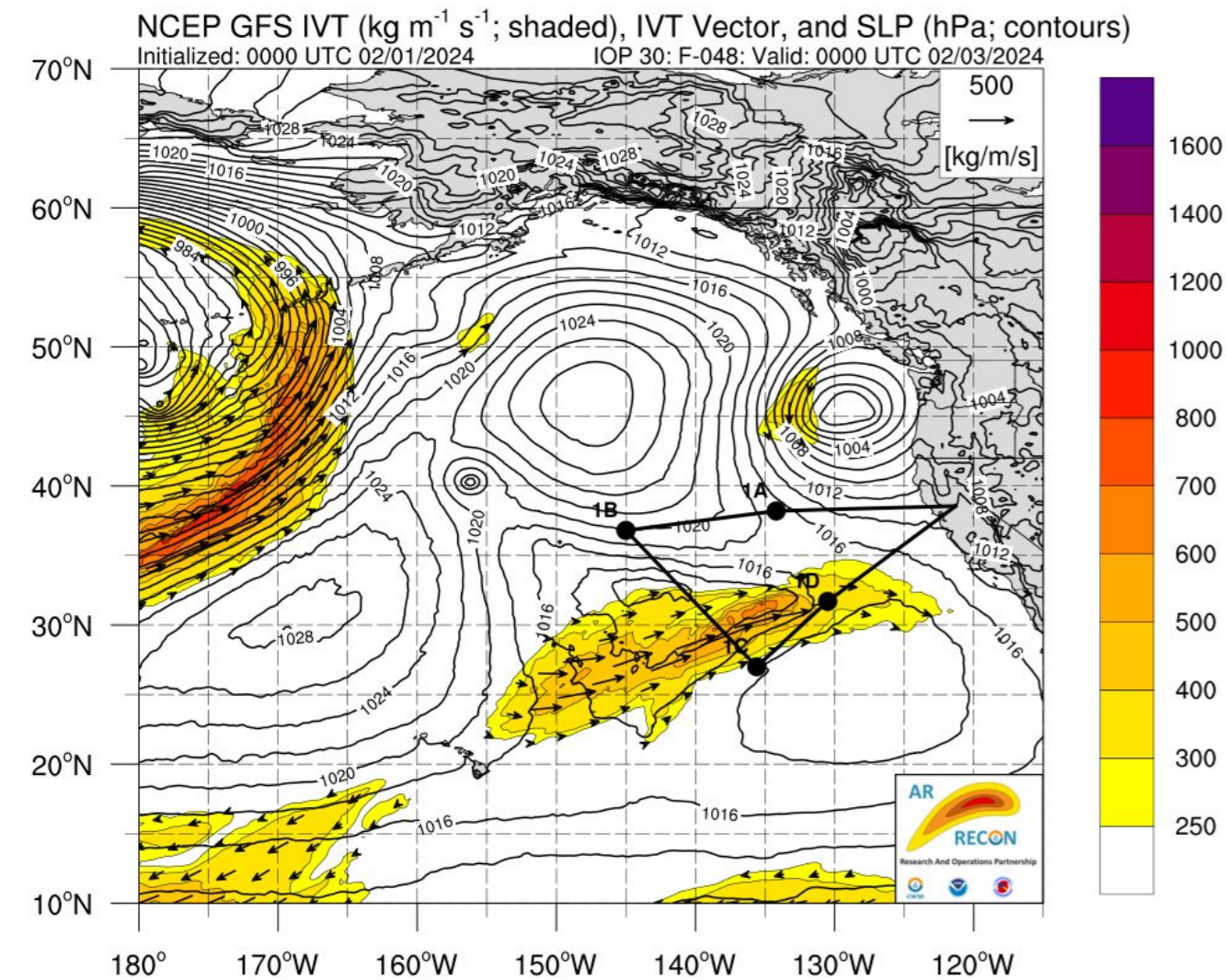
- NWS San Francisco has issued a high wind warning from the South Bay area to San Luis Obispo County for southerly wind gusts possibly exceeding 60 mph from 4am to 10pm Sunday 4 Feb.
- NWS Hanford is highlighting the potential for wind gusts on Sunday near 65 mph over the Grapevine with 45 mph gusts along the coast and San Joaquin Valley.

CW3E AR Outlook: 2 Feb 2024

Current AR Recon Planned Flight Sequence

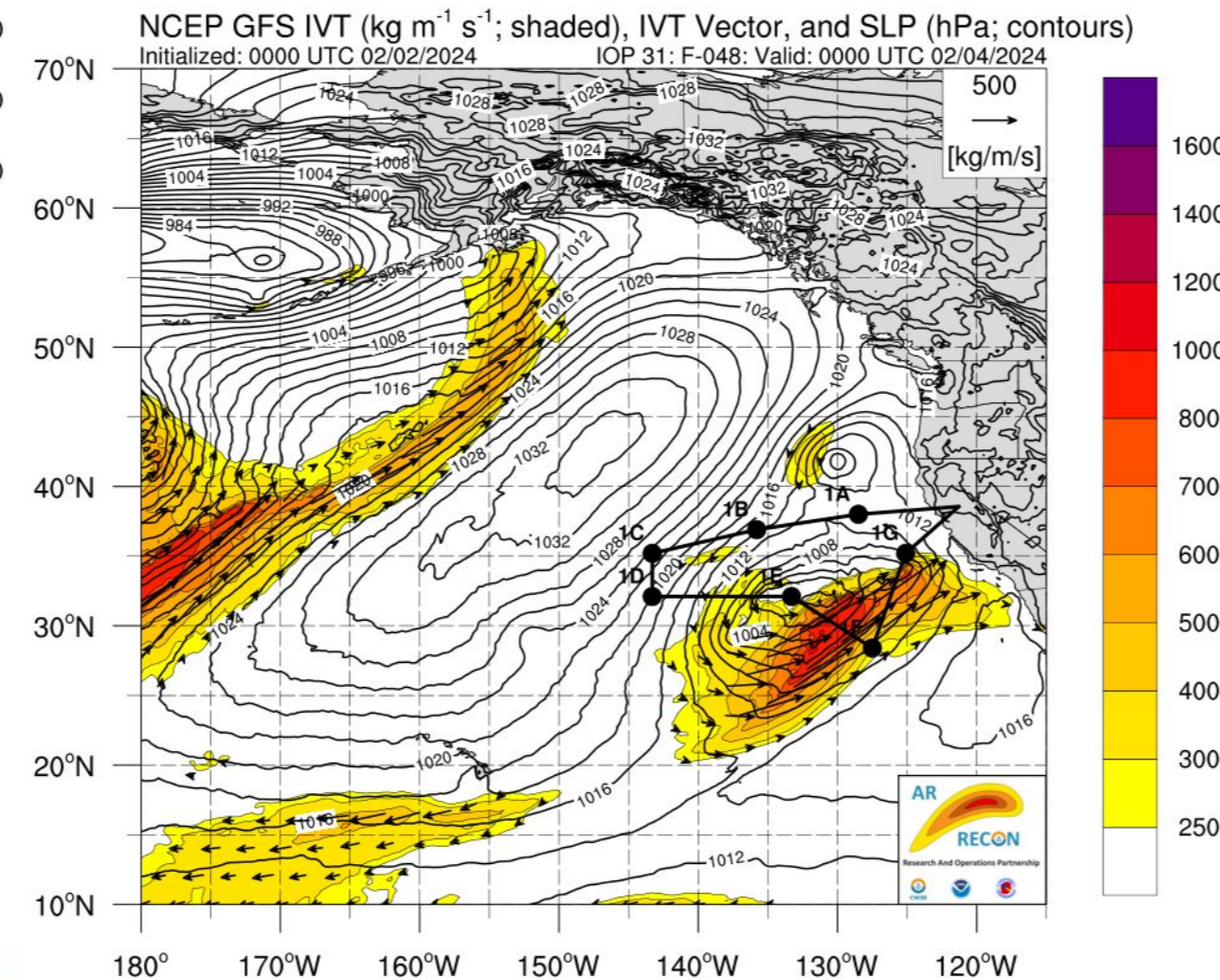


Research And Operations Partnership



IOP30 - 03 Feb 2024

IOP31 - 04 Feb 2024



- 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 AR.
- The AR Recon team planned multiple flights, 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.