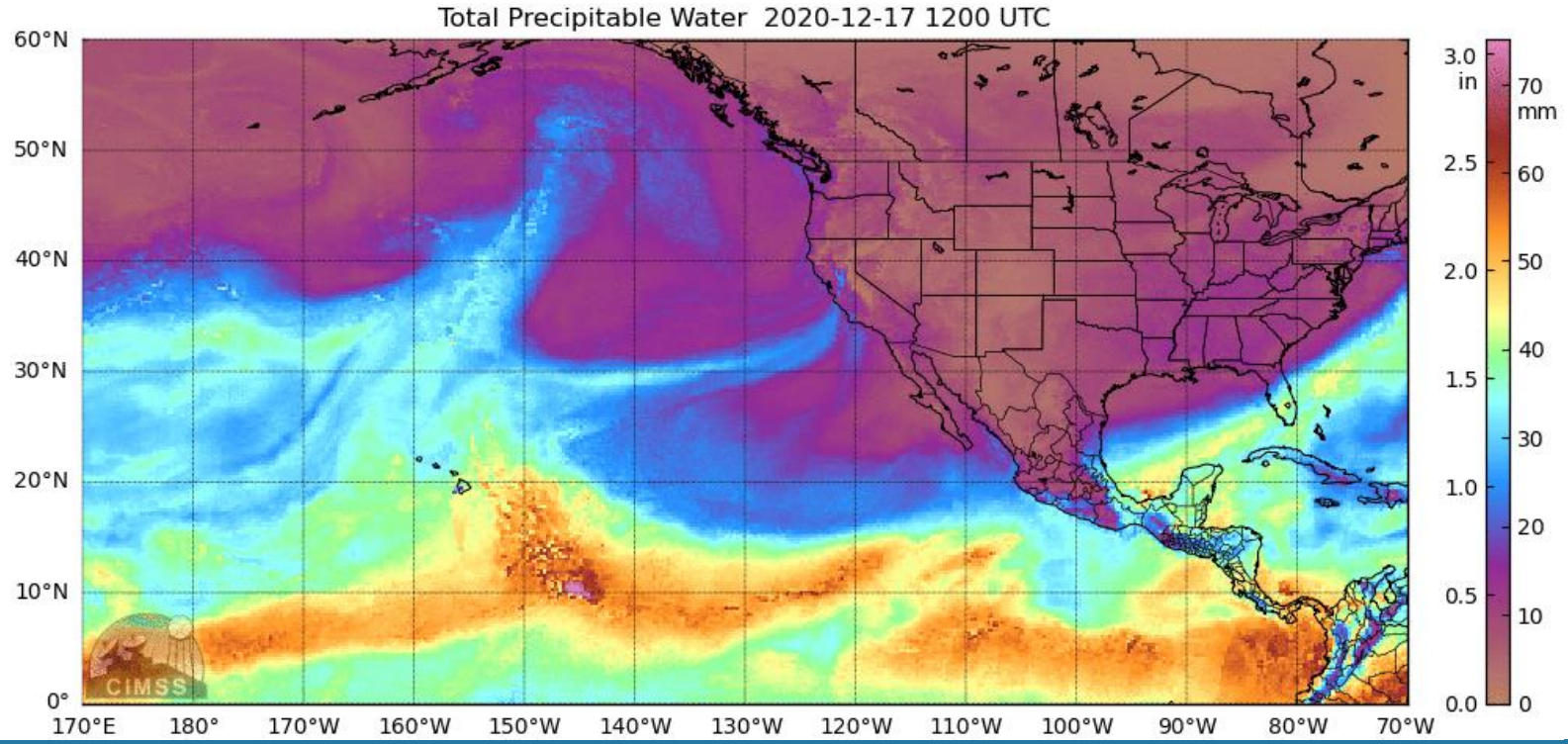
CW3E Post-Event Summary

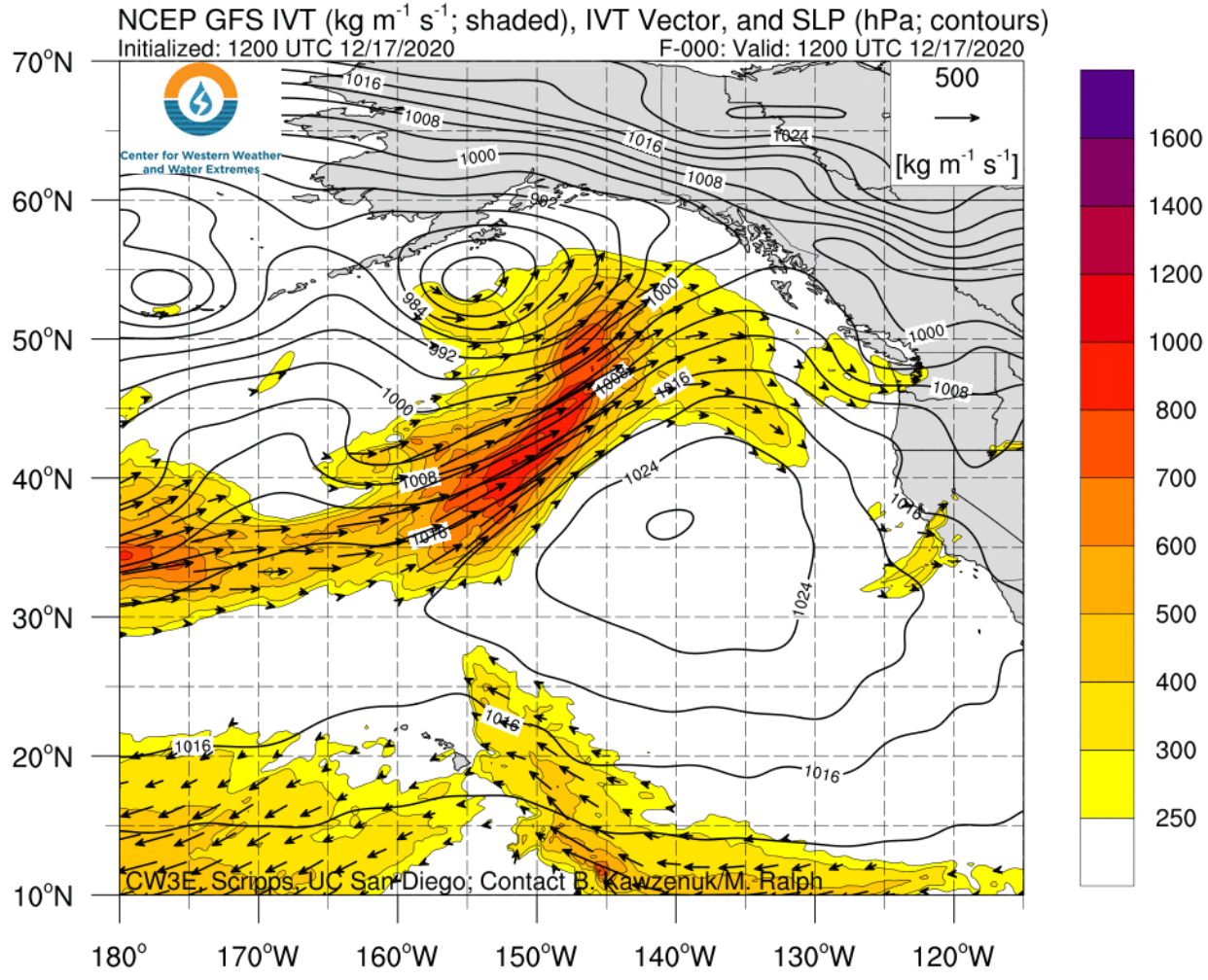
Multiple storms impacted the Pacific Northwest over the Weekend and into Monday

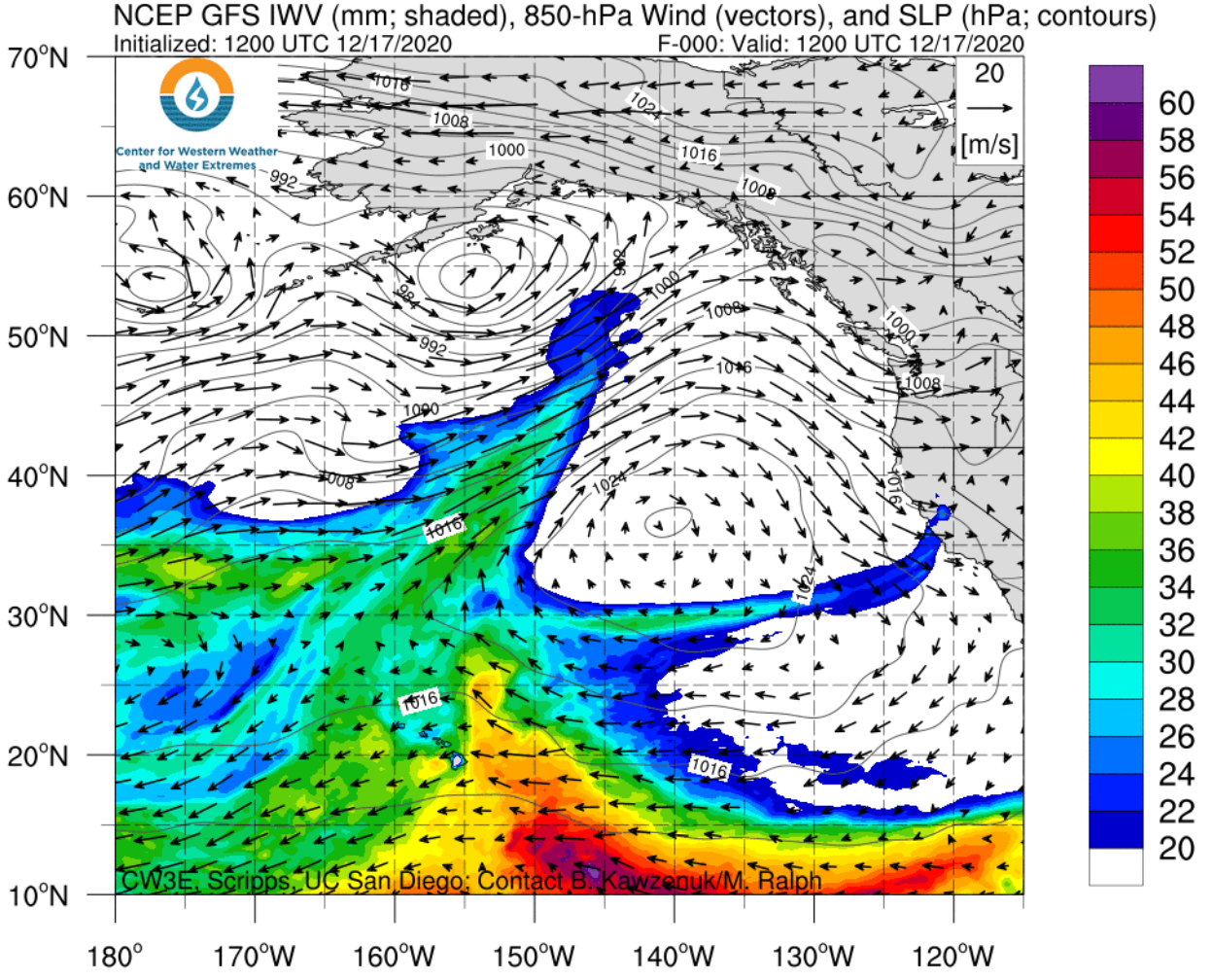
- The first event brought AR 1 conditions to far northwestern Washington as a decaying AR propagated down the coast from British Columbia
- The second AR was stronger and lasted several days, bringing AR 3 conditions to Coastal Oregon
- A mesoscale frontal wave developed along the second AR and resulted in an additional pulse of enhanced IVT and extended the overall duration of AR conditions
- Several daily precipitation records were broken across the Seattle Metropolitan area where several both urban and river flooding was observed



Event Summary: 17–22 December 2020

For California DWR's AR Program





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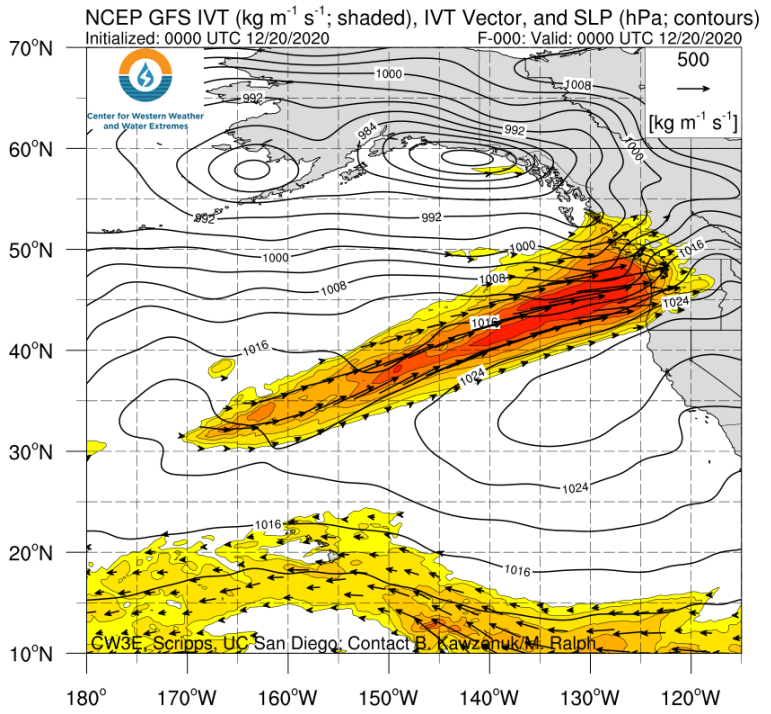

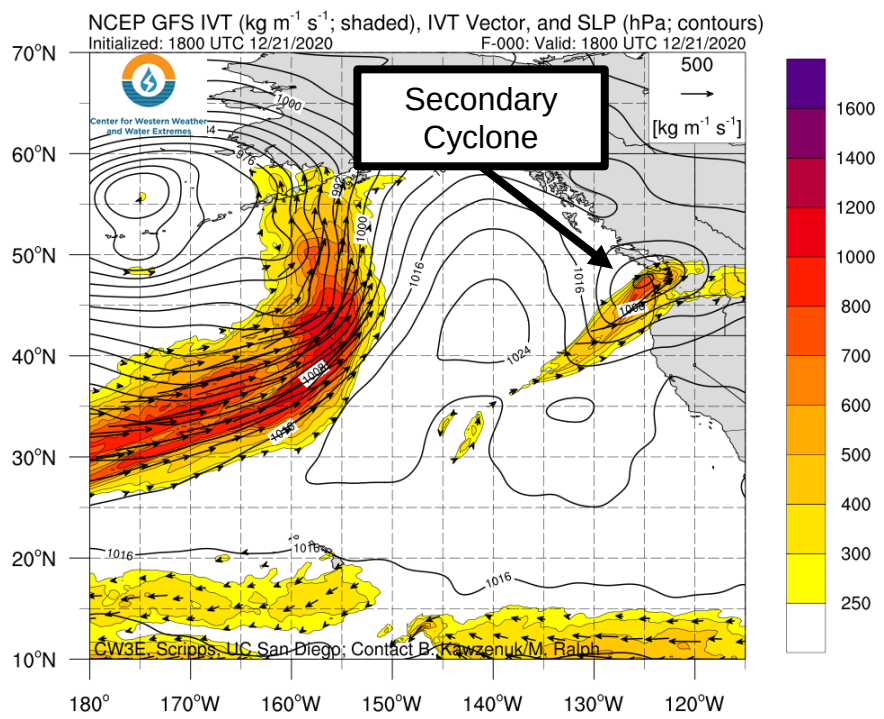

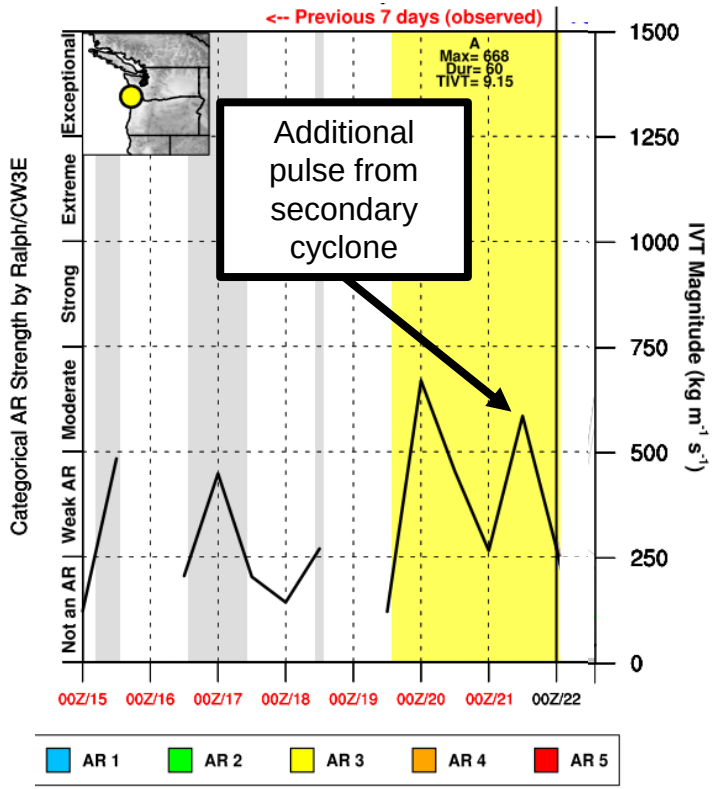

- The second AR made landfall over the PNW between 18 UTC on the 19th and 00 UTC on the 20th, bringing IVT magnitudes >500 kg m^{-1} s^{-1} to a large portion of the PNW
- A mesoscale frontal wave formed into a secondary cyclone and propagated over the PNW, prolonging the duration of AR conditions and resulting in an additional pulse of enhanced IVT
- Northern Coastal Oregon experienced a maximum IVT of 668 kg m^{-1} s^{-1} and a total AR duration of 60 hours, resulting in AR 3 conditions on the AR Scale (Ralph et al. 2019)

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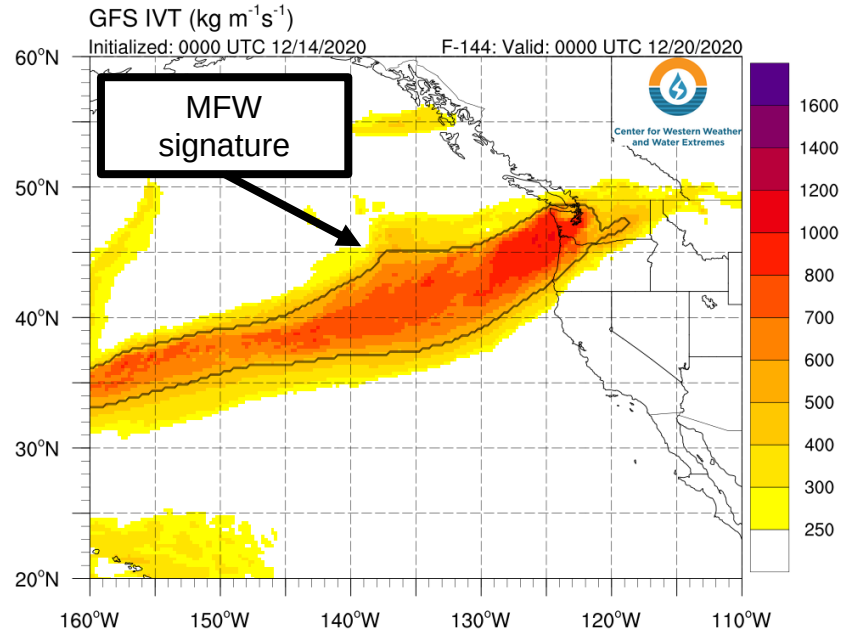
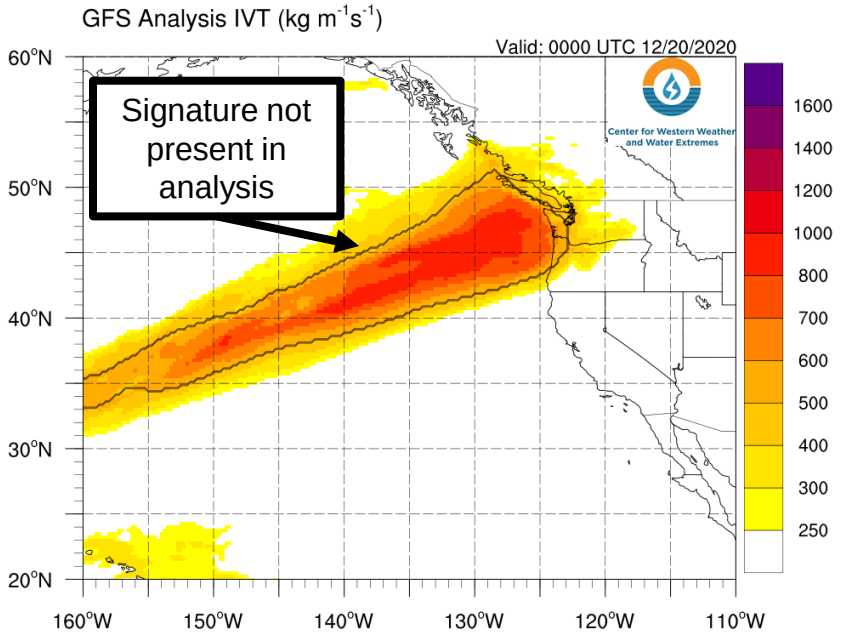
For California DWR's AR Program

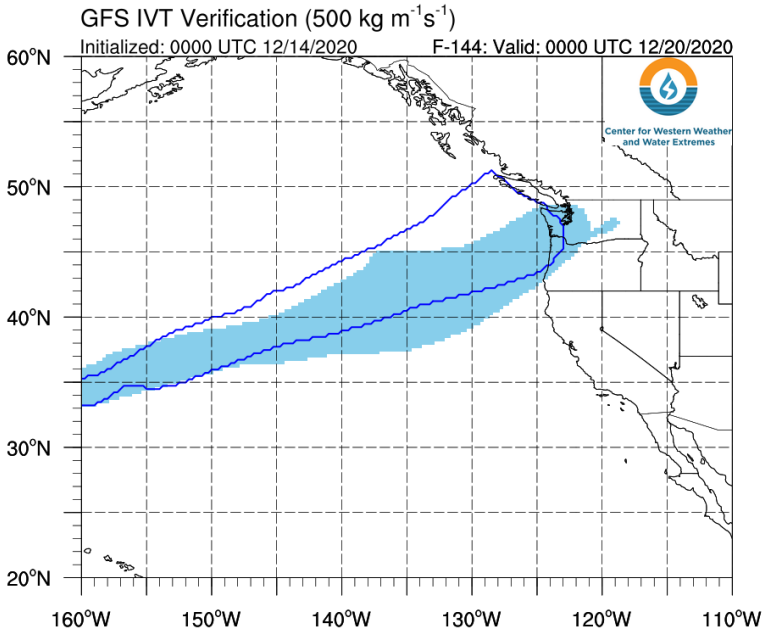
144-hour Forecast (Valid: 00 UTC 20 Dec.)



Analysis (F-00)



Forecast and Analysis AR Objects



Forecasted objects shaded (unmatched objects in gray)
Observed objects contoured (unmatched objects in black)

- The second AR was generally forecast well 6 days prior to AR landfall
- The GFS was forecasting an elongated, southwest to northeast oriented, landfalling AR over the Pacific Northwest, which verified in the analysis
- When comparing the forecast object to the analysis object, it is evident that the 144-hour forecast was several hours early on exact AR landfall
- The forecast also indicated the potential for a MFW over the central portion of the AR which did not verify in the analysis

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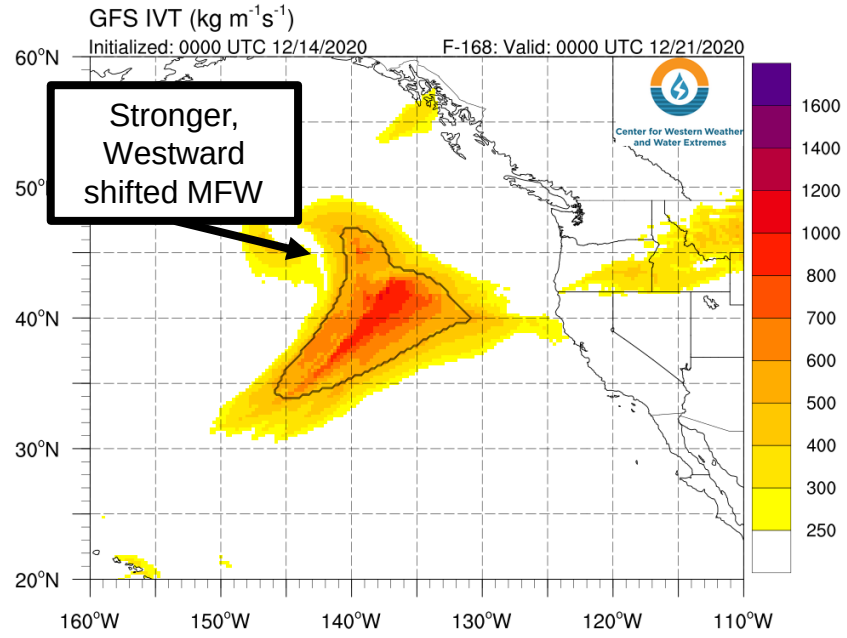
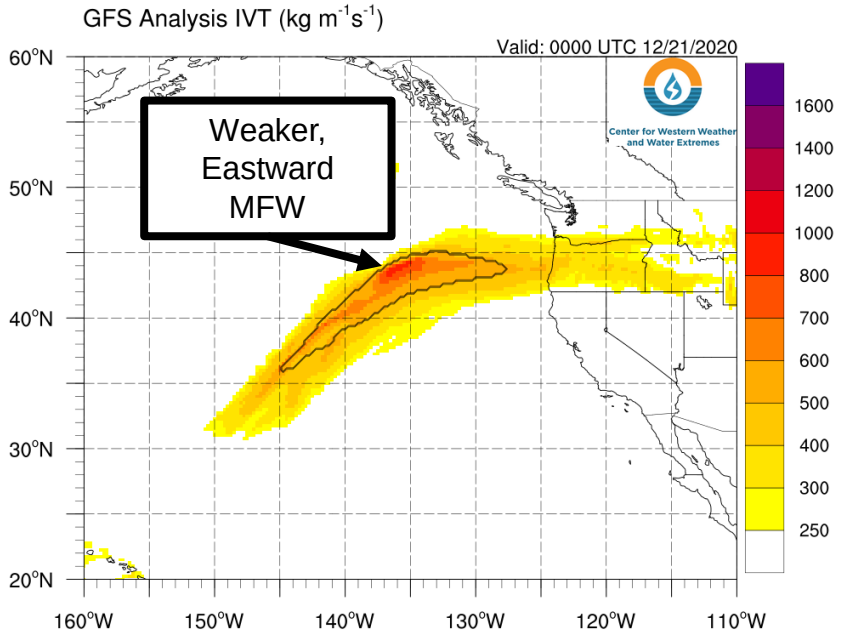
For California DWR's AR Program

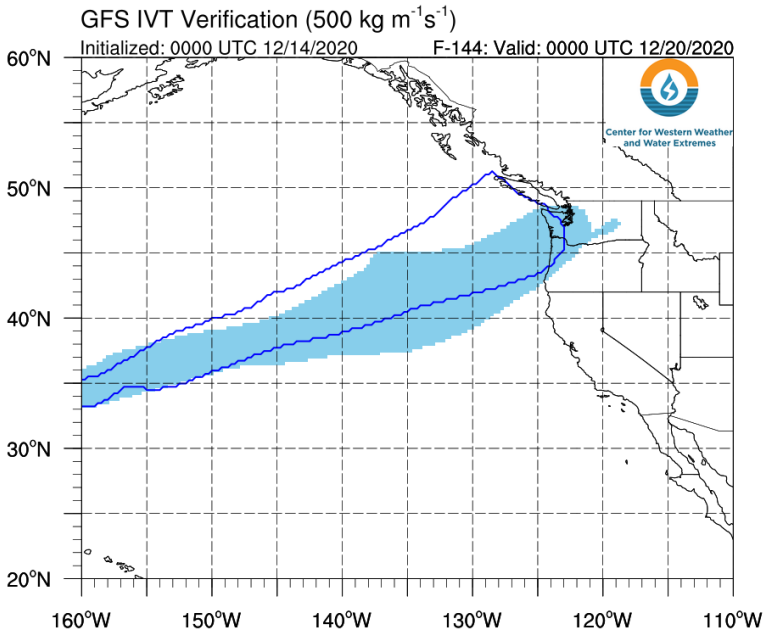
168-hour Forecast (Valid: 00 UTC 20 Dec.)



Analysis (F-00)



Forecast and Analysis AR Objects



Forecasted objects shaded (unmatched objects in gray)
Observed objects contoured (unmatched objects in black)

- While the forecast initialized at 00 UTC 14 December performed relatively well in forecasting initial AR landfall, the forecast of the development of the mesoscale frontal wave was not as accurate
- The 168-hour forecast suggested that AR conditions would end over the coast by 00 UTC 21 December and the secondary cyclone would be stronger over the Eastern Pacific
- The model analysis shows that AR conditions did not end over coastal Oregon and the MFW was weaker and closer to the PNW
- This analysis on forecast performance highlights the forecast difficulties pertaining to MFWs and their impacts

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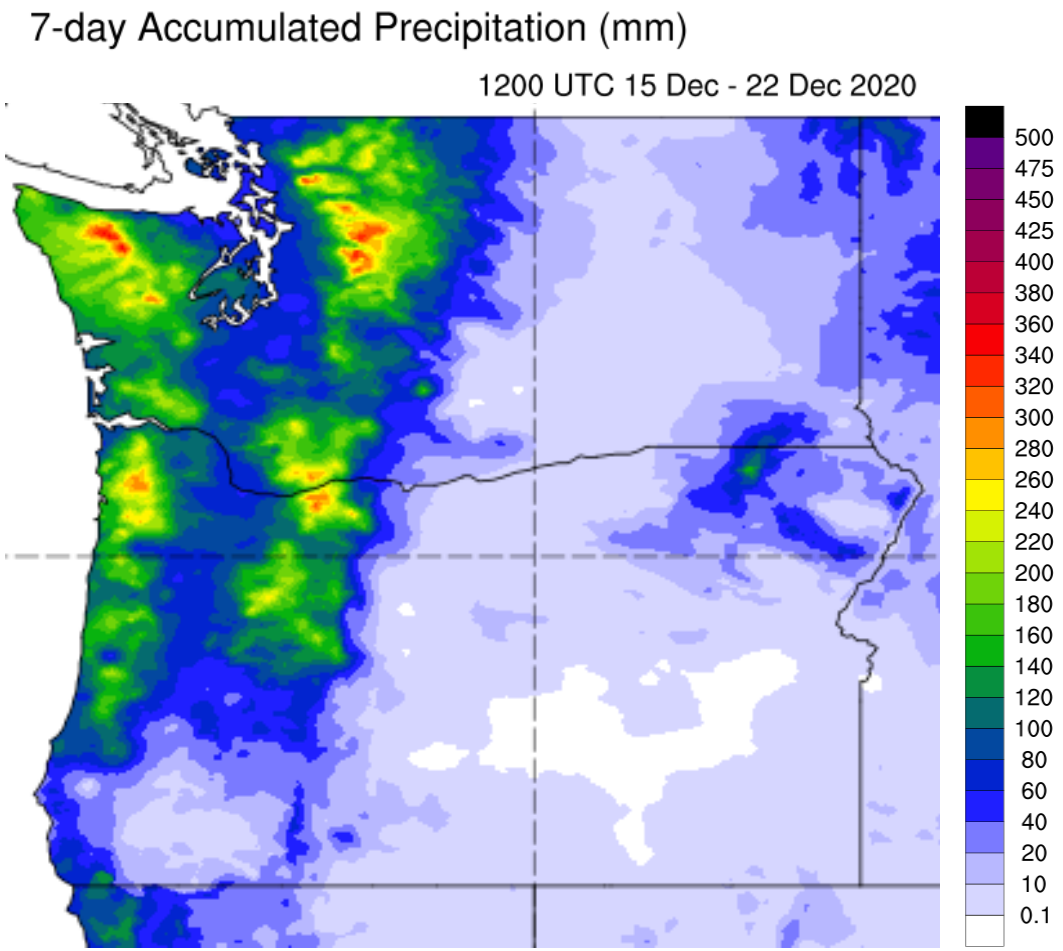
For California DWR's AR Program



- The active pattern over the Pacific Northwest has resulted in >300 mm (11.8 in) in some locations of the Olympic, Cascade, and Coastal Mountains during the previous 7 days
- Other lower elevations have received 1.5 to 3 inches

- The heavy precipitation broke numerous daily accumulation records in the Seattle Metropolitan area on 21 December, including 2.19 inches at the National Weather Service Forecast Office in Seattle

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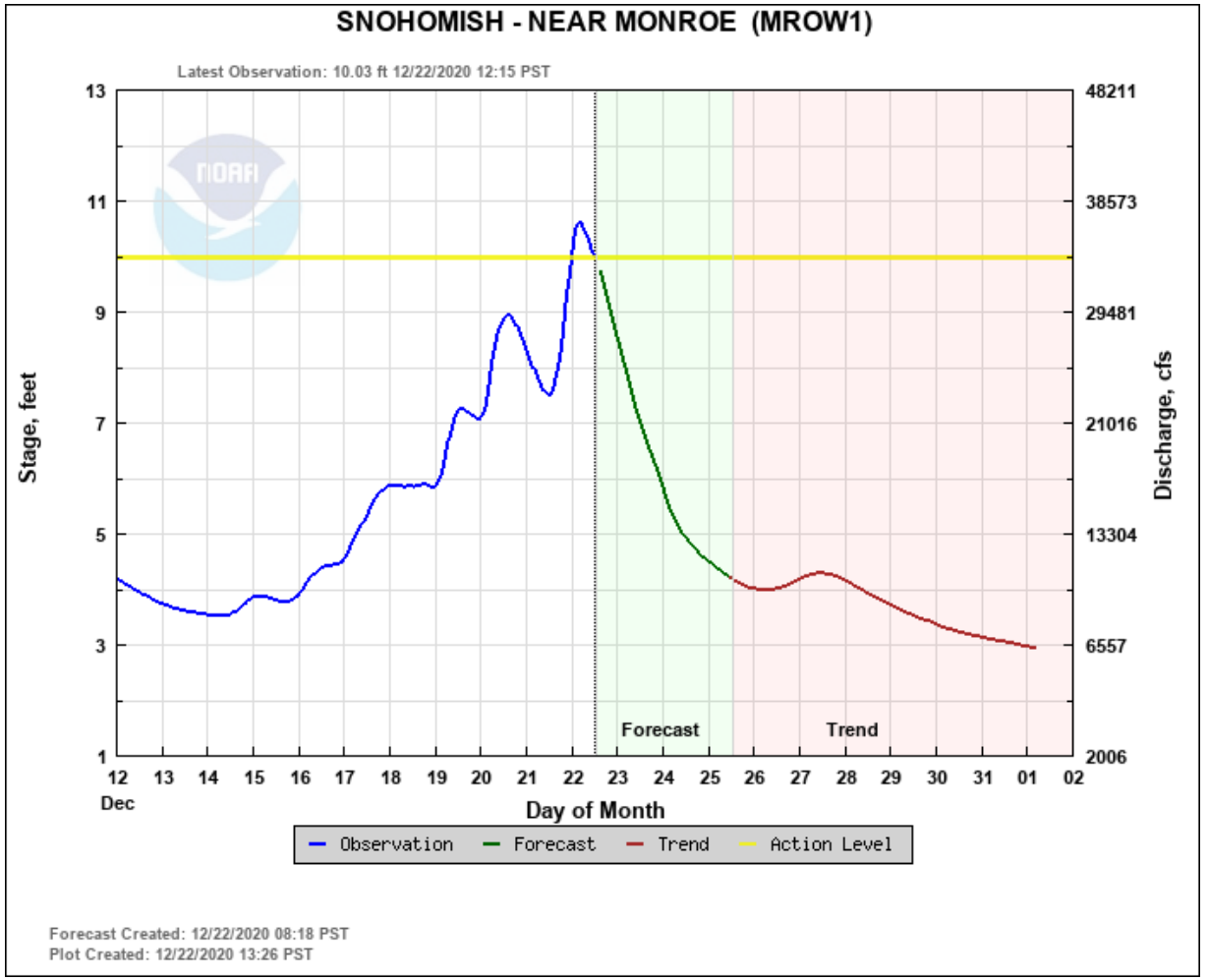
For California DWR's AR Program



- The heavy precipitation resulted in urban and river flooding across Northwestern Washington
- Numerous streets and roads across the region were closed including 44th Avenue in Lynnwood, Washington

- The Snohomish river near Monroe rose to ~10.5 feet, 0.5 feet above action stage

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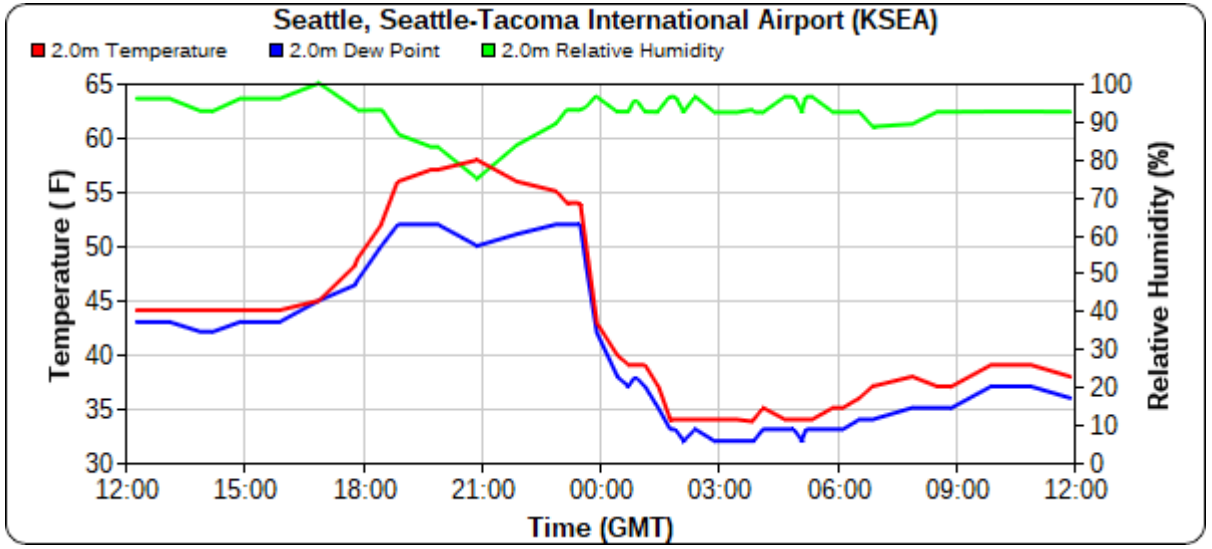
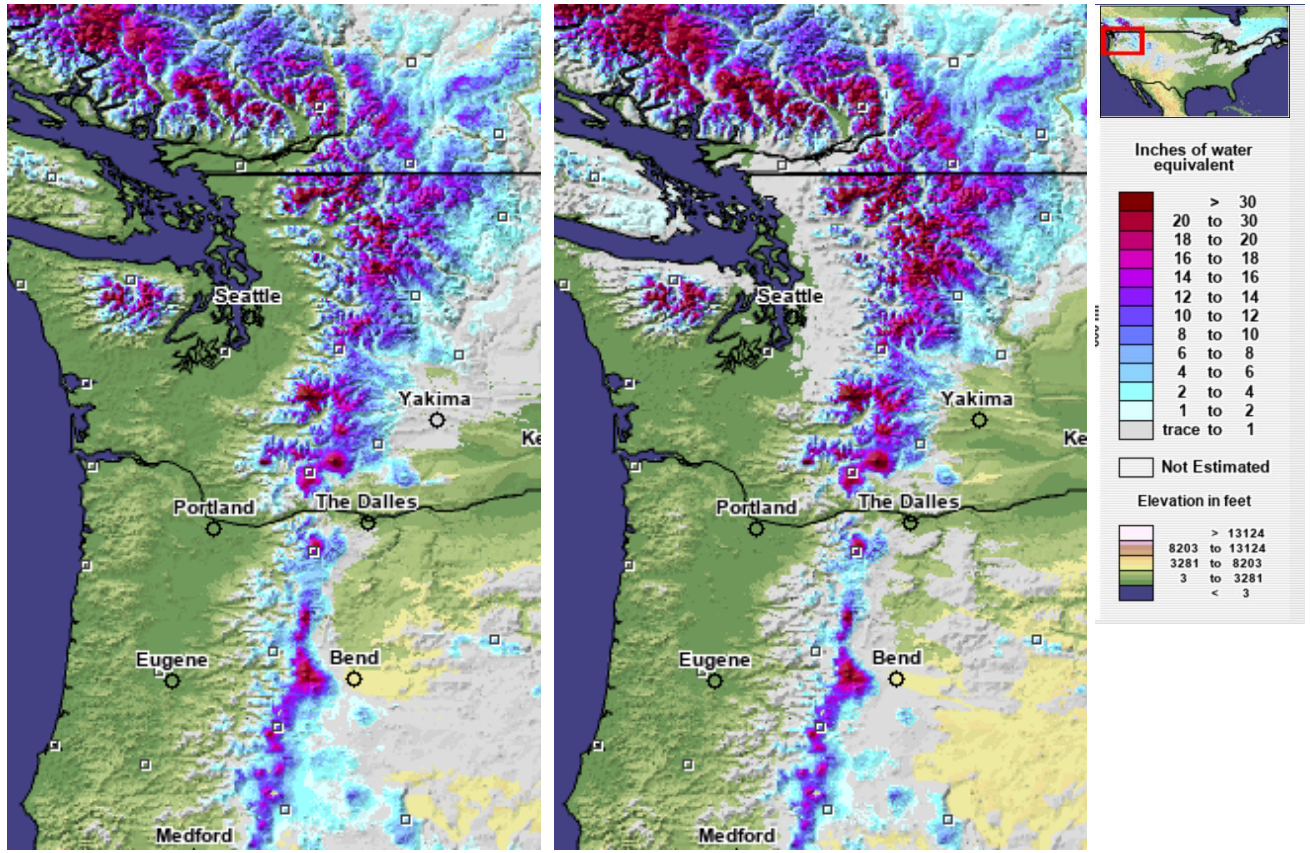


- Seattle-Tacoma International Airport broke a daily high temperature record of 59°F before the secondary low propagated inland and cold air advection combined with nighttime cooling to result in a temperature drop of >50°F in ~5 hours to <35°F
- The large drop in temperatures across the region allowed for freezing levels to fall to near sea-level where numerous low elevation locations across the Seattle Metropolitan area recorded trace to 1" of snow
- Snow also fell at higher elevations, bringing the snowpack to >30 inches over some locations of the Olympic Peninsula and Cascade Mountains

NOHRSC Snow Depth

Valid: 17 December 2020 Valid: 22 December 2020



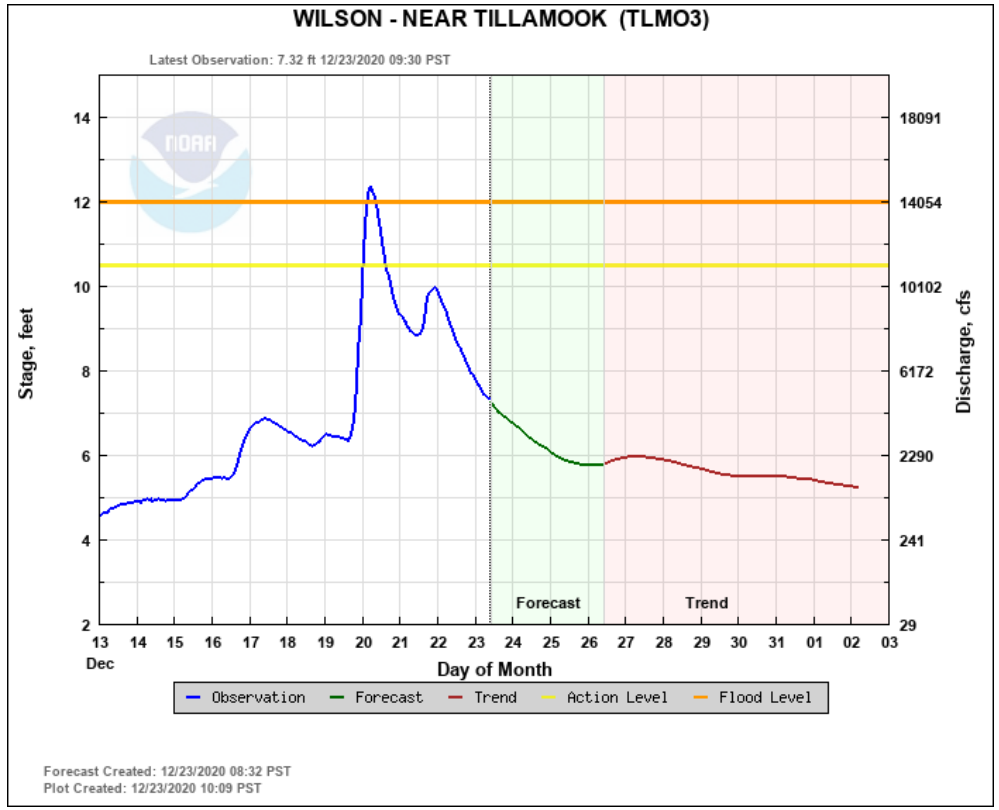
Source: NOAA/NWS NOHRSC, https://www.nohrsc.noaa.gov/

Event Summary: 17–22 December 2020

For California DWR's AR Program

Historic Columbia River Highway near Multnomah Falls

Image Source: KATU



- The heavy precipitation also resulted in numerous impacts in northwestern Oregon
- A debris flow closed the Columbia River Highway near Multnomah Falls
- The Wilson River near Tillamook, OR rose to ~12.25 feet on the 20th, ~.25 above flood stage