CW3E Atmospheric River Outlook: 17 March 2023

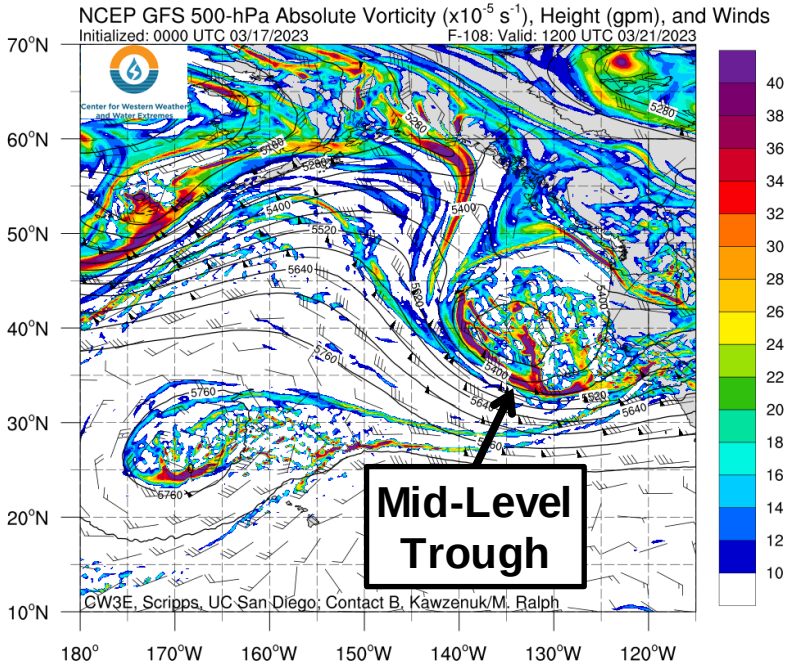
Atmospheric River Forecast to Bring Precipitation to Southern California

- An atmospheric river (AR) developing in the Eastern Pacific is forecast to make landfall in Southern California on 20 March and persist in the region until 21 March
- AR2 conditions (based on the Ralph et al. 2019 AR Scale) are forecast near San Diego, CA with AR1 conditions possible northward to San Luis Obispo, CA
- AR3 conditions are forecast in Southern Arizona as a result of the inland penetration of this AR
- There is still uncertainty between the GEFS and ECMWF EPS in the timing and intensity of AR conditions, including direction of IVT, which is leading to uncertainty in watershed precipitation forecasts over the next 7 days
- The 00Z ECMWF is forecasting 3.10 inches of precipitation over the Santa Ana watershed over the next 7 days, while the 00Z GFS is forecasting 1.81 inches; a difference of 1.29 inches
- The NWS Weather Prediction Center (WPC) is forecasting >1.5 inches of precipitation for Southern California coastal regions, >3 inches in the San Gabriel Mountains, and 1 inch over Central Arizona
- Experimental excessive rainfall outlooks have been issued by the WPC for 21 March with a marginal risk (at least 5%) of rainfall exceeding flash flood guidance for much of Southern California and most of the Central Valley as well as Central Arizona

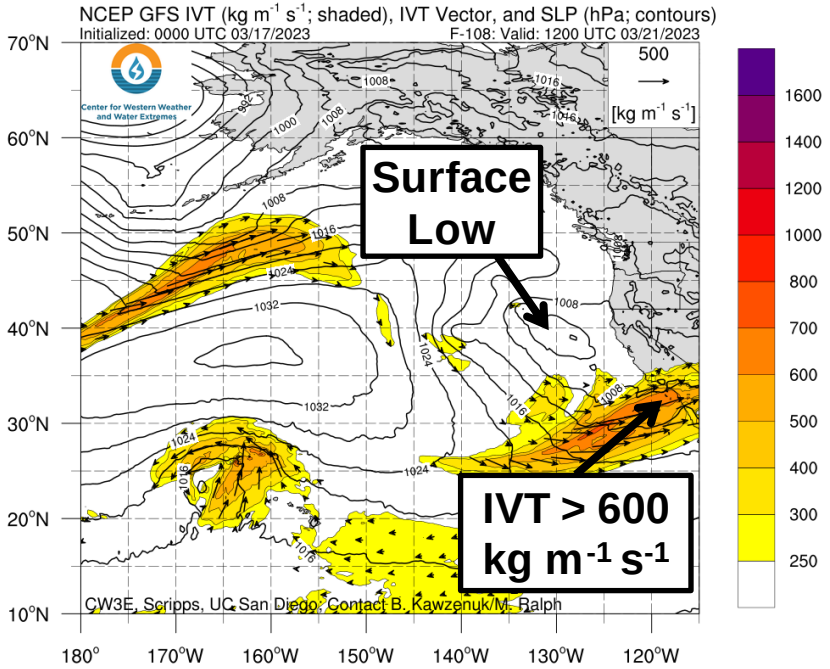
CW3E AR Outlook: 17 March 2023

GFS Model Forecast: Valid 5 AM PT 21 Mar (F-108)

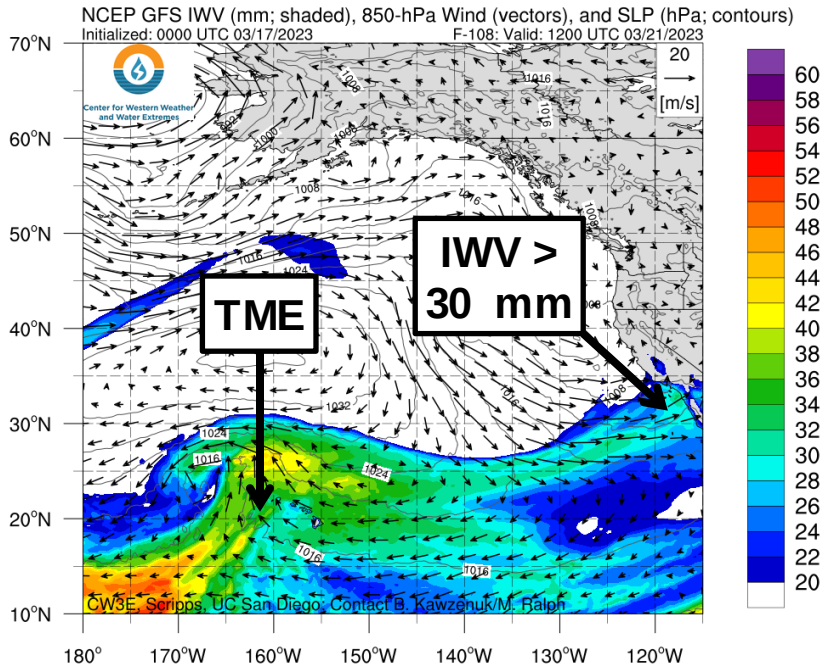
A) 500-hPa Vorticity, Height, and Wind



B) IVT and SLP



C) IWV and 850-hPa Wind

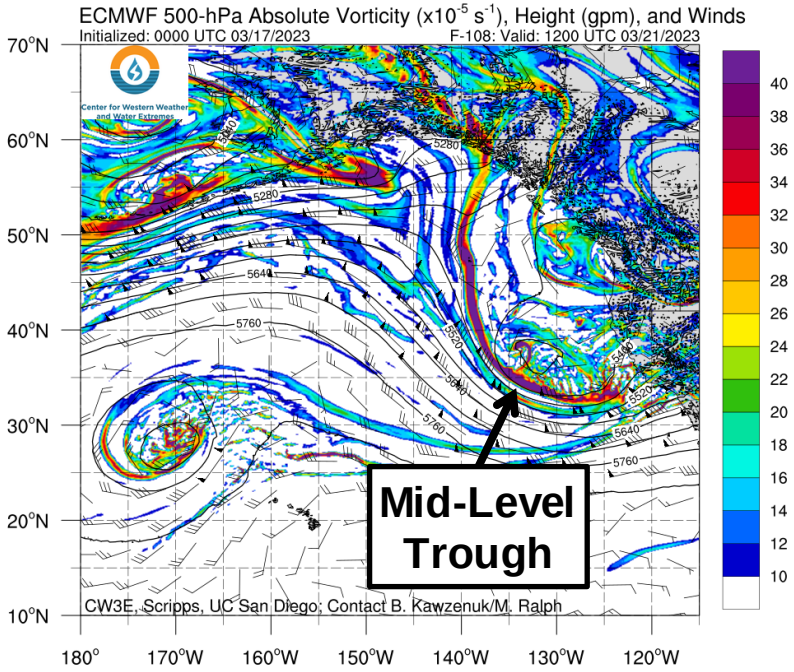


- The 00Z GFS deterministic model has a mid-level trough approaching the US West Coast (Figure A) and surface low just off the US West Coast (Figure B)
- An AR with IVT magnitudes > 600 kg m^{-1} s^{-1} is forecast to make landfall in Southern California (Figure B)
- This event is supported by another Pineapple Express source region with strong tropical moisture export near Hawaii bringing IWV values > 30 mm to the Southern California coast (Figure C)

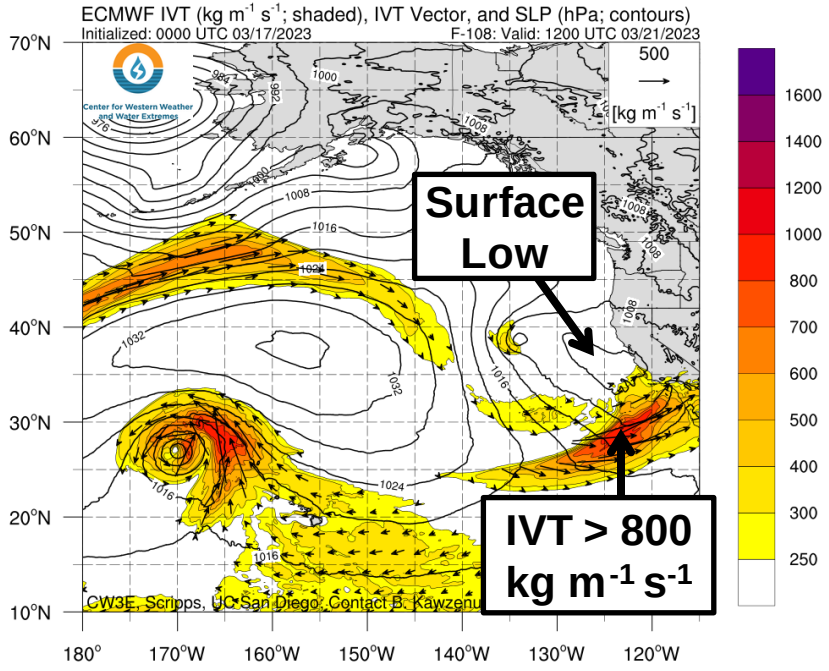
CW3E AR Outlook: 17 March 2023

ECMWF Model Forecast: Valid 5 AM PT 21 Mar (F-108)

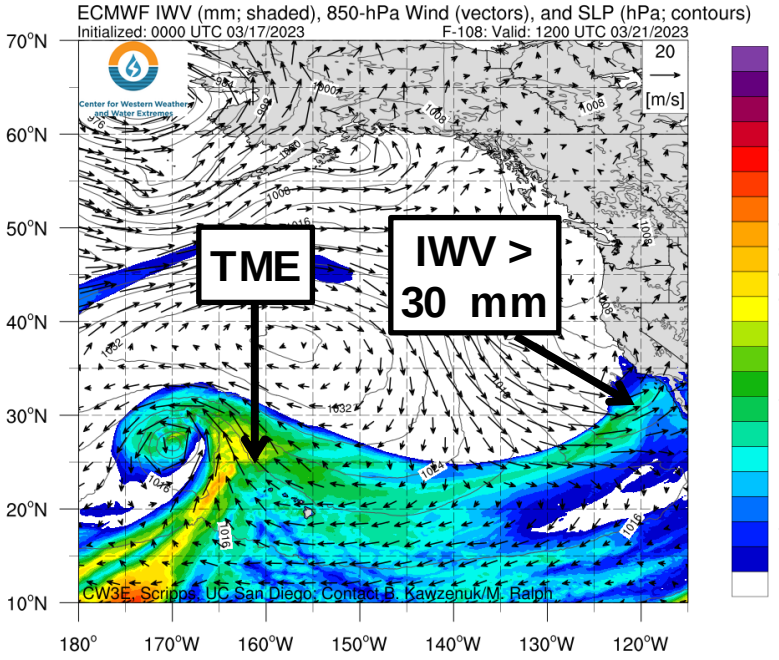
A) 500-hPa Vorticity, Height, and Wind



B) IVT and SLP



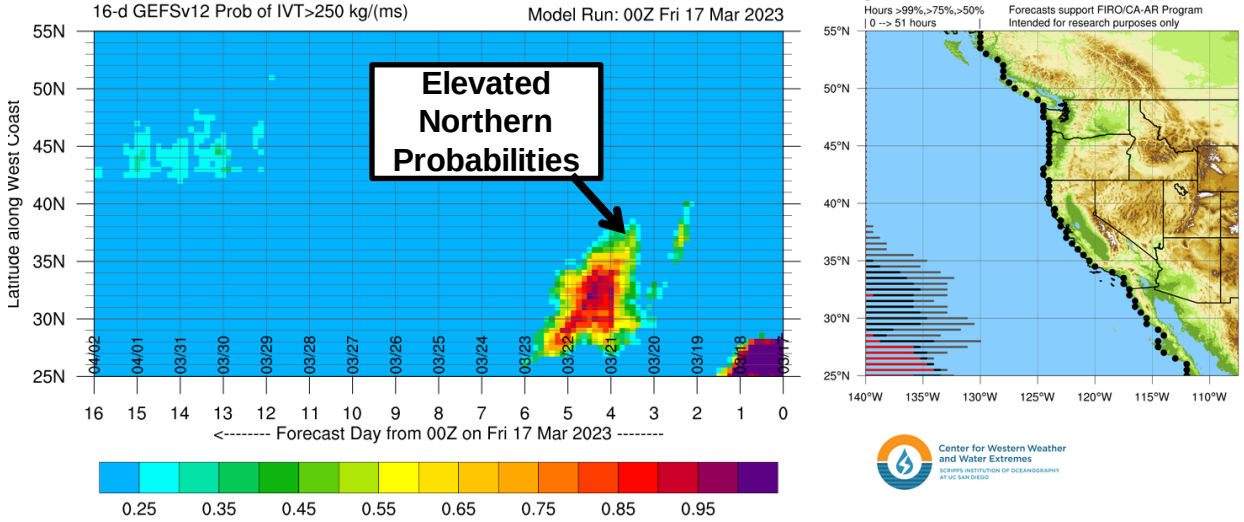
C) IWV and 850-hPa Wind



- The 00Z ECMWF deterministic model also shows a mid-level trough approaching the US West Coast (Figure A)
- IVT magnitudes at the core of the AR are greater in the ECMWF and because the surface low is further south the IVT takes on a more southwesterly orientation (Figures B), leading to precipitation uncertainty

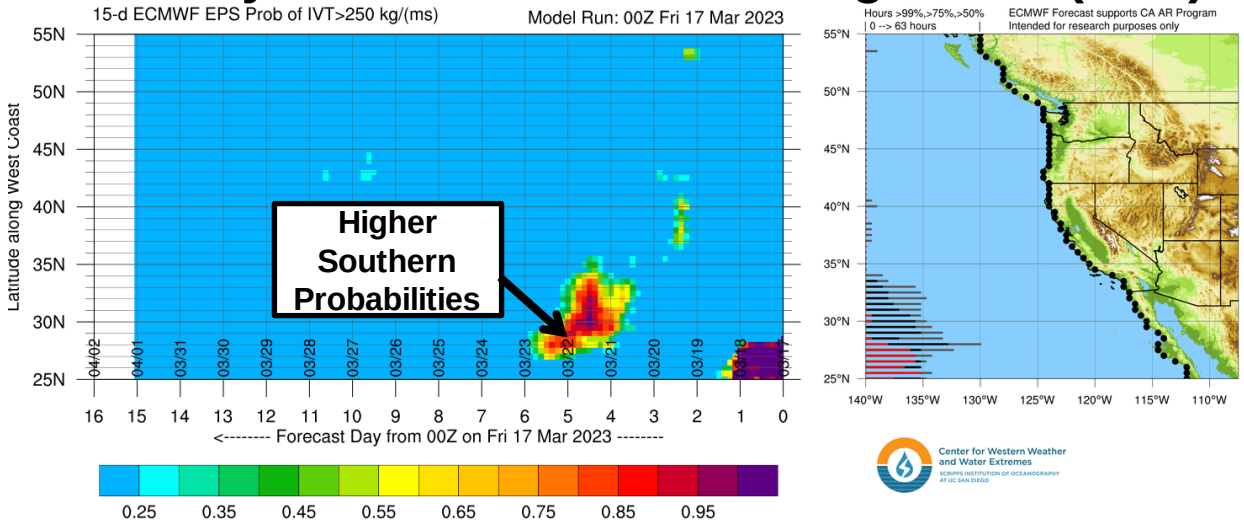
CW3E AR Outlook: 17 March 2023

Probability of AR Conditions Along Coast (GEFS)



- The 00Z GEFS is showing high confidence (> 90%) in a period of AR conditions (IVT > 250 kg m^{-1} s^{-1}) forecast into Southern California on 20 and 21 March
- There is medium confidence (55-75%) in IVT > 250 kg m^{-1} s^{-1} making landfall in central California on 20 March that is not currently forecast in EPS

Probability of AR Conditions Along Coast (EPS)



- The 00Z ECMWF EPS is showing high confidence (> 90%) in a period of AR conditions (IVT > 250 kg m^{-1} s^{-1}) forecast along Southern California on 21 March
- Compared to the 00Z GEFS, the highest probabilities of IVT > 250 kg m^{-1} s^{-1} making landfall are further south in the EPS

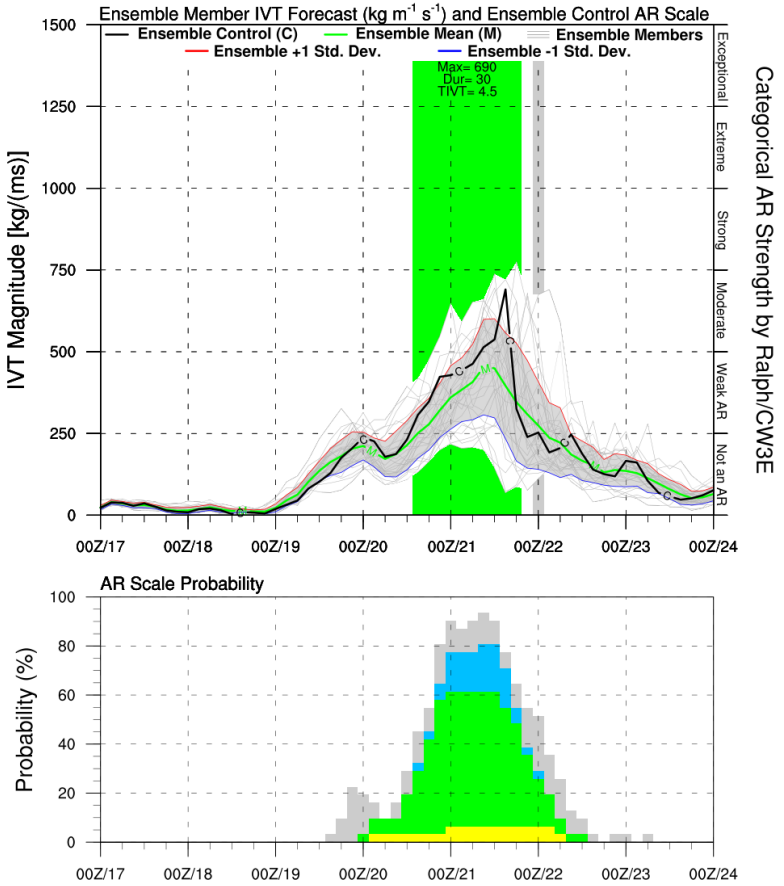
CW3E AR Outlook: 17 March 2023

Landfall Point: 33°N, 117.5°W

7-day AR Scale and IVT Forecast: 00Z GFS & ECMWF Ensemble

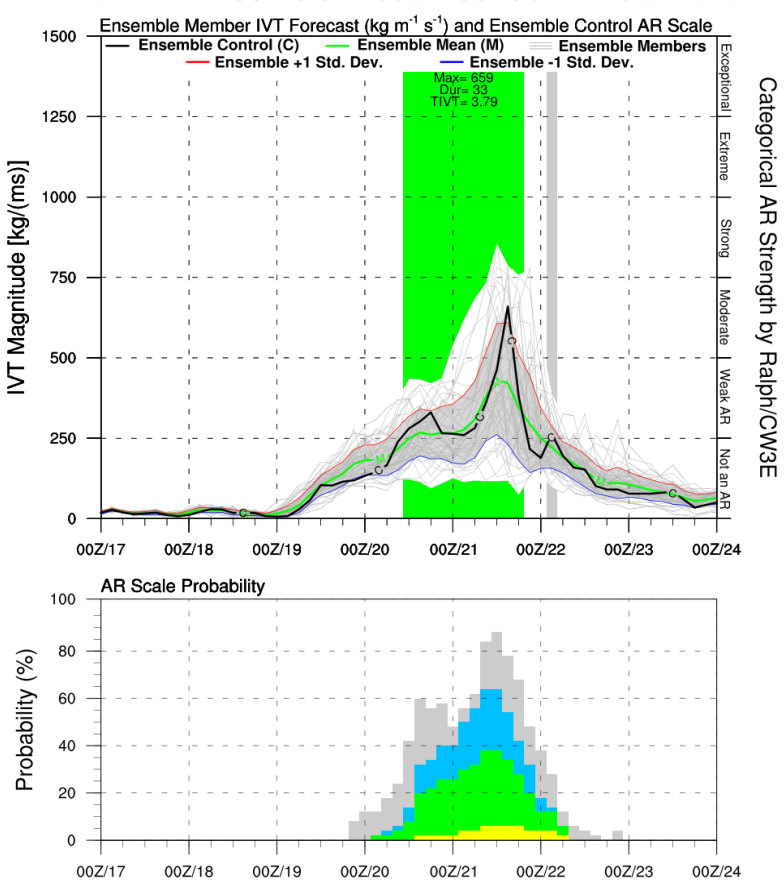
00Z GEFS Ensemble

GFS Ensemble Inititialized: 00Z Fri 03/17/23



00Z ECMWF Ensemble

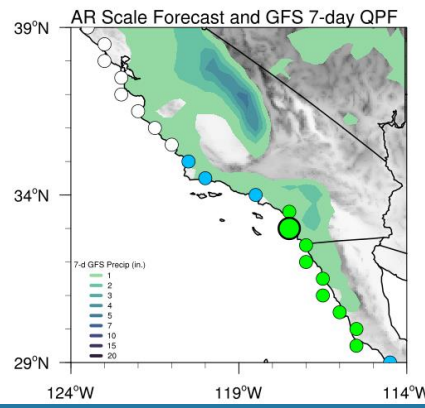
ECMWF Ensemble Inititialized: 00Z Fri 03/17/23



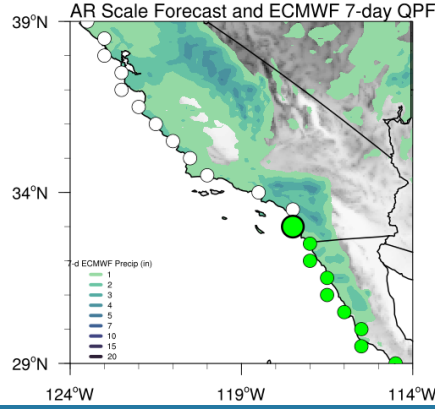
AR Ensemble Forecast

- 19/31 (61%) **GEFS ensemble** members are forecasting at least AR2 conditions at this location with 2/31 (6%) that are at least AR3
- 19/51 (37%) **ECMWF ensemble** members are forecasting at least AR2 conditions at this location with 3/51 (6%) that are at least AR3
- The GEFS is forecasting AR1/AR2 conditions for points along most of coastal Southern California and points south of the US/Mexico border, while the ECMWF ensemble is forecasting AR2 conditions for San Diego and points south of the US/Mexico border

GEFS Ensemble

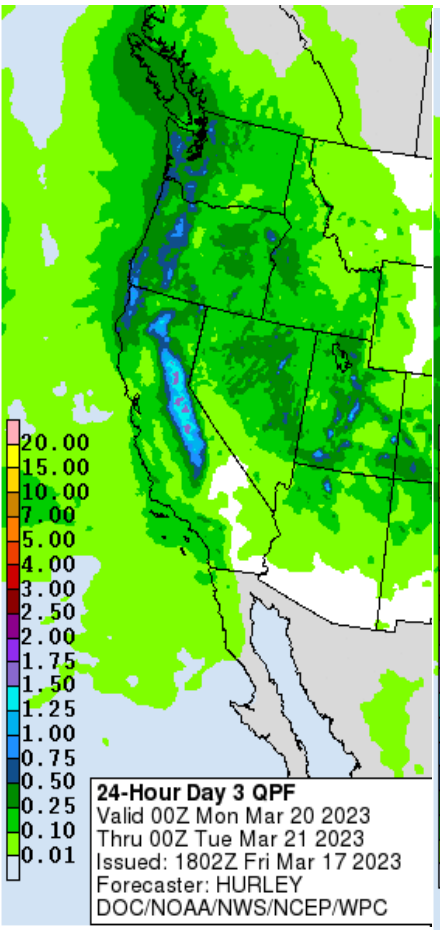


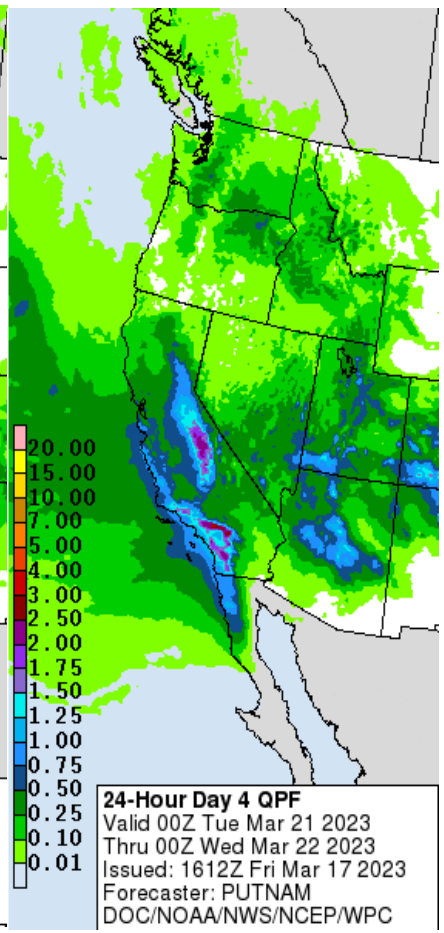
ECMWF Ensemble

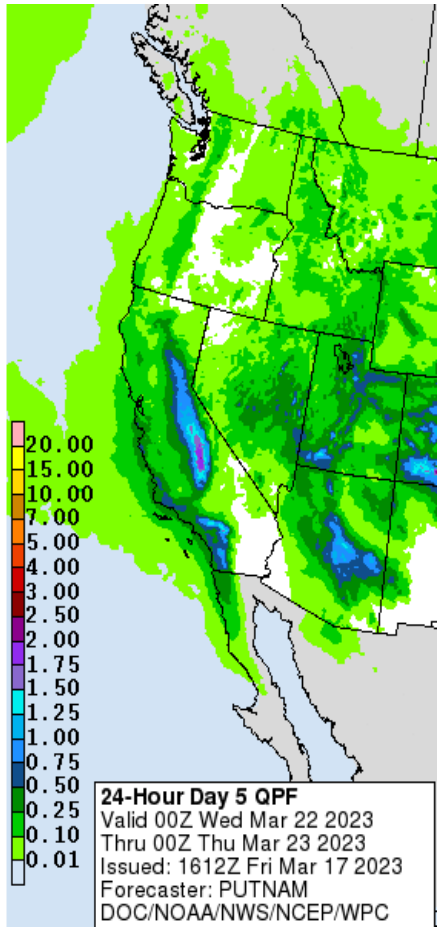


CW3E AR Outlook: 17 March 2023

WPC Quantitative Precipitation Forecasts and Excessive Rainfall Outlook





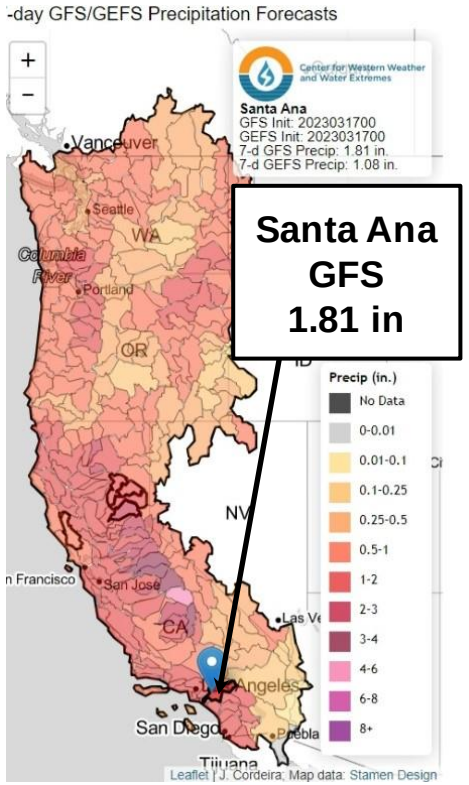


- NWS WPC is forecasting 48-hour precipitation totals > 3 inches for the highest elevations of the Transverse and Peninsular Ranges in Southern California and > 1.5 inches for coastal Southern California
- The highest forecast precipitation totals in Northern and Central California are tied to the low-pressure system moving into the region following the AR
- WPC has also forecast a marginal risk (at least 5%) of exceeding flash flood guidance for a region encompassing most of the Central Valley and southern Sierra Nevada foothills, the Coast Ranges of Southern California, and Central Arizona during this AR

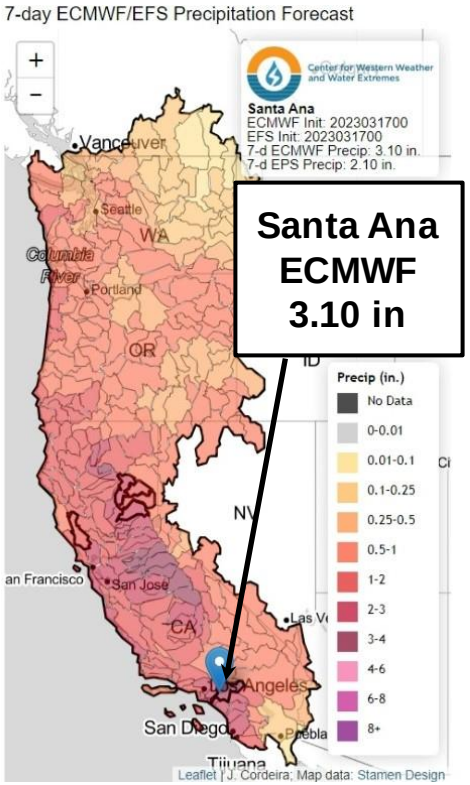
CW3E AR Outlook: 17 March 2023

7-day Watershed Precipitation Forecasts (Initialized 5 PM PDT 16 Mar)

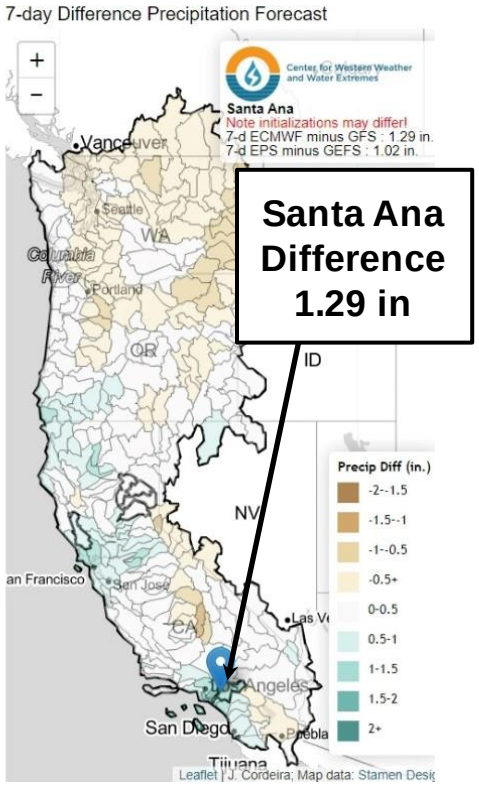
GFS



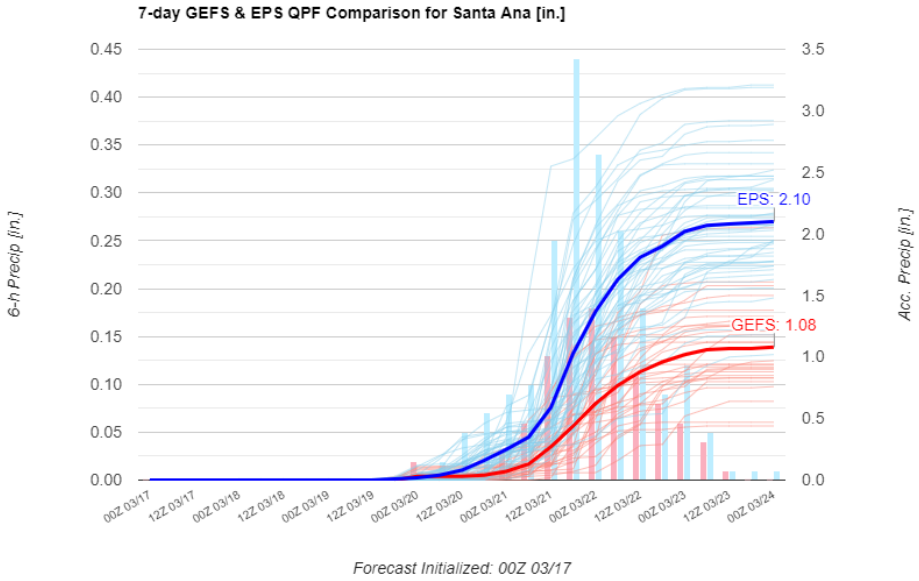
ECMWF



ECMWF minus GFS



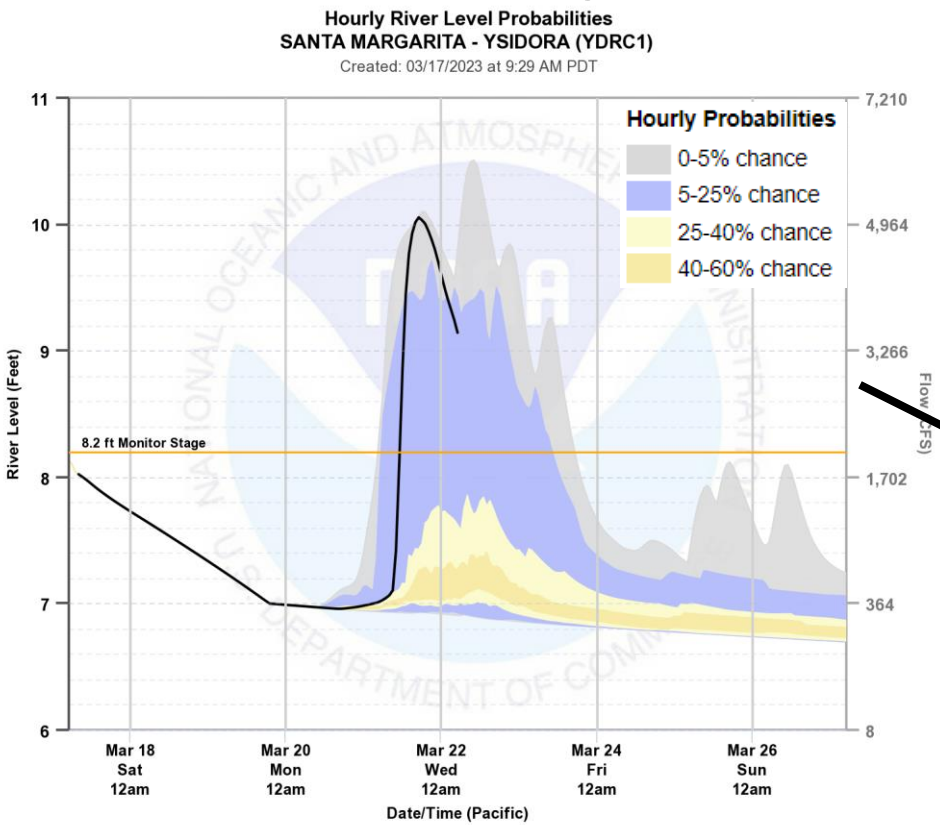
Ensemble Forecasts
7-day GEFS and EPS Forecast QPF: Santa Ana

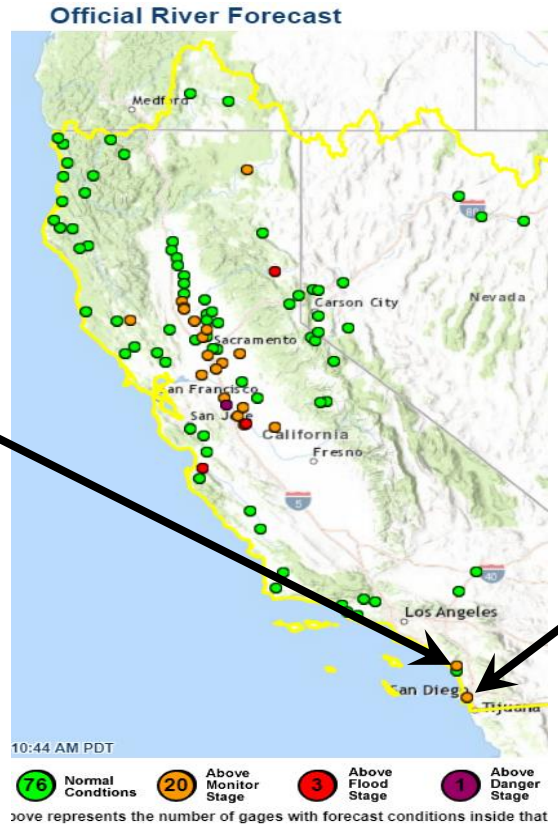


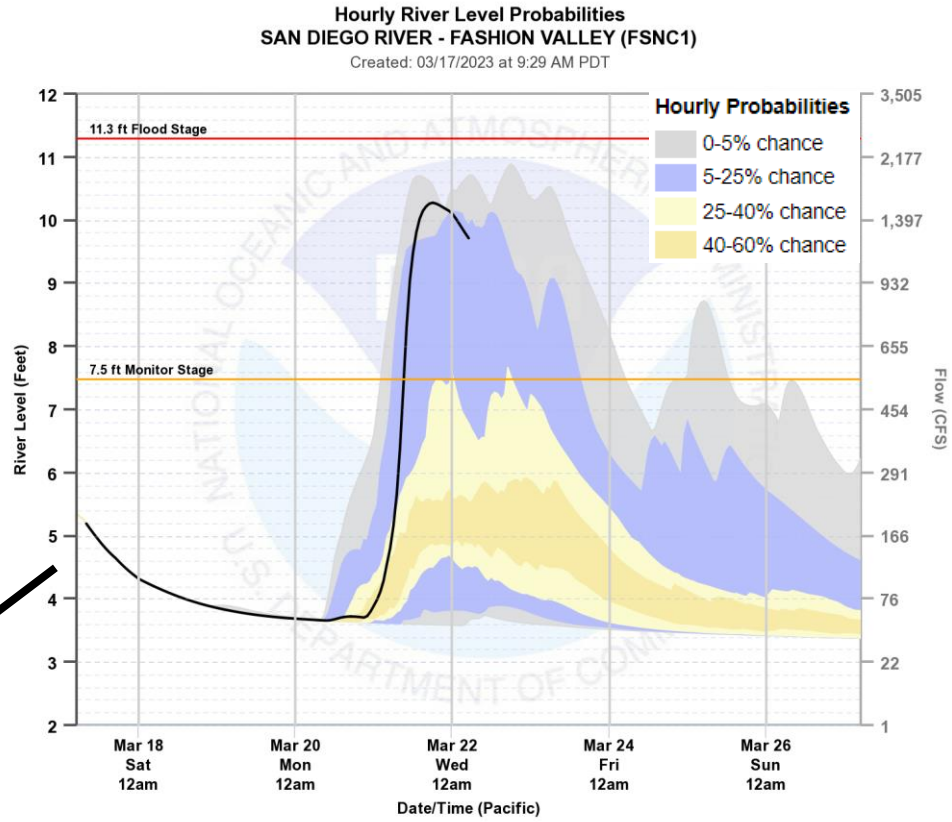
- The 00Z ECMWF is forecasting higher precipitation totals along the coast of Southern California and in the Transverse Ranges as compared to the 00Z GFS, primarily due to more southwesterly IVT forecast in the ECMWF during AR Landfall
- The 00Z ECMWF EPS is forecasting higher precipitation totals (2.10 inches) over the watershed as compared to the 00Z GFS ensemble (1.08 inches) during this AR, with higher 6-hourly precipitation totals forecast in the ECMWF ensemble

CW3E AR Outlook: 17 March 2023

NWS CNRFC River Stage Forecast







- The NWS CNRFC has forecast 20 location to rise above monitor stage, 3 above flood stage, and 1 above danger stage over the next 5 days, although only two of these locations in Southern California are forecast to reach monitor stage due to the AR
- The Santa Margarita – Ysidora and San Diego River – Fashion Valley are both forecast to rise to monitor stage as a result of this AR, with significant stream gauge increases (3-5 feet) forecast for both over the next 10 days
- CNRFC deterministic forecast guidance for both locations exceeds monitor stage, while the ensemble probabilities considering only meteorology uncertainty remain lower (5-25%) at each site during the AR