

CW3E Atmospheric River Outlook: 10 January 2022

Long-duration Atmospheric River to Bring Heavy Rainfall to Washington and British Columbia

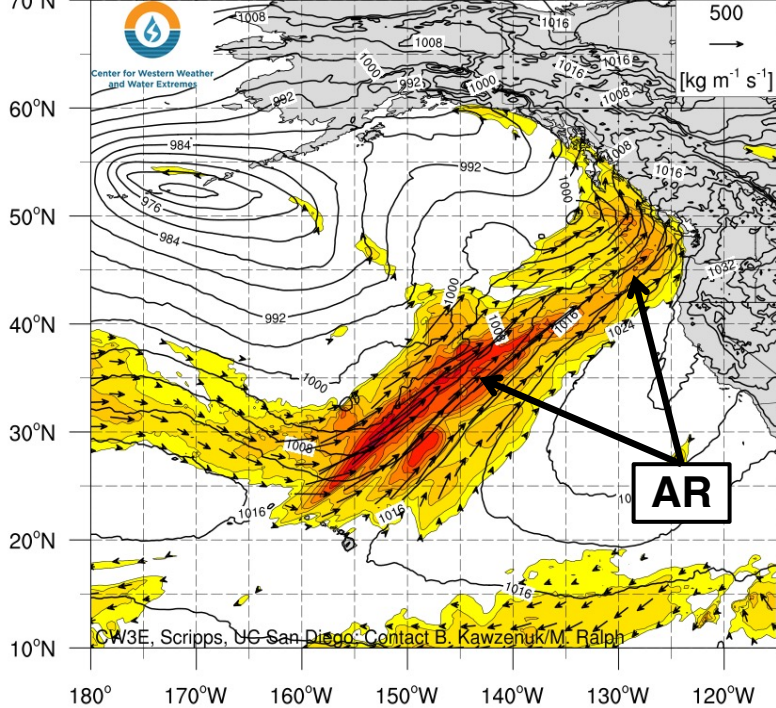
- An atmospheric river (AR) is forecasted to make landfall over Washington and Oregon later this evening
- An AR 3 (based on the Ralph et al. 2019 AR Scale) is forecasted in coastal Washington and northern coastal Oregon, where AR conditions are expected to persist for more than 48 consecutive hours
- There is still some uncertainty in the timing and magnitude of maximum IVT, as well as the overall duration of AR conditions
- More than 7 inches of precipitation are forecasted over portions of the Olympic Peninsula and Vancouver Island
- Flooding is possible in western Washington and southwestern British Columbia due to the combination of heavy rainfall, moist soils, and existing snowpack at lower elevations
- High freezing levels will increase the potential for rain-on-snow, which may exacerbate surface runoff and flooding

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GFS IVT & SLP Forecasts

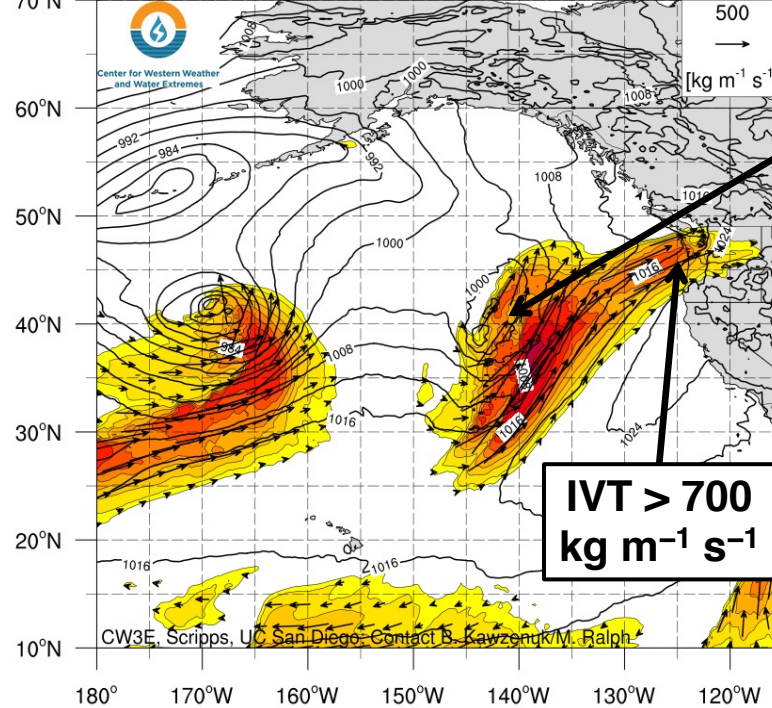
(A) Valid: 7 PM PT 10 Jan (F-15)

NCEP GFS IVT ($\text{kg m}^{-1} \text{s}^{-1}$; shaded), IVT Vector, and SLP (hPa; contours)
Initialized: 1200 UTC 01/10/2022 F-015: Valid: 0300 UTC 01/11/2022



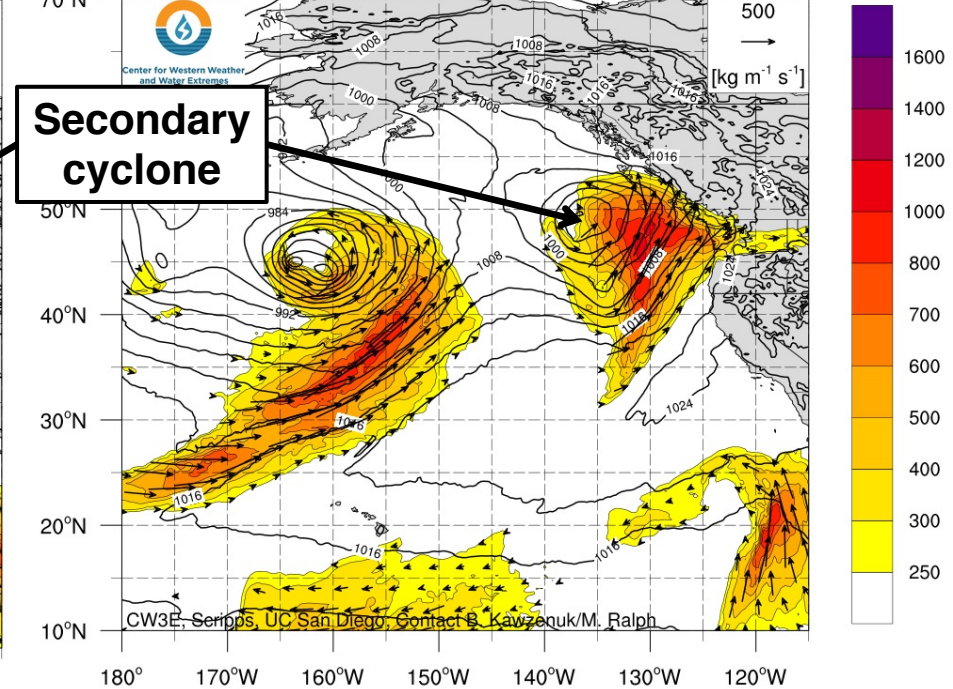
(B) Valid: 4 PM PT 11 Nov (F-36)

NCEP GFS IVT ($\text{kg m}^{-1} \text{s}^{-1}$; shaded), IVT Vector, and SLP (hPa; contours)
Initialized: 1200 UTC 01/10/2022 F-036: Valid: 0000 UTC 01/12/2022



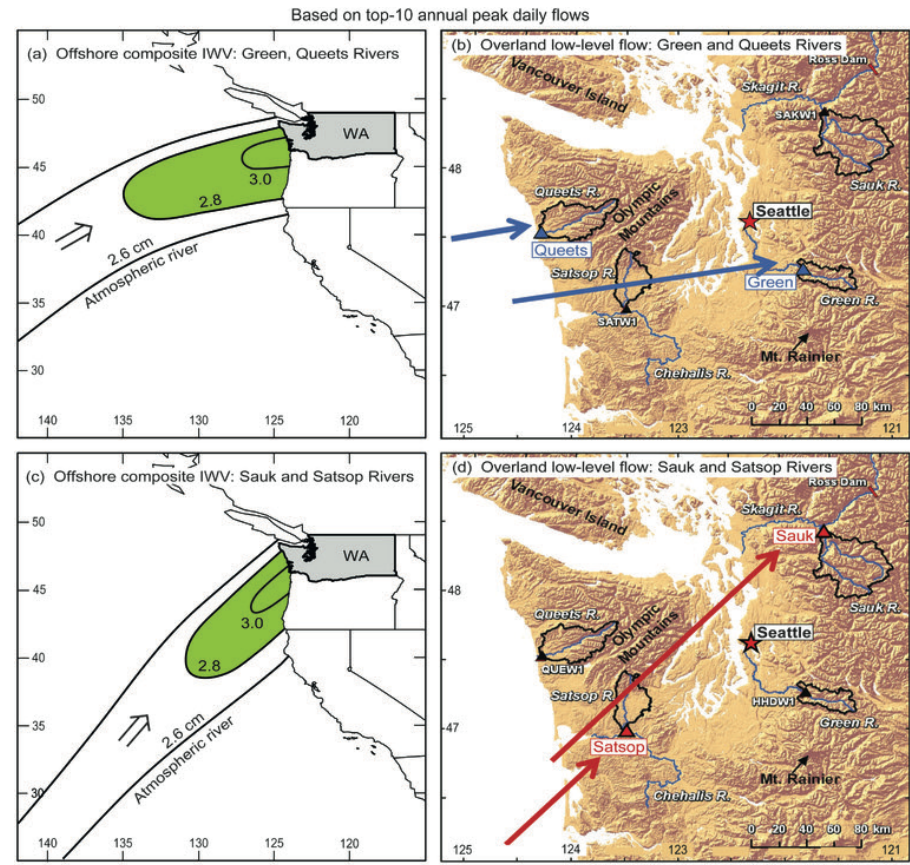
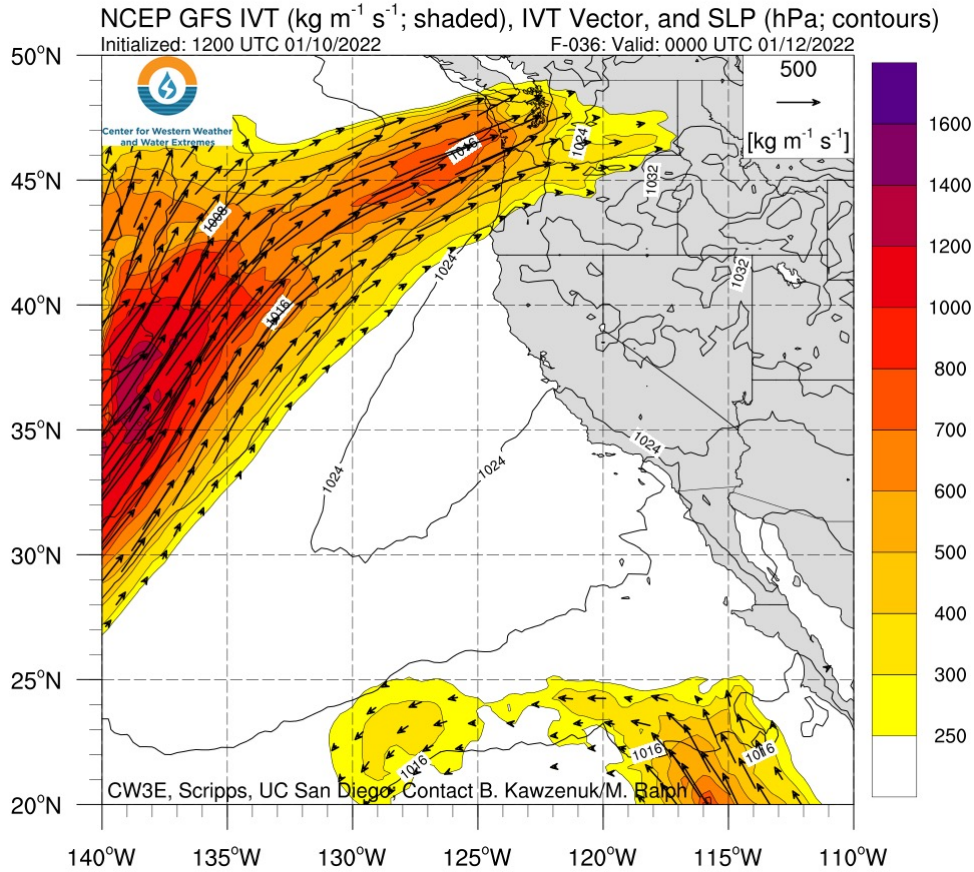
(C) Valid: 7 AM PT 12 Nov (F-51)

NCEP GFS IVT ($\text{kg m}^{-1} \text{s}^{-1}$; shaded), IVT Vector, and SLP (hPa; contours)
Initialized: 1200 UTC 01/10/2022 F-051: Valid: 1500 UTC 01/12/2022



- The AR is forecasted to make landfall over Washington and northern Oregon this evening (Figure A)
- The strongest moisture transport is forecasted to occur near the Washington/Oregon border tomorrow afternoon, with IVT values approaching $700 \text{ kg m}^{-1} \text{s}^{-1}$ (Figure B)
- A secondary cyclone is forecasted to develop west of the main AR and intensify as it moves northeastward (Figures B–C)
- Uncertainty in the track and intensity of this cyclone is leading to uncertainty in the strength and duration of AR conditions
- If the cyclone tracks closer to the coast, a second pulse of strong moisture transport is possible on 12 Jan (Wednesday)

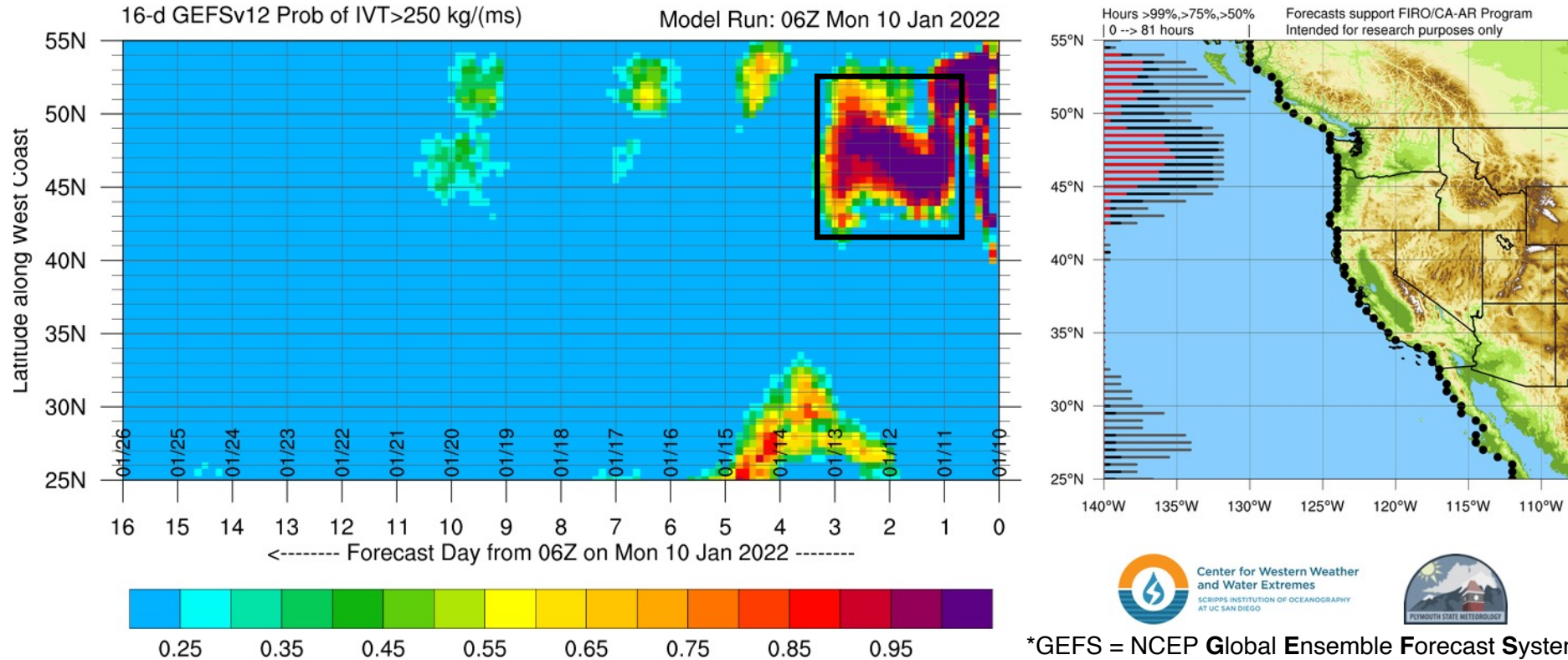
CW3E AR Outlook: 10 January 2022



Source: Figure 15 from Neiman et al. (2011)

- The strongest moisture transport on 11 Jan is forecasted to occur with a west-southwesterly IVT direction over western Washington
- Previous research by Neiman et al. (2011) found that this IVT direction is favorable for orographic enhancement of precipitation and flooding along the western flank of the Olympic Mountains

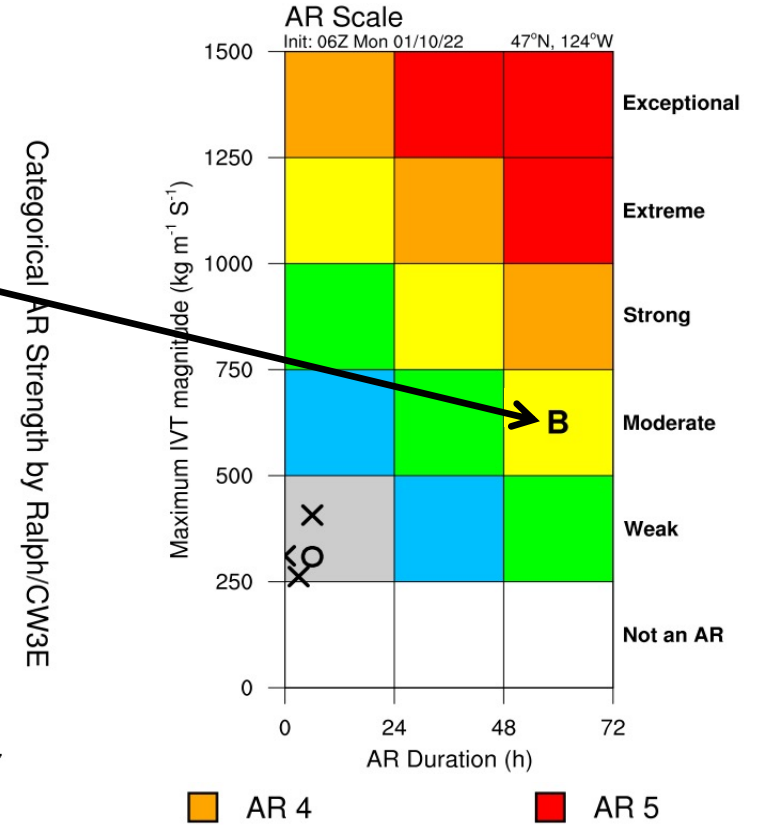
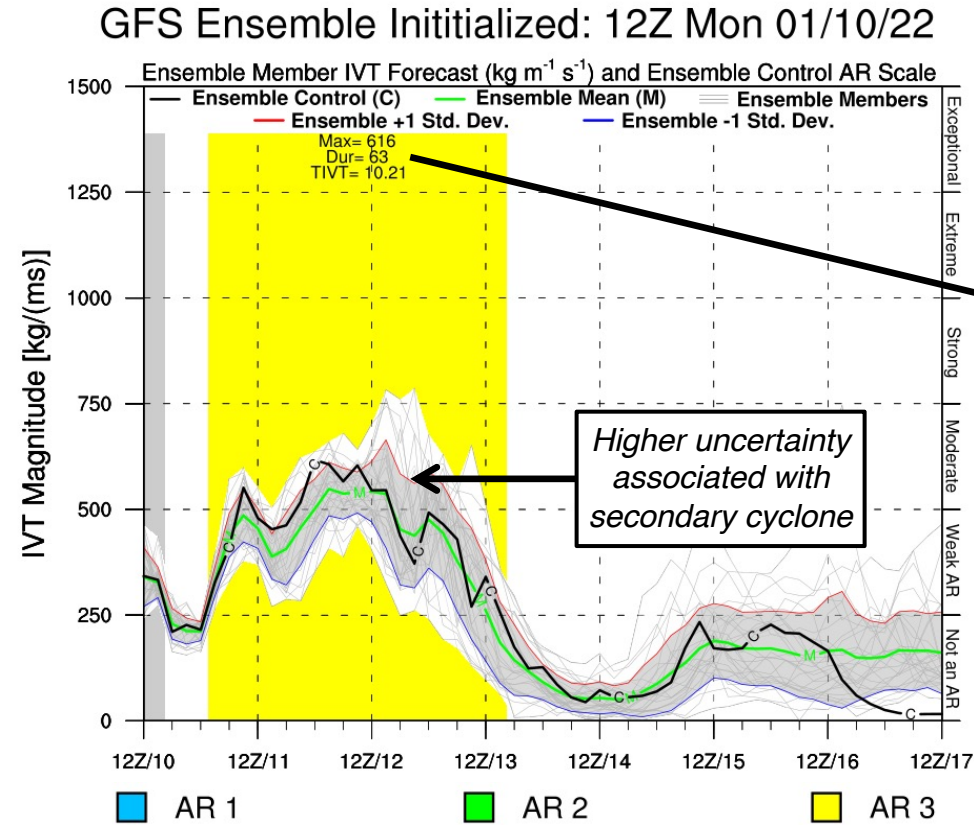
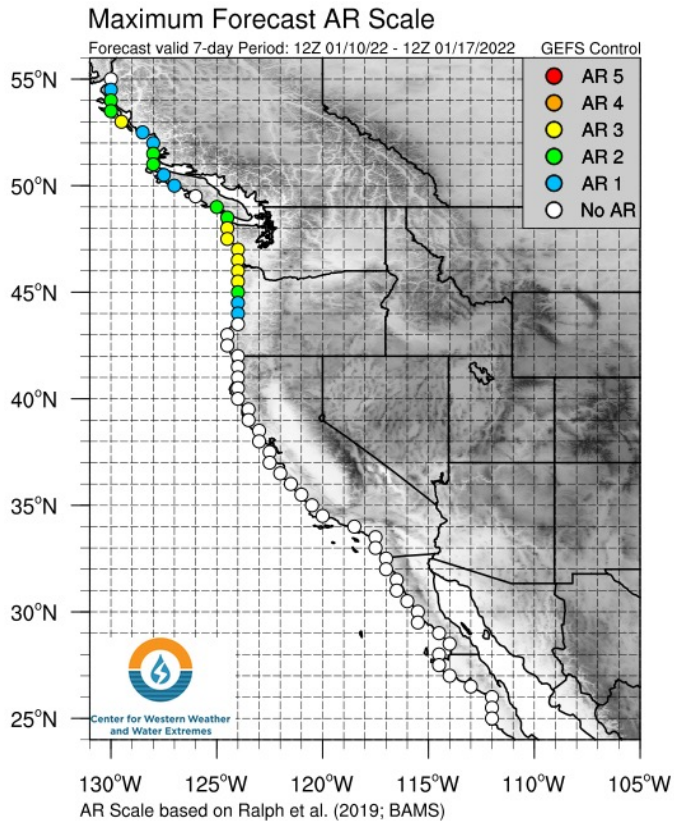
Probability of AR Conditions Along Coast



- The 12Z GEFS is showing high confidence (> 90% probability) in AR conditions ($IVT > 250 \text{ kg m}^{-1} \text{ s}^{-1}$) over coastal Washington and northern coastal Oregon during 11–13 January
- Some locations may experience AR conditions for more than 48 consecutive hours
- There is still some uncertainty in the location and duration of AR conditions as the secondary cyclone intensifies and moves northeastward on 12 Jan

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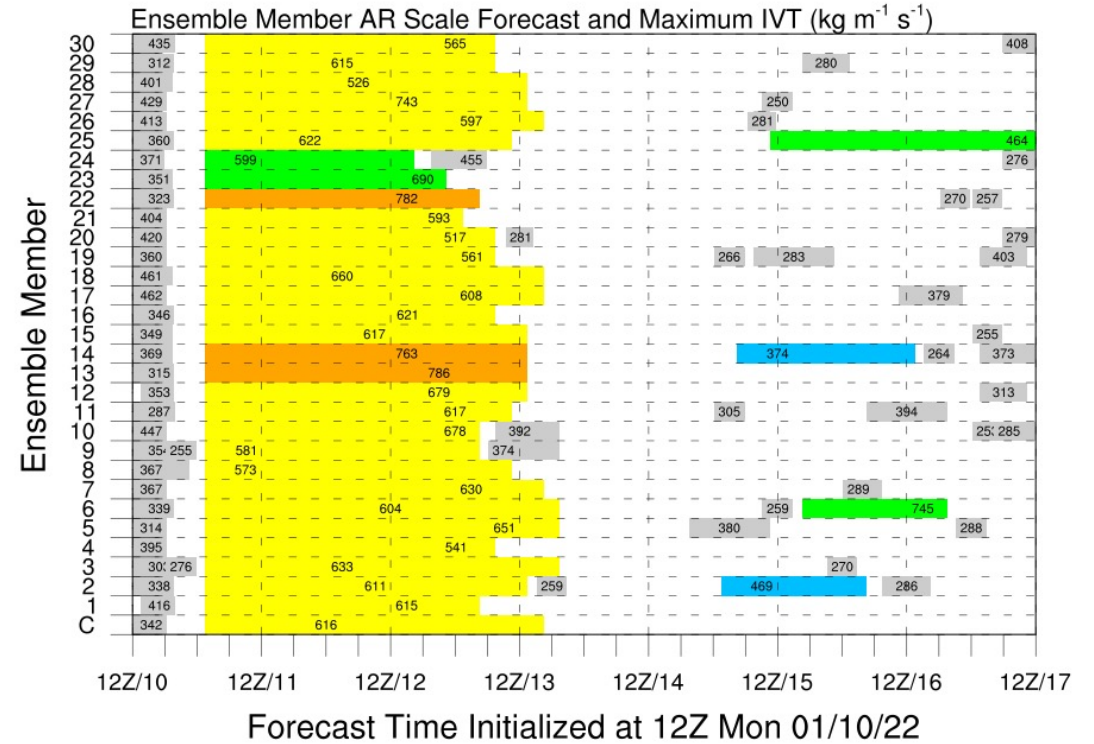
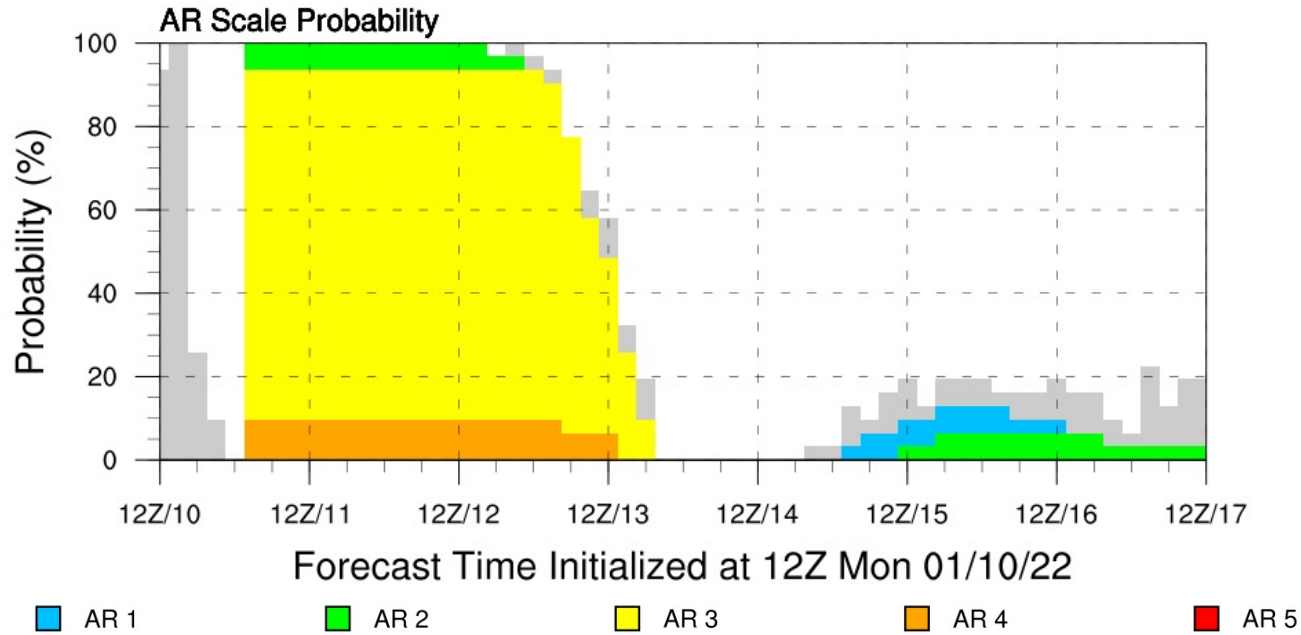
GEFS AR Scale and IVT Forecasts



- The 12Z GEFS control run is forecasting AR 3 conditions (based on the Ralph et al. 2019 AR Scale) over coastal Washington and northern coastal Oregon
- A maximum IVT of $616 \text{ kg m}^{-1} \text{ s}^{-1}$ and an AR duration of 63 hours is currently forecasted at 47°N , 124°W (near Hoquiam, WA)
- There is large forecast uncertainty in the IVT magnitude on 12 Jan due to uncertainty in the evolution of the secondary cyclone

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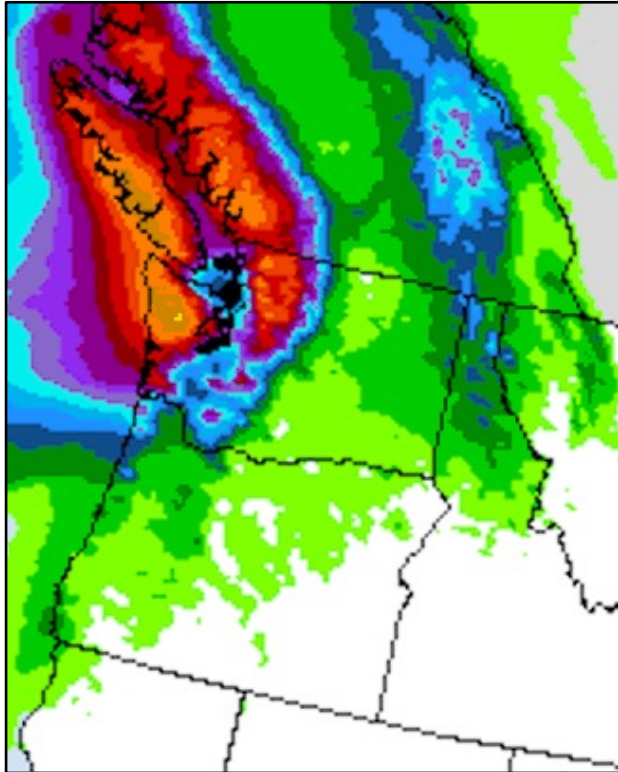
GEFS AR Scale and IVT Forecasts



- There is high confidence in the likelihood of AR 3 or greater conditions over coastal Washington
- 94% of the 12Z GEFS members are predicting an AR 3 or greater
- Nearly all ensemble members are predicting a maximum IVT $\geq 500 \text{ kg m}^{-1} \text{ s}^{-1}$ and an AR duration ≥ 48 hours
- However, there is still considerable ensemble spread in the timing and magnitude of the strongest moisture transport
- There is also some uncertainty in the AR duration

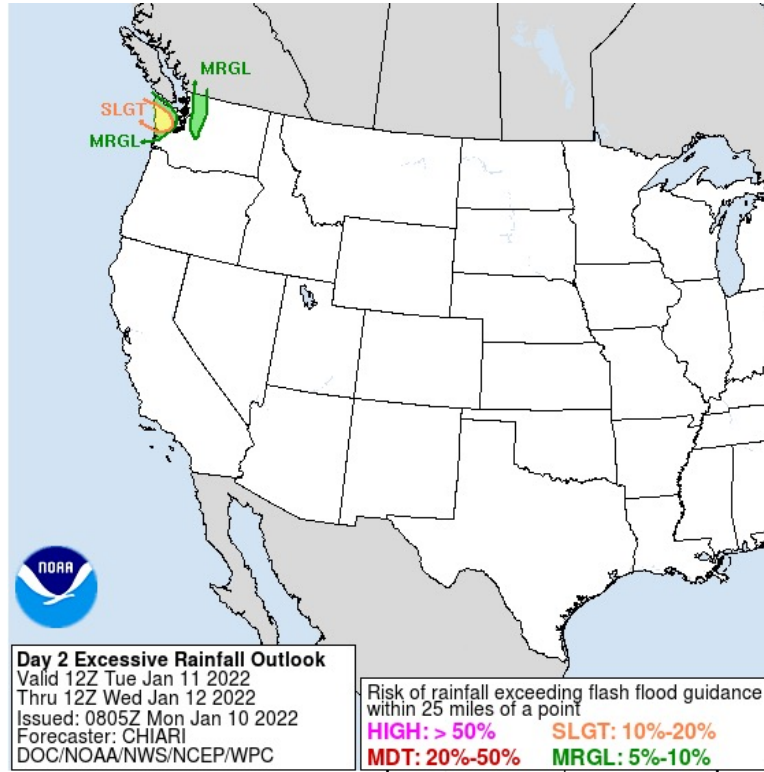
AR Scale	# of Ensembles	% of Ensembles
1	0	0%
2	2	6%
3	26 (Control)	84%
4	3	10%
5	0	0%

WPC 72-h QPF: Valid 4 AM PT 10–13 Jan



Source: NOAA/NWS Weather Prediction Center

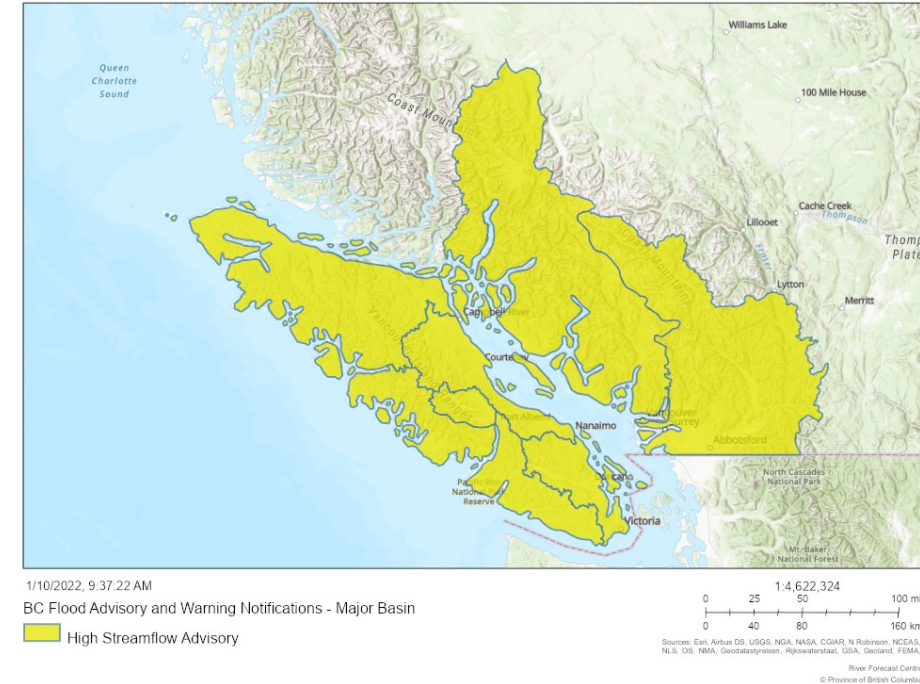
WPC Day 2 Excessive Rainfall Outlook



Day 2 Excessive Rainfall Outlook
Valid 12Z Tue Jan 11 2022
Thru 12Z Wed Jan 12 2022
Issued: 0805Z Mon Jan 10 2022
Forecaster: CHIARI
DOC/NOAA/NWS/NCEP/WPC

Risk of rainfall exceeding flash flood guidance within 25 miles of a point
HIGH: > 50% **SLGT: 10%-20%**
MDT: 20%-50% **MRGL: 5%-10%**

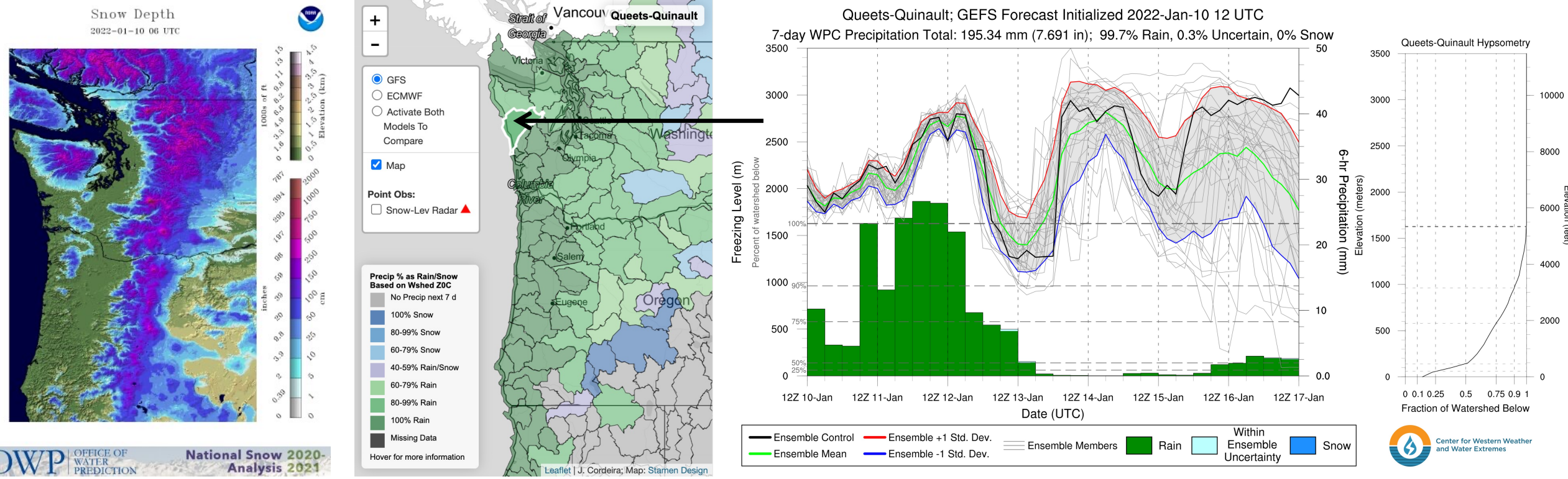
River Forecast Centre Flood Advisory and Warning Notifications



Source: British Columbia River Forecast Centre

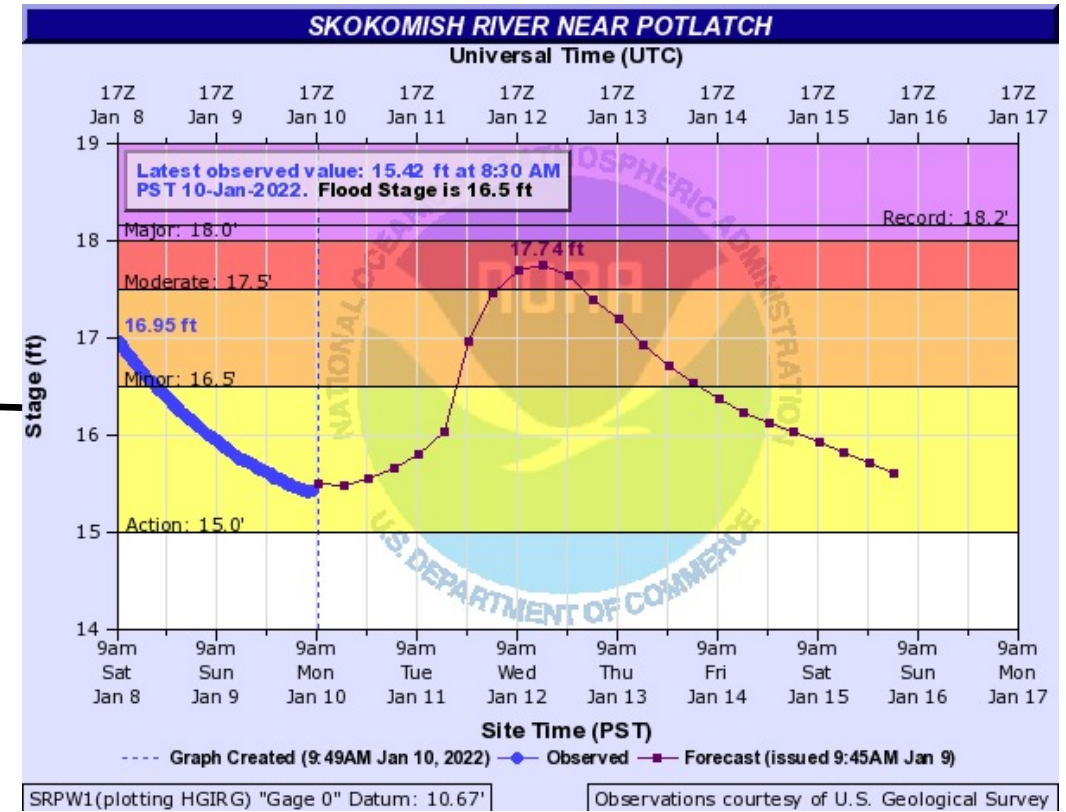
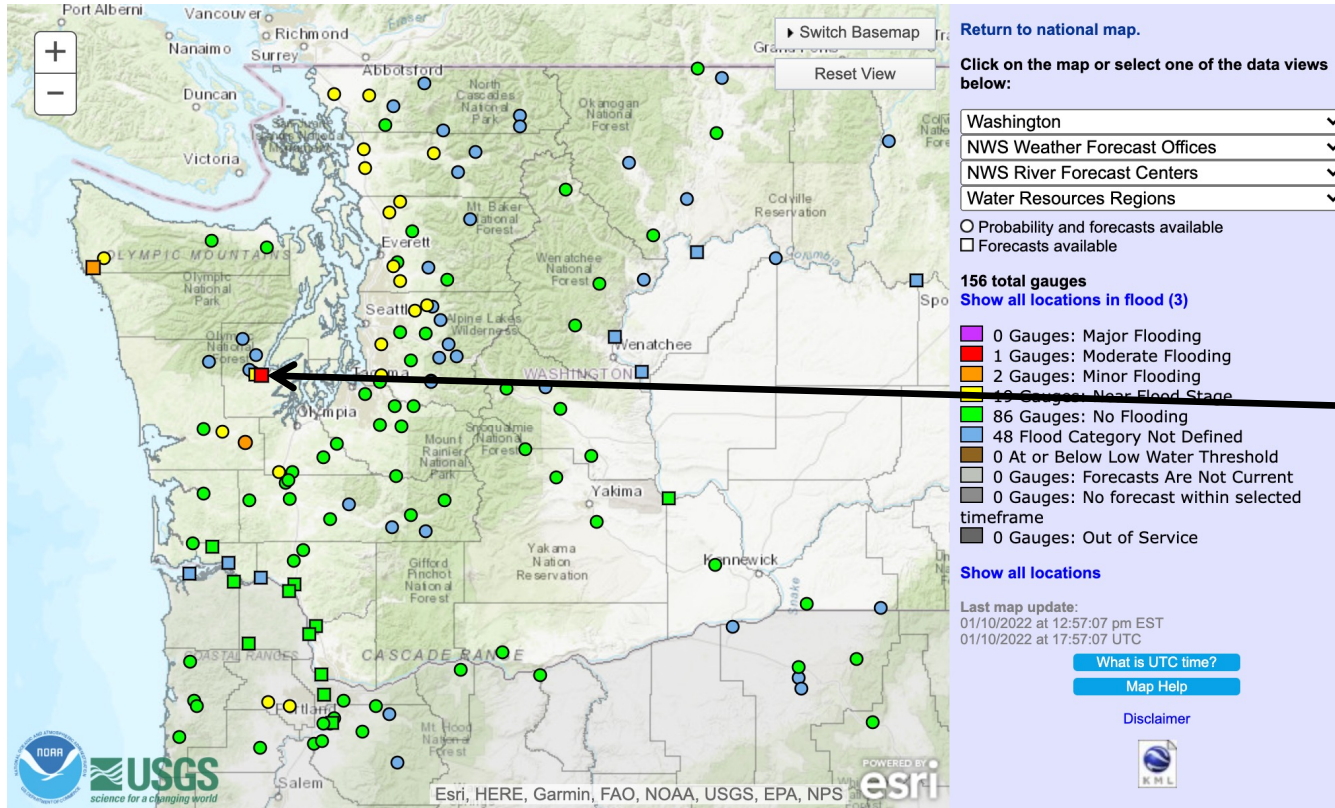
- The NWS Weather Prediction Center (WPC) is forecasting more than 7 inches of total precipitation over portions of the Olympic Peninsula and Vancouver Island during the next 3 days
- More than 5 inches of precipitation are possible in the Cascades in Northern Washington and southern British Columbia
- The NWS WPC has issued a slight risk of rainfall exceeding flash flood guidance over the Olympic Peninsula
- The BC River Forecast Centre has also issued a High Streamflow Advisory for much of southwestern British Columbia

Watershed Freezing Level and Precipitation Forecasts: Queets-Quinault



- The WPC is forecasting about 7.7 inches of mean areal precipitation in the Queets-Quinault watershed during the next 7 days
- Nearly all of the precipitation is expected to fall as rain due to very high freezing levels (> 6,000 feet)
- Given the substantial amount of existing snowpack at elevations < 6,000 feet, rain-on-snow will likely exacerbate surface runoff

Hydrologic Forecasts



Source: NOAA/NWS Advanced Hydrologic Prediction Service

- Flooding is possible in western Washington due to heavy rainfall in areas with saturated soils and existing snowpack
- The Skokomish River (near Potlatch, WA) is forecasted to rise above moderate flood stage (17.5 ft) during the morning of 12 Jan
- The Bogachiel River (near La Push, WA) is forecasted to rise above minor flood stage (37.0 ft)