

# CW3E Atmospheric River Outlook: 10 February 2025

---

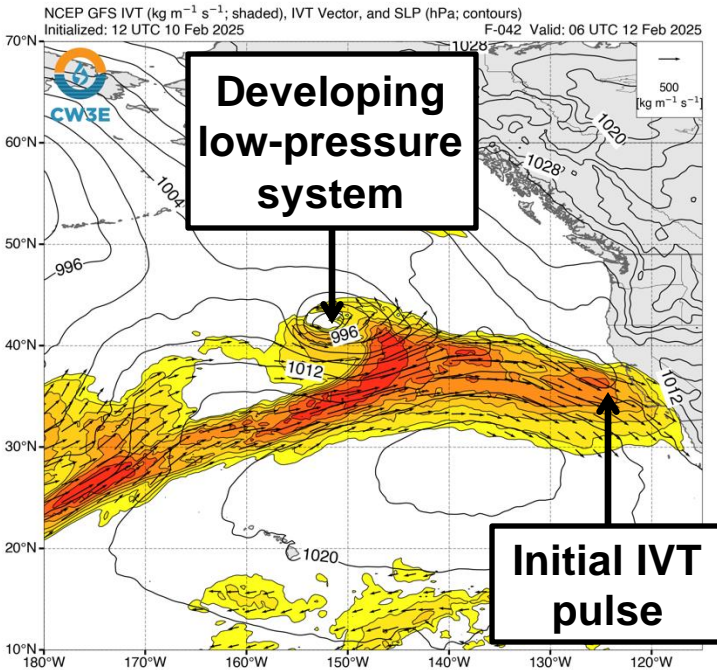
## Atmospheric River Forecast to Impact California This Week

- A weak pulse of moisture transport is forecast to move onshore late Tue 11 Feb and bring light precipitation to coastal Central and Southern California.
- A stronger atmospheric river (AR) associated with a low-pressure system is forecast to bring heavy rain and mountain snow to much of California late Wed 12 Feb through Fri 14 Feb.
- Ensemble and deterministic models are still showing some subtle differences in both the initial moisture pulse and the subsequent AR.
- The GEFS control member is forecasting an AR 2 (based on the Ralph et al. 2019 AR Scale) over coastal Central California and an AR 1 over coastal Southern California, whereas the EPS control member is forecasting an AR 3 over San Diego County.
- Storm-total precipitation amounts of 5–10 inches are possible in the Sierra Nevada, Central California Coast Ranges, and Southern California Transverse Ranges.
- The heaviest precipitation and greatest impacts from this AR are expected Thu 13 Feb into Fri 14 Feb. The NWS Weather Prediction Center (WPC) has issued a **slight risk** excessive rainfall outlook (ERO) for much of coastal California, the Central/Southern Sierra Nevada, and portions of the Central Valley.
- Compared to the deterministic GFS, the deterministic ECMWF is forecasting lower precipitation amounts over the Sierra Nevada and higher precipitation amounts over the Central California Coast Ranges and Southern California.
- Heavy snowfall is also likely in the higher terrain of the Sierra Nevada, with >4 feet possible in the Central and Southern Sierra Nevada. Major-to-extreme winter storm impacts are likely in these areas.

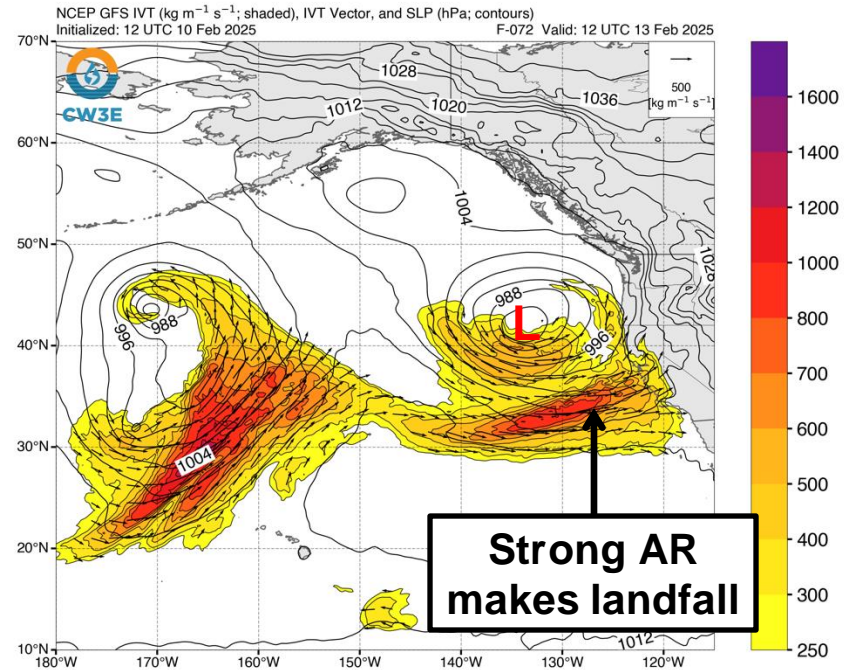
# AR Outlook: 10 February 2025

## GFS IVT & SLP Forecasts

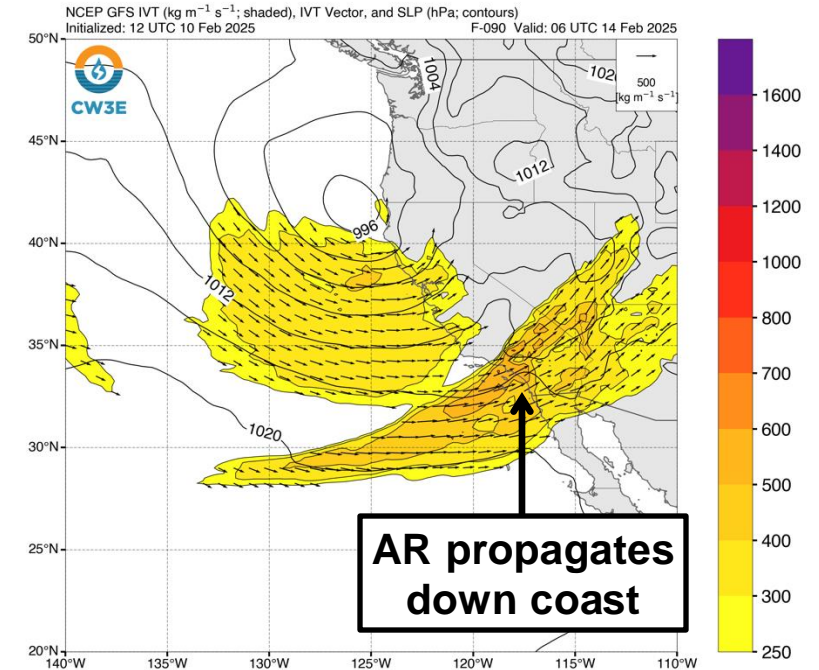
Valid 10 PM PST 11 Feb (F-042)



Valid 4 AM PST 13 Feb (F-072)



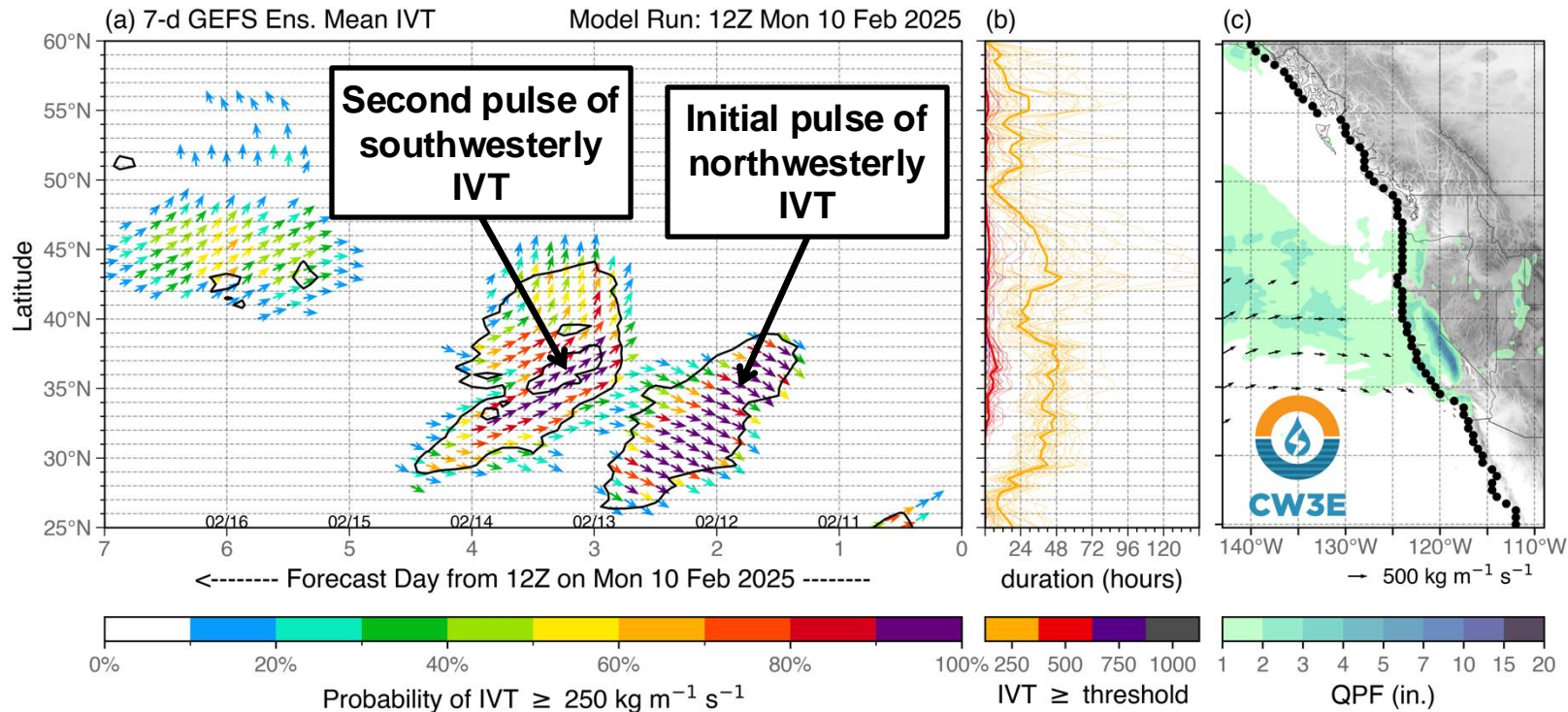
Valid 10 PM PST 13 Feb (F-090)



- Over the next few days, moisture surge from the tropical Western Pacific will facilitate the formation of a strong atmospheric river (AR) forecast to impact California late Wed 12 Feb through Fri 14 Feb.
- An initial pulse of moisture transport is forecast to move onshore late Tue 11 Feb, but little-to-no precipitation is forecast due to an unfavorable IVT direction (northwesterly) and a lack of dynamical forcing.
- Meanwhile, a strong low-pressure system and AR are forecast to develop along the moisture plume and propagate eastward, eventually reaching the California coast by early Thu 13 Feb.
- This AR is forecast to bring a period of moderate AR conditions ( $\text{IVT} \geq 500 \text{ kg m}^{-1} \text{ s}^{-1}$ ) to Central California and propagate down the coast late Thu 13 Feb into Fri 14 Feb.

# AR Outlook: 10 February 2025

## GEFS Probability of AR Conditions and Ensemble Mean IVT Vectors Along Coast



Forecasts support FIRO/CA-AR Program and NSF #2052972 | Intended for research purposes only \*GEFS = NCEP Global Ensemble Forecast System (United States)

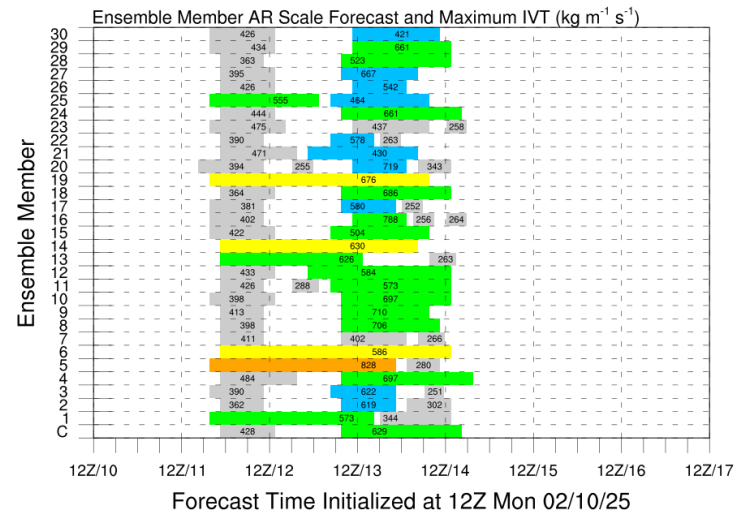
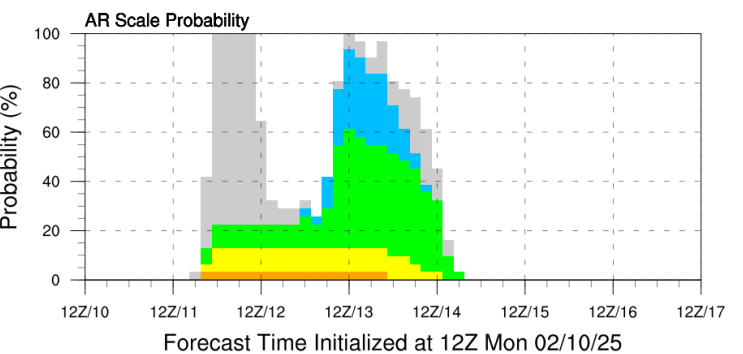
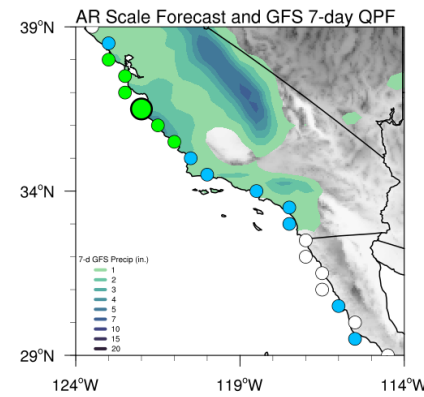
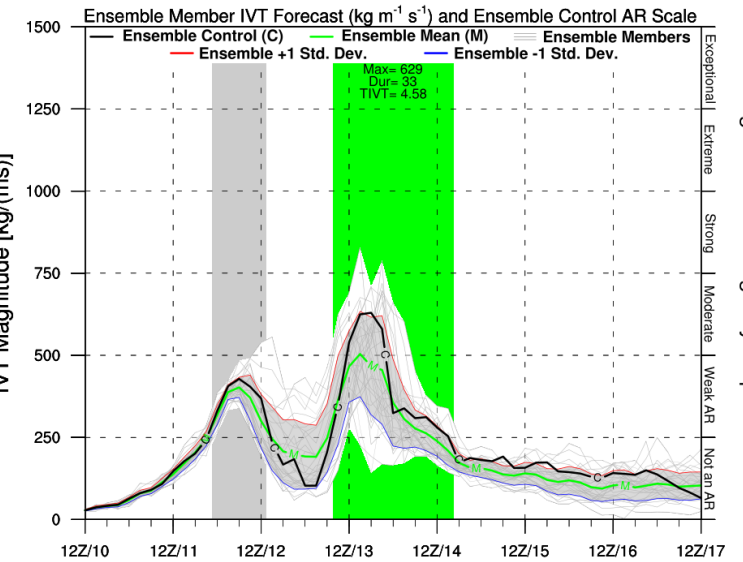
- The 06Z GEFS is showing high confidence (>90% probability) in two distinct periods of AR conditions (IVT  $\geq 250 \text{ kg m}^{-1} \text{ s}^{-1}$ ) over coastal Central and Southern California on 11–12 Feb and 13–14 Feb.
- Little precipitation is expected during the initial pulse of moisture transport due to an unfavorable IVT direction (northwesterly).
- The IVT direction within the second pulse of moisture transport is forecast to be southwesterly, which is much more favorable for orographic enhancement of precipitation over the Sierra Nevada, Central California Coast Ranges, and Transverse Ranges.

# AR Outlook: 10 February 2025

## GEFS AR Scale and IVT Forecasts

GFS Ensemble Initialized: 12Z Mon 02/10/25

Location: 36.5°N 122°W



- The GEFS control member is forecasting an AR 2 (based on the Ralph et al. 2019 AR Scale) along the California coast from Marin County to San Luis Obispo County, as well as an AR 1 over coastal Southern California.
- About 65% (20/31) of GEFS members are forecasting an AR 2 or greater at 36.5°N, 122°W (Monterey County, CA) during the next 7 days.
- Most GEFS members are forecasting a break in AR conditions between the initial pulse of moisture transport late Tue 11 Feb and the stronger second pulse of moisture transport on Thu 13 Feb.
- There is still some uncertainty in the timing, duration, and magnitude of AR conditions, particularly during the second pulse of moisture transport.



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

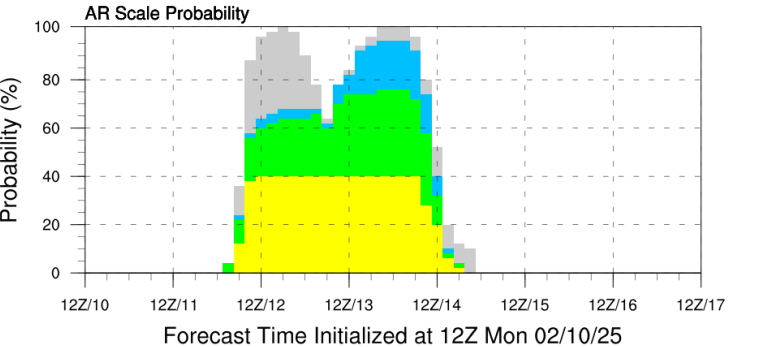
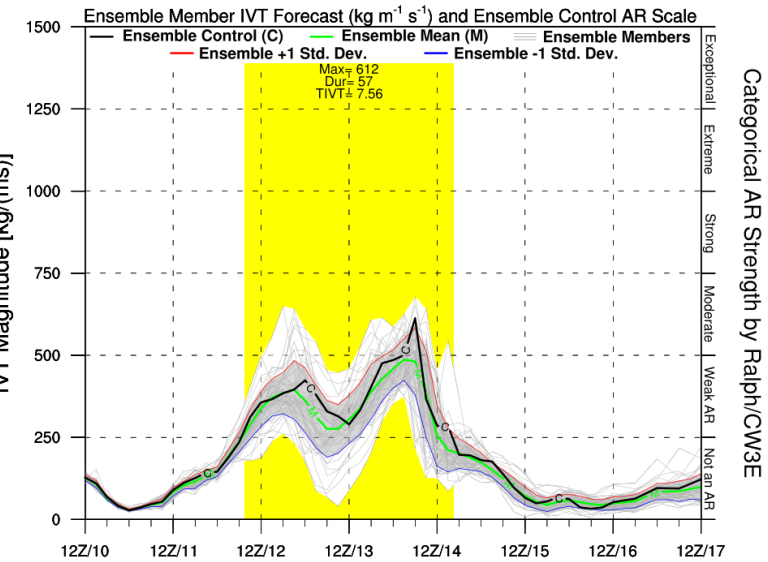
Image created: 17 UTC 02/10/2025

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

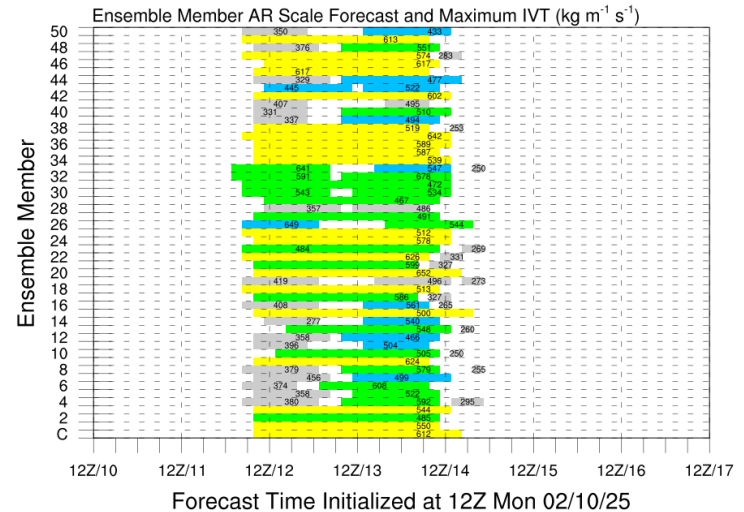
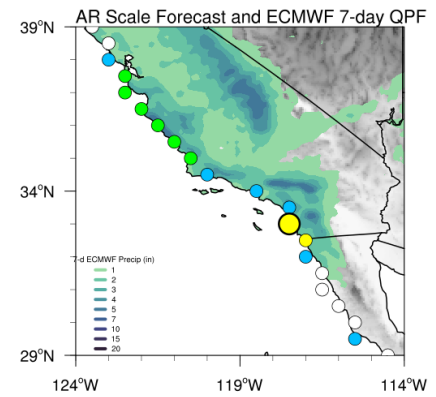
# AR Outlook: 10 February 2025

## EPS AR Scale and IVT Forecasts

ECMWF Ensemble Initialized: 12Z Mon 02/10/25



Location: 33°N 117.5°W



- Similar to GEFS, the EPS control member is forecasting an AR 2 along the Central California coast.
- However, about 40% of EPS members (including the control member) are forecasting an AR 3 in San Diego County due to the lack of a break in AR conditions between the first and second pulses of moisture transport.
- Compared to GEFS, the EPS is also forecasting higher maximum IVT magnitudes at this location during the second pulse of moisture transport.



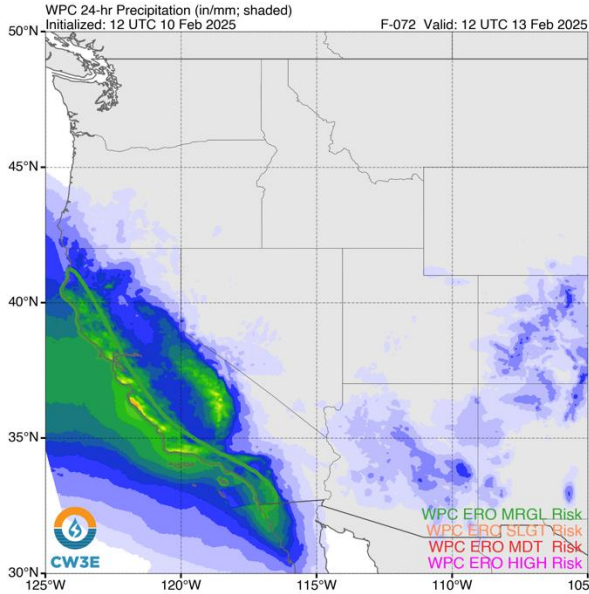
AR 1 (blue) AR 2 (green) AR 3 (yellow) AR 4 (orange) AR 5 (red)

Image created: 20 UTC 02/10/2025

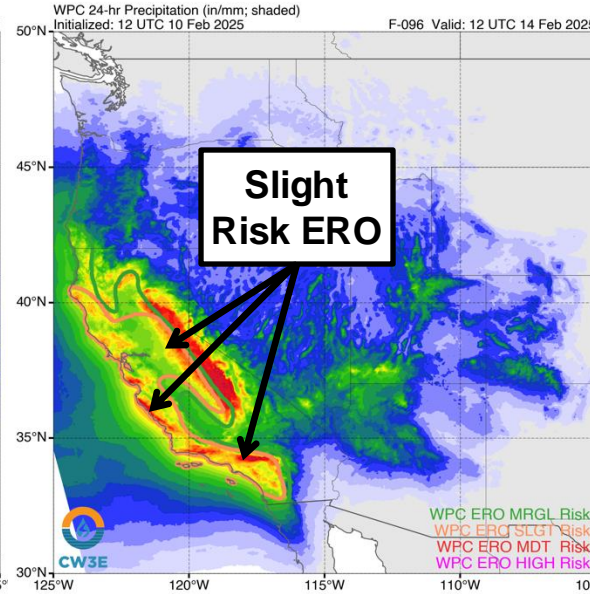
More information: <http://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

## Precipitation Forecasts

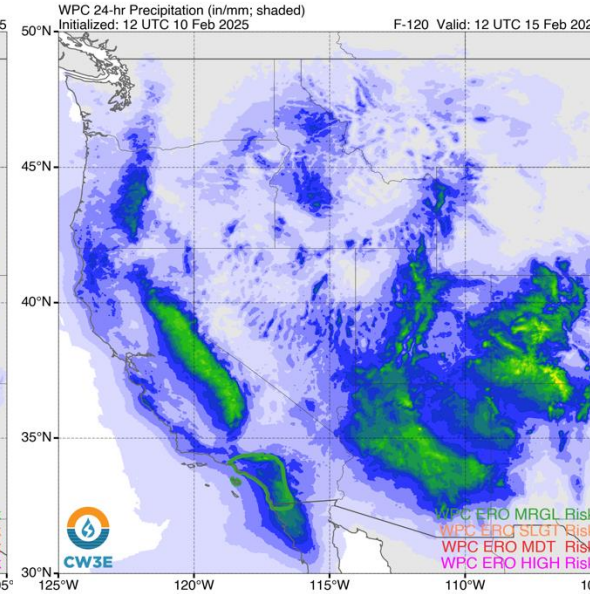
WPC Day 3 24-h QPF  
Valid: 4 AM PT 13 Feb



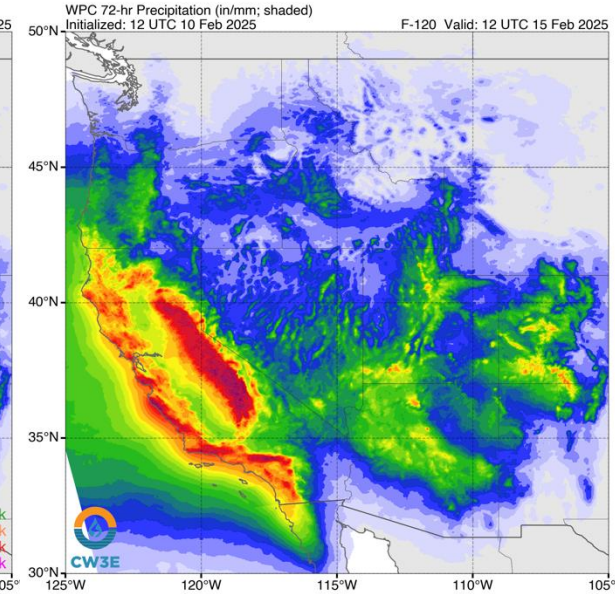
WPC Day 4 24-h QPF  
Valid: 4 AM PT 14 Feb



WPC Day 5 24-h QPF  
Valid: 4 AM PT 15 Feb



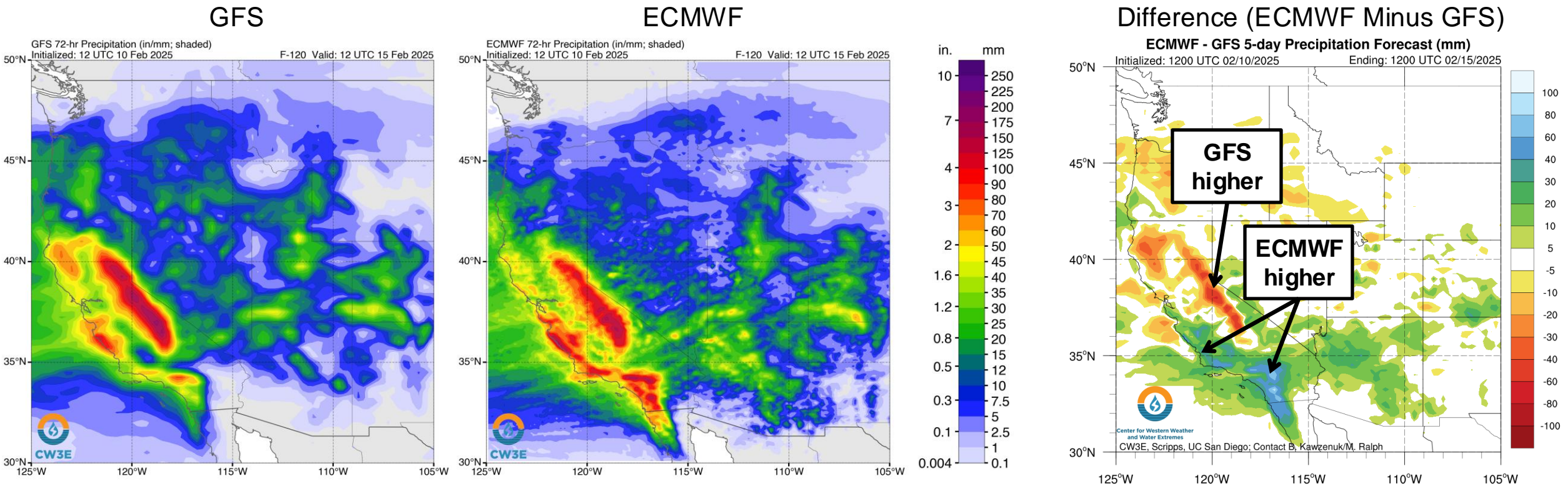
WPC 72-h Total QPF  
Valid: 4 AM PT 15 Feb



- The heaviest precipitation during this AR is expected Thu 13 Feb into Fri 14 Feb, with as much as 3–6 inches forecast over the Sierra Nevada, Central California Coast Ranges, and Transverse Ranges during the 24-h period ending Fri 14 Feb.
- The WPC has issued a **slight risk** (level 2 of 4; 15% probability) excessive rainfall outlook (ERO) for much of coastal California, the Central/Southern Sierra Nevada foothills, and portions of the Central Valley Thu 13 Feb into Fri 14 Feb.
- One area of particular concern is the Transverse Ranges, where heavy rain falling on recent burn scars could trigger flash flooding and debris flows.
- Storm-total precipitation amounts of 5–10 inches are possible over the Sierra Nevada, Central California Coast Ranges, and Transverse Ranges. About 2–4 inches of total precipitation are forecast in the lower elevations of Southern California.

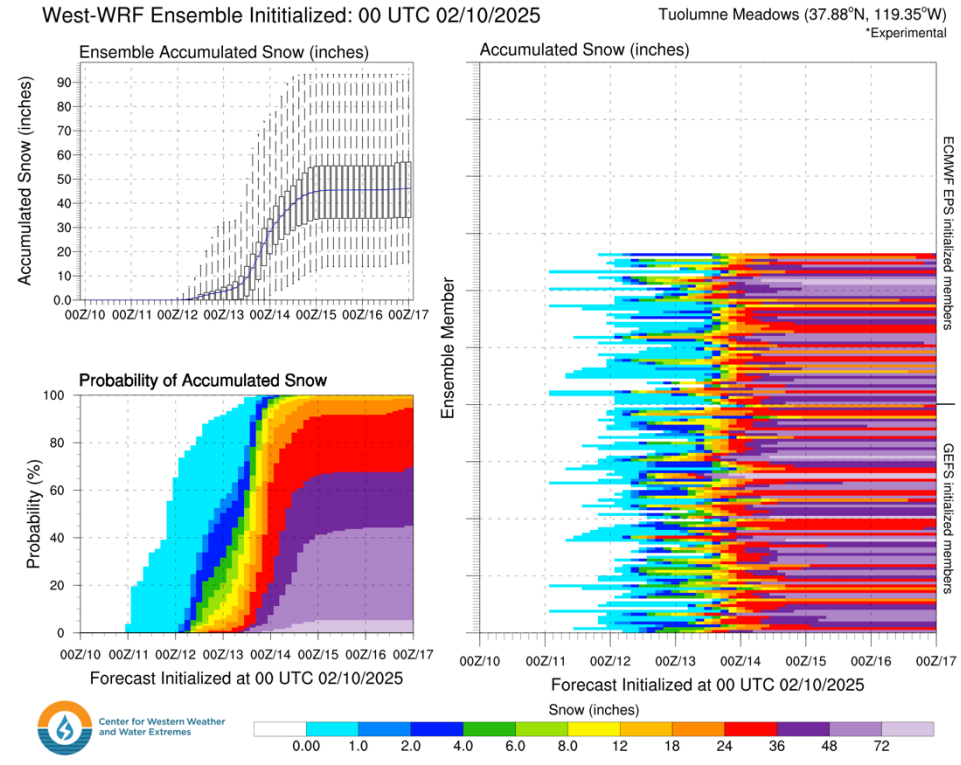
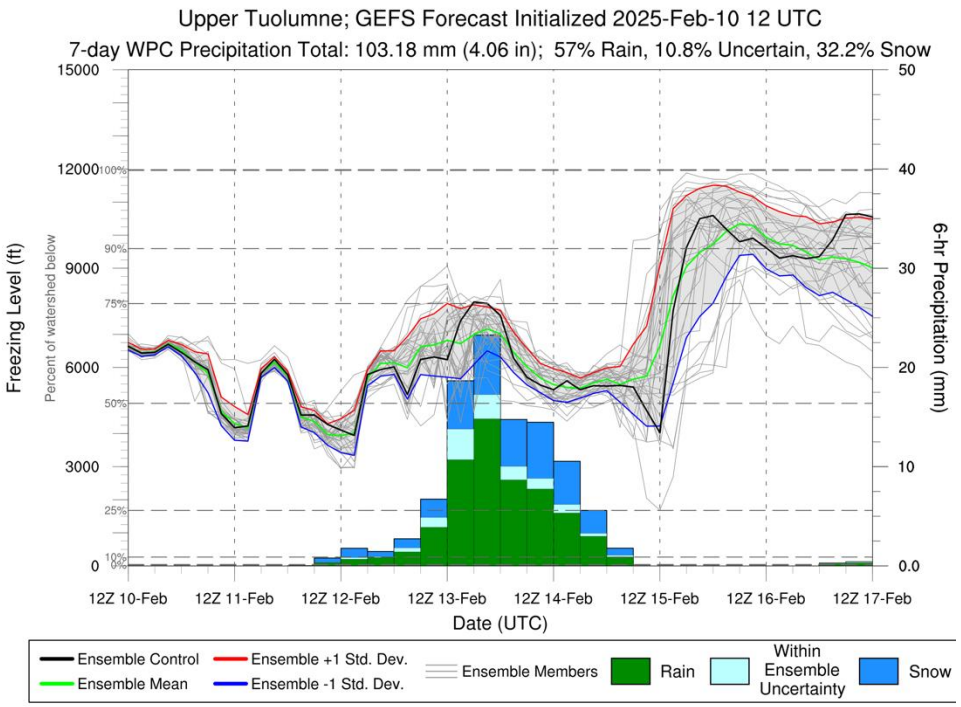
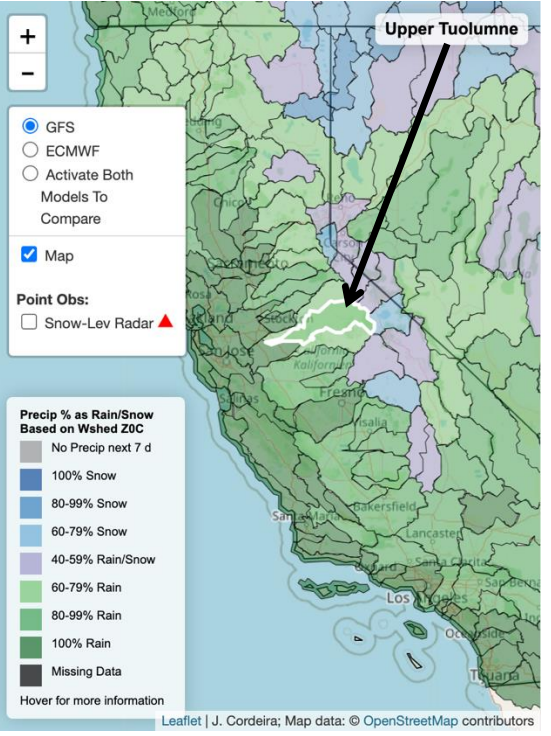
# AR Outlook: 10 February 2025

## GFS vs. ECMWF 5-day QPF Forecasts: Valid 4 AM PT 15 Feb



- Subtle model differences in the forecast evolution of these two moisture pulses are contributing to large differences in forecast precipitation over California.
- The deterministic GFS is forecasting heavier precipitation over the Sierra Nevada, whereas the deterministic ECMWF is forecasting heavier precipitation over the Central California Coast Ranges and Southern California.

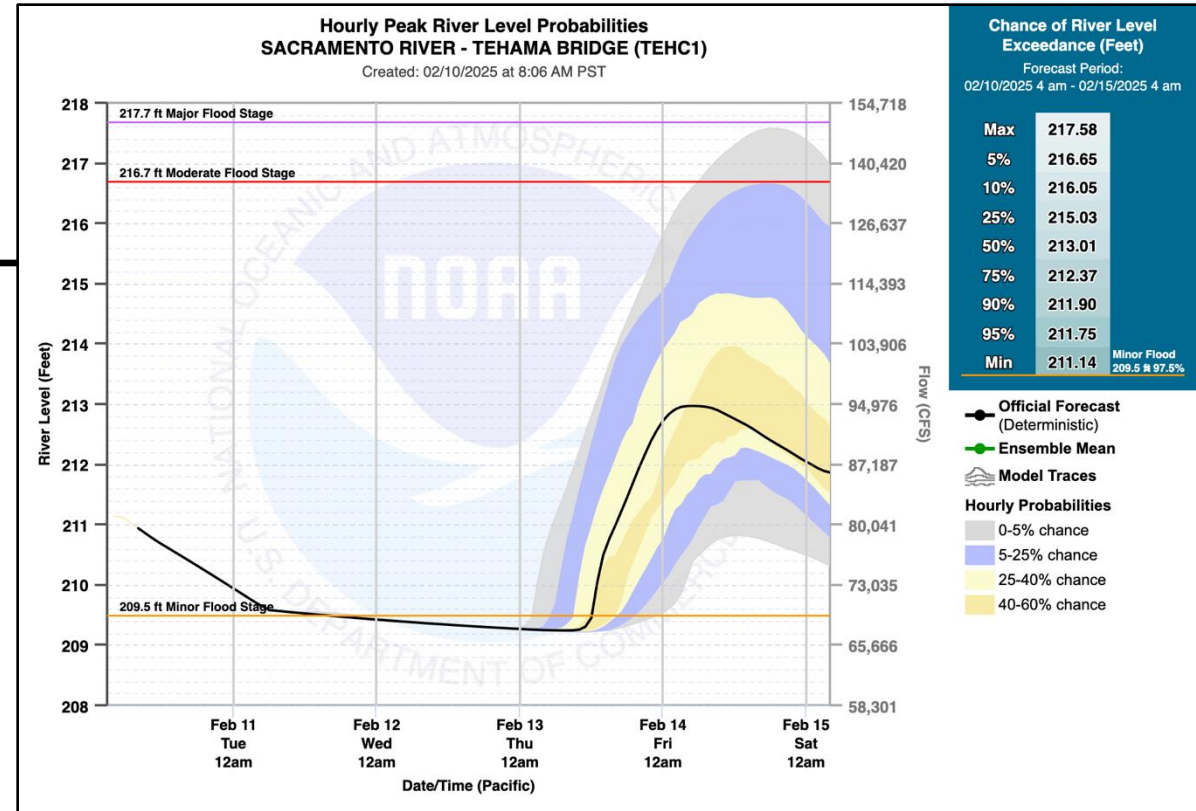
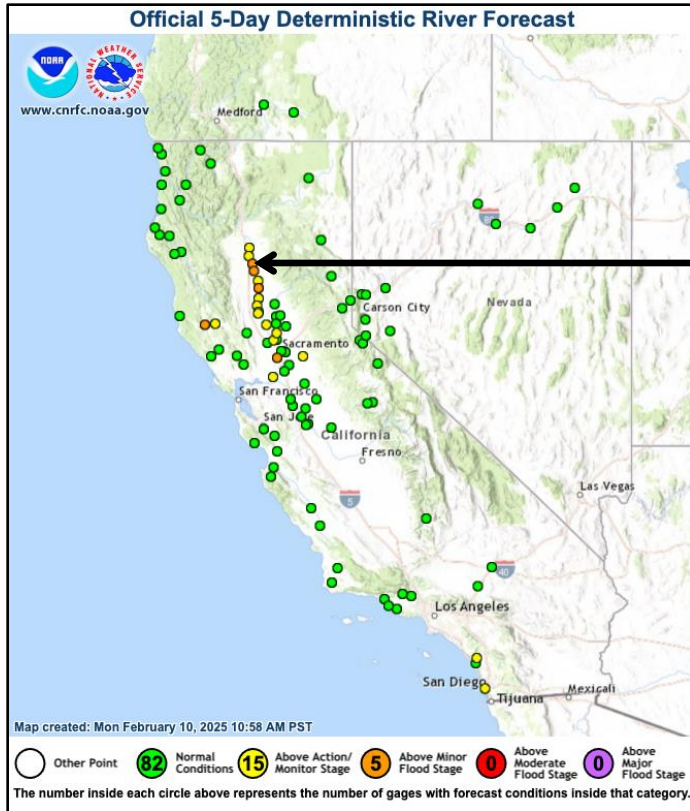
## GEFS Freezing Level & West-WRF Snowfall Forecasts



- Freezing levels in the Central Sierra Nevada are forecast to rise to 6,000–8,000 feet as the second pulse of moisture transport moves onshore on Thu 13 Feb and then fall below 6,000 feet as the AR propagates down the coast.
- GEFS is forecasting ~32% of storm-total precipitation to fall as snow in the Upper Tuolumne watershed.
- This AR is forecast to produce heavy snowfall in the higher terrain of the Sierra Nevada.
- CW3E’s West-WRF ensemble is showing >90% likelihood of 2+ feet of total snow and >40% likelihood of 4+ feet of total snow at Tuolumne Meadows.

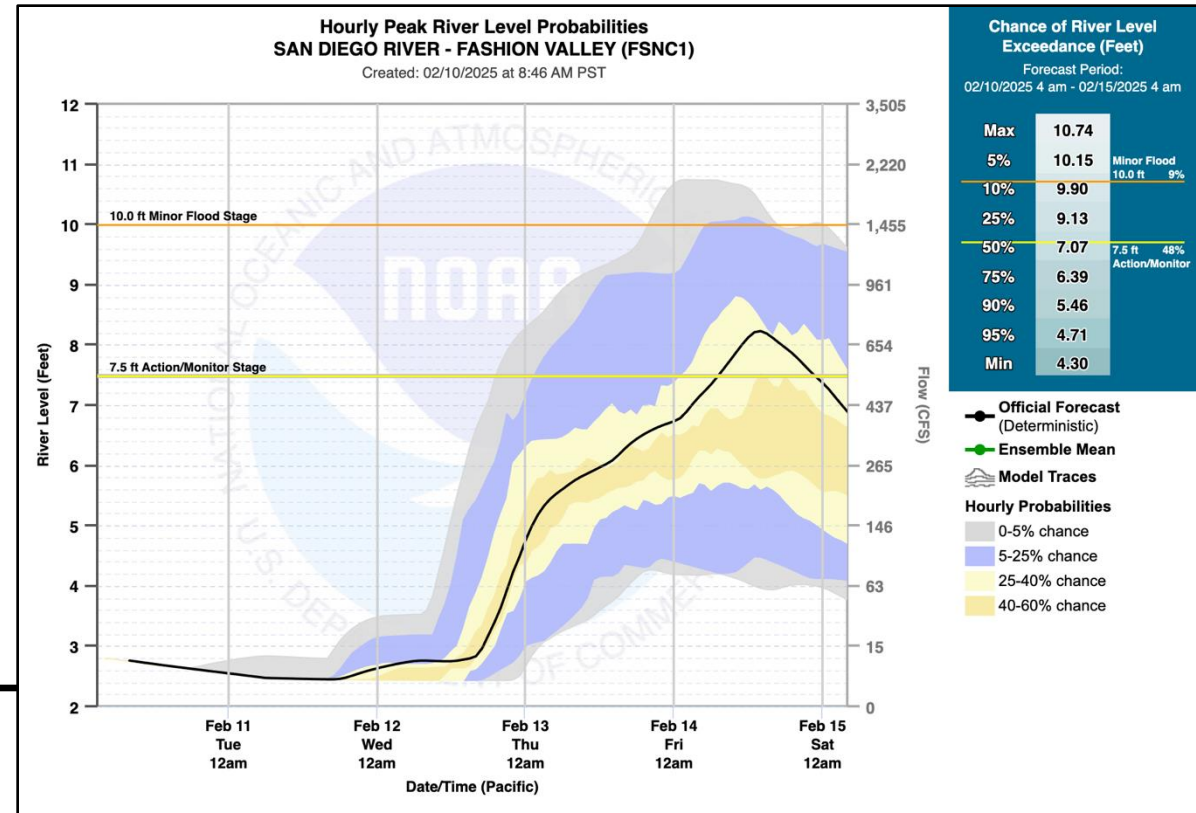


## Hydrologic Impacts



- The California–Nevada Forecast Center is currently forecasting 15 stream gages to rise above action/monitor stage and 5 stream gages to rise above minor flood stage during the next 5 days.
- Current streamflow is still elevated over much of the Sacramento Valley due to heavy rainfall from recent ARs. Rainfall from this week’s AR is forecast to result in additional flooding in these areas.
- Ensemble streamflow forecasts from the CNRFC are showing >95% likelihood of the Sacramento River exceeding minor flood stage at Tehama Bridge.

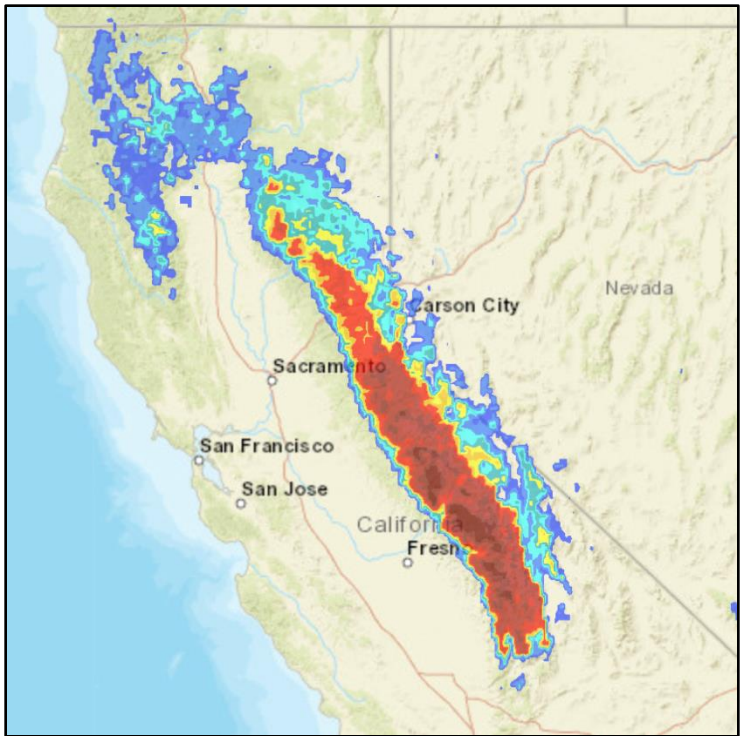
## Hydrologic Impacts



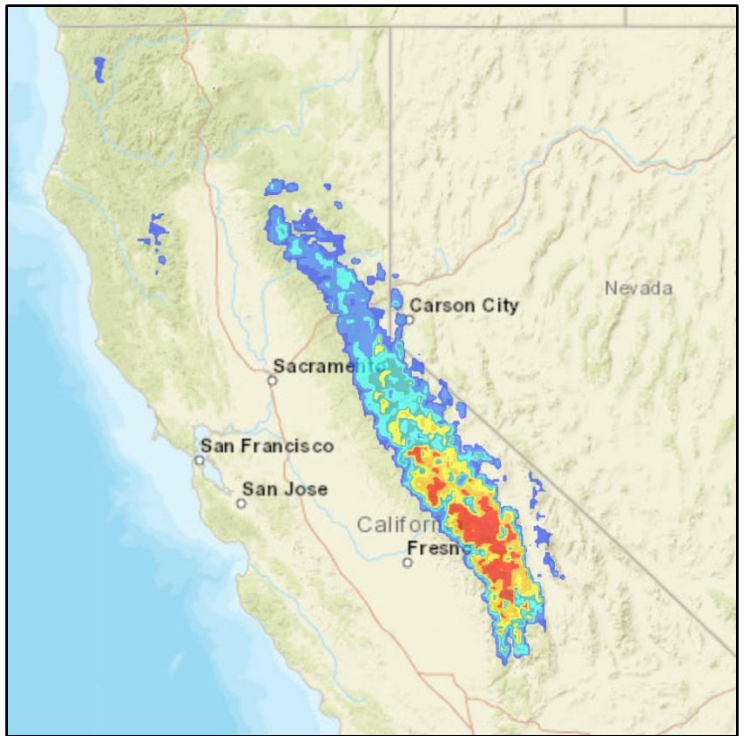
- Heavy rainfall may also result in riverine flooding in coastal Southern California.
- Ensemble streamflow forecasts from the CNRFC are showing 48% likelihood of the San Diego River exceeding action/monitor stage at Fashion Valley, with a 9% likelihood of exceeding minor flood stage.

## Winter Storm Impacts

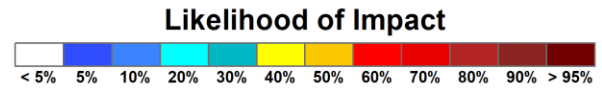
WSSI Probability of Major Impacts  
Valid: 24-h Period 4 AM PT 14 Feb



WSSI Probability of Extreme Impacts  
Valid: 24-h Period 4 AM PT 14 Feb



Potential Winter Storm Impacts	
<b>Minor Impacts</b>	<p>Expect a few inconveniences to daily life.</p> <ul style="list-style-type: none"> <li>Winter driving conditions. <b>Use caution while driving.</b></li> </ul>
<b>Moderate Impacts</b>	<p>Expect disruptions to daily life.</p> <ul style="list-style-type: none"> <li>Hazardous driving conditions. <b>Use extra caution while driving.</b></li> <li>Closures and disruptions to infrastructure may occur.</li> </ul>
<b>Major Impacts</b>	<p>Expect considerable disruptions to daily life.</p> <ul style="list-style-type: none"> <li>Dangerous or impossible driving conditions. <b>Avoid travel if possible.</b></li> <li>Widespread closures and disruptions to infrastructure may occur.</li> </ul>
<b>Extreme Impacts</b>	<p>Expect substantial disruptions to daily life.</p> <ul style="list-style-type: none"> <li>Extremely dangerous or impossible driving conditions. <b>Travel is not advised.</b></li> <li>Extensive and widespread closures and disruptions to infrastructure may occur.</li> <li>Life-saving actions may be needed.</li> </ul>



Credit: NOAA NWS Weather Prediction Center

- The combination of heavy snow and strong winds are forecast to produce hazardous weather conditions over the Sierra Nevada, particularly on Thu 13 Feb into early Fri 14 Feb.
- The WPC's probabilistic Winter Storm Severity Index (WSSI) is showing >80% likelihood of **major** winter storm impacts over the Central and Southern Sierra Nevada.
- In the higher terrain of the Southern Sierra Nevada, the likelihood of **extreme** winter storm impacts exceeds 50%.