CW3E Event Summary: 10 November 2022

- **A Moderate Strength Atmospheric River with Strong Dynamical Forcing Produced Heavy Precipitation Throughout California**
- California was impacted by a dynamic storm system on 7 and 8 November that featured both a landfalling AR and potent upper-level trough that combined to produce strong upslope moisture flux and heavy precipitation
- The AR was ranked as an AR2 (based on the Ralph et al. 2019 AR Scale) was observed in coastal San Diego County with AR conditions persisting for 24 consecutive hours with maximum IVT values exceeding 500 kg m^{-1} s^{-1}
- Precipitation totals in the Transverse Ranges of Southern California exceeded 8 inches with widespread totals around the state exceeding 2 inches
- More than 2 feet of snow fell throughout the Sierra Nevada Mountains with locations in the Central and Southern Sierra picking up as much as 5 feet of snow
- CW3E's surface meteorology station at Seven Oaks Dam observed 2 inches of rain during the event, accounting for roughly 60% of water year to date precipitation at the dam
- Debris flows occurred in the vicinity of the El Dorado and Apple fires, which were under evacuation warnings, as well as in other parts of the San Bernardino Mountains causing HWY 38 and 18 to close for a short time
- The NWS confirmed that an EF-0 tornado touched down on 8 Nov near Galt in Sacramento County

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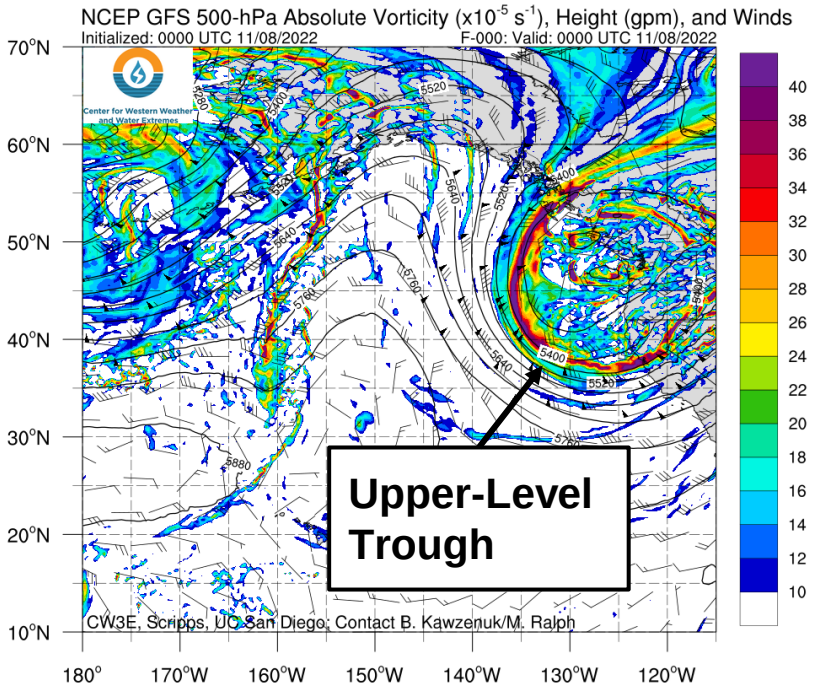
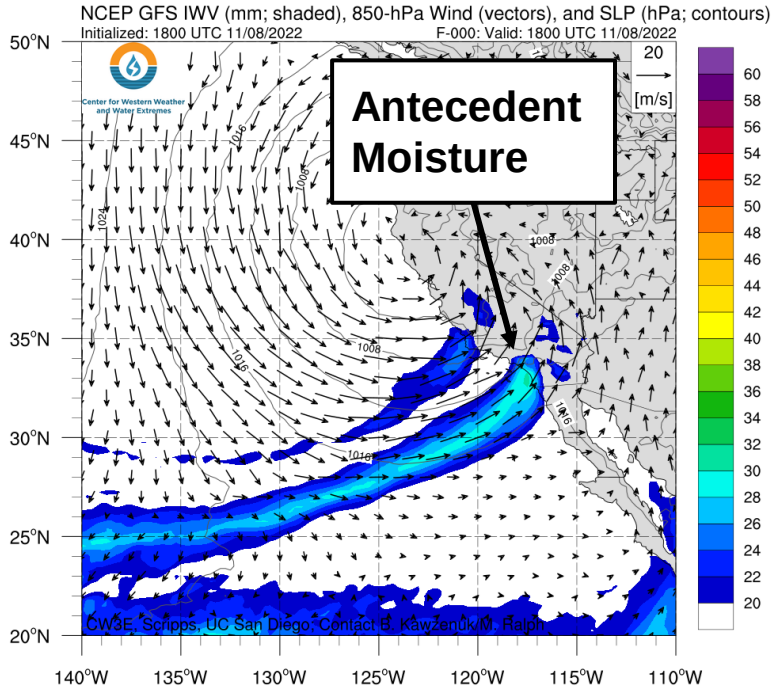
500-hPa, IWV, and IVT Analysis

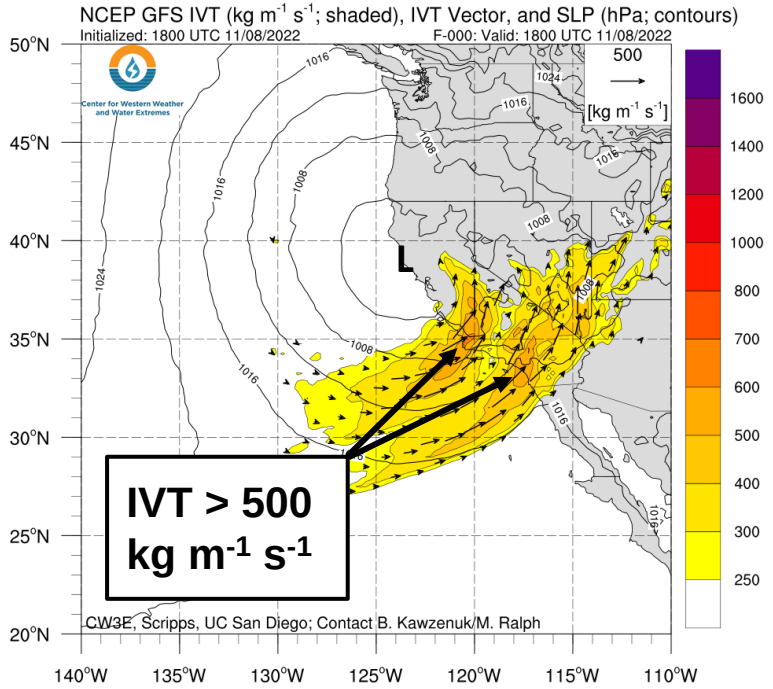
(A) Valid 4 PM PT 7 Nov



(B) Valid 10 AM PT 8 Nov



(C) Valid 10 AM PT 8 Nov



- An upper-level trough that formed in the Gulf of Alaska moved south along the west coast of North America (Figure A) and interacted with a weakening AR in Northern California
- Antecedent moisture associated with the weakening AR moved south into Southern California (Figure B)
- Strong low-to-mid level winds associated with the upper-level trough (Figure B) resulted in enhanced IVT and AR conditions in Southern California (Figure C)

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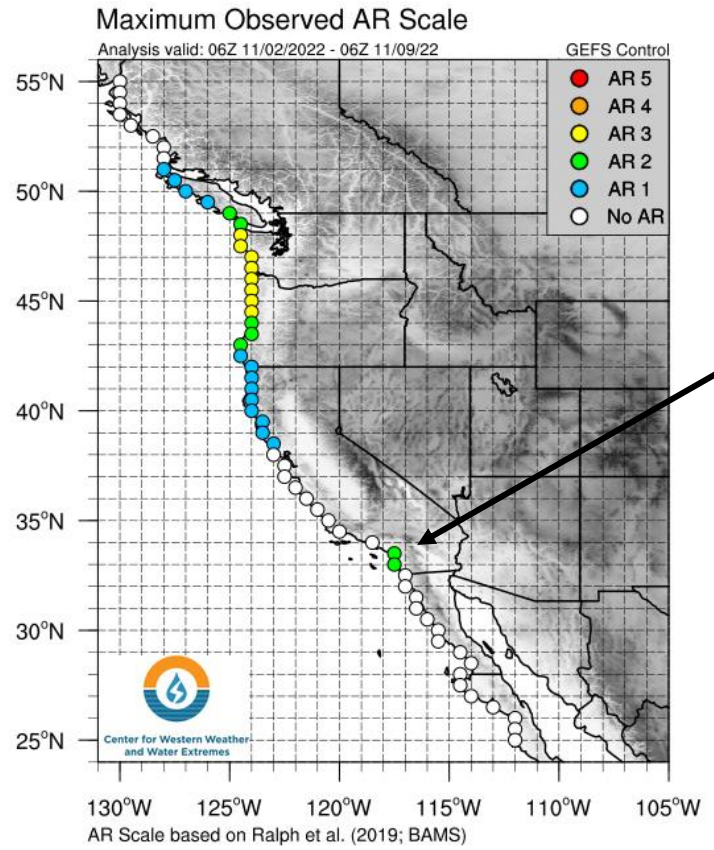
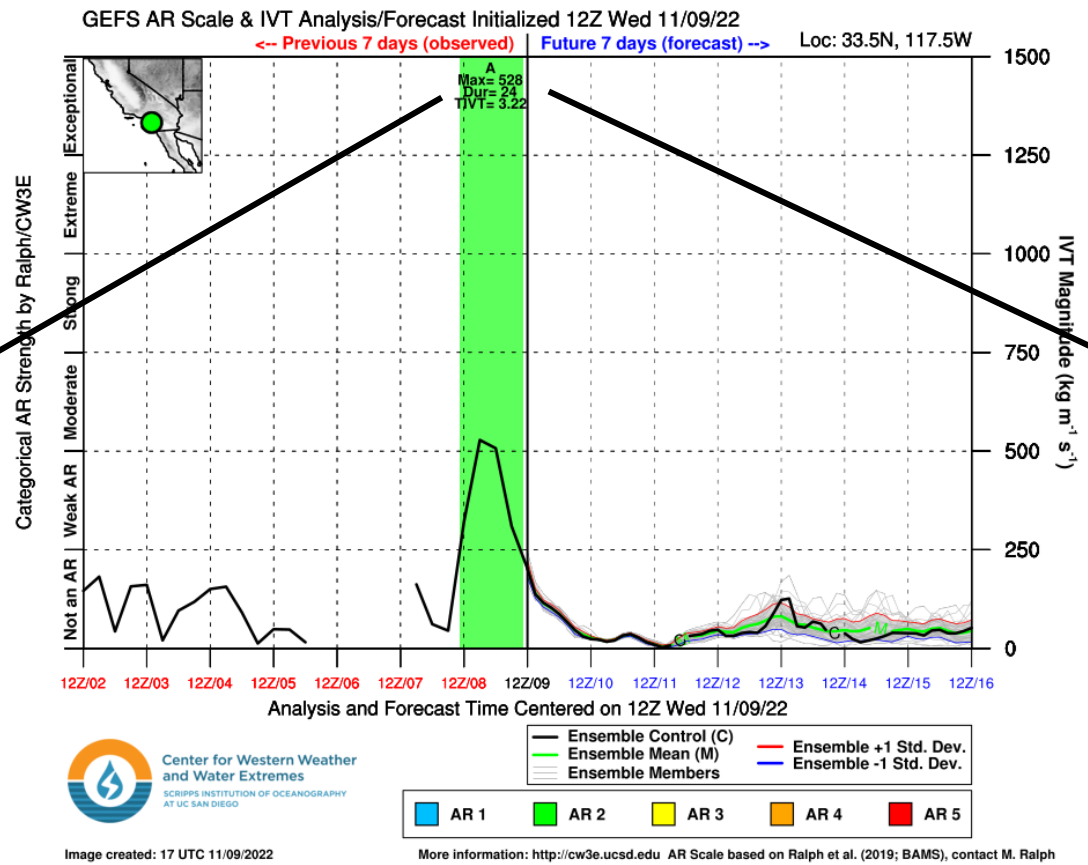
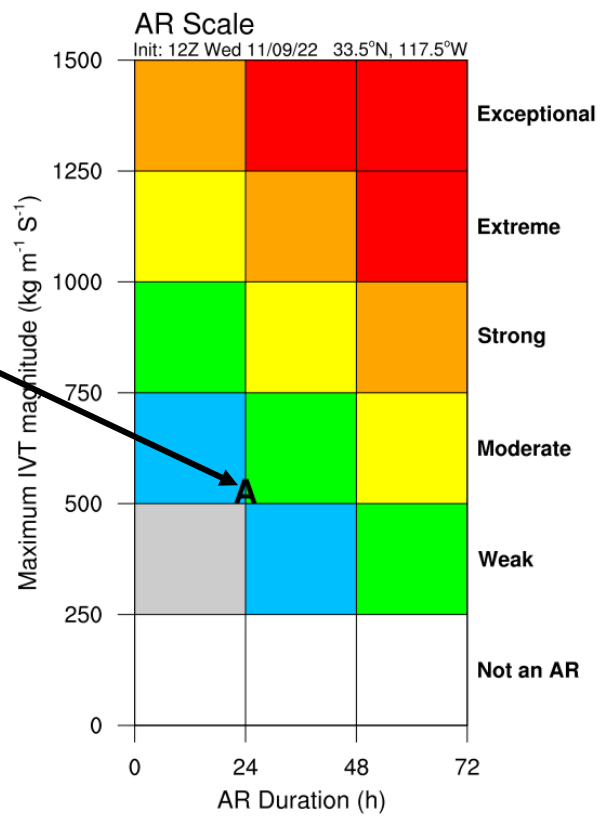
GEFS AR Scale







- AR 2 conditions were observed along coastal Southern California with this event
- San Diego County, CA, 33.5N, 117.5W experienced a maximum IVT value of 528 kg m^{-1} s^{-1} with a total of 24 hours of AR conditions

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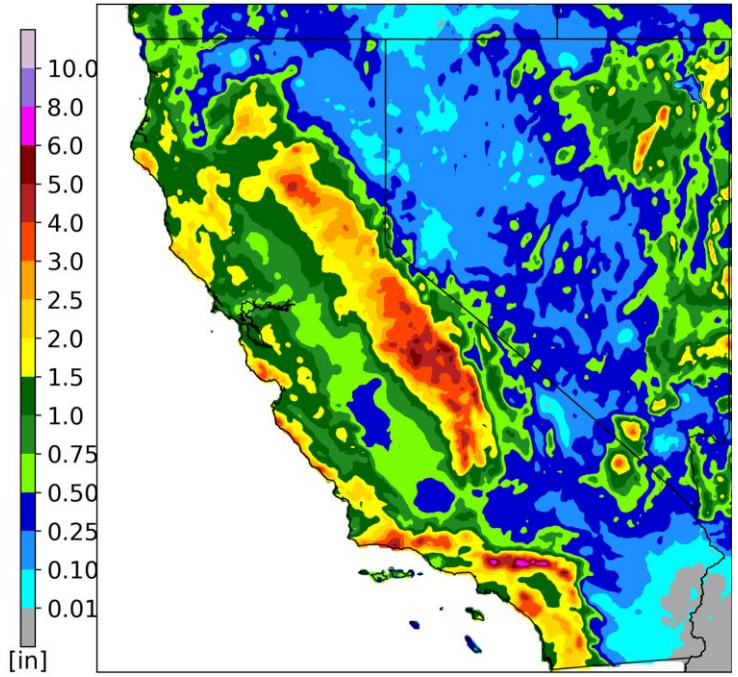
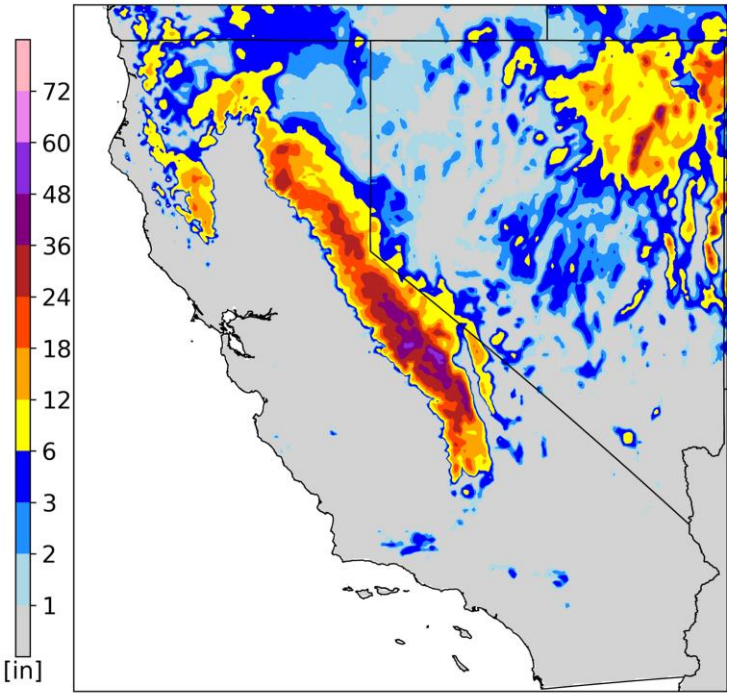
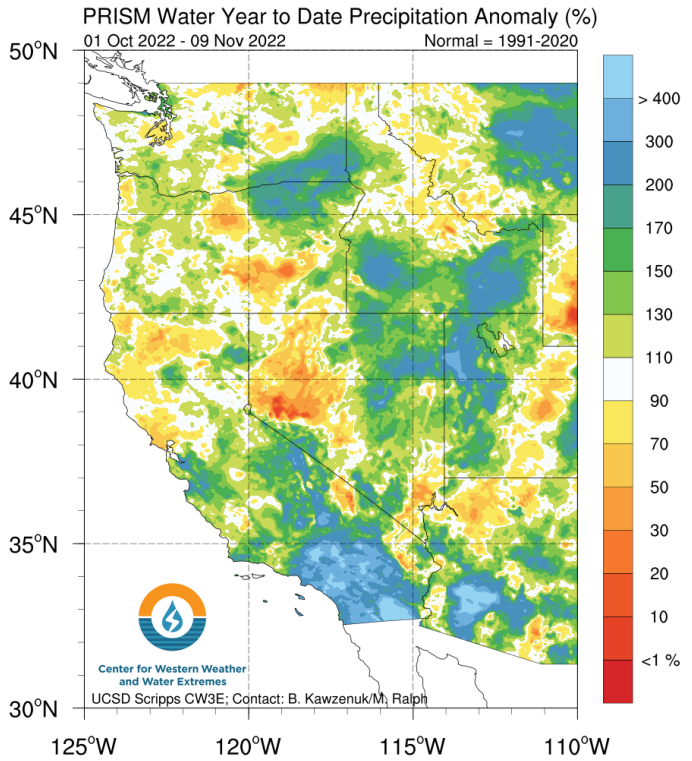
NCEP Stage IV 48-h QPE
Valid: 4 AM PT 7 Nov - 4 AM PT 9 Nov



NOHRSC 48-h Snowfall Analysis
Valid: 4 AM PT 7 Nov - 4 AM PT 9 Nov



PRISM WY to Date
Valid: 1 Oct - 9 Nov



- The storm produced moderate-to-heavy precipitation throughout California with the heaviest precipitation (>6”) in the Southern Sierra and Transverse Ranges of Southern California
- More than 2 feet of snow fell throughout the Sierra Nevada Mountains with locations in the Central and Southern Sierra picking up as much as 5 feet of snow
- PRISM is indicating a great start to the wet season with many locations in the US West experiencing normal to much above normal water year precipitation to date

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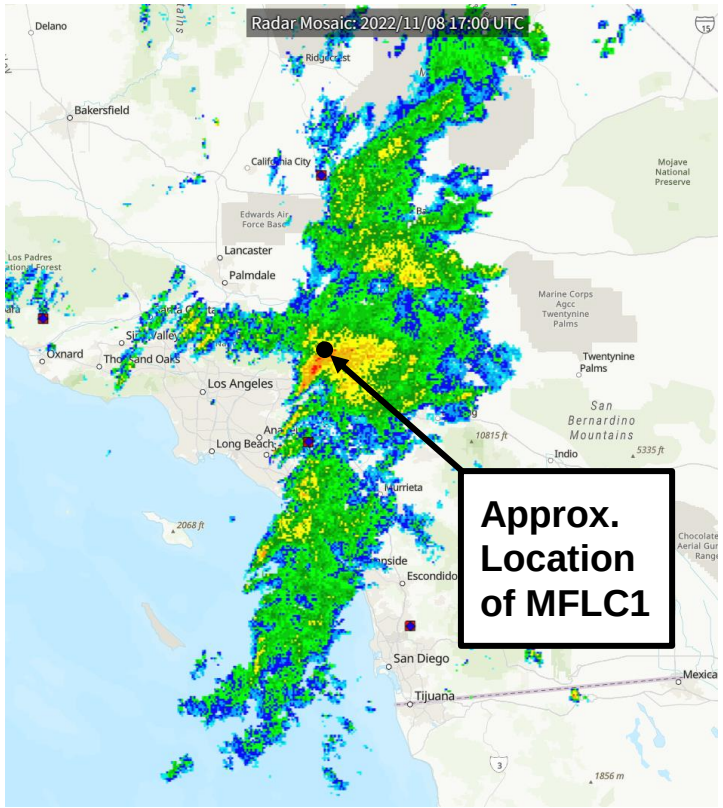
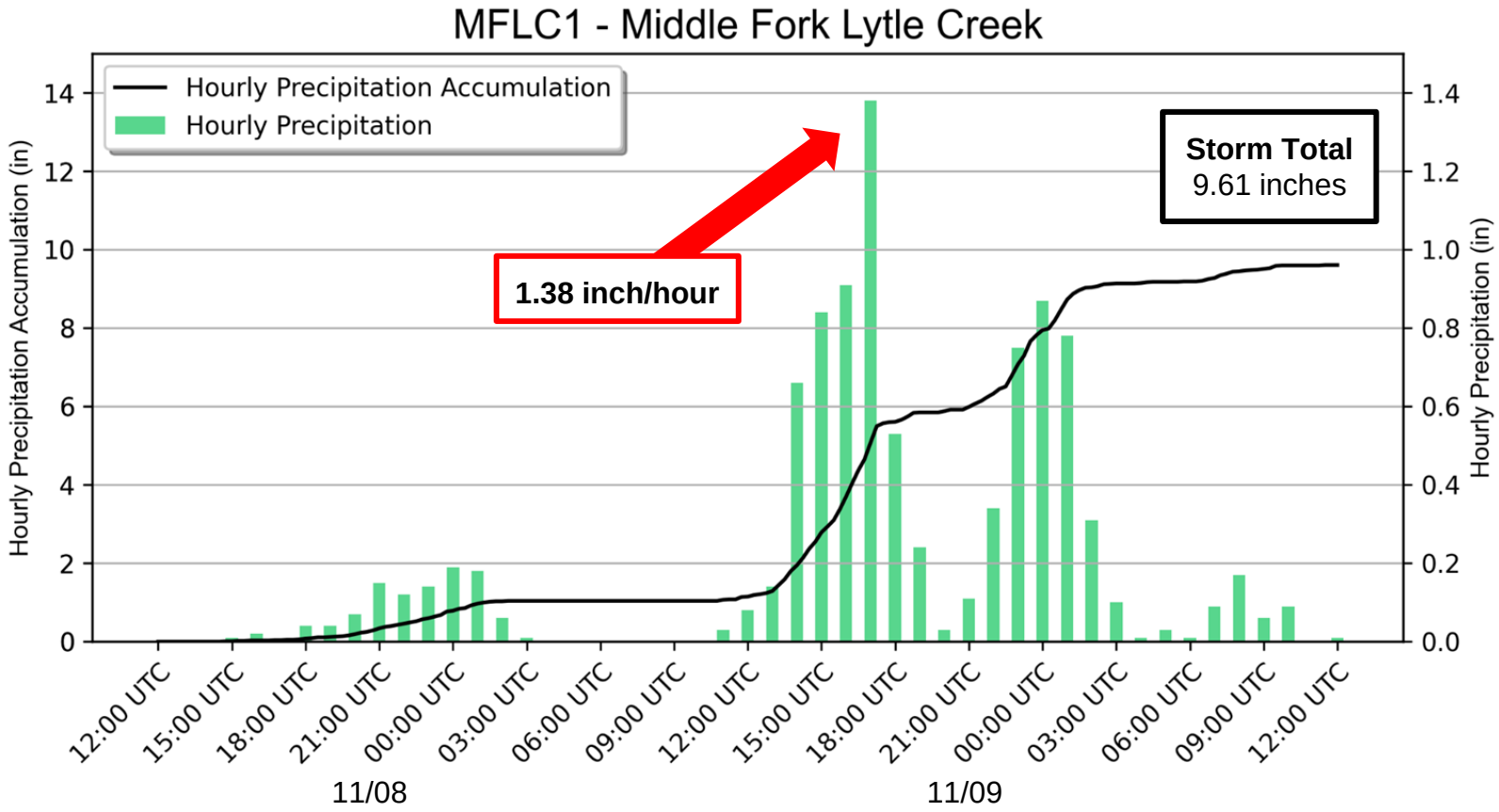
Precipitation Analysis

NWS Radar Mosaic



https://www.ncei.noaa.gov/maps/radar/



- A frontal rainband associated with the AR produced the heaviest precipitation over the San Gabriel Mountains
- The Middle Fork Lytle Creek weather station observed 9.61 inches over the storm period
- Rainfall rates at this site exceeded half an inch per hour for a 5-hour period between 5–10 AM PT on 08 Nov (13–18 UTC)
- Maximum hourly rainfall observed during the storm period was 1.38 inches

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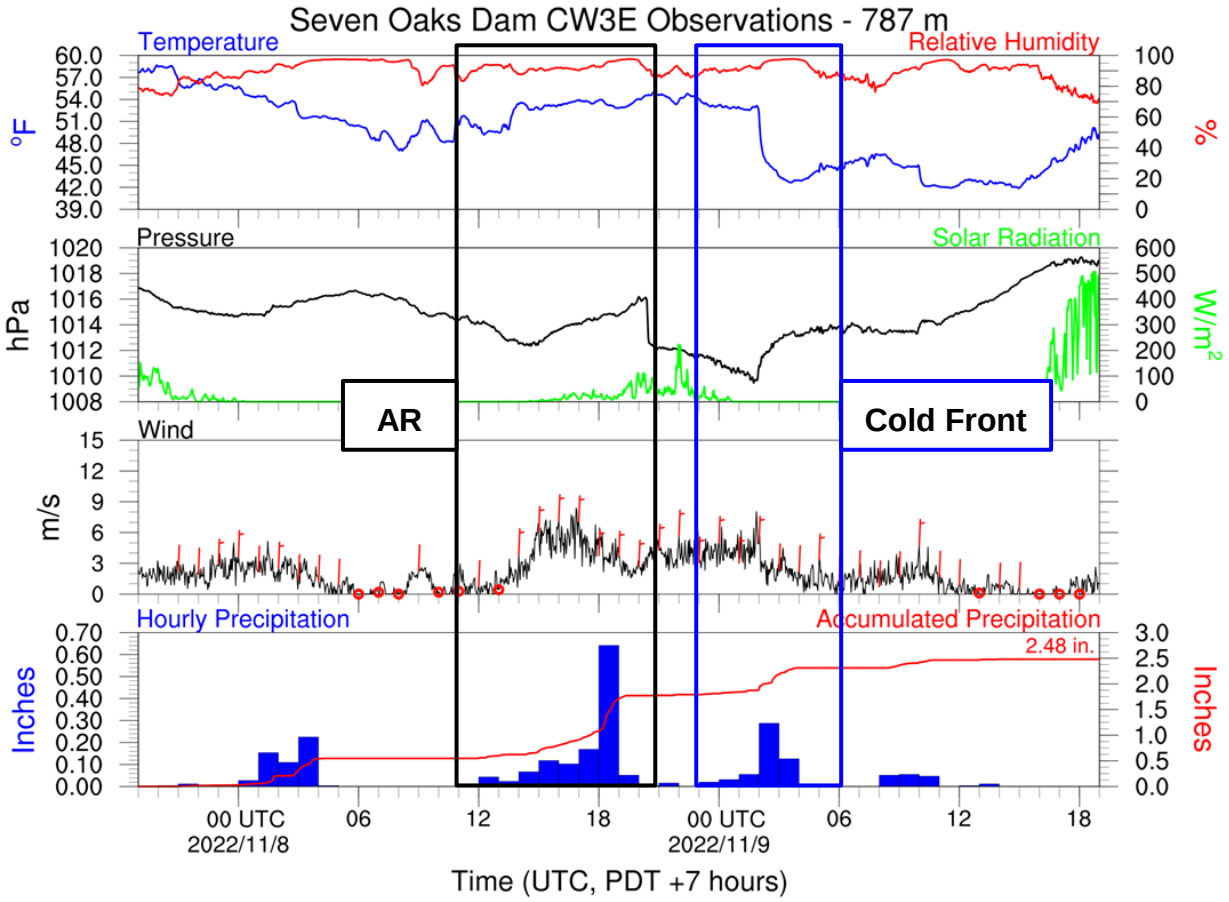
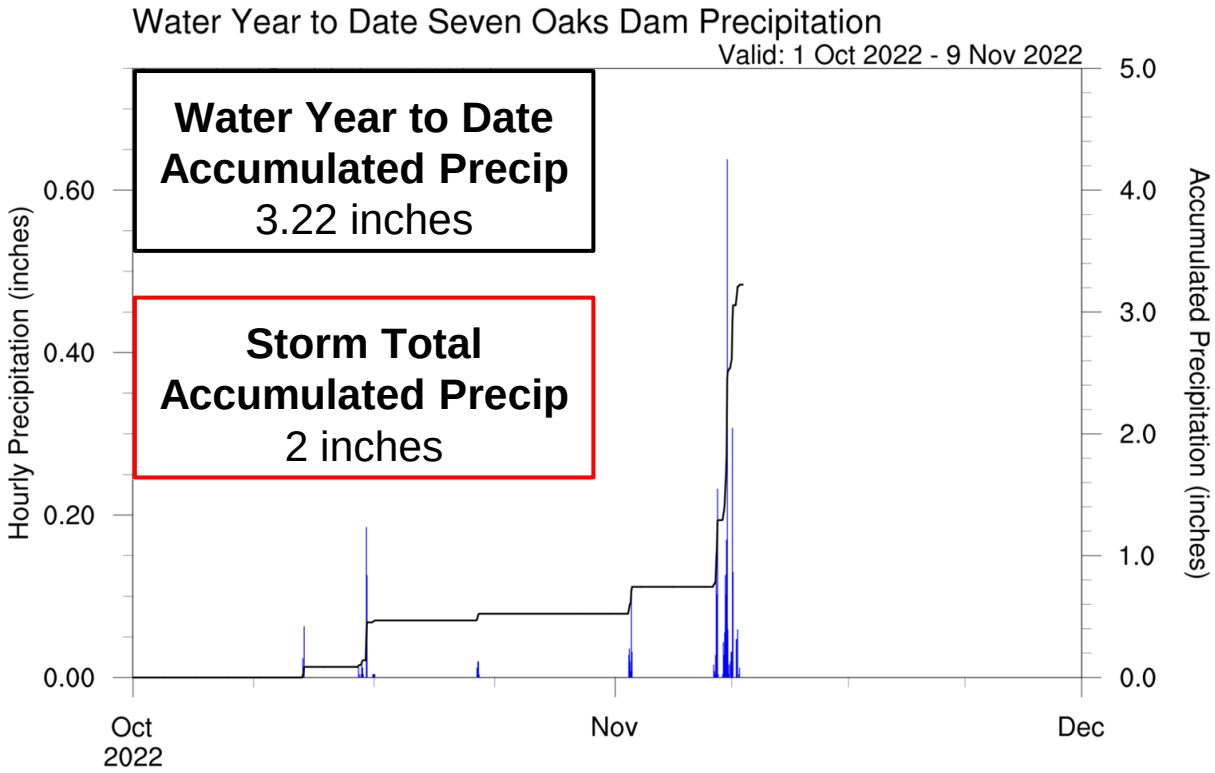
Seven Oaks Dam - CW3E Observations





- CW3E's surface meteorology station at Seven Oaks Dam captured both the AR and cold frontal passage
- **AR passage** is characterized by the heaviest precipitation, while **frontal passage** is shown with the steep drop in temperature
- Approximately 2 inches of rain fell over 24 hours at Seven Oaks during this AR event
- This represents roughly 60% of total water year to date precipitation at the site (3.22 inches)

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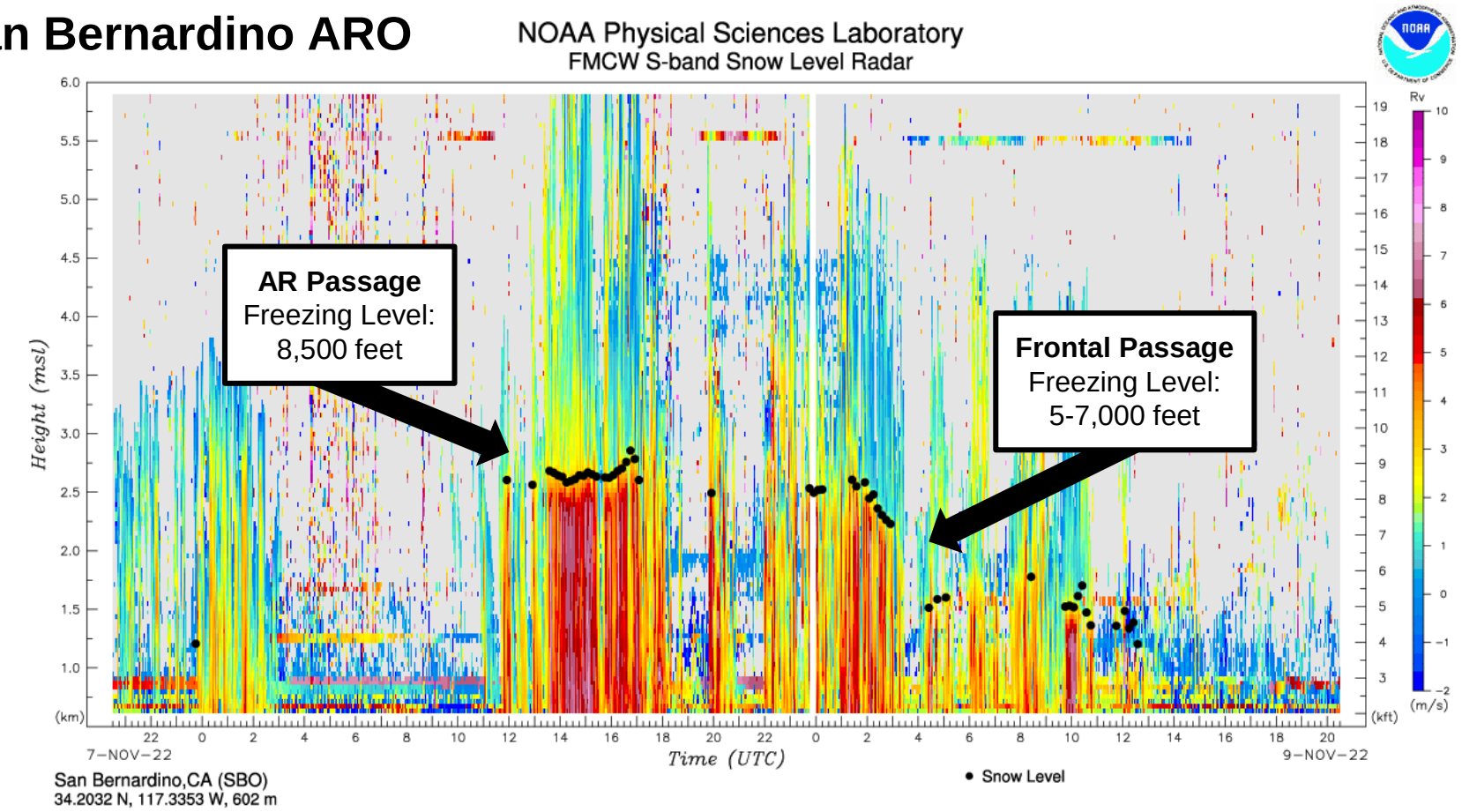
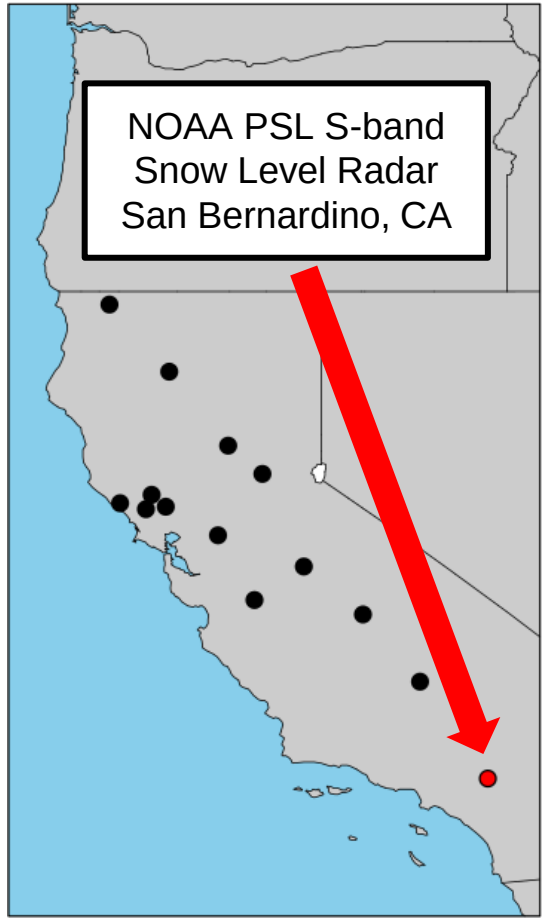
San Bernardino ARO





- A vertically-pointed S-band radar at the Atmospheric River Observation site located in San Bernardino captured precipitation from both the AR passage and the following cold frontal passage
- The initial precipitation from the event is characterized by freezing levels above 8,500 feet in the atmosphere
- As the cold front passed, observed freezing levels in the precipitation band fell to below 5,000 feet

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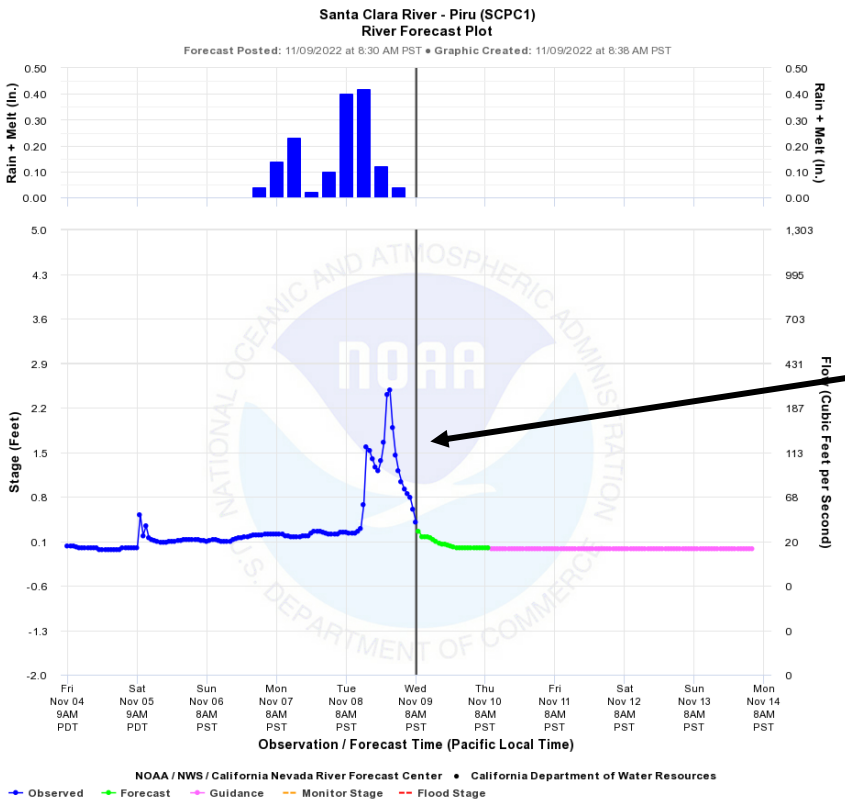
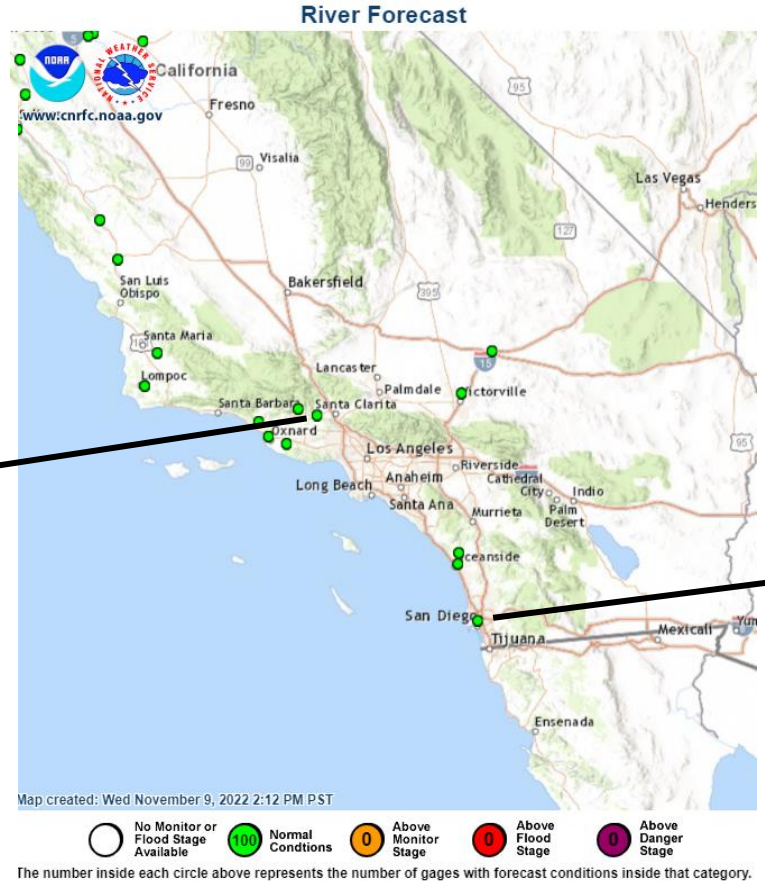
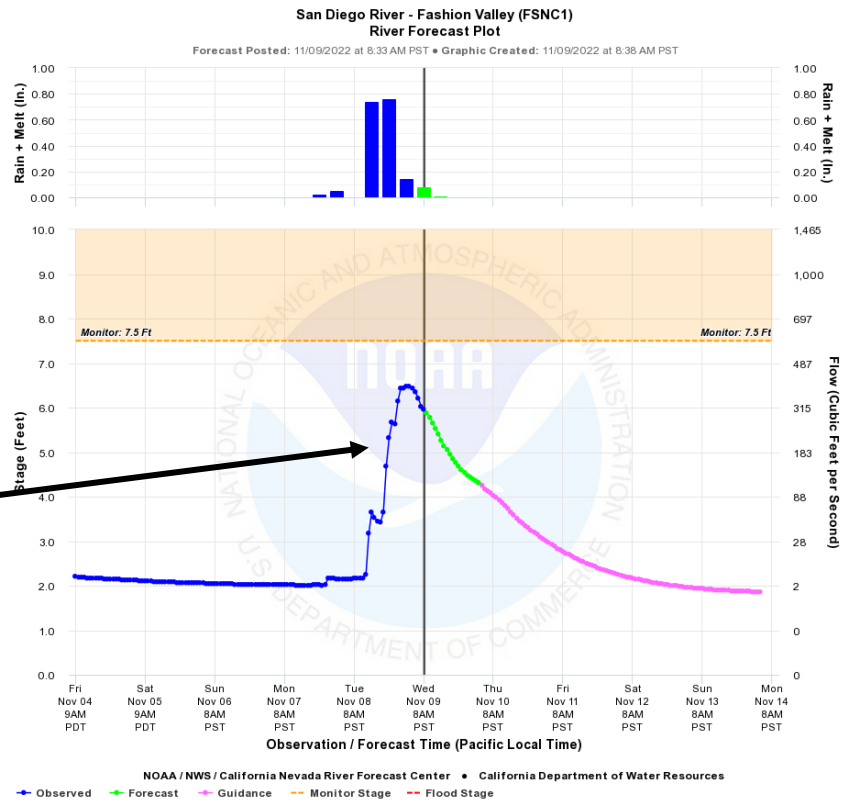
Hydrologic Impacts







- Precipitation from this event led to rising river levels across Southern California
- River levels at the Santa Clara River at Piru increased 2 feet in response to this event
- The San Diego River at Fashion Valley rose 4.5 feet to within 1 foot of Monitor Stage
- Riverine flooding was not observed due to dry antecedent soil conditions

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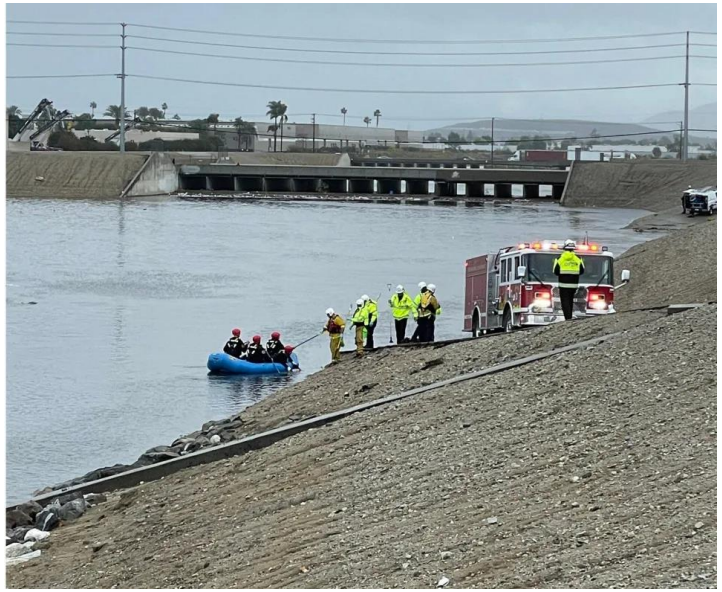
Water rescue in Ontario, CA



Source: Rene Ray De La Cruz, Victorville Daily Press

Debris flow in Oak Glen, CA

Source: KTLA news via OnScene.TV

EF-0 tornado near Galt, CA

Source: KCRA via Chet Flem

- One fatality was reported after six people were swept away in a wash in Ontario, CA. Three had to be rescued
- Hwy 38 and 18 were both closed for a short time due to mud and debris from the heavy rain
- Areas around the El Dorado and Apple fire burn scars were under evacuation warnings due to the possibility of debris flows
- The NWS confirmed that an EF-0 tornado touched down on 8 Nov near Galt in Sacramento County. The tornado knocked down power lines and ripped off the tin roof of a barn