

CW3E Atmospheric River Outlook: 31 October 2022

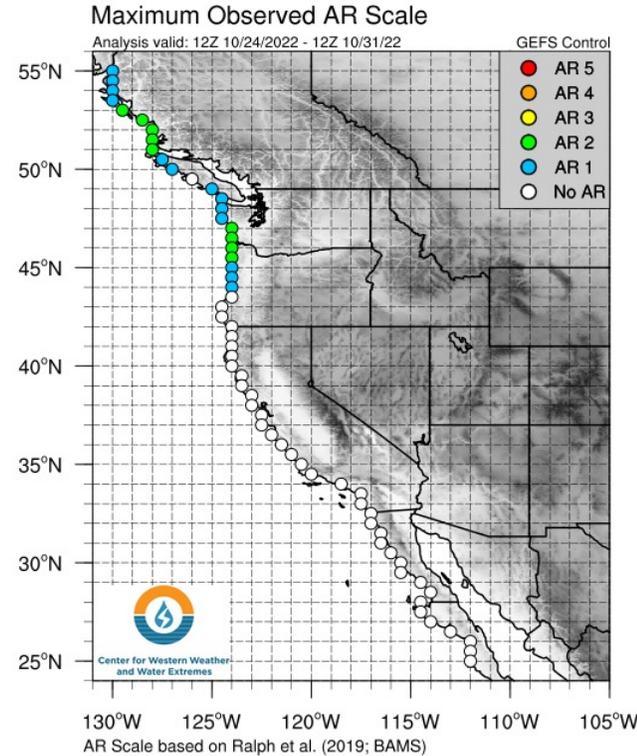
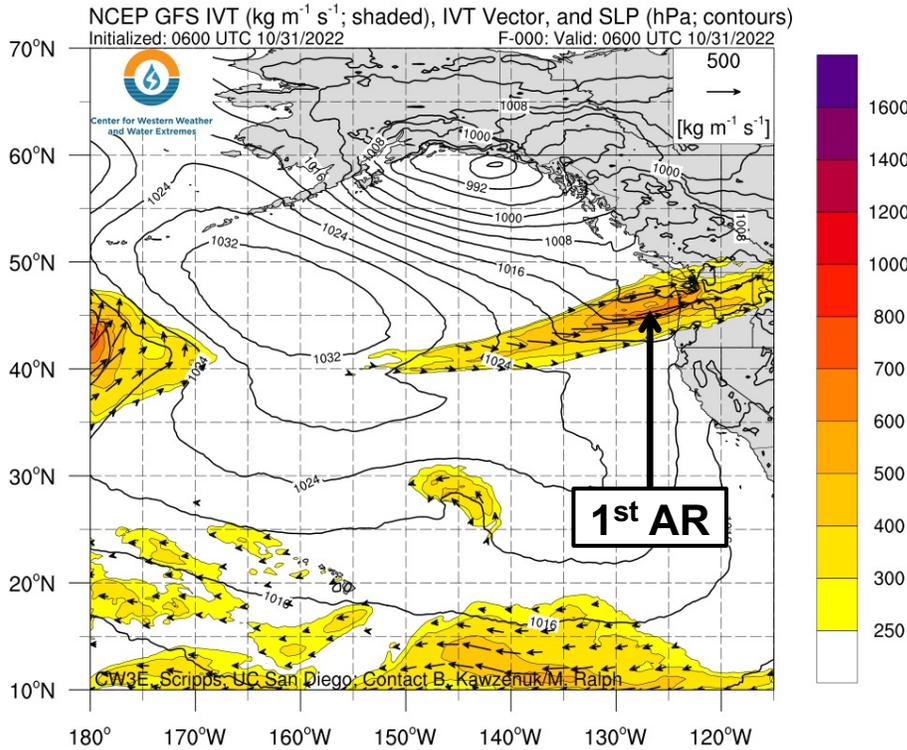
Strong Atmospheric River Forecast to Impact Pacific Northwest Later this Week

- An atmospheric river (AR) made landfall yesterday, bringing AR 1/AR 2 conditions (based on the Ralph et al. 2019 AR Scale) to coastal Washington and Oregon
- This AR produced heavy rainfall in western Washington, with portions of the Olympic Peninsula receiving more than 5 inches of precipitation since Sunday morning
- An upper-level shortwave trough will interact with the remnants of the first AR, bringing the first significant snowfall of the season to the Sierra Nevada
- A stronger AR is forecast to make landfall over Washington on Thursday and gradually move southward into Oregon and California
- AR 3/AR 4 conditions are currently forecast across much of coastal Washington and Oregon, with AR 1/AR 2 conditions forecast in Northern California
- AR 2/AR 3 conditions are also possible in interior Washington and Oregon due to significant inland penetration of the second AR
- The NWS Weather Prediction Center is forecasting more than 5 inches of total precipitation over portions of western Washington and Oregon during the next 7 days
- Additional heavy rainfall in areas that received heavy precipitation from the first AR could lead to riverine flooding in western Washington
- Significant snowfall is possible in the higher terrain of the North Cascades during the second AR

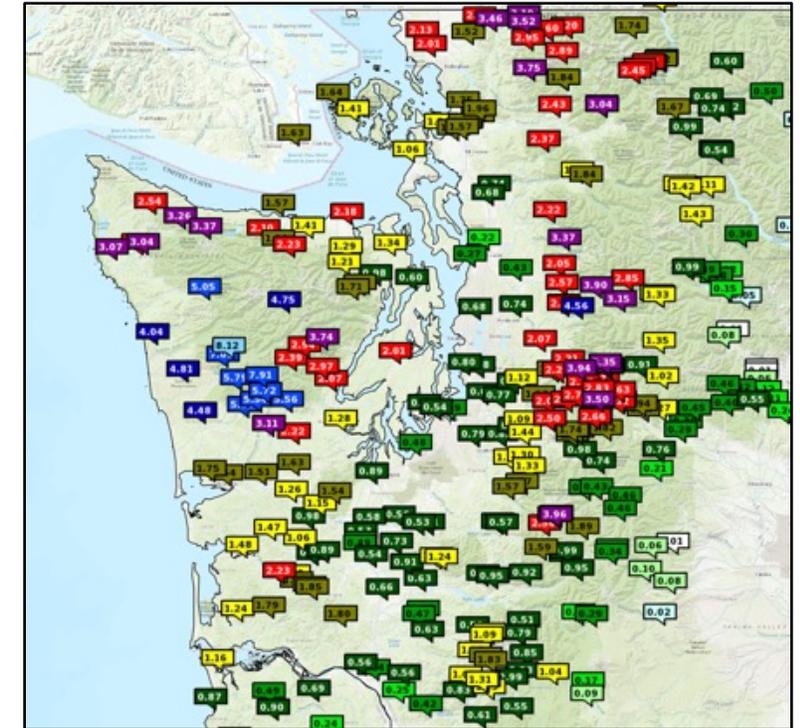
AR Outlook: 31 Oct 2022

Analysis of the First AR

GFS IVT Analysis (Valid: 11 PM PT 30 Oct)



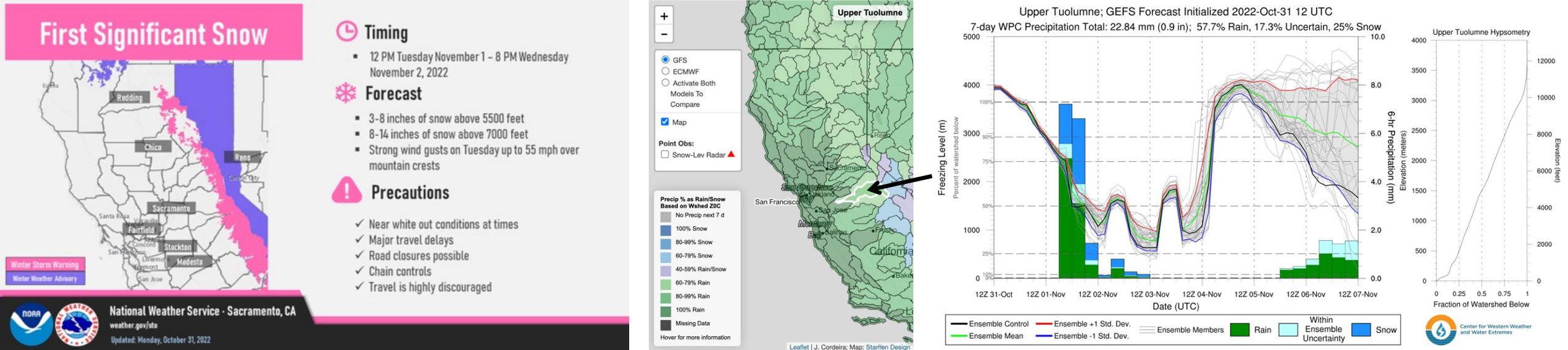
24-h QPE: Valid 5 AM PT 30–31 Oct



- The first AR made landfall yesterday, bringing AR 1/AR 2 conditions to coastal Washington and Oregon
- Although the moisture transport was not particularly strong, this AR still produced heavy rainfall over western Washington
- Some locations in the Olympic Peninsula have already received more than 5 inches of precipitation during the 24-hour period ending 5 AM PT this morning

AR Outlook: 31 Oct 2022

Analysis of the First AR

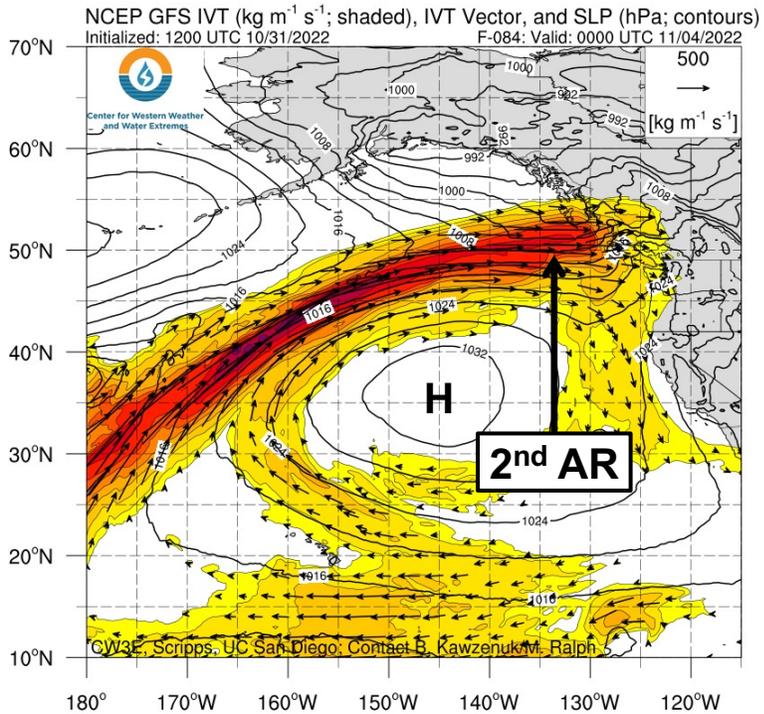


- An amplifying upper-level shortwave trough is expected to interact with the remnants of the first AR and produce light-to-moderate precipitation across much of California
- NWS Sacramento has issued a Winter Storm Warning for portions of the Northern and Central Sierra Nevada
- Freezing levels are expected to drop below 6,000 ft tomorrow, allowing for significant snowfall accumulations in the higher terrain
- The combination of snow and strong winds will likely cause hazardous travel conditions, especially at mountain passes

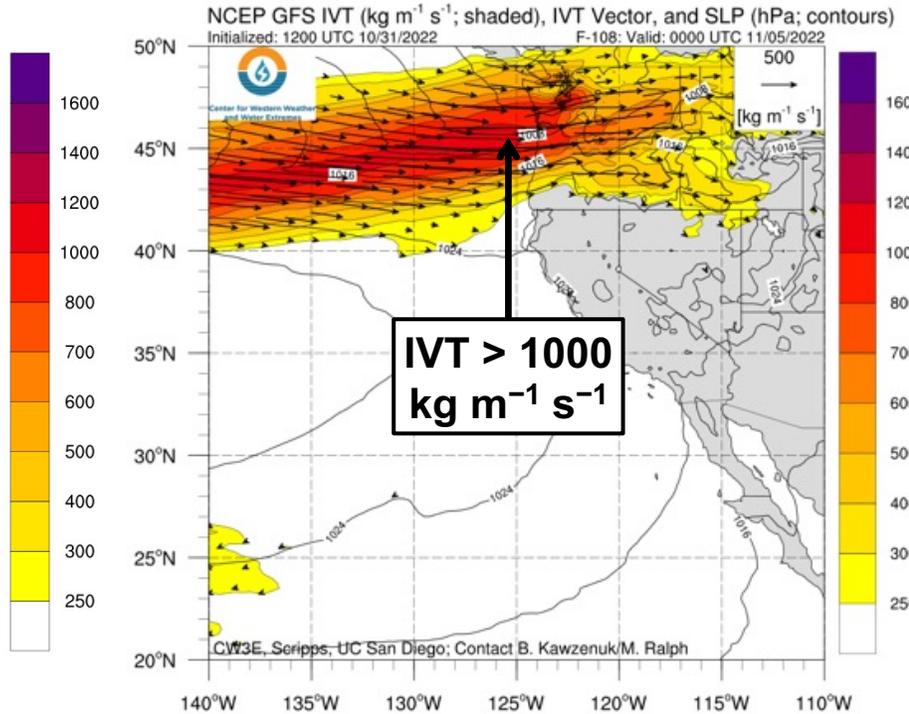
AR Outlook: 31 Oct 2022

GFS IVT Forecasts of the Second AR

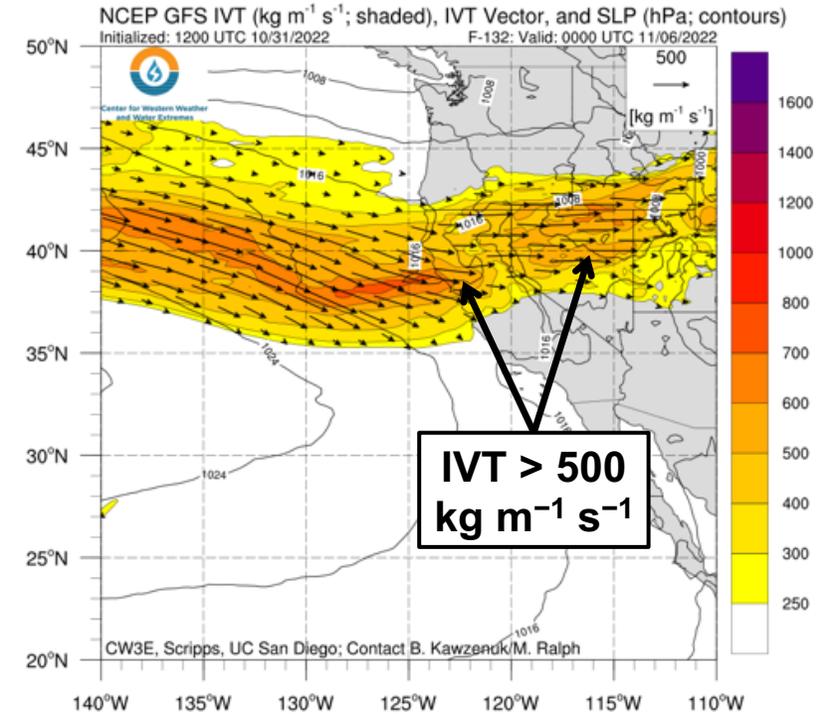
(A) Valid: 5 PM PT 3 Nov (F-84)



(B) Valid: 5 PM PT 4 Nov (F-108)



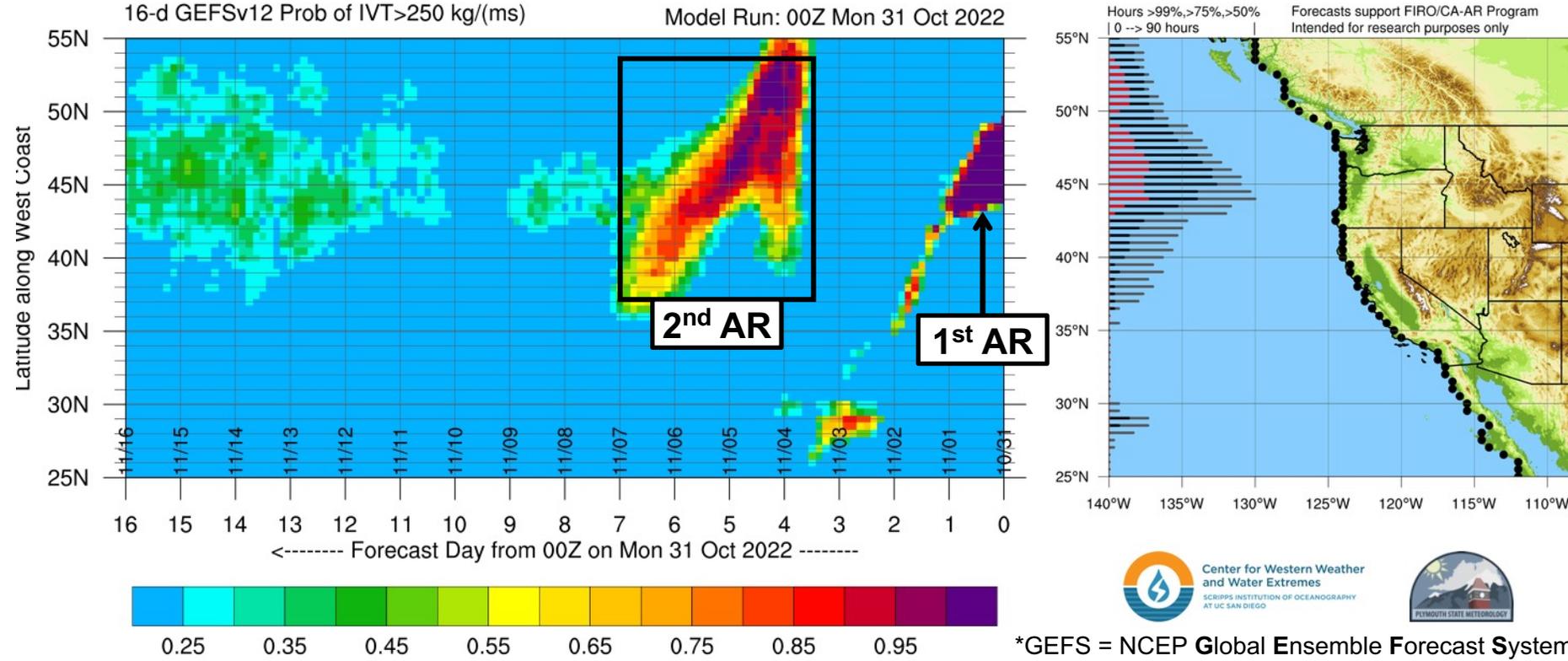
(C) Valid: 5 PM PT 5 Nov (F-132)



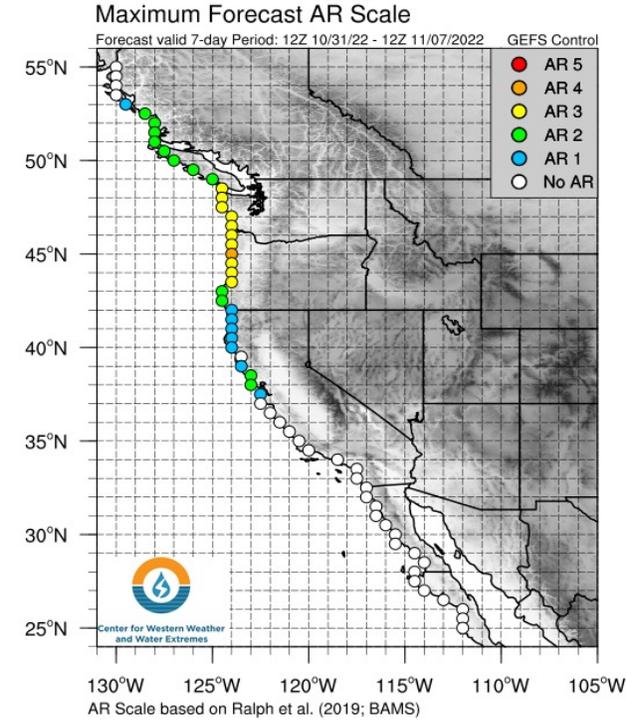
- The second AR is forecast to make landfall over British Columbia and Washington on 3 Nov on the poleward side of surface high pressure (Figure A)
- This AR is forecast to bring much stronger moisture transport to the region than the first AR, with maximum IVT values approaching $1000 \text{ kg m}^{-1} \text{ s}^{-1}$ near the Washington/Oregon border (Figure B)
- As time progresses, the AR is forecasted to bring moderate AR conditions ($500 \text{ kg m}^{-1} \text{ s}^{-1}$) to coastal Northern California as well as the Great Basin (Figure C)

AR Outlook: 31 Oct 2022

Probability of AR Conditions Along Coast



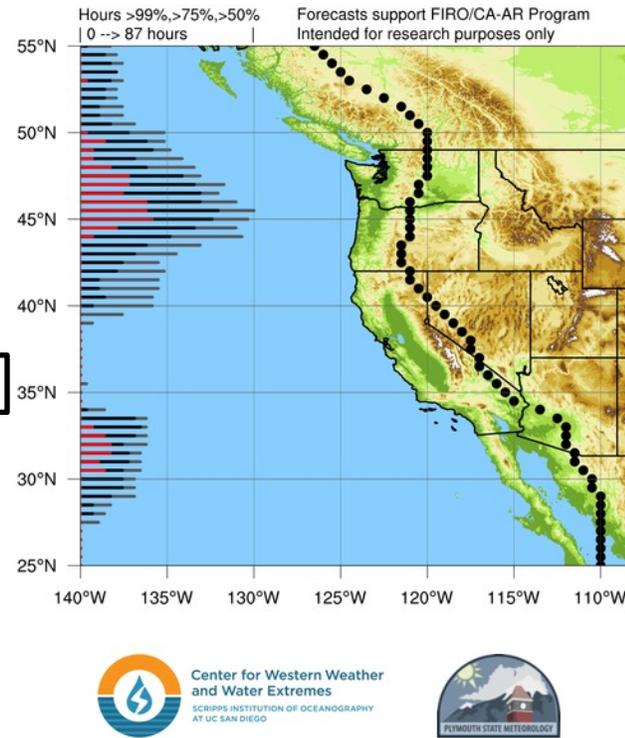
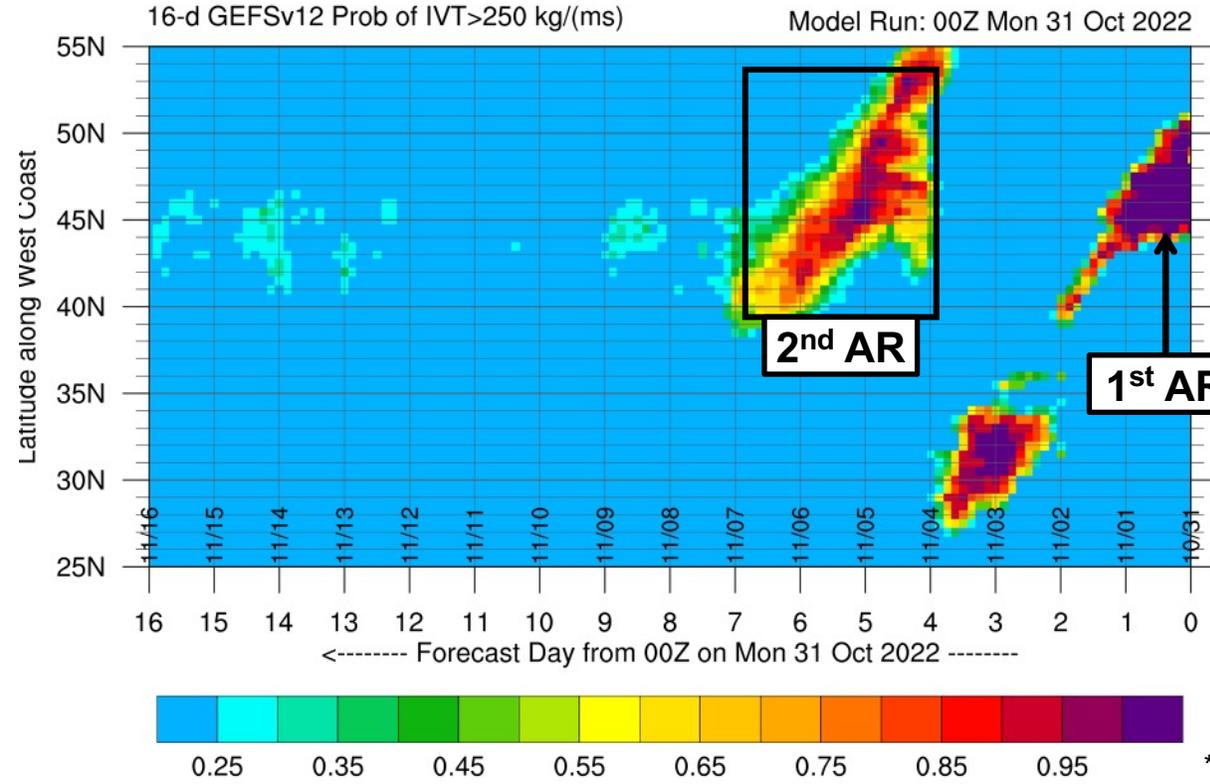
AR Scale



- The 00Z GEFS is showing high confidence (> 80% 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 3–5 Nov
- There is lower forecast confidence (60–80% probability) in AR conditions over Northern California
- 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 3/AR 4 conditions (based on the Ralph et al. 2019 AR Scale) over much of coastal Washington and Oregon, with AR 1/AR 2 conditions currently forecast over Northern California

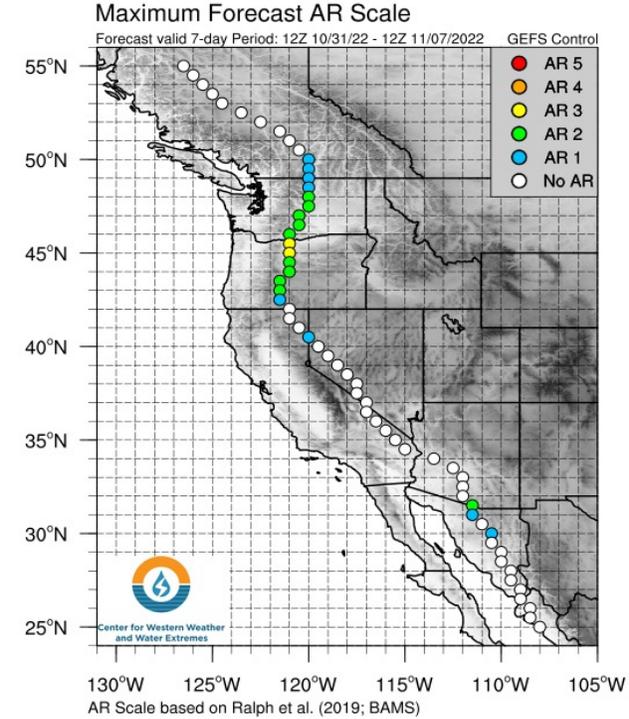
AR Outlook: 31 Oct 2022

Probability of AR Conditions Inland



*GEFS = NCEP Global Ensemble Forecast System (United States)

AR Scale



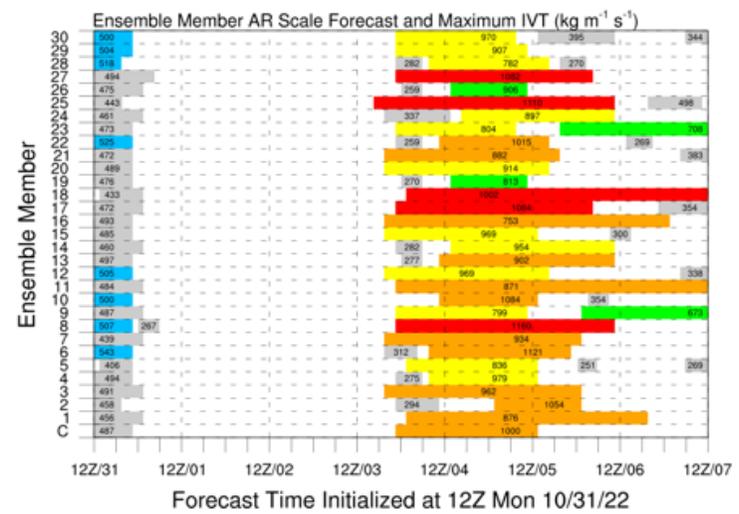
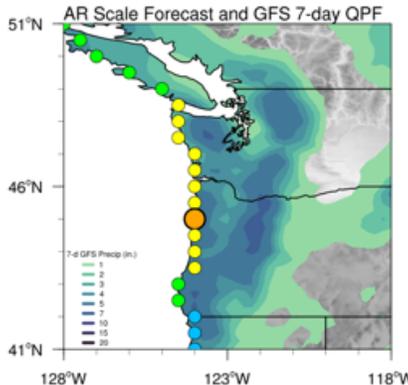
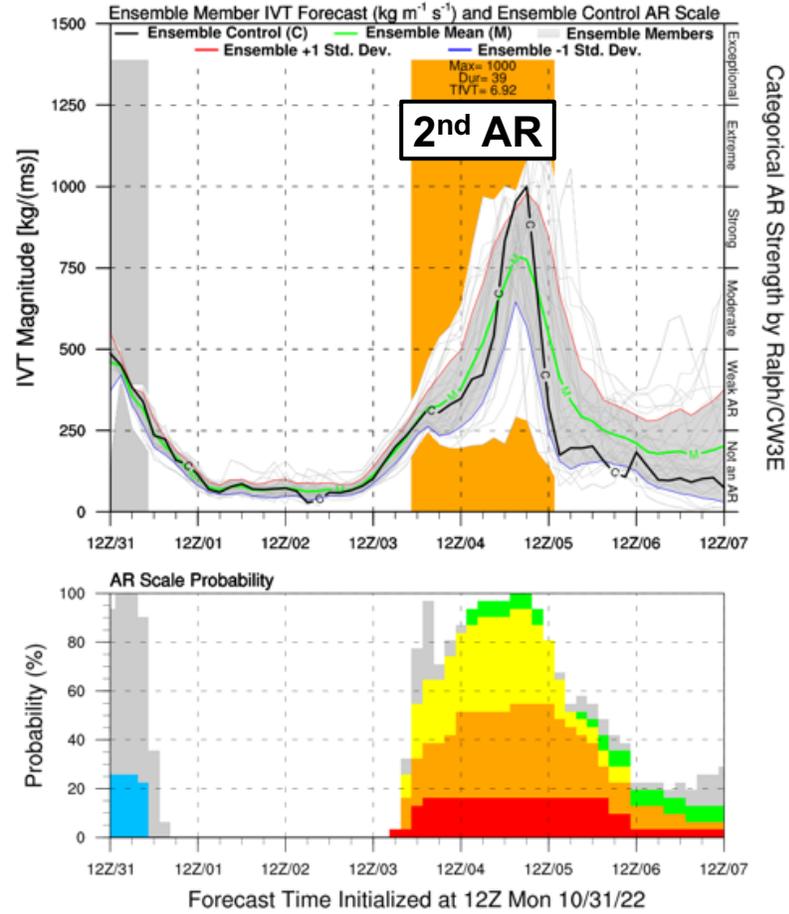
- The 00Z GEFS is also showing high confidence (> 80% probability) in a period of AR conditions over interior Washington and Oregon in association with the second AR
- The 12Z GEFS control run is forecasting an AR 2/AR 3 in interior Washington and Oregon due to significant inland penetration of moderate-to-strong AR conditions ($IVT > 500 \text{ kg m}^{-1} \text{ s}^{-1}$)

AR Outlook: 31 Oct 2022

GEFS AR Scale and IVT Forecasts

GFS Ensemble Initialized: 12Z Mon 10/31/22

Location: 45°N 124°W



- The 12Z GEFS control run is forecasting an AR 4 at 45°N, 124°W (near Lincoln City, OR) in association with the second AR
- 17/31 (55%) ensemble members are forecasting an AR 4 or an AR 5, and all but two ensemble members are forecasting at least an AR 3 at this location
- 10/31 (32%) ensemble members are predicting a peak IVT magnitude $\geq 1000 \text{ kg m}^{-1} \text{ s}^{-1}$
- There is still considerable uncertainty in the maximum IVT magnitude as well as the timing and duration of the second AR



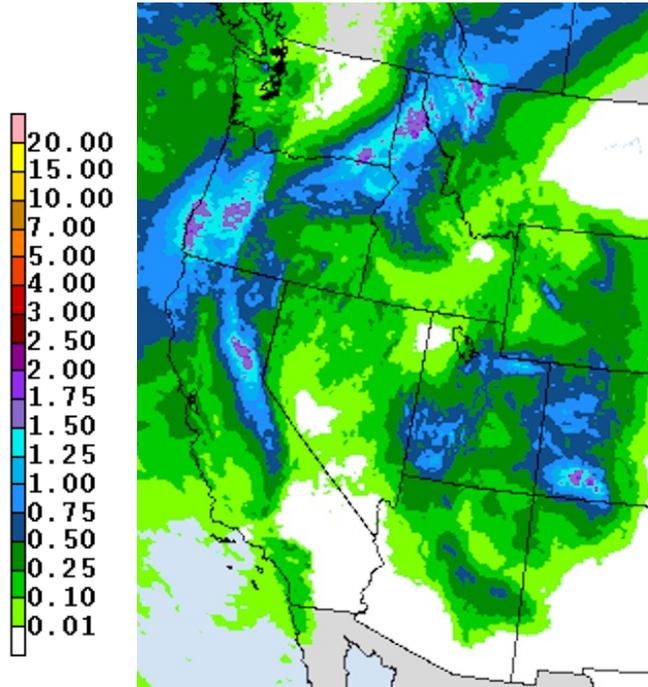
AR 1 AR 2 AR 3 AR 4 AR 5

Image created: 17 UTC 10/31/2022

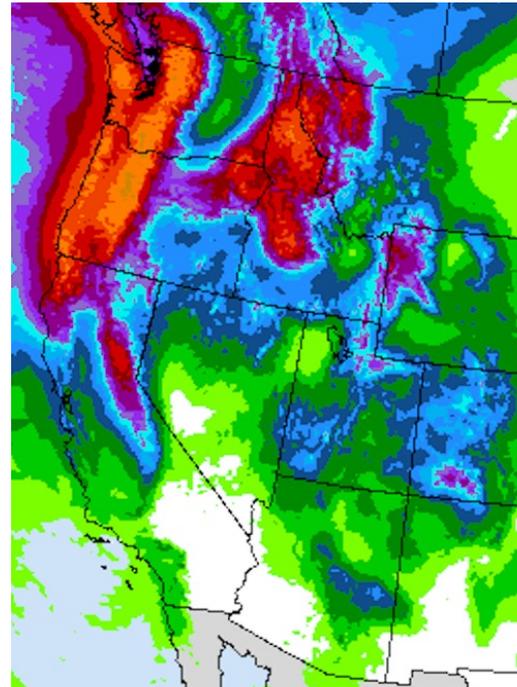
More information: <http://cw3e.ucsd.edu> AR Scale based on Ralph et al. (2019; BAMS), contact M. Ralph

Precipitation Impacts

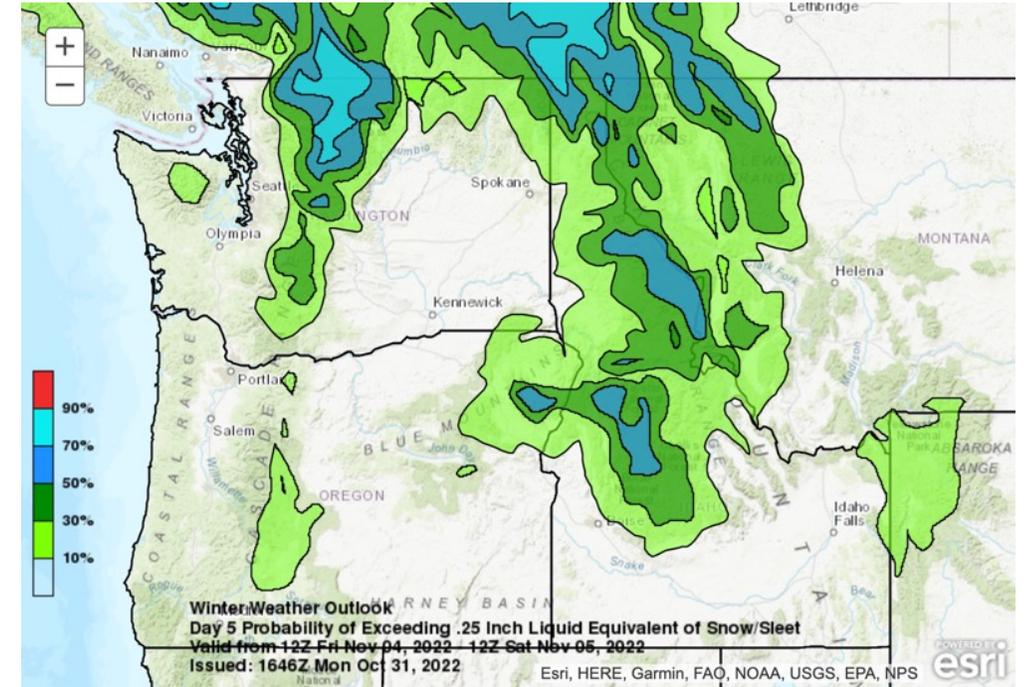
WPC 3-day QPF:
Valid 5 PM PT 31 Oct – 3 Nov



WPC 7-day QPF:
Valid 5 PM PT 31 Oct – 7 Nov



WPC Day 5 Probability of > 0.25" Frozen Precipitation:
Valid 5 AM 4–5 Nov

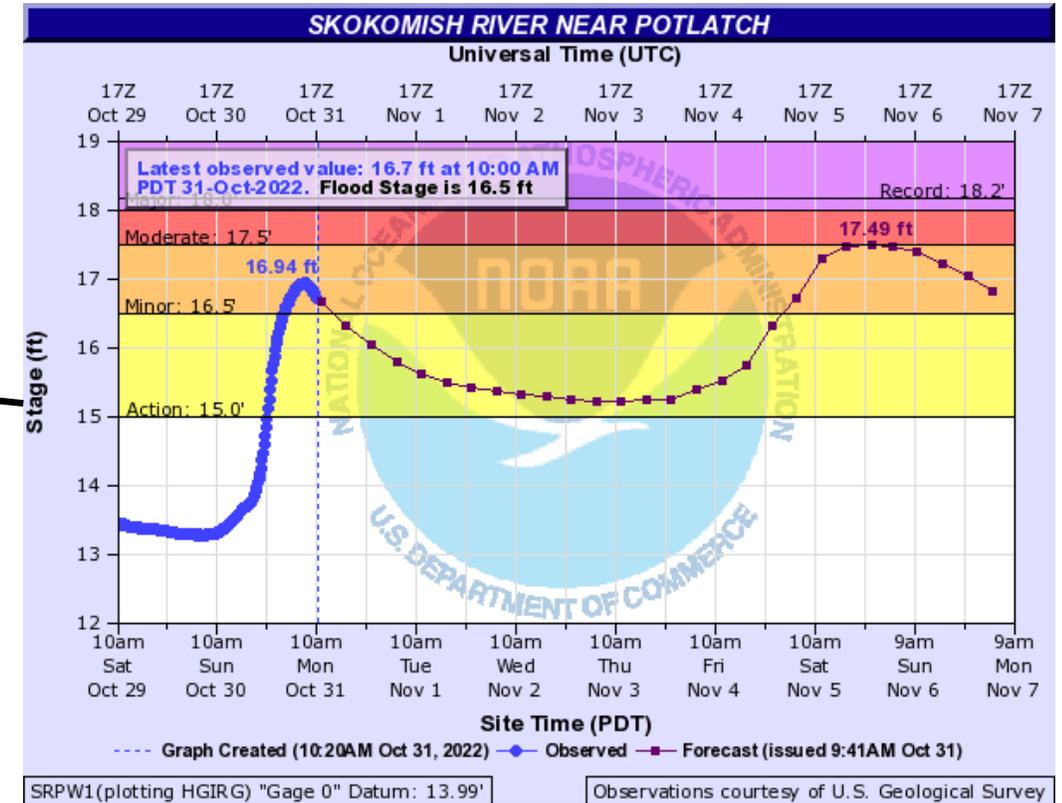
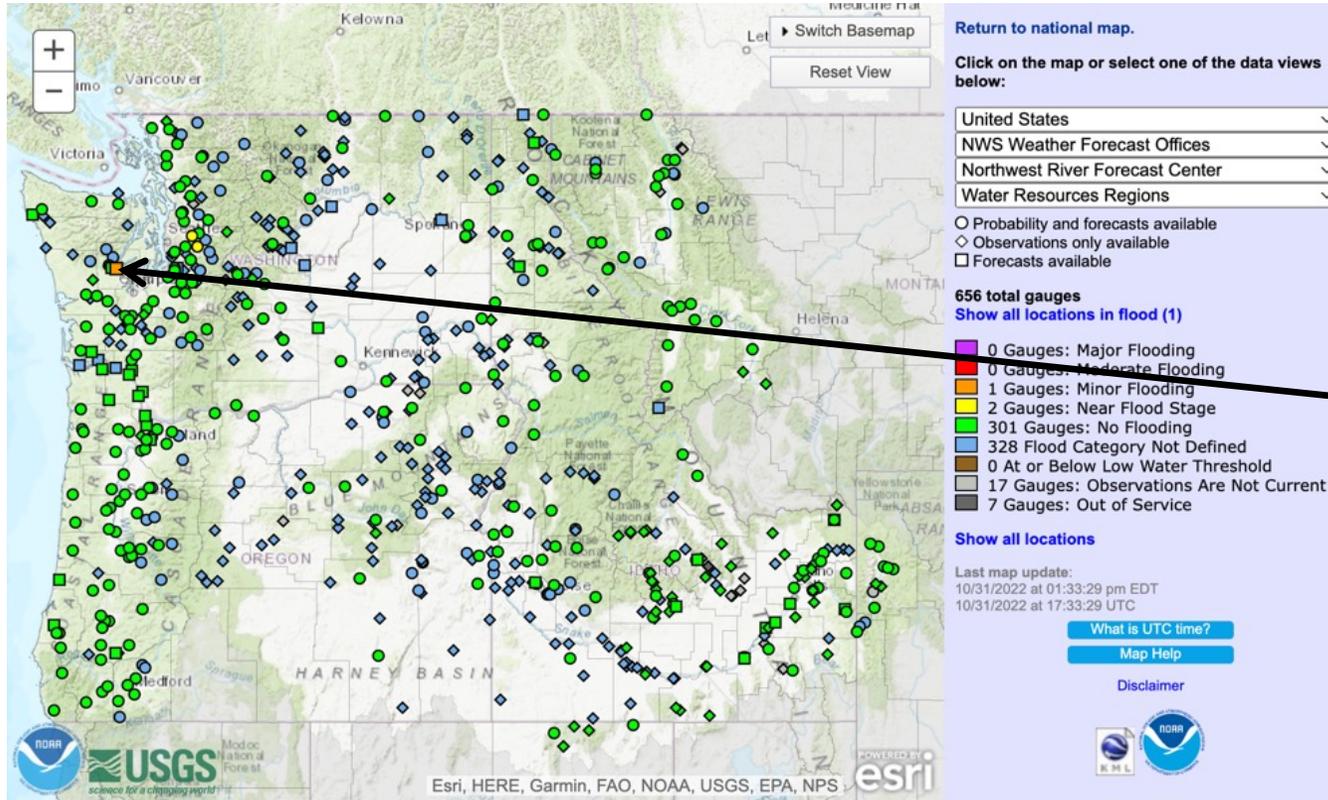


Source: NOAA/NWS Weather Prediction Center, <https://www.wpc.ncep.noaa.gov/>

- The remnants of the first AR and a shortwave trough over the U.S. West Coast are expected to bring 1–2 inches of precipitation to portions of the interior Pacific Northwest, the Oregon Coast Ranges and Cascades, the Sierra Nevada, and the Upper Colorado Basin over the next 3 days
- The NWS Weather Prediction Center is forecasting more than 5 inches of total precipitation in the Coast Ranges and Cascades of Washington and Oregon over the next 7 days, with most of this precipitation coming from the second AR
- More than 3 inches of total precipitation are possible in the interior Pacific Northwest, far northwestern California, and the Northern Sierra Nevada
- Freezing levels are forecast to rise as the second AR makes landfall, but significant snowfall is possible in the higher terrain of the North Cascades

AR Outlook: 31 Oct 2022

Hydrologic Forecasts



Source: NOAA/NWS Advanced Hydrologic Prediction Service, <https://water.weather.gov/ahps/>

- Heavy rain from the first AR caused the Skokomish River (near Potlach, WA) to rise above flood stage (16.5 ft) early this morning
- River levels are forecast to remain above action stage (15.0 ft) for the next several days and then exceed flood stage once again after the second AR makes landfall