

CW3E Atmospheric River Outlook: 24 March 2022

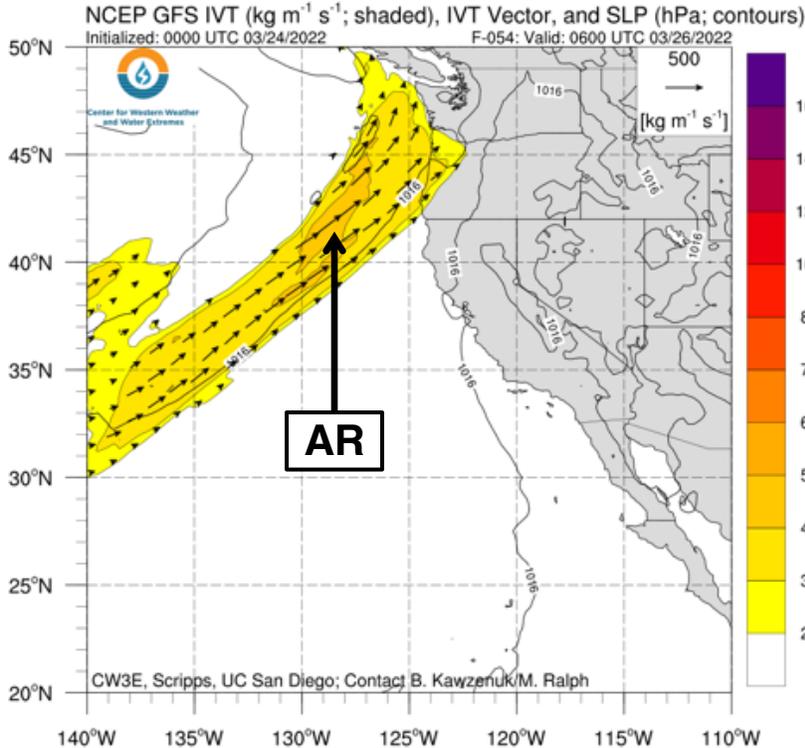
Weak Atmospheric River and Low-Pressure System to Bring Precipitation to Southern and Central CA

- A weak atmospheric river (AR) is forecasted to make landfall over the Pacific Northwest tomorrow night
- A secondary cyclone is forecasted to develop west of the AR and slowly approach the California coast, bringing a brief period of AR conditions to much of the state
- Model-to-model differences in the forecast evolution of the surface cyclone and AR are leading to large differences in the forecast timing and location of the heaviest precipitation in California
- The NWS Weather Prediction Center is forecasting 1–3 inches of precipitation over portions of coastal Southern California and the Sierra Nevada, with the highest amounts in the Transverse Ranges
- Compared to the GFS, the ECMWF is forecasting higher (lower) precipitation amounts over the Transverse Ranges (Sierra Nevada)

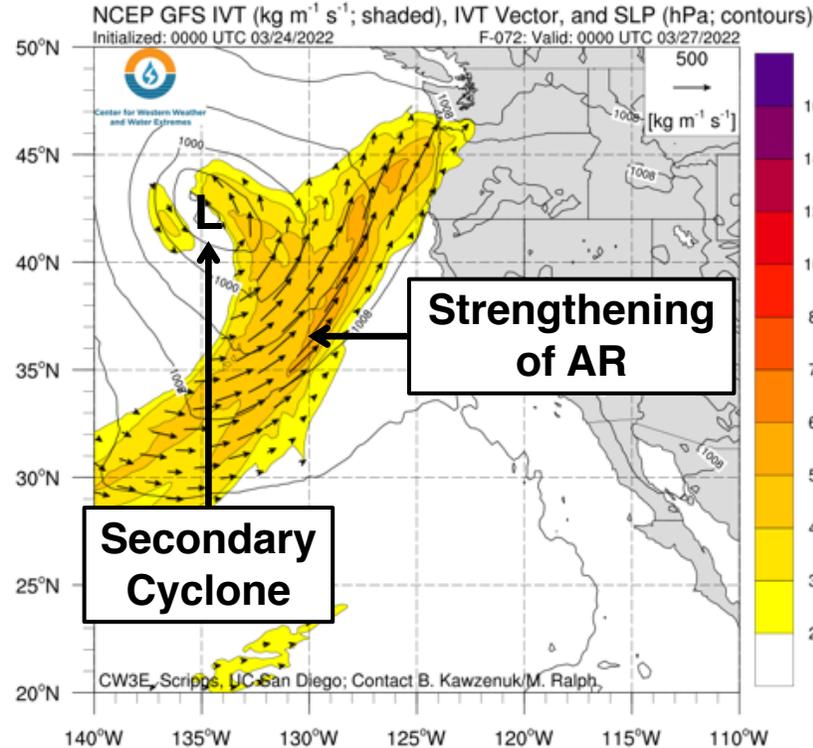
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GFS IVT & SLP Forecasts

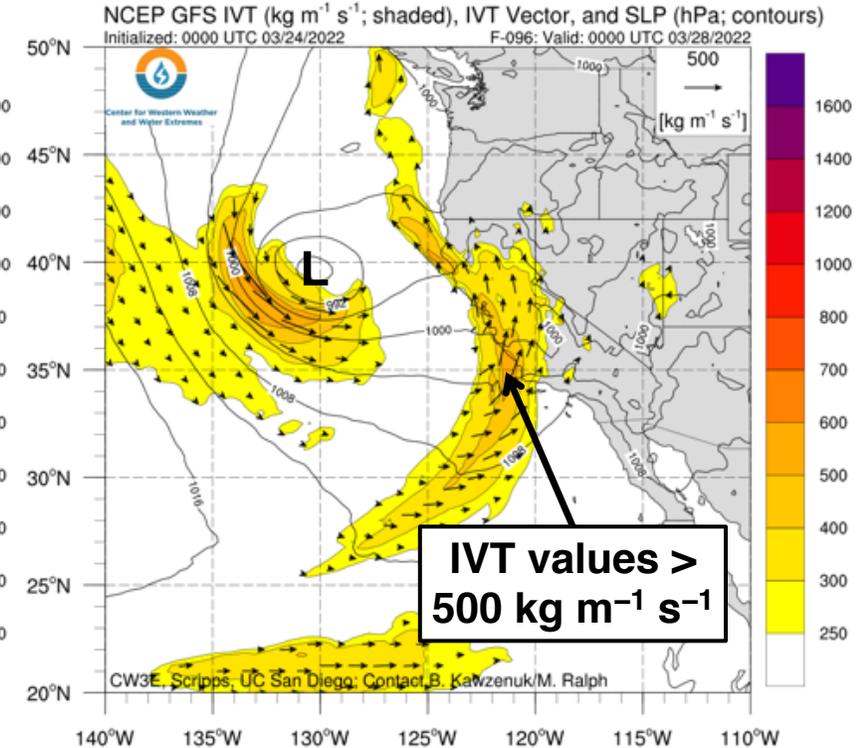
(A) Valid: 11 PM PT 25 Mar (F-54)



(B) Valid: 5 PM PT 26 Mar (F-72)



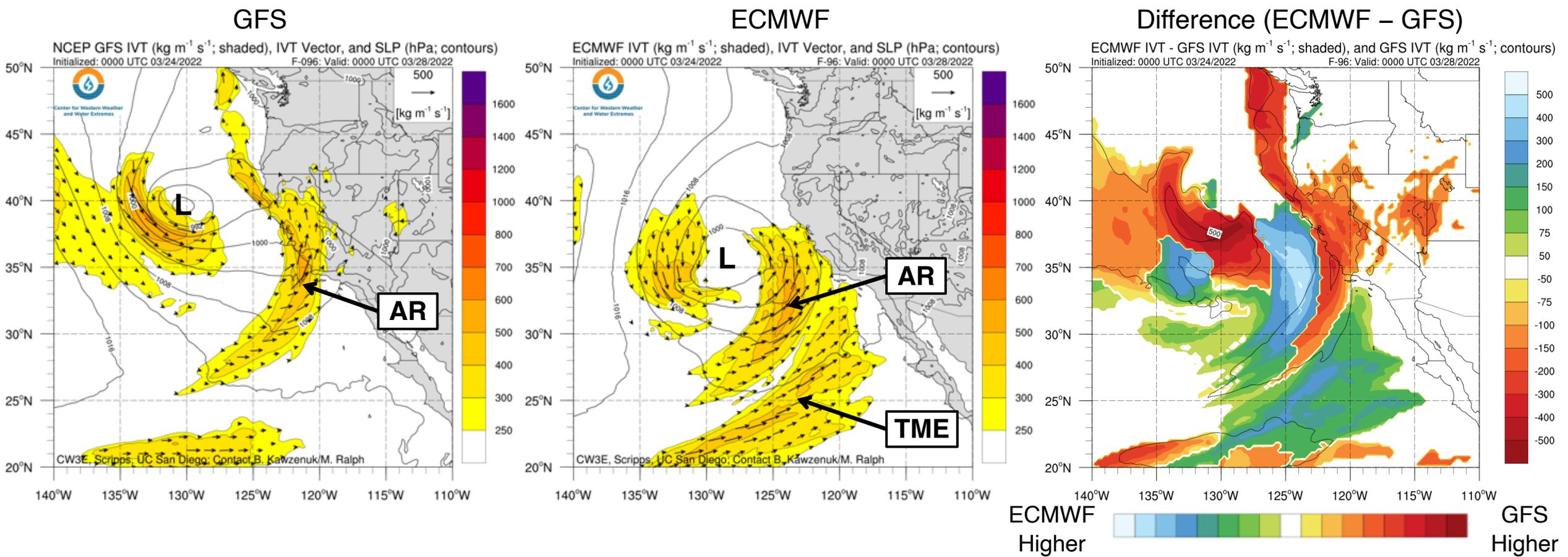
(C) Valid: 5 PM PT 27 Mar (F-96)



- An AR is forecasted to make landfall over the Pacific Northwest tomorrow night (Figure A)
- As time progresses, a secondary cyclone is forecasted to develop along the western edge of the AR, leading to a strengthening of moisture transport within the AR (Figure B)
- The AR is forecasted to gradually move east and bring a brief period of AR conditions to much of coastal California during 27–28 Mar, but there is considerable uncertainty in the evolution of the AR and associated secondary cyclone
- The 00Z GFS is forecasting maximum IVT values $> 500 \text{ kg m}^{-1} \text{ s}^{-1}$ near Point Conception at 5 PM PT 27 Mar (Figure C)

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GFS vs. ECMWF IVT Forecasts: Valid 00Z 28 Mar

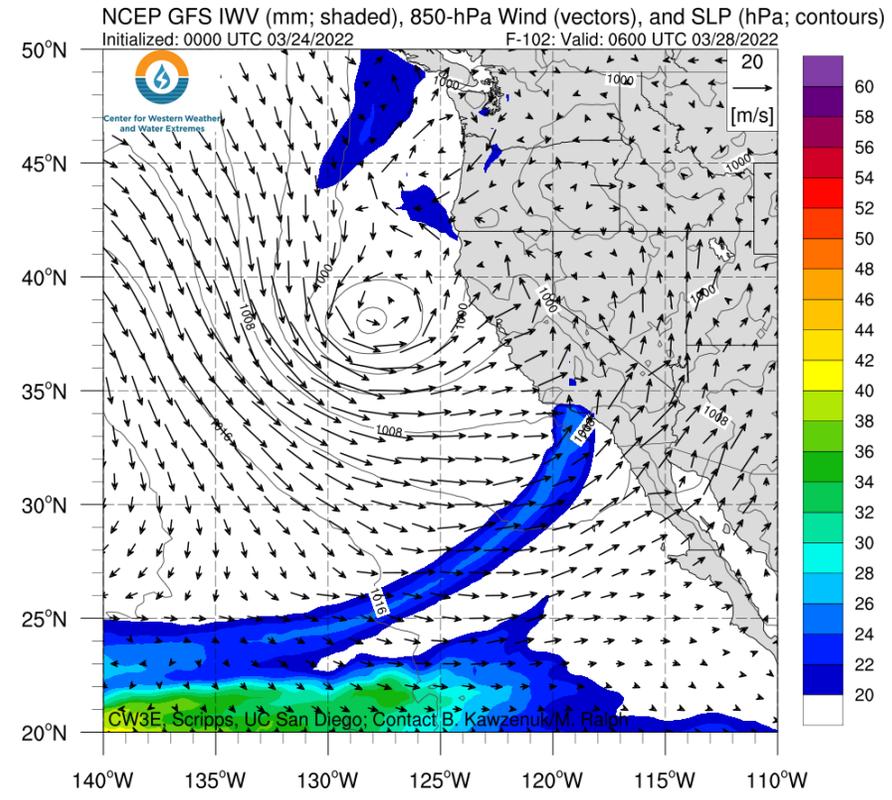


- There are large model-to-model differences in the evolution of the second AR and the associated secondary cyclone
- The 00Z GFS is forecasting the secondary cyclone to develop farther north and intensify more rapidly than the 00Z ECMWF
- Additionally, the GFS is forecasting the AR to make landfall in California several hours earlier and bring AR conditions farther north than the ECMWF
- The ECMWF is also showing the development of a tropical moisture export (TME) downstream of the surface cyclone, but this feature is absent in the GFS

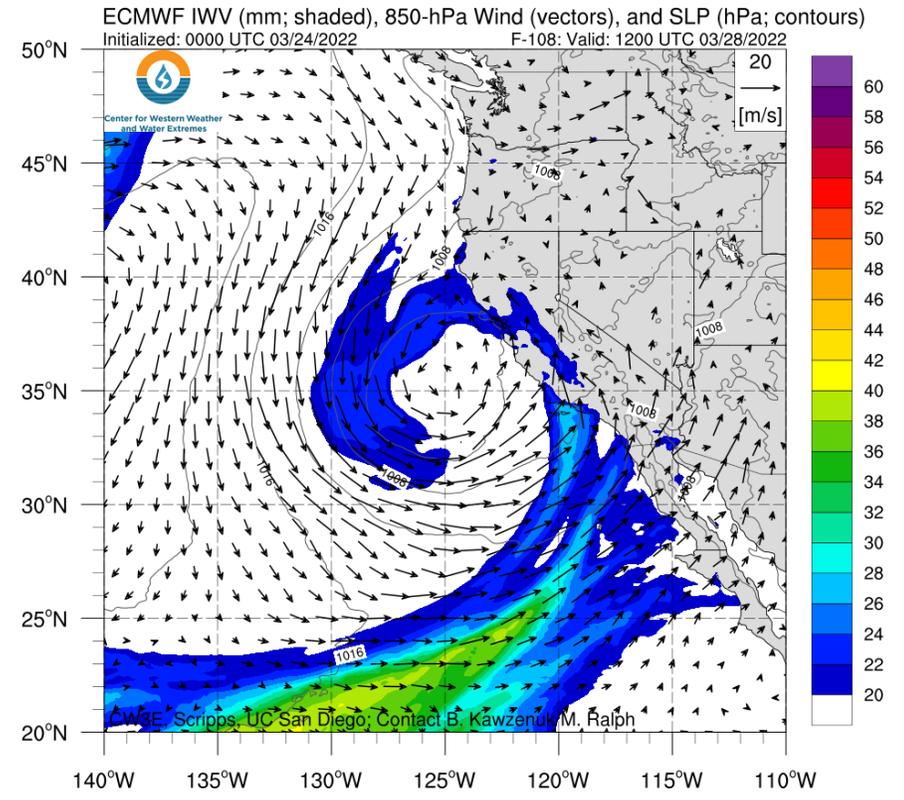
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GFS vs. ECMWF IWV Forecasts

GFS: Valid 11 PM PT 27 Mar (F-102)

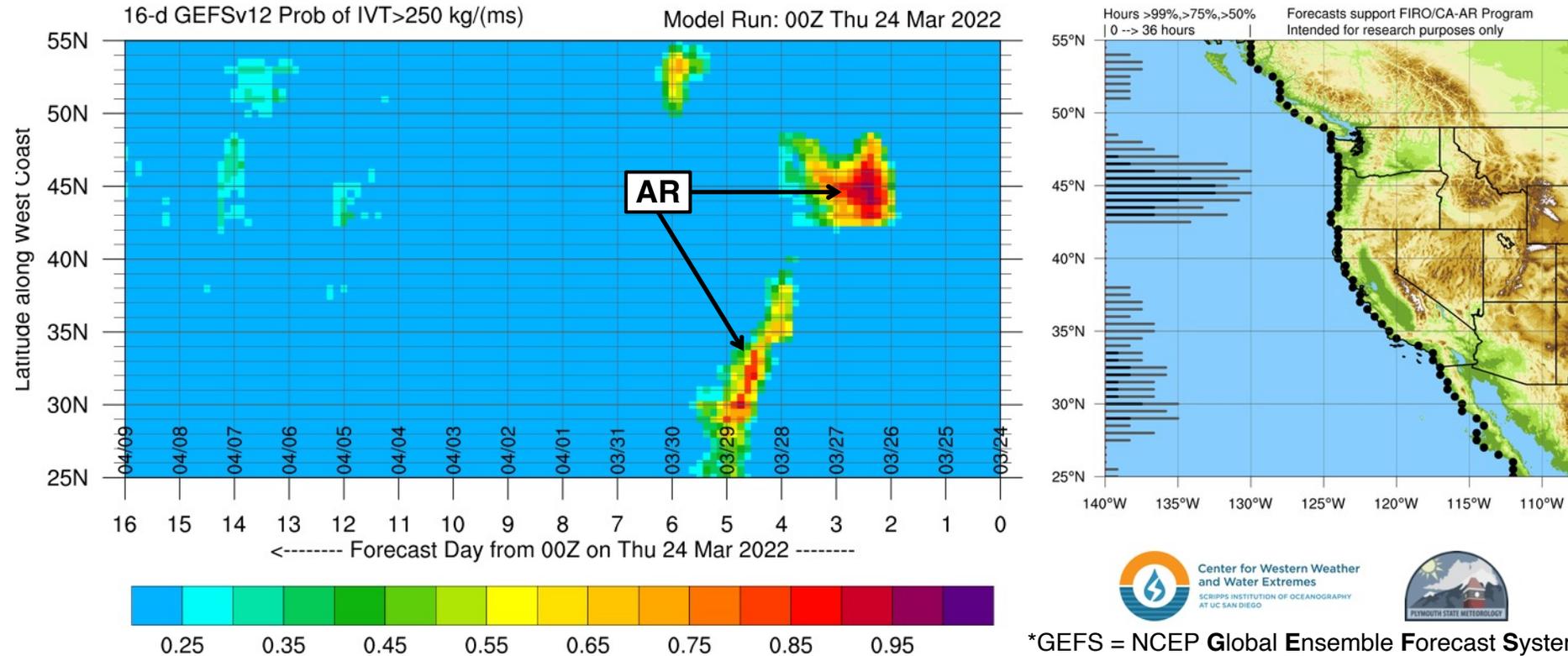


ECMWF: Valid 5 AM PT 28 Mar (F-108)



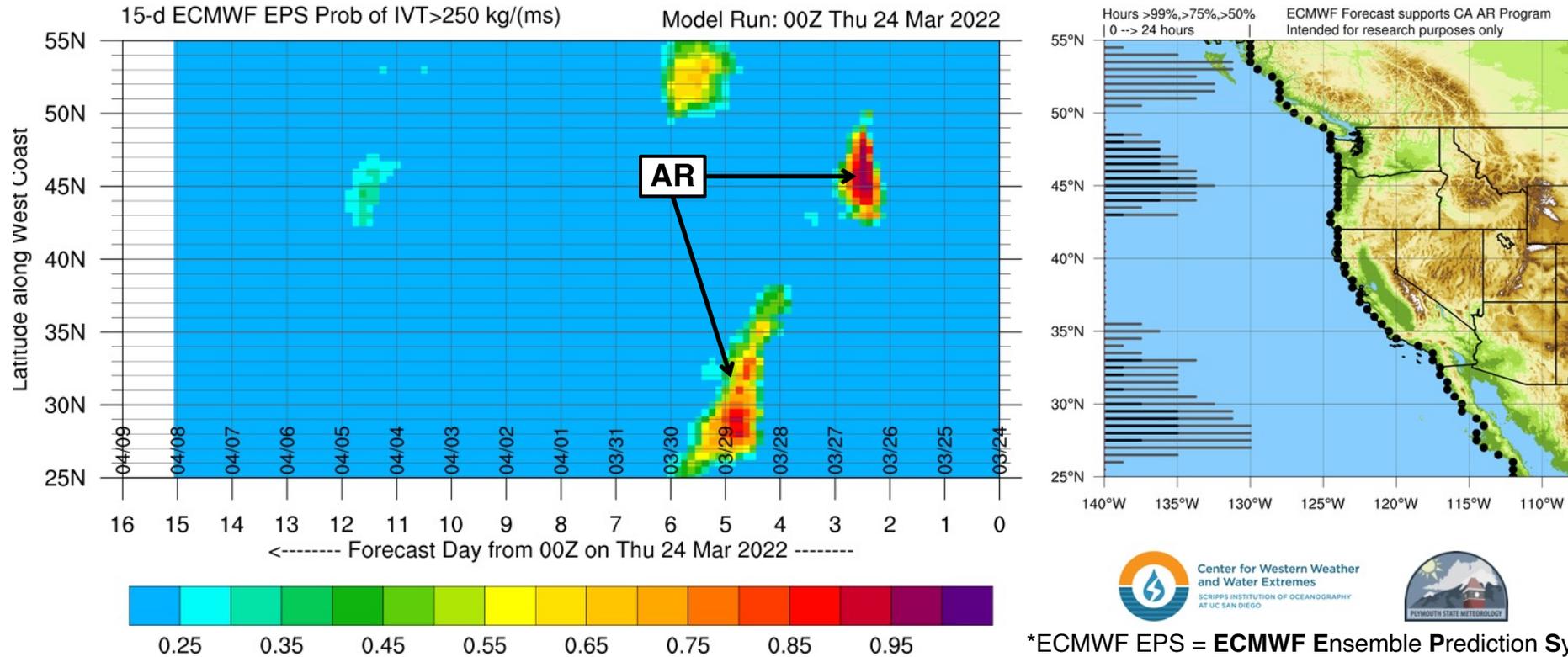
- At the time of maximum forecast IVT over the California Bight, the ECMWF is forecasting higher IWV values and stronger low-level southerly flow compared to the GFS
- These differences imply stronger upslope moisture flux over the Transverse Ranges in the ECMWF, which could lead to greater orographic enhancement of precipitation

Probability of AR Conditions Along Coast (GEFS)



- The 00Z GEFS is showing high confidence (> 85% probability) in AR conditions ($IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$) over coastal Oregon on 26 Mar as the AR makes landfall over the Pacific Northwest
- The 00Z GEFS is also showing moderate-to-high confidence (50–80% probability) in a brief period AR conditions over Central and Southern California on 27–28 Mar as the AR strengthens and moves eastward

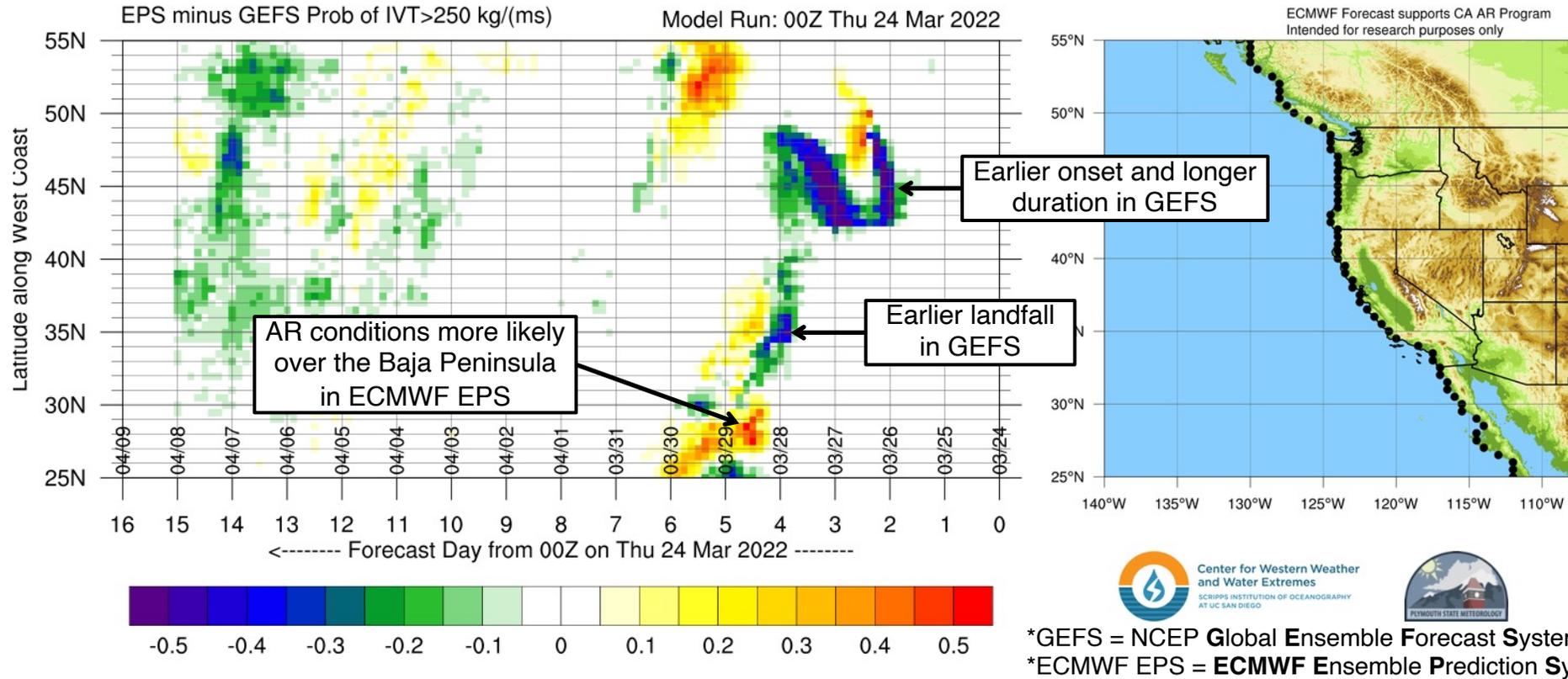
Probability of AR Conditions Along Coast (ECMWF EPS)



*ECMWF EPS = **ECMWF Ensemble Prediction System** (Europe)

- The 00Z ECMWF EPS is showing very high confidence (> 90% probability) in AR conditions over coastal Washington and Oregon on 26 Mar, and moderate-to-high confidence (50–80% probability) in AR conditions over Southern California on 28 Mar
- The 00Z ECMWF EPS is also showing high confidence (> 80% probability) in AR conditions over the Baja Peninsula on 28 Mar in association with the TME

Probability of AR Conditions Along Coast: ECMWF EPS Minus GEFS



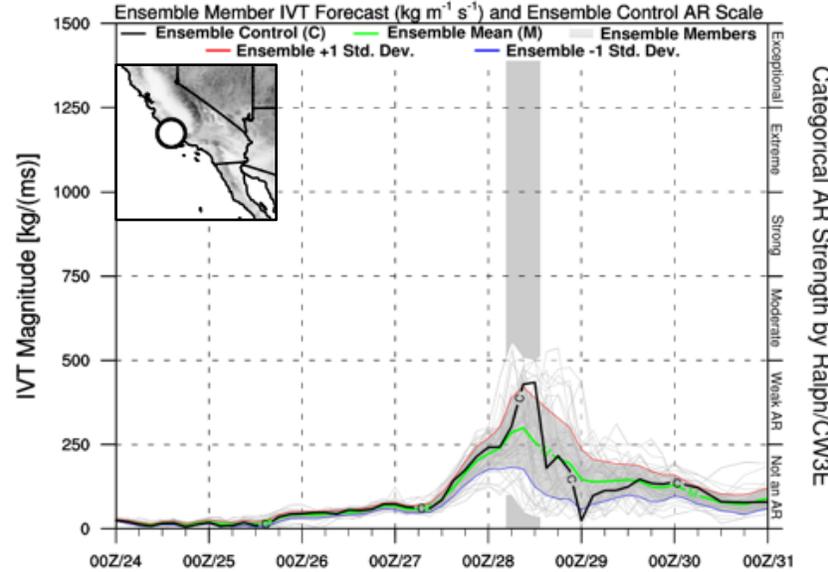
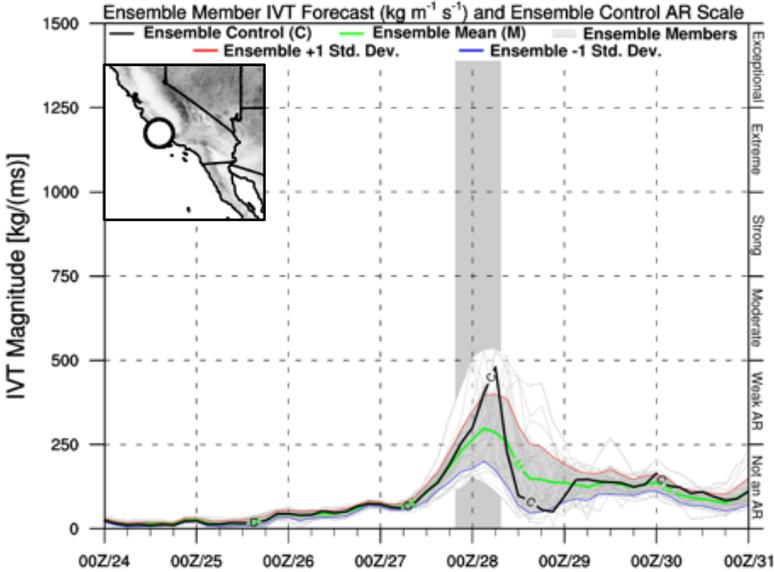
- There are substantial model-to-model differences in the forecast timing, location, and duration of AR conditions
- GEFS is forecasting an earlier onset and a longer duration of AR conditions in the Pacific Northwest compared to ECMWF EPS
- GEFS is also forecasting AR conditions to begin about 6–12 hours earlier in Central and Southern California
- ECMWF EPS is forecasting higher probabilities of AR conditions in the Baja Peninsula on 28 Mar in association with the TME

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AR Scale and IVT Forecasts: GEFS vs. ECMWF EPS

GFS Ensemble Initialized: 00Z Thu 03/24/22

ECMWF Ensemble Initialized: 00Z Thu 03/24/22

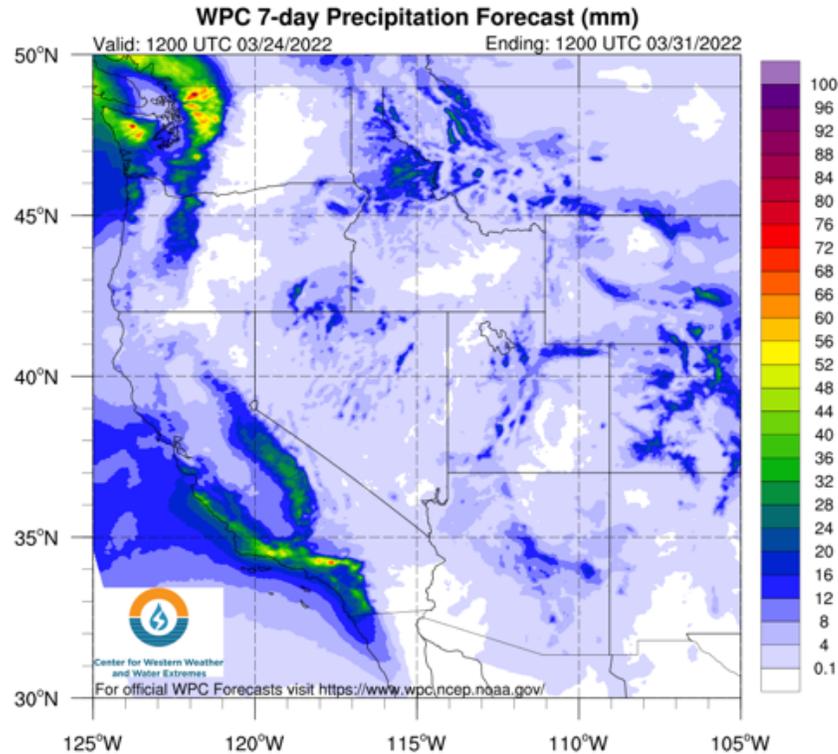


- The 00Z GEFS and ECMWF EPS control runs are both forecasting weak AR conditions $< 500 \text{ kg m}^{-1} \text{ s}^{-1}$ for less than 24 hours at 35°N , 120.5°W (near Santa Maria, CA)
- Less than 20% of GEFS and ECMWF EPS members are predicting an AR 1 (based on the Ralph et al. 2019 AR Scale) at this location
- There is considerable uncertainty in the timing of maximum IVT, but GEFS is currently favoring an earlier onset of AR conditions compared to ECMWF EPS

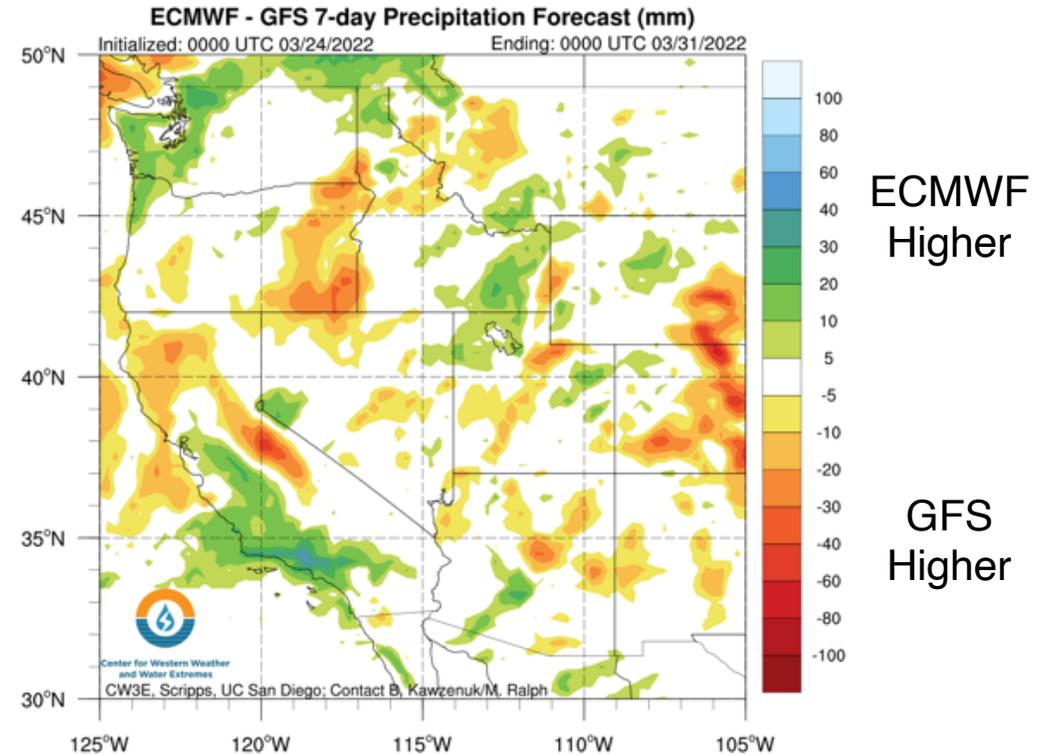
AR 1 AR 2 AR 3 AR 4 AR 5

Precipitation Forecasts

WPC 7-day QPF: Valid 12Z 24–31 Mar



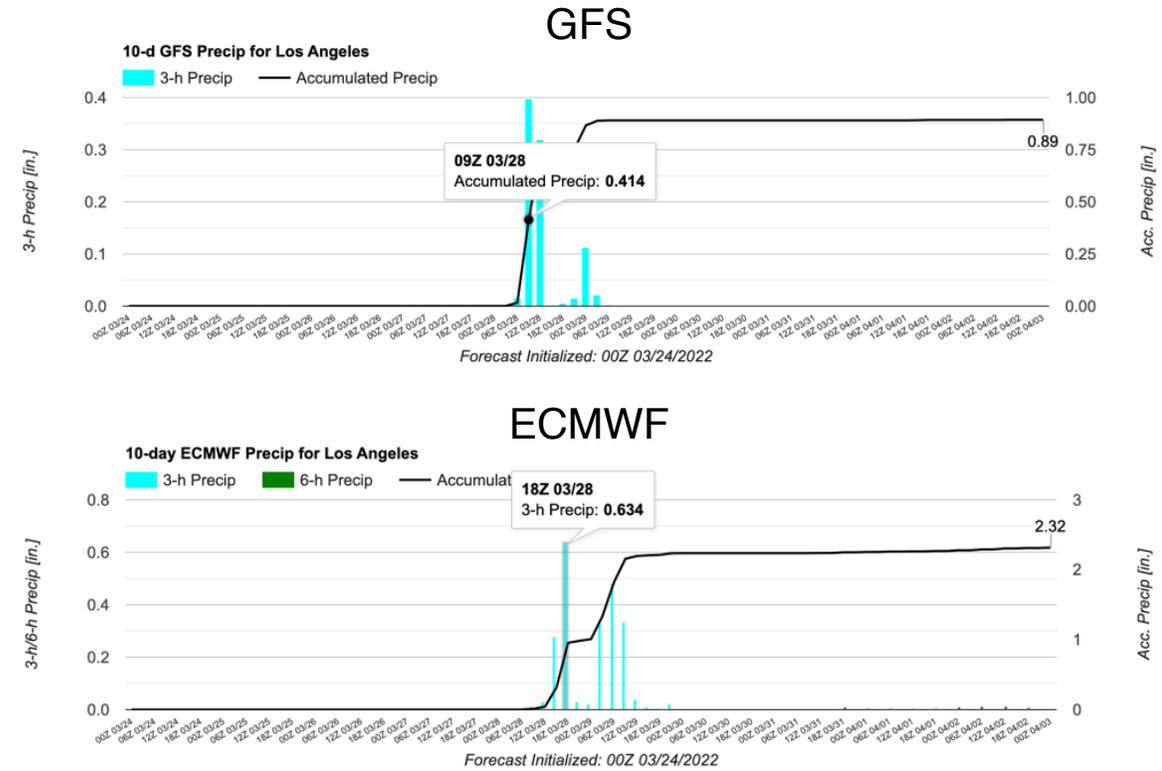
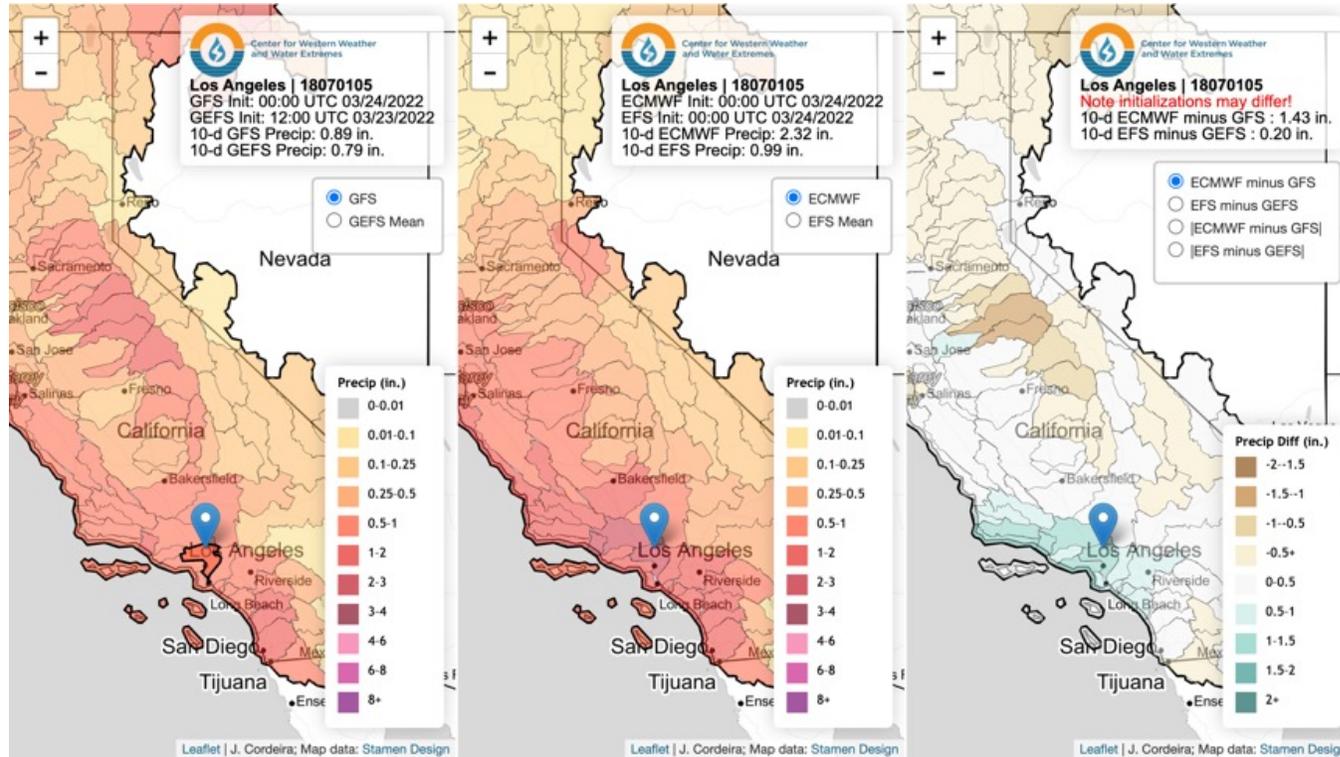
ECMWF Minus GFS 7-day QPF



- The NWS Weather Prediction Center is forecasting about 1–3 inches of precipitation in portions of coastal Southern California and the Sierra Nevada during the next 7 days
- The heaviest precipitation is currently forecasted in the Transverse Ranges
- Global models are showing large differences in forecast precipitation over California
- Compared to the 00Z GFS, the 00Z ECMWF is forecasting higher (lower) precipitation amounts in the Transverse Ranges (Sierra Nevada)

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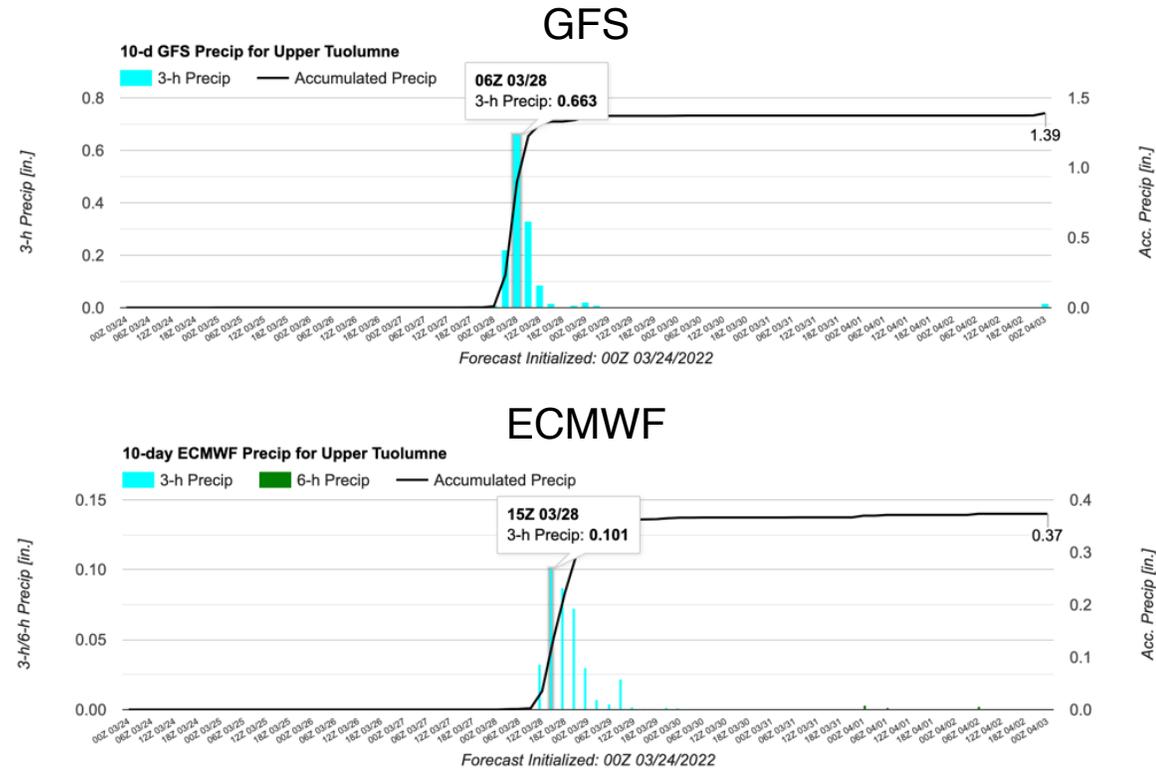
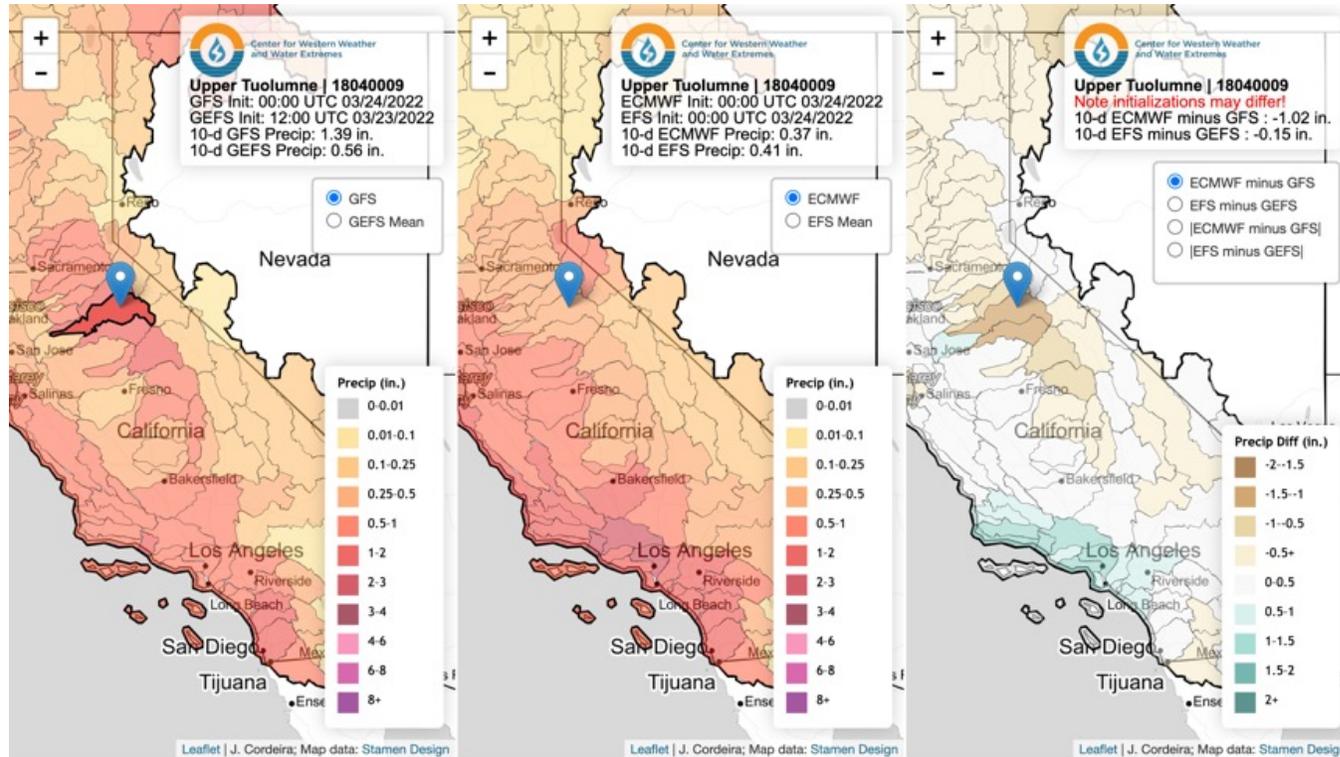
Watershed Precipitation Forecasts: Los Angeles Watershed



- Compared to the 00Z GFS, the 00Z ECMWF is forecasting higher precipitation totals over the Transverse Ranges
- The ECMWF is forecasting 2.32 inches of mean areal precipitation in the Los Angeles Watershed during the next 10 days, whereas the GFS is forecasting only 0.89 inches of mean areal precipitation
- Due to the earlier predicted AR landfall, the GFS is forecasting the heaviest precipitation to occur about 9 hours earlier than the ECMWF

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Watershed Precipitation Forecasts: Upper Tuolumne Watershed



- Compared to the 00Z GFS, the 00Z ECMWF is forecasting lower precipitation totals over the Sierra Nevada
- The ECMWF is forecasting only 0.37 inches of mean areal precipitation in the Upper Tuolumne Watershed during the next 10 days, whereas the GFS is forecasting 1.39 inches of mean areal precipitation
- Once again, the GFS is forecasting the heaviest precipitation to occur about 9 hours earlier than the ECMWF