CW3E Atmospheric River Outlook: 8 December 2022

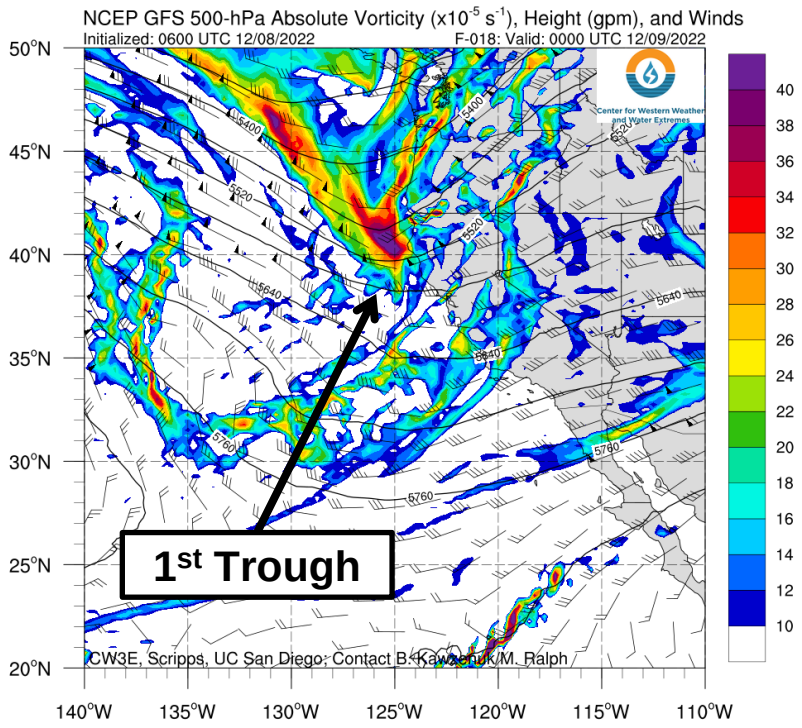
Atmospheric River to Bring Impactful Winter Weather to California

- An initial weak AR associated with a shortwave trough will bring rain and snow to the Coast Ranges of Northern California Thursday evening into early Friday
- A stronger AR will make landfall near the border of Oregon and California late Friday, bringing AR 1/AR 2 conditions (based on the Ralph et al. 2019 AR scale) to much of California through Sunday afternoon
- Precipitation associated with this storm will fall primarily as snow, with freezing levels remaining between 3,500–5,000 feet in the Sierra Nevada
- NWS WPC's QPF for the Northern California Coast Ranges and Sierra Nevada regions are between 3–6 inches, with CW3E's watershed precipitation forecast tool showing strong model agreement between the GEFS and ECMWF EPS ensembles.
- This storm will bring major winter weather impacts to the Sierra Nevada, with NWS WPC's Winter Storm Severity Index forecasting the potential for "Major" or "Extreme" impacts and disruption to daily life
- NWS Weather Forecast Offices have issued snowfall forecasts for between 48–60 inches the Northern Sierra and 36–48 inches for the southern Sierra

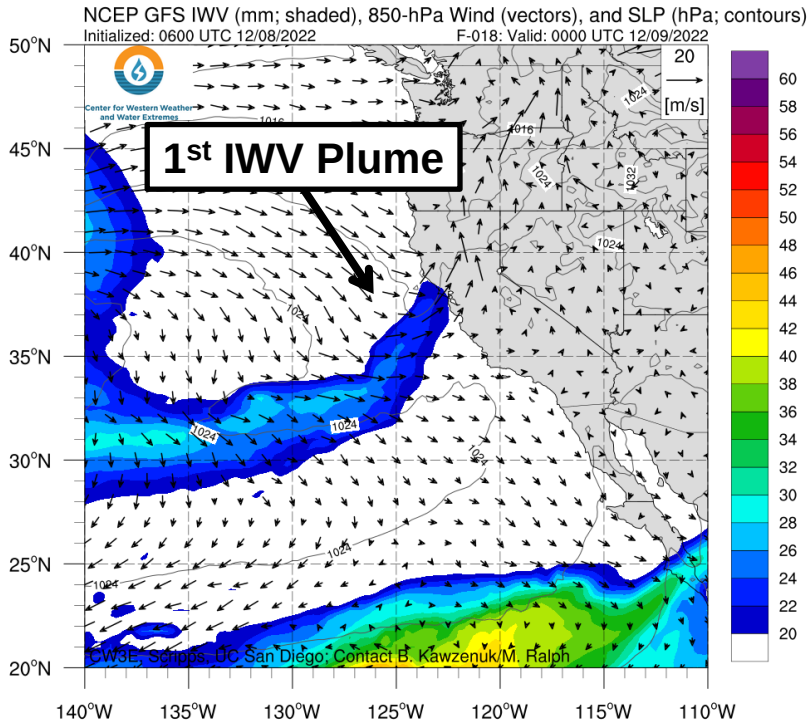
CW3E AR Outlook: 8 December 2022

GFS Model Forecast: Valid 4 PM PST 8 Dec (F-18)

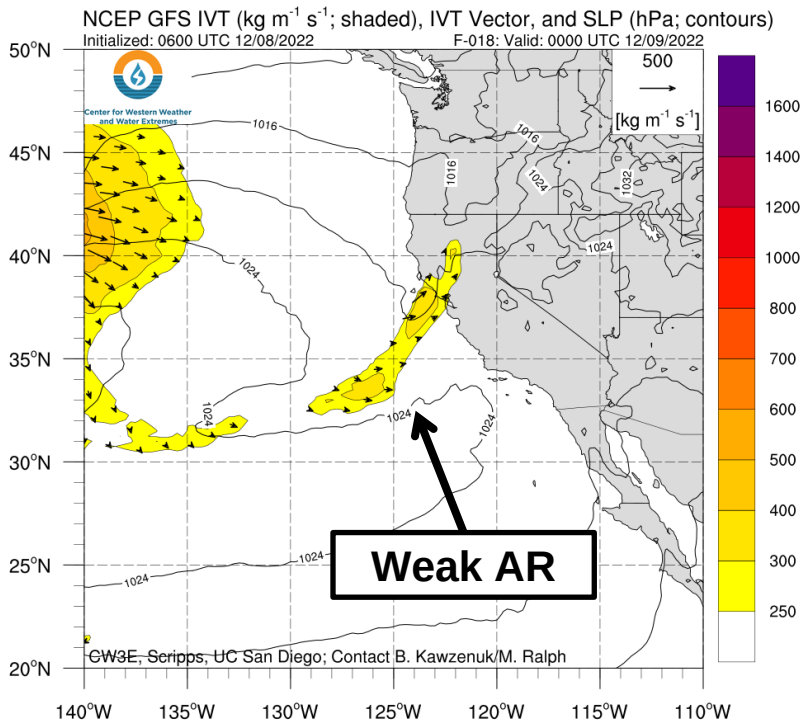
500-hPa Vorticity, Height, and Wind



IWV, SLP, and 850-hPa Wind



IVT and SLP

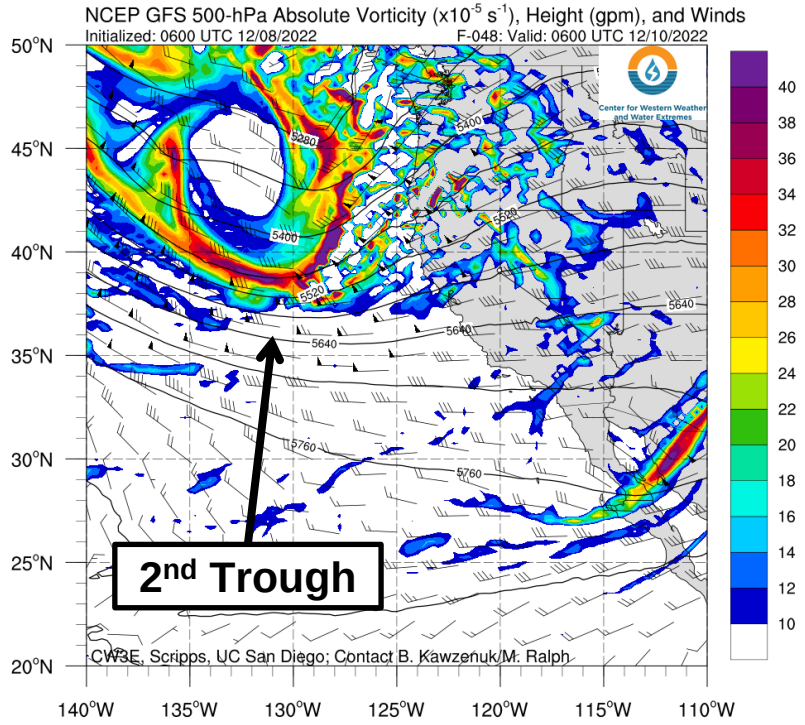


- A shortwave trough moving into the region will bring mid-level support for precipitation in the Coast Ranges of Oregon and Northern California late Thursday into early Friday morning
- The energy associated with this shortwave trough will interact with a region of moisture near the coast of California, leading to a narrow corridor of vapor transport along the coast
- This narrow plume of IVT is forecast to remain weak, with 300 kg m^{-1} s^{-1} of IVT in the core of the plume

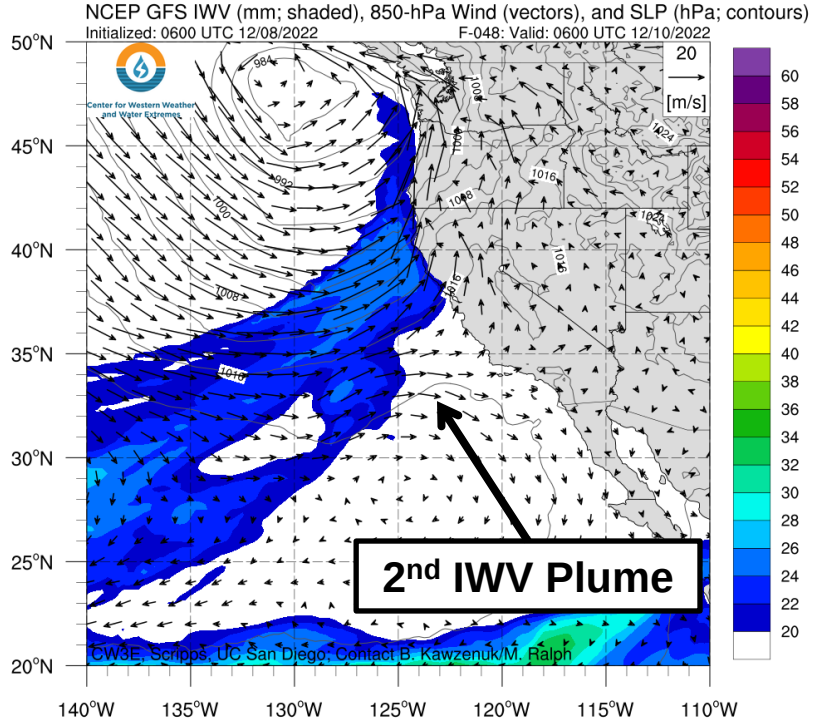
CW3E AR Outlook: 8 December 2022

GFS Model Forecast: Valid 10 PM PST 9 Dec (F-48)

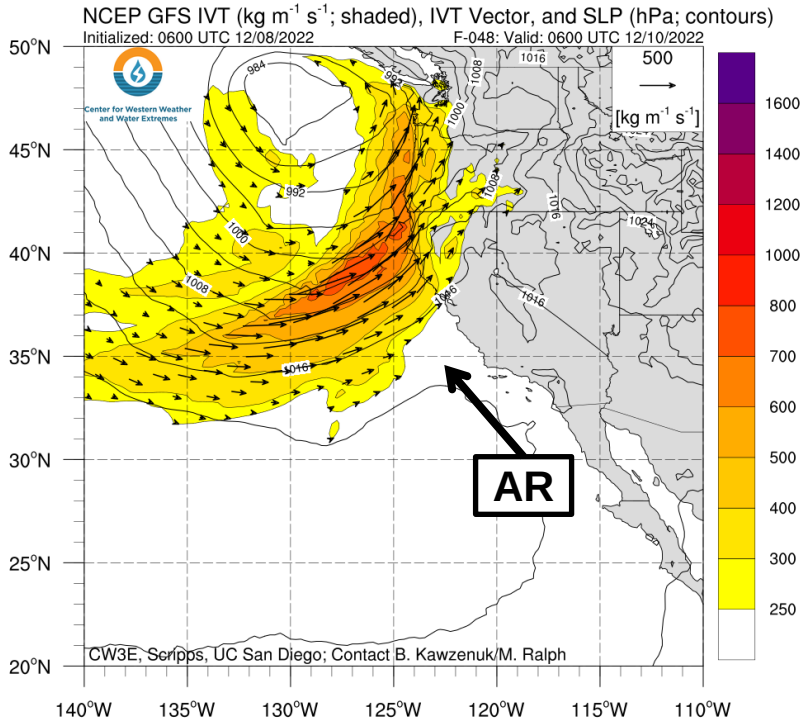
500-hPa Vorticity, Height, and Wind



IWV, SLP, and 850-hPa Wind



IVT and SLP

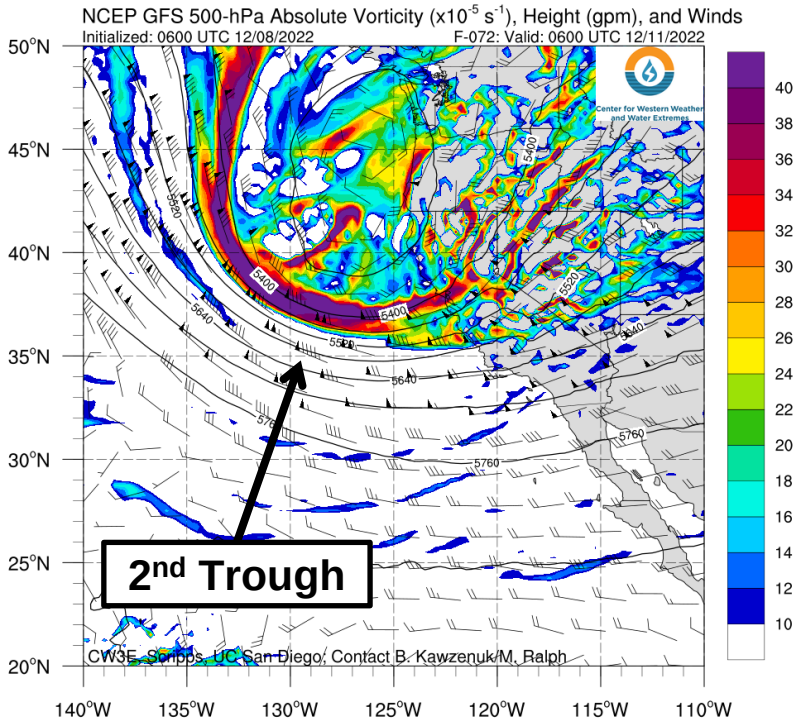


- A second shortwave trough moving into the region will provide mid-level support for a second AR making landfall Friday afternoon
- The second IWV plume which makes its way into the area will provide moisture to the system as it develops
- Moisture transport will be strongest during the early stages of this AR, with IVT values exceeding 700 kg m^{-1} s^{-1} during landfall

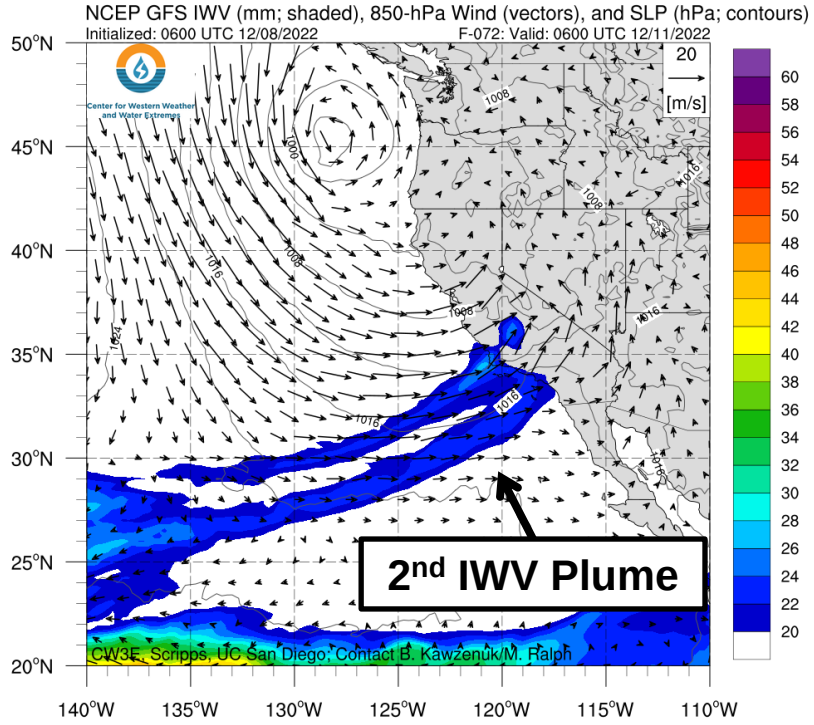
CW3E AR Outlook: 8 December 2022

GFS Model Forecast: Valid 10 PM PST 10 Dec (F-72)

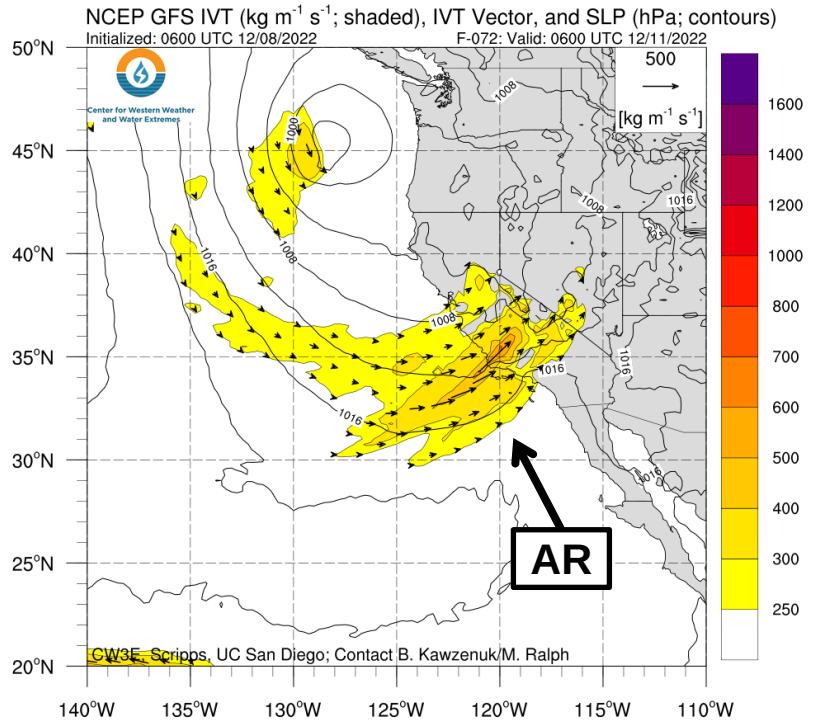
500-hPa Vorticity, Height, and Wind



IWV, SLP, and 850-hPa Wind



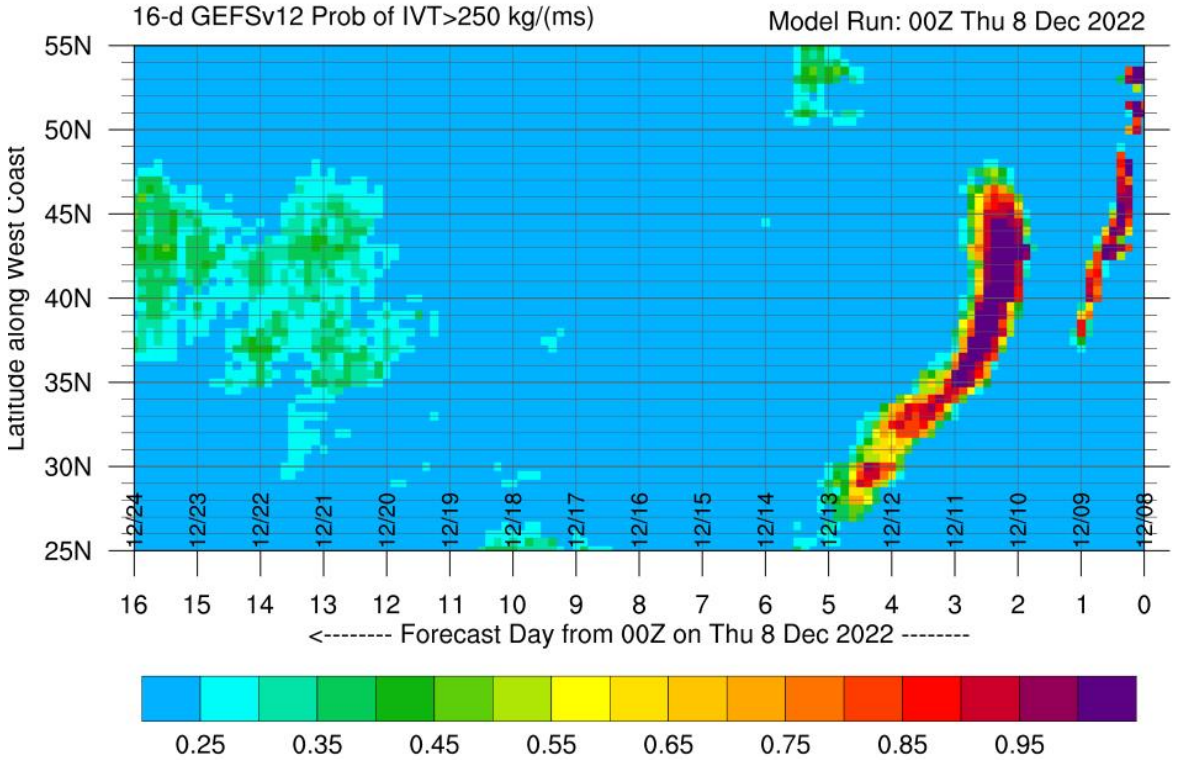
IVT and SLP

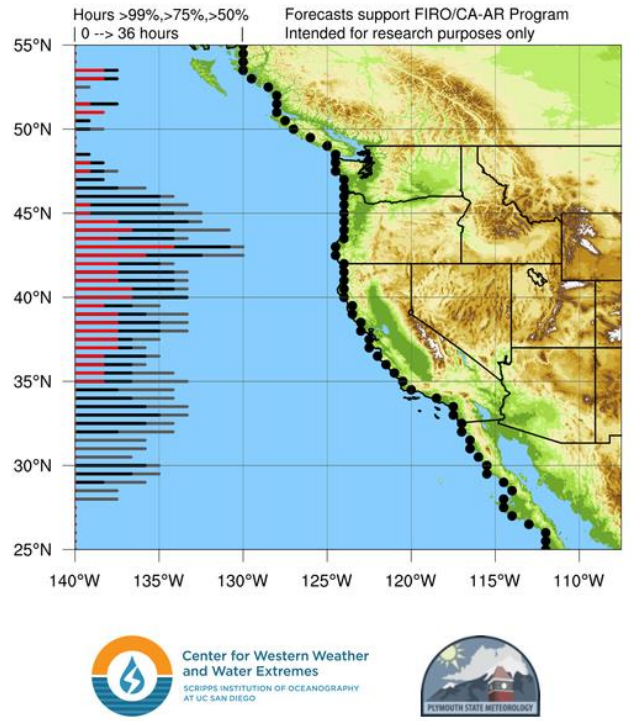


- The trough will shift southwest and continue to provide mid-level support to the AR as it slides down the coast of California
- This secondary IWV plume will weaken during this period, with the primary IWV plume splitting
- The AR will weaken slightly as it slides down the coast with IVT values of 400 kg m^{-1} s^{-1} present as it impacts southern California.

CW3E AR Outlook: 8 December 2022

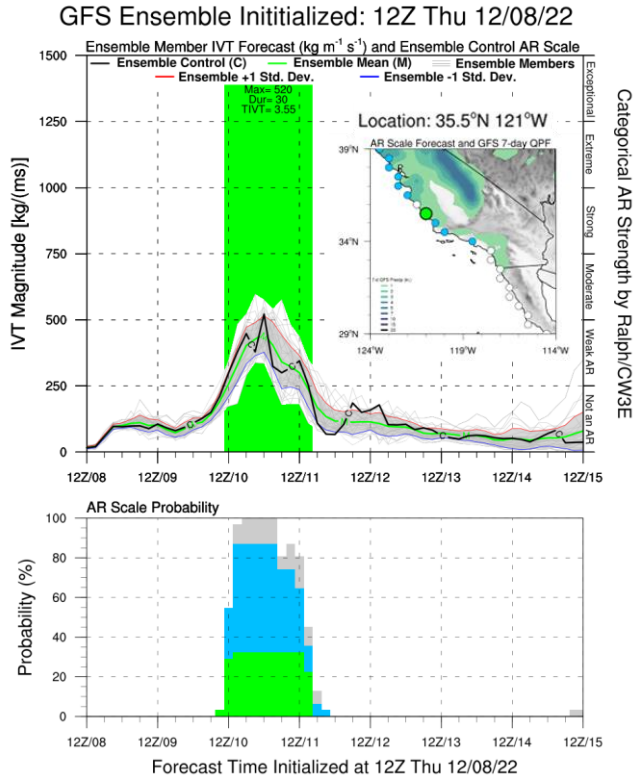
Probability of AR Conditions Along Coast (GEFS)





Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

AR Scale

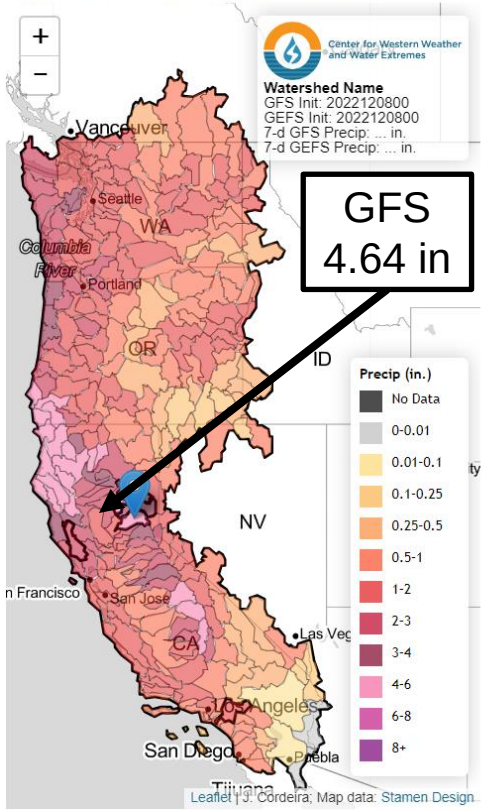


- The 00Z GEFS is showing high confidence (> 95%) in a period of AR conditions (IVT > 250 kg m^{-1} s^{-1}) along the coast of Oregon, Northern, and Central California between 10 and 11 December in association with the primary AR landfall
- Model confidence is slightly lower (up to 85 %) for a period of AR conditions along the coast of Southern California later in the event, from 11 into 12 December
- The GEFS Ensemble control member is forecasting AR2 conditions for central California near San Luis Obispo
- The strength of this AR and its impacts will be limited by the speed of the system, as it will move through the region quickly

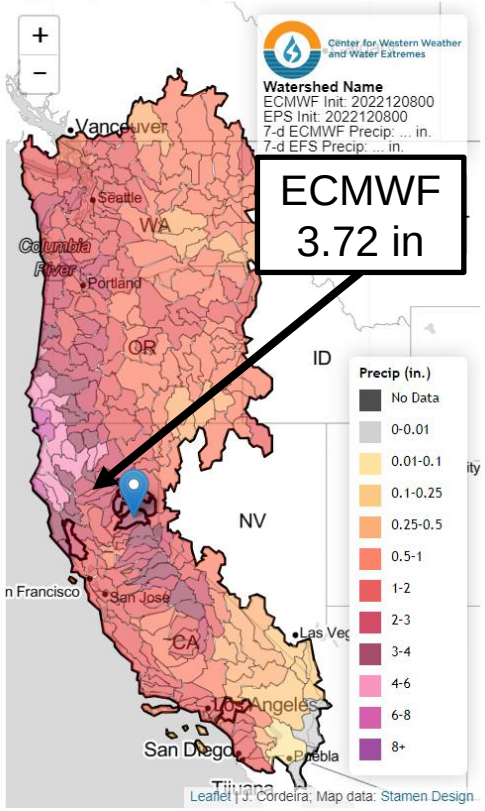
CW3E AR Outlook: 8 December 2022

Watershed Precipitation Forecasts (Upper Yuba Watershed Highlighted Below)

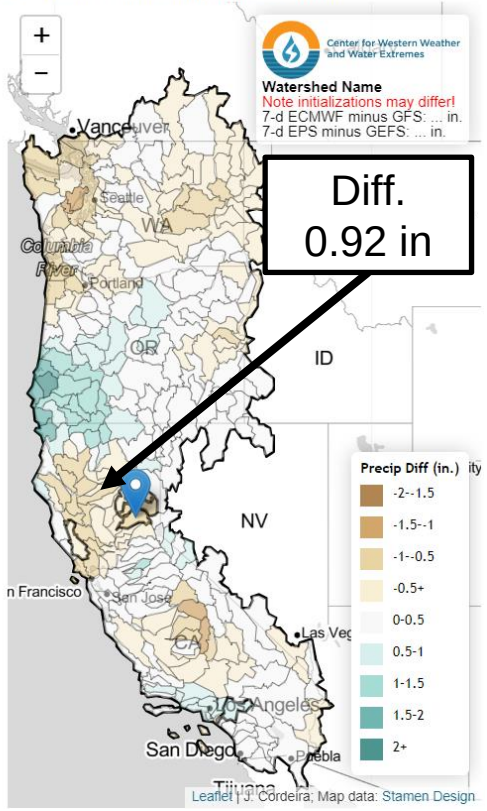
7-day GFS/GEFS Precipitation Forecasts

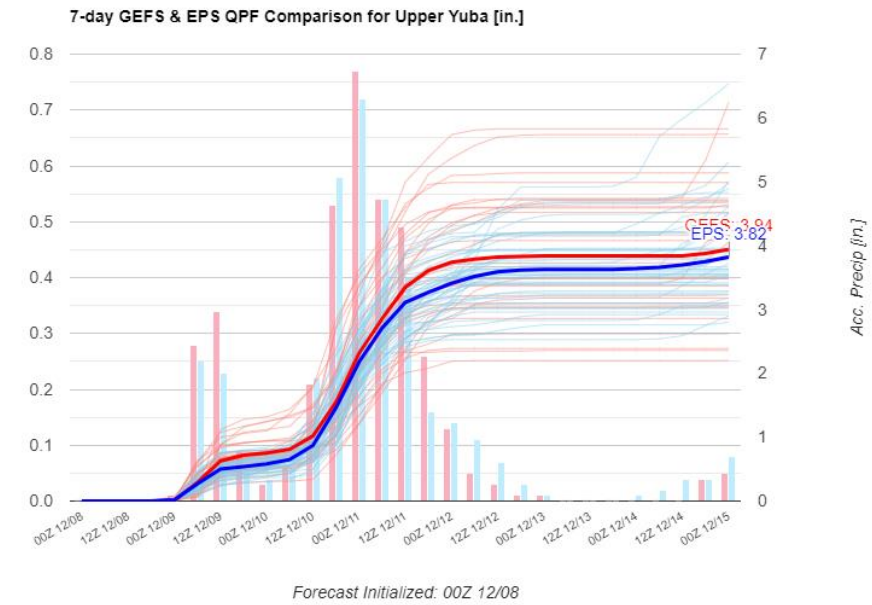


7-day ECMWF/EFS Precipitation Forecast



7-day Difference Precipitation Forecast

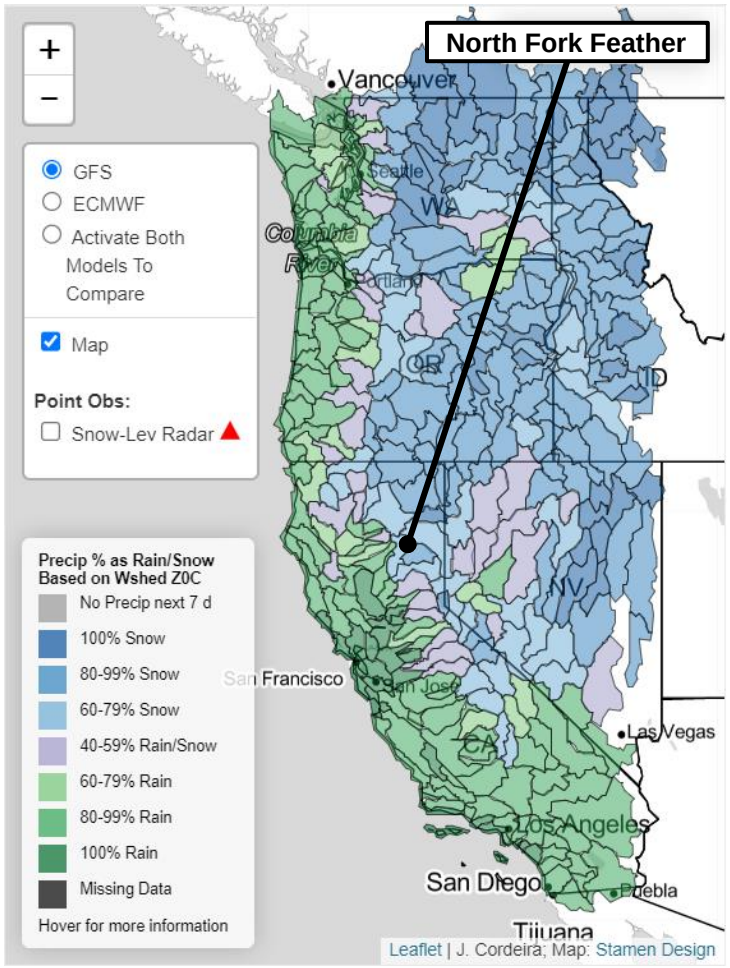


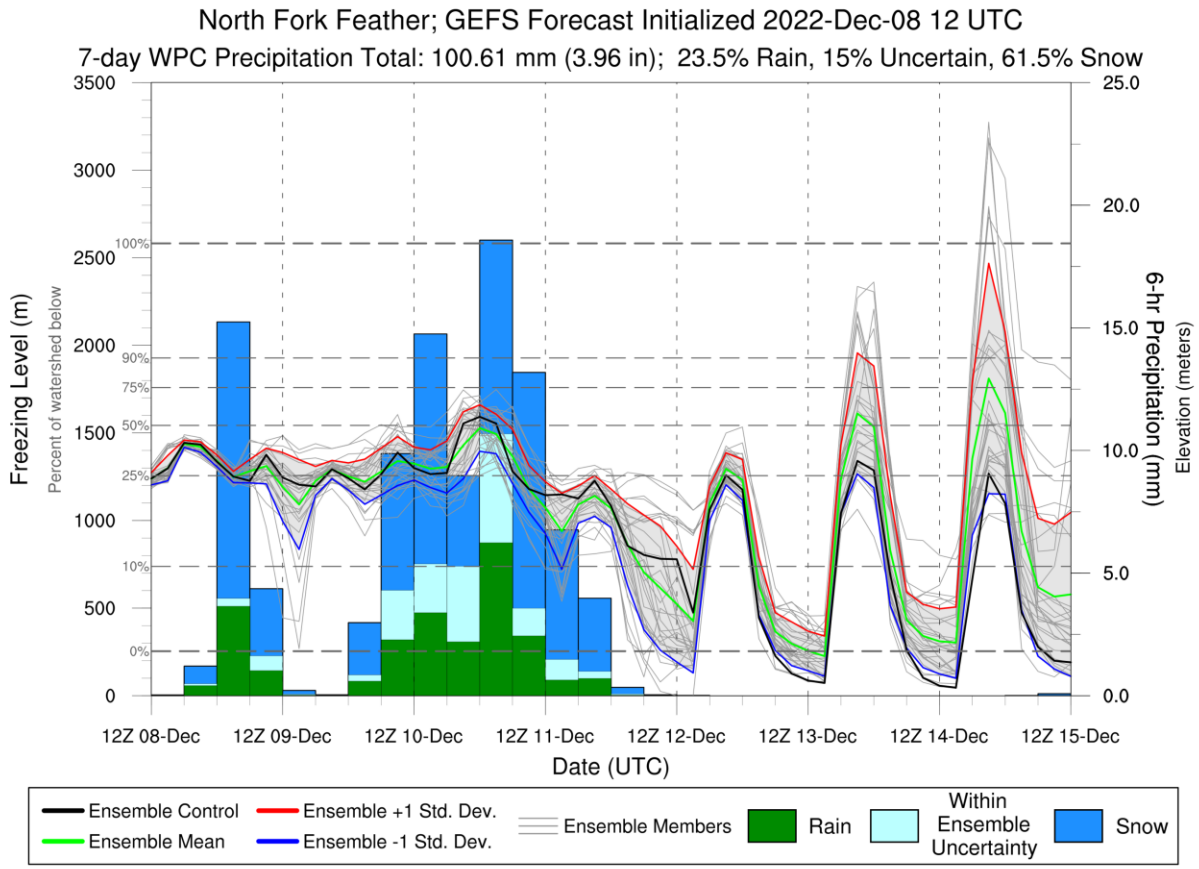


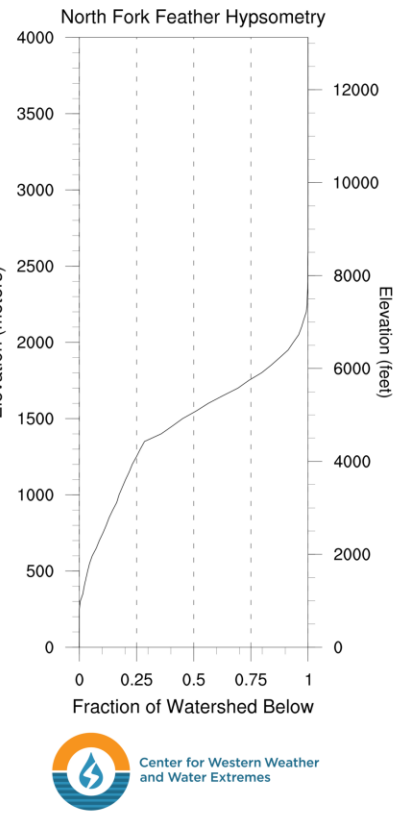
- The GFS 7-Day precipitation forecast for the Upper Yuba watershed is approximately 1 inch higher than the ECMWF
- Although the deterministic models are showing a 1-inch difference in precipitation totals during the period, the GEFS and ECMWF EPS ensemble mean precipitation forecast for this watershed are similar during this period
- Compared with the ECMWF EPS, the GEFS ensemble members show more spread in forecast precipitation amounts

CW3E AR Outlook: 8 December 2022

Freezing Level and Snow Forecasts



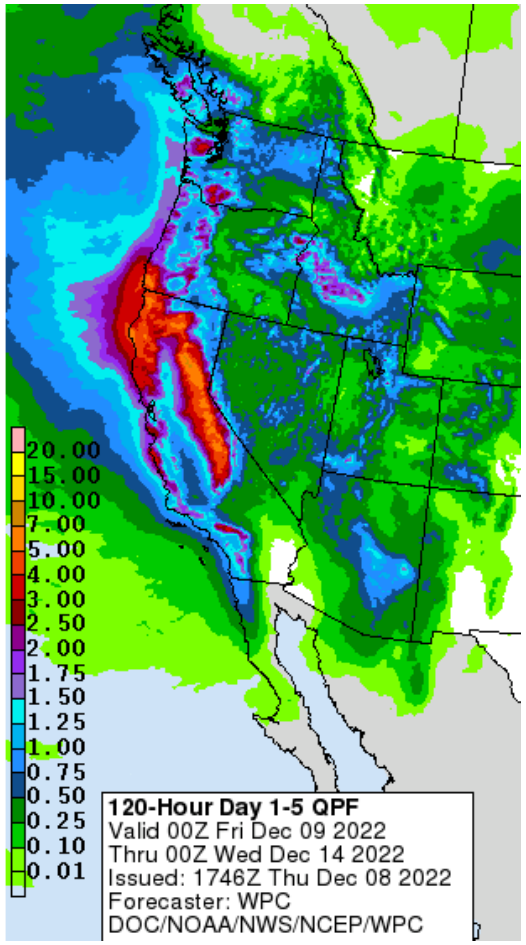




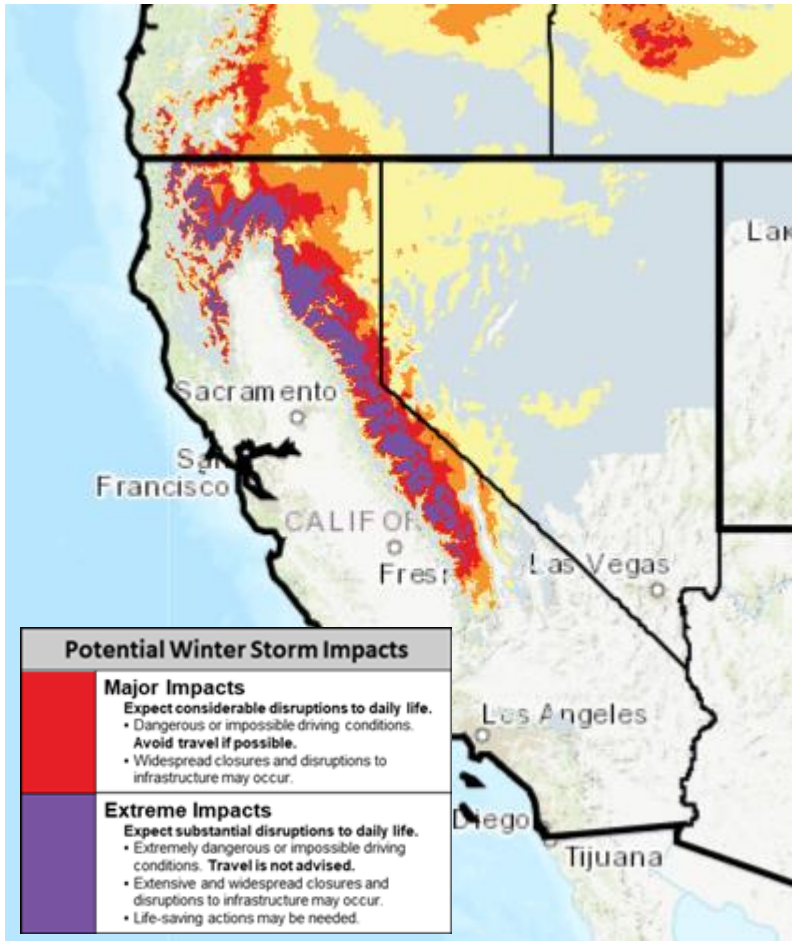
- Precipitation from this event will fall primarily as snow in the Klamath Mountains and Sierra Nevada
- Freezing levels will remain low, between 3,500 to 5,000 feet for the duration of this event

CW3E AR Outlook: 8 December 2022

NWS WPC QPF, Excessive Rainfall, and WSSI



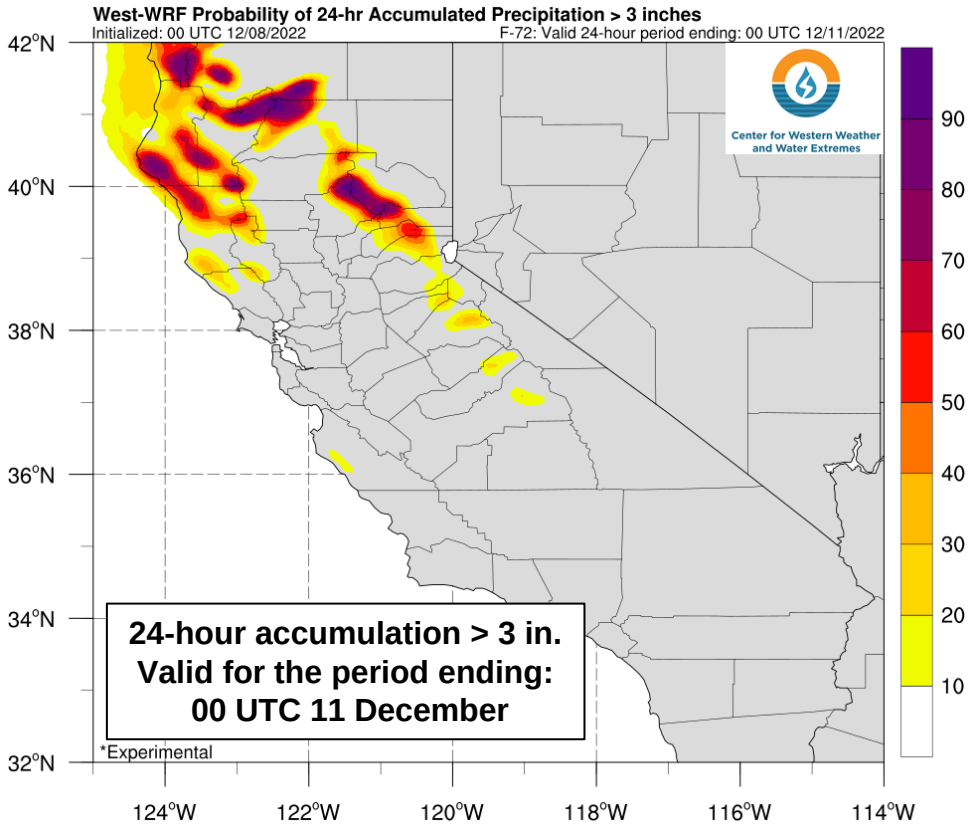
NWS Winter Storm Severity Index

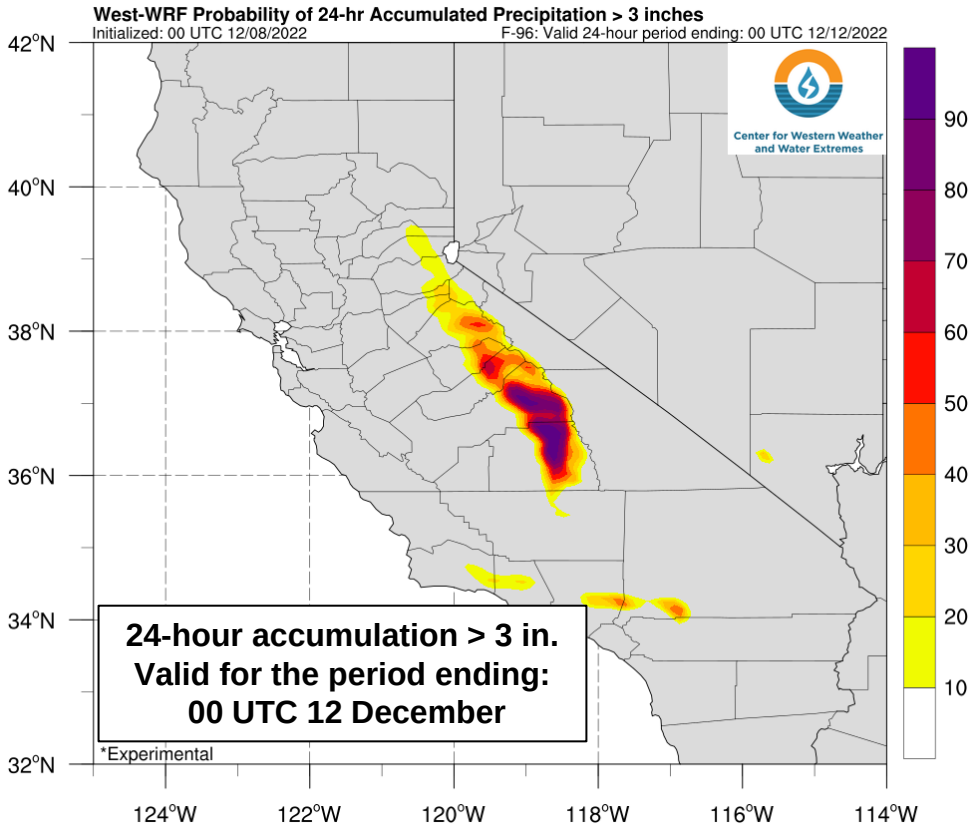


- NWS WPC's 5-Day QPF shows 3–6 inches in the highest elevations of the Coast Ranges and Sierra Nevada, also highlighting a marginal risk for excessive rainfall on Friday for coastal Northern California and on Saturday for coastal Central California
- NWS's Winter Storm Severity Index currently forecasts "Major" to "Extreme" impacts in the Sierra Nevada over the next three days

CW3E AR Outlook: 8 December 2022

CW3E Experimental West-WRF 24-hour Precipitation Forecast

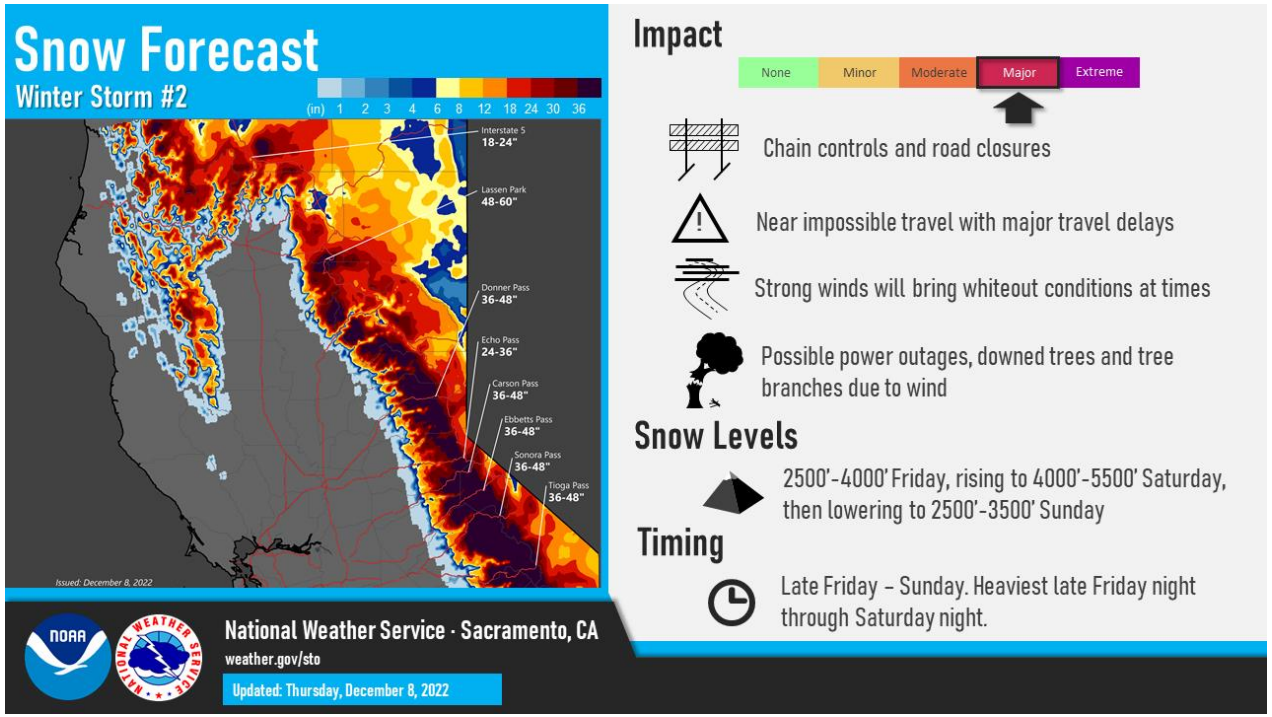


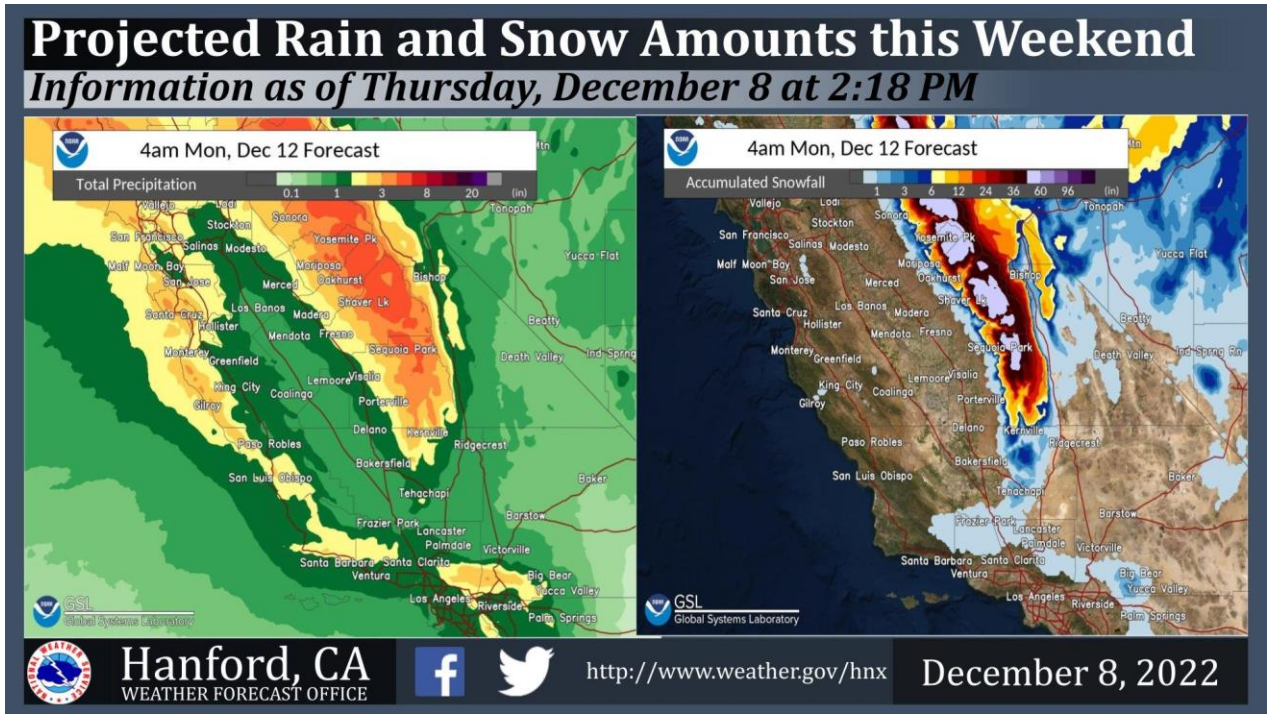


- CW3E's experimental 9-km West-WRF forecast shows high confidence (> 90%) in 24-hr precipitation accumulation >3 in. for this AR
- The highest probabilities for the period ending 00 UTC 12/11 are in the Coast Ranges of Northern California and the Northern Sierra
- Probabilities are highest for the Southern Sierra for the period ending 00 UTC 12/12

CW3E AR Outlook: 8 December 2022

NWS Weather Forecast Office Forecasts

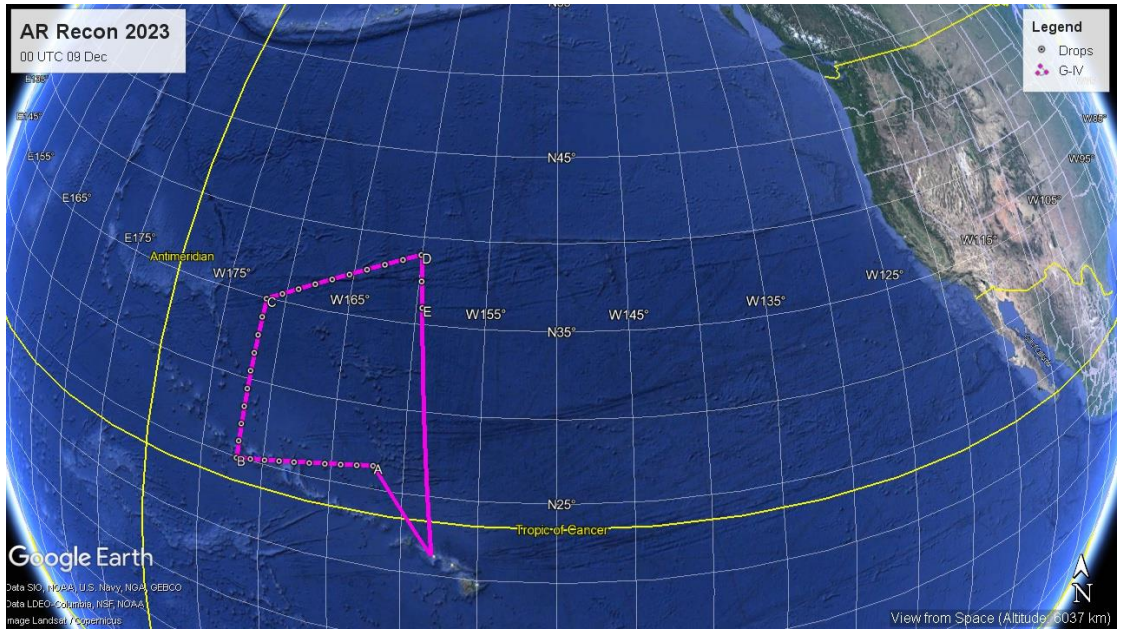


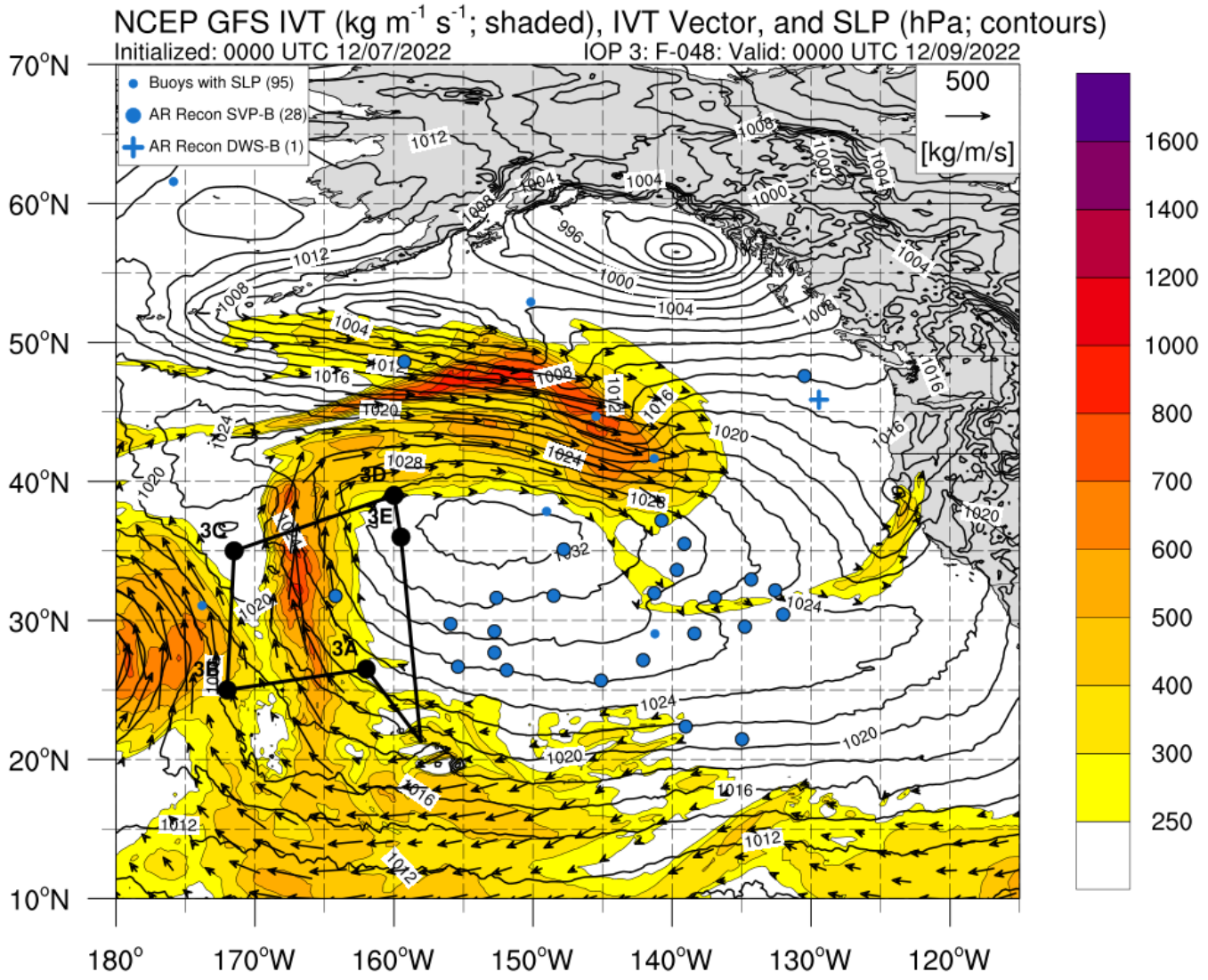


- NWS Sacramento highlighted the “Major” impact of this storm, with high winds and heavy snowfall forecast to include snowfall totals of 48–60 inches in the highest elevations of the Northern Sierra
- NWS Hanford latest forecast has snowfall totals of 36–60 inches across the Southern Sierra during this storm

AR Recon 2023 – IOP3 Forecast for 9 December 2022

- This mission will be the first mission of CW3E's 2023 Atmospheric River Reconnaissance to involve NOAA's GIV
- Crews from NOAA's Office of Marine and Aviation Operations will deploy from Honolulu, HI to sample targets over the Pacific
- NOAA's Gulfstream IV research aircraft will deploy ~30 dropsondes, collecting critical meteorological data
- This data will be fed back into global forecast models, to improve weather forecasts in the region





AR Recon 2023 – IOP4 Forecast for 10 December 2022

- Crews from NOAA's Office of Marine and Aviation Operations will deploy from Honolulu, HI to sample targets over the Pacific
- NOAA's Gulfstream IV research aircraft will deploy ~30 dropsondes, collecting critical meteorological data
- This data will be fed back into global forecast models, to improve weather forecasts in the region