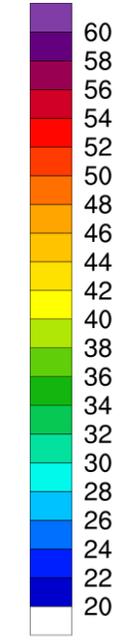
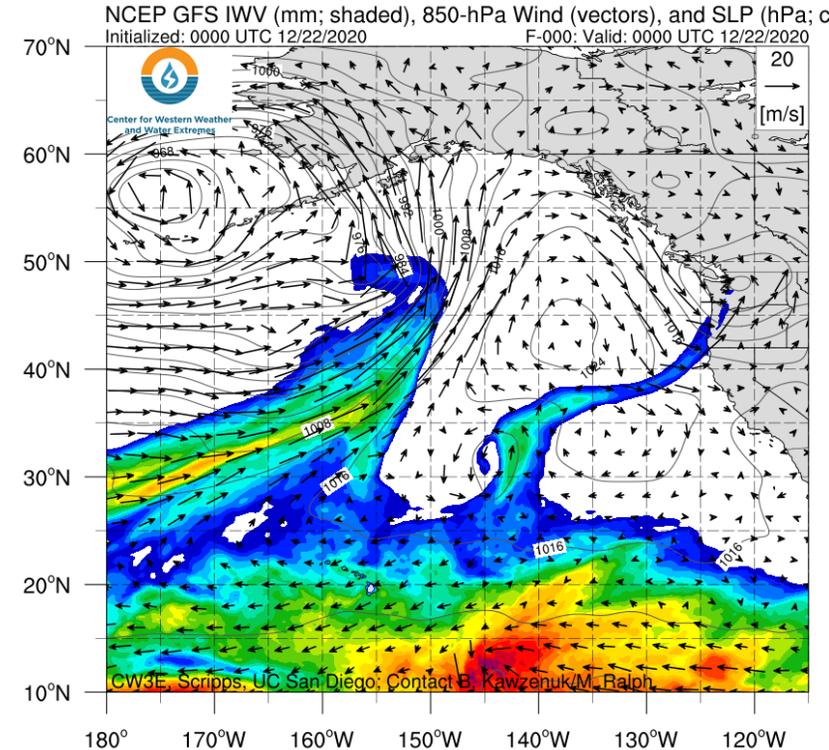
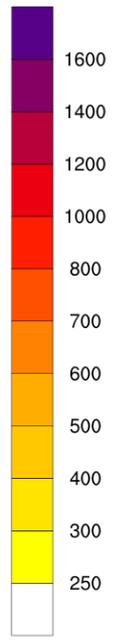
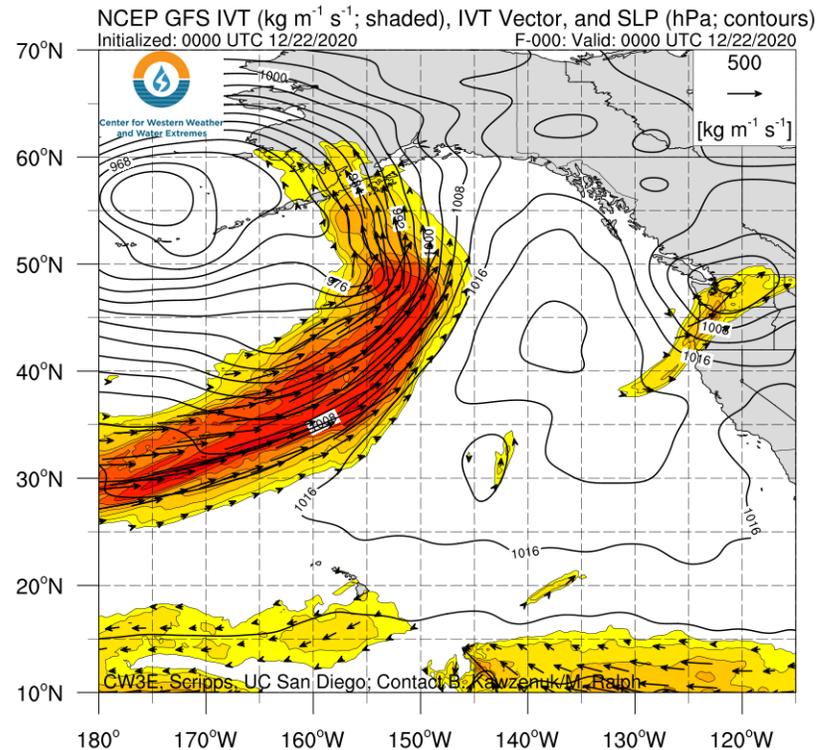


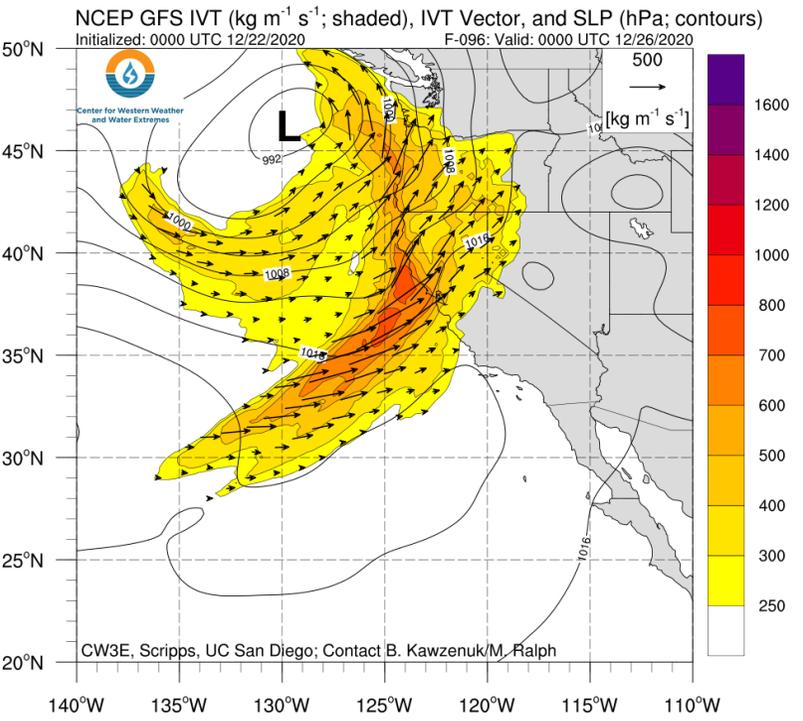
Multiple storms forecast to bring precipitation to the Western U.S. over the next 7 days

- An atmospheric river (AR) associated with a surface cyclone is forecast to make landfall along the U.S. West Coast on 25–26 Dec
- A cutoff low may bring additional impacts to the southwestern U.S. on 28–29 Dec, but forecast uncertainty is currently high
- The GFS and ECMWF are forecasting more than 2 inches of precipitation over portions of the Pacific Coast Ranges and Cascades during the next 7 days

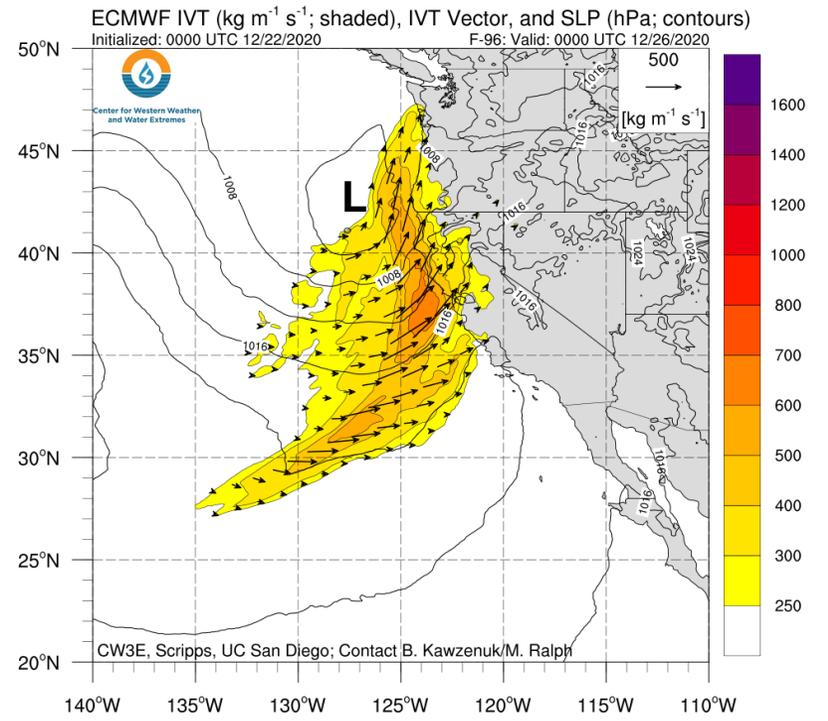


IVT & SLP Forecasts: Valid 00Z 26 Dec (F-96)

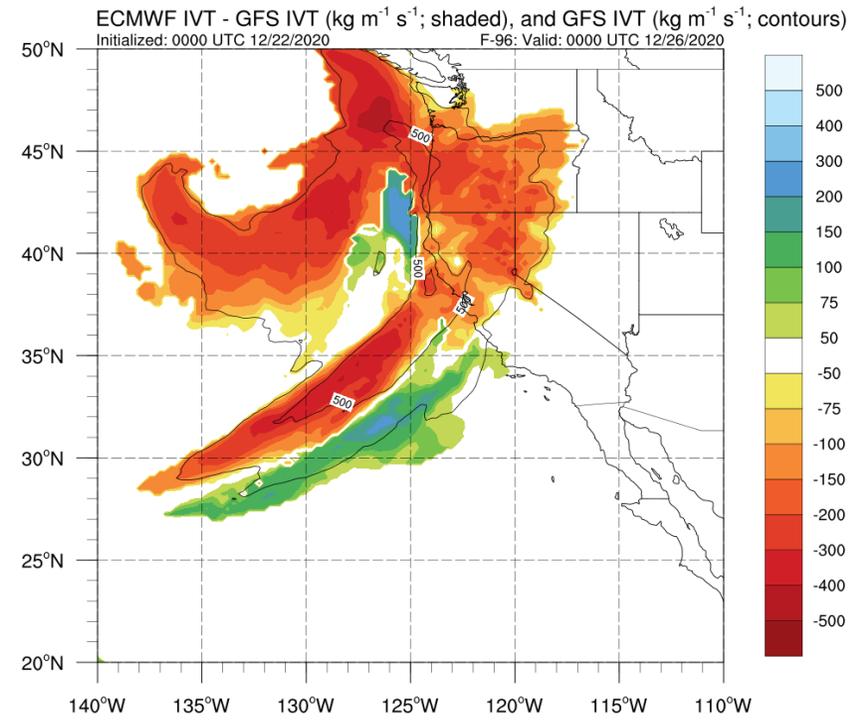
NCEP GFS



ECMWF



ECMWF - GFS



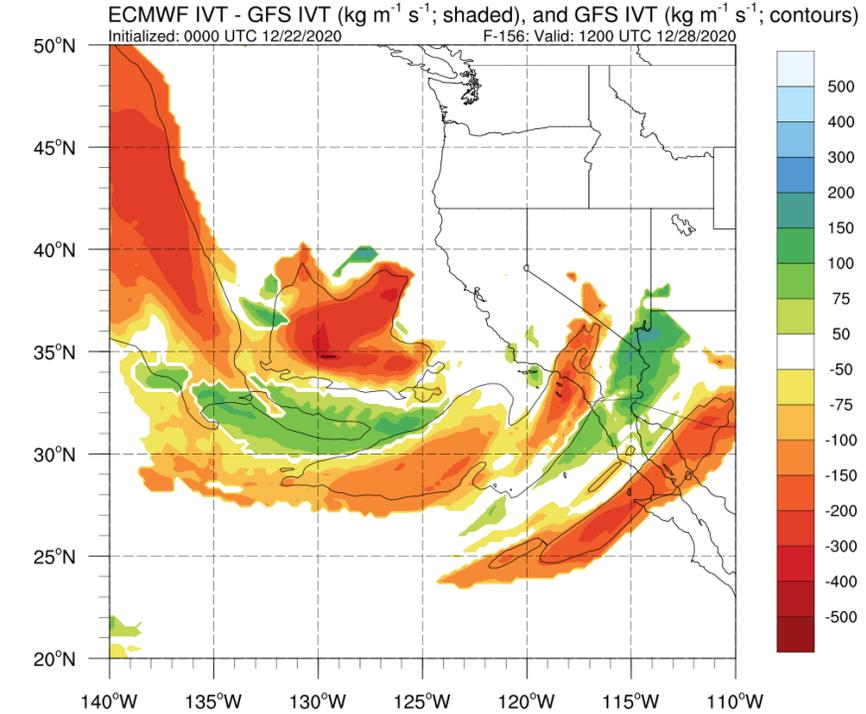
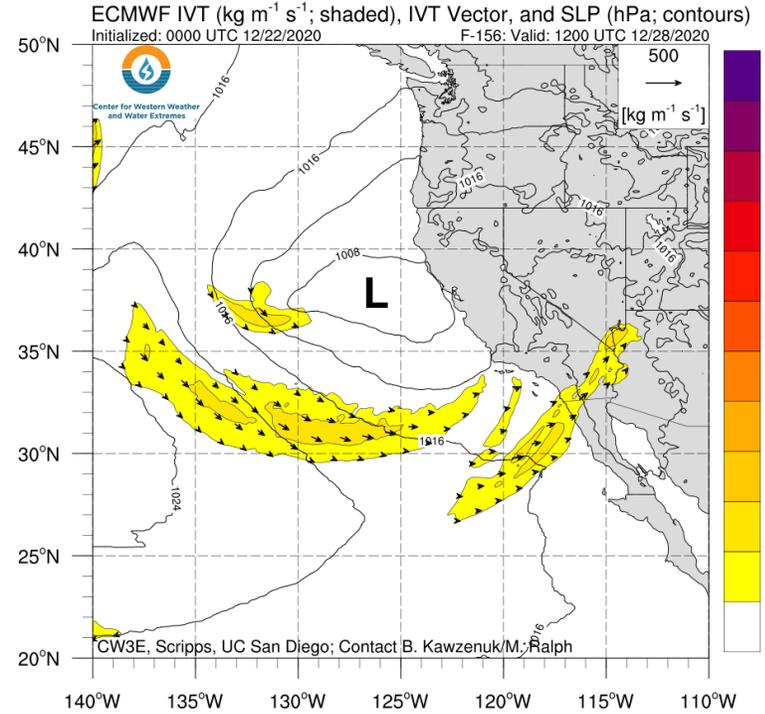
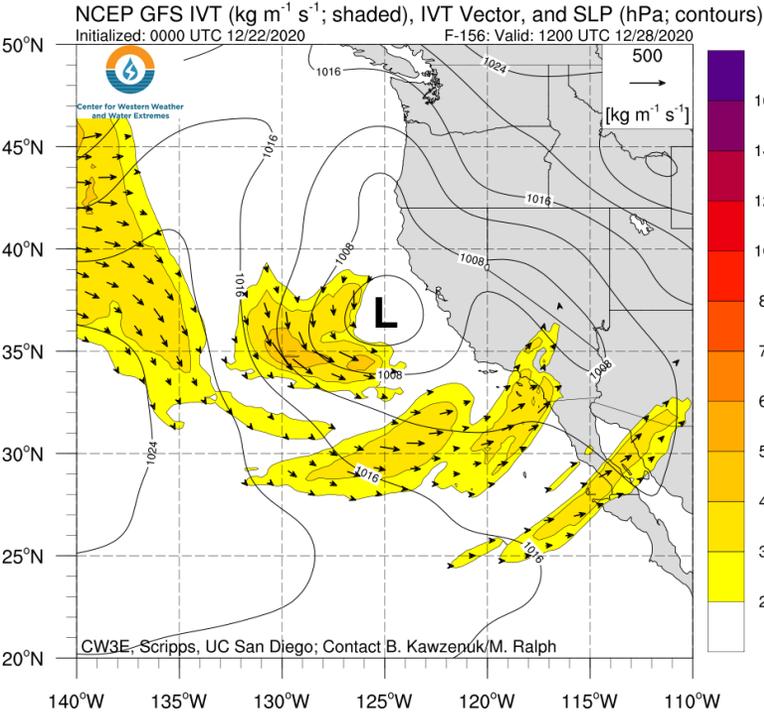
- An AR is currently forecast to make landfall over Northern California and Oregon on 25 Dec
- There are differences in the forecast IVT, as well as the forecast cyclone strength and location, between the GFS and ECMWF
- The GFS is forecasting higher IVT values (stronger moisture transport) in the core of the AR
- The GFS is forecasting the surface cyclone to be deeper (992-hPa vs. 1004-hPa) and further north at 00Z 26 Dec (4 PM PST 25 Dec)

IVT & SLP Forecasts: Valid 12Z 28 Dec (F-156)

NCEP GFS

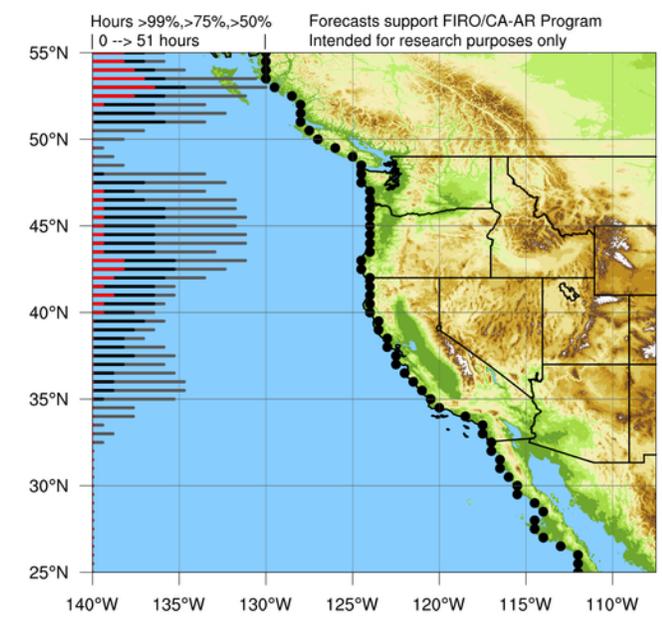
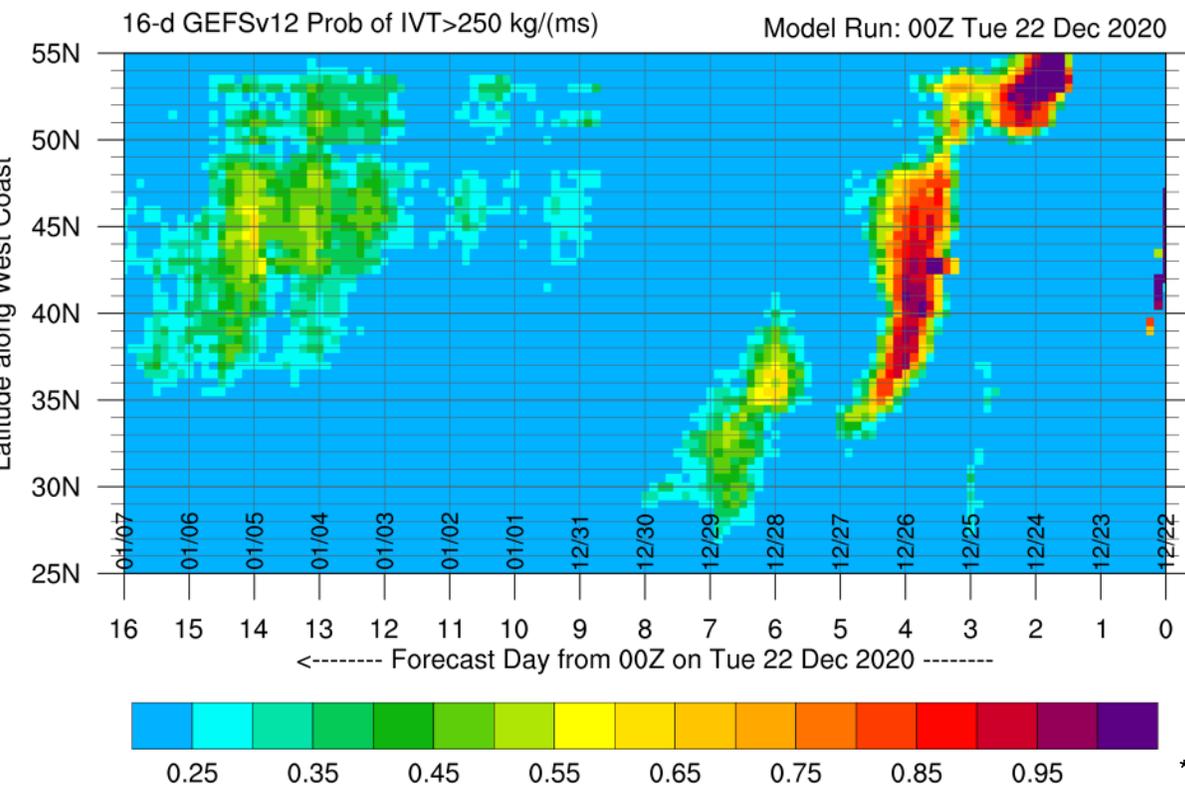
ECMWF

ECMWF - GFS

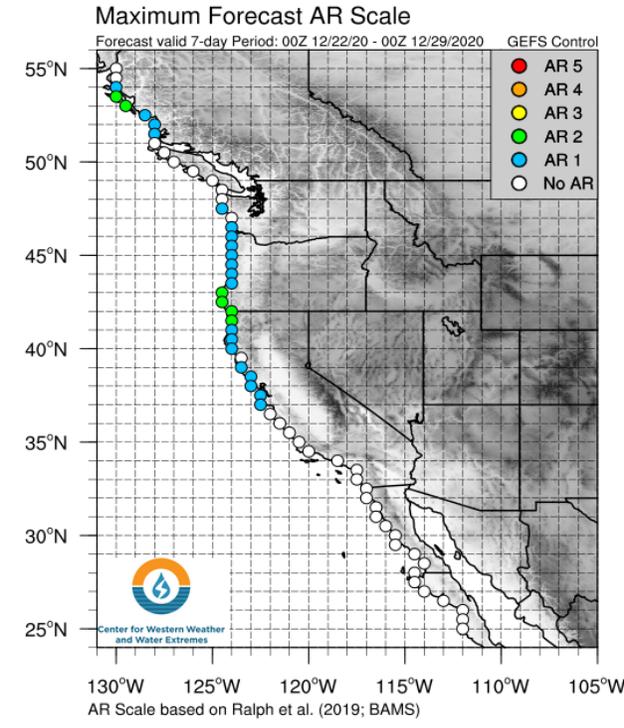


- A weak cutoff low is forecast to develop near the U.S. West Coast on 28 Dec and gradually move across the southwestern U.S.
- Although neither model is predicting a well-defined AR, the GFS is currently forecasting stronger moisture transport over Southern California and Arizona downstream of the cutoff low

Probability of AR Conditions Along Coast



AR Scale

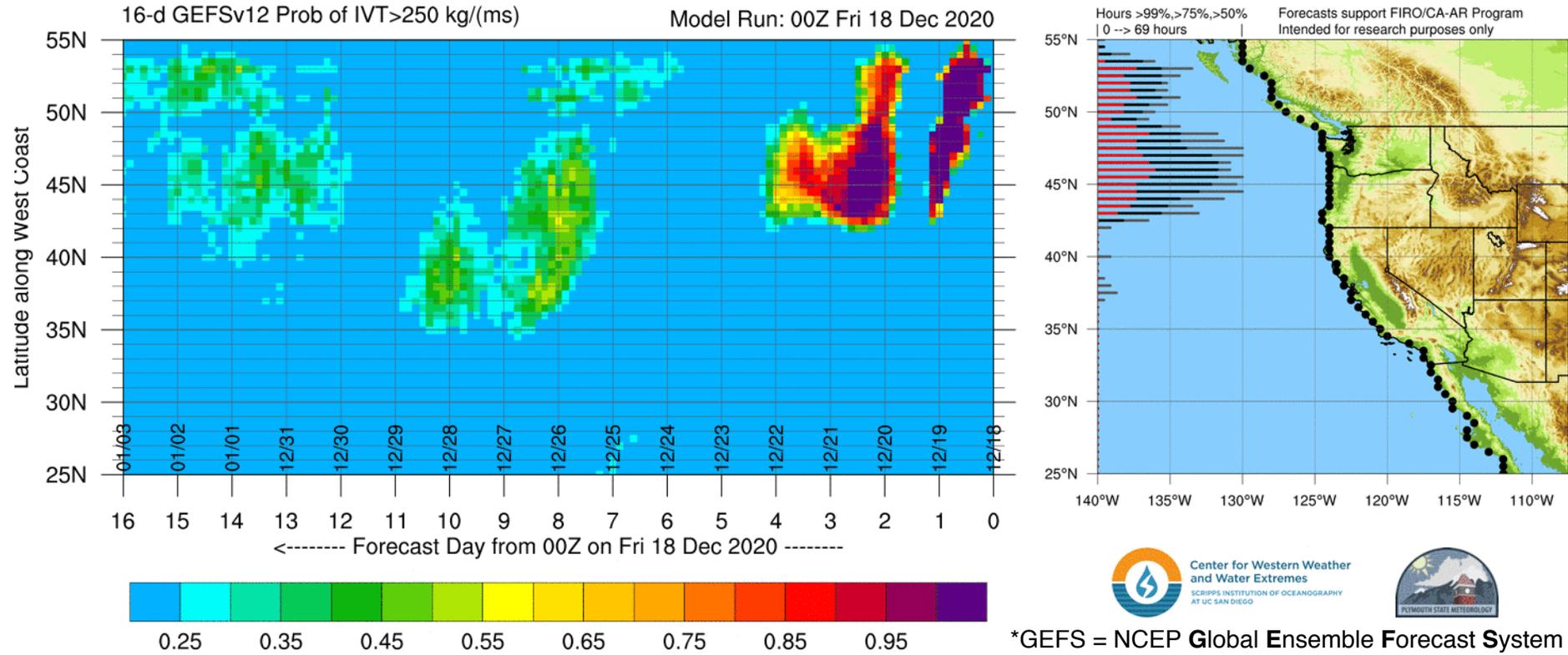


*GEFS = NCEP Global Ensemble Forecast System (United States)

- The 00Z GEFS is showing high confidence (> 80% probability) in a period of AR conditions ($IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$) along the U.S. West Coast in association with the first storm on 25–26 Dec
- AR 1/AR 2 conditions (based on the Ralph et al. 2019 AR Scale) are forecast over coastal Northern California and Oregon
- Another period of AR conditions is possible (> 40% probability) along the coast of Southern and Central California in association with the cutoff low, but forecast confidence is currently low

Probability of AR Conditions Along Coast: dProg/dt

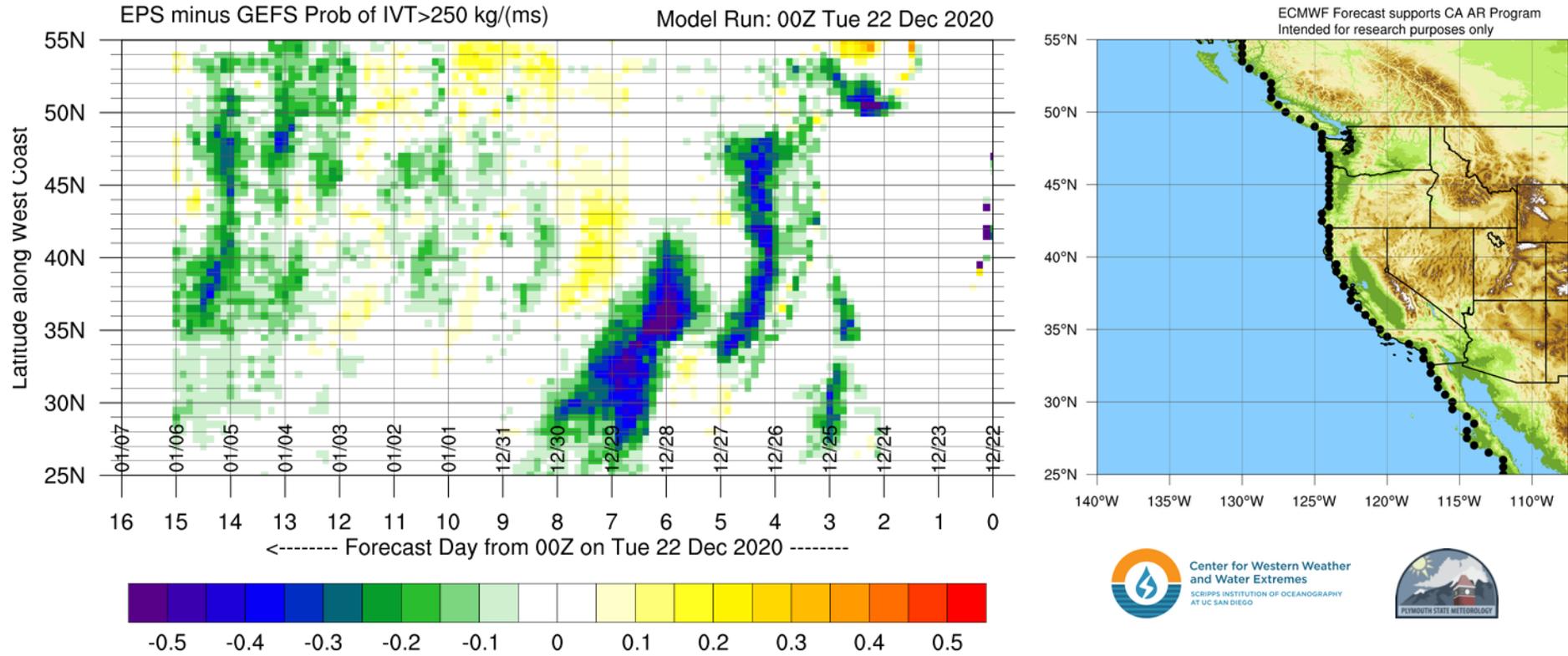
This loop shows how the forecast probability of AR conditions (based on GEFS) has changed since 00Z 18 Dec (every 12 hours)



- Forecast confidence in AR conditions during the first storm has increased substantially over the past few days
- The probability of AR conditions associated with the second storm has increased over Southern California, but forecast uncertainty remains high

Probability of AR Conditions Along Coast: EPS – GEFS

This figure shows the difference in forecast probability of AR conditions between the EPS and GEFS for the next 15 days



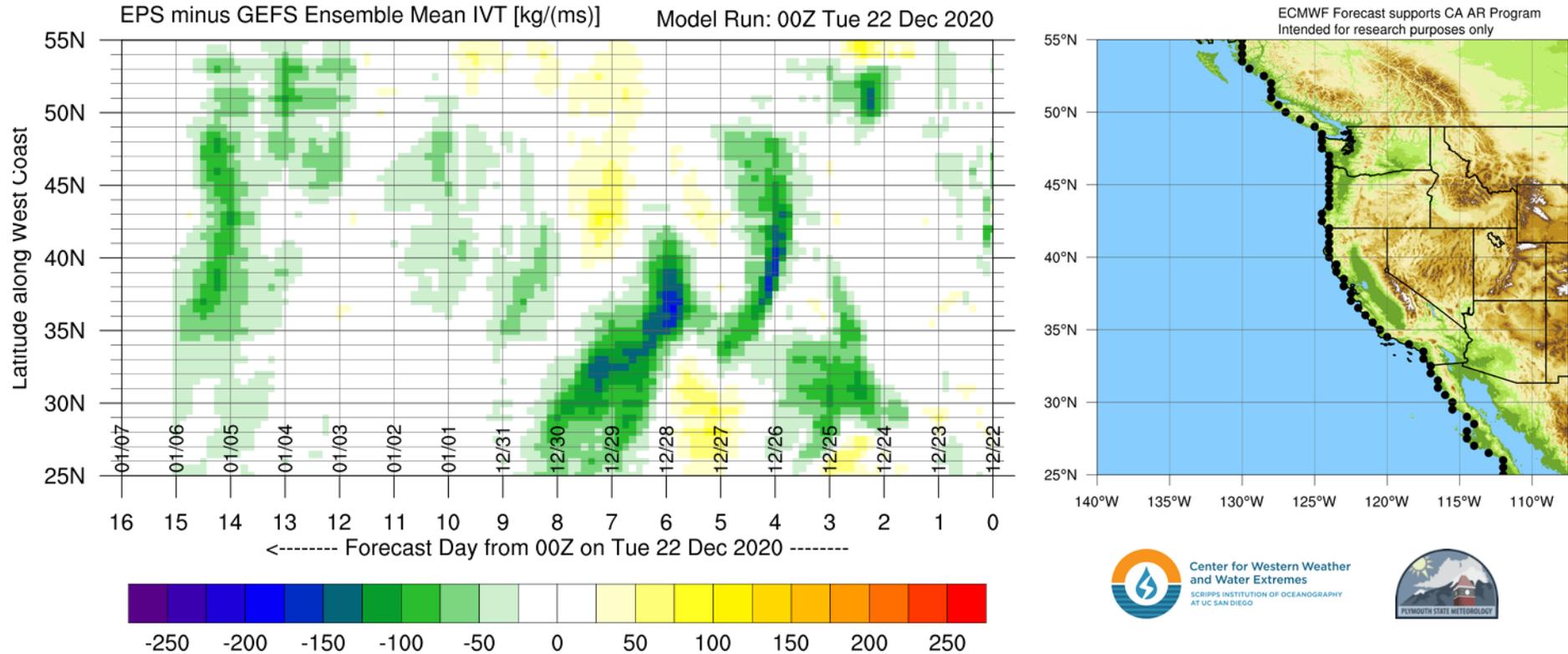
*EPS = ECMWF Ensemble Prediction System (Europe)

*GEFS = NCEP Global Ensemble Forecast System (United States)

- Compared to the GEFS, the EPS is showing much smaller probabilities of AR conditions for both storms
- This difference is especially pronounced over Southern and Central California for the second storm

Ensemble Mean IVT Along Coast: EPS – GEFS

This figure shows the difference in ensemble mean forecast IVT between the EPS and GEFS for the next 15 days

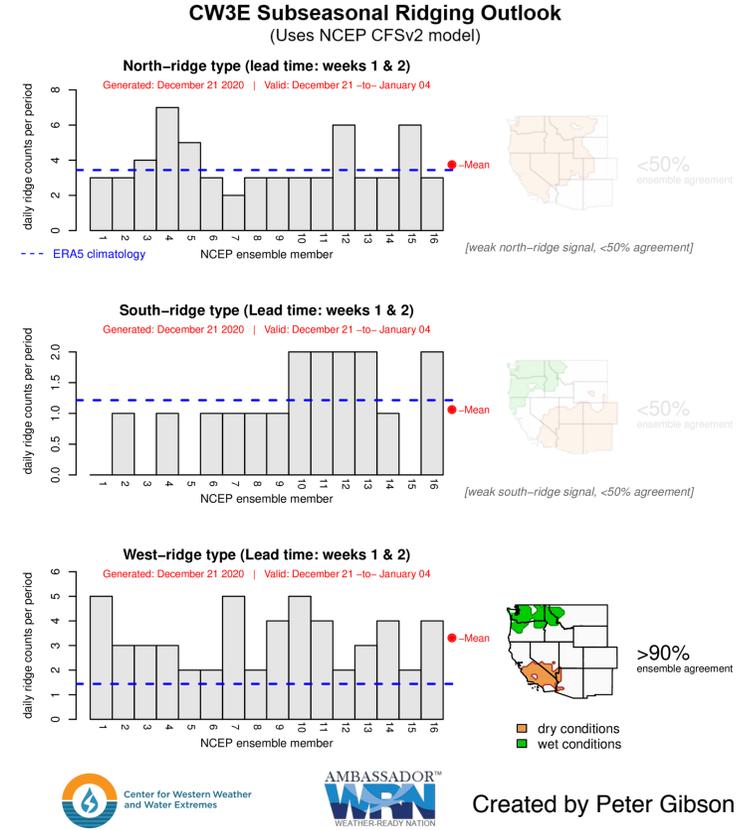
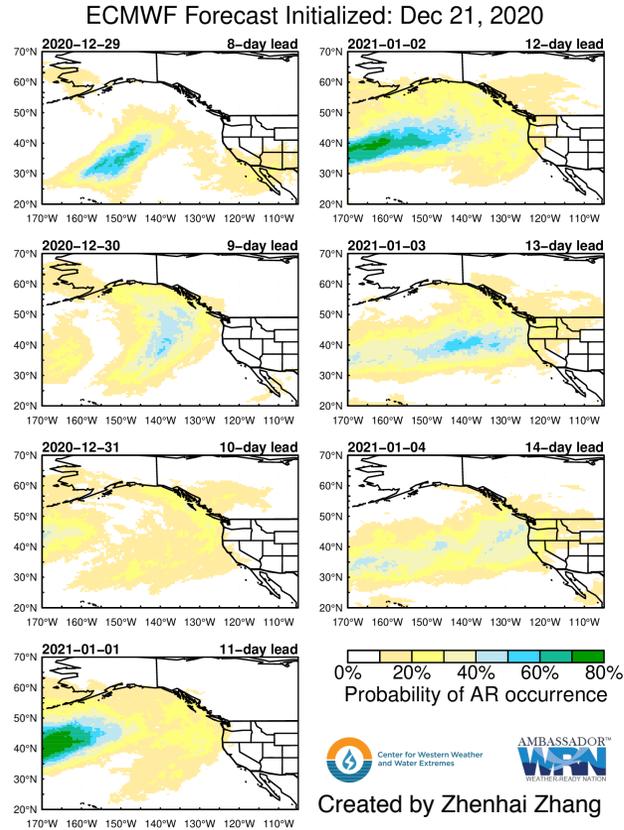
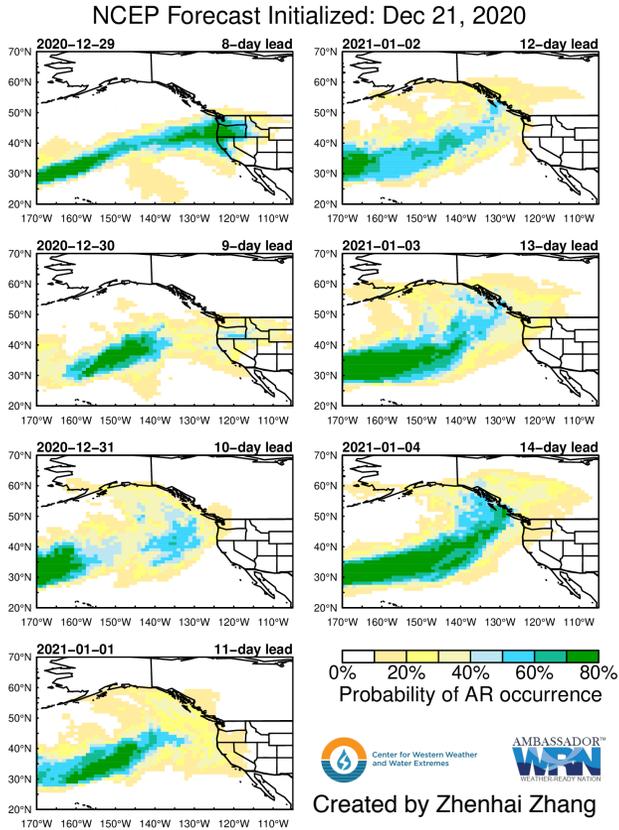


*EPS = ECMWF Ensemble Prediction System (Europe)

*GEFS = NCEP Global Ensemble Forecast System (United States)

- Compared to the GEFS, the EPS is also predicting lower IVT (weaker moisture transport) during both storms

Experimental S2S AR Forecasts: Week 2



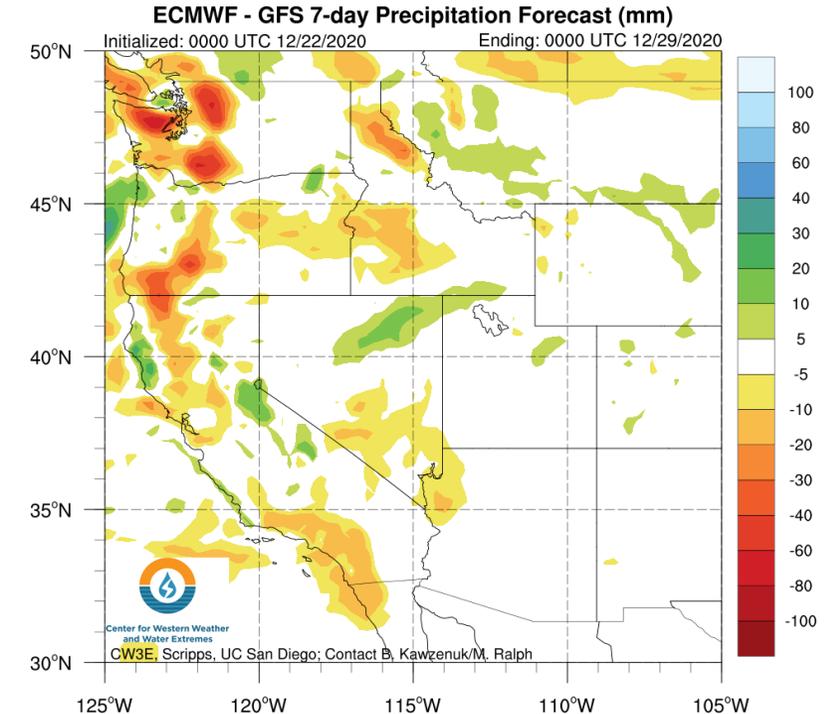
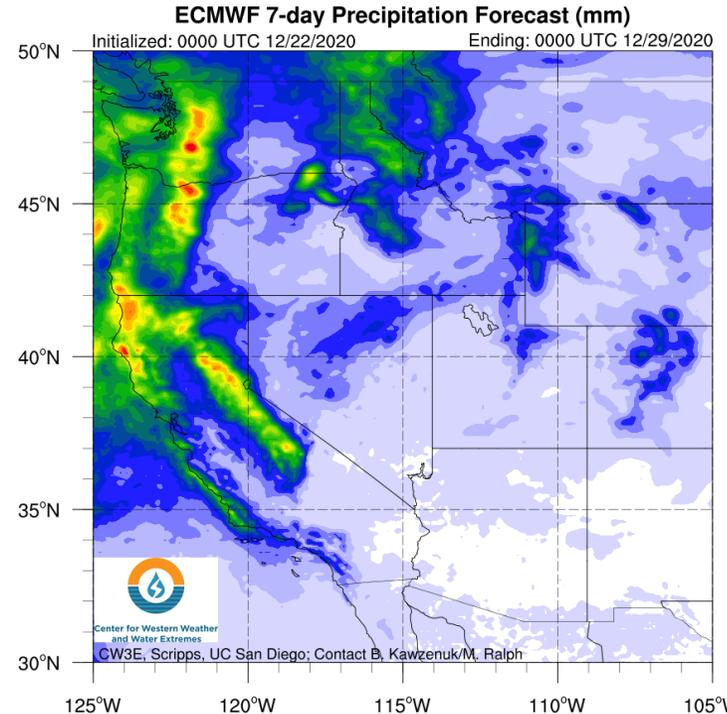
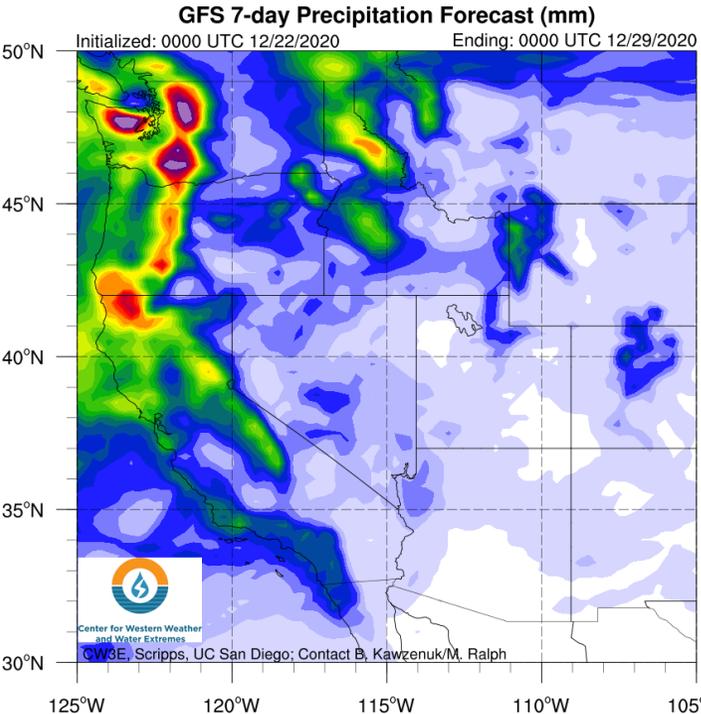
- The NCEP seasonal ensemble forecasts are showing high confidence in AR activity over the Northeast Pacific Ocean during Week 2 (29 Dec – 4 Jan), including a high probability of AR occurrence over the Pacific Northwest on Day 8 (29 Dec)
- The ECMWF seasonal ensemble forecasts are showing much lower probabilities of AR activity over the Northeast Pacific Ocean
- The NCEP seasonal ensemble forecasts are also showing a high probability of ridging west of California during Weeks 1 & 2, which is typically associated with wetter (drier) than normal conditions in the Pacific Northwest (Southwest)

Model 7-day QPF: Valid 00Z 22–29 Dec

NCEP GFS

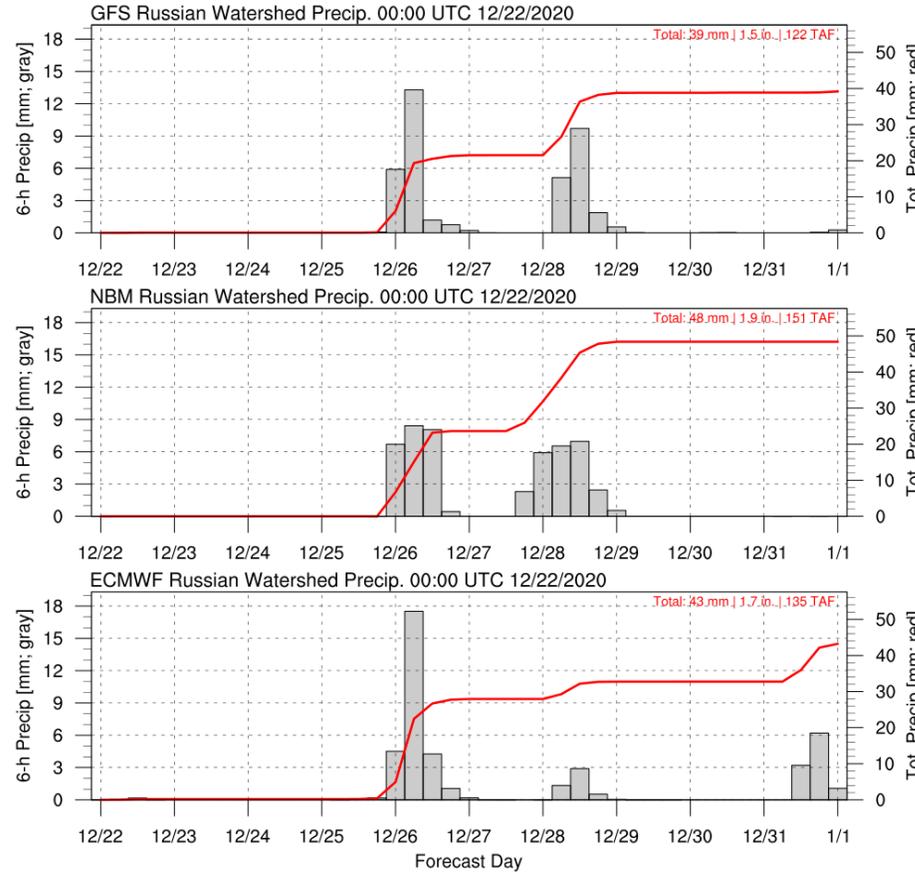
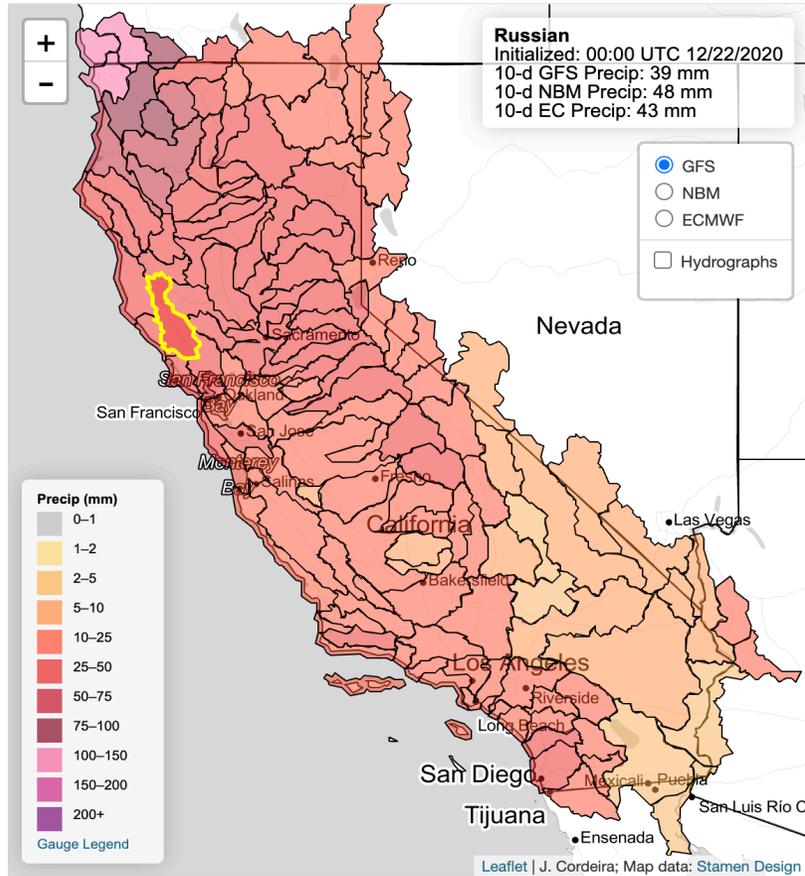
ECMWF

ECMWF – GFS



- The 00Z GFS and ECMWF are both forecasting at least 2 inches of total precipitation across portions of the Pacific Coast Ranges and Cascades during the 7-day period ending 00Z 29 Dec (4 pm PST 28 Dec)
- The GFS is currently forecasting higher precipitation than the ECMWF in the Olympic Mountains, Cascades, and Klamath Mountains, as well as over the Southern California Transverse and Peninsular Ranges
- The ECMWF is currently forecasting higher precipitation amounts in the Northern California Coast Ranges and Sierra Nevada

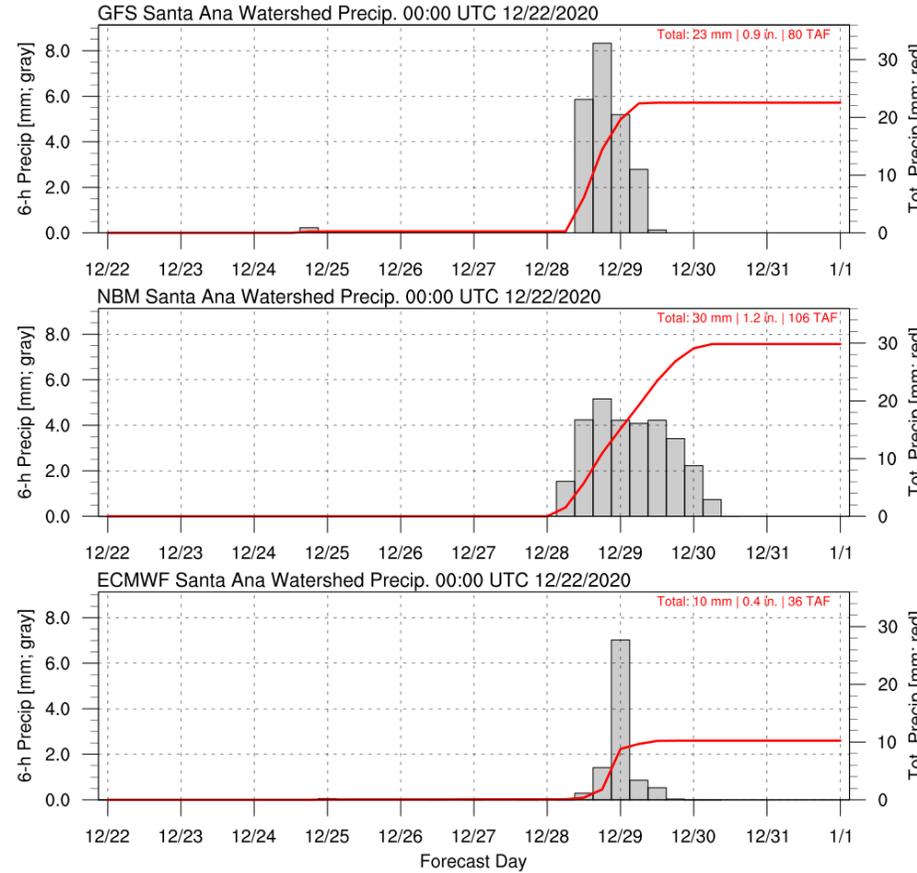
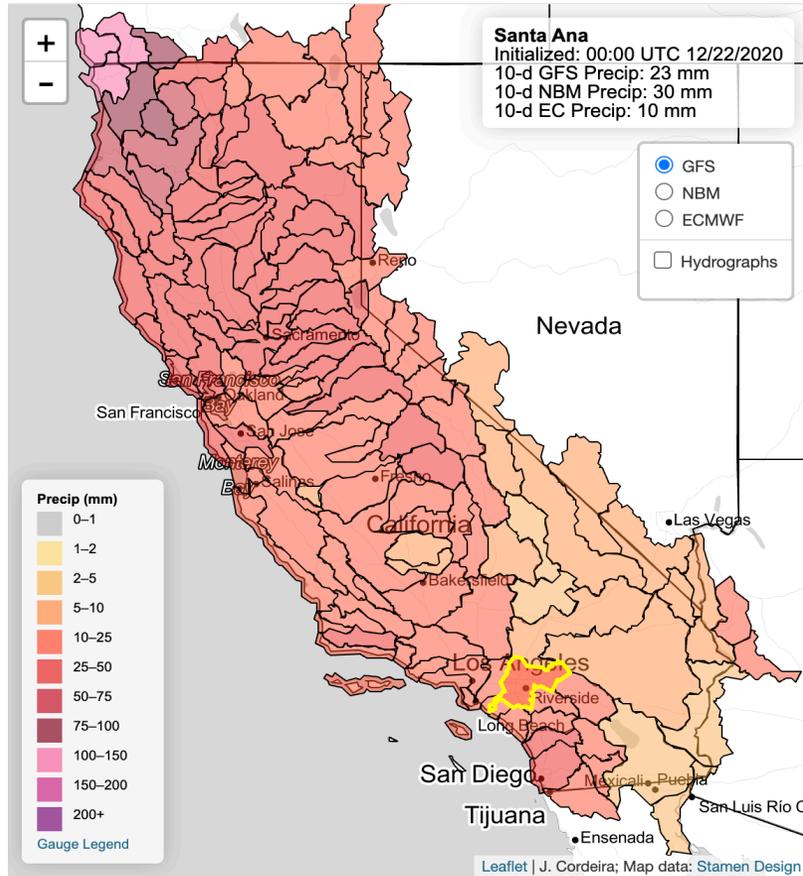
10-day Watershed Precipitation Forecasts



*GFS = NCEP **G**lobal **F**orecast **S**ystem (United States)
 *NBM = **N**ational **B**lend of **M**odels (Blend of NWS and non-NWS models)
 *ECMWF = **E**uropean **C**enter for **M**edium-Range **W**eather **F**orecasts (Europe)

- The 00Z GFS, NBM, and ECMWF are all forecasting 1.5–2 inches of areal mean precipitation in the Russian River watershed during the next 10 days
- The GFS and NBM are forecasting more precipitation during the second storm (28 Dec) than the ECMWF

10-day Watershed Precipitation Forecasts



*GFS = NCEP **G**lobal **F**orecast **S**ystem (United States)

*NBM = **N**ational **B**lend of **M**odels (Blend of NWS and non-NWS models)

*ECMWF = **E**uropean **C**enter for **M**edium-Range **W**eather **F**orecasts (Europe)

- There is significant uncertainty in forecast precipitation associated with the second storm in Southern California
- The 00Z NBM is forecasting 1.2 inches of areal mean precipitation in the Santa Ana watershed, whereas the ECMWF is only forecasting 0.4 inches of areal mean precipitation