

# CW3E Atmospheric River Outlook: 13 March 2023

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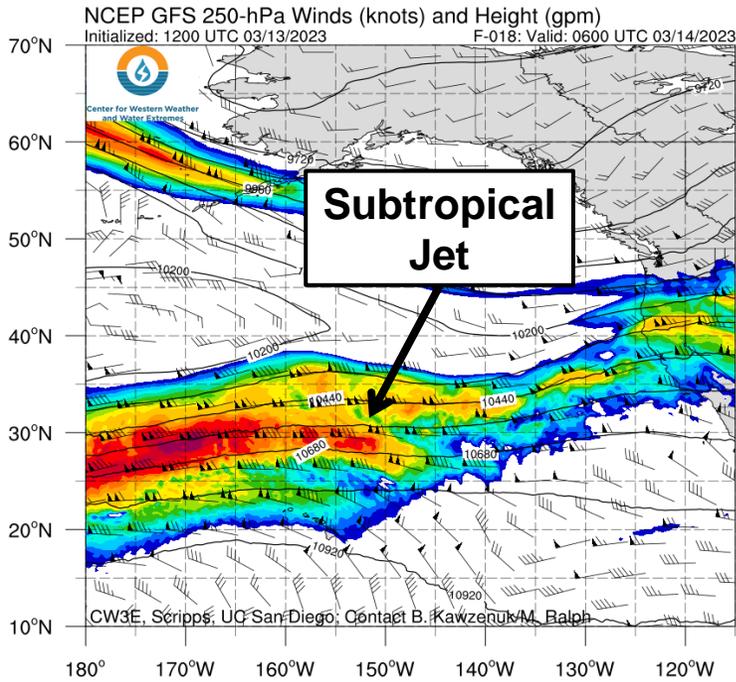
## **Strong Atmospheric River to Bring Additional Heavy Precipitation and Flooding to California**

- Another atmospheric river (AR) will impact California this evening into Wednesday
- AR3 conditions (based on the Ralph et al. 2019 AR Scale) are forecast near Santa Cruz, CA, while AR2 conditions are forecast over much of the remainder of coastal California between Sonoma County and San Diego County
- Strong upslope moisture flux will support heavy precipitation over the Sierra Nevada, Central California Coast Ranges, and Transverse Ranges
- The NWS Weather Prediction Center (WPC) is forecasting at least 3–7 inches of precipitation in these areas over the next 3 days, as well as 1–3 inches of precipitation in the lower elevations of coastal Southern California
- Moderate precipitation amounts of 1–3 inches are also forecast in the higher terrain of the Colorado River Basin due to inland penetration of the AR
- Heavy rain falling in areas with saturated soil conditions and high river/stream levels will likely produce major hydrologic impacts throughout California
- The NWS WPC has issued a moderate-to-high risk of rainfall exceeding flash flood guidance in the vicinity of the Sierra Nevada, Coast Ranges, and Transverse Ranges through Wednesday morning
- The California–Nevada River Forecast Center is currently forecasting 13 stream gages to rise above flood stage over the next 5 days
- Similar to the previous storm, freezing levels will be relatively high, and a majority of the precipitation is forecast to fall as rain in watersheds along the Sierra Nevada
- Extreme winter storm impacts are expected in the higher terrain of the Sierra Nevada, where up to 5 feet of snow are possible

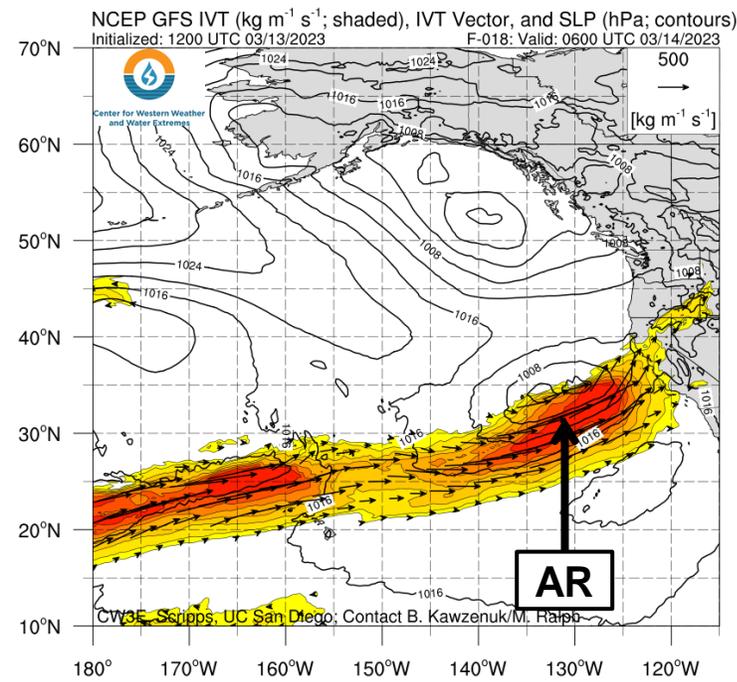
# CW3E Atmospheric River Outlook: 13 March 2023

## GFS Model Forecasts: Valid 11 PM PT 13 Mar (F-18)

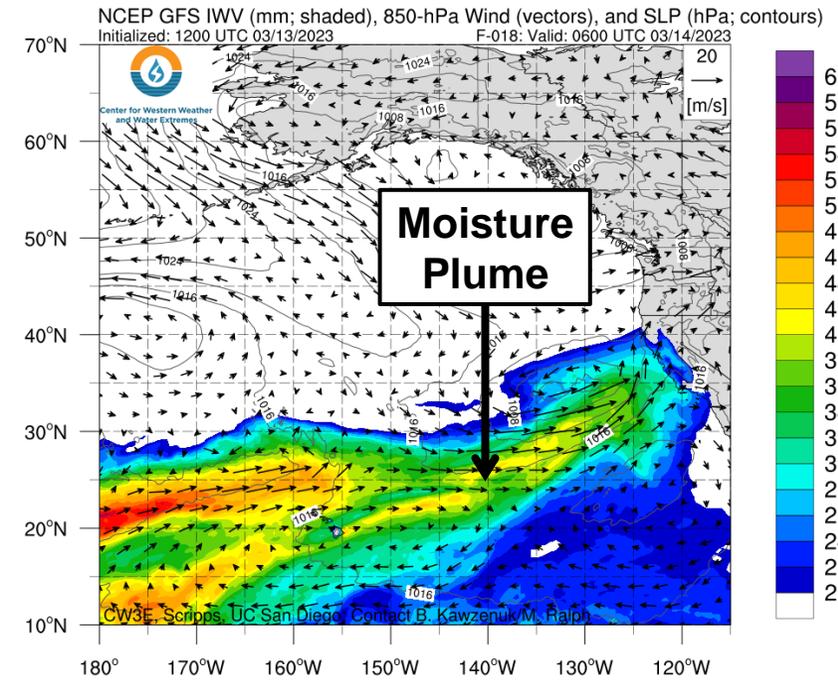
### A) 250-hPa Height and Wind



### B) IVT and SLP



### C) IWV, SLP, and 850-hPa Wind

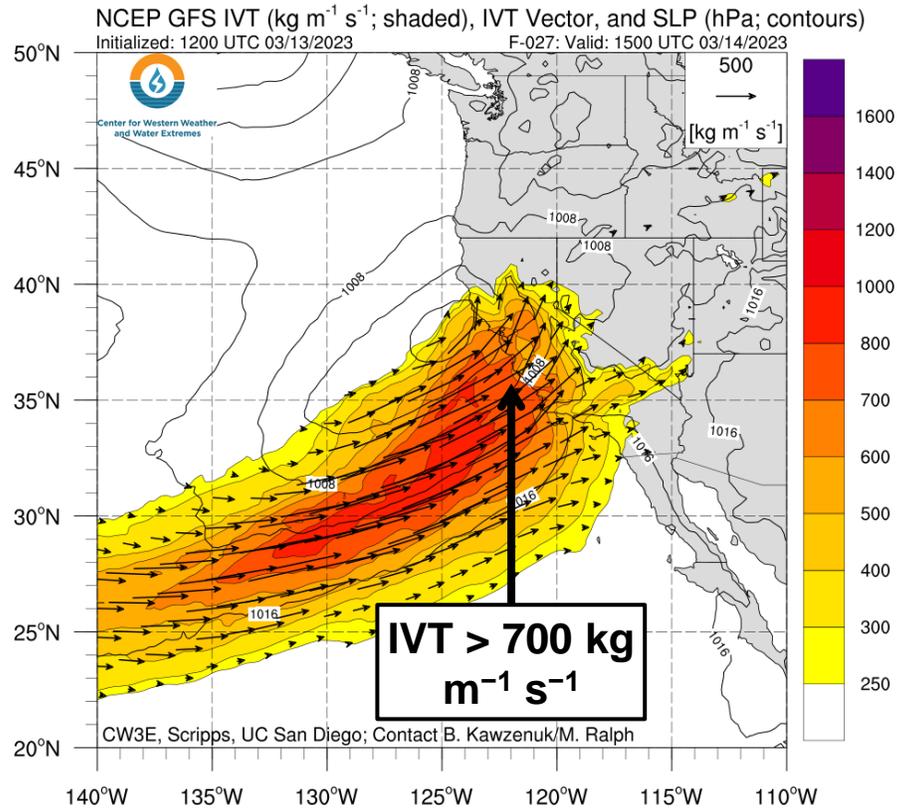


- A strong upper-level jet over the subtropical Northeast Pacific will support continued storm track and AR activity into California early this week (Figure A)
- The AR is forecast to make landfall later today in association with a developing low-pressure system and a broad plume of tropical moisture extending northeastward from Hawaii (Figures B and C)

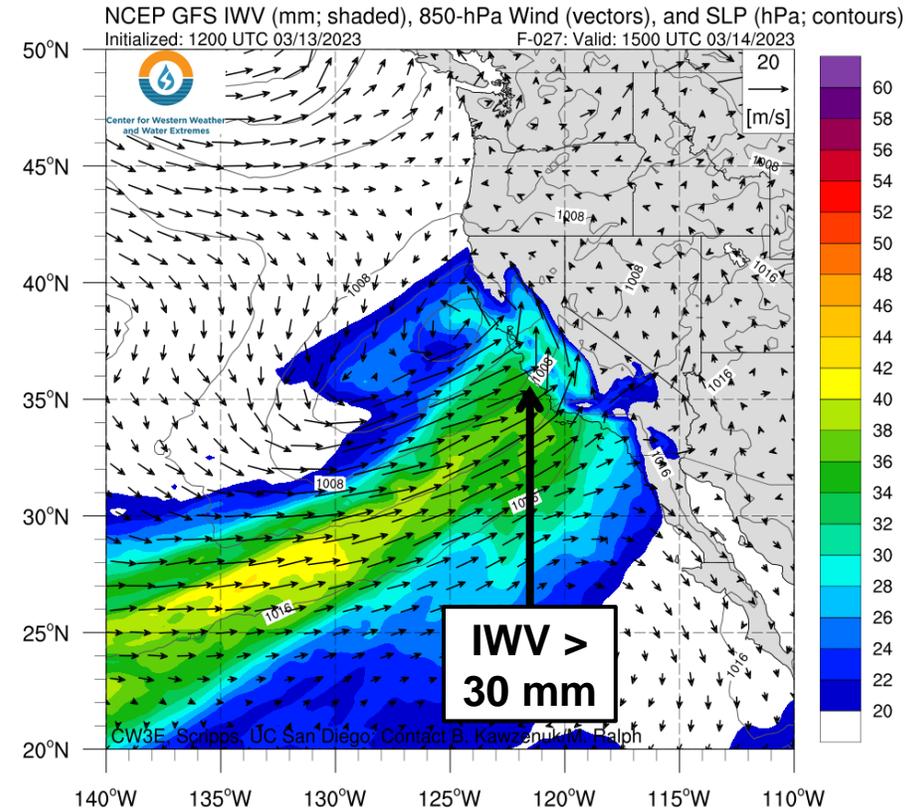
# CW3E Atmospheric River Outlook: 13 March 2023

## GFS Model Forecasts: Valid 8 AM PT 14 Mar (F-27)

### A) IVT and SLP



### B) IWV, SLP, and 850-hPa Wind

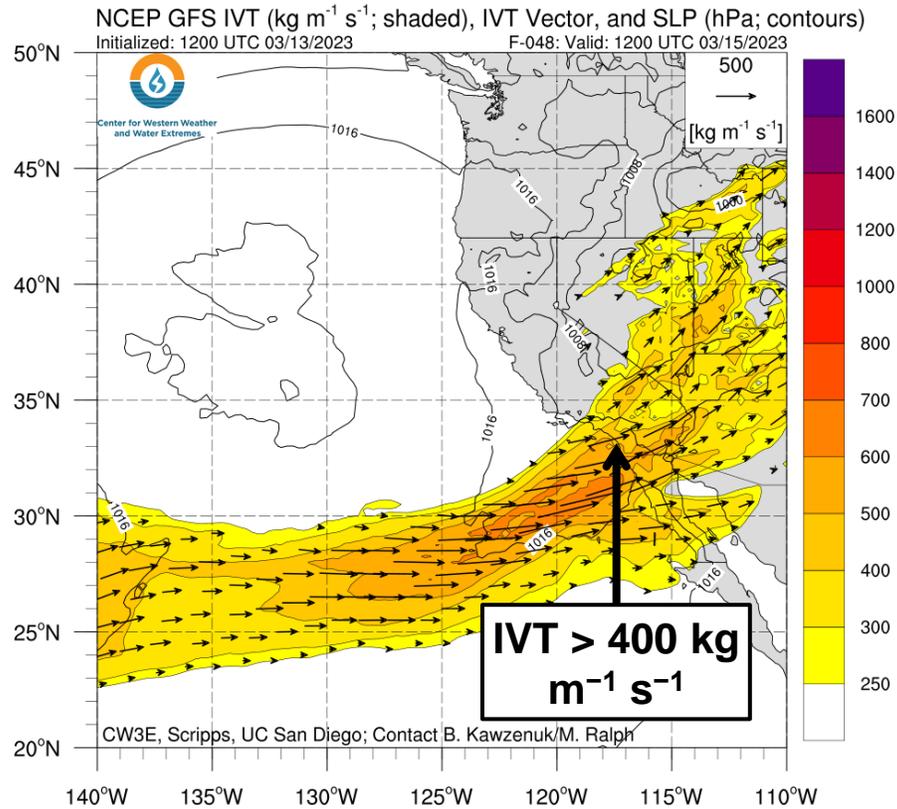


- The strongest moisture transport is forecast to occur along the Central California coast, with IVT magnitudes exceeding  $700 \text{ kg m}^{-1} \text{ s}^{-1}$  (Figure A)
- Strong low-level southwesterly flow combined with IWV values  $> 30 \text{ mm}$  will support strong upslope moisture flux over the Central California Coast Ranges (Figure B)

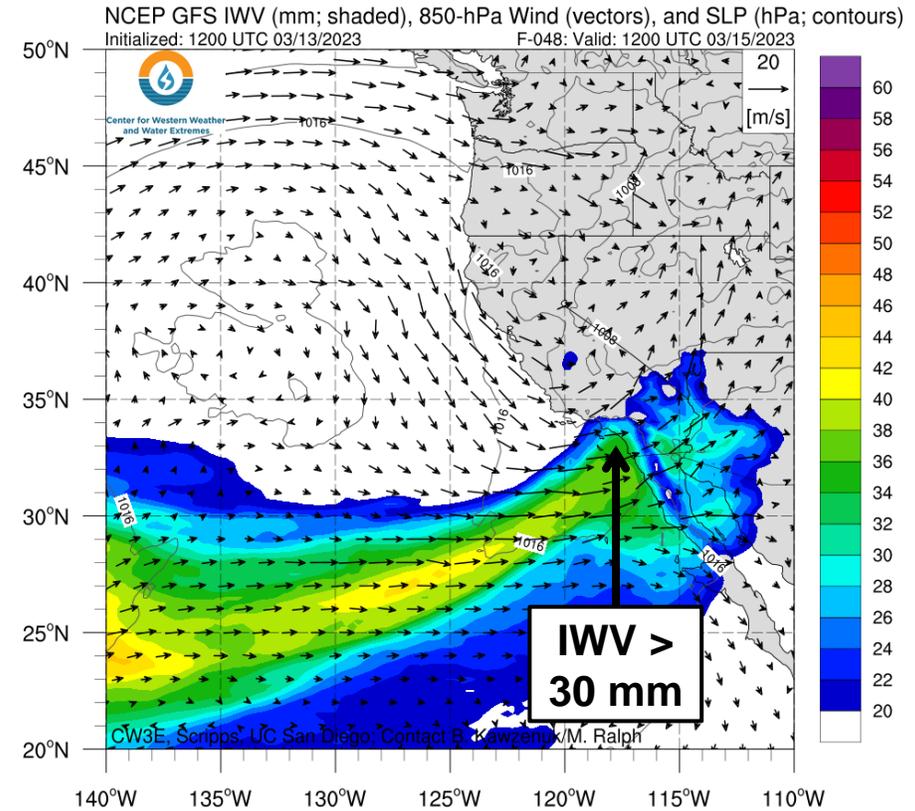
# CW3E Atmospheric River Outlook: 13 March 2023

## GFS Model Forecasts: Valid 5 AM PT 15 Mar (F-48)

### A) IVT and SLP



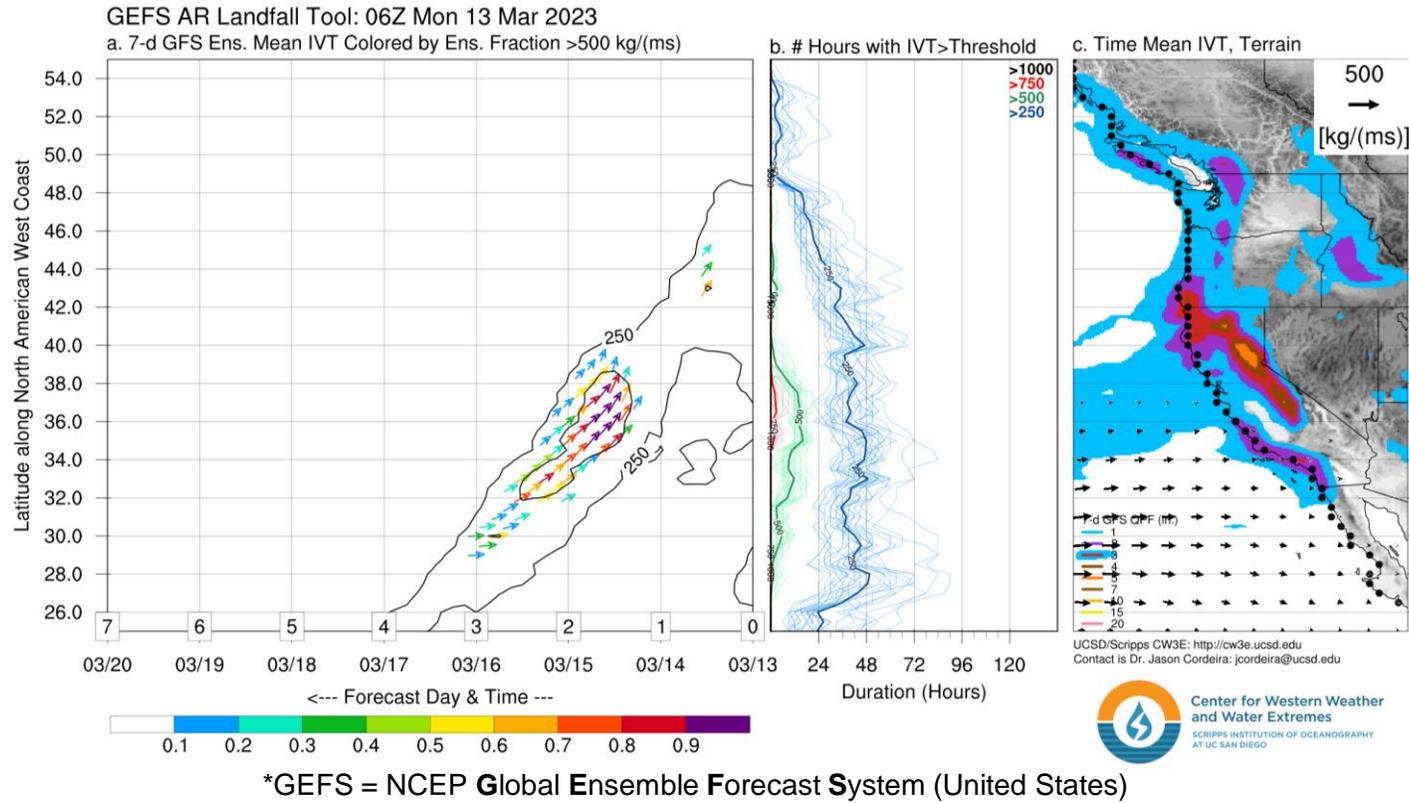
### B) IWV, SLP, and 850-hPa Wind



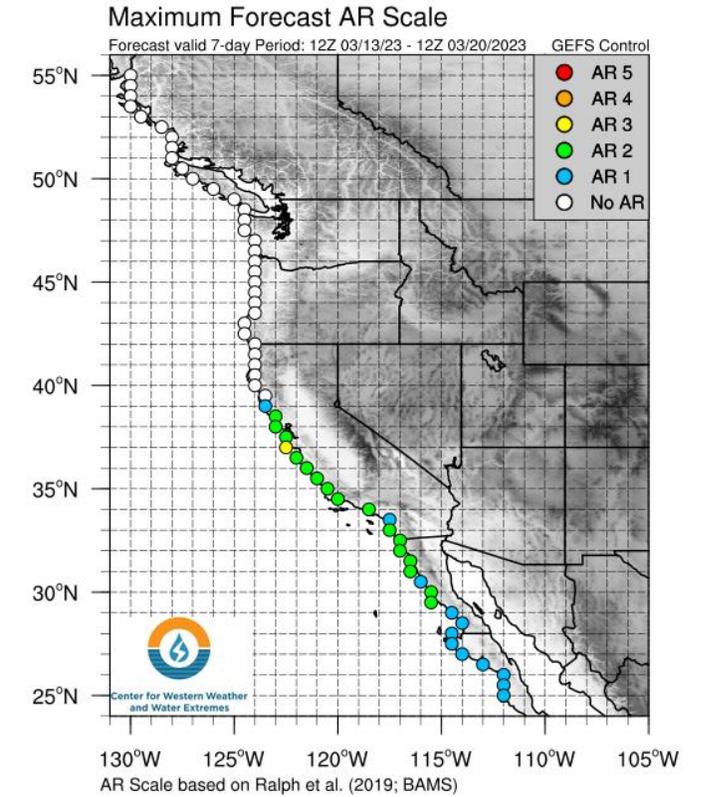
- As time progresses, the AR is forecast to slowly move down the California coast, bringing IVT magnitudes of 400–600  $\text{kg m}^{-1} \text{s}^{-1}$  and IWV values  $> 30 \text{ mm}$  to coastal Southern California (Figures A and B)
- Significant inland penetration of AR conditions ( $\text{IVT} > 250 \text{ kg m}^{-1} \text{s}^{-1}$ ) is also forecast to occur over the interior southwestern US (Figure A)

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## GEFS AR Landfall Tool w/ IVT Vectors



## GEFS AR Scale

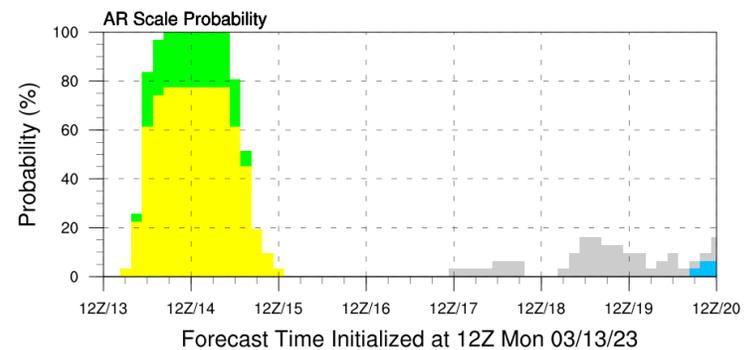
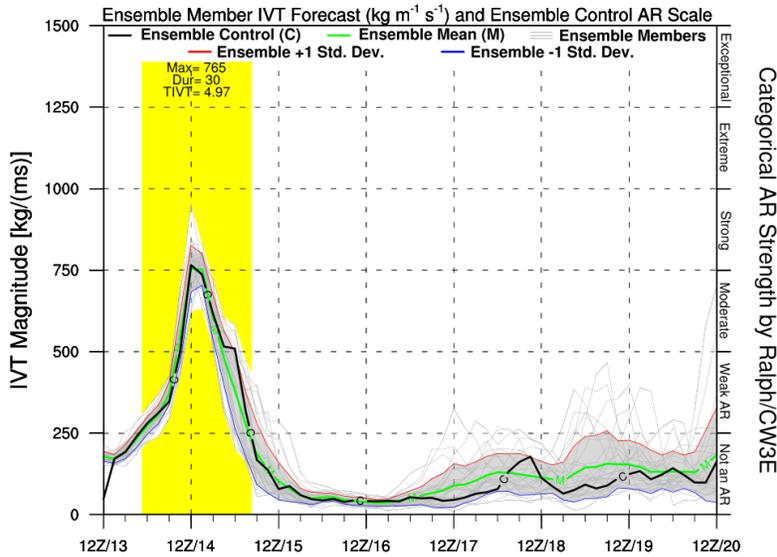


- GEFS is showing very high confidence (> 90% probability) in a brief period of moderate AR conditions ( $IVT > 500 \text{ kg m}^{-1} \text{ s}^{-1}$ ) over the Central California coast in association with this AR
- The southwesterly orientation of the IVT vectors is favorable for upslope moisture flux and orographic enhancement of precipitation over the Coast Ranges as well as the Sierra Nevada
- The 12Z GEFS control run is forecasting an AR3 (based on the Ralph et al. 2019 AR Scale) near Santa Cruz, CA, and an AR2 over much of the remainder of coastal California from Sonoma County to San Diego County

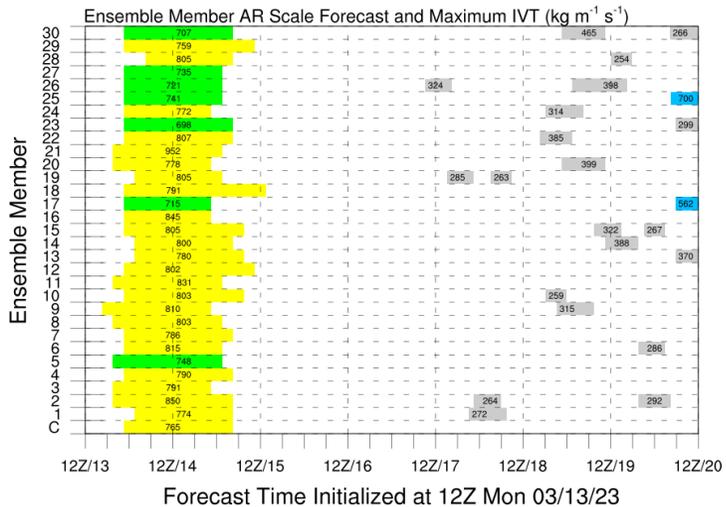
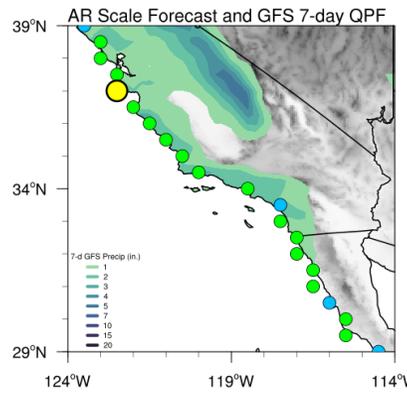
# CW3E Atmospheric River Outlook: 13 March 2023

## GEFS AR Scale and IVT Plume Forecasts

GFS Ensemble Initialized: 12Z Mon 03/13/23



Location: 37°N 122.5°W



- The 12Z GEFS control run is forecasting an AR3 at 37.0°N, 122.5°W (near Santa Cruz, CA)
- 24/31 (77%) ensemble members are forecasting an AR3 and 7/31 (23%) are forecasting an AR2 at this location
- There is still some uncertainty in both the maximum IVT magnitude and the duration of AR conditions
- Uncertainty in maximum IVT magnitude is responsible for the differences in forecast AR Scale



AR 1 (Blue) AR 2 (Green) AR 3 (Yellow) AR 4 (Orange) AR 5 (Red)

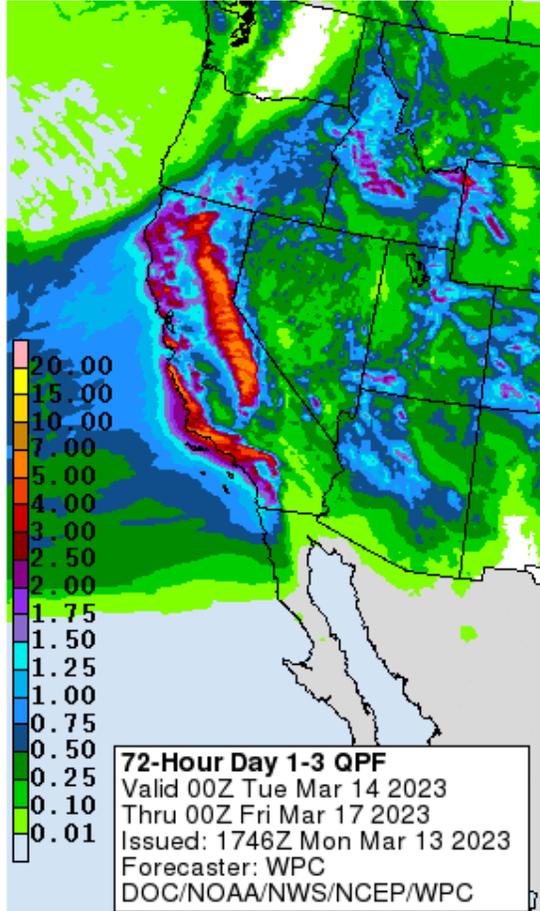
Image created: 17 UTC 03/13/2023

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

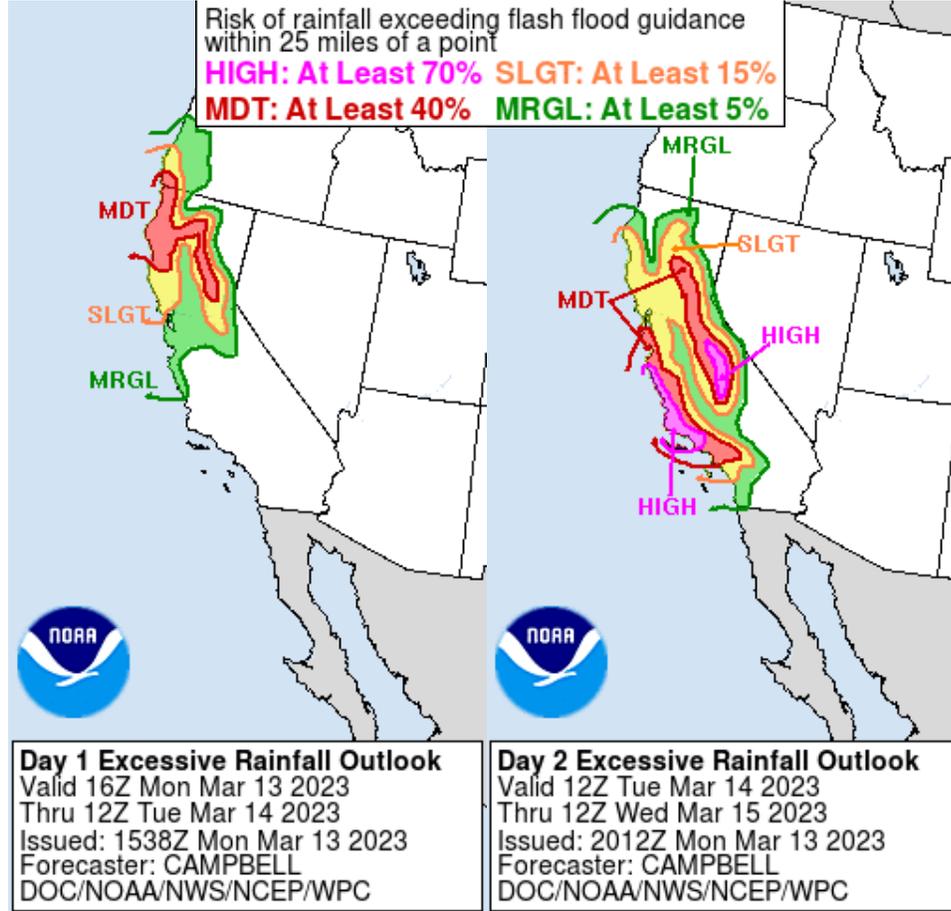
## Precipitation Forecasts

NWS WPC 72-hour QPF

Valid Ending 5 PM PT 16 Mar



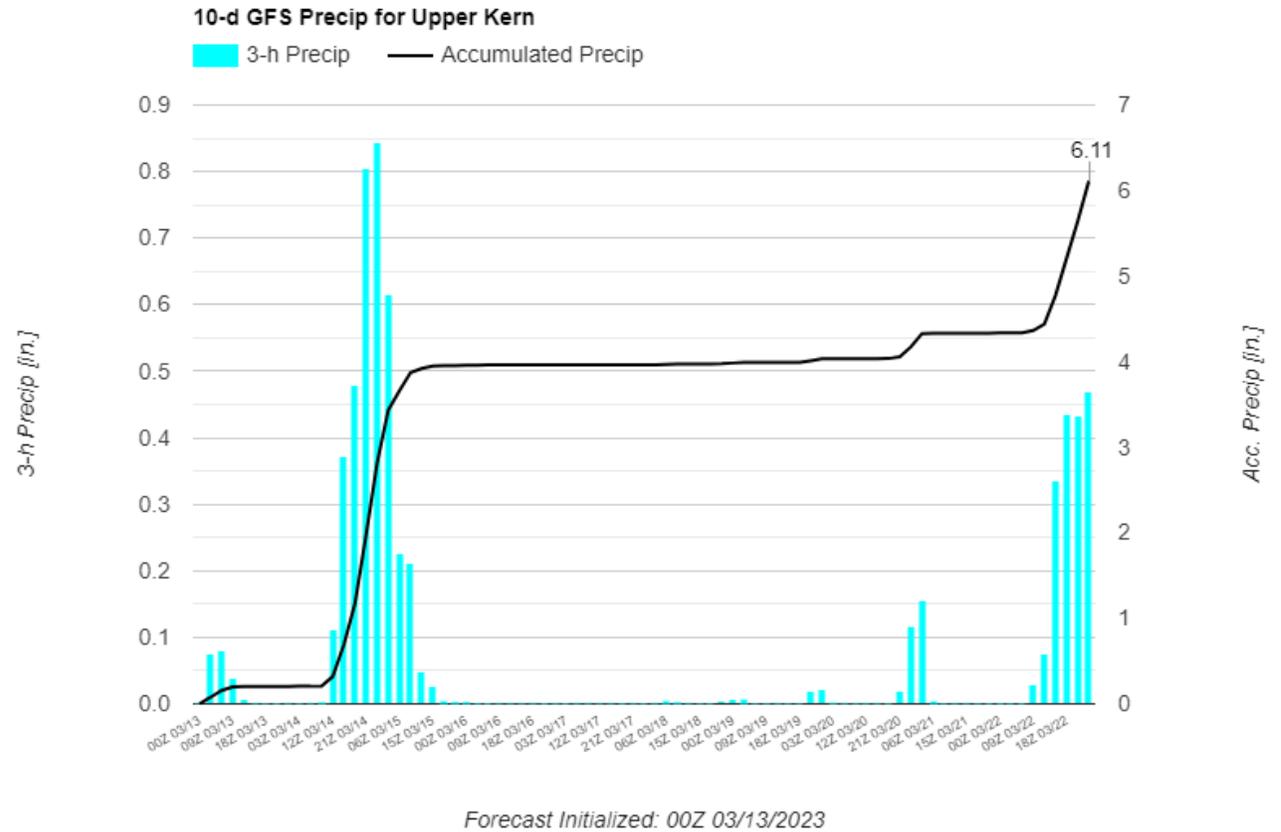
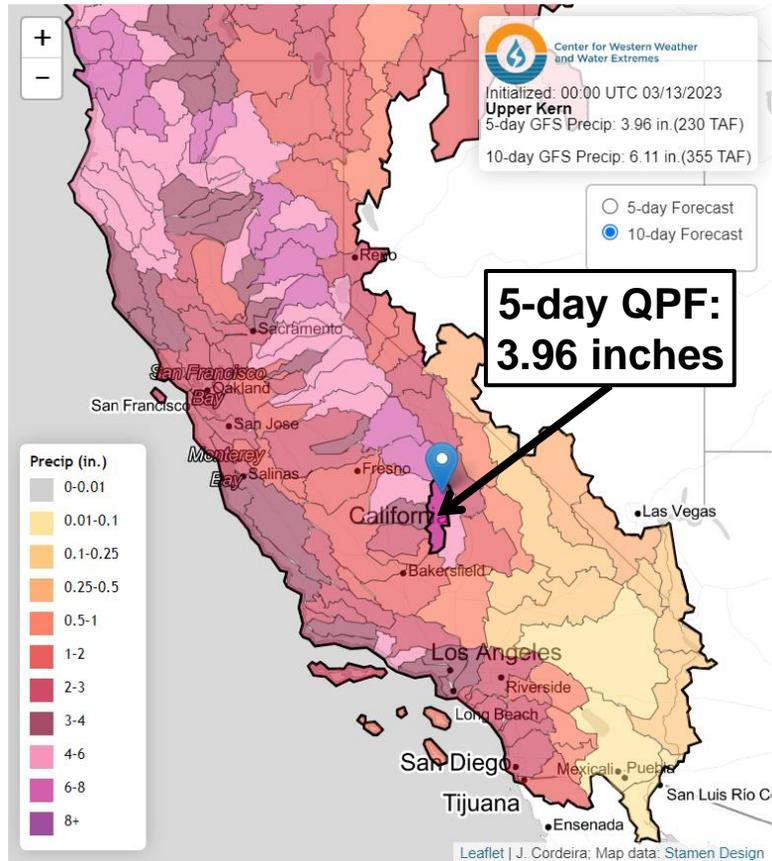
## NWS WPC Excessive Rainfall Forecasts



- The NWS Weather Prediction Center (WPC) is forecasting 3–7 inches of precipitation over the Sierra Nevada, Central CA Coast Ranges, and Transverse Ranges during the next 3 days, with 1–3 inches forecast in the lower elevations of coastal Southern CA
- Precipitation amounts of 1–3 inches are also forecast in the higher terrain of the Colorado River Basin due to inland penetration of the AR
- The NWS WPC has issued a moderate-to-high risk of rainfall exceeding flash flood guidance in the vicinity of the California Coast Ranges, the Transverse Ranges, and the Sierra Nevada (including the Yuba–Feather Watersheds) through Wednesday morning
- There is also a slight-to-moderate risk of rainfall exceeding flash flood guidance in the Central Valley, the Russian River Watershed, and the Santa Ana Watershed

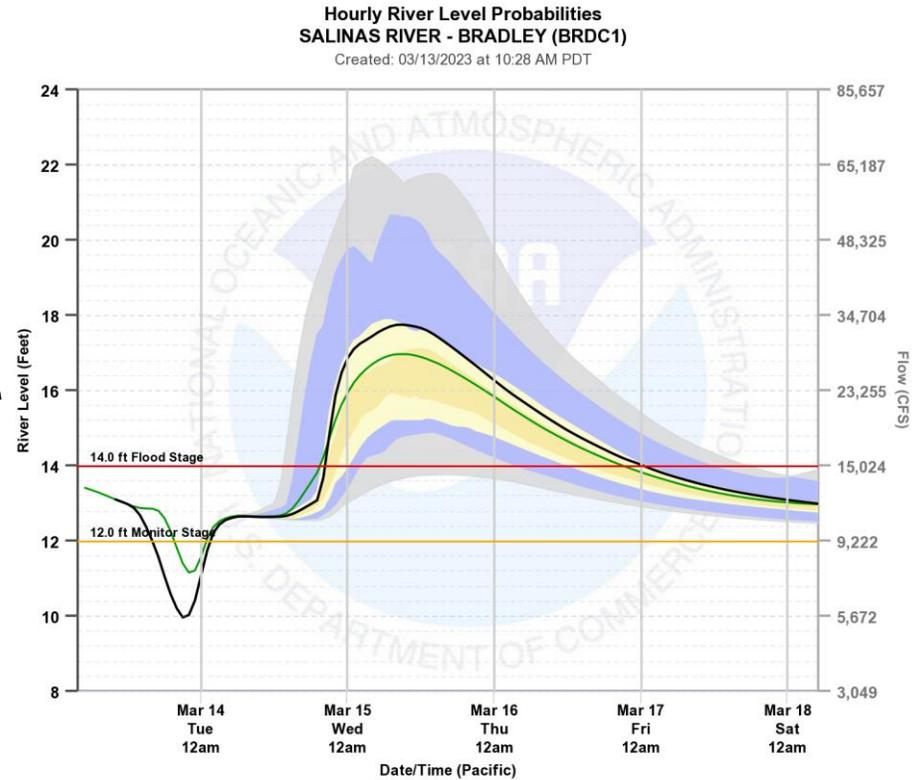
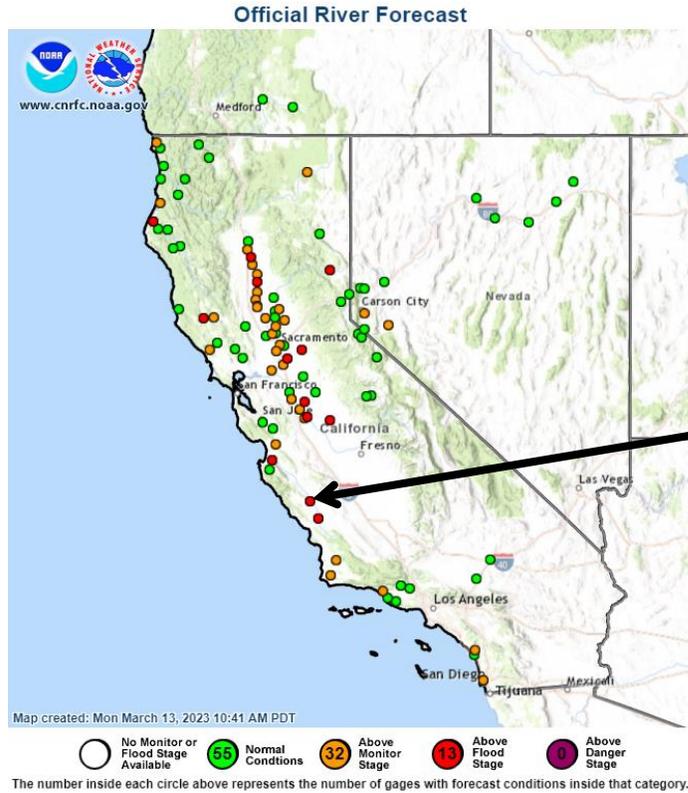
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## GFS Watershed Precipitation Forecasts: Upper Kern



- The 00Z GFS is forecasting nearly 4 inches of mean areal precipitation over the Upper Kern Watershed during the next 5 days
- There is potential for several hours of moderate-intensity rainfall as the core of the AR passes through the Southern Sierra Nevada, with 3-hourly mean areal precipitation in excess of 0.75 inches
- Such precipitation rates will likely result in additional flooding along the Kern River, which already experienced destructive flooding from the previous AR

## Hydrologic Impacts



Chance of River Level Exceedance (Feet)	
Forecast Period: 03/13/2023 5 am - 03/18/2023 5 am	
Max	22.21
5%	21.61
10%	19.82
25%	17.93
50%	16.33
75%	15.26
90%	14.96
95%	14.65
97%	14.0
Min	13.75

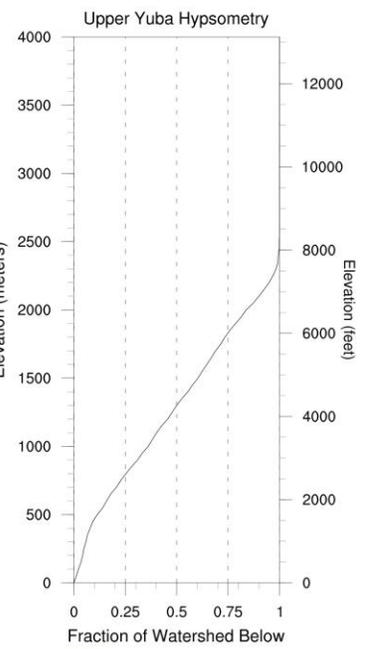
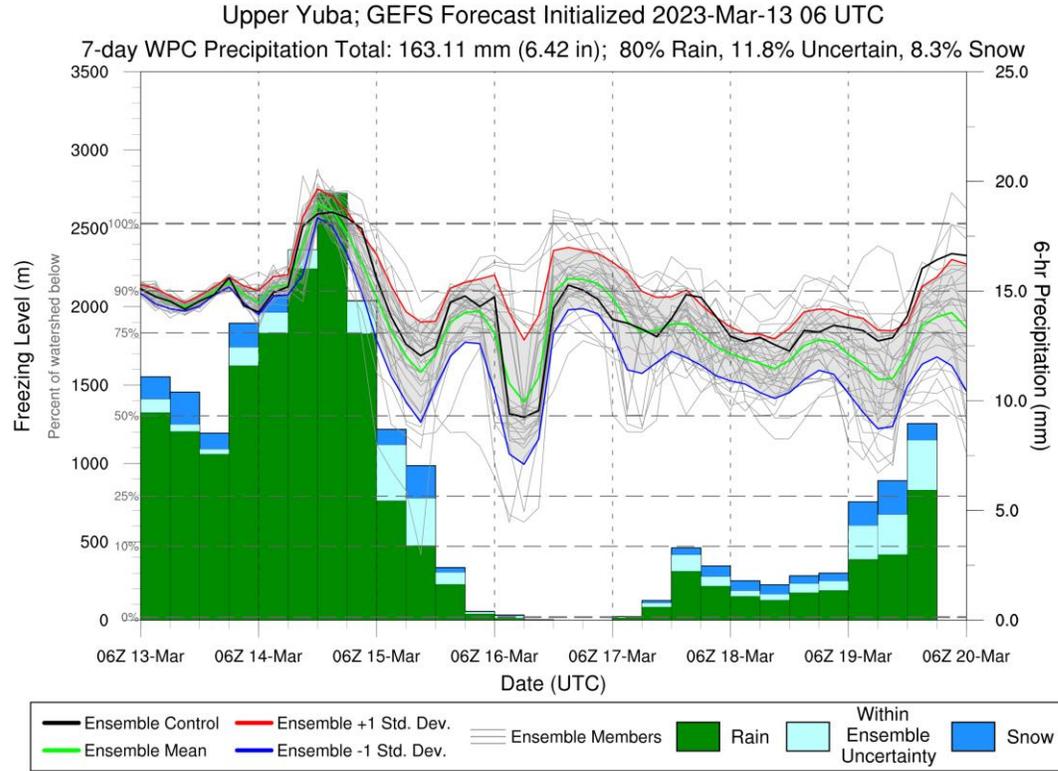
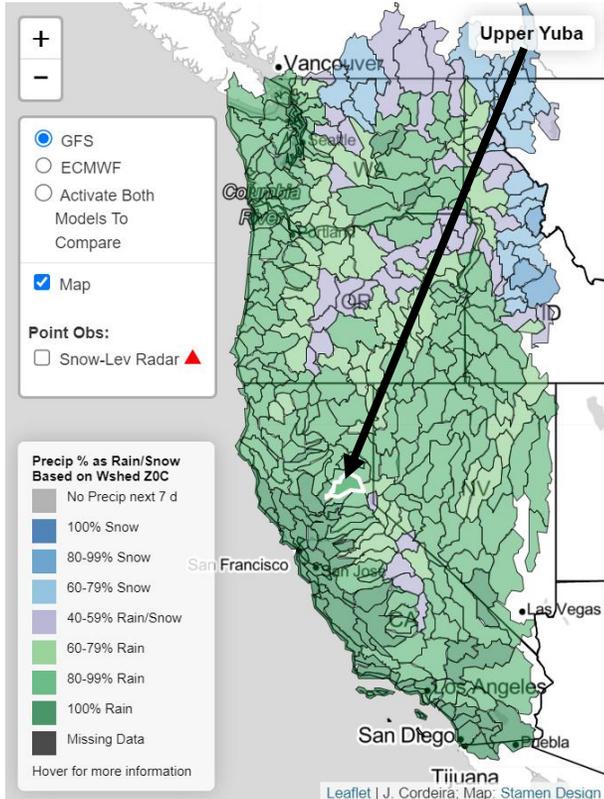
12.0 ft > 98%

— Official Forecast (Deterministic)  
— Ensemble Mean  
— Model Traces  
**Hourly Probabilities**  
■ 0-5% chance  
■ 5-25% chance  
■ 25-40% chance  
■ 40-60% chance

- Heavy rain falling in areas with nearly saturated soil conditions and elevated river/stream levels will likely produce significant hydrologic impacts throughout California
- The California–Nevada River Forecast Center (CNRFC) is forecasting 13 stream gages to rise above flood stage and 32 additional stream gages to rise above action/monitor stage over the next 5 days
- The Salinas River at Bradley is forecast to rise above flood stage on Tuesday evening and reach a peak stage of 17.7 feet
- The CNRFC hydrologic ensemble forecast service (HEFS) is showing a 97% probability of this gage exceeding flood stage

# CW3E Atmospheric River Outlook: 13 March 2023

## Watershed Freezing Level Forecasts: Upper Yuba Watershed

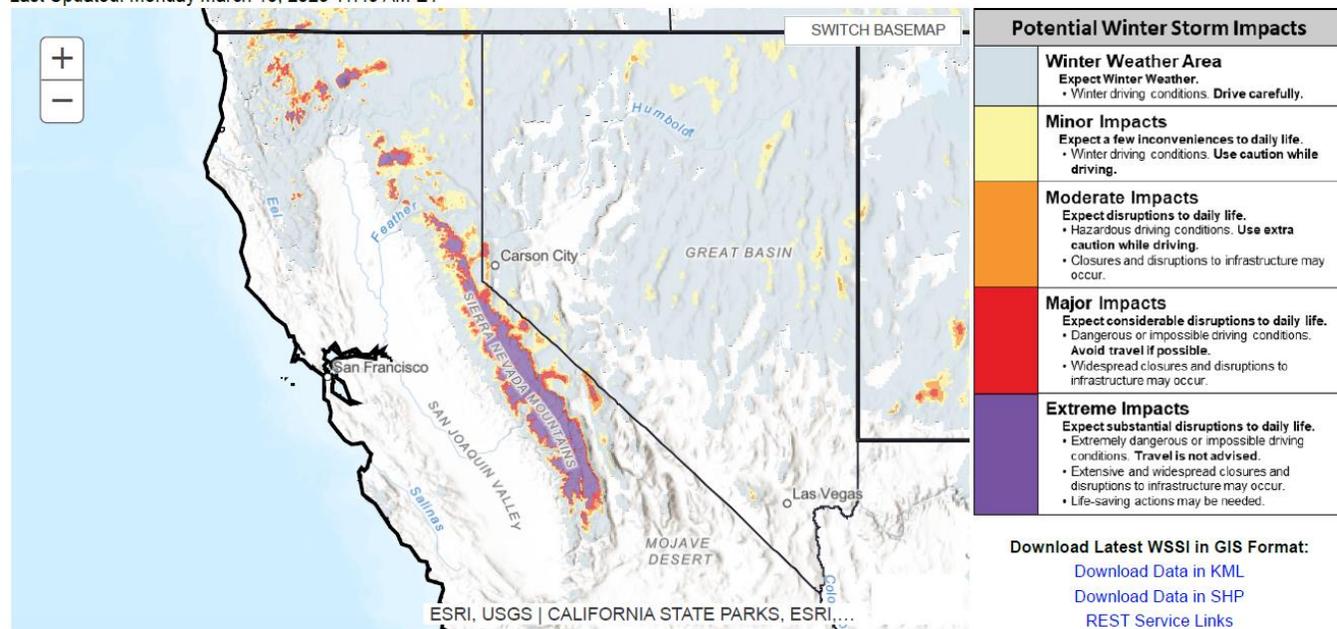


- This AR will be another warm storm, with a majority of the precipitation forecast to fall as rain in watersheds along the Sierra Nevada
- Freezing levels in the Upper Yuba watershed are forecast to remain above 6,000 feet throughout most of the storm's duration, potentially rising as high as 9,000 feet on Tuesday
- The CW3E watershed freezing level tool is forecasting 80% of the total precipitation over the next 7 days to fall in the form of rain in the Upper Yuba watershed
- Heavy rain falling on existing snowpack could lead to increased runoff and flood risk at lower elevations

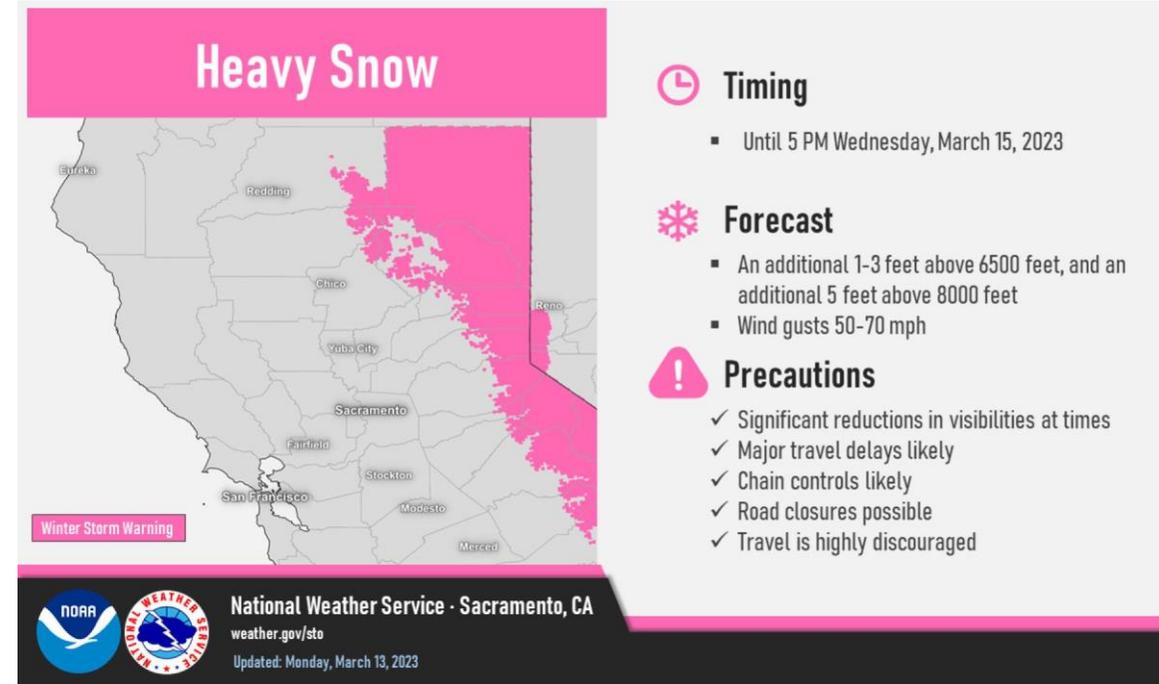
## Winter Weather Hazards

Days 1–3 Experimental Winter Storm Severity Index:  
Valid: 8 AM PT 13 Mar – 5 AM PT 16 Mar

Winter Storm Severity Index - Effective From Mon, Mar 13, 2023 11 AM ET Through Thu, Mar 16, 2023 08 AM ET  
Last Updated: Monday March 13, 2023 11:49 AM ET



Source: NOAA/NWS Weather Prediction Center



Source: NWS Sacramento

- The NWS WPC is forecasting **extreme** winter storm impacts (i.e., extremely dangerous travel conditions, widespread disruptions to infrastructure, life-threatening conditions) in the higher terrain of the Sierra Nevada (primarily above 7,000 feet)
- Significant snowfall accumulations are expected above 6,500 feet, with as much as 5 feet of snow possible above 8,000 feet