CW3E Atmospheric River Outlook: 2 November 2022

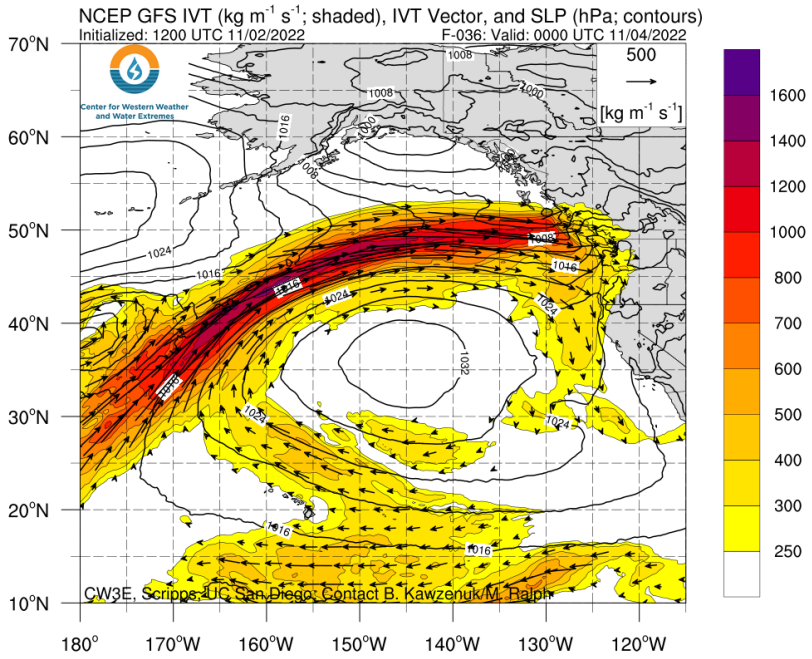
Strong Atmospheric River to impact Washington and Oregon

- A strong atmospheric river will make landfall along the coast of British Columbia and slide south along the coast of Washington and Oregon, bringing AR3/AR4 (based on the Ralph et al. 2019 AR Scale) conditions to the area
- The AR is also forecast to bring AR2/AR3 conditions to locations east of the Cascades in interior Washington and Oregon
- The NWS Weather Prediction Center is forecasting more than 5 inches of total precipitation in portions of western Washington and Oregon over the next 5 days
- There are significant differences in forecast precipitation between the 00Z GFS and 00Z ECMWF, with the GFS showing a stronger rain shadow effect east of the Olympic Mountains and Cascades
- High freezing levels will limit snowfall accumulations below 7,000 ft, but strong uplsope moisture flux and inland penetration of the AR will likely produce significant snowfall in the higher terrain of the North Cascades and Northern Rockies
- Precipitation from this storm will bring favorable conditions for debris flows in areas of Washington and Oregon with burn scars from recent fire seasons
- As part of CW3E's Atmospheric River Reconnaissance program, this event will be sampled by the 53rd Weather Reconnaissance Squadron on 3 November, feeding meteorological data into the global forecast models

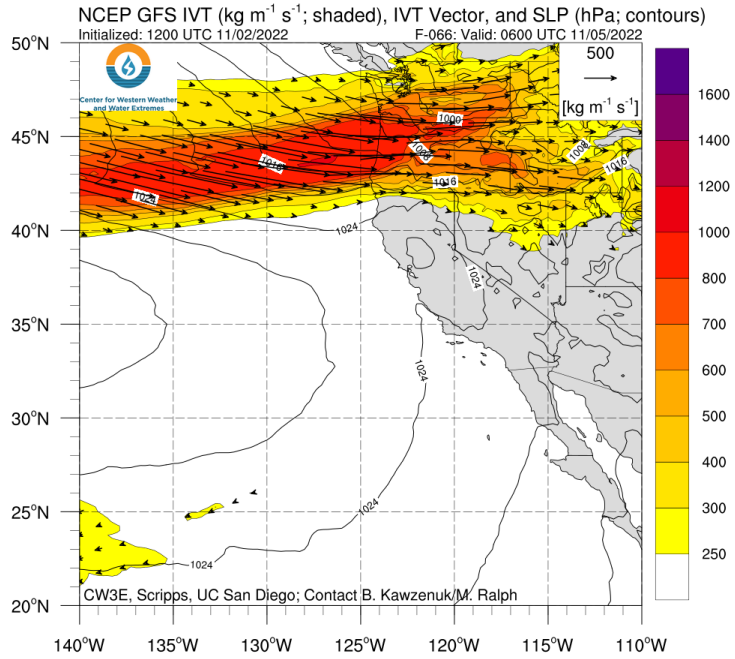
CW3E AR Outlook: 2 November 2022

Model IVT & SLP Forecasts

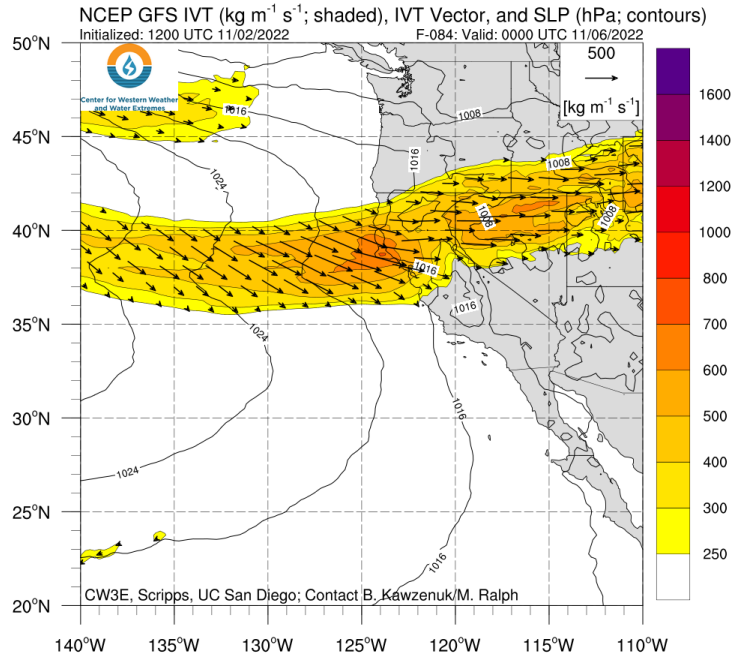
(A) GFS Valid: 5 PM PT 03 Nov (F-36)



(B) GFS Valid: 11 PM PT 04 Nov (F-66)



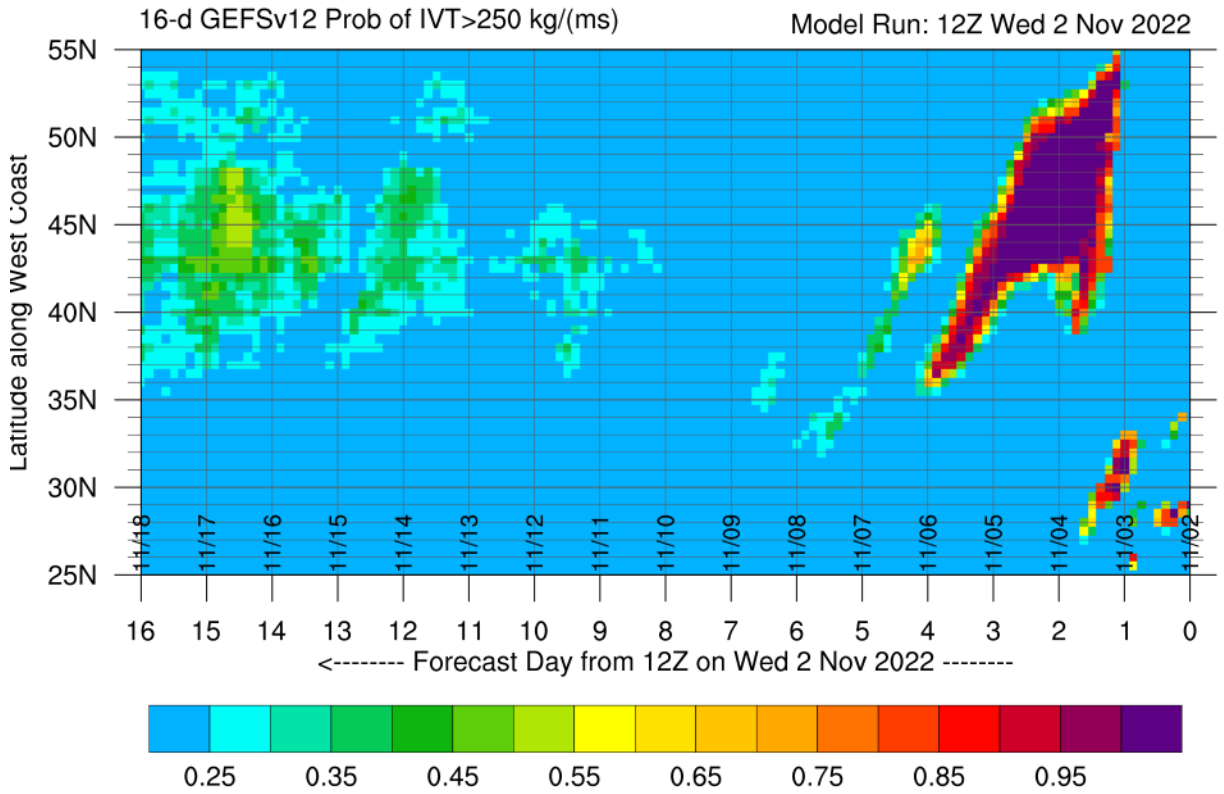
(C) GFS Valid: 5 PM PT 05 Nov (F-84)

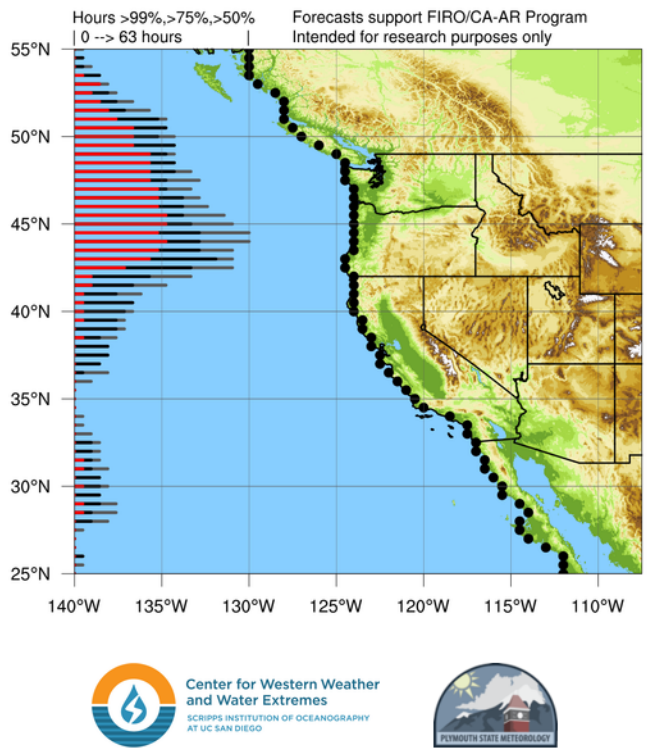


- AR landfall will occur along the coast of British Columbia during the evening of Thursday 03 Nov (Figure A)
- As the AR begins to slide down the west coast, it will bring strong AR conditions to coastal Washington and Oregon, with the highest moisture transport of approximately 1,000 kg m^{-1} s^{-1} occurring along the border of Washington and Oregon (Figure B)
- The AR will weaken (IVT ~700 kg m^{-1} s^{-1}) as it propagates into coastal Northern California (Figure C)

CW3E AR Outlook: 2 November 2022

Probability of AR Conditions Along Coast (GEFS)

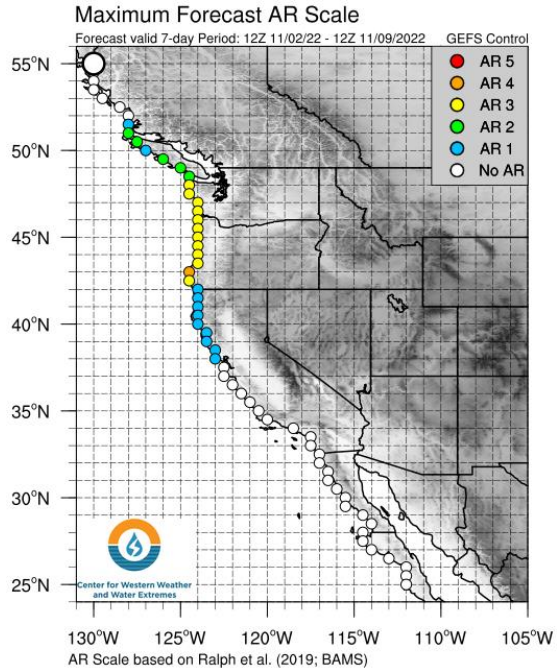




Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

PLYMOUTH STATE METEOROLOGY

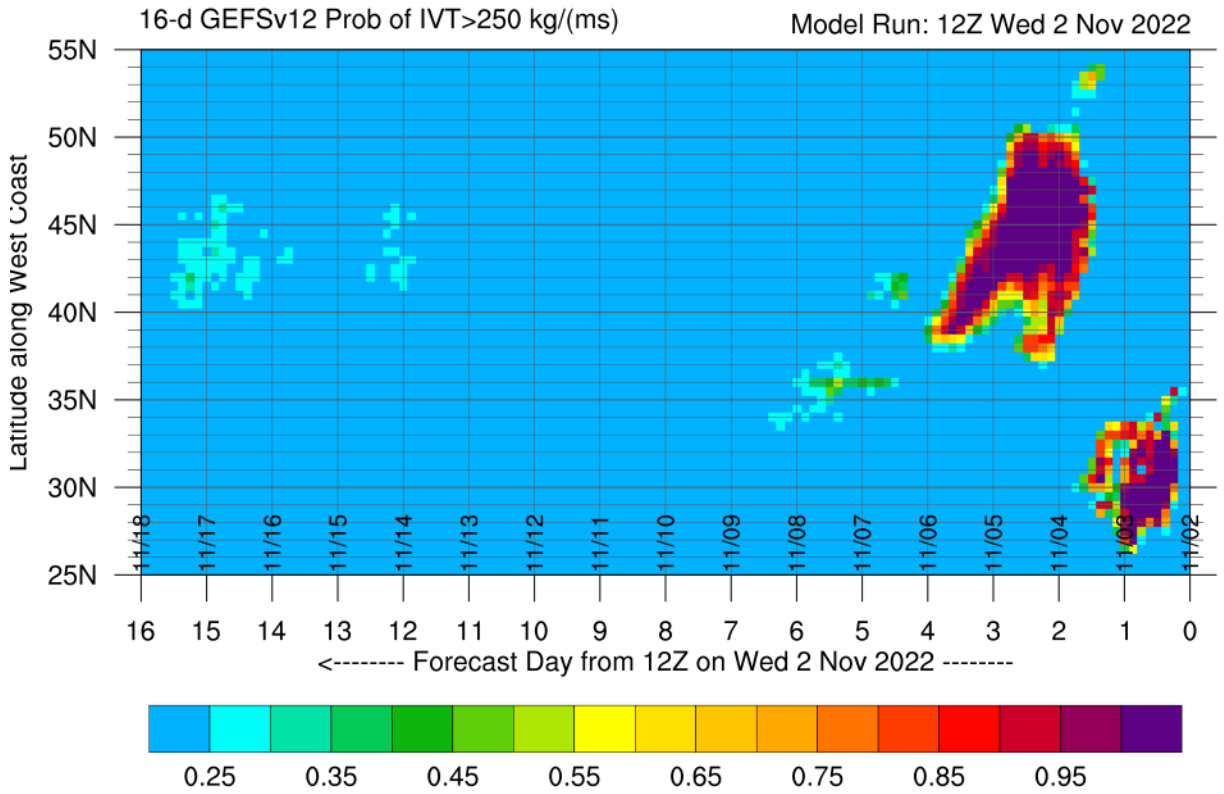
AR Scale

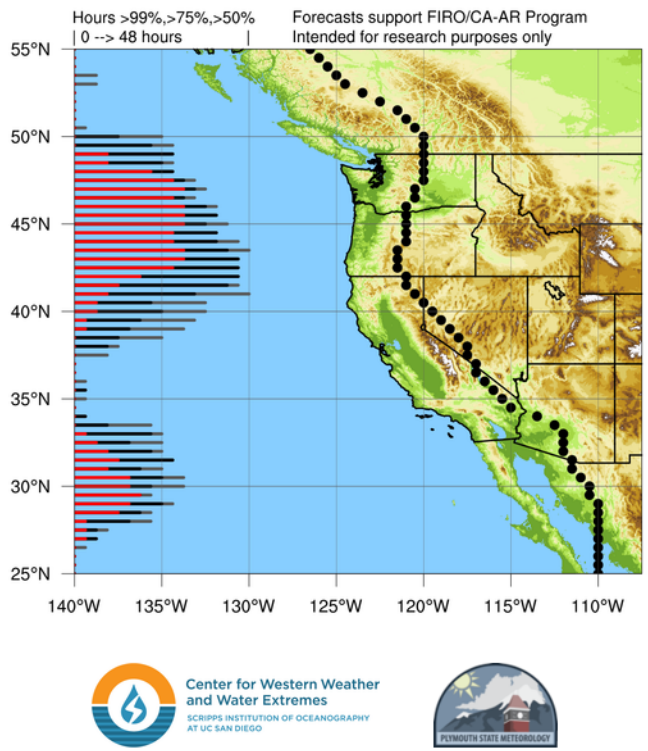


- The 12Z GEFS is showing high confidence (> 90%) in a period of AR conditions (IVT > 250 kg m^{-1} s^{-1}) from southern British Columbia into coastal Washington and Oregon during 3–5 November
- Model confidence is slightly lower (75-85 %) along the coast of Northern California on 6 November
- The 12Z GEFS control run is forecasting AR3/AR4 conditions (based on the Ralph et al. 2019 AR scale) over coastal Washington and Oregon

CW3E AR Outlook: 2 November 2022

Probability of AR Conditions Inland (GEFS)





Center for Western Weather and Water Extremes
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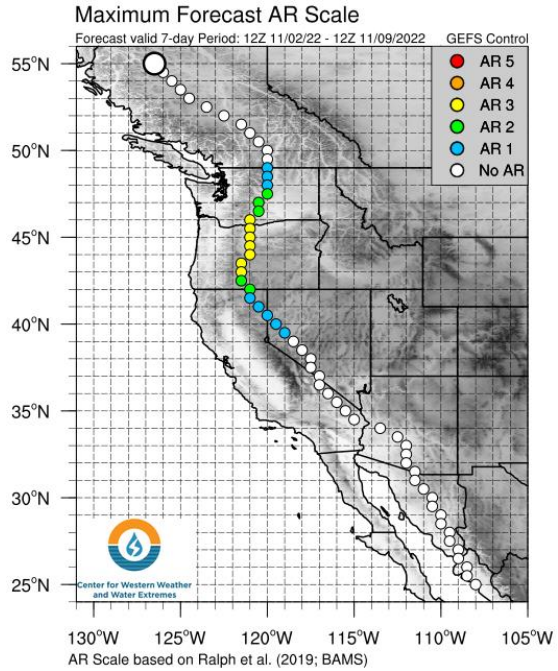
PLYMOUTH STATE METEOROLOGY

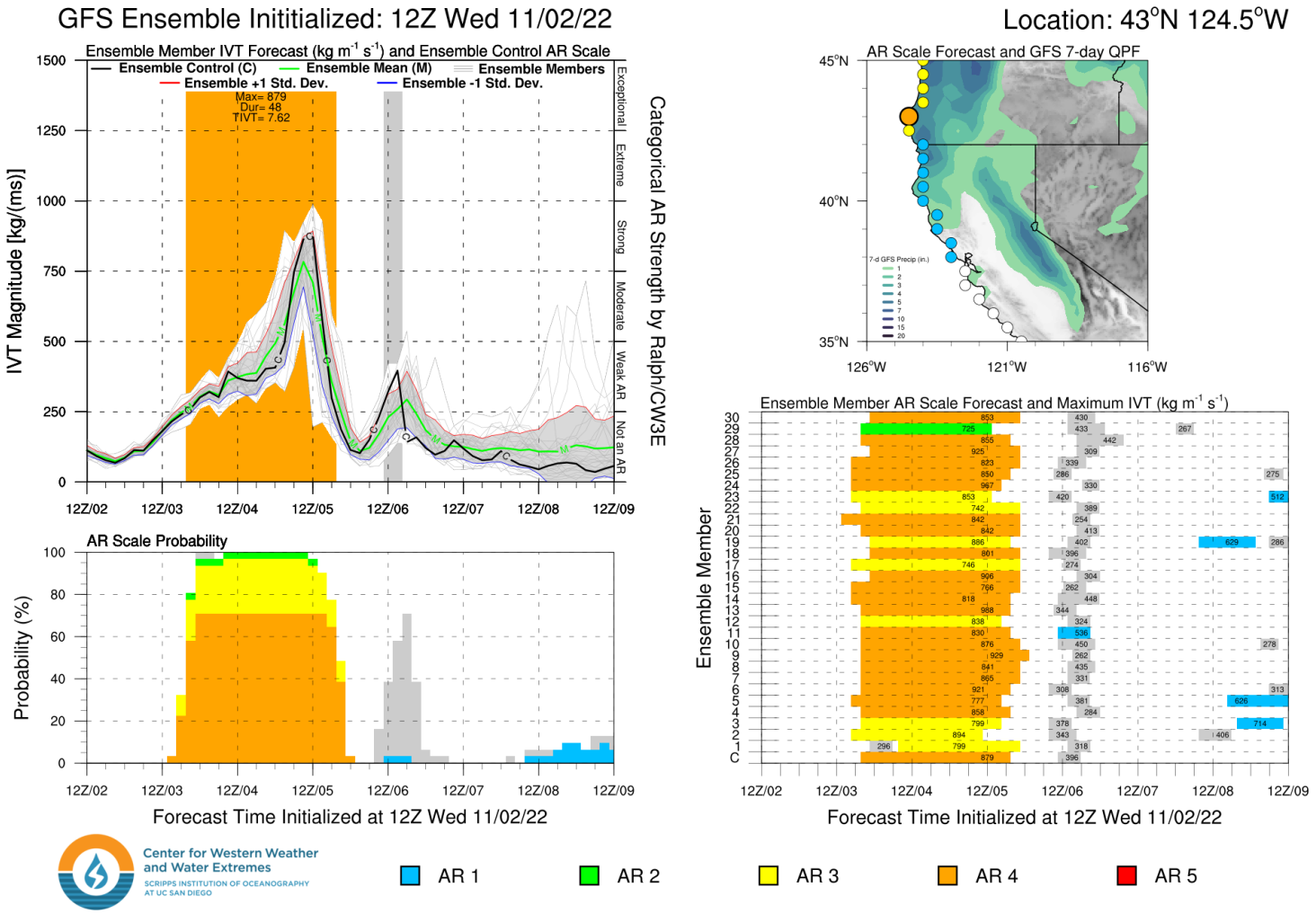
AR Scale



- CW3E's Landfall Tool also highlights GEFS forecast for AR conditions at points inland, to the east of the Cascades.
- The 12Z GEFS is forecasting AR conditions to extend farther inland, with AR2/AR3 conditions expected east of the Cascades

CW3E AR Outlook: 2 November 2022

GEFS AR Scale and IVT Forecasts

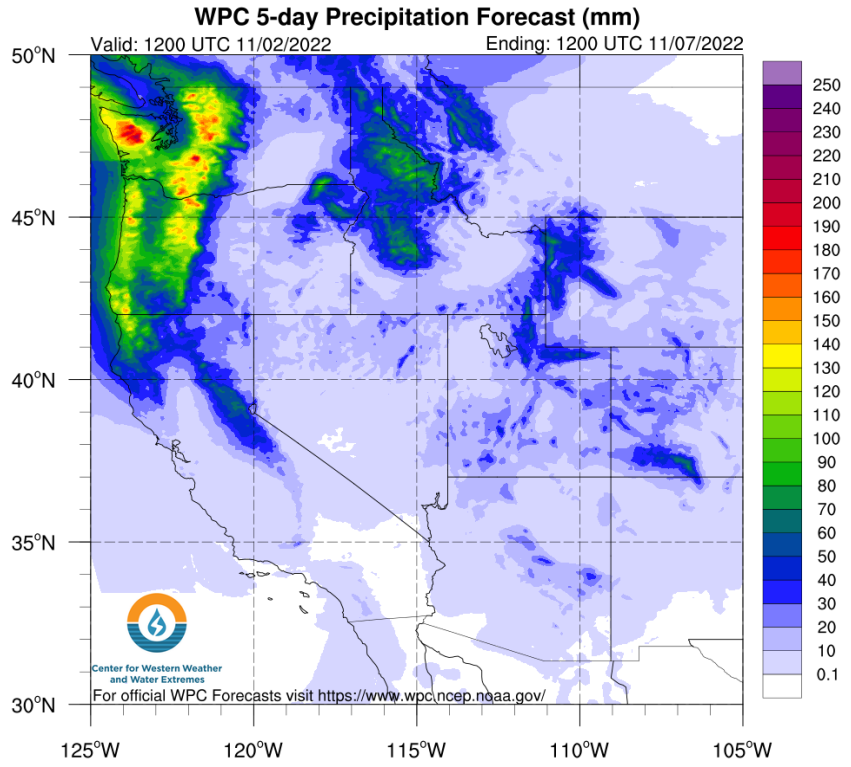


- The 12Z GEFS control run is forecasting an AR 4 at 43.0N, 124.5W (Coos County, OR) in association with this AR
- 30/31 (96%) GEFS ensemble members are forecasting above AR 3 conditions, with 22/31 (71%) forecasting above AR 4 conditions
- 15/31 (48%) ensemble members are forecasting a peak IVT magnitude of > 850 kg m^{-1} s^{-1}
- Points along coastal Washington/northern Oregon are forecast to experience AR3 conditions due to a shorter AR duration

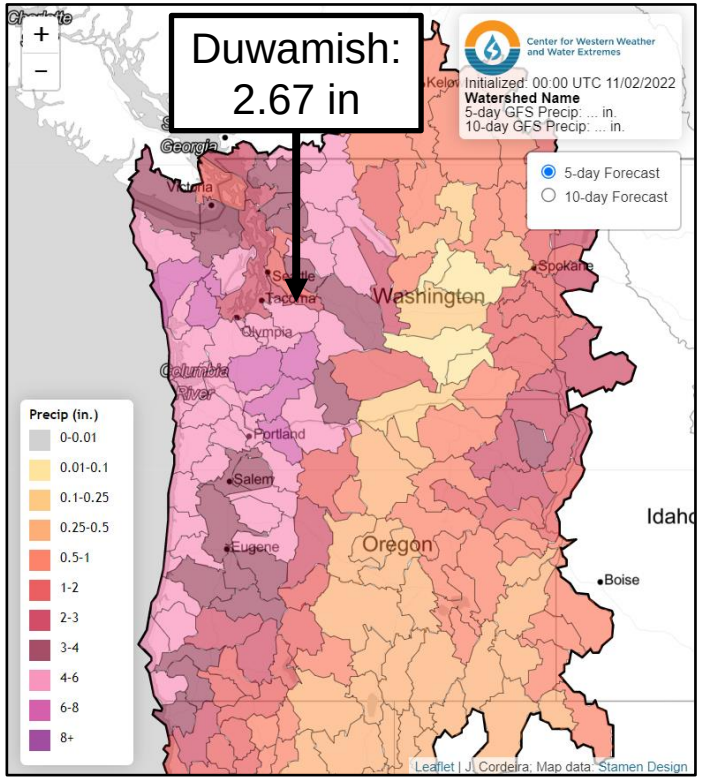
CW3E AR Outlook: 2 Nov 2022

Precipitation Forecasts

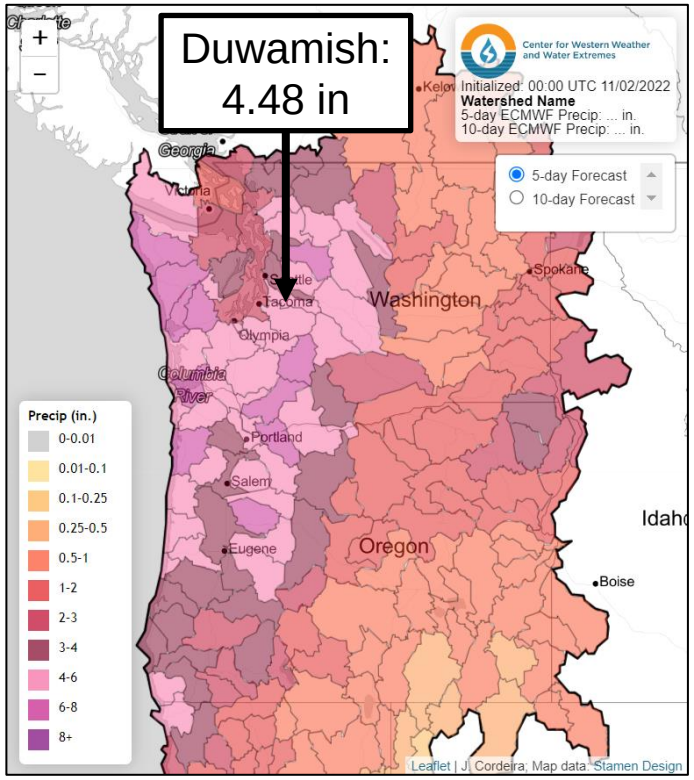
WPC 5-day QPF: Valid 5 AM PT 2–7 Nov



GFS 5-day Watershed Precipitation



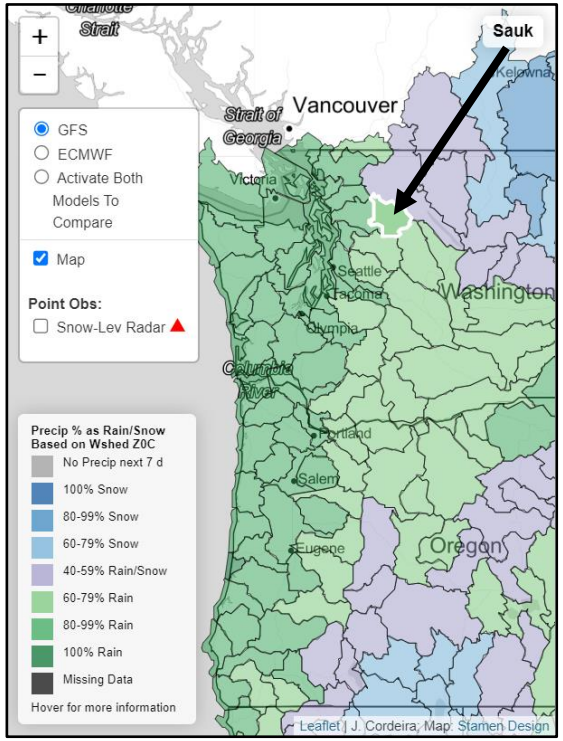
ECMWF 5-day Watershed Precipitation

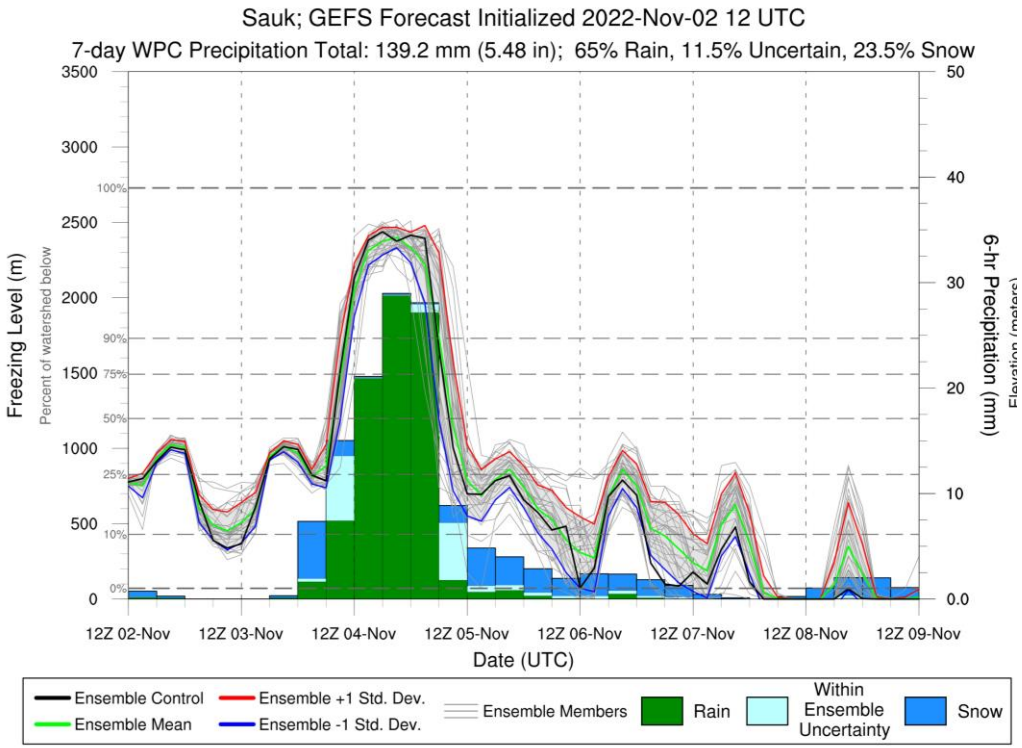


- The NWS Weather Prediction Center is forecasting more than 5 inches of total precipitation over portions of the Olympic Peninsula, the Cascades, the Oregon Coast Ranges, and far northwestern California during the next 5 days
- Compared to the 00Z ECMWF, the 00Z GFS shows a stronger rain shadow effect east of the Olympic Mountains and Cascades
- For example, the 00Z ECMWF is forecasting 4.48 inches of watershed mean precipitation in the Duwamish watershed during the next 5 days, whereas the 00Z GFS is only forecasting 2.67 inches of watershed mean precipitation

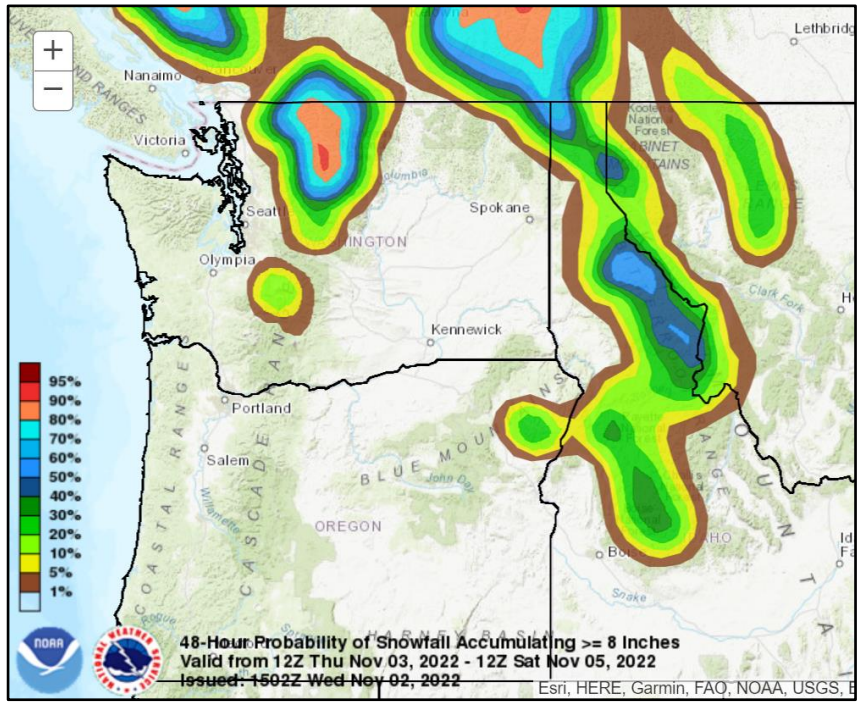
CW3E AR Outlook: 2 Nov 2022

Freezing Level and Snow Forecasts





WPC 48-h Probability of Snowfall > 8 inches
Valid 5 AM PT 3–5 Nov



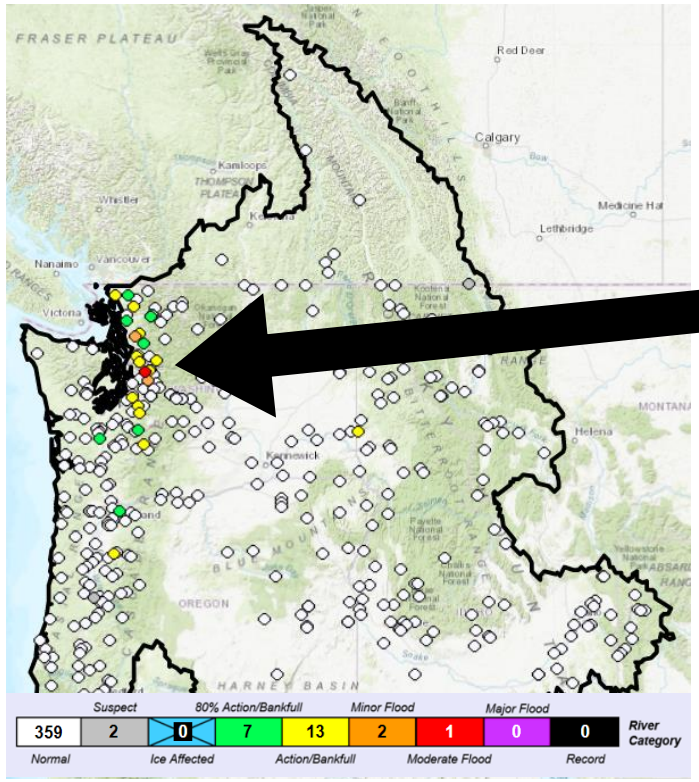
Source: NOAA/NWS Weather Prediction Center

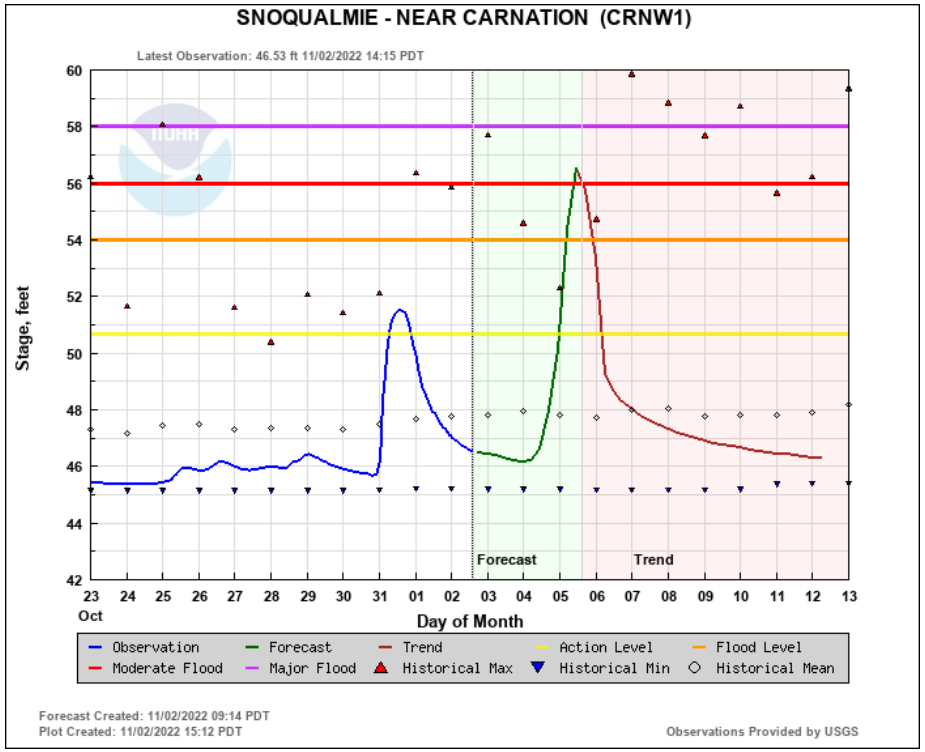
- Freezing levels in the Pacific Northwest are forecast to rapidly rise after the AR makes landfall, thereby limiting snowfall accumulations below 7,000 feet during the period of heaviest precipitation
- Given the strong upslope moisture flux and inland penetration of the AR, significant snowfall is likely in the higher terrain of the North Cascades and Northern Rockies
- Freezing levels are forecast to drop below 3,000 feet on Saturday as the core of the AR moves southward

CW3E AR Outlook: 2 November 2022

Northwest RFC Map and Outflow

Northwest River Forecast Center



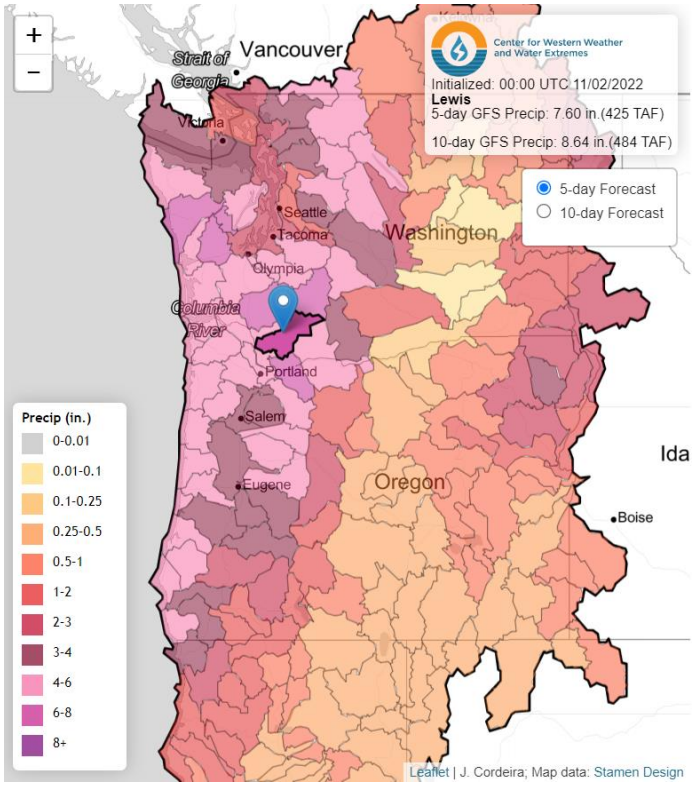


- The NWS Northwest River Forecast Center currently has 1 location forecast to reach Moderate Flood levels (red dot), 2 location to reach Minor Flood (orange dots), and 5 locations to reach Action/Bankfull levels (yellow dots) during the timeframe of the AR
- A station on the Snoqualmie River near Carnation rose above action level on 31 Oct, and is forecast to rise again to above flood level on 05 Nov in association with this AR.

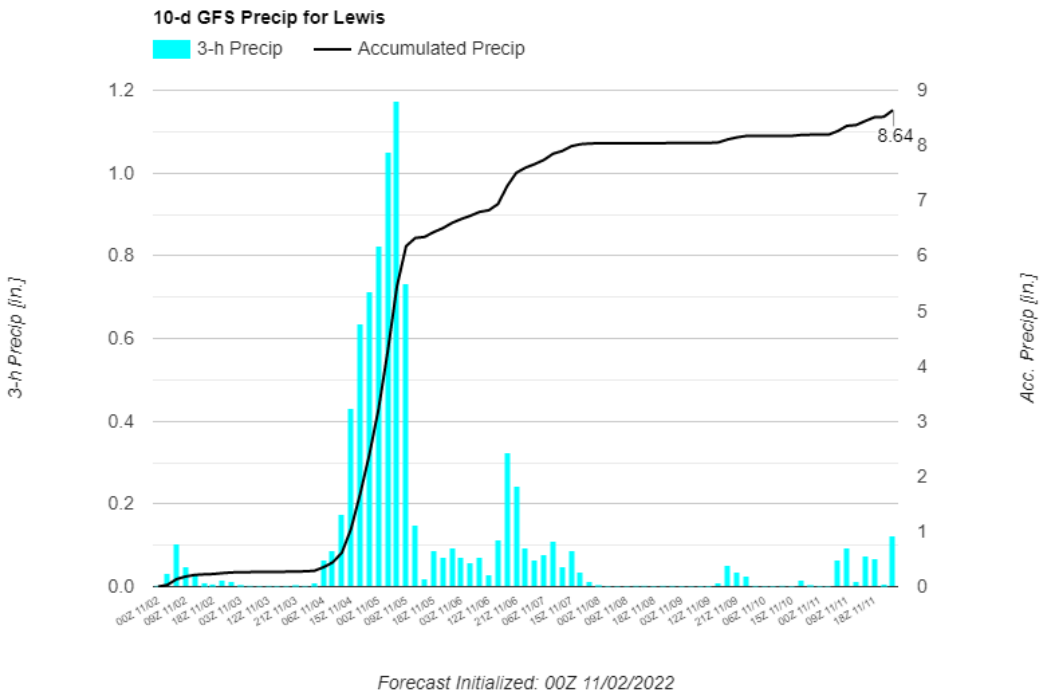
CW3E AR Outlook: 2 November 2022

Precipitation near Burn Scars - Lewis Watershed

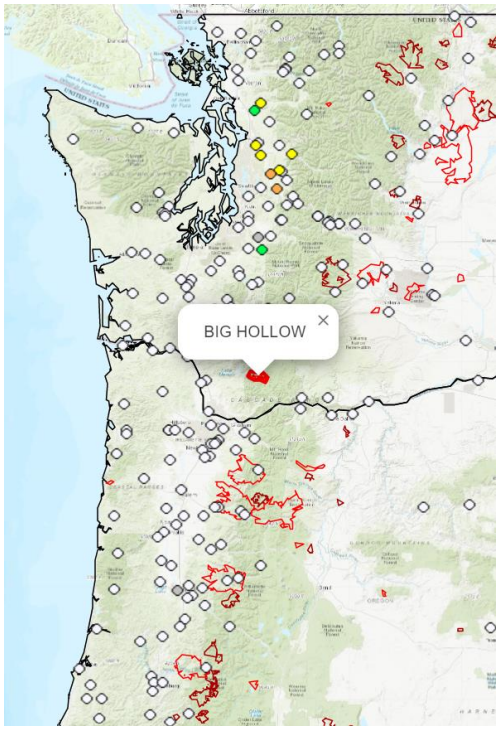
GFS 5-Day Precipitation Issued 00Z 2 Nov



GFS 3-Hourly Total Accumulated Precipitation



2020/2021 Fire Boundaries



- The 00Z GEFS 5-day precipitation totals are > 6 inches for multiple watersheds in the coastal ranges of Washington and Oregon
- The plot of GEFS 3-hourly total accumulated precipitation in the Lewis watershed (southern Washington) shows multiple 3-hour periods with accumulation of > 1 inch, highlighting the possibility for high intensity precipitation embedded within the storm
- Higher rainfall intensities in the vicinity of the 2020 Big Hollow burn scar may create a favorable situation for post-fire debris flows

CW3E AR Outlook: 2 November 2022

AR Recon 2023 – IOP 1 Forecast for 03 November 2022

- The first mission of CW3E's Atmospheric River Reconnaissance for WY 2023 will take place on 03 Nov
- Crews from the 53rd Weather Reconnaissance Squadron will be flying from Mather Air Force Base in California
- C-130 Aircraft will deploy ~25 dropsondes, collecting critical meteorological data across the core of the AR
- This data will be fed back into global forecast models, improving upcoming weather forecasts for this event