

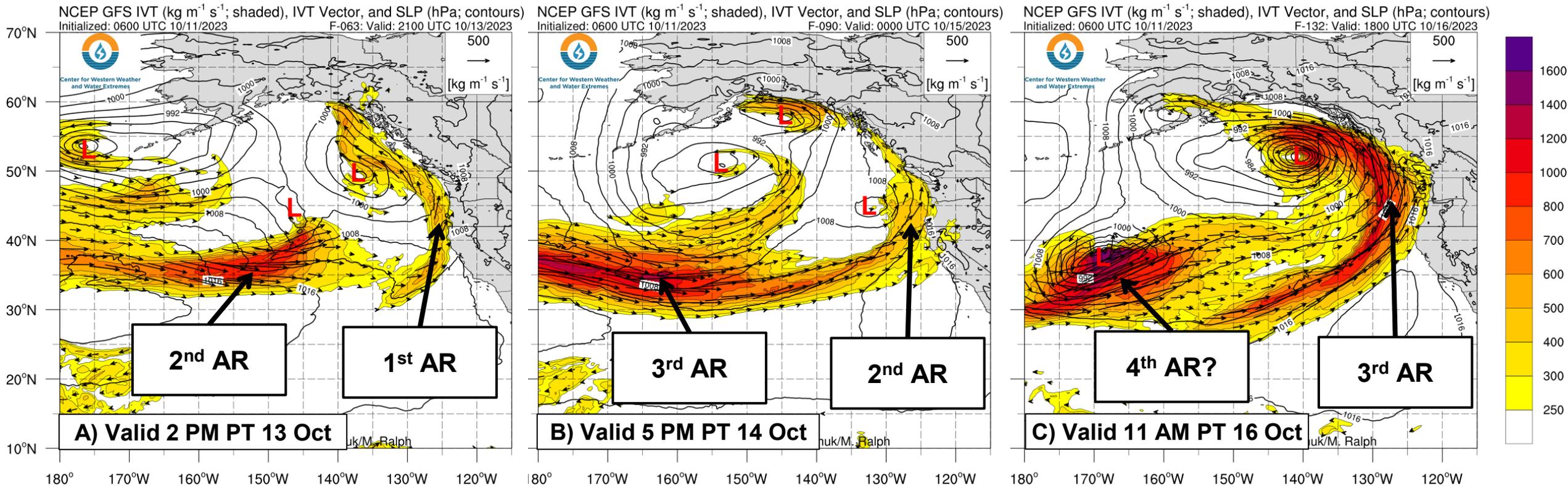
CW3E Atmospheric River Outlook: 11 October 2023

Several ARs to Move Across the Pacific Northwest During the Next Week

- Several Atmospheric Rivers (ARs) will impinge on the Washington, Oregon, and Northern California coasts beginning Friday (Oct 13) and continuing into early next week.
- Weak AR1-2 conditions (based on the Ralph et al. 2019 AR Scale) are likely Friday afternoon through Sunday (Oct 15) along the WA/OR coastal areas with the 1st and 2nd ARs.
- The jet stream will remain very active across the North Pacific Ocean early next week, providing optimal conditions for continued AR activity in the Monday (Oct 16) to Wednesday (Oct 18) timeframe.
- However, there is considerable model uncertainty surrounding the details of the 3rd AR.
- In total, AR1 or stronger conditions are likely (90%) from Point Reyes, CA and northward around Monday. There is a moderate chance (70%) of up to AR3 conditions along the WA and OR coasts during this time and a low (20%) chance for AR5 conditions along the OR coast.
- Through the next seven days, 2-5" of rain are expected along the coastal mountains and Cascades with localized higher amounts possible.
- Snow levels will remain elevated and mostly above 8,000' through the event.
- While notable rain is forecast and area rivers will rise, currently no rivers are forecast to exceed flood stage.
- With much more uncertainty, there is potential for a 4th AR later next week.

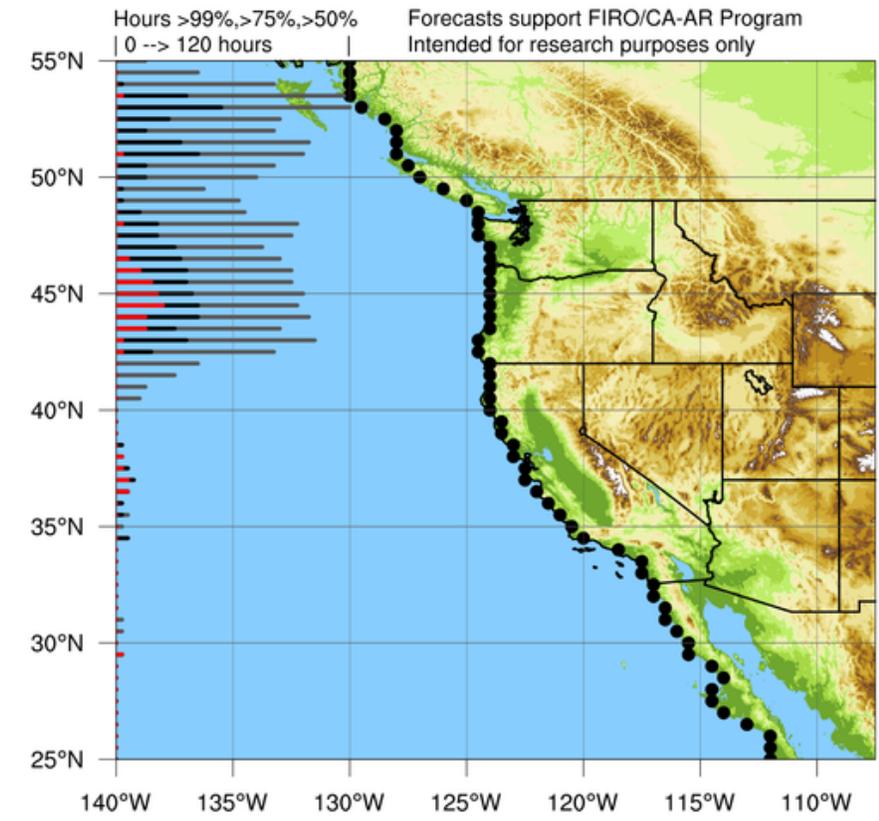
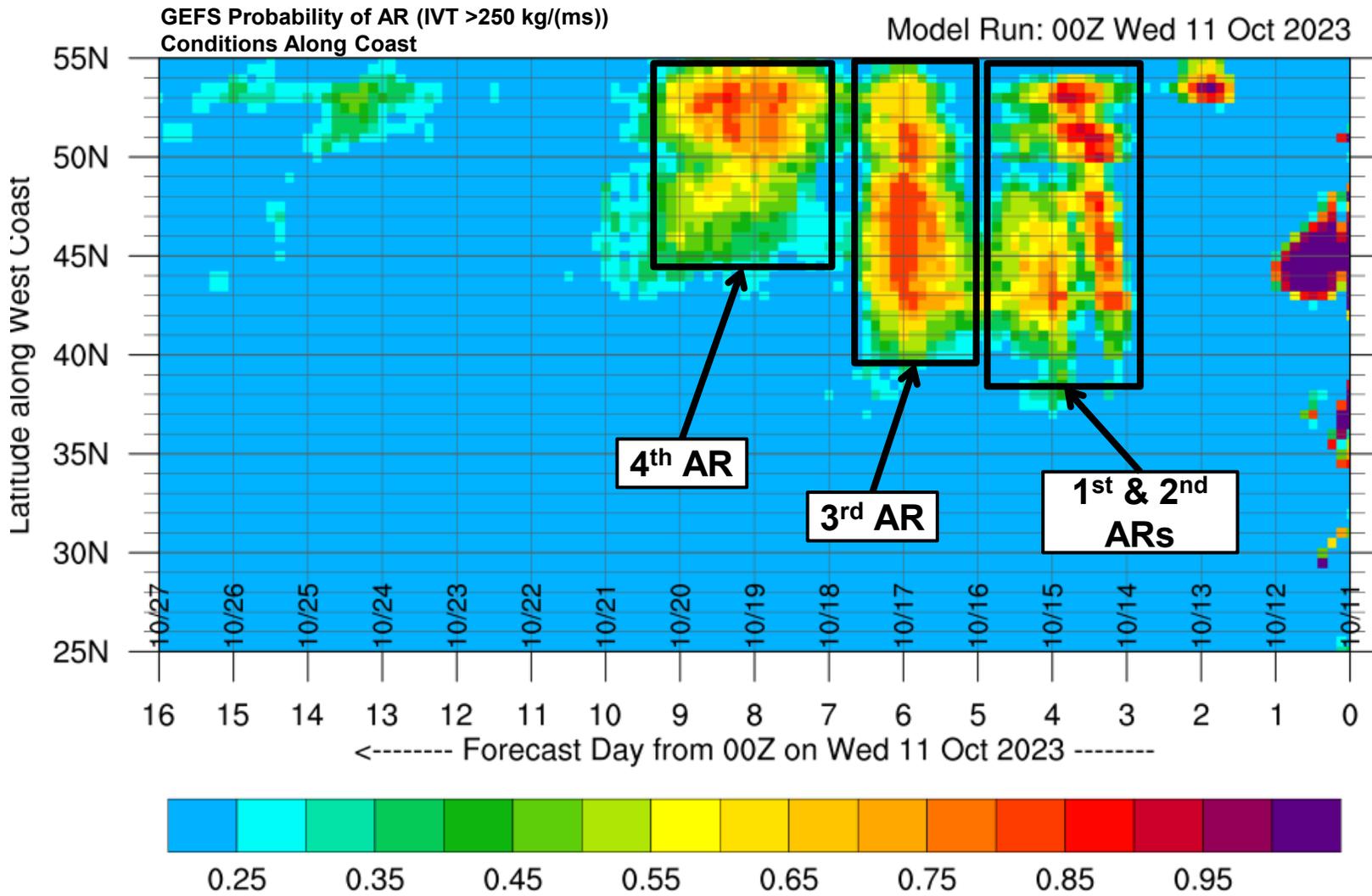
CW3E Atmospheric River Outlook: 11 October 2023

GFS IVT and SLP Forecasts



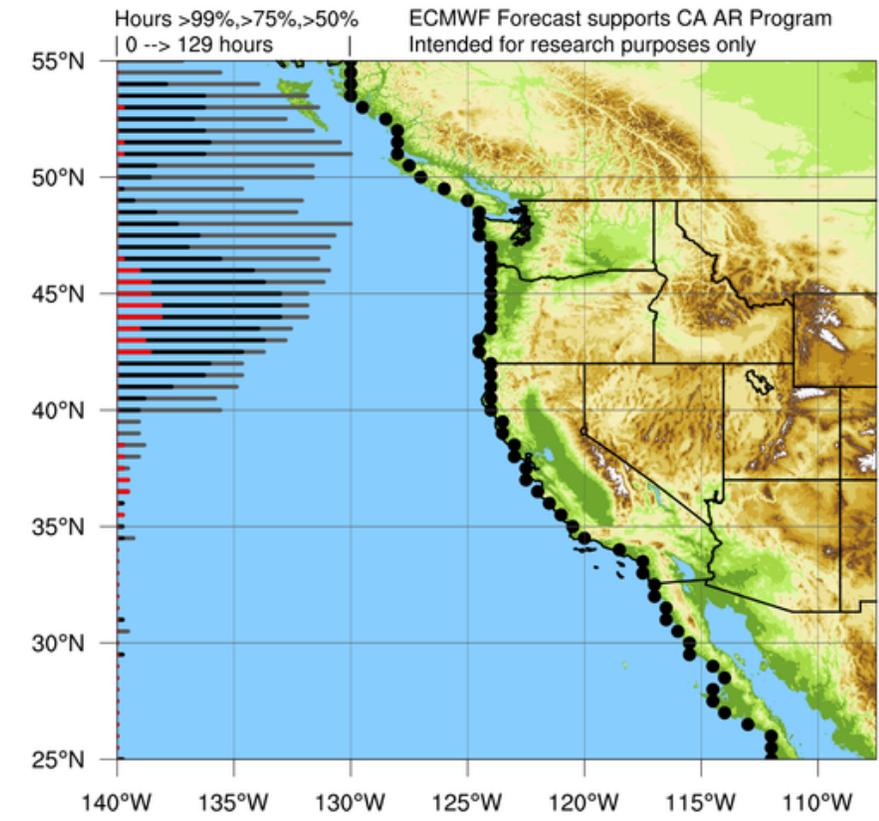
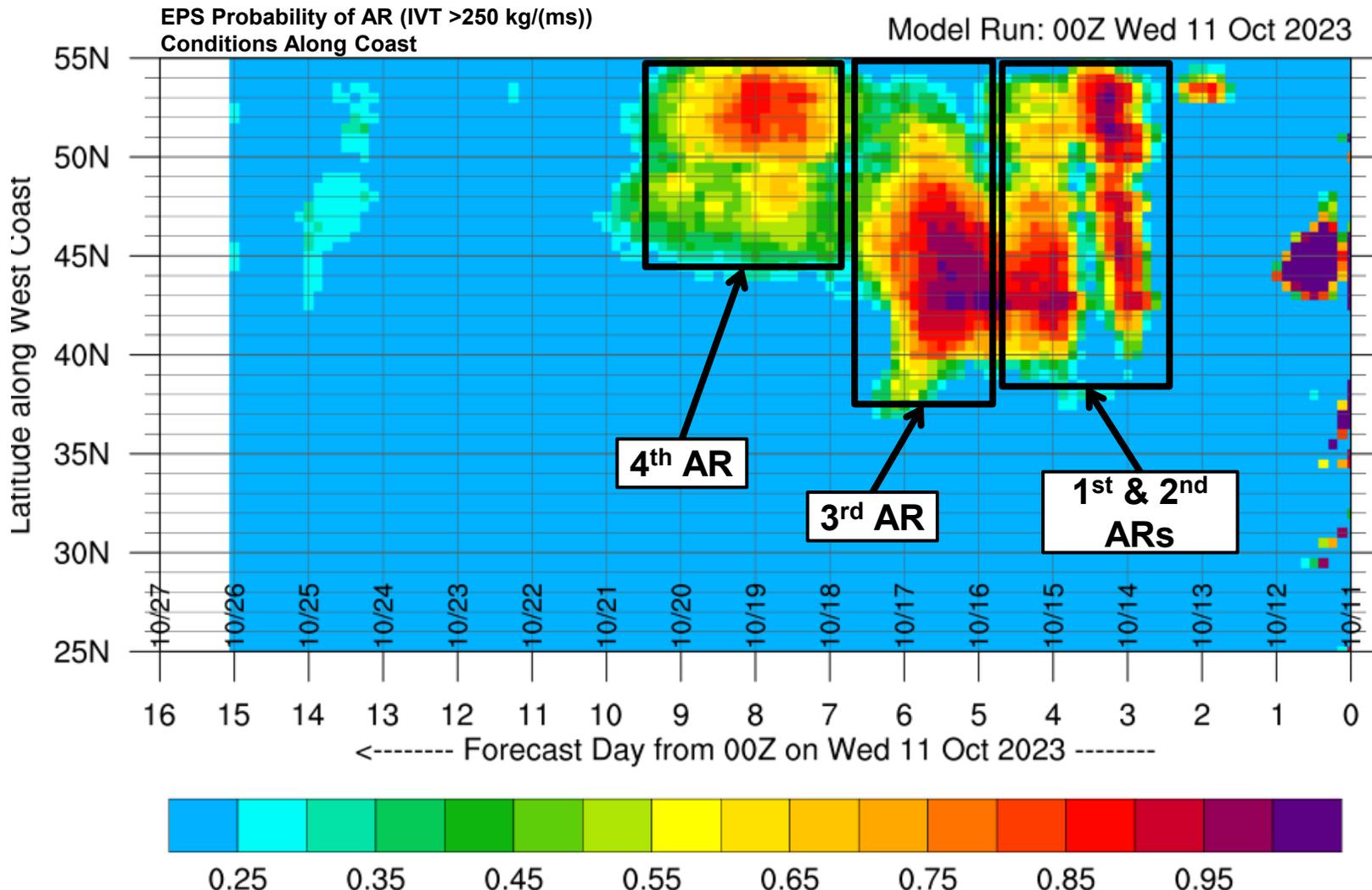
- Exemplified here by the GFS, the 1st AR will arrive Friday Oct 13 (Fig. A) with weak (IVT $<500 \text{ kg}/(\text{ms})$) to moderate (IVT $500\text{-}750 \text{ kg}/(\text{ms})$) AR conditions.
- By Saturday Oct 14, the 2nd AR is arriving (Fig. B) with weak to moderate AR conditions. A mesoscale frontal wave may develop.
- The larger 3rd AR approaches Monday Oct 16 (Fig. C) with moderate to strong (IVT $750+ \text{ kg}/(\text{ms})$) conditions possible.
- A 4th AR (Fig. C) will be possible toward the Tuesday Oct 17 to Wednesday Oct 18 timeframe, though the forecast at that point is complicated as the remnants of Super Typhoon Bolaven are absorbed into the jet stream.

CW3E Atmospheric River Outlook: 11 October 2023



- GEFS data currently supports a period of AR activity, with four distinct ARs, beginning Fri 13 Oct and continuing into next week.
- Successive ARs are forecast to make landfall further northward with time, bringing greater potential impacts to the WA/OR coasts as well as into British Columbia.

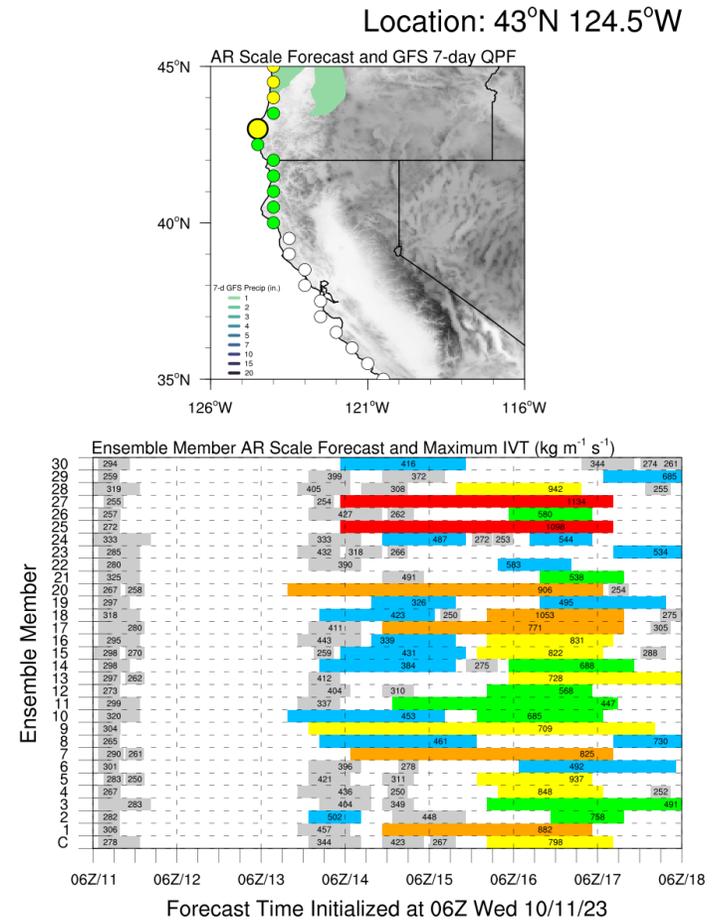
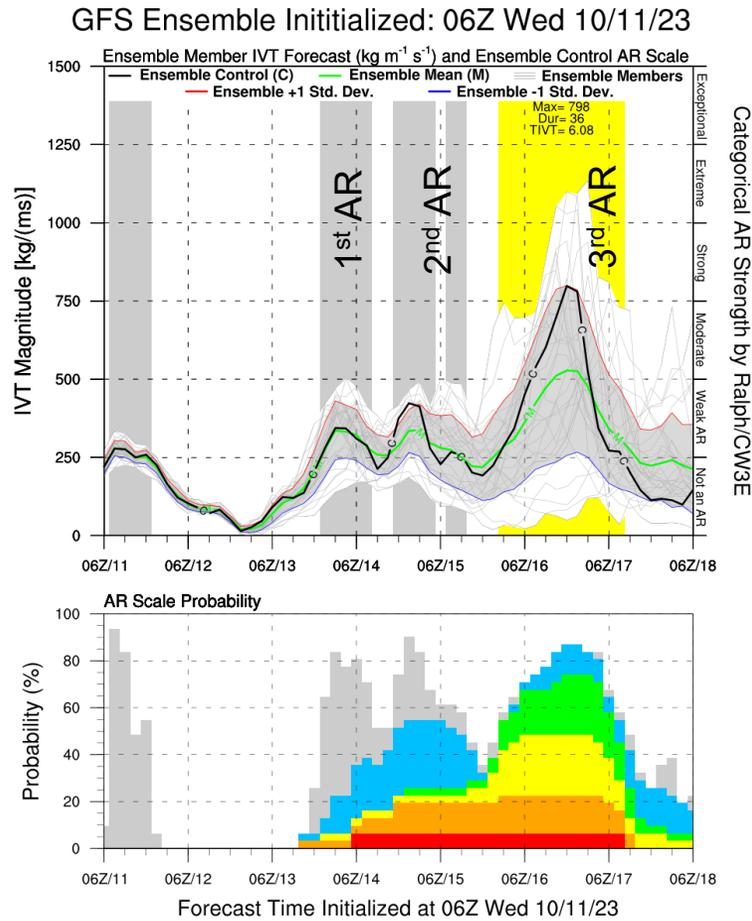
CW3E Atmospheric River Outlook: 11 October 2023



- EPS data are comparable for the 1st and 2nd ARs but are more substantial (80-100% chance for AR conditions) and further south for the 3rd AR.
- A similar forecast for the 4th AR is seen as in the GEFS.

CW3E Atmospheric River Outlook: 11 October 2023

GEFS AR Scale and IVT Plume Forecasts



- Along the southwest coast of Oregon, the GEFS data suggest AR1 conditions possible (~50%) for the 1st and 2nd events and less than a 20% chance for AR2+ conditions.
- More uncertainty exists for the 3rd AR, with higher maximum IVT values possible. Outlier members indicate IVT of $>1000 \text{ kg m}^{-1} \text{ s}^{-1}$ are possible.
- About 20% of members indicate AR4 conditions are possible, with <10% indicating AR5.
- Significant differences are seen between members regarding duration of the 2nd and 3rd ARs.



AR 1 AR 2 AR 3 AR 4 AR 5

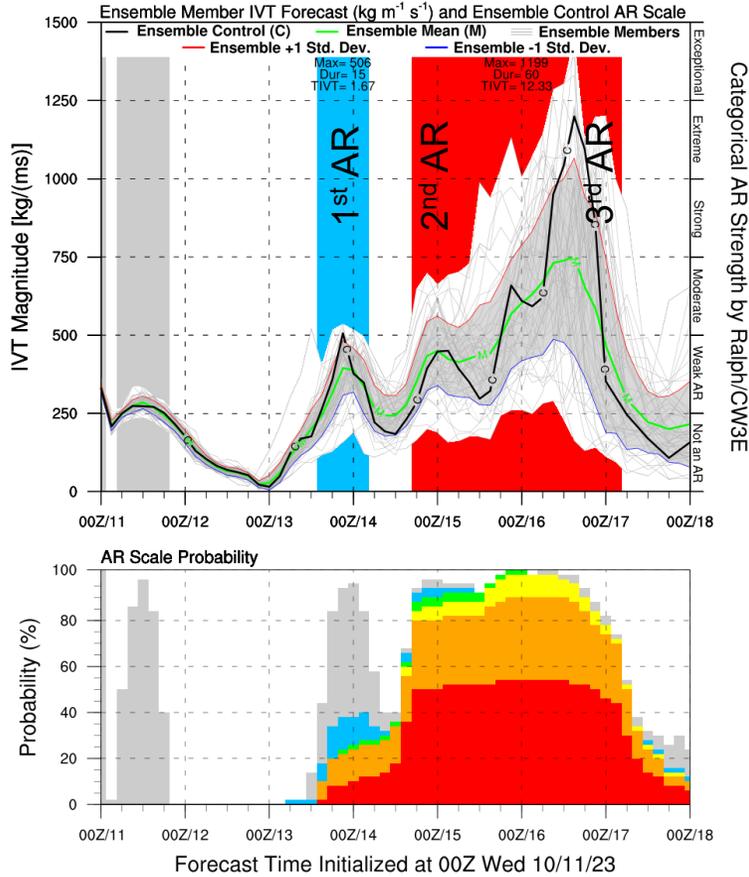
Image created: 11 UTC 10/11/2023

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

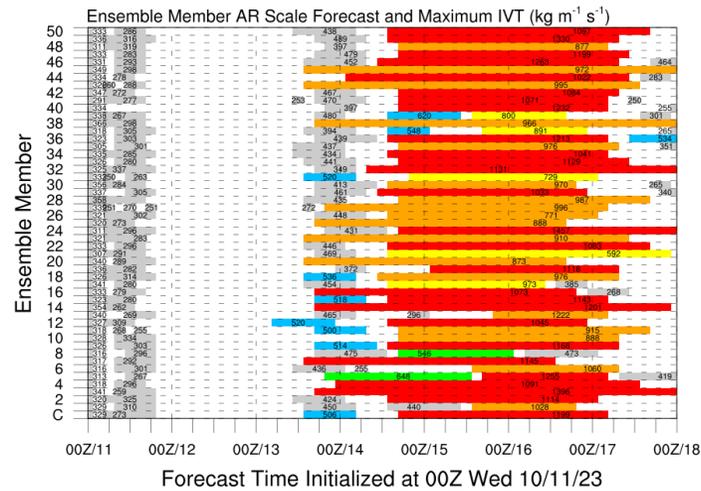
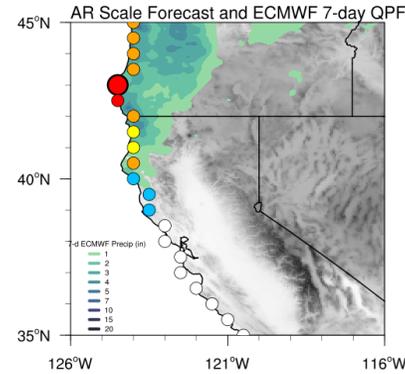
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EPS AR Scale and IVT Plume Forecasts

ECMWF Ensemble Initialized: 00Z Wed 10/11/23



Location: 43°N 124.5°W



- For the same location, the EPS is slightly stronger with the 1st AR though similarly depicts a 20% chance for AR2+ conditions.
- AR conditions may continue/show little pause between the 2nd and 3rd ARs.
- There is a significantly higher potential (80%) for AR4-5 conditions at this location with the 3rd AR. About 60% of EPS members forecast peak IVT values of 1000+ kg/(ms).
- IVT values exhibit both higher magnitude and longer duration, resulting in more AR4-5 forecasts from individual members though with notable spread.
- There is a large absolute range though, with peak IVT values of 300-1400 $\text{kg m}^{-1} \text{s}^{-1}$ possible.



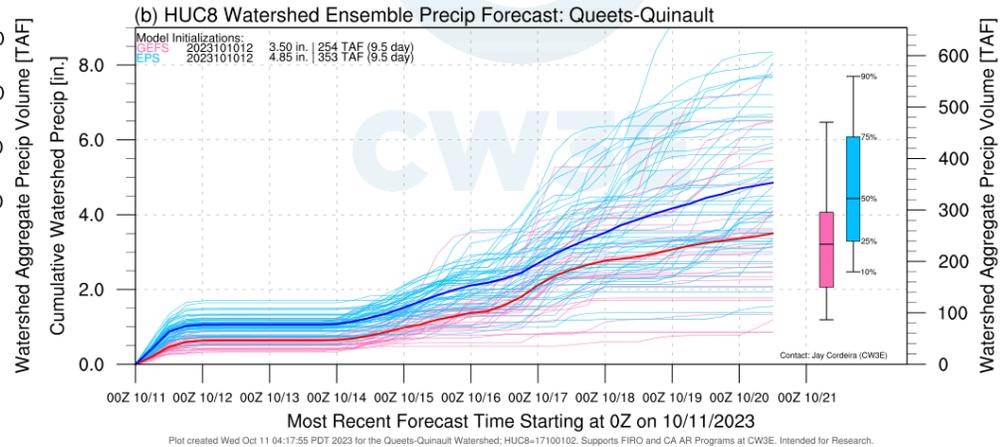
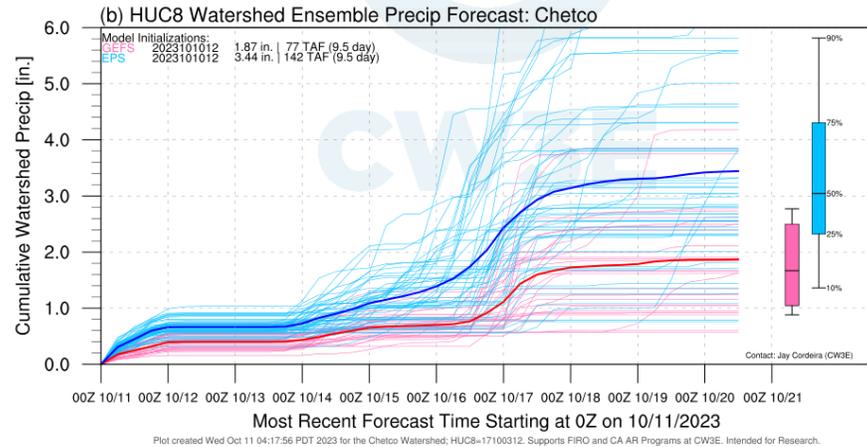
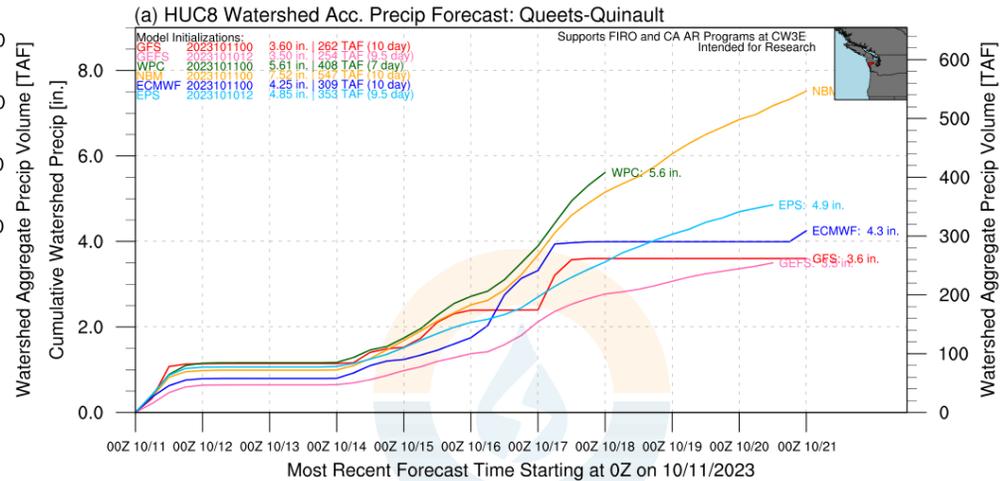
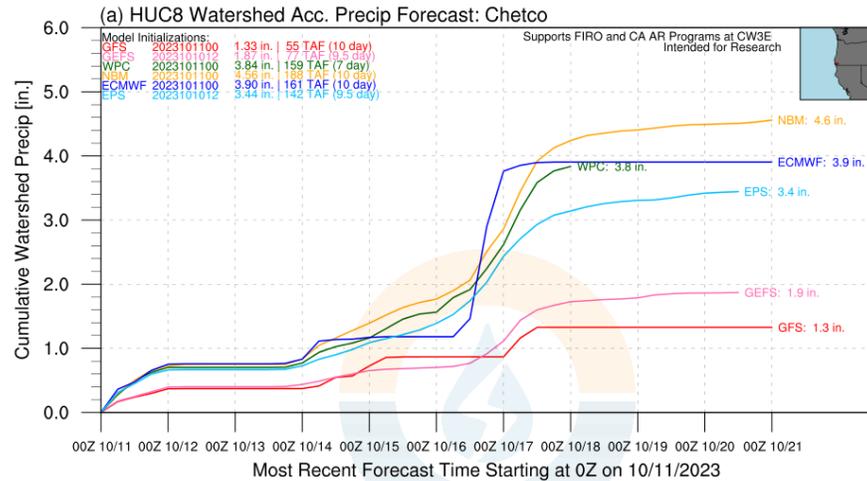
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AR 1 AR 2 AR 3 AR 4 AR 5

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

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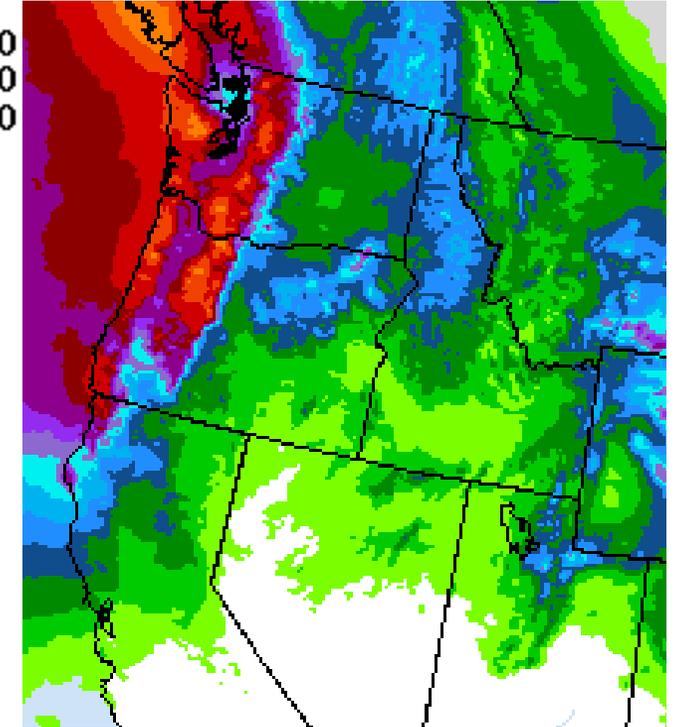
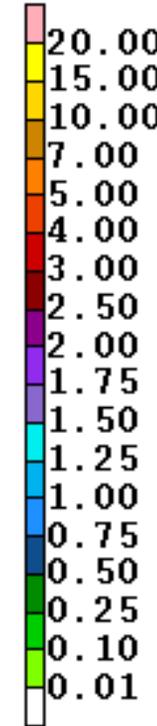
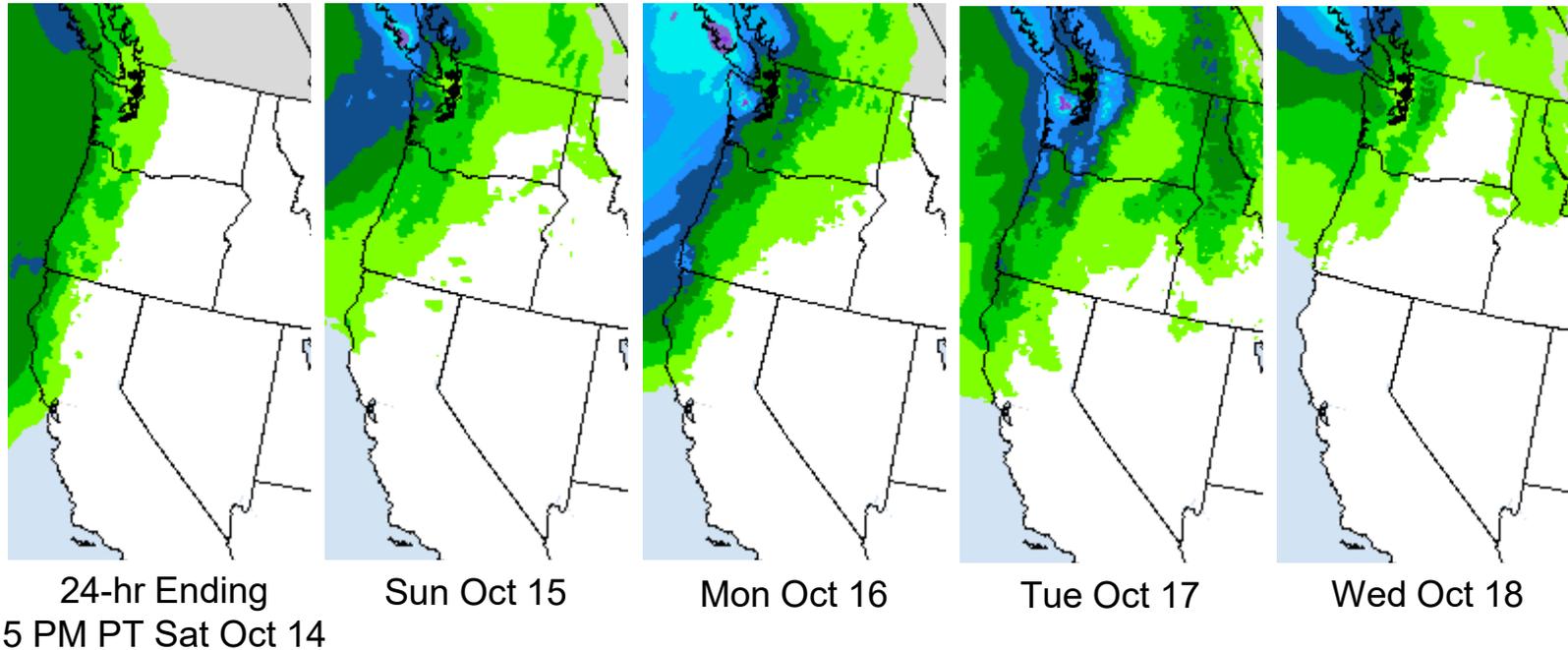
Model Precipitation Forecasts



- Deterministic and ensemble (mean) model forecasts for Chetco, WA (top-left) and Queets-Quinault, WA (top-right) watersheds show general agreement in QPF timing and amount while individual ensemble members (bottom panels) depict the wide range.
- Note the ECWMF/EPS forecasts are greater than the GFS/GEFS forecasts.

WPC Precipitation Forecasts

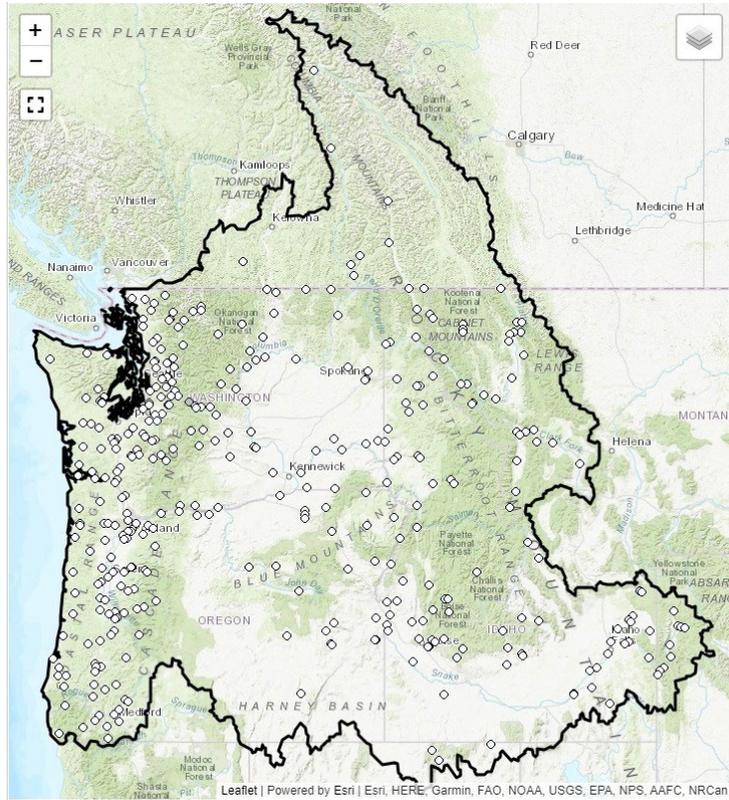
7-day QPF: Wed Oct 11 - Wed Oct 18



Source: NOAA/NWS Weather Prediction Center (Issued 10 AM PT Wed Oct 11)

- The NWS Weather Prediction Center (WPC) is forecasting 2-5" inches of precipitation in the Pacific Coast Ranges and Cascades in Washington and Oregon during the next 7 days, with lighter amounts (0.5-2.0") for surrounding areas
- The bulk of this precipitation is forecast to occur with the 3rd AR around Monday Oct 16.

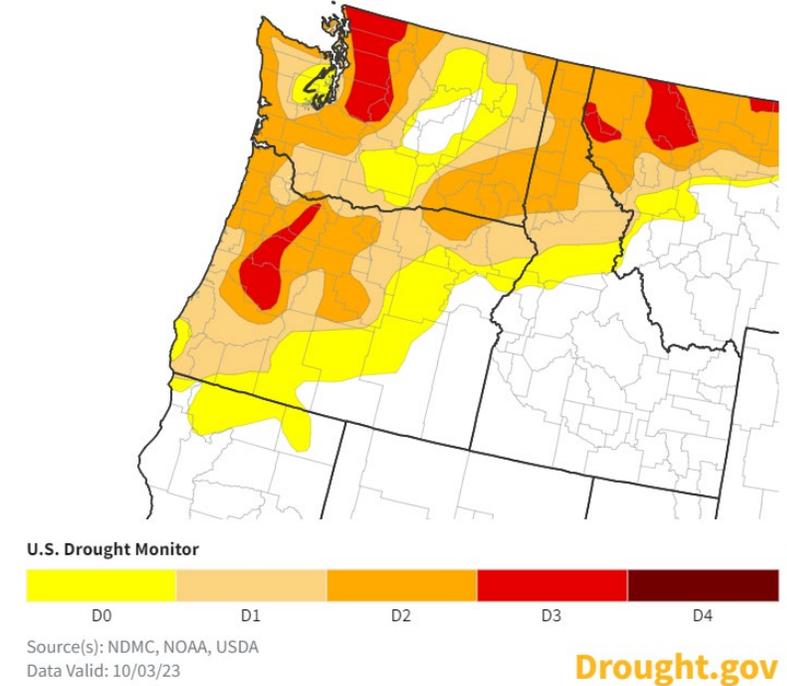
Hydrologic Impacts



Source: NOAA/NWS Advanced Hydrologic Prediction Service



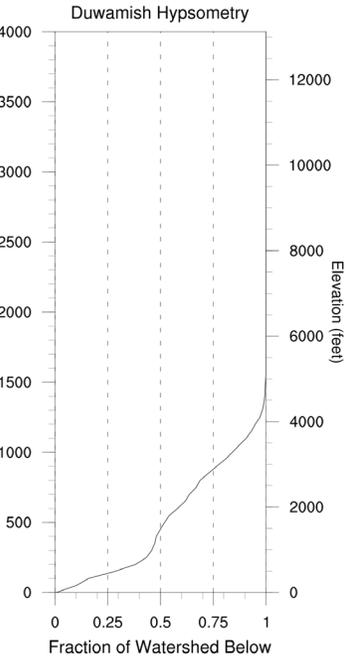
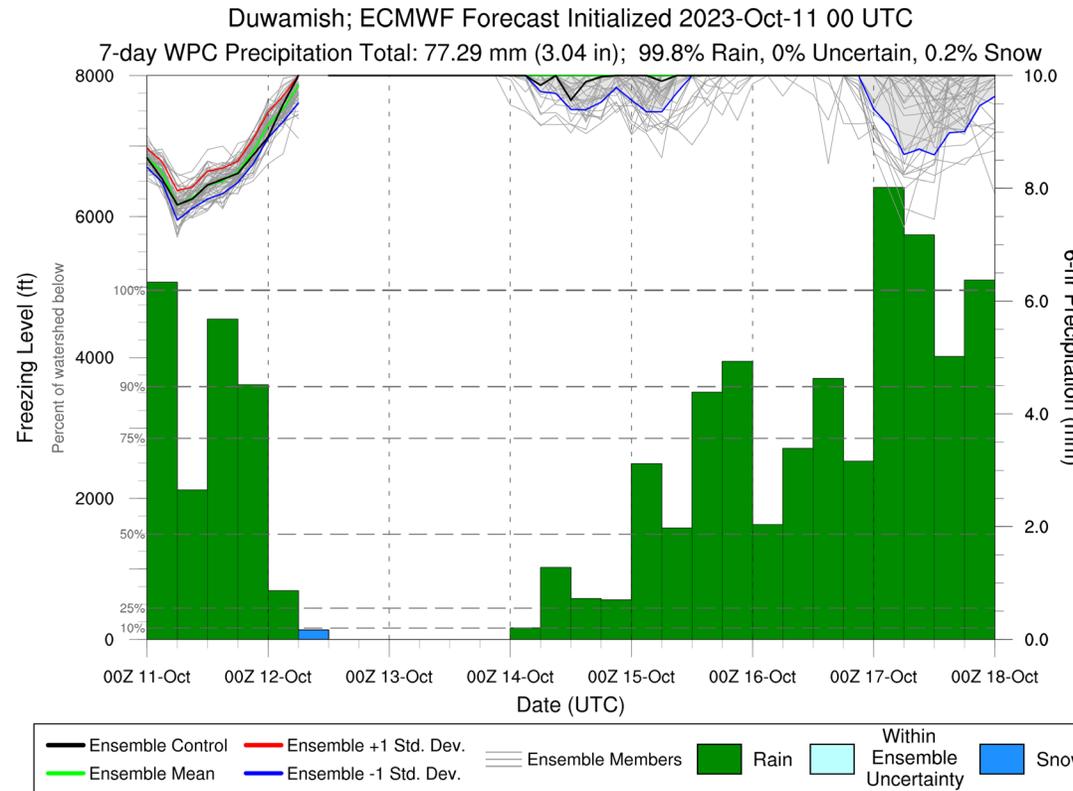
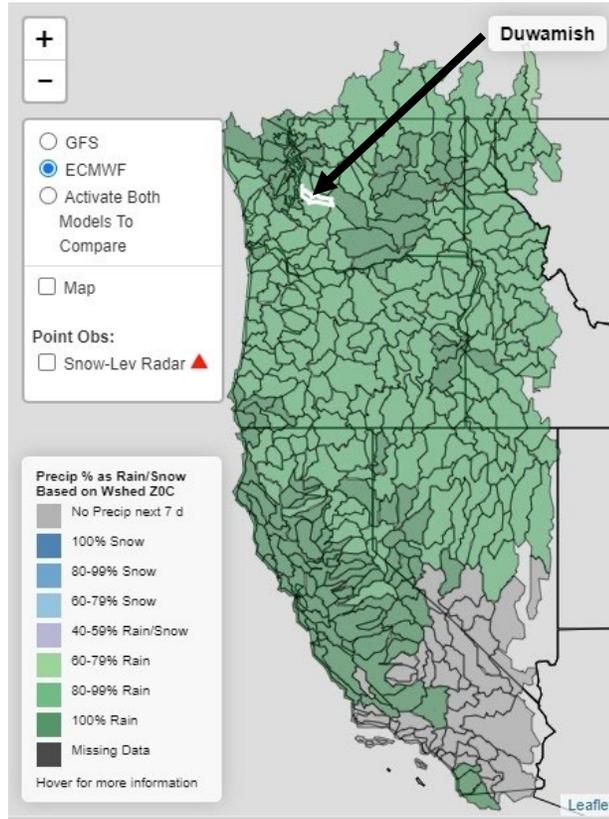
U.S. Drought Monitor



- While rises are forecast on rivers across the AR impacted areas, no locations are currently forecast to exceed Flood Stage.
- Rains will be beneficial as many areas are currently experiencing Moderate (D1) to Extreme (D3) drought conditions.

CW3E Atmospheric River Outlook: 11 October 2023

Watershed Freezing Level Forecasts: Duwamish Watershed



- Being early in the season, these storms are forecast to be warm.
- The cooler EPS forecasts show freezing levels remaining at or above 6000' in western Washington throughout the forecast period (and mostly above 8000').