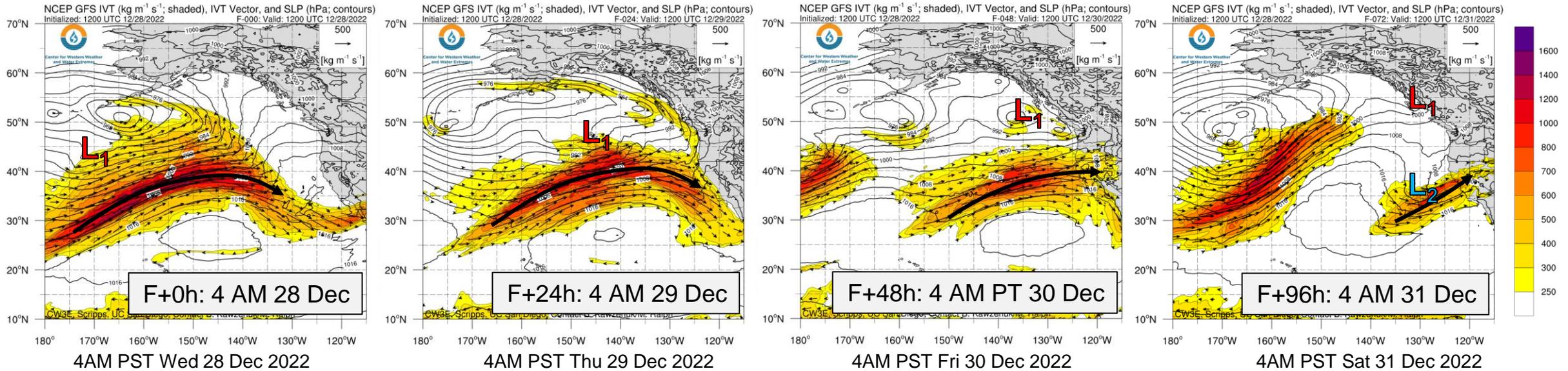


CW3E AR Outlook: 28 December 2022

NCEP GFS Model IVT and SLP Forecast (initialized 1200 UTC 28 Dec 2022)

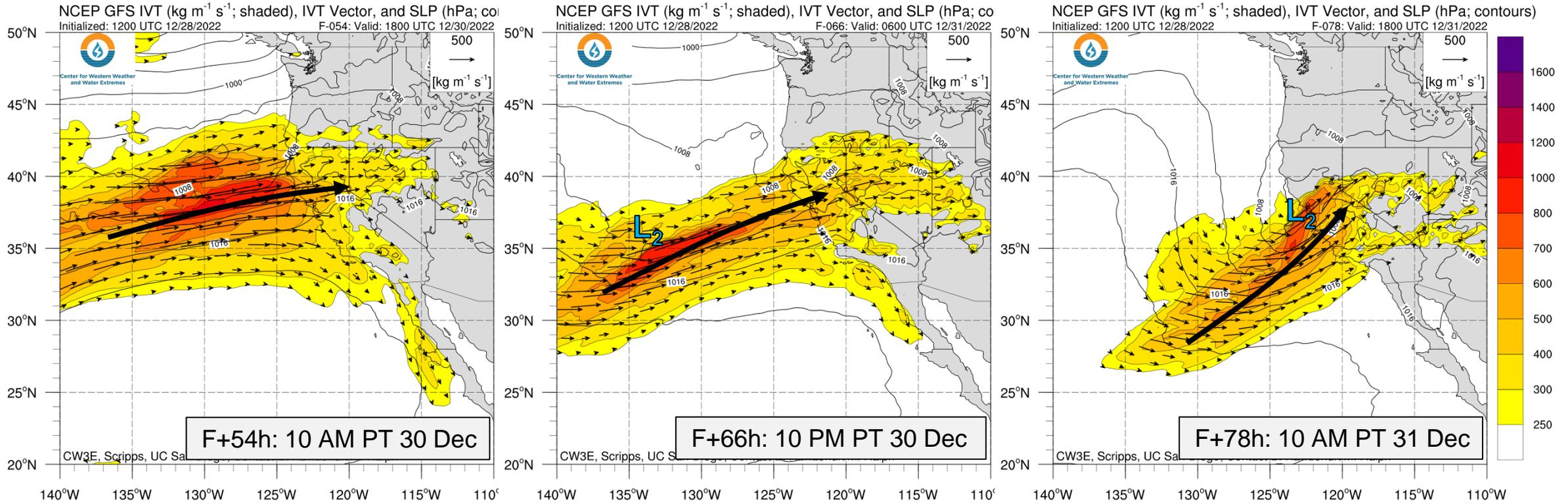


Landfalling AR to bring additional precipitation and impacts to California 30–31 December 2022

- Cyclogenesis (L₁) over the Gulf of Alaska and a long fetch of subtropical moisture will be associated with a landfalling AR on 29–31 December 2022
- Landfall on 29–30 December will occur in association with west-northwest IVT, a less favorable orientation for heavy precipitation
- Landfalling AR becomes oriented more westerly and southwesterly with secondary cyclogenesis (L₂) over Northeast Pacific on 30–31 December

CW3E AR Outlook: 28 December 2022

NCEP GFS Model IVT and SLP Forecast (initialized 1200 UTC 28 Dec 2022)

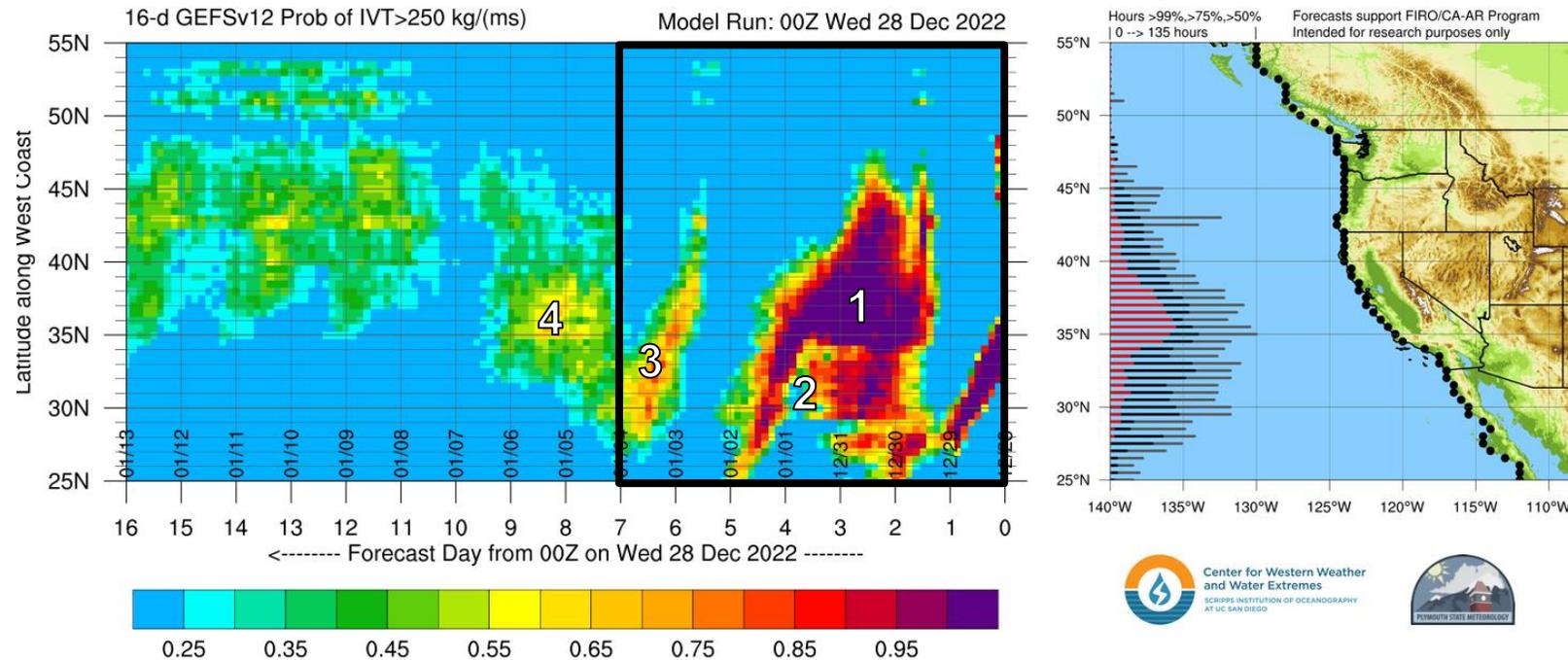


Latest GFS model forecast suggests AR Landfall in California occurs in multiple phases

- (1) WNW IVT on 29 December (not shown)
- (2) Westerly IVT on 30 December with IVT magnitudes of ~1000 kg/ms
- (3) A slight weakening early on 31 Dec, but IVT magnitudes of ~500 kg/ms as direction transitions to WSW
- (4) Mesoscale frontal wave/secondary cyclone leads to final SW IVT with magnitudes >750 kg/ms

CW3E AR Outlook: 28 December 2022

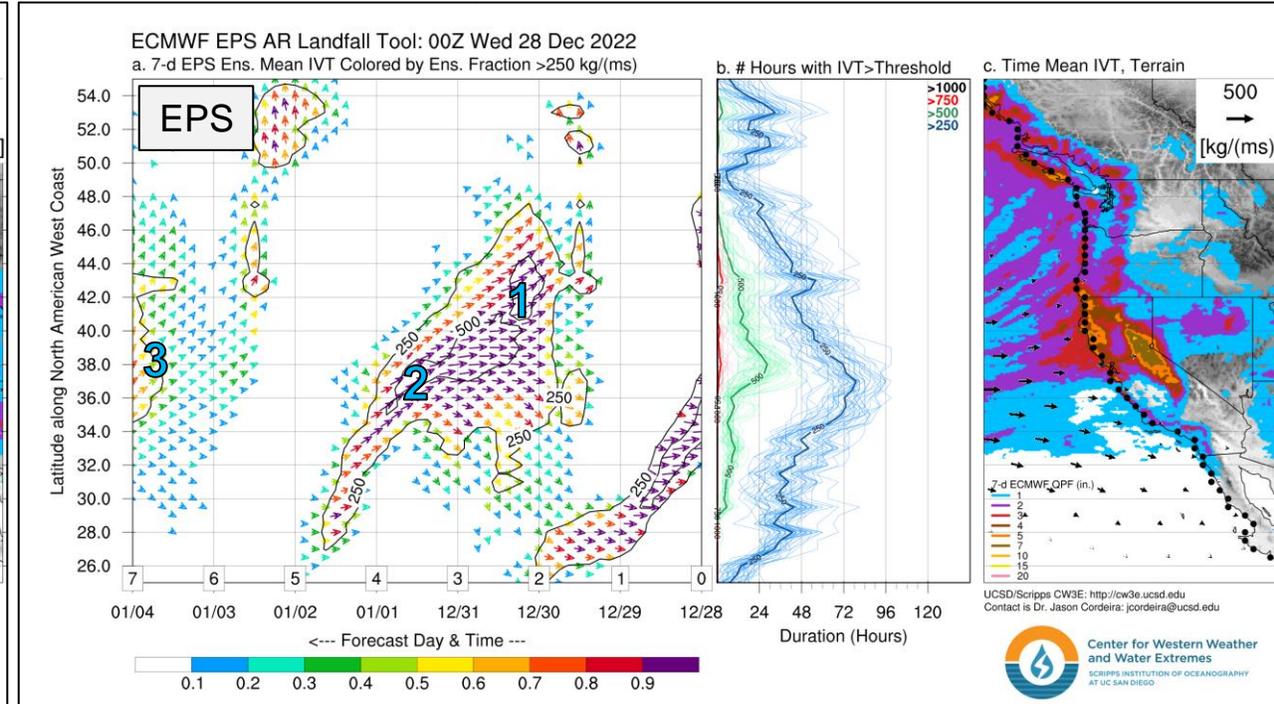
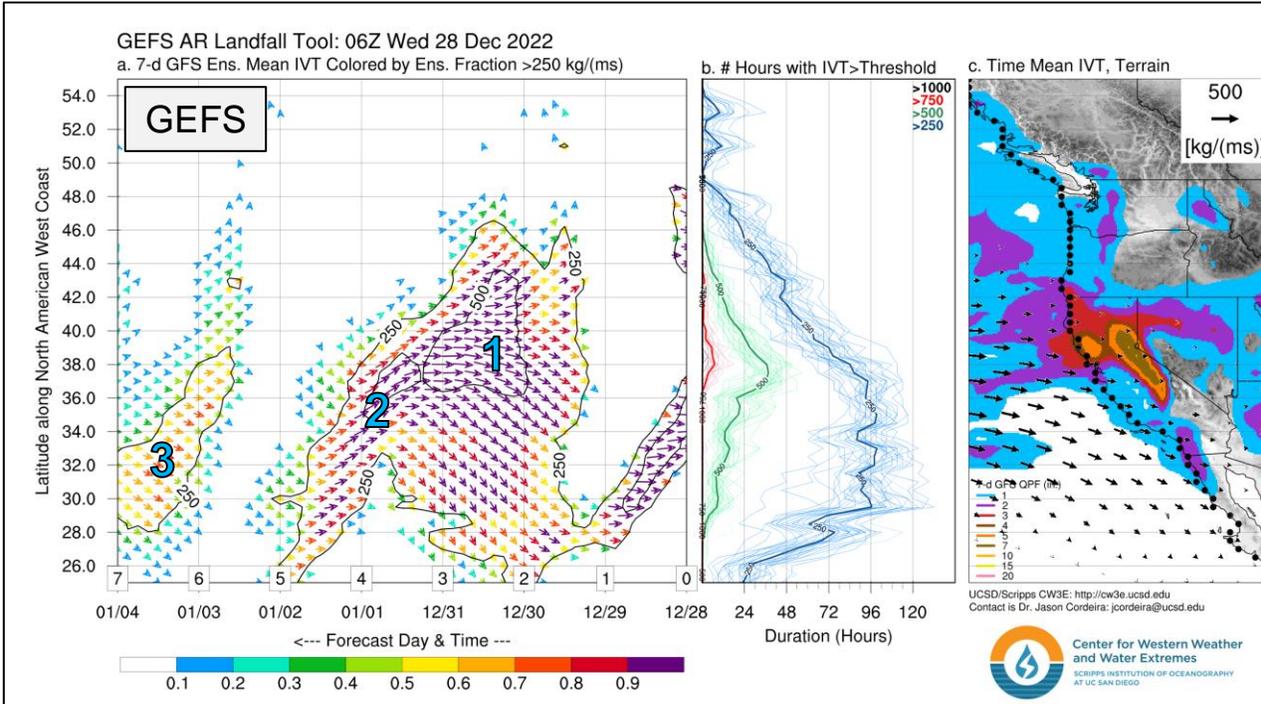
NCEP GEFS Model Forecast of Coastal Probability of IVT magnitudes >250 kg/ms (initialized 0000 UTC 28 Dec 2022)



1. NCEP GEFS AR Landfall Tool captures 100% odds of AR Landfall between ~1200 UTC (4 AM) 29 December and 0000 (4 PM) UTC 1 January in central California
2. Landfalling AR at the back of the sequence traverses the coast into Southern California/Baja on 1 January
3. Subsequent AR landfall is possible in California on 3 January with odds of landfall at ~80%
4. Subsequent AR landfall is possible in California on 5 January with odds of landfall at ~50%

CW3E AR Outlook: 28 December 2022

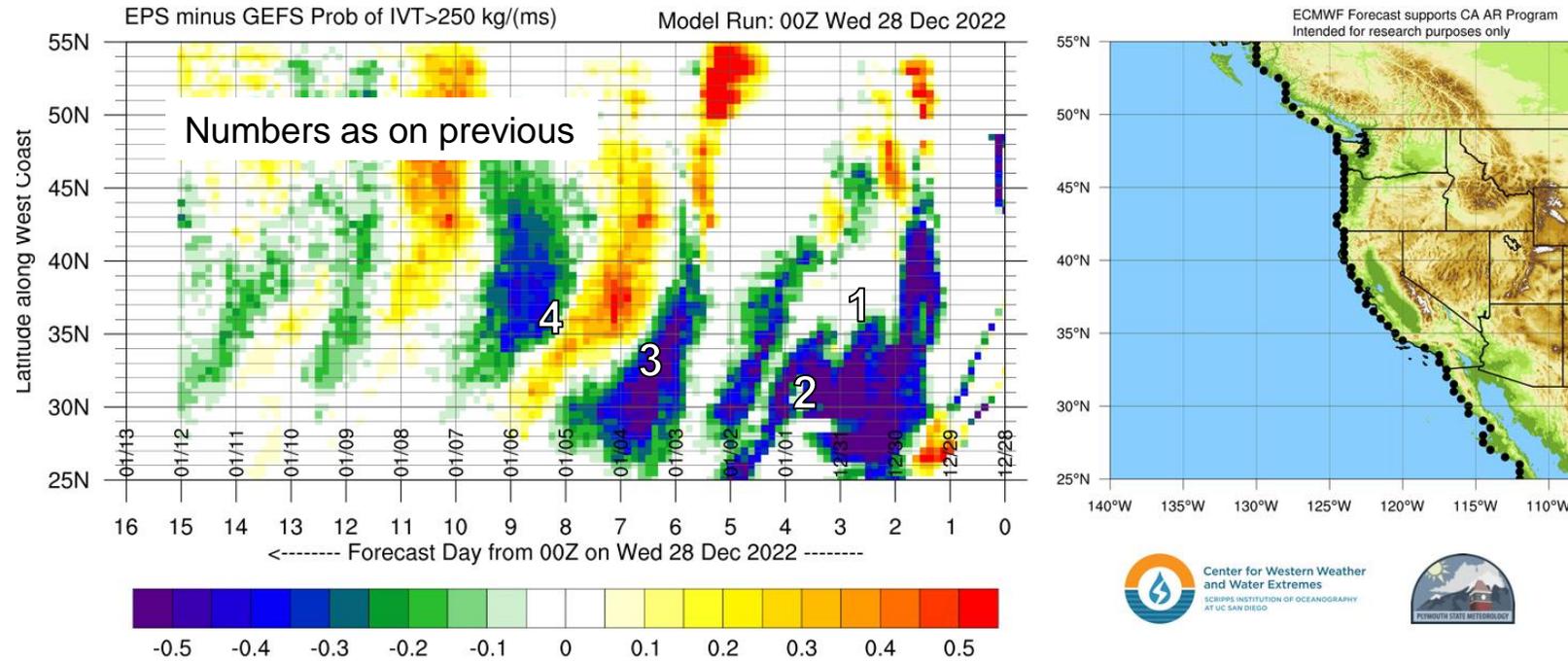
NCEP GEFS and ECMWF EPS Model Forecast of Coastal Probability of IVT magnitudes >250 kg/ms (initialized 0000 UTC 28 Dec 2022)



- GEFS and EPS coastal IVT very similar, except GEFS is earlier than EPS on 29 Dec and longer duration
- Both models forecast a transition to southwest IVT on 31 Dec
- Subsequent landfalling AR on 3-4 January is more southwesterly in EPS and more west-northwest in GEFS

CW3E AR Outlook: 28 December 2022

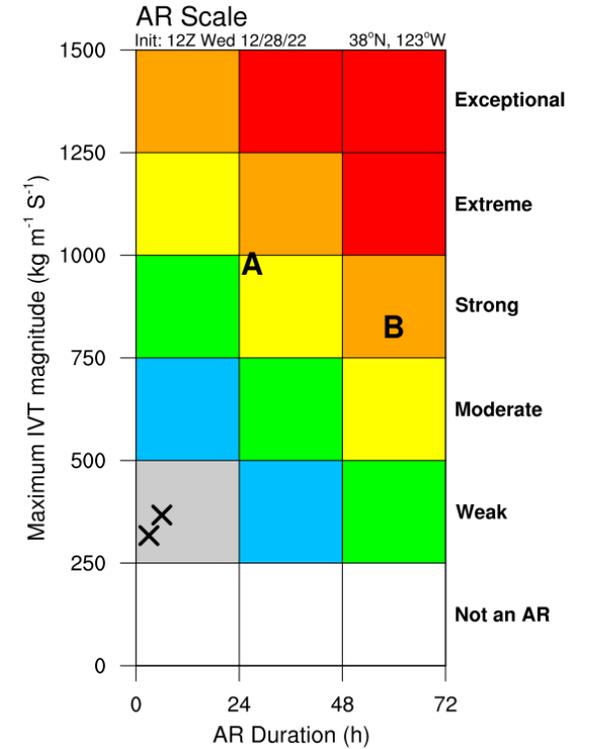
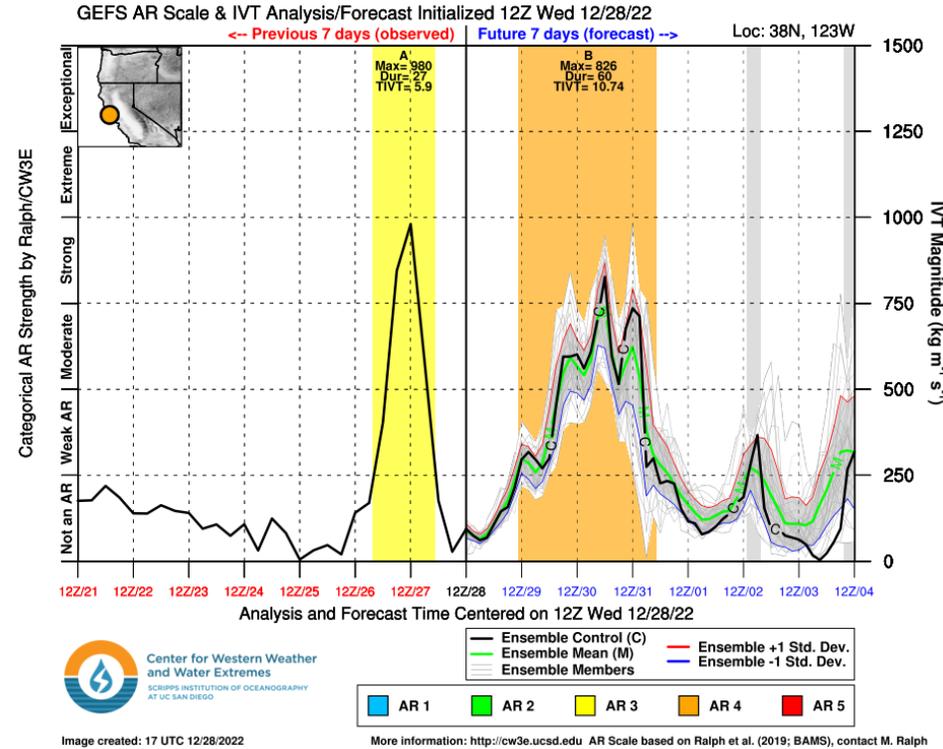
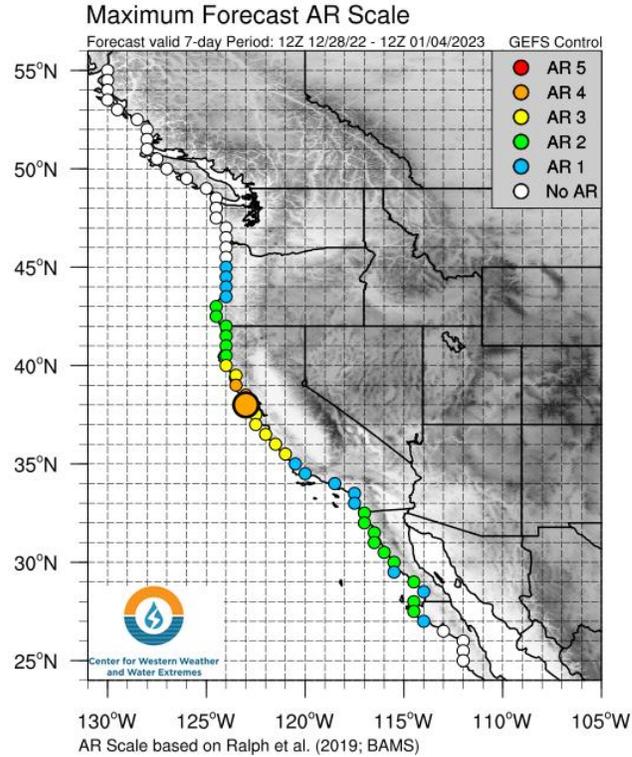
ECMWF EPS minus NCEP GEFS Model Forecast of Coastal Probability of IVT magnitudes >250 k/ms (initialized 0000 UTC 28 Dec 2022)



- Differences in AR landfall tool probability largely point to (a) uncertainty in how far south enhanced IVT makes it into southern California (GEFS is higher than EPS) and (b) the timing and location of subsequent AR landfalls beyond 3 January

CW3E AR Outlook: 28 December 2022

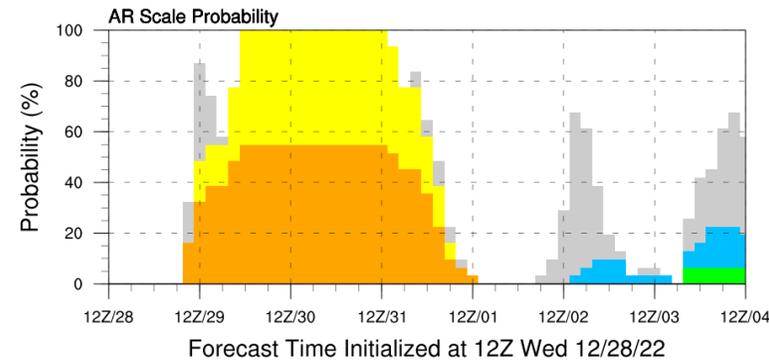
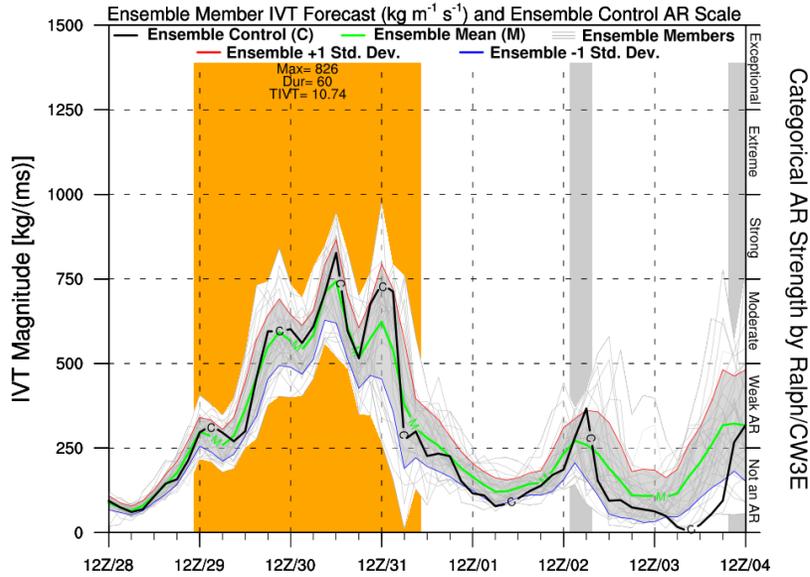
NCEP GEFS AR Scale and IVT Analysis/Forecast (initialized 1200 UTC 28 December 2022)



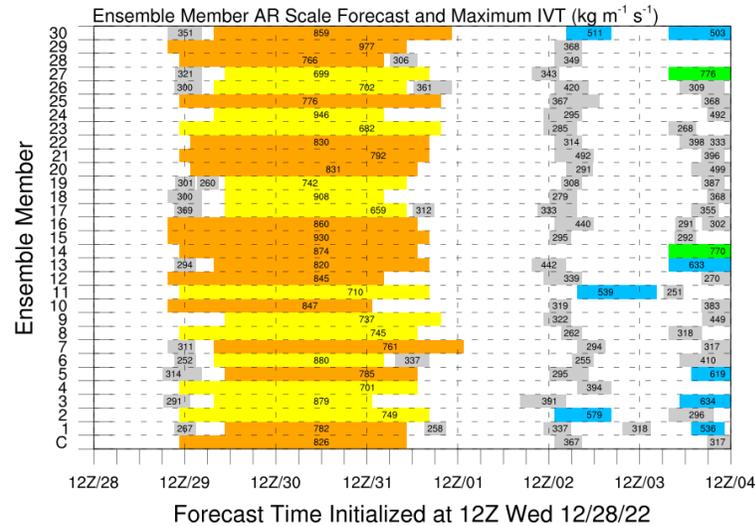
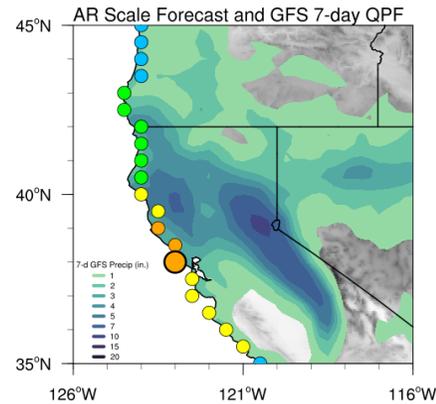
- Maximum AR Scale forecast is AR4 along the California Coast in the Bay Area
- IVT magnitudes include three peaks on 30 and 31 December corresponding to the west-northwesterly, west-southwesterly, and southwest periods of enhanced IVT

CW3E AR Outlook: 28 December 2022

GFS Ensemble Initialized: 12Z Wed 12/28/22



Location: 38°N 123°W



NCEP GEFS AR Scale and IVT Analysis/Forecast (initialized 1200 UTC 28 December 2022)

- All ensemble members currently forecast at least AR3 conditions in the California Bay Area
- 16 of 30 members currently forecast AR4 conditions
- Uncertainty in duration of IVT conditions related to initial peak in IVT on 29 December is responsible for differences between AR3, 4, or 5 ranking

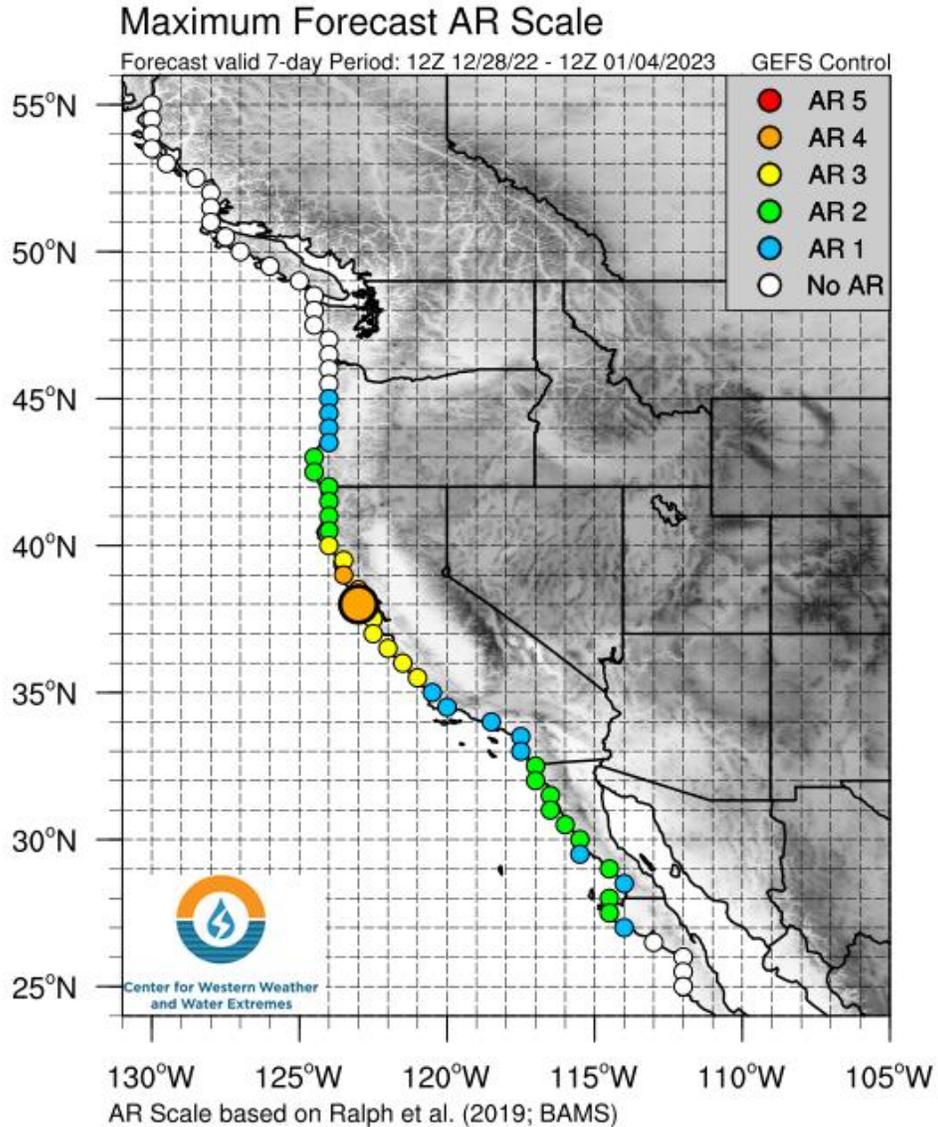


Image created: 17 UTC 12/28/2022

AR 1 AR 2 AR 3 AR 4 AR 5

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

CW3E AR Outlook: 28 December 2022

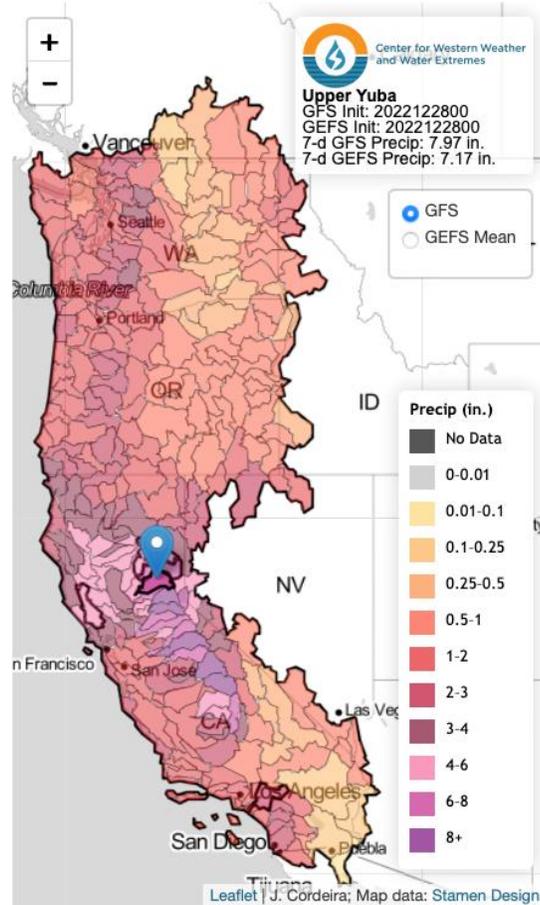


- Ralph et al. (2019) AR Scale ranking of AR4 is consistent with *storms on average producing mostly hazardous, but also beneficial impacts*
- Caveat #1: the unfavorable west-northwesterly flow during the onset of AR conditions will likely lower the potential for hazardous impacts
- Caveat #2: the antecedent conditions provided by strong AR on 27 December will have primed watersheds for enhanced runoff

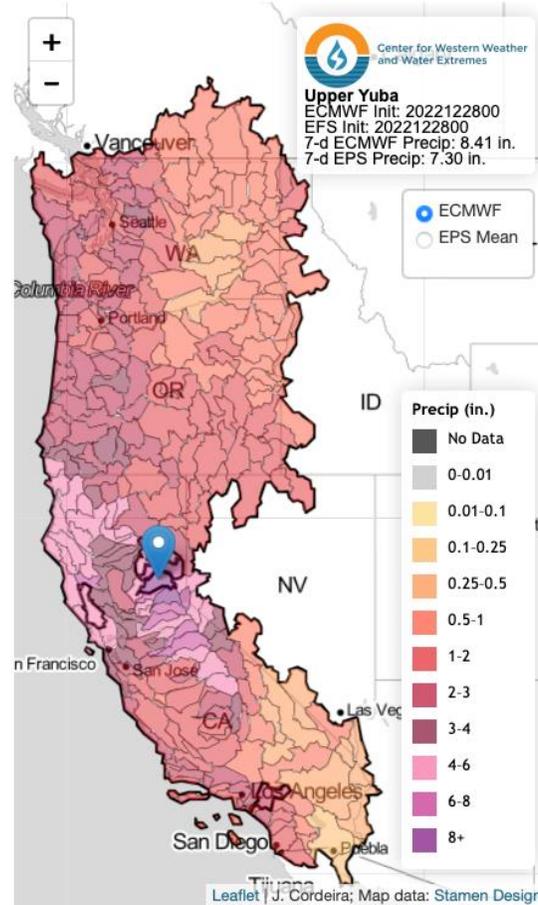
CW3E AR Outlook: 28 December 2022

GFS/GEFS and ECMWF/EFS 7-day Watershed Precipitation Forecast (initialized 0000 UTC 28 December 2022)

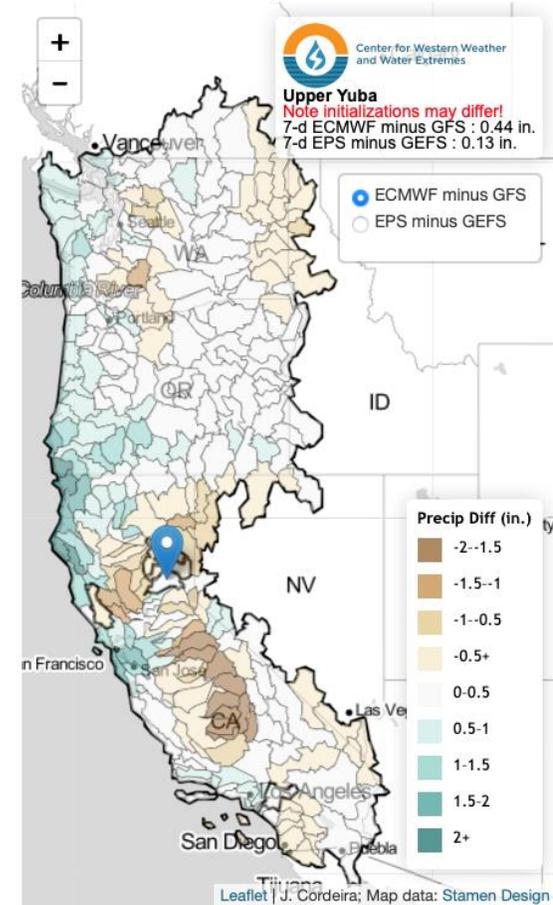
7-day GFS/GEFS Precipitation Forecasts



7-day ECMWF/EFS Precipitation Forecast



7-day Difference Precipitation Forecast



- Watershed precipitation forecasts across north-coastal California and the Sierra are >6–8”
- ECMWF forecast is wetter in north-coastal California than GFS and drier southern Sierra

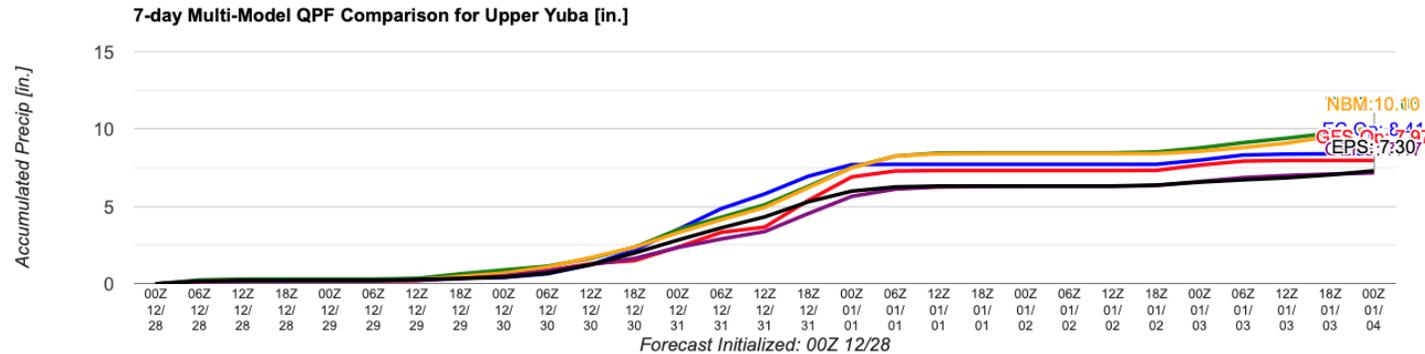
CW3E AR Outlook: 28 December 2022

Multi-model 7-day Watershed Precipitation Forecast (initialized 0000 UTC 28 December 2022)

Multit-Model Forecast Accumulated QPF: Upper Yuba
Forecast initialized: 00Z 12/28 | Through F168

[Refresh Chart](#)

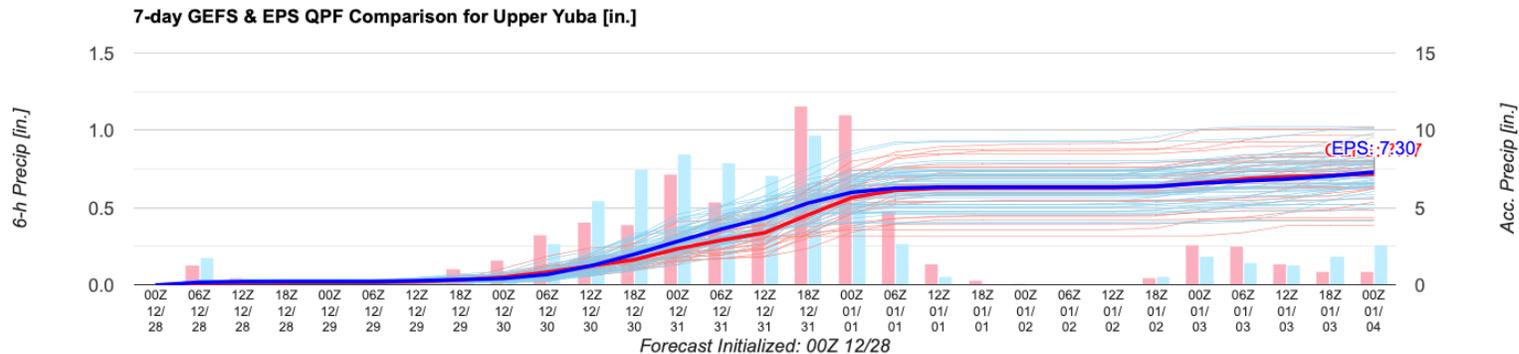
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GEFS and EPS Forecast QPF: Upper Yuba
Forecast initialized: 00Z 12/28 | Through F168

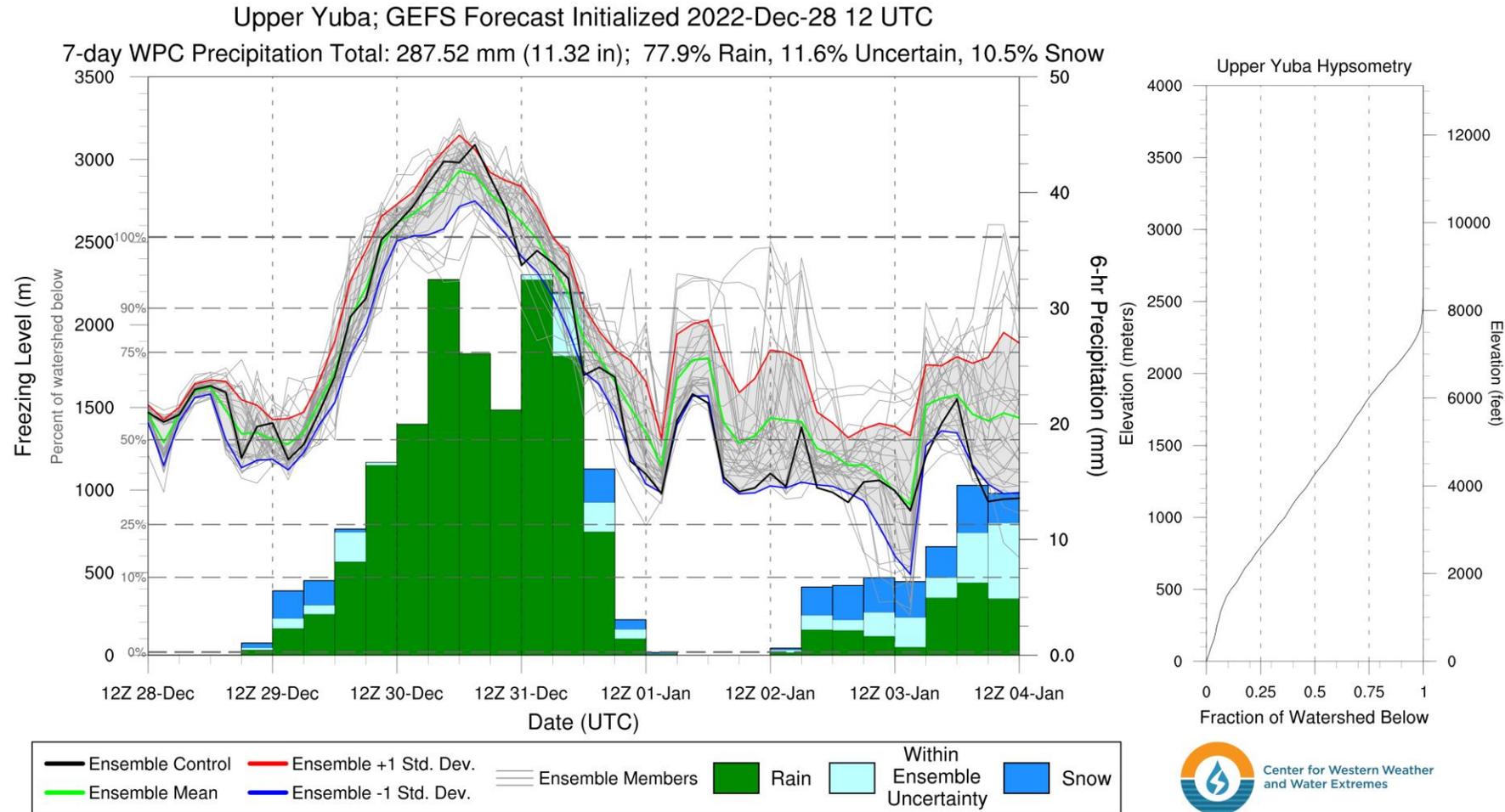
[Refresh Chart](#)

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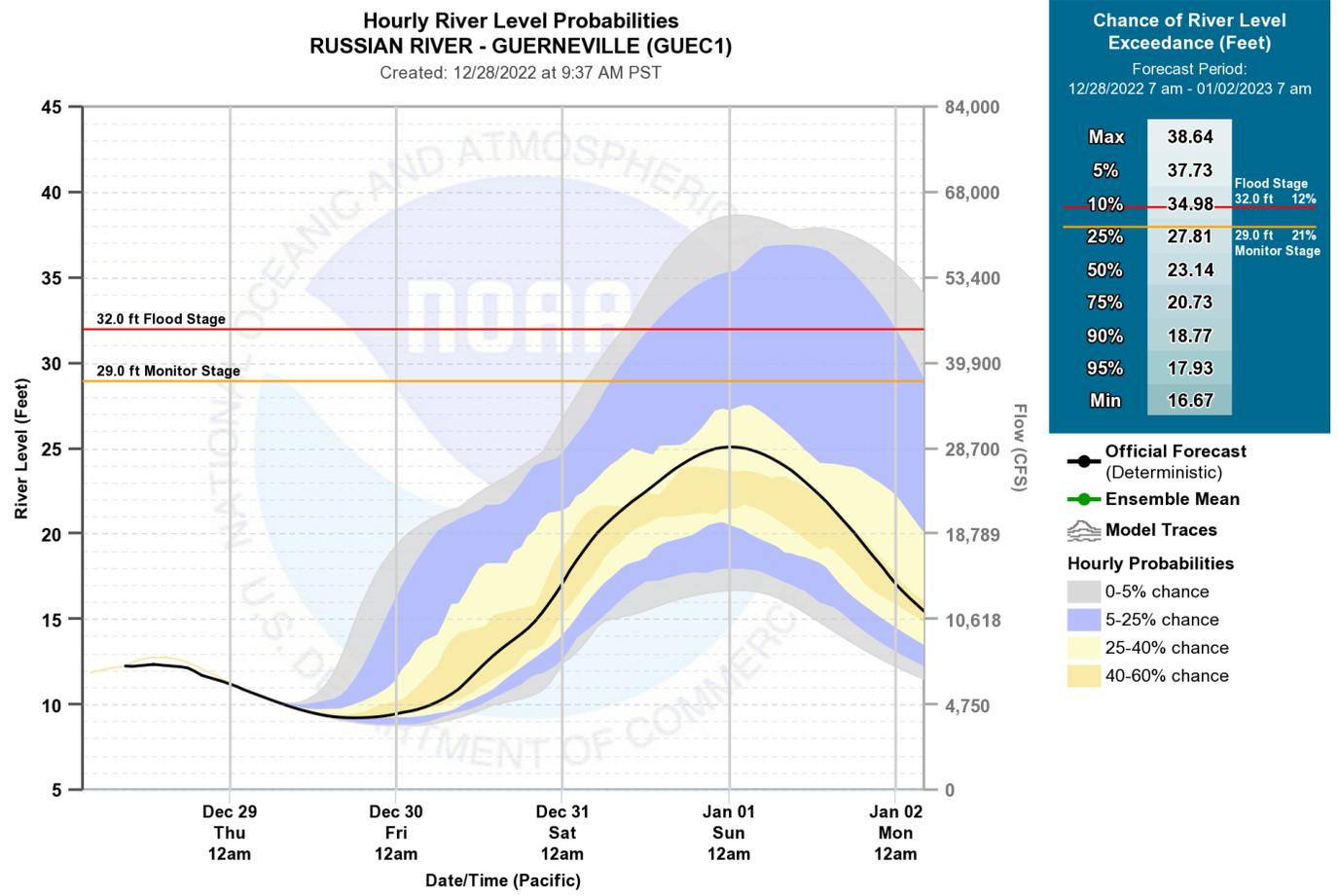
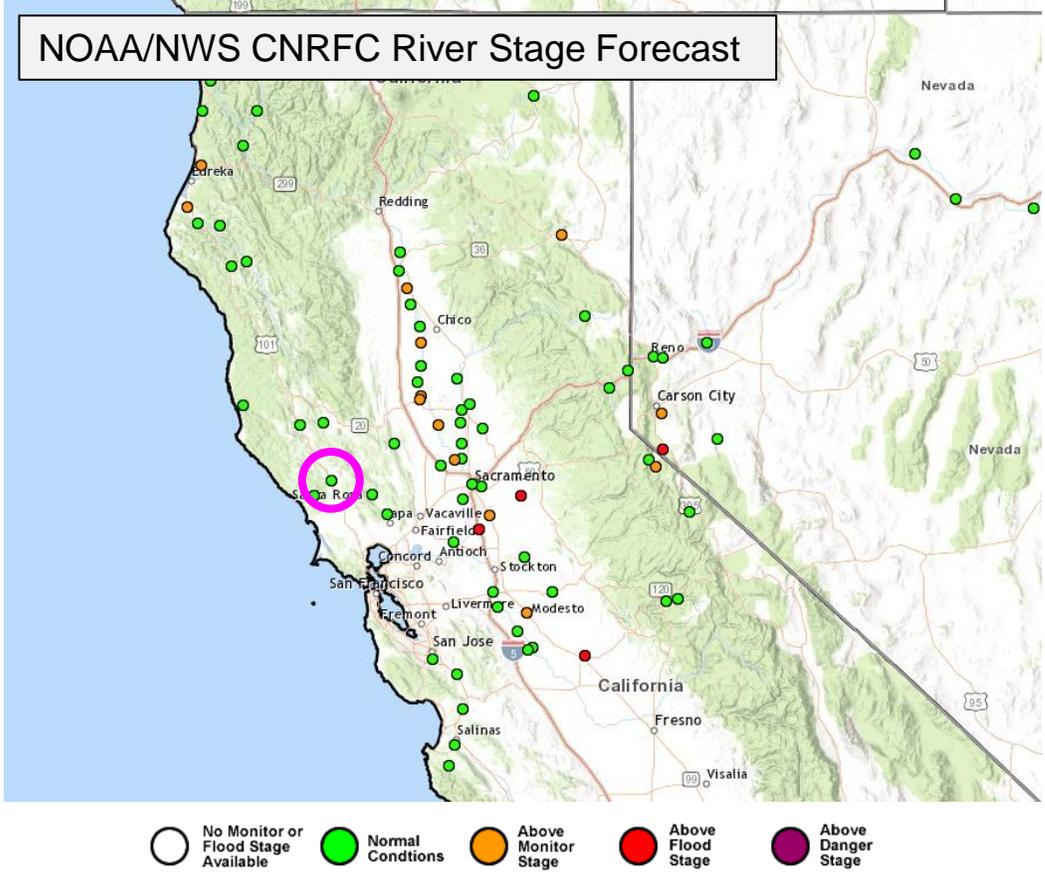
- National Blend of Models and WPC forecast is >10” of precipitation in Upper Yuba watershed
- Both GEFS and EPS ensembles are similarly producing >7” of precipitation with spread of +/- 2”

CW3E AR Outlook: 28 December 2022



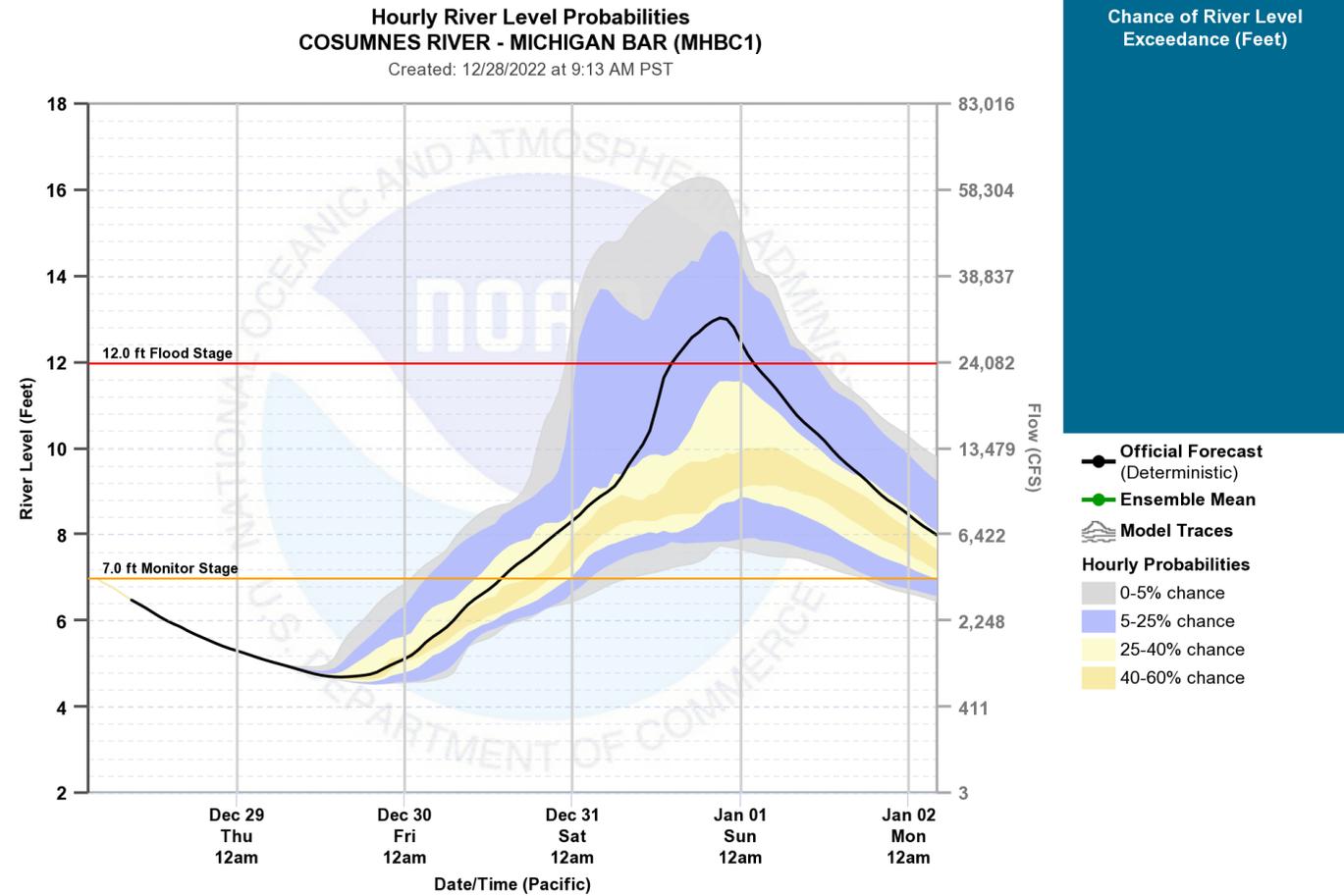
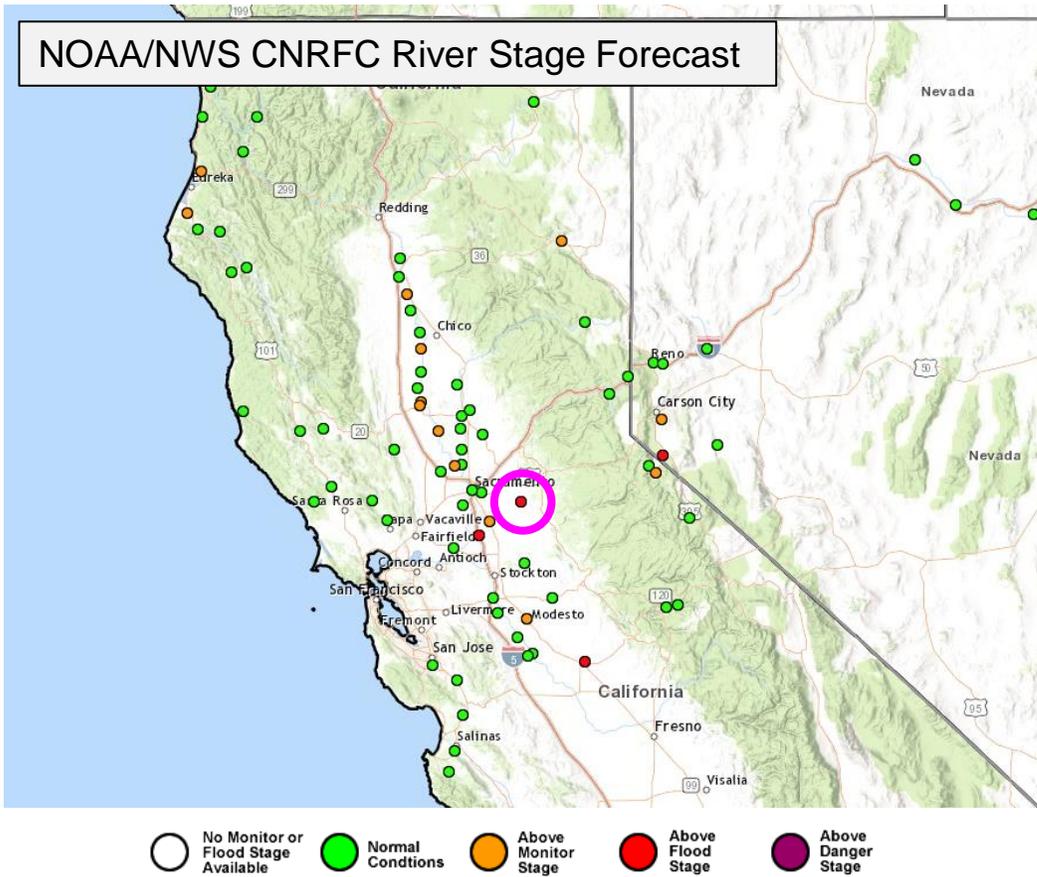
- Melting levels are expected to climb above 2500 meters with several ensemble members in the GEFS predicting a peak near 3000 meters (9800 ft) completely above the Upper Yuba watershed
- GEFS melting level forecast indicates an overwhelming majority of precip will fall as rain 30-31 Dec

CW3E AR Outlook: 28 December 2022



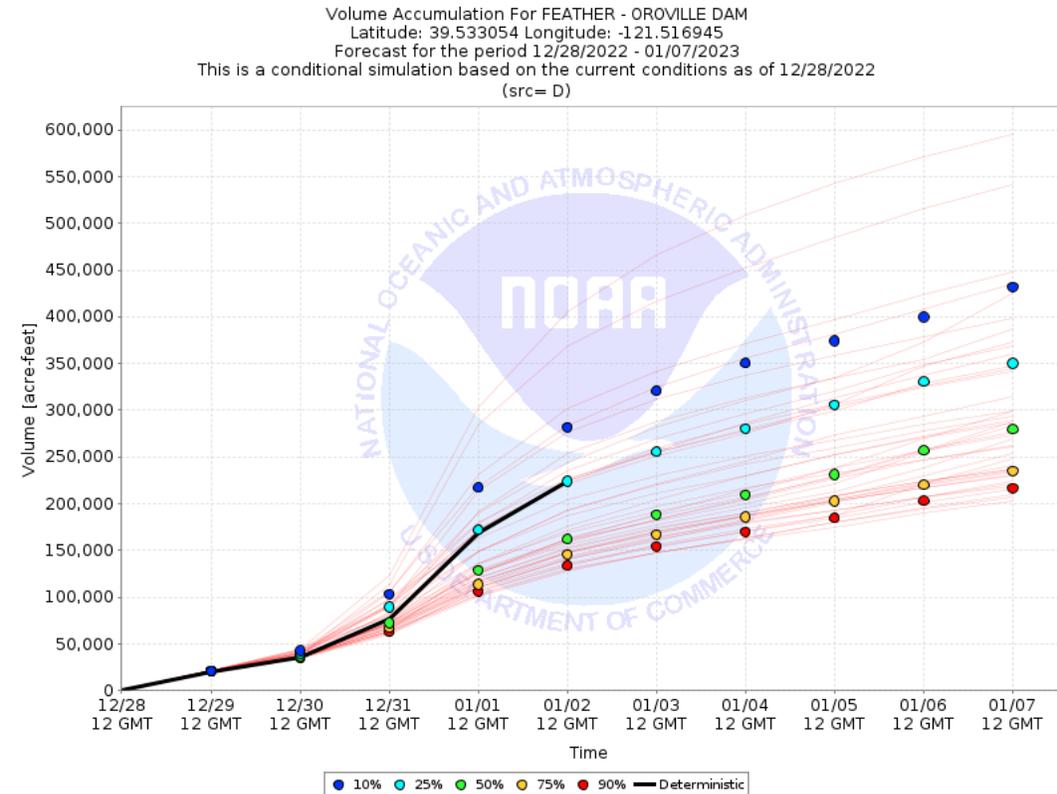
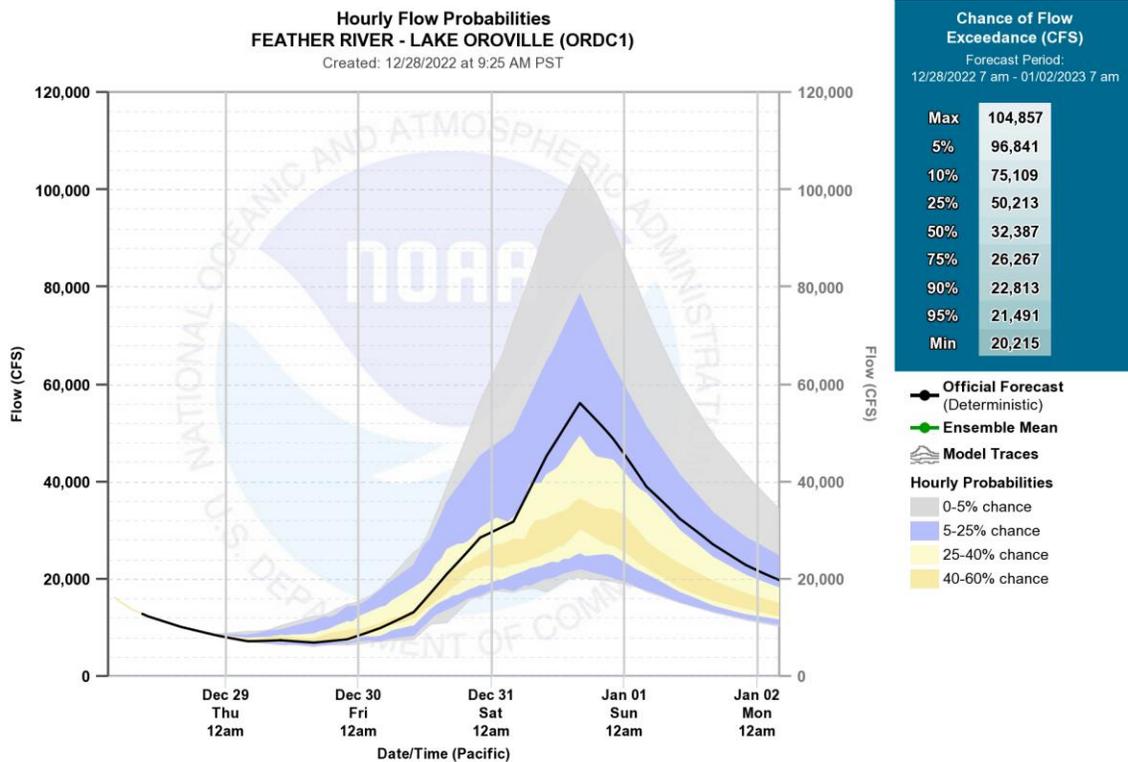
- Rainfall is expected to bring the Russian River at Guerneville to just below monitor stage (29 ft) with an official forecast of 25 ft on 1 Jan
- Ensemble-based odds of reaching flood stage (32 ft) are 12%

CW3E AR Outlook: 28 December 2022



- Rainfall is expected to bring the Cosumnes River at Michigan Bar to above flood stage (12 ft) with an official forecast of 13 feet
- Ensemble-based odds of reaching flood stage (12 ft) are ~85%

CW3E AR Outlook: 28 December 2022



- Rainfall in the Feather River Watershed is expected to result in inflows into Lake Oroville >30,000 CFS with a current official forecast peak of 56,000 CFS late on 31 December
- Associated accumulated volume forecast follows the 25th percentile of the ensemble and reaches ~250,000 CFS by 2 January and ~350,000 CFS by 7 January
- Forecast adds ~25% to the current storage of Oroville and could bring the reservoir to ~50% of capacity.

