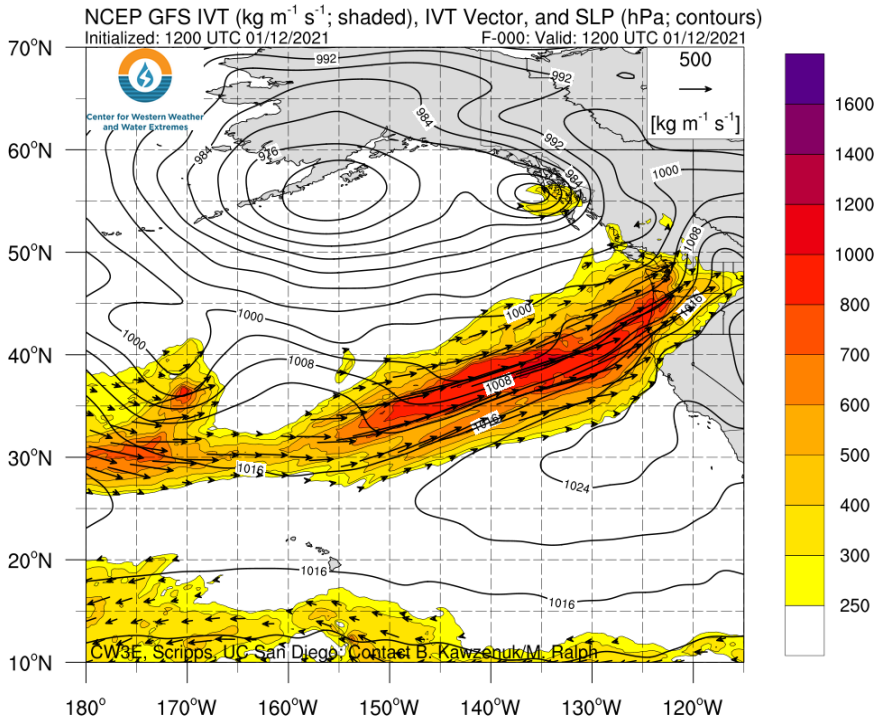
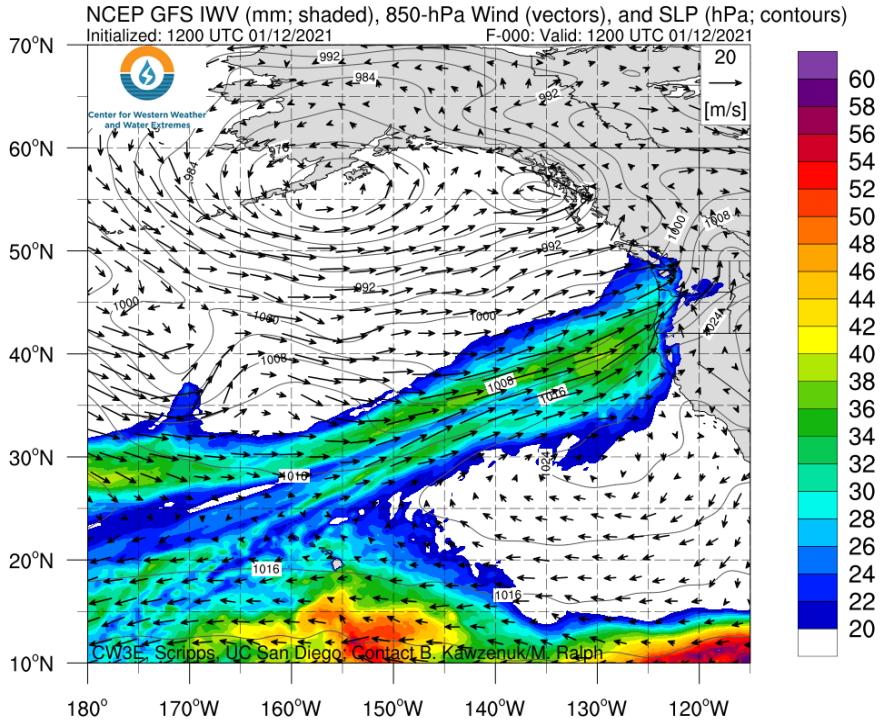
CW3E Atmospheric River Outlook

For California DWR's AR Program

Strong atmospheric river will continue to impact the U.S. West Coast today

- A strong atmospheric river (AR) made landfall across Washington, Oregon, and Northern California late yesterday
- Forecasts of maximum IVT magnitude have increased substantially since yesterdays outlook and the GEFS control is now forecasting **AR 5** conditions (based on the Ralph et al. 2019 AR Scale) over portions of coastal Oregon
- Some areas in western Washington and northwestern Oregon have already received 3–5 inches of precipitation
- An additional 3–7 inches of precipitation are forecast in the Pacific Coast Ranges and Cascades, with the heaviest amounts expected in extreme southwestern Oregon and northwestern California
- Widespread riverine flooding and landslides are possible in western Washington and Oregon



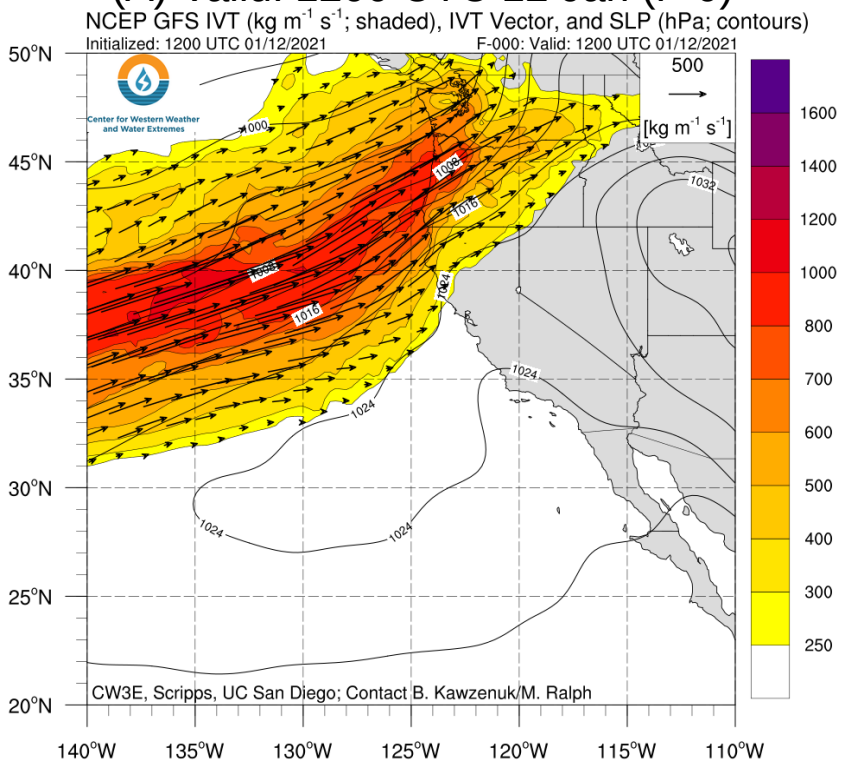


AR Outlook: 12 Jan 2021

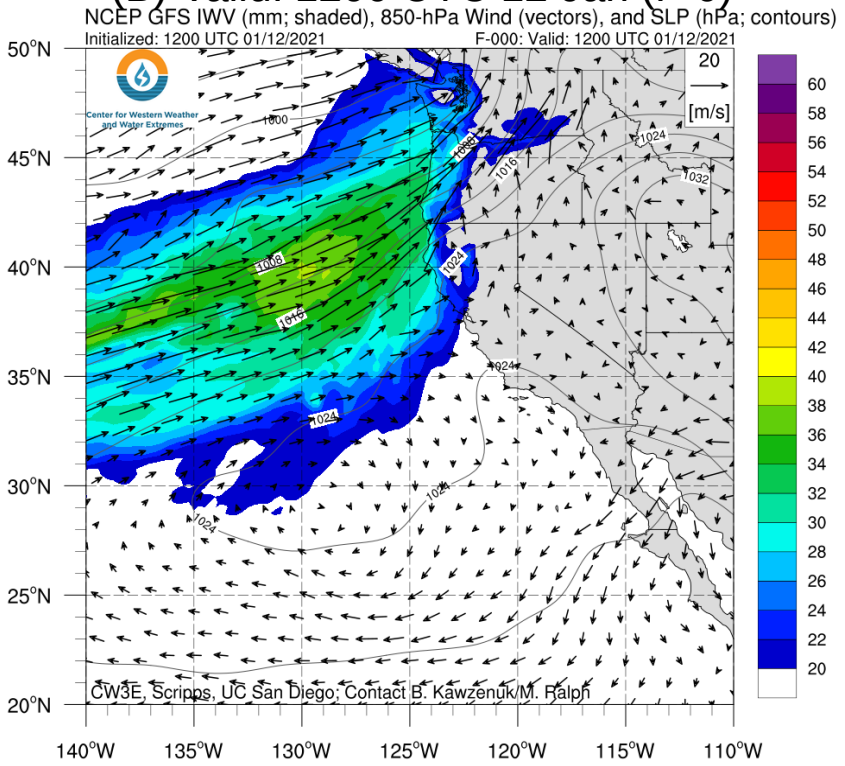
For California DWR's AR Program

GFS IVT/IWV Analyses and Forecasts

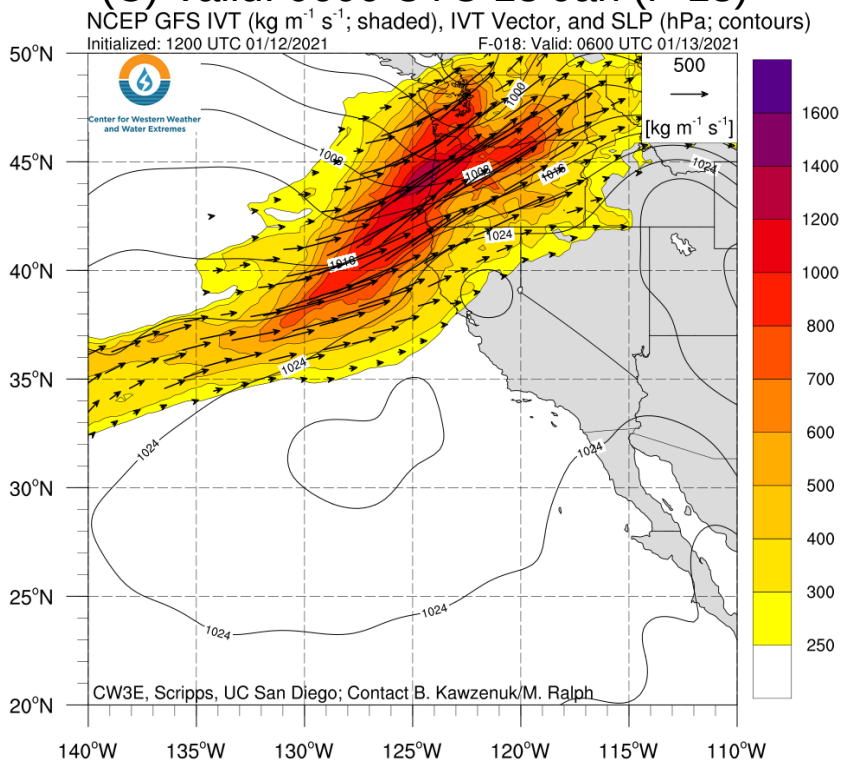
(A) Valid: 1200 UTC 12 Jan (F-0)



(B) Valid: 1200 UTC 12 Jan (F-0)



(C) Valid: 0600 UTC 13 Jan (F-18)

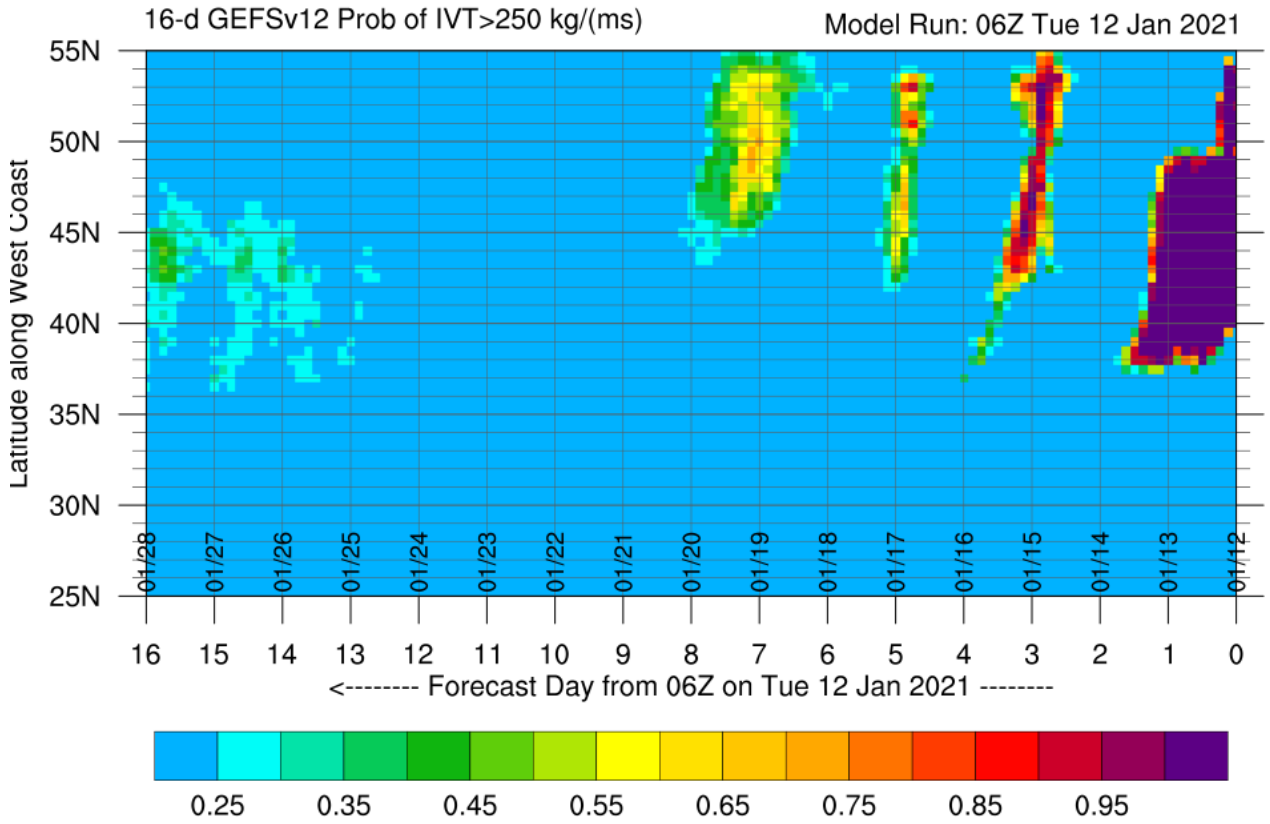


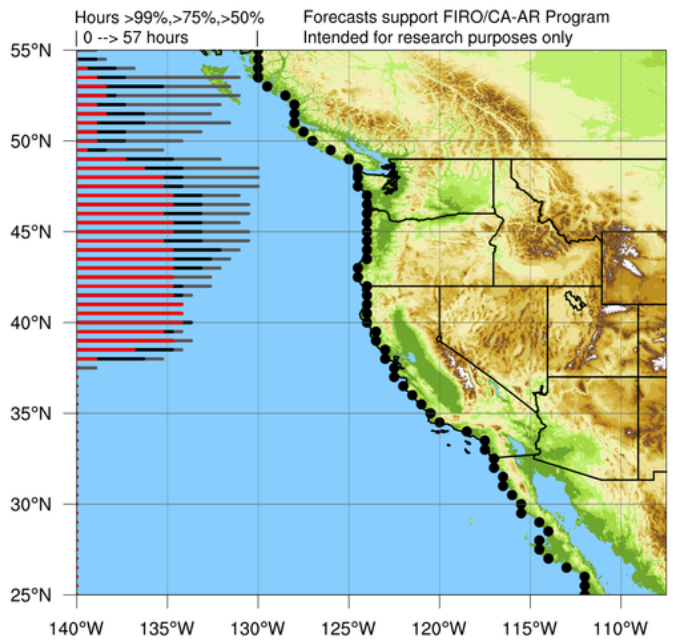
- The 12Z 12 Jan GFS analysis shows the AR currently impacting the Pacific Northwest, with IVT > 800 kg m^{-1} s^{-1} over western Oregon (Figure A)
- The core of the AR is characterized by a plume of very moist air, with IWV values approaching 30 mm along the coast of Oregon and northwestern California (Figure B)
- The strongest moisture transport (IVT > 1200 kg m^{-1} s^{-1}) is forecast to occur around 06Z 13 Jan as a frontal wave intensifies and moves onshore (Figure C)
- The magnitude and orientation of the IVT vectors imply vigorous upslope moisture flux and orographic enhancement of precipitation

AR Outlook: 12 Jan 2021

For California DWR's AR Program

Probability of AR Conditions Along Coast





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

PLYMOUTH STATE METEOROLOGY

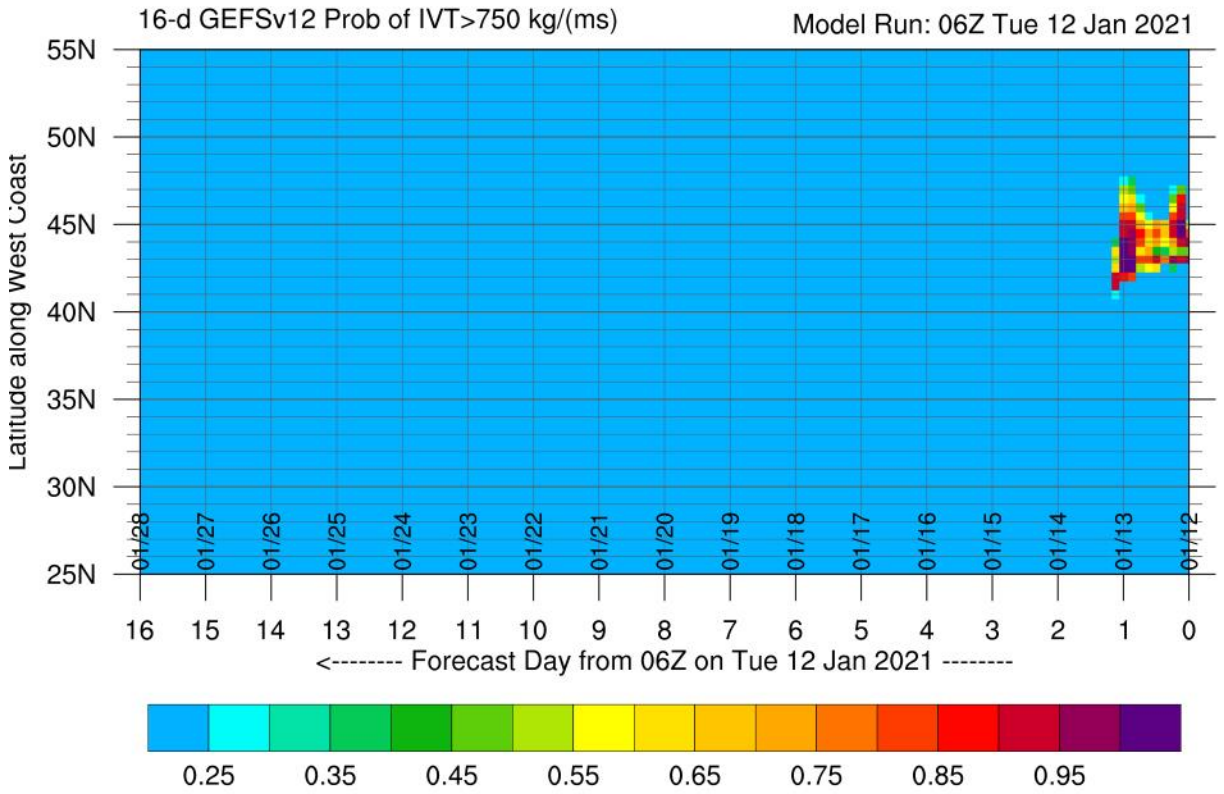
*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

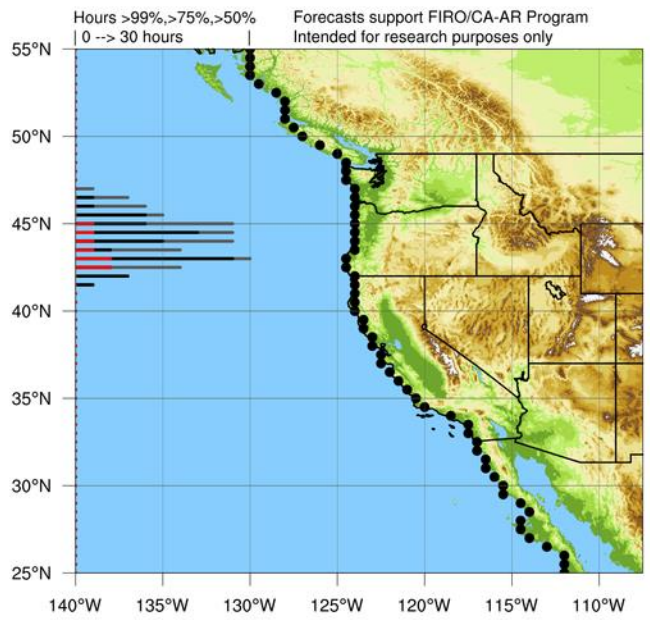
- There continues to be high ensemble agreement within the GEFS that AR conditions will last until ~12 UTC 13 January over Washington, Oregon, and Northern California
- Ensemble agreement continues to increase in association with an AR that is forecast to impact the Pacific Northwest on 14 and 15 January
- The GEFS is also forecasting the potential for additional ARs on days 5 and 7, but uncertainty is currently high

AR Outlook: 12 Jan 2021

For California DWR's AR Program

Probability of Strong AR Conditions Along Coast





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PLYMOUTH STATE METEOROLOGY

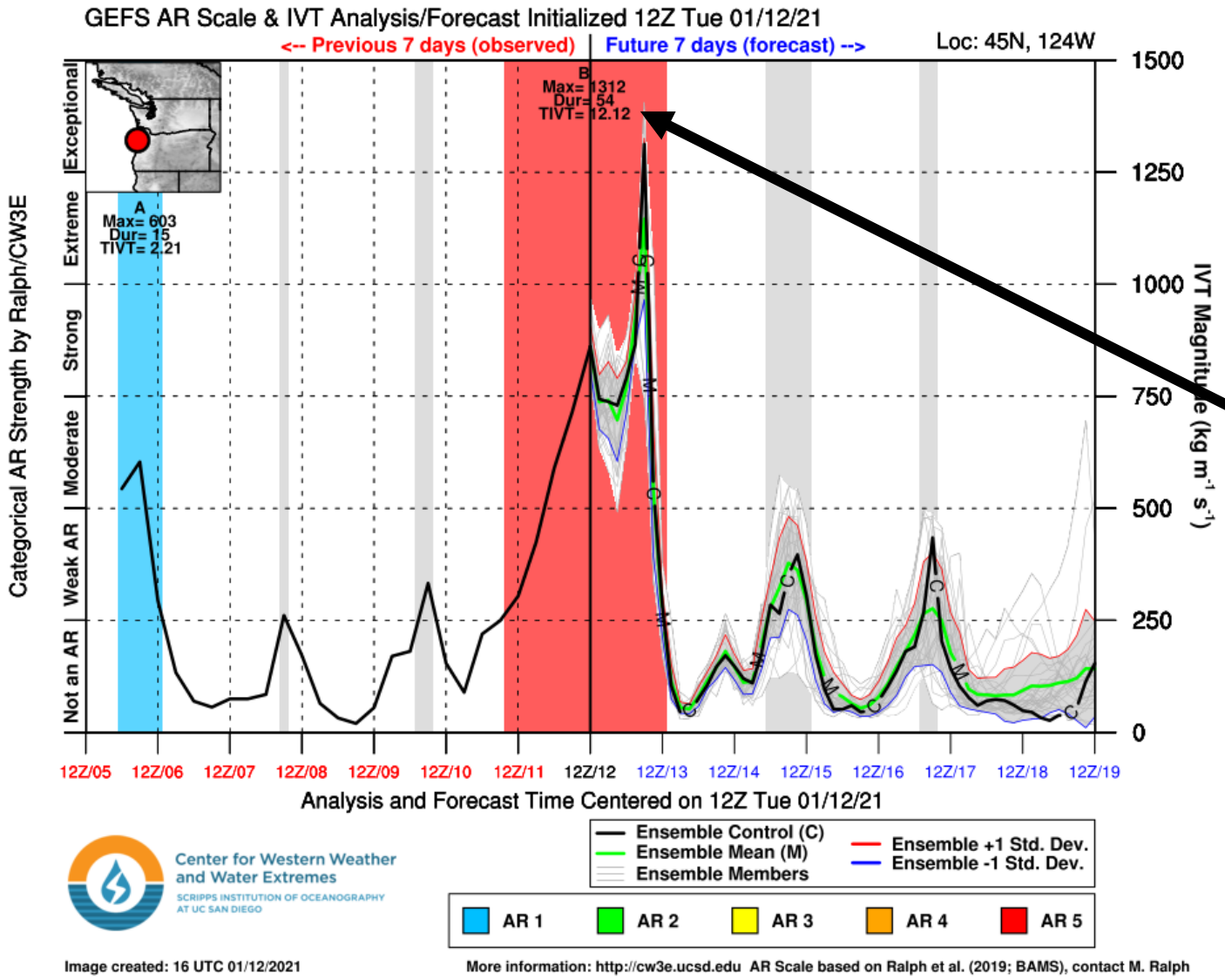
*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The probability of strong AR conditions (IVT > 750 kg m^{-1} s^{-1}) over Oregon continues to be high
- There is some uncertainty in how long the strong AR conditions will last with forecast durations ranging from 0 to 30 hours

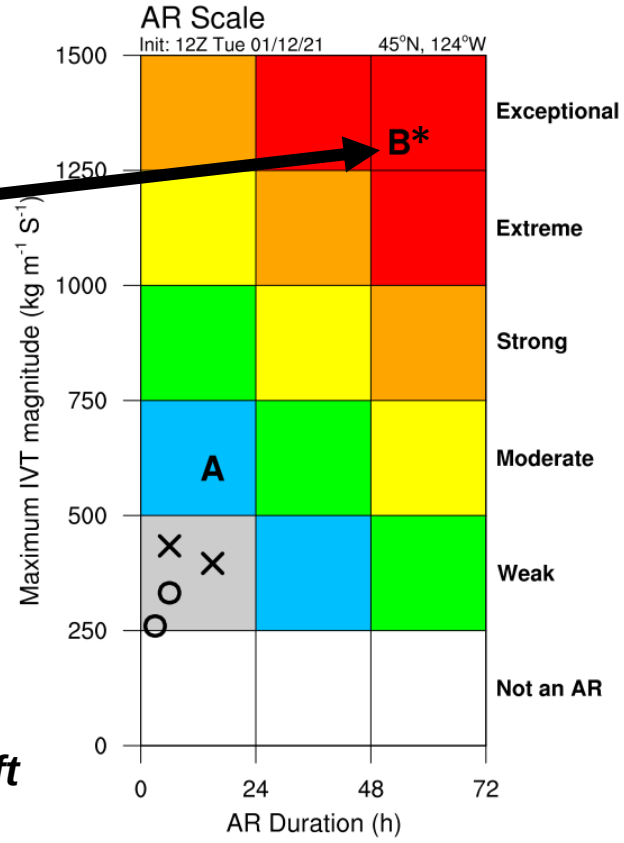
AR Outlook: 12 Jan 2021

For California DWR's AR Program

GEFS IVT/AR Scale Forecasts



- The GFS Analysis indicates that AR conditions began at ~9 UTC 11 January and have steadily increased to ~900 kg m^{-1} s^{-1} at 12 UTC 12 January over N. OR
- The secondary peak of enhanced IVT magnitudes produced by a mesoscale frontal wave is forecast to reach a magnitude of 1312 kg m^{-1} s^{-1} while also extending the overall duration of AR conditions
- The extended duration of AR conditions lasting 54 hours and maximum IVT magnitude of 1312 kg m^{-1} s^{-1} results in AR 5 conditions on the AR Scale (Ralph et al. 2019)

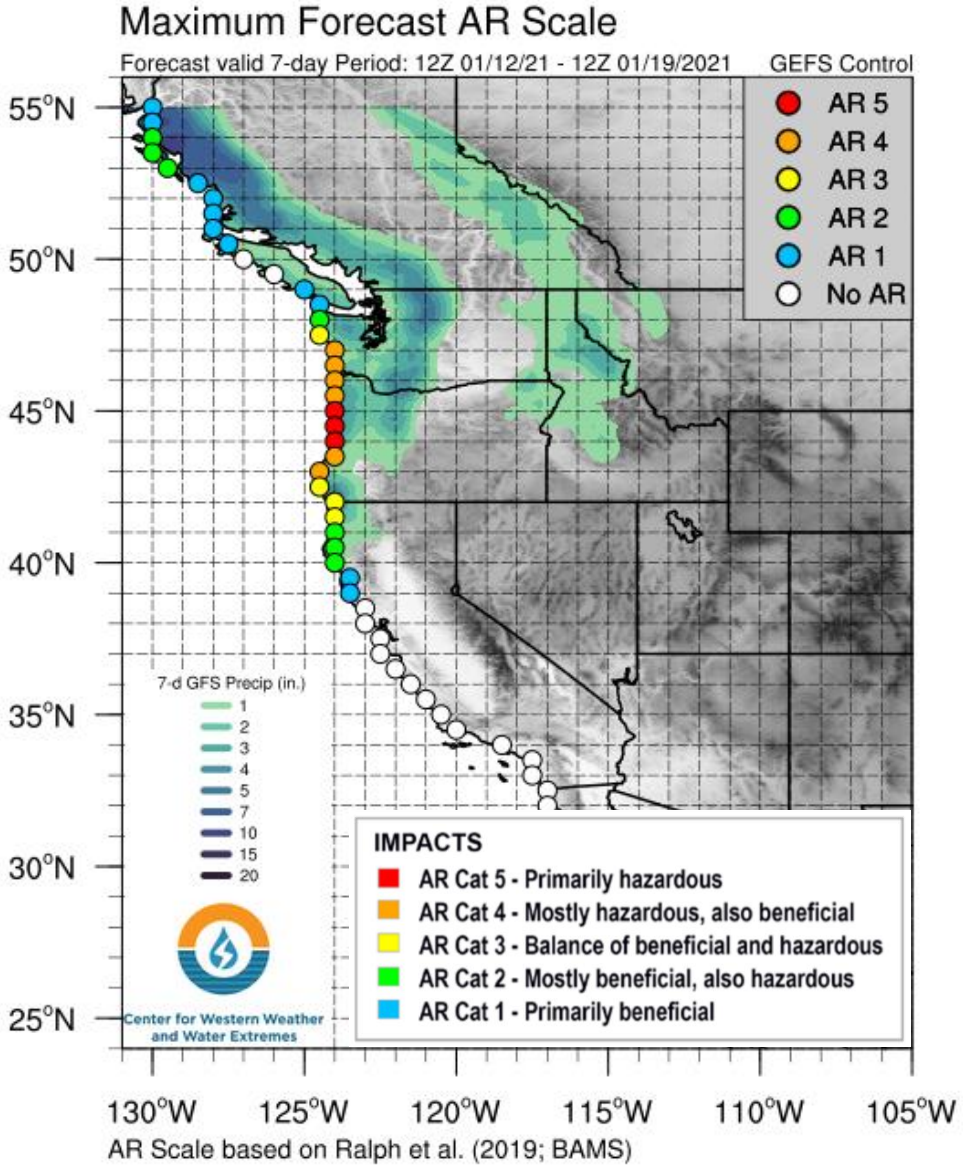


Letters on the right image correspond to ARs labelled on the left forecast plot

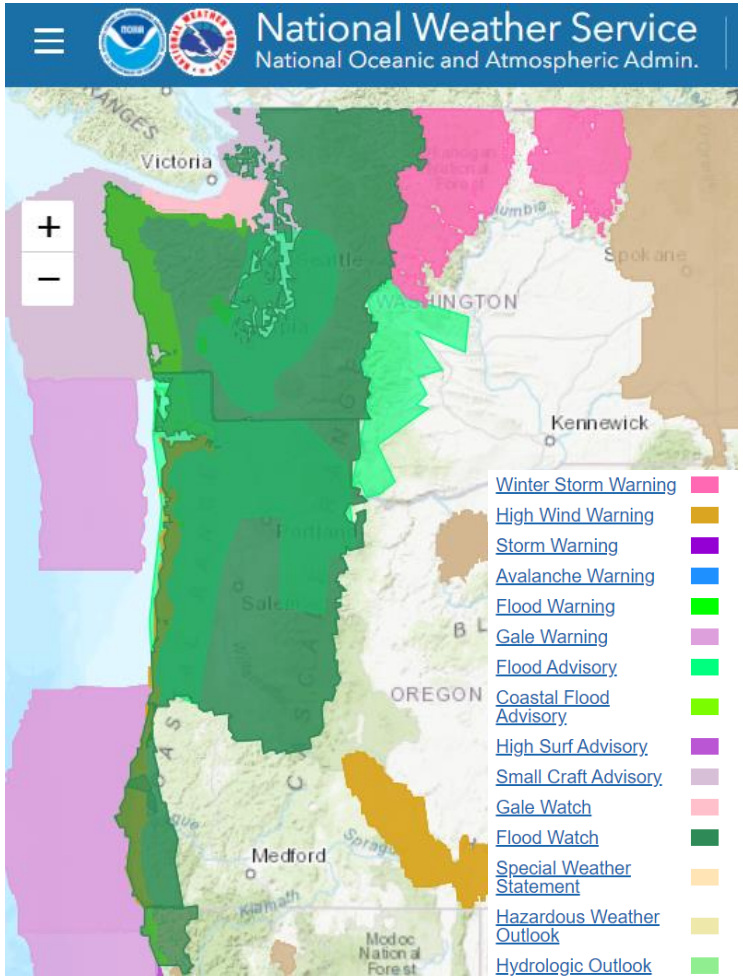
AR Outlook: 12 Jan 2021

AMBASSADOR™ WRN WEATHER-READY NATION

For California DWR's AR Program



- The GEFS control is currently forecasting AR 5 conditions for Coastal Oregon from 43°N to 45°N leading to mostly hazardous impacts
- Other coastal locations from far Northern California to Washington are forecast to receive AR 3 to AR 4 conditions
- The purpose of the AR Scale is to better communicate the potential risks and benefits that a given AR is likely to bring by characterizing the strength, duration, and potential impacts of an atmospheric river at a specific location
- Multiple ARs in the PNW have led to antecedent conditions that increase the impacts and potential hazards resulting from the AR5 and AR4.
- Some of these potentially hazardous impacts are highlighted by the watches and warnings that have been issued by the National Weather Service (right)
- Visit https://cw3e.ucsd.edu/wp-content/uploads/Two_Pagers/C3WE_ARscale.pdf or refer to Ralph et al. 2019



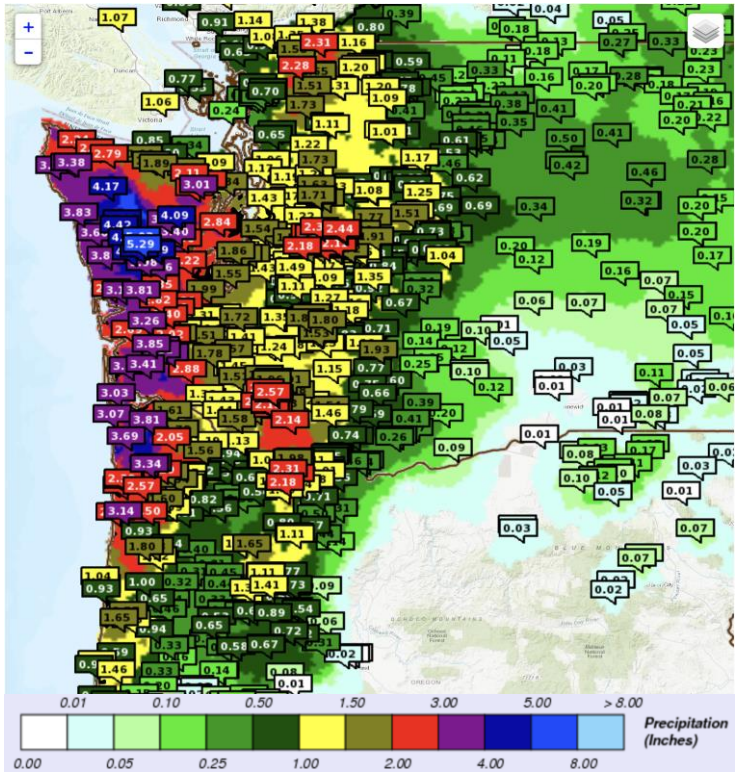
AR Outlook: 12 Jan 2021

AMBASSADOR™ WRN WEATHER-READY NATION

For California DWR's AR Program

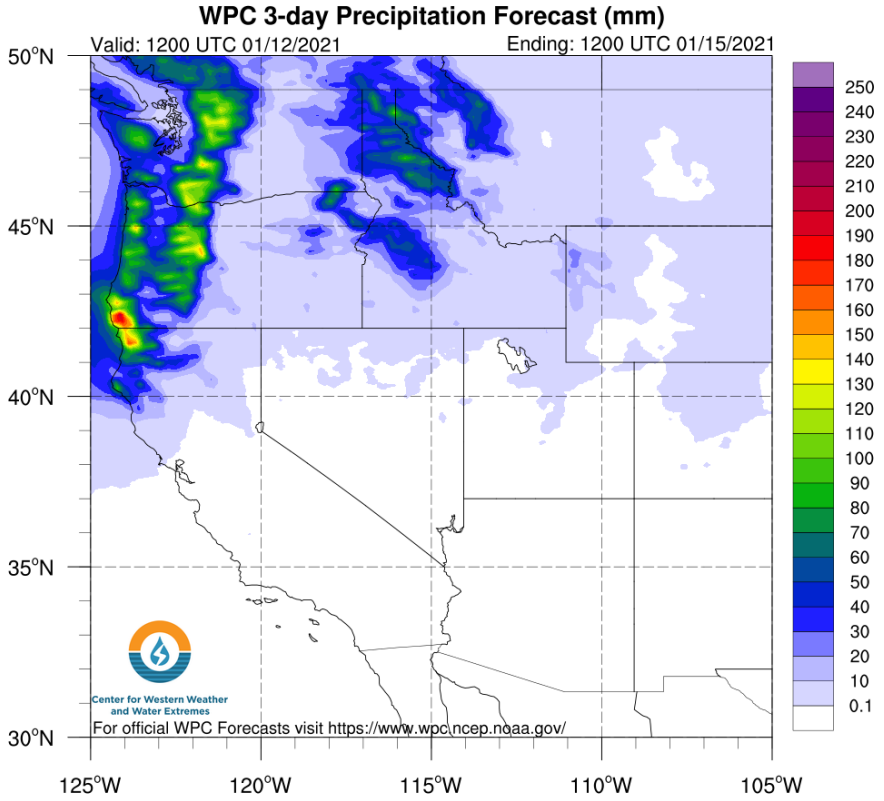
Precipitation Impacts

NWRFC 24-h Observed Precipitation: Valid 12Z 11–12 Jan

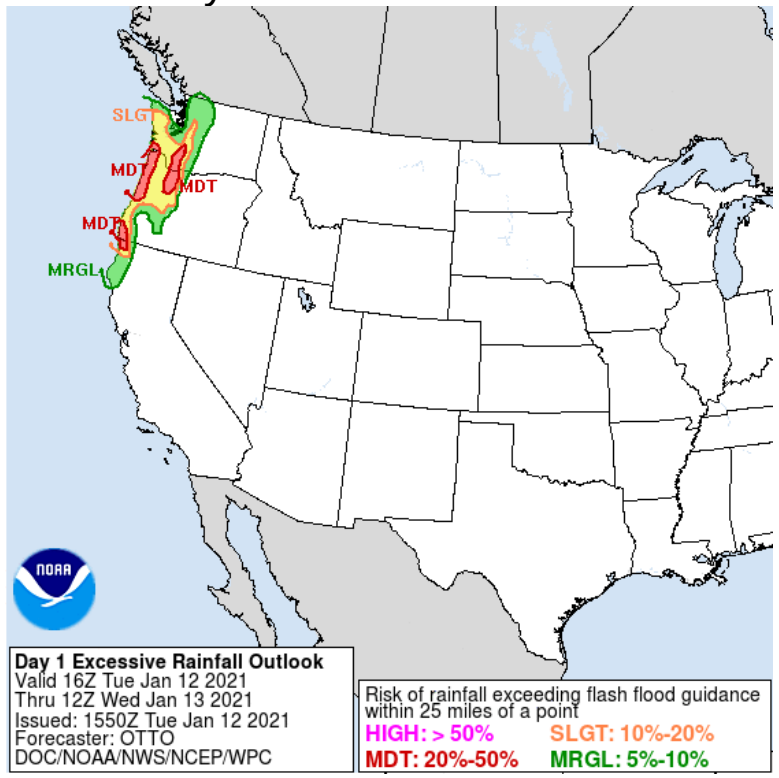


Source: NOAA/NWS NWRFC, https://www.nwrfc.noaa.gov/

WPC 3-day QPF: Valid 12Z 12–15 Jan



WPC Day 1 Excessive Rainfall Outlook



Source: NOAA/NWS WPC, https://www.wpc.ncep.noaa.gov/

- An estimated 3–5 inches of precipitation has already fallen in portions of western Washington and northwestern Oregon as of 12Z (4 AM PST) 12 Jan (left)
- The NWS Weather Prediction Center (WPC) is forecasting an additional 3–7 inches of precipitation in parts of the Pacific Coast Ranges and Cascades, with the highest amounts expected in extreme southwestern Oregon and northwestern California (center)
- The NWS WPC has issued a moderate risk of excessive rainfall for portions of the Pacific Coast Ranges and Cascades (right)

AR Outlook: 12 Jan 2021

AMBASSADOR™ WRN WEATHER-READY NATION

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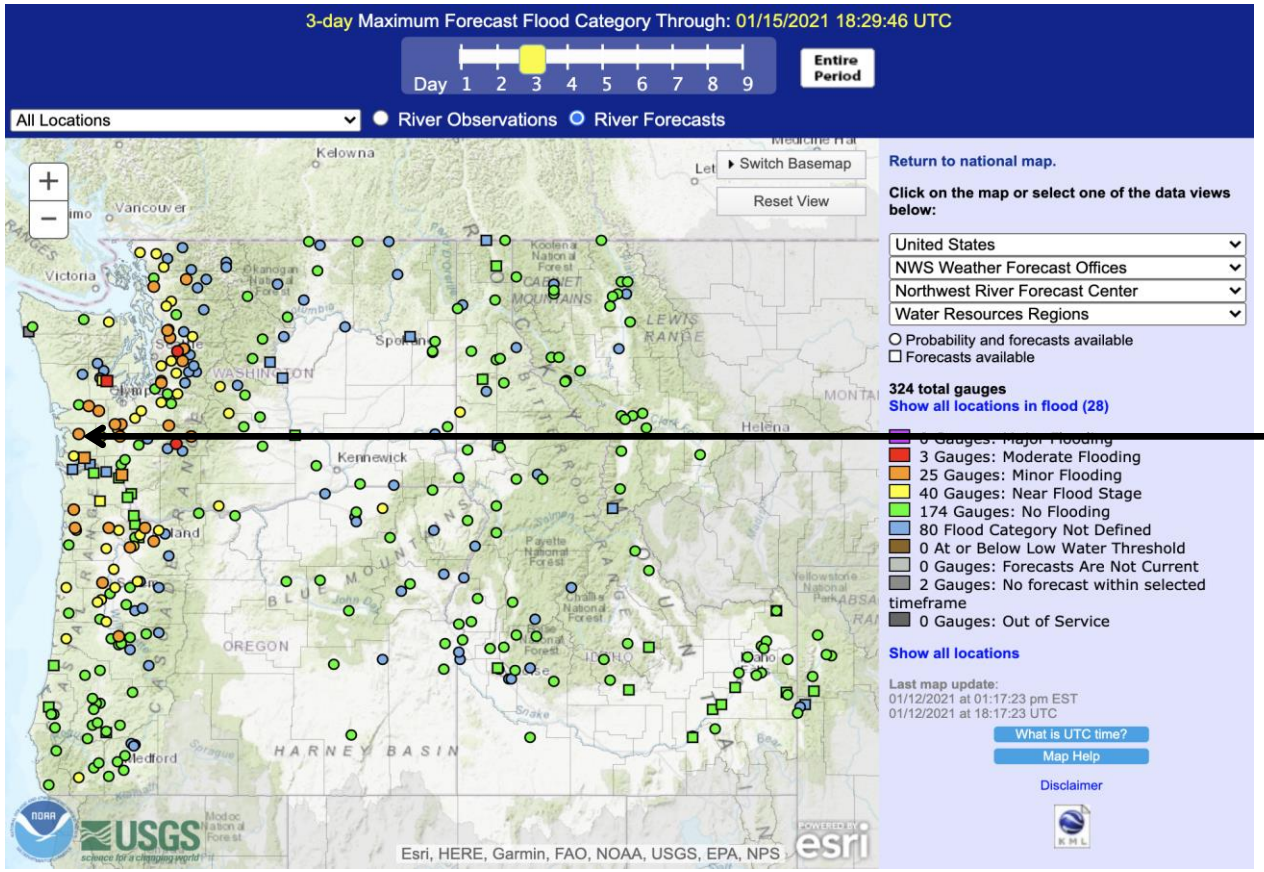
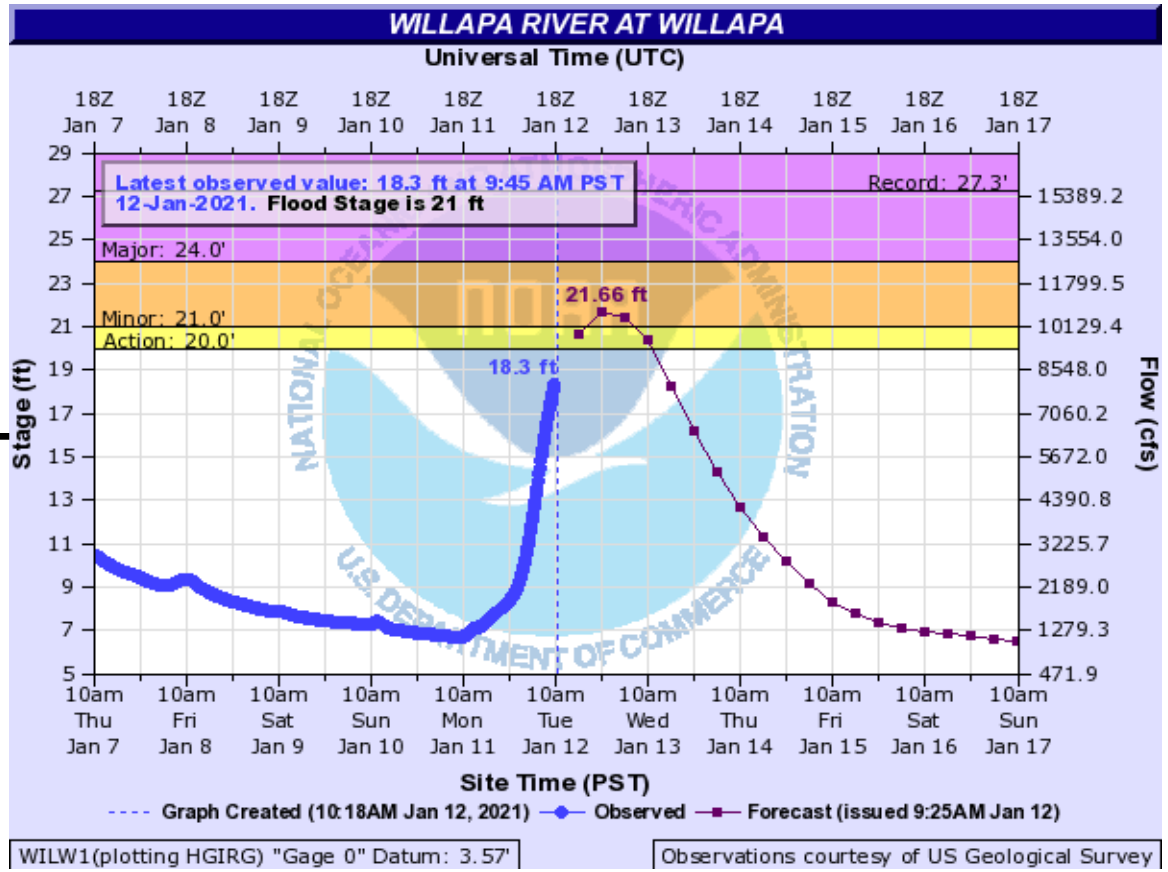
Precipitation Impacts





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

- Widespread flooding is expected in western Washington and northwestern Oregon during the next 3 days
- The Willapa River (at Willapa, WA) rose about 10 feet between 10 PM 11 Jan and 10 AM 12 Jan
- The Cowlitz River (at Randle, WA) and the Snoqualmie River (near Carnation, WA) are forecast to reach moderate flood stage on 13 Jan