# CW3E Atmospheric River Outlook

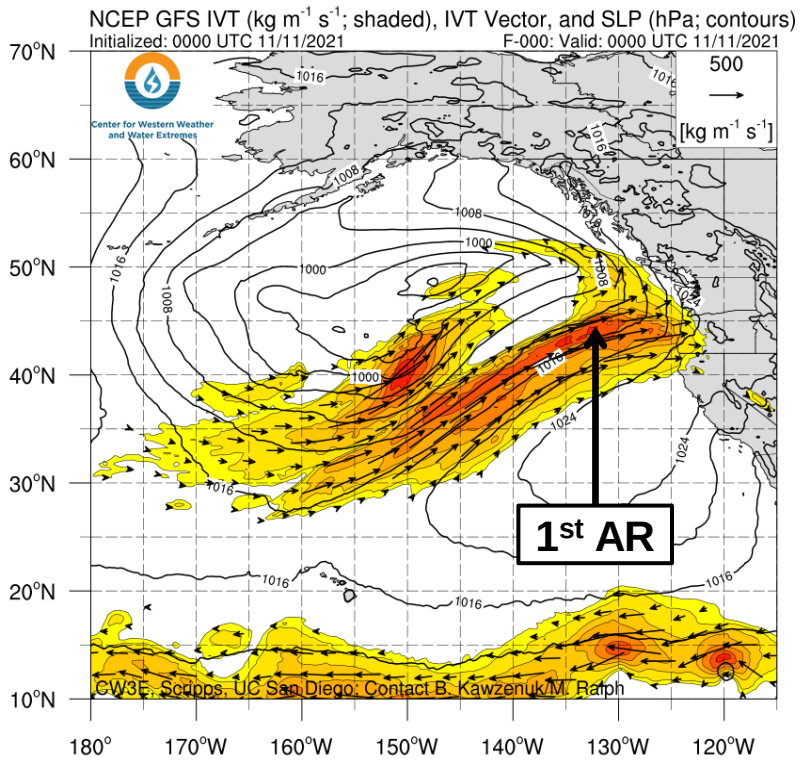
**Unsettled Weather to Continue through the Weekend in Pacific Northwest**

- A strong atmospheric river (AR) made landfall on Wednesday, bringing AR 3/AR 4 conditions (based on the Ralph et al. 2019 AR Scale) to southern coastal Washington and coastal Oregon
- Another strong AR is forecasted to make landfall in Washington and northern Oregon tomorrow
- AR 3/AR 4 conditions are once again likely across portions of coastal Washington and Oregon
- The first AR produced heavy rainfall in western Washington and northwestern Oregon yesterday into this morning
- An additional 5–10 inches of precipitation are forecasted over the Olympic Peninsula and Washington Cascades during the next 5 days
- Widespread riverine flooding is expected in western Washington in association with these two ARs
- Snowfall accumulations will be limited due to high initial freezing levels, but significant snow is possible in the North Cascades toward the end of the second event

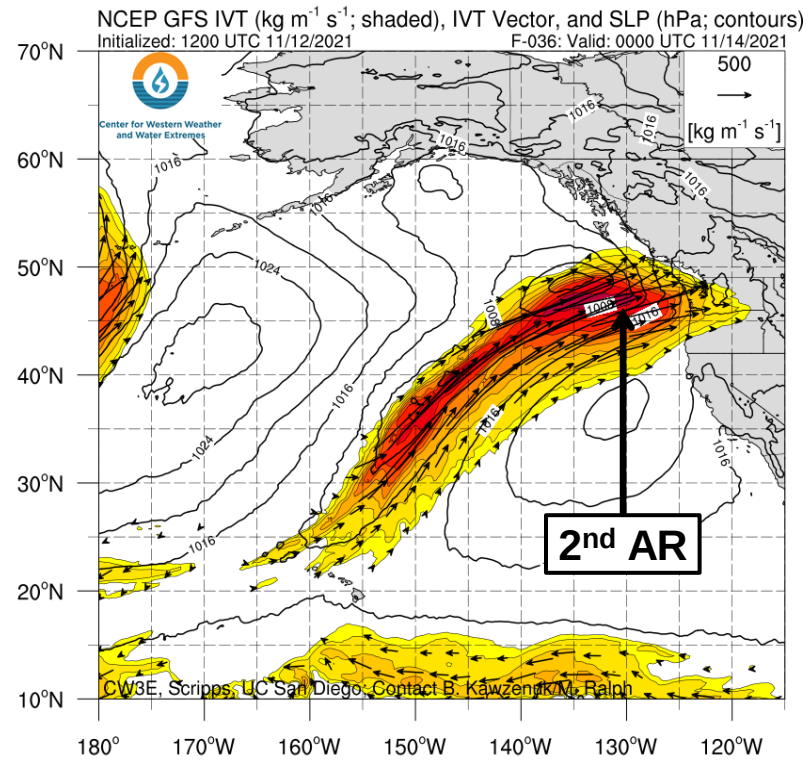
# AR Outlook: 12 Nov 2021

## GFS IVT Analyses and Forecasts

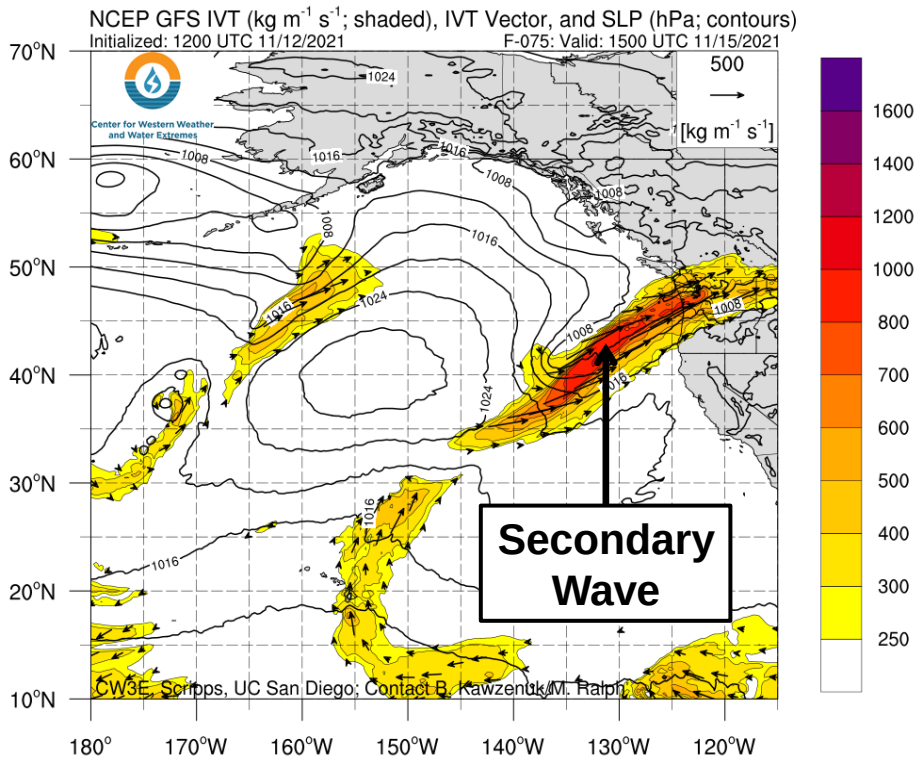
(A) Valid: 4 PM PT 10 Nov




(B) Valid: 4 PM PT 13 Nov (F-36)



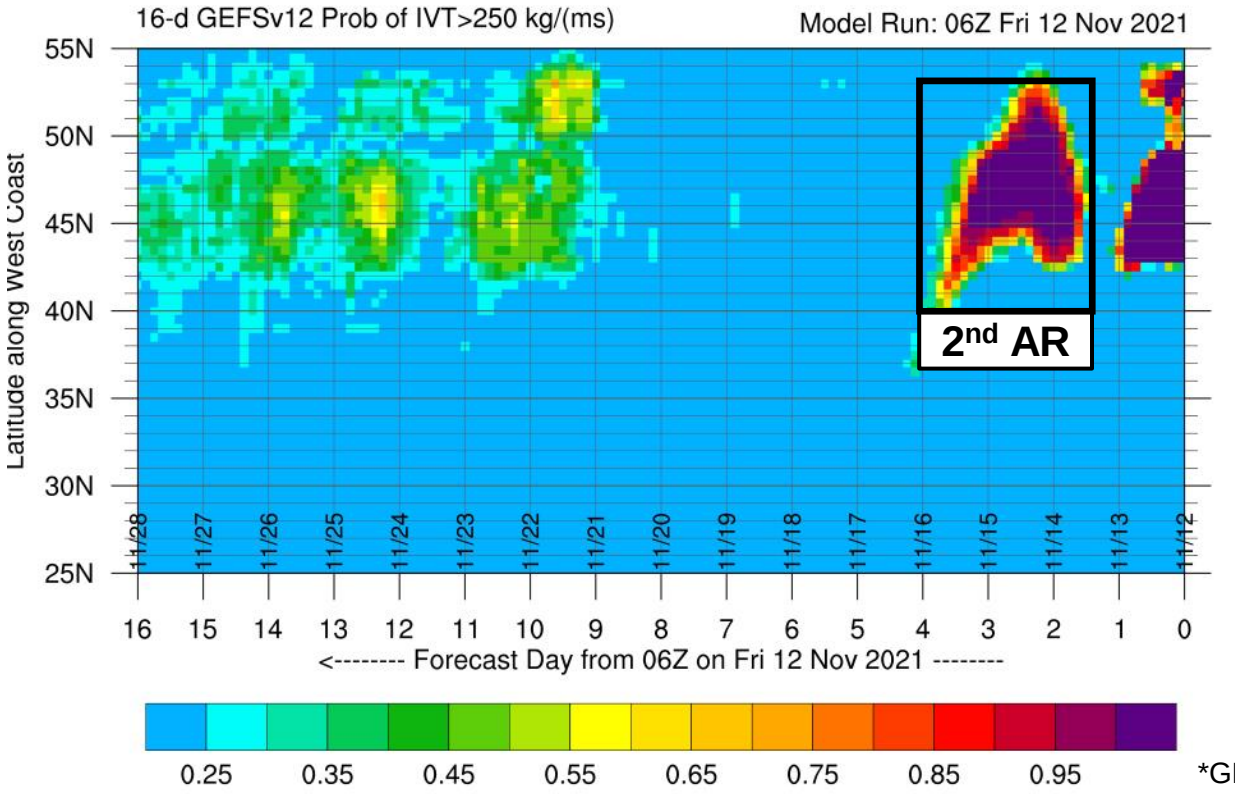

(C) Valid: 7 AM PT 15 Nov (F-75)

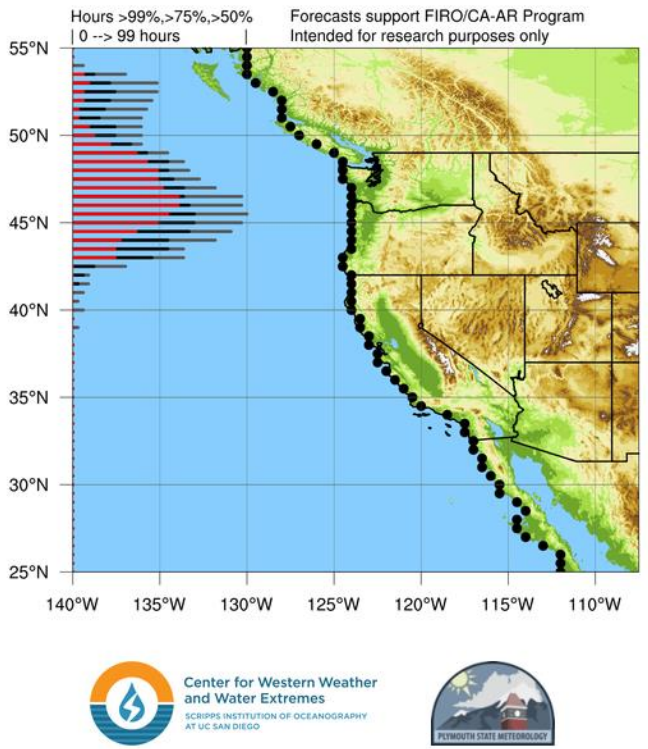



- The first AR made landfall in Oregon on the poleward side of a surface anticyclone on 10 Nov (Figure A)
- The second AR is forecasted to make landfall across Washington and northern Oregon on 13 Nov in association with a weak cyclogenesis event (Figure B)
- A second pulse of enhanced moisture transport is forecasted to occur on 15 Nov as a secondary wave propagates along the AR, but there is some uncertainty in the evolution of this feature (Figure C)

# AR Outlook: 12 Nov 2021

## Probability of AR Conditions Along Coast

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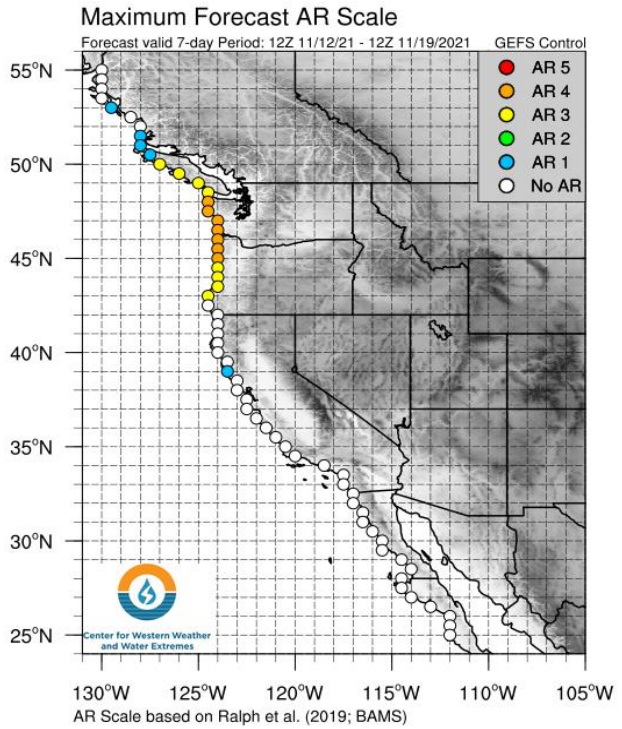
PLYMOUTH STATE METEOROLOGY

## AR Scale

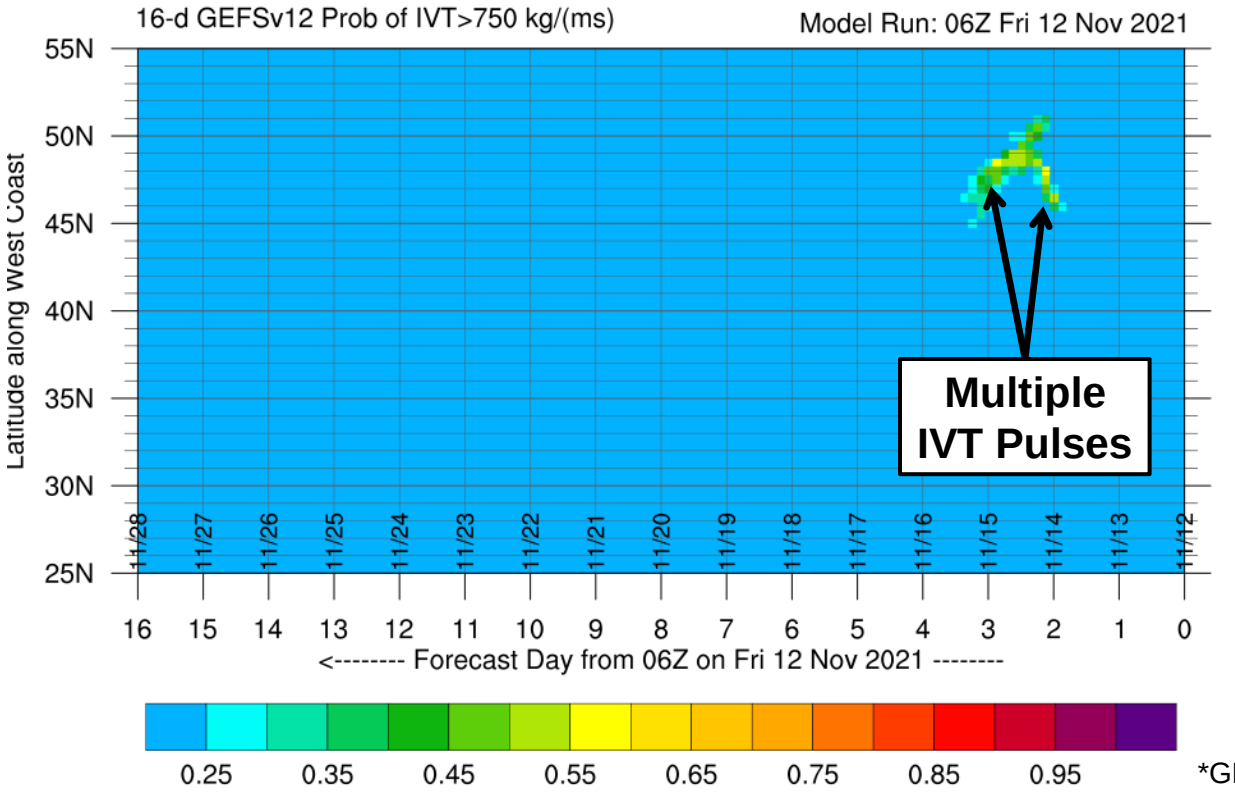


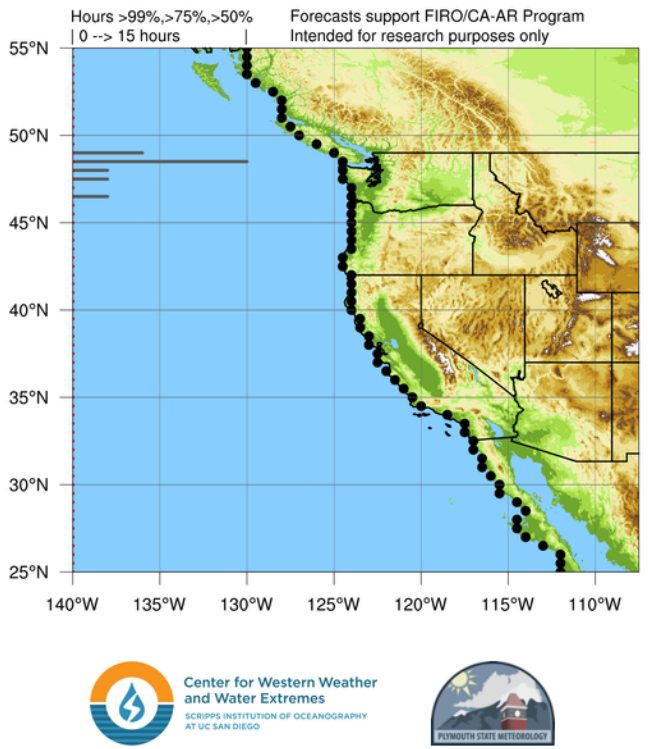

*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 06Z GEFS is showing very high confidence (100% probability) in a period of AR conditions (IVT > 250 kg $m^{-1}$ $s^{-1}$) over coastal Washington and Oregon in association with the second AR during 13–15 Nov
- Some locations near the Washington/Oregon border may experience AR conditions for more than 48 consecutive hours
- The 12Z GEFS control run is forecasting AR 4 conditions (based on the Ralph et al. 2019 AR Scale) in coastal Washington and northern coastal Oregon

# AR Outlook: 12 Nov 2021

## Probability of Strong AR Conditions Along Coast

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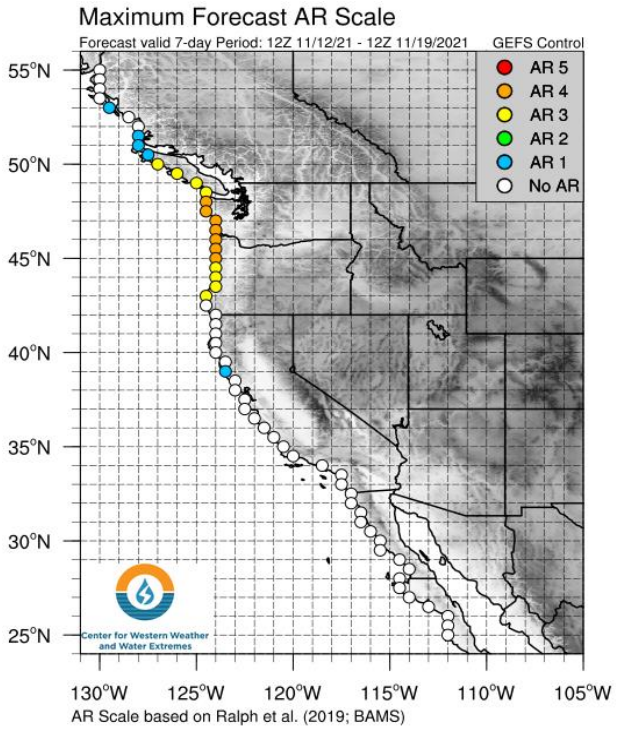
## AR Scale

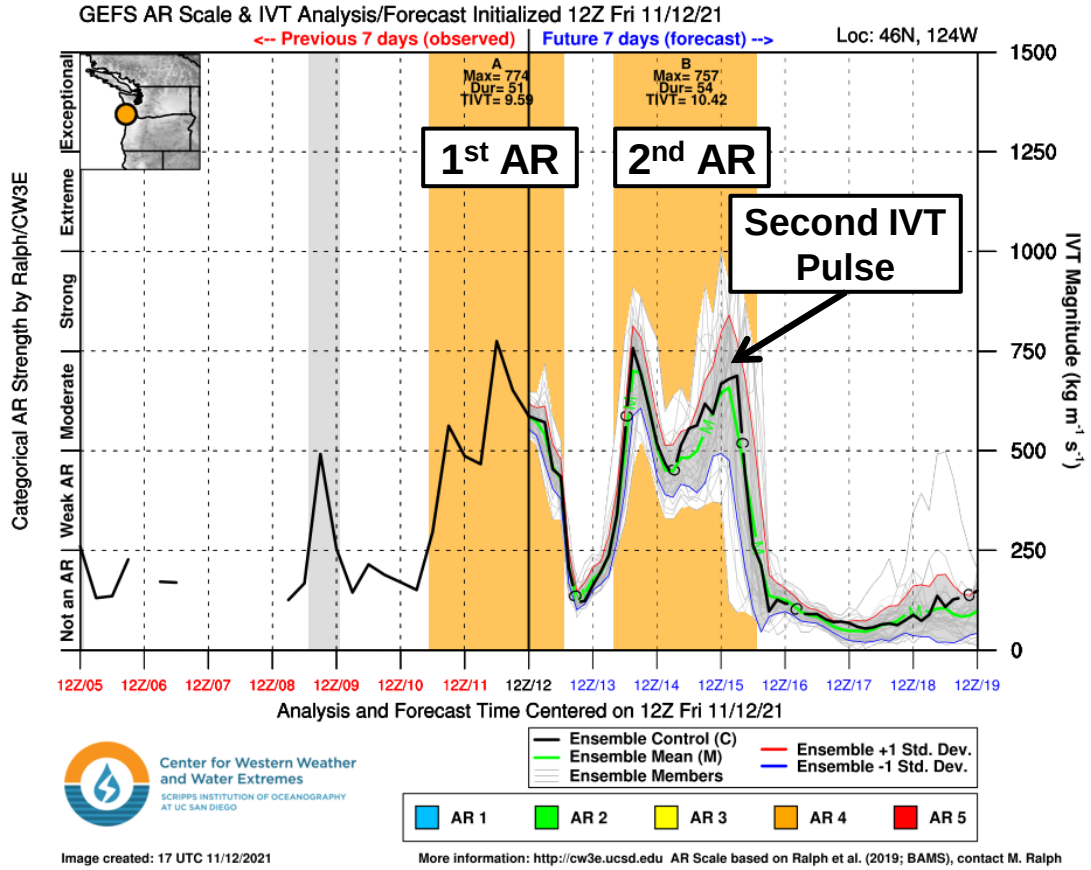


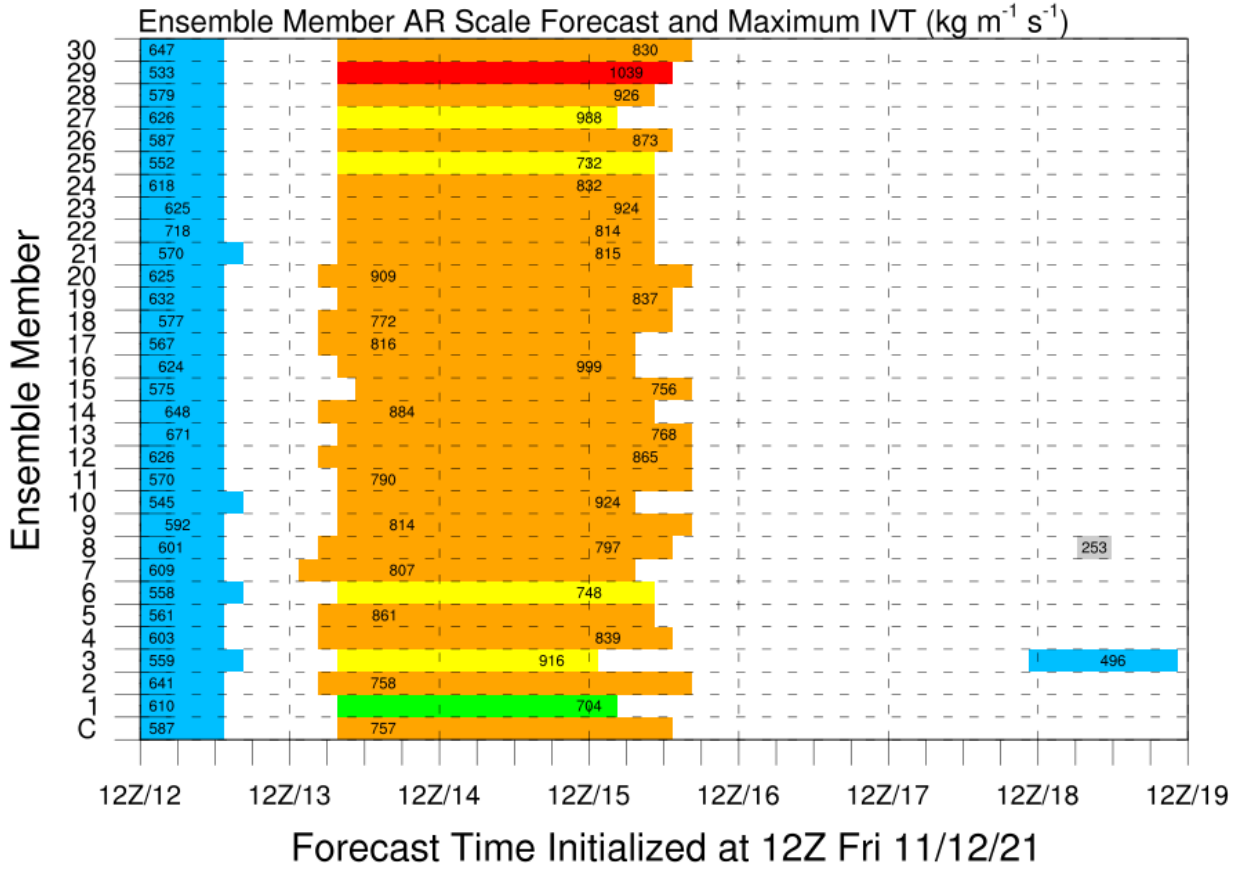

*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 06Z GEFS is also showing elevated probabilities (> 40%) of strong AR conditions (IVT > 750 kg $m^{-1}$ $s^{-1}$) during the second AR in coastal Washington and northern coastal Oregon
- The highest probabilities coincide with the two IVT pulses forecasted to occur around 06Z 14 Nov and 06Z 15 Nov

# AR Outlook: 12 Nov 2021

## GEFS AR Scale and IVT Forecasts



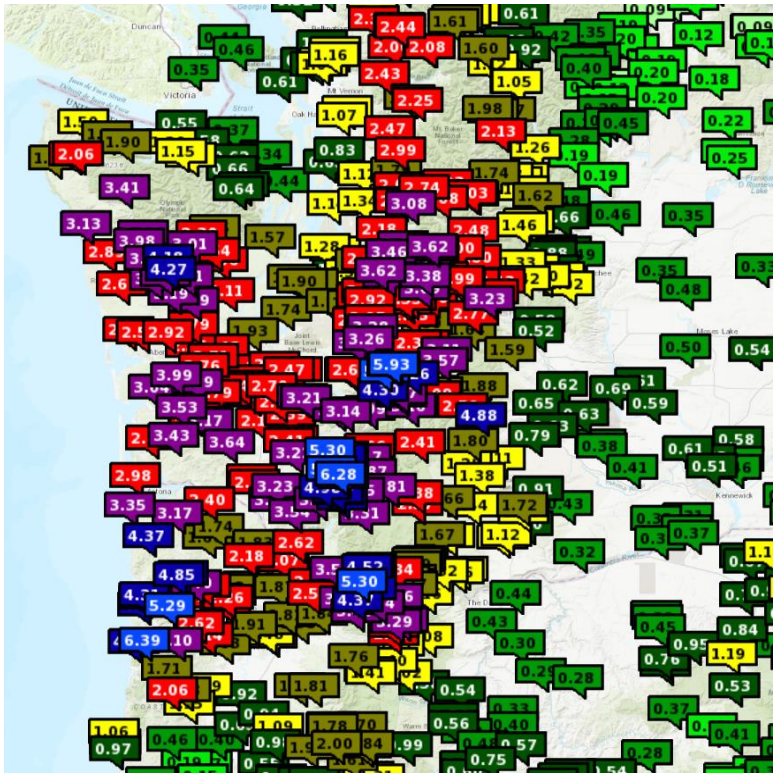

- The first AR produced AR 4 conditions at 46°N, 124°W (Clatsop County, OR)
- The 12Z GEFS control run is forecasting AR 4 conditions at this location in association with the second AR
- 26/31 (84%) ensemble members are predicting an AR 4/AR 5, and nearly all members are predicting an AR duration ≥ 48 hours
- The greatest forecast uncertainty is in the timing and strength of the second pulse of moisture transport on 15 Nov

# AR Outlook: 12 Nov 2021

AMBASSADOR™ WRN WEATHER-READY NATION

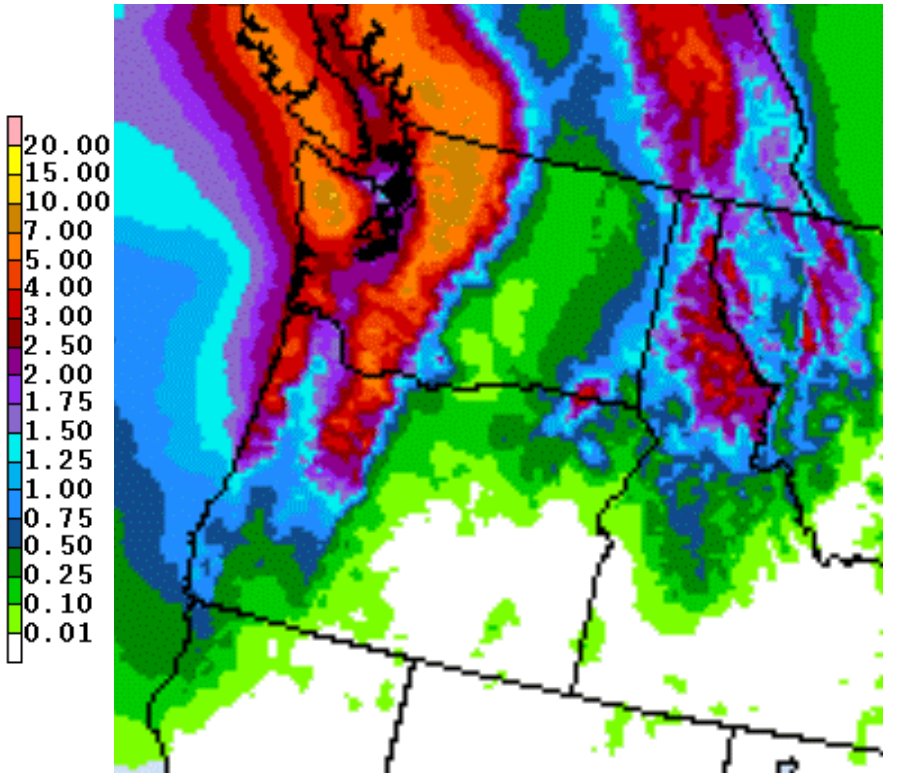
## Precipitation Impacts

24-h QPE: Valid 4 AM PT 11–12 Nov



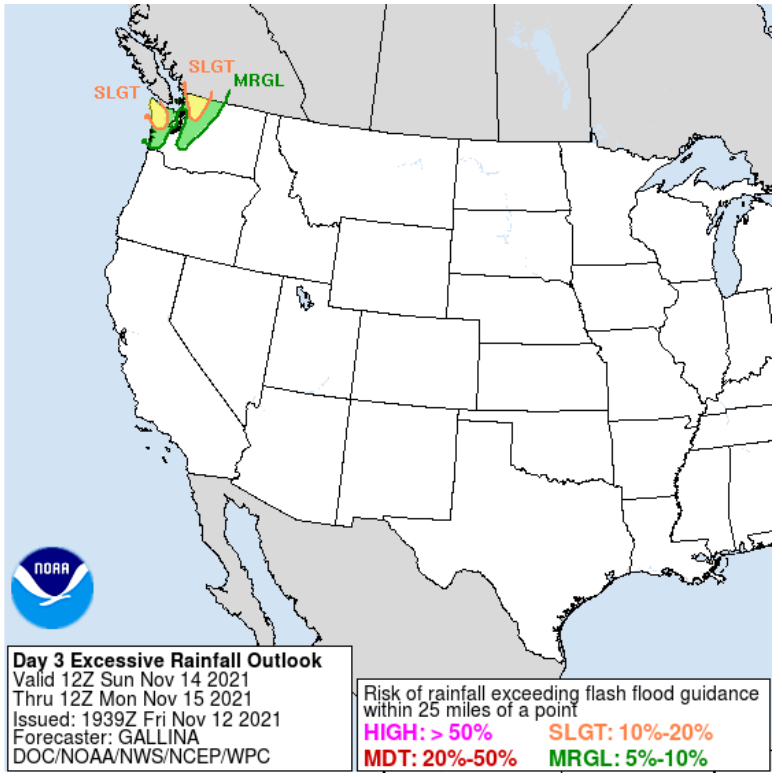
Source: NOAA/NWS NWRFC, https://www.nwrfc.noaa.gov/

WPC 5-day QPF: Valid 4 AM PT 12–17 Nov




Source: NOAA/NWS Weather Prediction Center, https://www.wpc.ncep.noaa.gov/

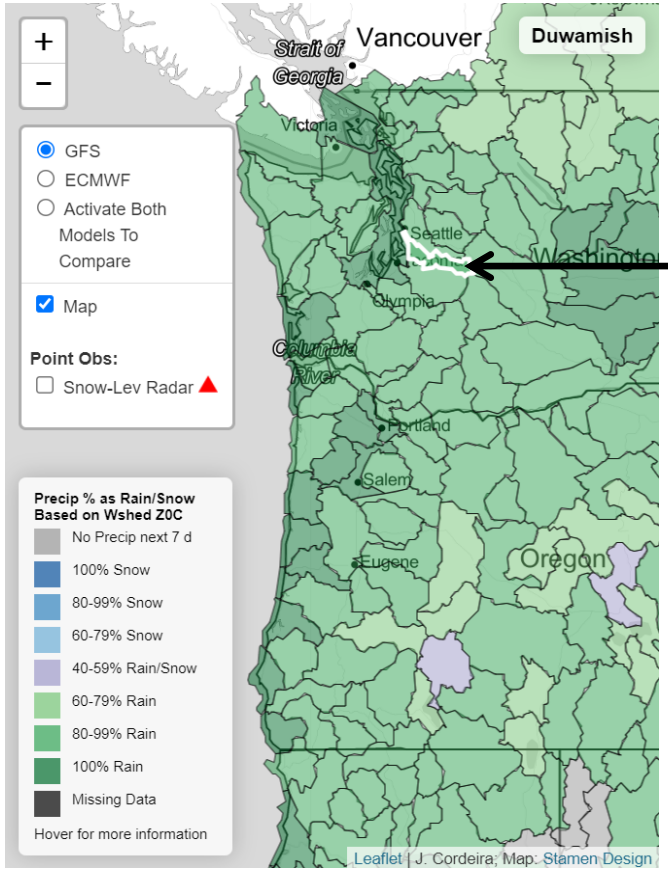
WPC Day 3 Excessive Rainfall Outlook

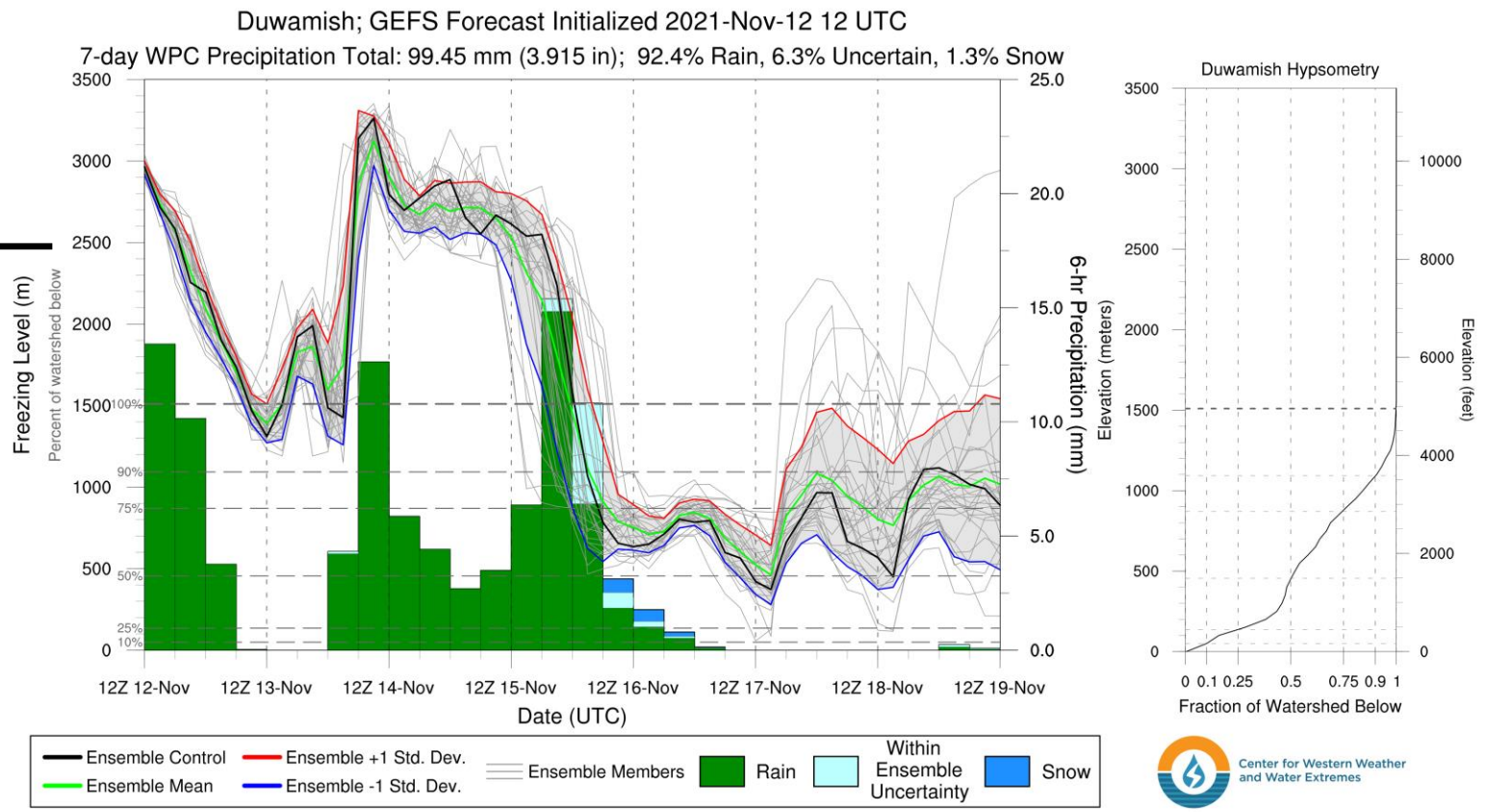



- The first AR produced heavy rainfall in western Washington and northwestern Oregon yesterday through this morning
- Several stations in the Cascades and Oregon Coast Ranges recorded > 5 inches of precipitation during the 24-h period ending 4 AM PT today
- The NWS Weather Prediction Center is forecasting an additional 5–10 inches of precipitation in the Olympic Peninsula and Washington Cascades over the next 5 days
- The NWS WPC has issued a slight risk of rainfall exceeding flash flood guidance for these areas following the second AR landfall

# AR Outlook: 12 Nov 2021

## Watershed Freezing Level and Precipitation Forecasts: Duwamish (Green River)

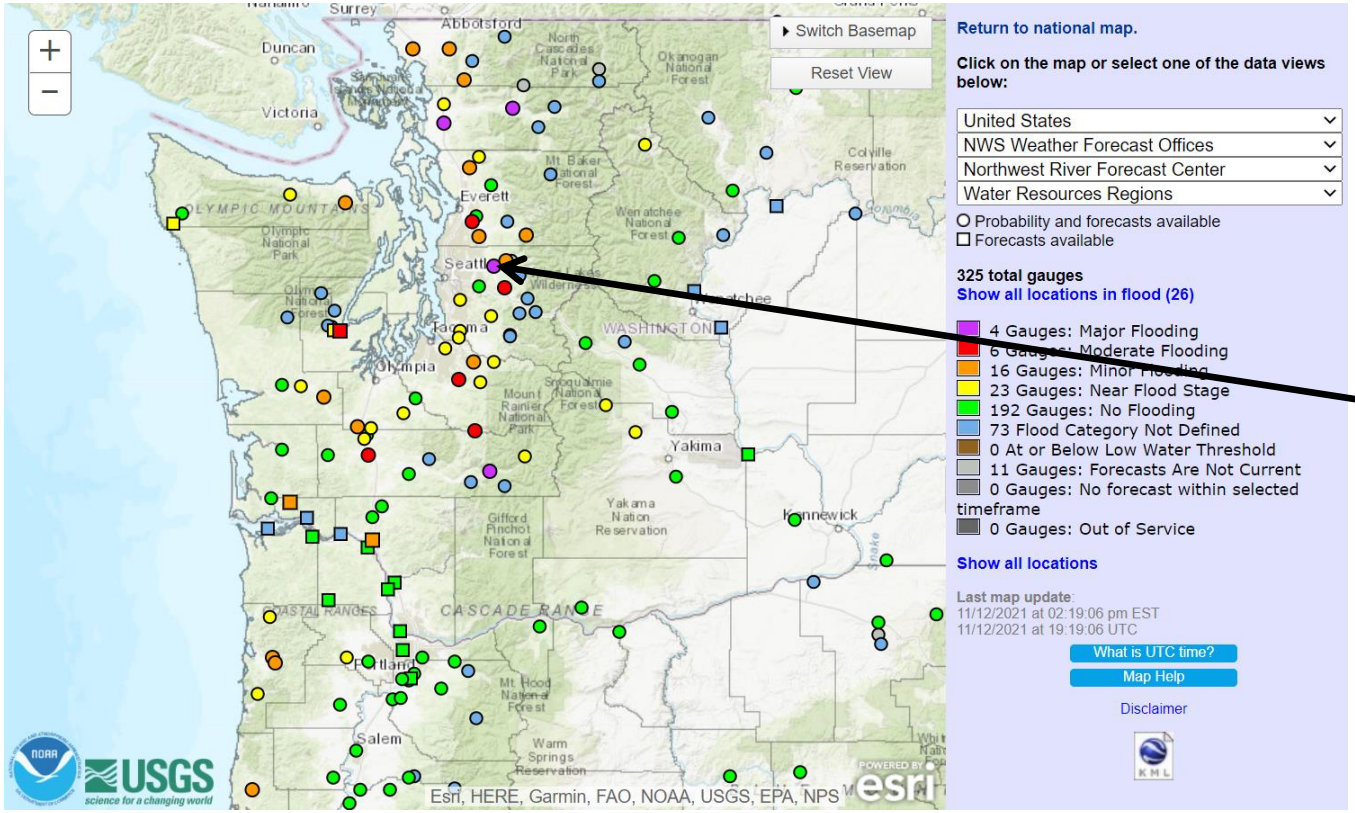


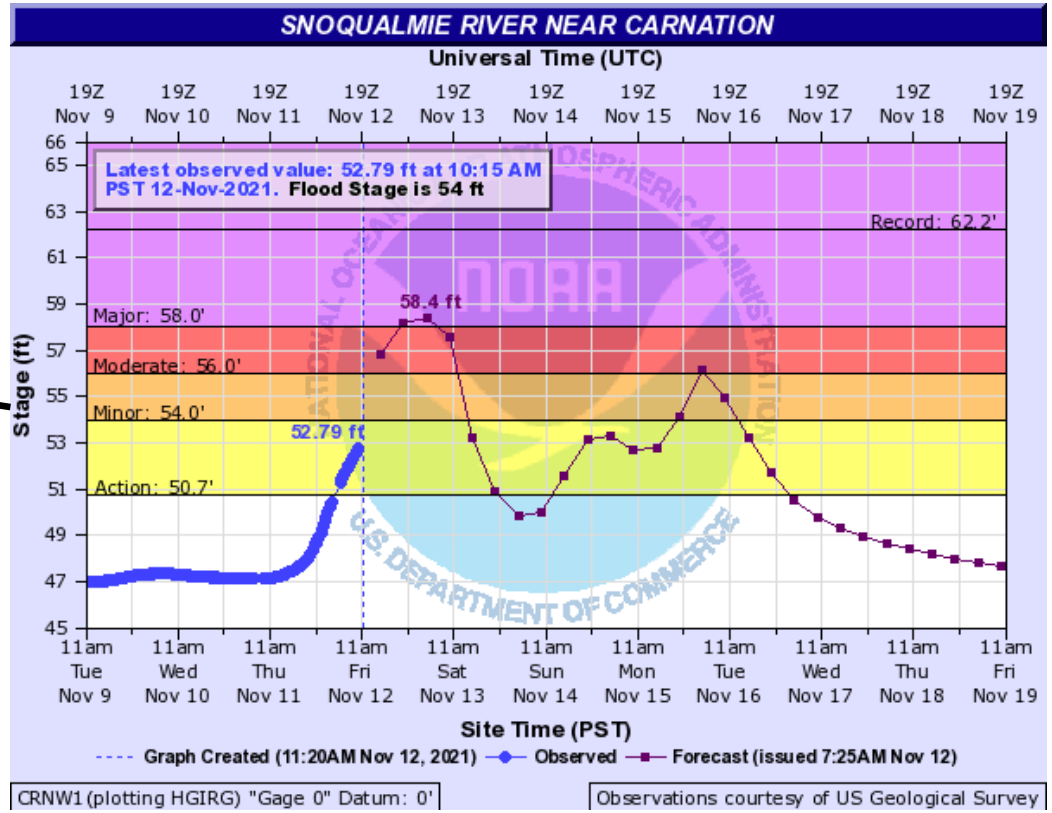




- The WPC is forecasting nearly 4 inches of mean areal precipitation in the Duwamish watershed during the next 7 days
- Most of the precipitation during the second AR is expected to fall in the form of rain due to very high freezing levels (increasing to > 8,000 feet as the AR makes landfall in Washington)
- Accumulating snow is likely in the Cascades toward the end of the event as freezing levels rapidly drop throughout the day on 15 Nov

# AR Outlook: 12 Nov 2021

## Hydrologic Forecasts



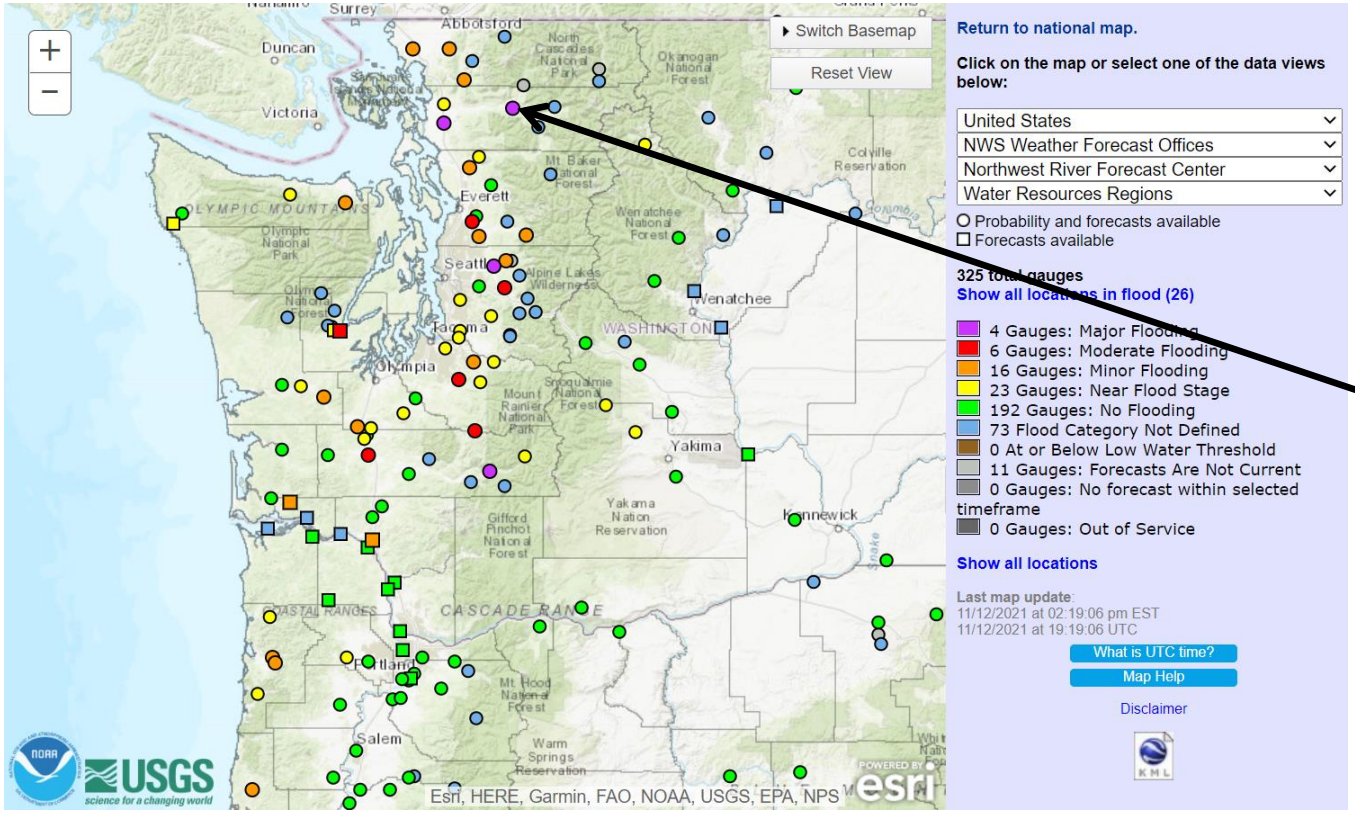



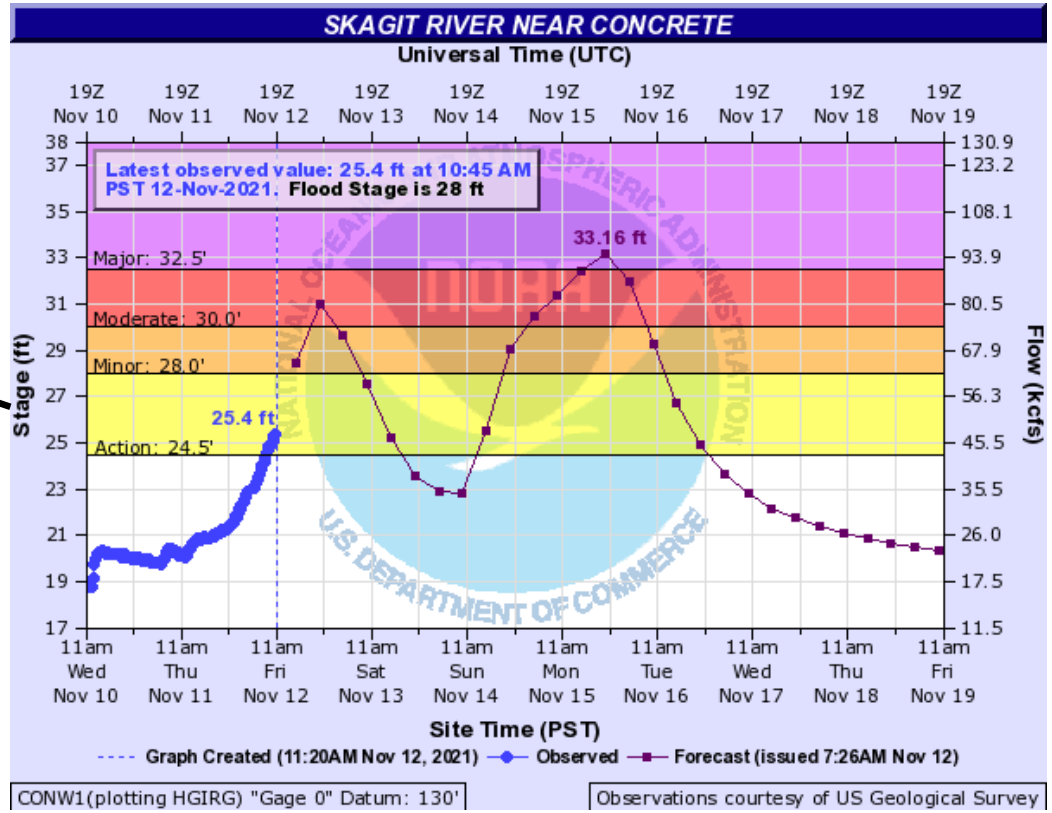

Source: NOAA/NWS Advanced Hydrologic Prediction Service, https://www.nifc.gov/

- The combination of heavy rain and moist soil conditions is expected to produce widespread riverine flooding in western Washington, particularly on the western side of the Cascade Mountains
- The Snoqualmie River (near Carnation, WA) is forecasted to rise to major flood stage (58.0 ft) late tonight

# AR Outlook: 12 Nov 2021

## Hydrologic Forecasts




Source: NOAA/NWS Advanced Hydrologic Prediction Service, https://www.nifc.gov/

- The worst flooding during the second AR is expected to occur downstream of the North Cascades
- The Skagit River (near Concrete, WA) is forecasted to rise to major flood stage (32.5 ft) on 15 Nov