CW3E Atmospheric River Outlook: 22 Dec 2021

Strong Atmospheric River and Multiple Upper-level Systems to Produce Heavy Rain and Snow in the Western US

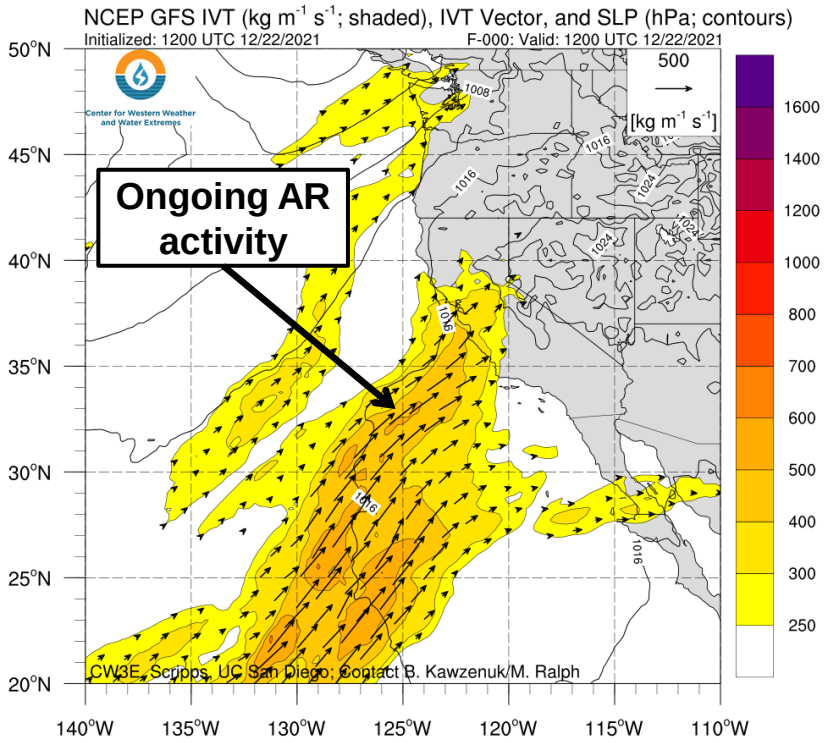
- AR activity and heavy precipitation is expected over much of the western US today through Friday
- The 12Z GEFS control member is forecasting AR 2/AR 3 conditions over coastal Southern and Central California
- AR 5 conditions are currently forecasted over south-central Arizona, where maximum IVT magnitude may exceed 1250 kg m^{-1} s^{-1}
- As the AR weakens, a series of upper-level shortwave troughs is forecast to move down along the US West Coast and bring additional periods of precipitation to the Pacific Northwest and Northern California
- Freezing levels are forecasted to decrease starting on 23 Dec to 3000-4000 ft and remain below 5000 ft during the passing of the shortwaves.
- A second period of AR activity is possible over the southwestern US on 25–26 Dec
- The NWS Weather Prediction Center (WPC) is forecasting at least 5–10 inches of total precipitation in portions of the Pacific Coast Ranges, the Cascades, and the Sierra Nevada over the next 7 days, with more than 10 inches likely in the higher terrain of the Sierra Nevada
- At least 2–5 inches of precipitation are forecasted in Southern California and parts of the Rocky Mountains in Utah, Colorado, Idaho, and Wyoming with up to 2.5 inches in parts of Arizona
- More than 8 feet of snow are possible in the higher terrain of the Sierra Nevada
- Although significant flooding is not expected at this time, minor flooding is possible in the vicinity of the Central California Coast Ranges and the mountains in Southern California

CW3E Atmospheric River Outlook: 22 Dec 2021

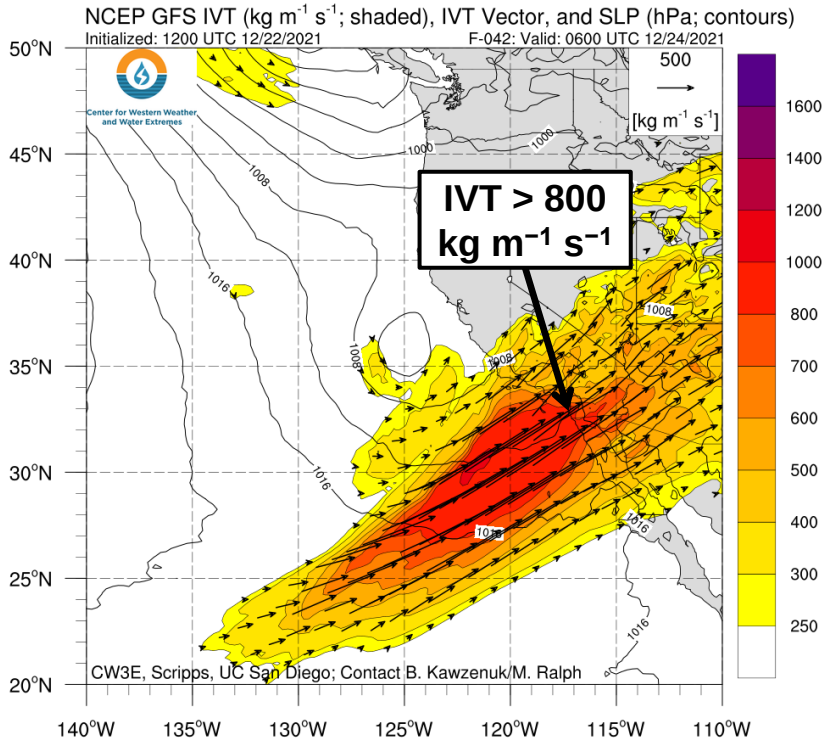
For California DWR's AR Program

GFS IVT Analyses & Forecasts

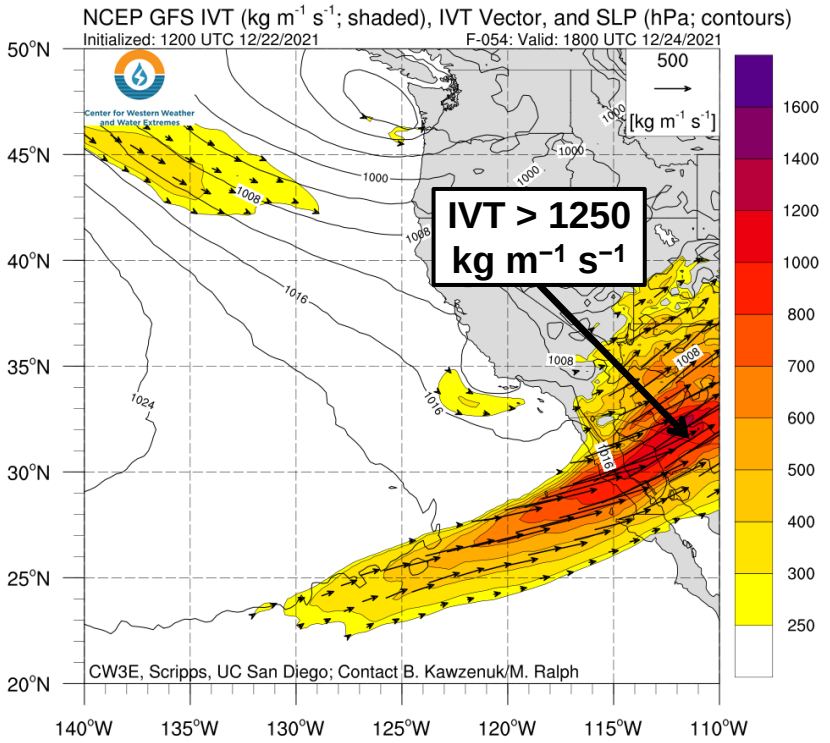
(A) Valid: 4 AM PT 22 Dec (F-0)



(B) Valid: 10 PM PT 23 Dec (F-42)



(C) Valid: 7 PM PT 24 Dec (F-111)



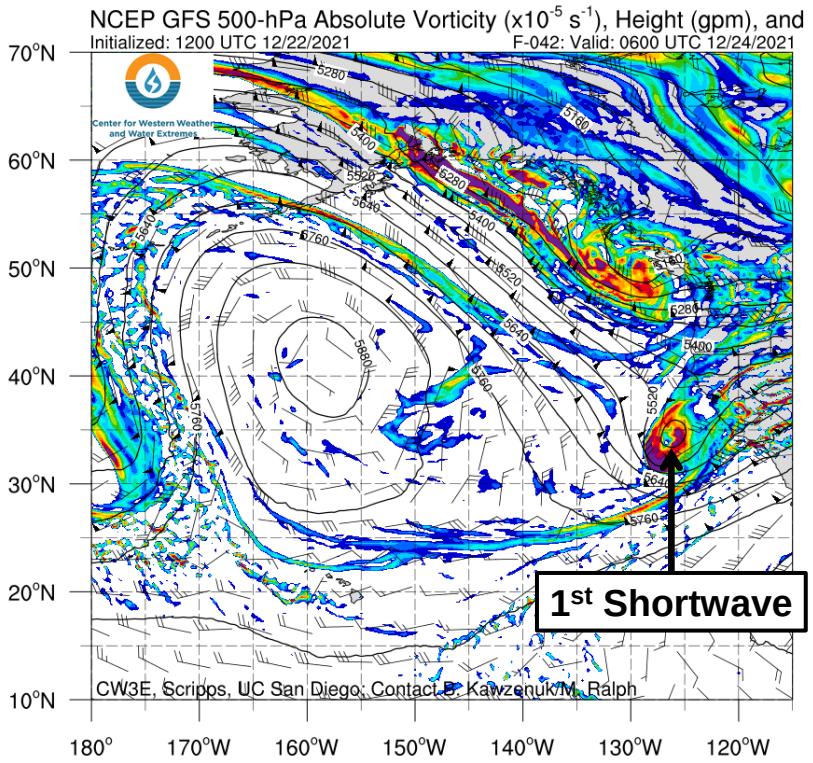
- Ongoing AR conditions over California are expected to strengthen as an upper-level shortwave trough interacts with a region of tropical moisture over the East Pacific Ocean (Figures A and B)
- The 12Z GEFS deterministic model is forecasting IVT values > 800 kg m^{-1} s^{-1} and IWV values > 30 mm (not shown) over coastal San Diego County around 10 PM PT 23 Dec (Figure B)
- The strongest moisture transport is forecasted to occur over south-central Arizona as the AR moves inland, with maximum IVT values potentially exceeding 1250 kg m^{-1} s^{-1} (Figure C)

CW3E Atmospheric River Outlook: 22 Dec 2021

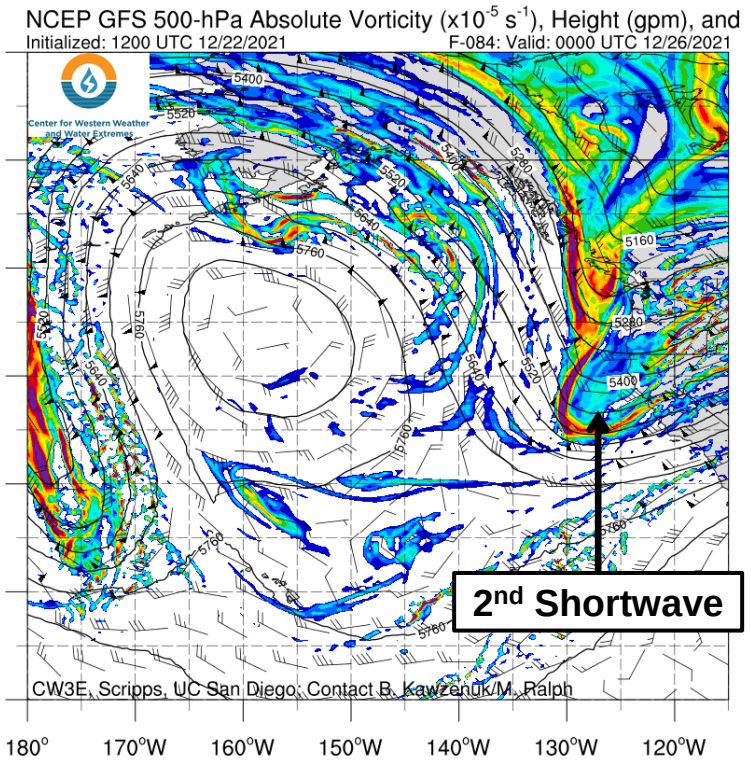
For California DWR's AR Program

GFS 500-mb Height & Vorticity Forecasts

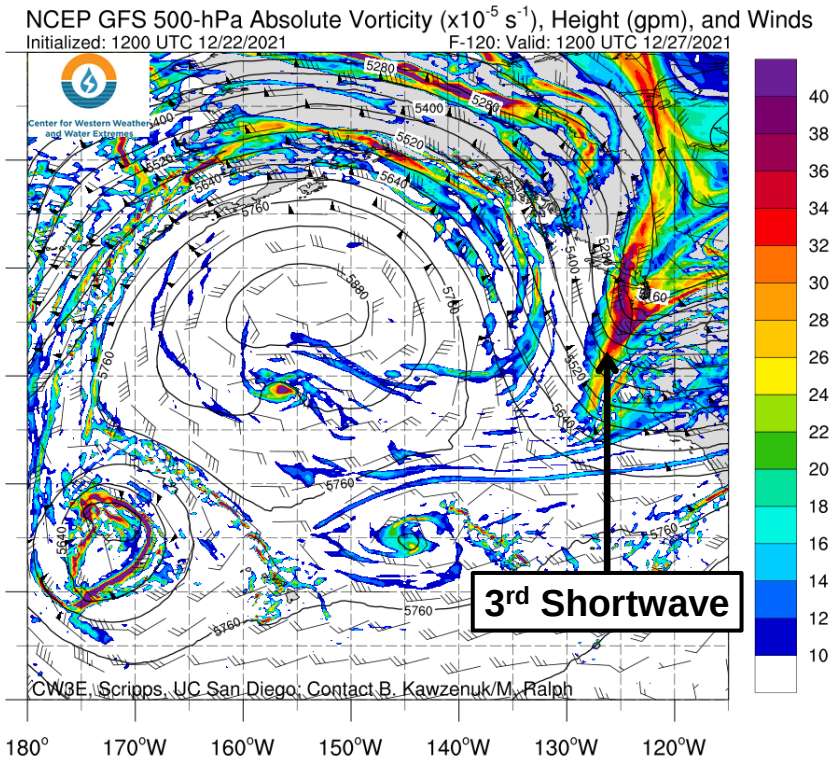
(A) Valid: 10 PM PT 23 Dec (F-42)



(B) Valid: 4 PM PT 25 Dec (F-84)



(C) Valid: 4 AM PT 27 Dec (F-120)

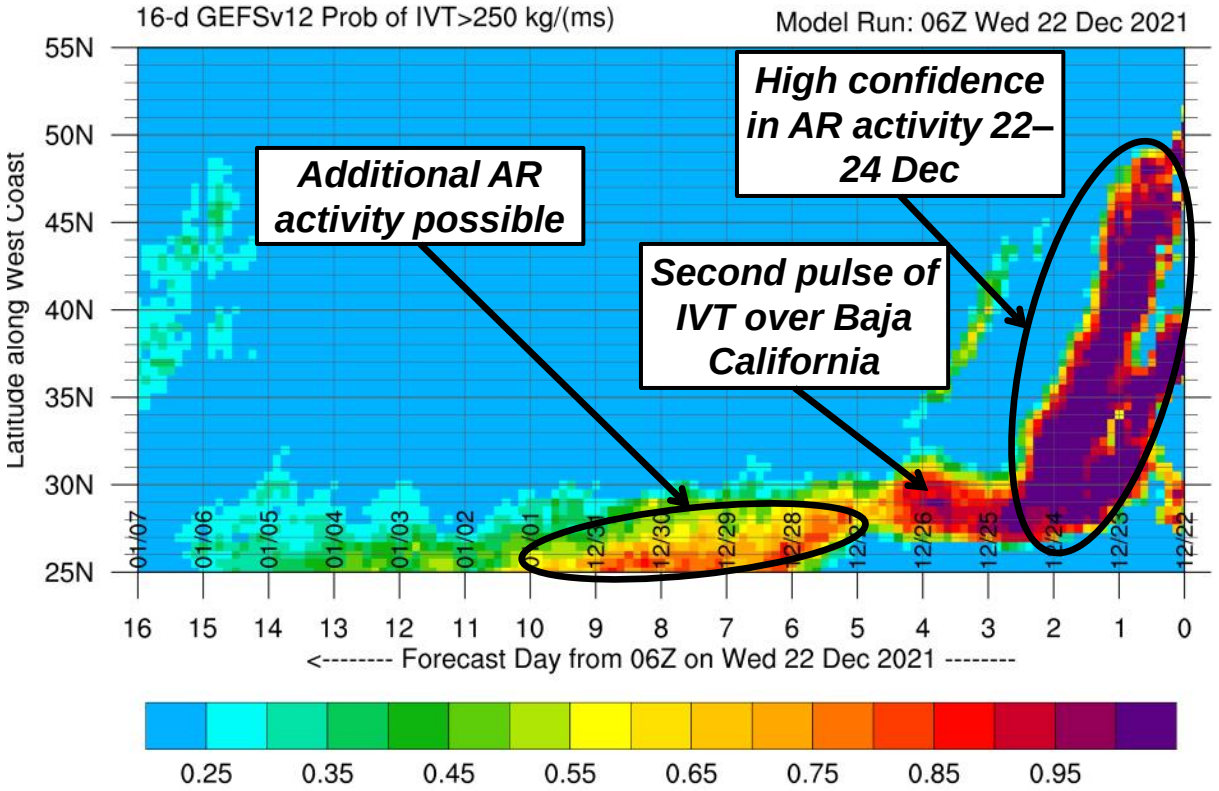


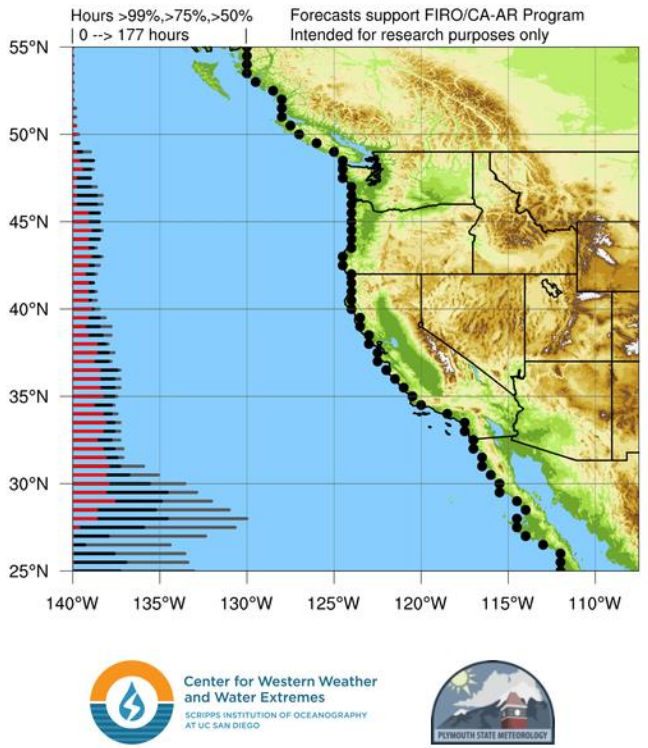
- The 12Z deterministic GFS shows a potent 500-hPa shortwave just offshore as the AR strengthens over Southern California and Arizona (Figure A)
- Another round of moderate-to-heavy precipitation is forecasted across the Sierra Nevada on 25–26 Dec as a second shortwave approaches US West Coast (Figure B)
- A third shortwave is forecasted to move down along the US West Coast on 27 Dec, bringing additional precipitation to the Pacific Northwest and Northern California (Figure C)

CW3E Atmospheric River Outlook: 22 Dec 2021

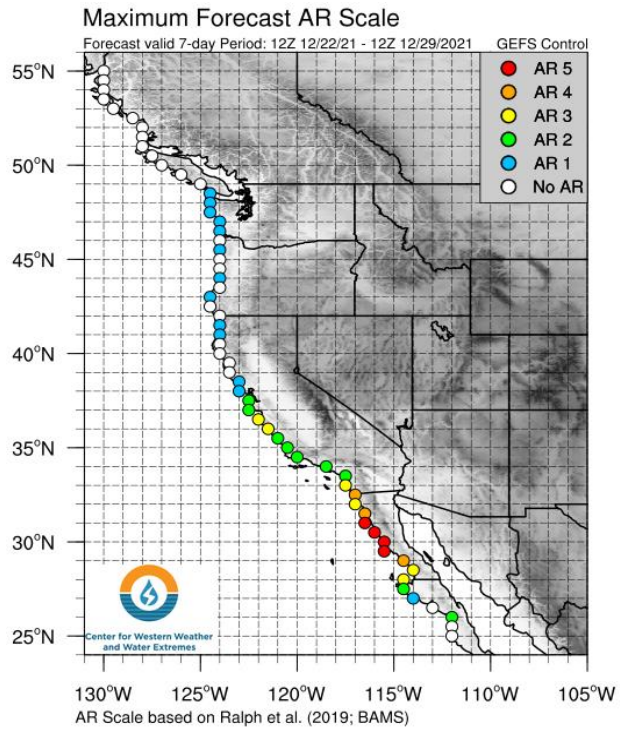
For California DWR's AR Program

Probability of AR Conditions Along Coast





AR Scale

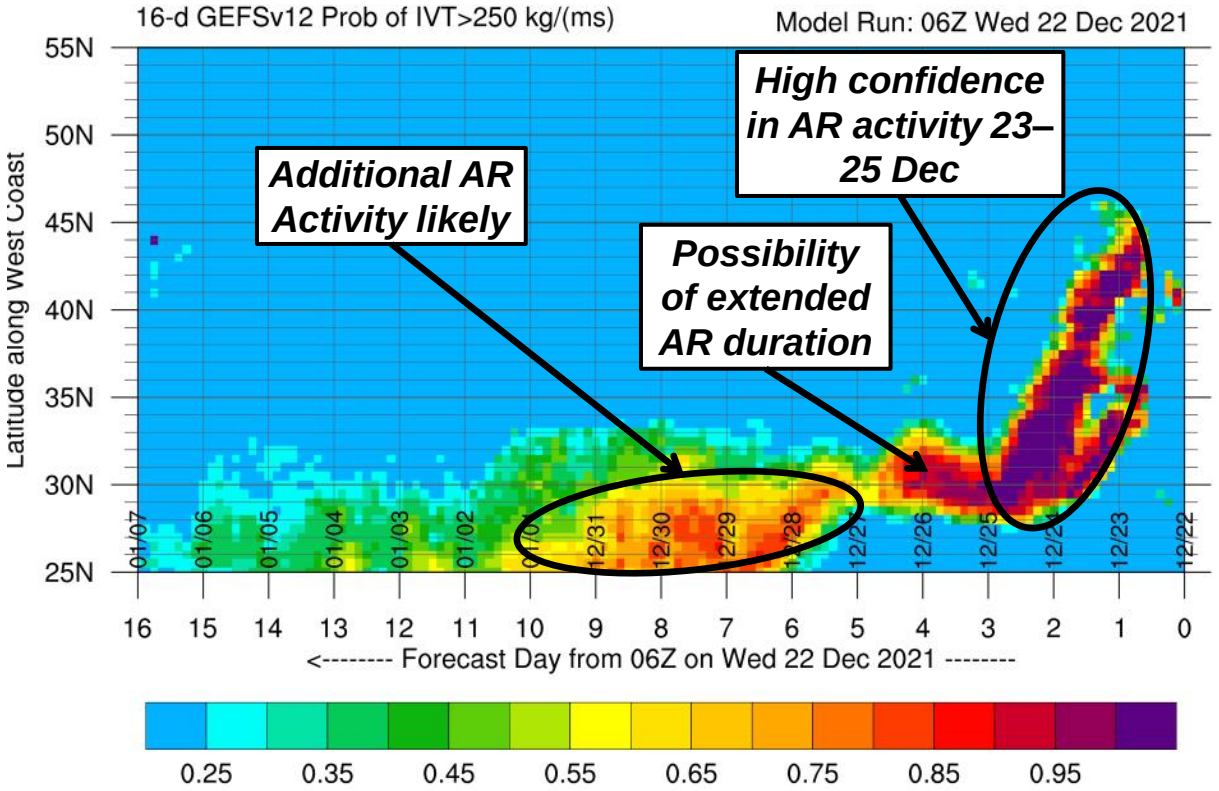


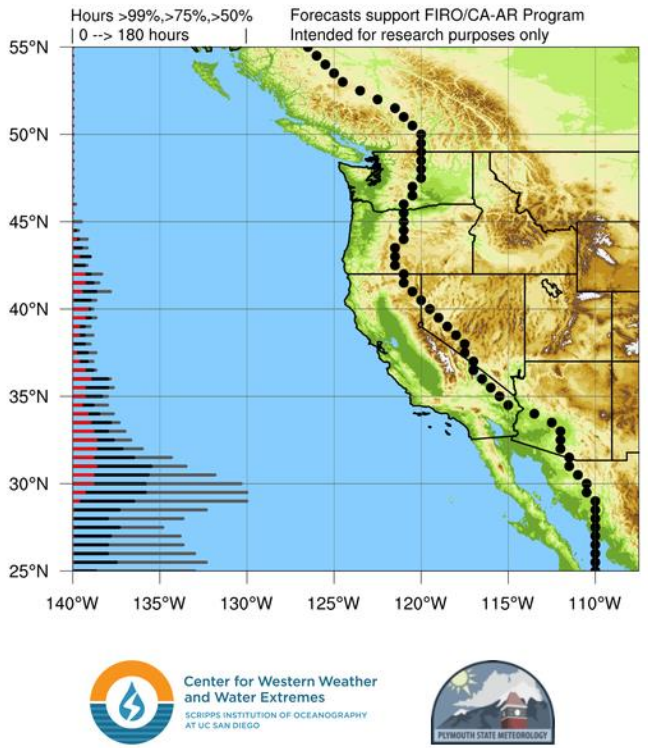
- The 06Z GEFS is showing very high confidence (> 95% probability) in periods of AR activity over the US West Coast and Baja California today through Friday (24 Dec)
- Some locations in Baja California may experience AR conditions for more than 48 consecutive hours
- There is less certainty regarding the timing and location of AR conditions associated with a second pulse of IVT over Baja California on 25–26 Dec
- The 06Z GEFS is also highlighting the possibility of additional landfalling AR activity over the Baja Peninsula during 27–31 Dec
- The 12Z GEFS control run is predicting the first period of AR activity to produce AR 2/AR 3 conditions from San Diego, CA, to San Francisco, CA with AR 5 conditions possible in Baja California

CW3E Atmospheric River Outlook: 22 Dec 2021

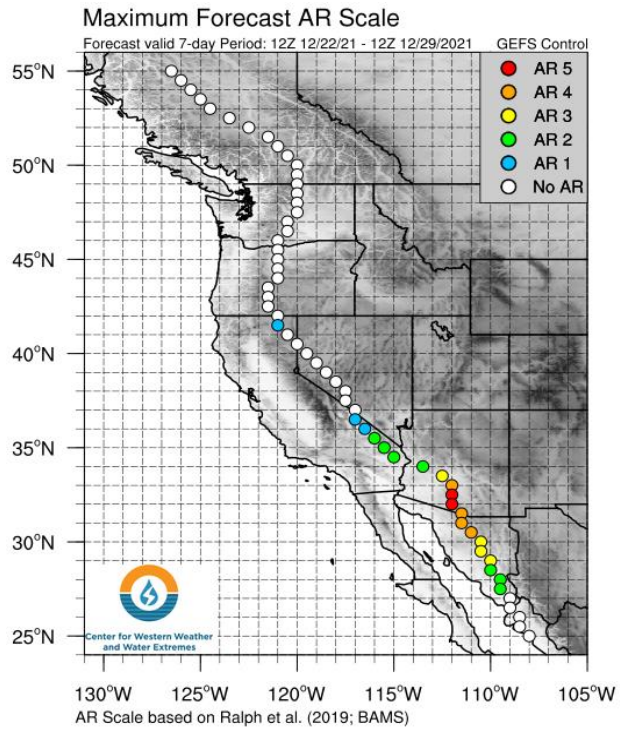
For California DWR's AR Program

Probability of AR Conditions Inland





AR Scale

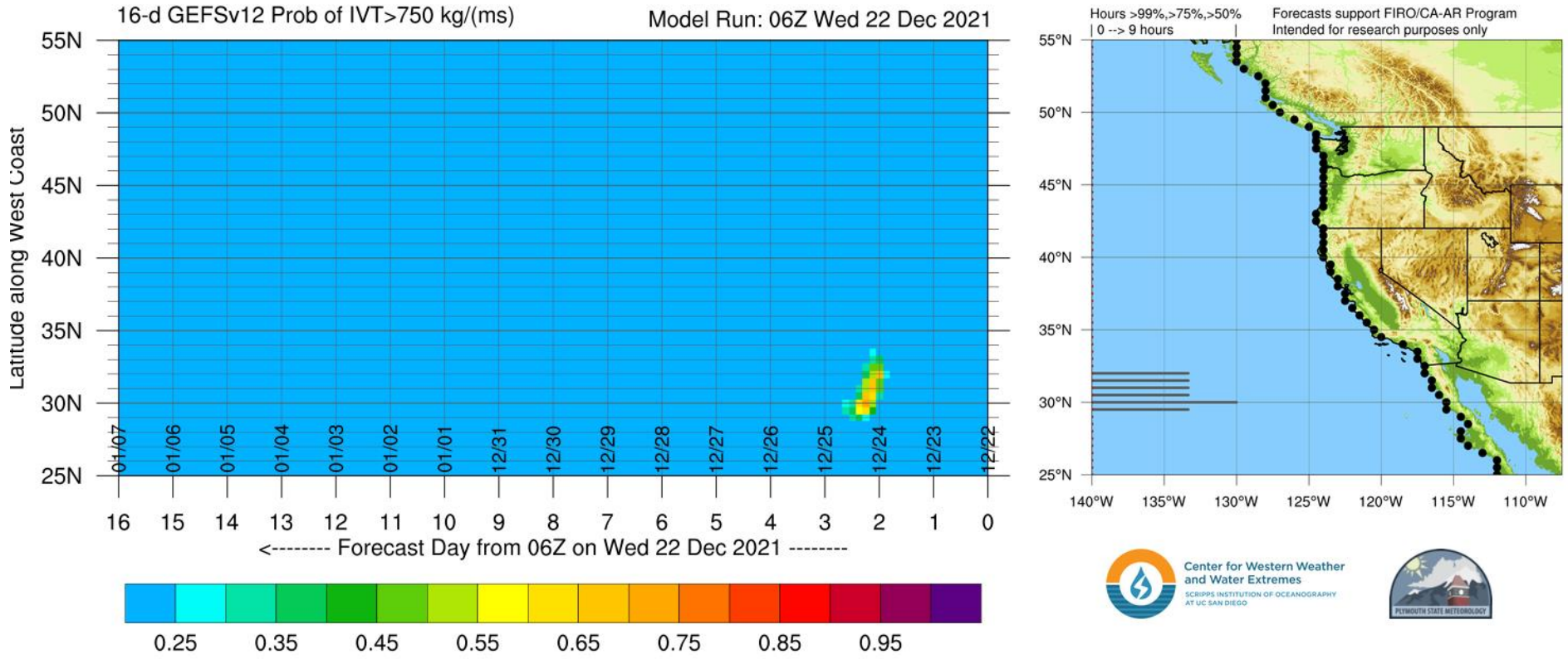


- The 06Z GEFS is also showing very high confidence (> 95% probability) in periods of AR activity over the interior western US and Sonora, Mexico during 23–25 Dec
- Some locations in southern Arizona and northern Sonora may experience a very prolonged period of AR conditions as a second pulse of IVT moves over Baja California on 25–26 Dec
- Additional landfalling AR activity is likely (> 70% probability) over Sonora during 27–31 Dec, but there is considerable uncertainty in how far north AR activity will extend
- The 12Z GEFS control run is predicting AR 5 conditions over south-central Arizona during the next 7 days

CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

Probability of Strong AR Conditions Along Coast



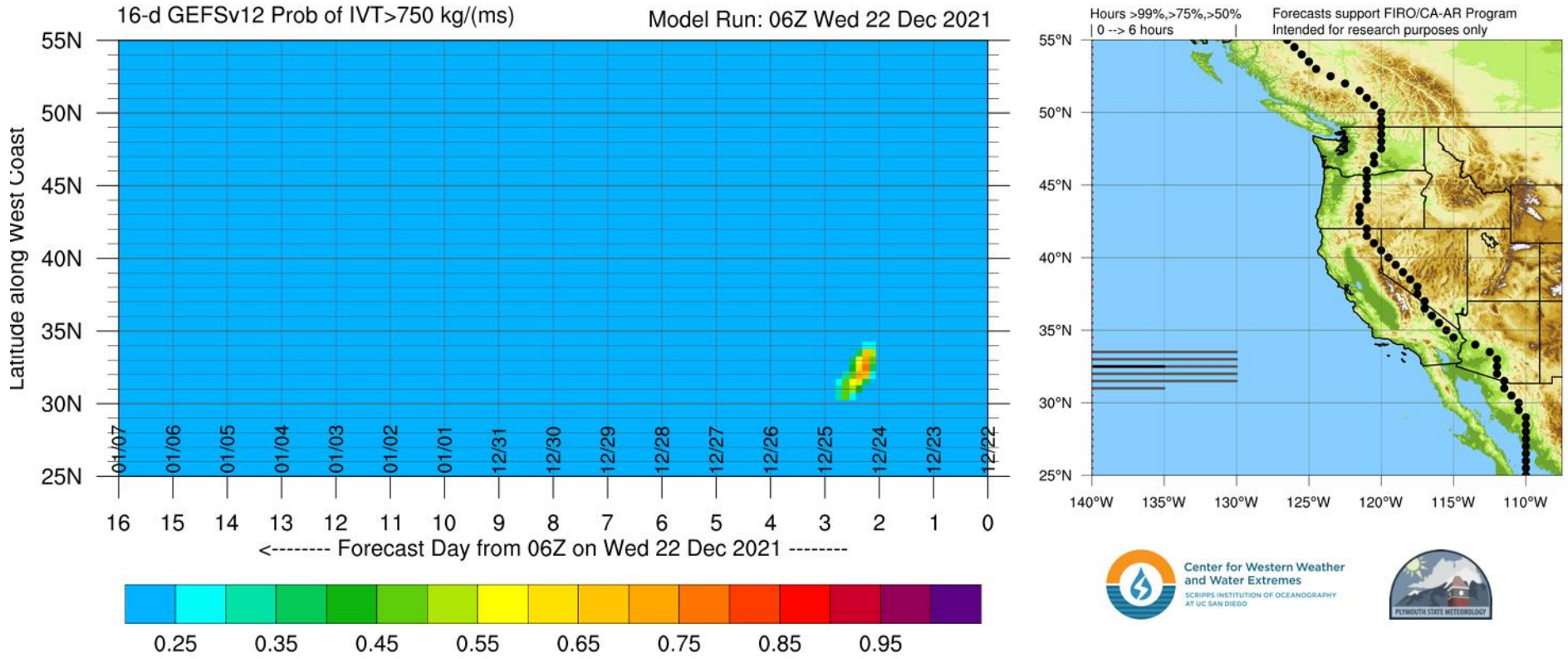
*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 06Z GEFS is showing an elevated likelihood (50–70% probability) of strong AR conditions (IVT > 750 kg m^{-1} s^{-1}) over San Diego County around 06Z 24 Dec

CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

Probability of Strong AR Conditions Along Coast



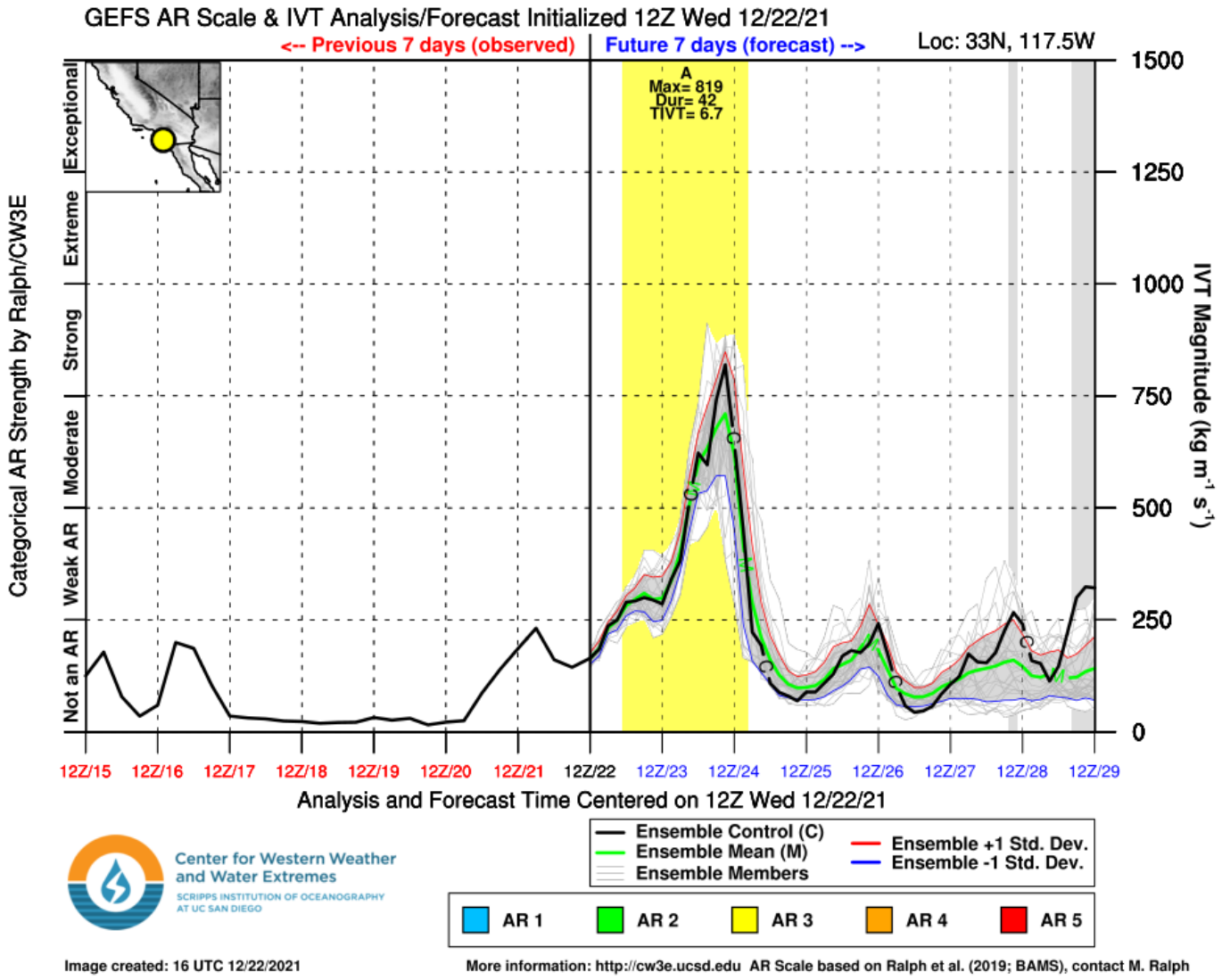
*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 06Z GEFS is also showing an elevated likelihood (60–80% probability) strong AR conditions (IVT > 750 kg m^{-1} s^{-1}) over south-central Arizona around 12Z 24 Dec

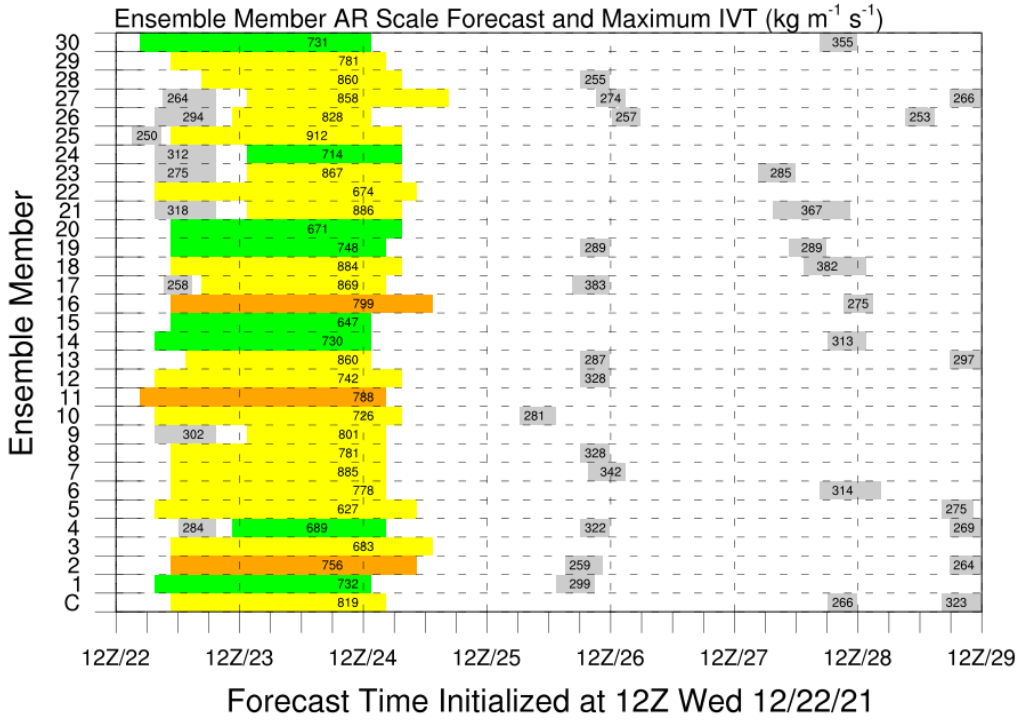
CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

GEFS AR Scale and IVT Forecasts



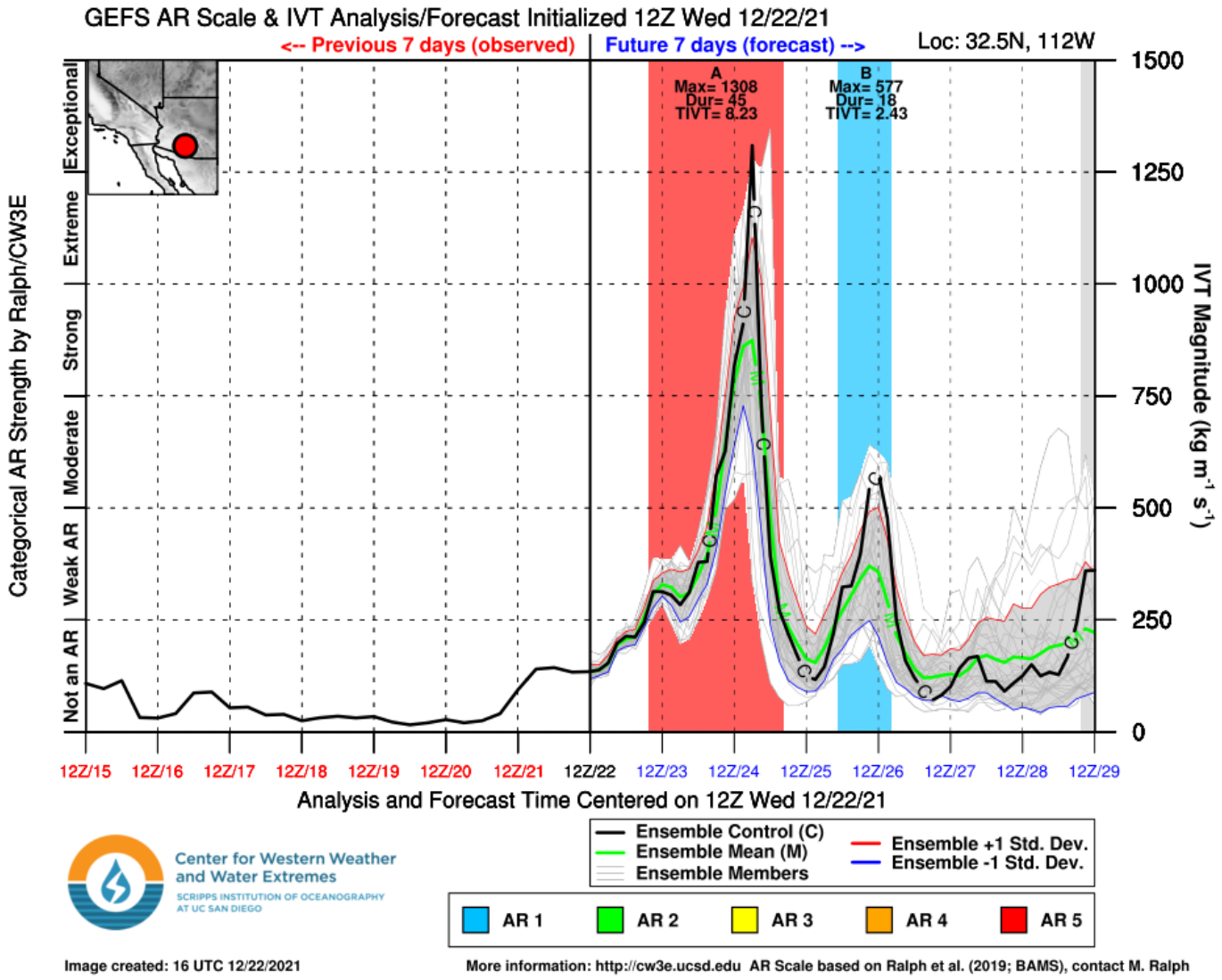
- The 12Z GEFS control member is forecasting AR 3 conditions over coastal San Diego County, with a maximum IVT of 819 kg m^{-1} s^{-1}, and an AR duration of 42 h
- There is still some uncertainty in the timing, magnitude, and duration of AR conditions
- 3/31 ensemble members are predicting an AR 4 at this location, 20/31 are predicting an AR 3, and 8/31



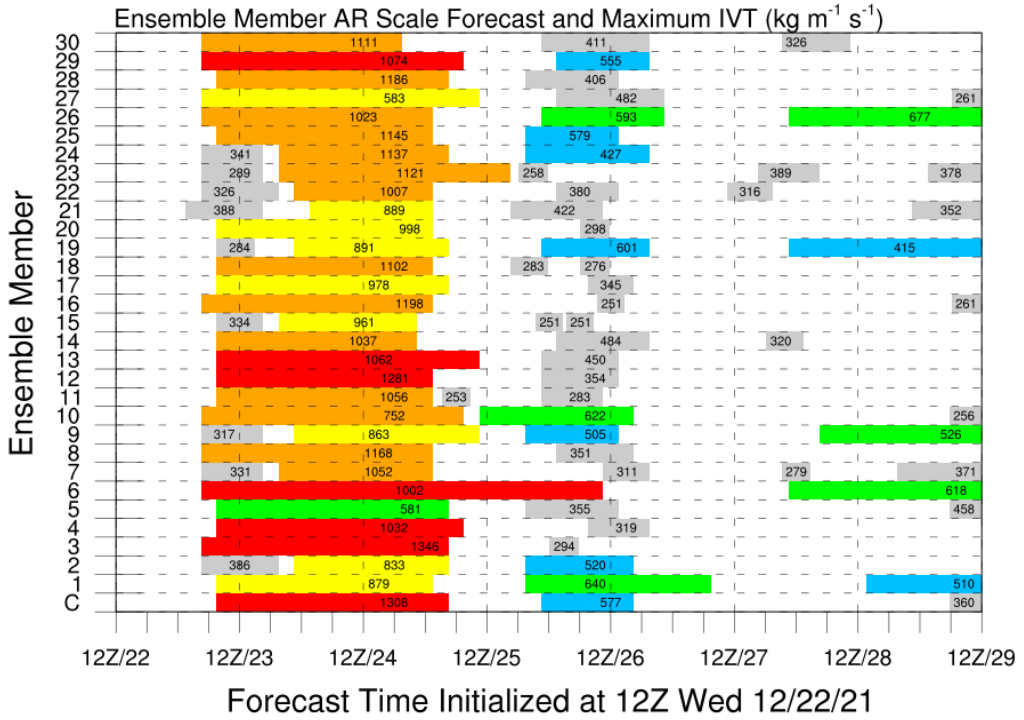
CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

GEFS AR Scale and IVT Forecasts



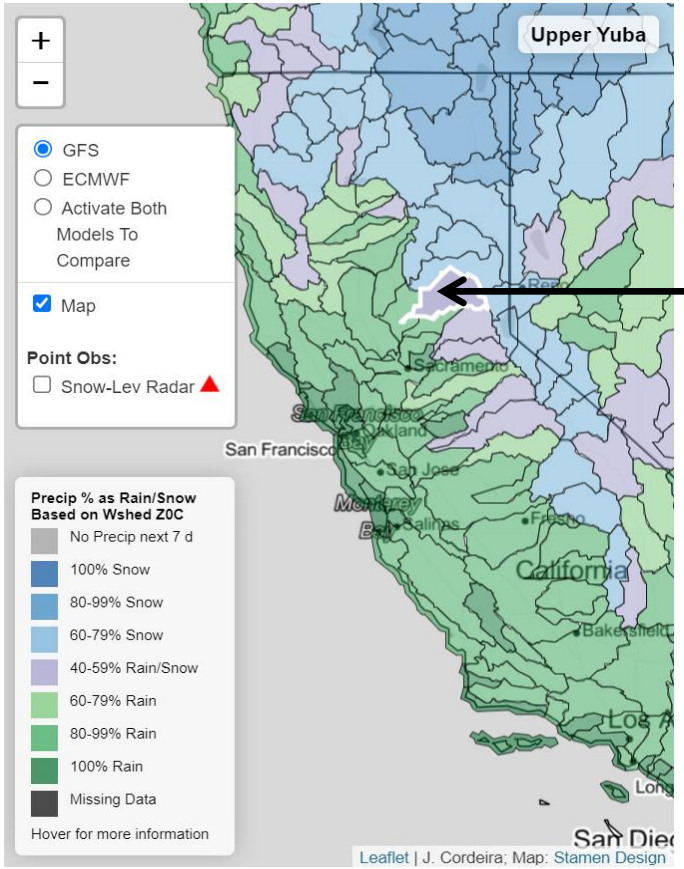
- The 12Z GEFS control member is forecasting AR 5 conditions over Pima County, AZ, with a maximum IVT of 1308 kg m^{-1} s^{-1}, and an AR duration of 45 h
- There is still considerable uncertainty in the forecast IVT magnitude at this location
- 7/31 ensemble members are predicting an AR 5, 14/31 are predicting an AR 4, and 9/31 are predicting an AR 3

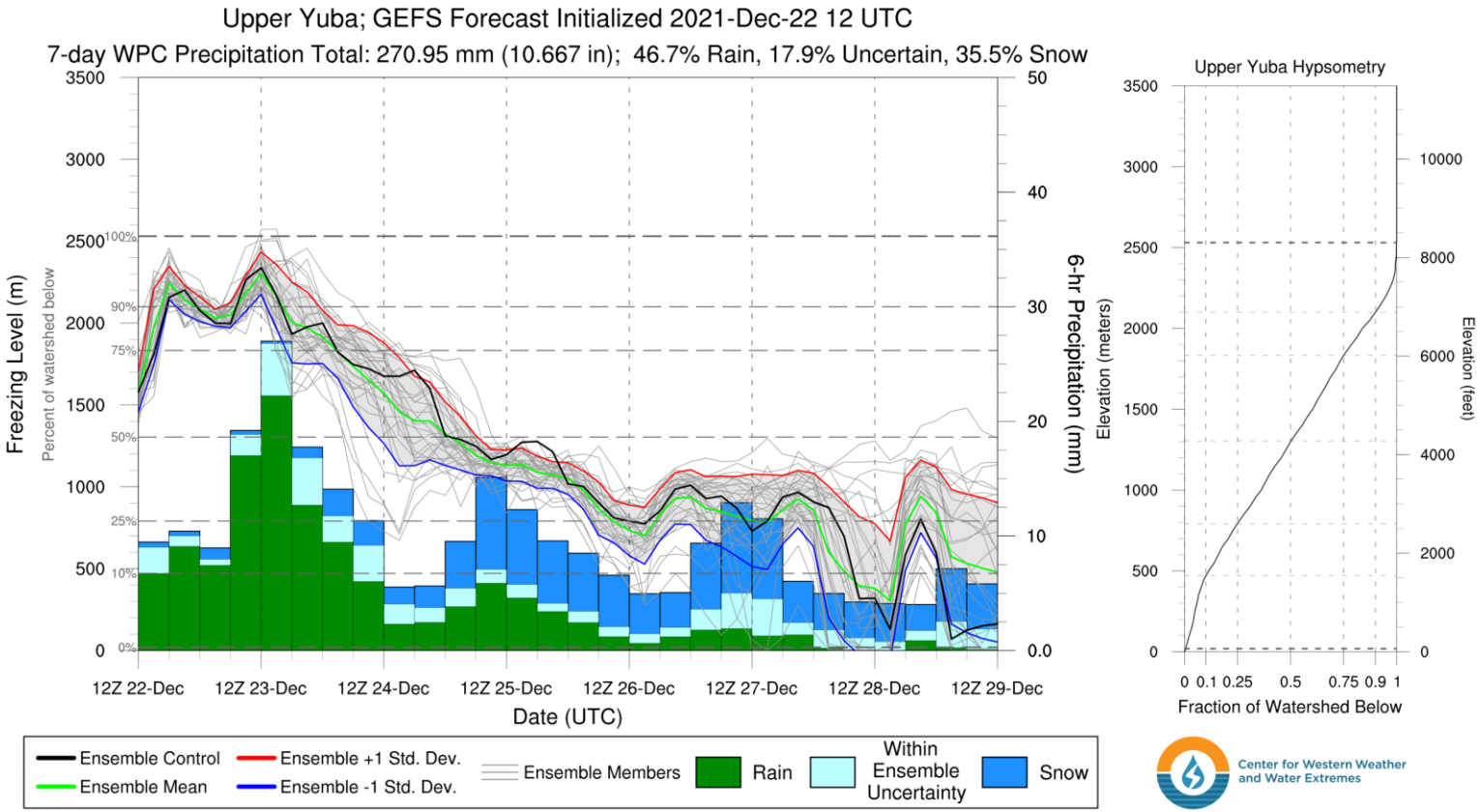


CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

7-day GEFS Watershed Freezing Level Forecasts: Upper Yuba





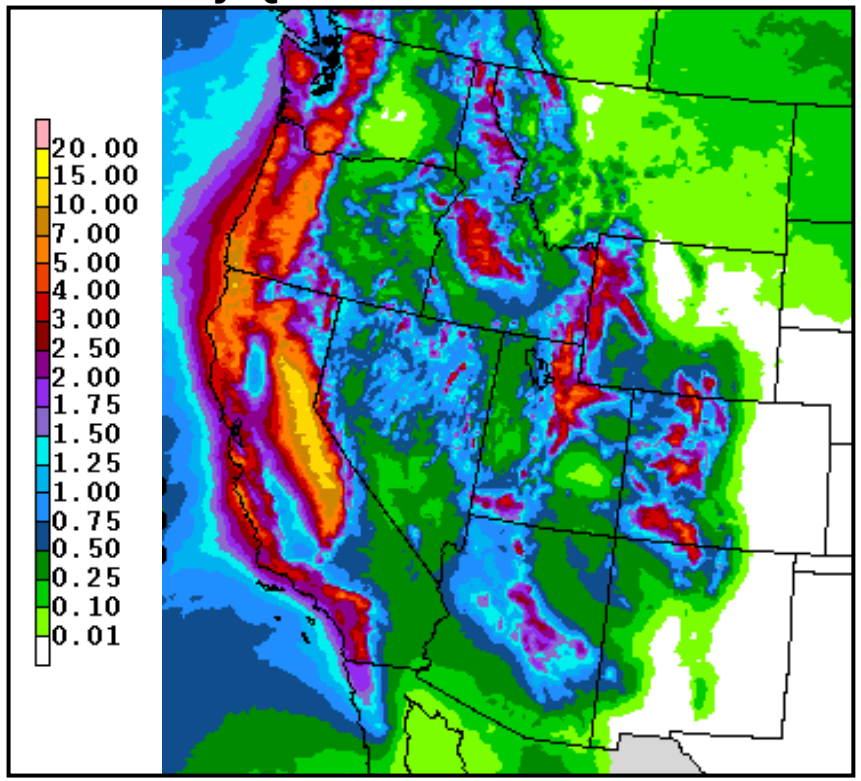
- The NWS WPC is forecasting 10.7 inches of mean areal precipitation in the Upper Yuba watershed over the next 7 days
- Freezing levels in the Northern Sierra Nevada are expected to remain between 5,000 and 7,000 ft during much of the first and heaviest precipitation episode
- Freezing levels are forecasted to drop below 4,000 ft by 25 Dec and remain below 4,000 ft through 29 Dec
- Most of the precipitation from 25 Dec onward is expected to fall as snow in the Upper Yuba watershed

CW3E Atmospheric River Outlook: 22 Dec 2021

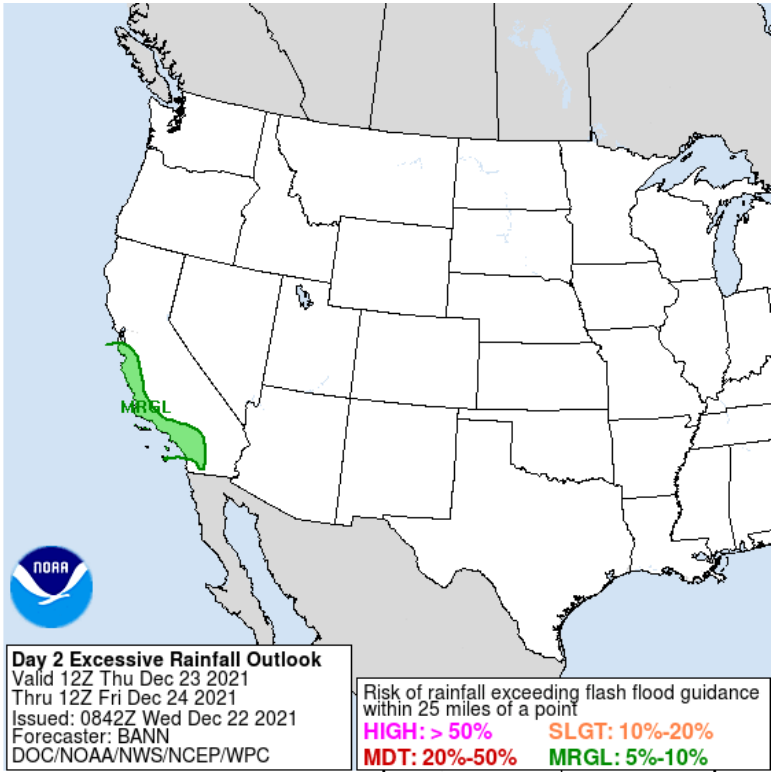
AMBASSADOR™ WRN WEATHER-READY NATION

For California DWR's AR Program

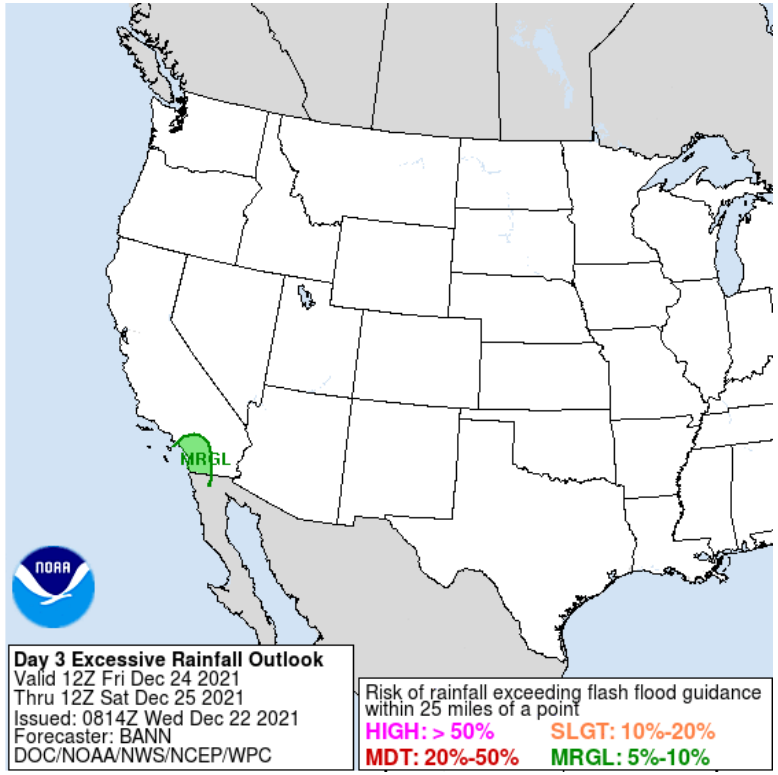
WPC 7-day QPF: Valid 4 AM PT 22–29 Dec



WPC Day 2 Excessive Rainfall



WPC Day 3 Excessive Rainfall



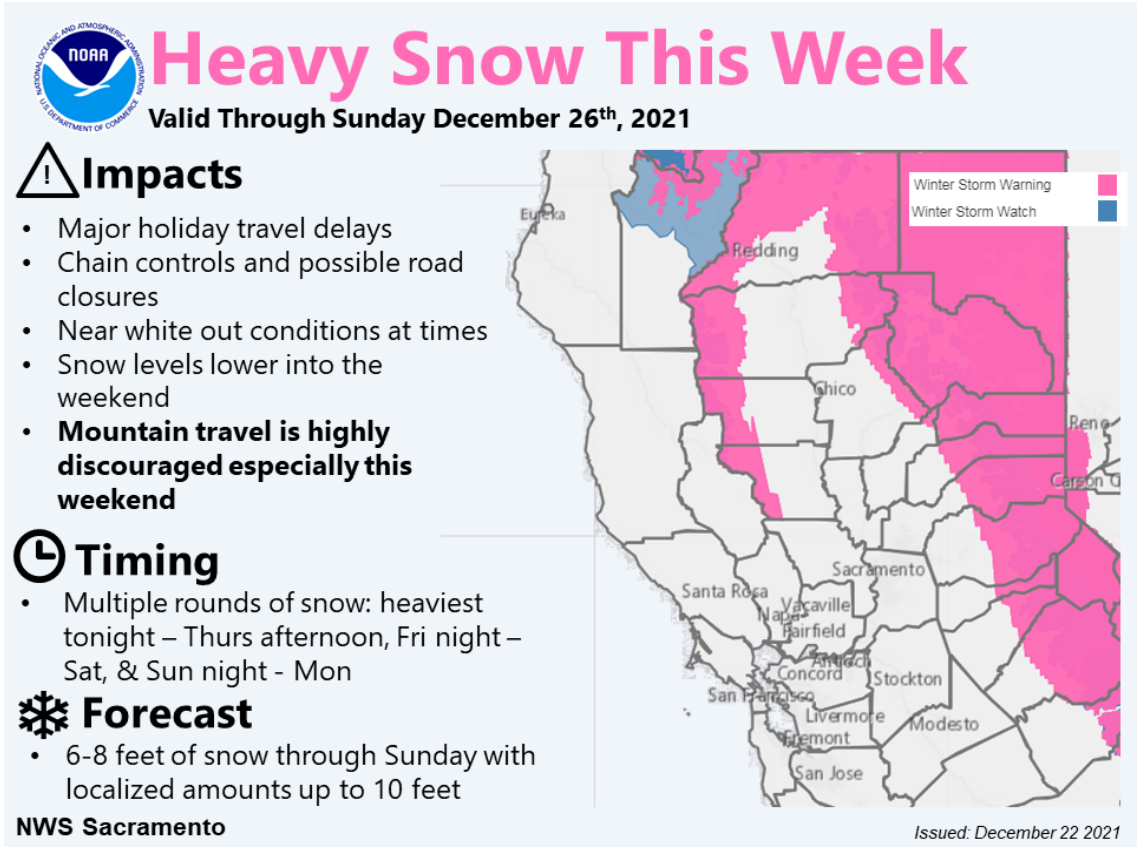
Source: NOAA/NWS Weather Prediction Center

- The NWS WPC is forecasting at least 5–10 inches of total precipitation over portions of the Pacific Coast Ranges, the Cascades, and the Sierra Nevada during the next 7 days
- The heaviest precipitation (> 10 inches) is expected in the higher terrain of the Sierra Nevada
- At least 2–5 inches of precipitation are forecasted over coastal and mountain areas of Southern California as well as portions of the Rocky Mountains in northern Utah, western Colorado, central Idaho, and western Wyoming with up to 2.5 inches in parts of Arizona
- The NWS WPC has issued a marginal risk of excessive rainfall in the vicinity of the Central CA Coast Ranges and Southern CA mountains

CW3E Atmospheric River Outlook: 22 Dec 2021

AMBASSADOR™ WRN WEATHER-READY NATION

For California DWR's AR Program



Source: NWS Sacramento

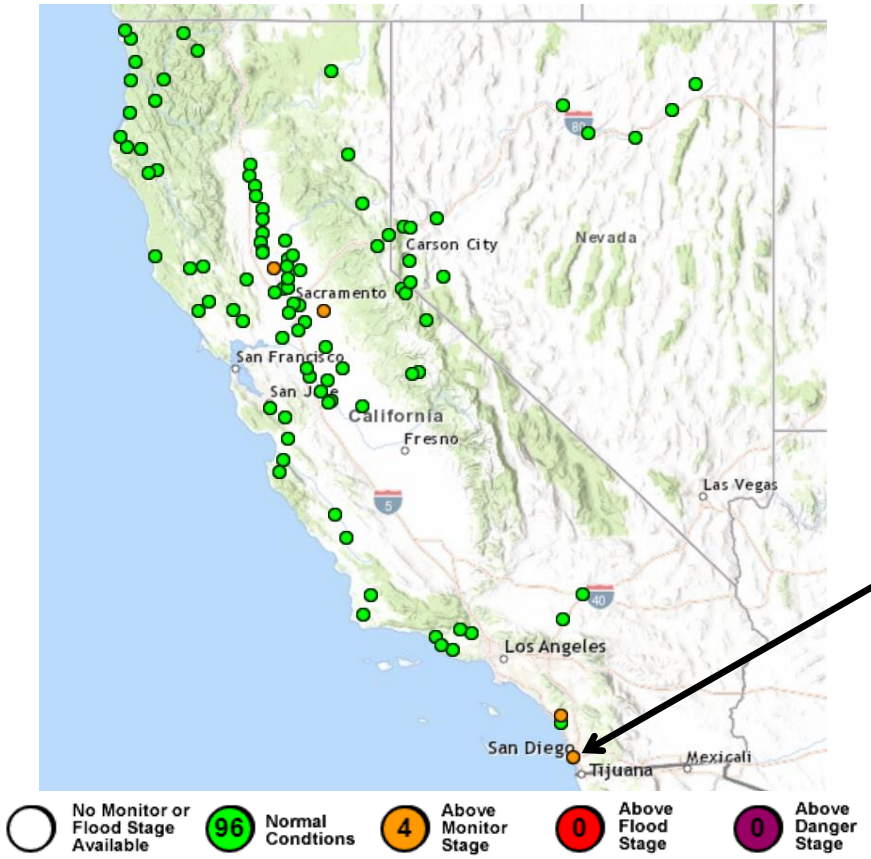
Source: NWS Hanford

- Winter Storm Warnings have been issued for the entire Sierra Nevada in anticipation of very heavy snow through this weekend
- More than 6 feet of snow are forecasted in the Northern and Central Sierra Nevada, with as much as 10 feet possible in some locations
- More than 3 feet of snow are forecasted across the Southern Sierra Nevada, with as much as 8 feet possible in the highest elevations

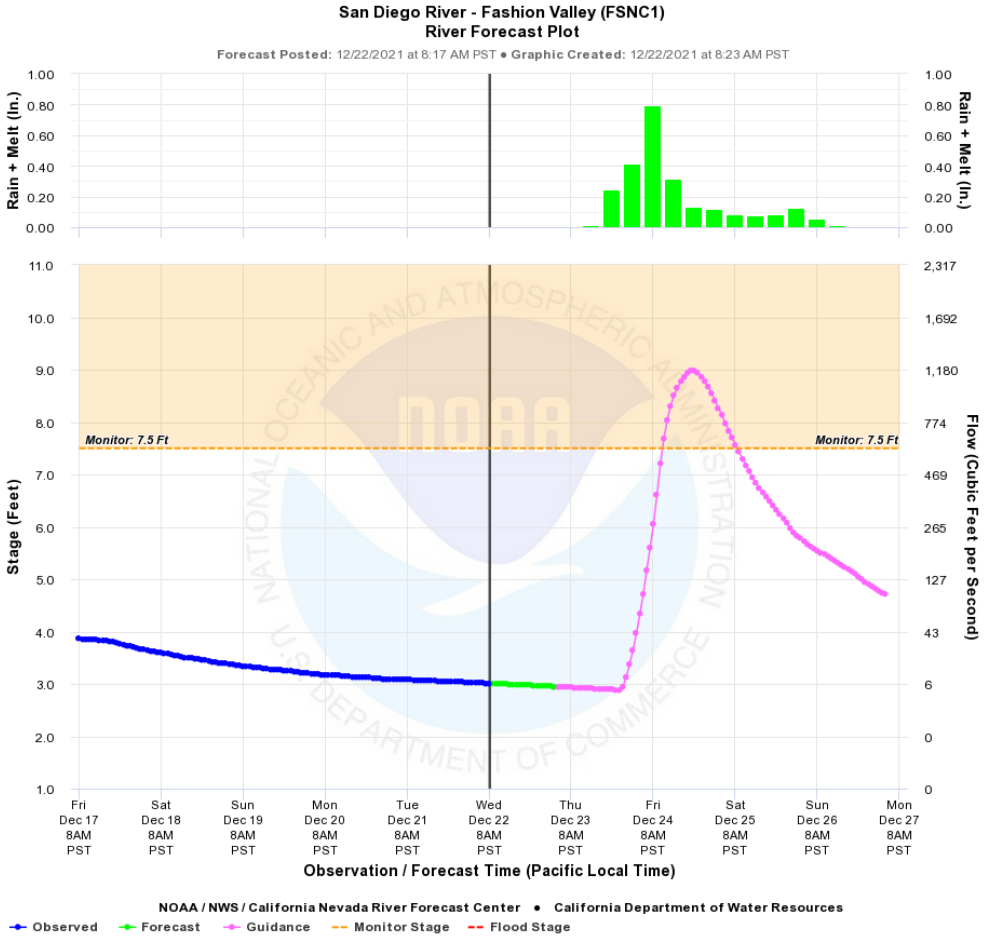
CW3E Atmospheric River Outlook: 22 Dec 2021

For California DWR's AR Program

CNRFC 5-day River Forecasts



Source: NOAA/NWS/CNRFC



- Despite the heavy precipitation forecasted over the next 7 days, significant flooding is not expected in California
- The San Diego River (at Fashion Valley) is forecasted to rise above monitor stage (7.5 ft) on Friday following a period of heavy rainfall Thursday night into Friday morning