CW3E Atmospheric River Outlook: 28 Sep 2021

For California DWR's AR Program

Atmospheric River Brings Rain to the Pacific Northwest

- A strong atmospheric river (AR) made landfall over Washington during the early morning of 26 September
- Portions of coastal Washington and Oregon experienced AR 3/AR 4 conditions (based on the Ralph et al. 2019 AR Scale)
- More than 3 inches of precipitation fell in parts of the Olympic Peninsula and North Cascades

September to End on a Wet Note in the Pacific Northwest

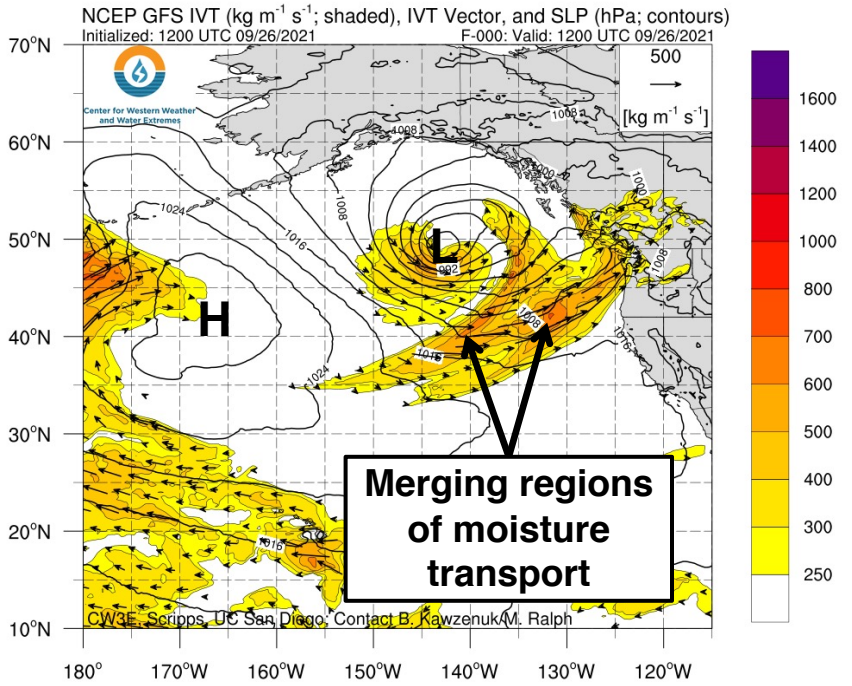
- Yet another AR is forecast to make landfall over the Pacific Northwest tomorrow
- AR 2/AR 3 conditions (based on the Ralph et al. 2019 AR Scale) are possible over coastal Washington and northern coastal Oregon
- About 1–3 inches of precipitation are forecasted across much of western Washington over the next 72 hours, with higher amounts possible in the Olympic Mountains and North Cascades
- Given the more northerly track of the AR and associated surface cyclone, little or no precipitation is expected in most of Oregon and Northern California

Event Summary: 26–28 Sep 2021

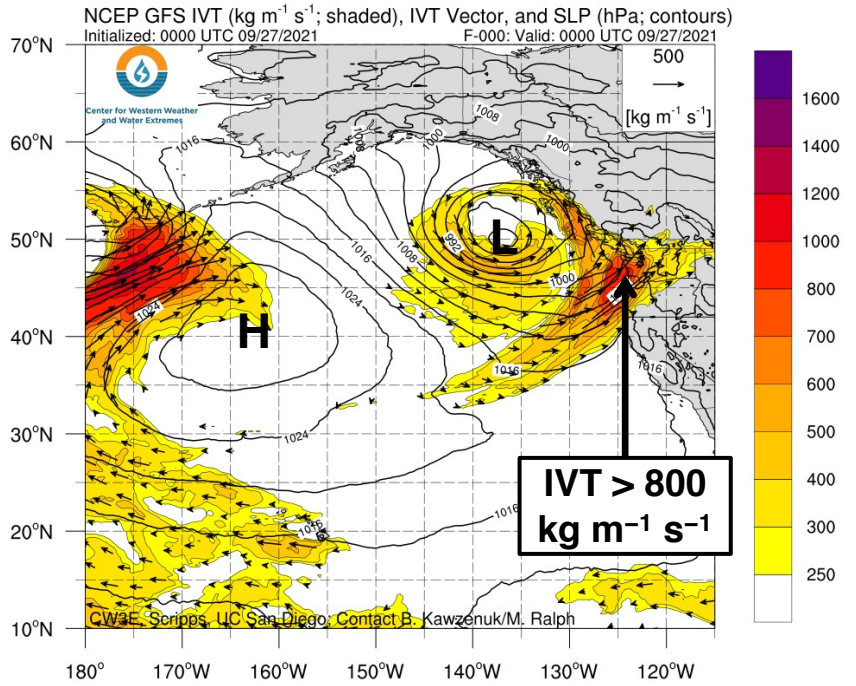
For California DWR's AR Program

GFS IVT & IWV Analyses

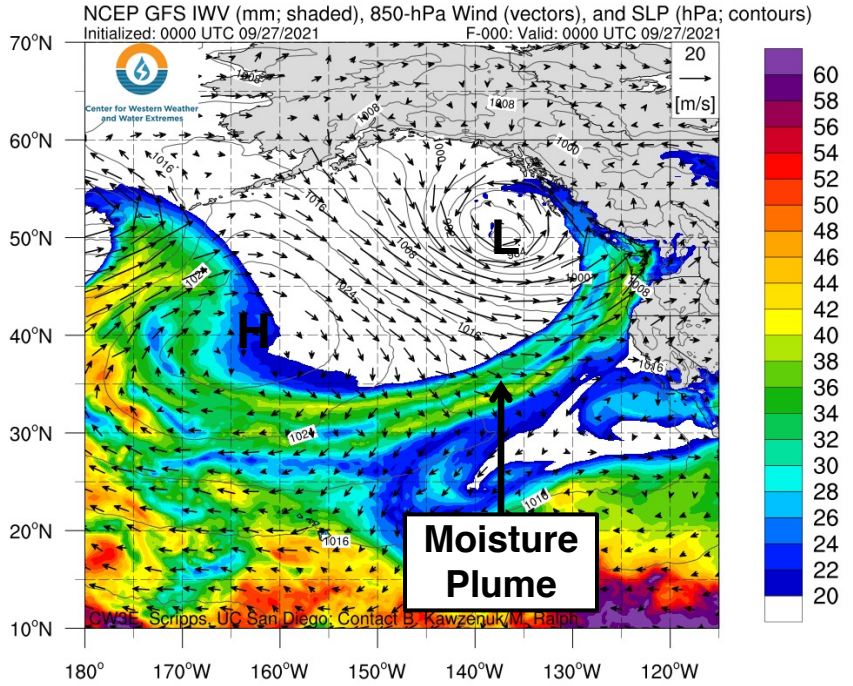
A) Valid: 5 AM PT 26 Sep



B) Valid: 5 PM PT 26 Sep



C) Valid: 5 PM PT 26 Sep

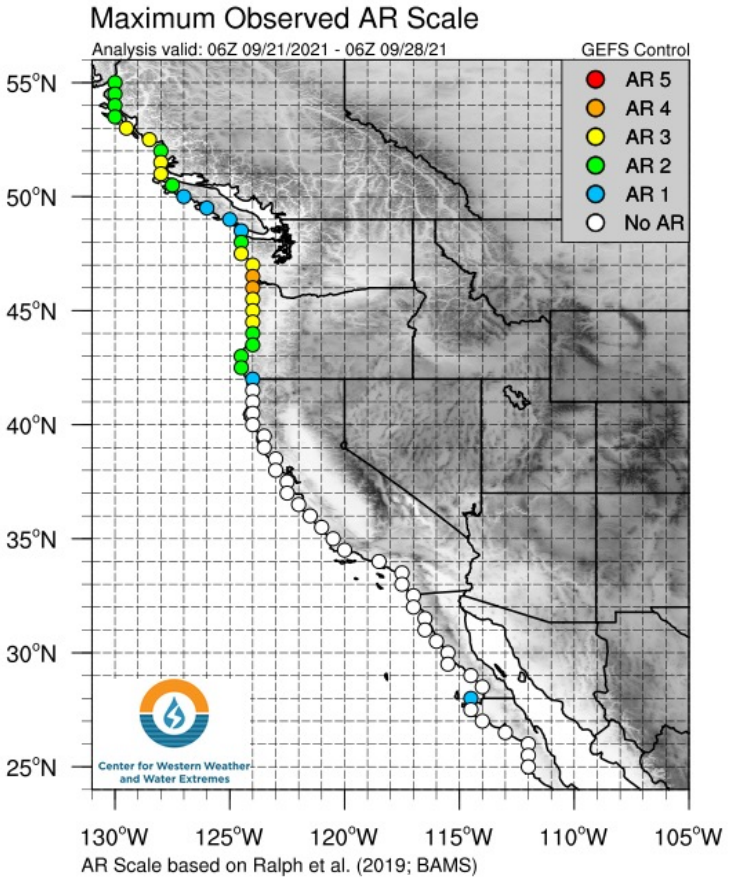


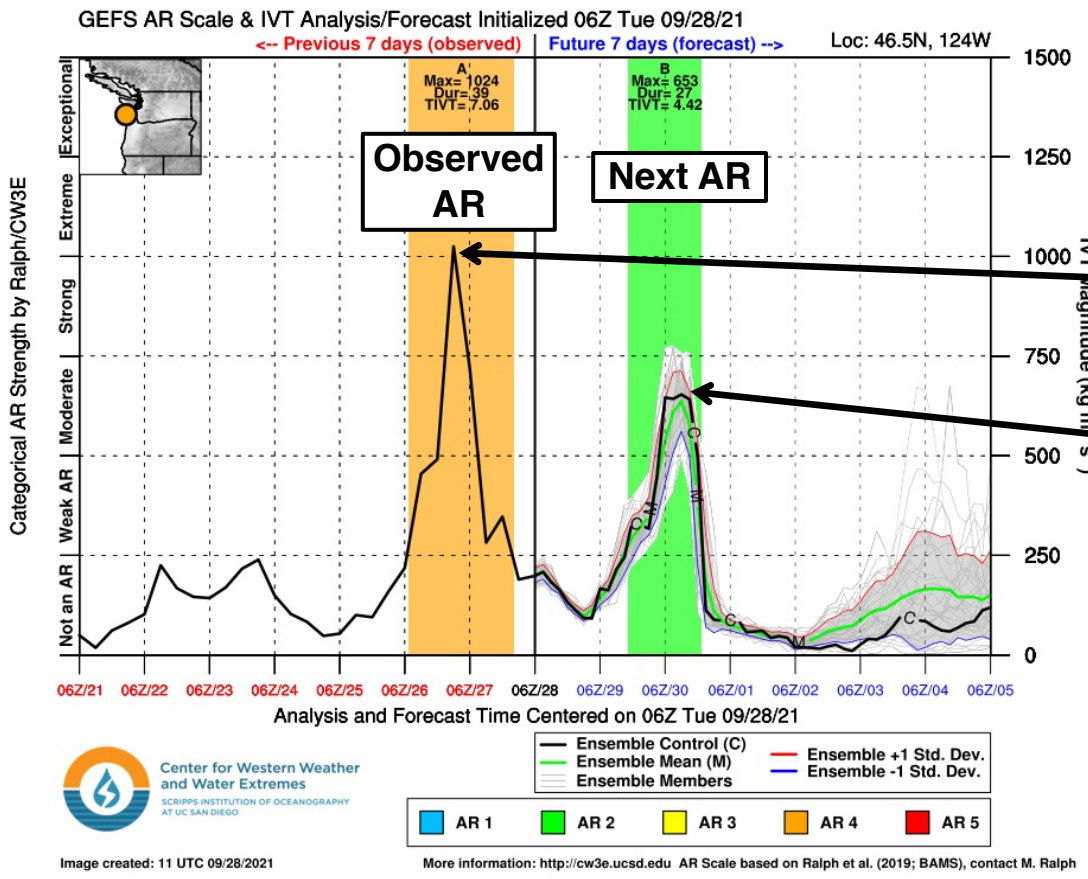
- An AR made landfall over Washington during the early morning of 26 Sep as a region of strong moisture transport associated with a surface cyclone merged with an existing region of strong moisture transport to the east (Figure A)
- The strongest moisture transport occurred around 5 PM Pacific Time (PT) 26 Sep, with IVT values approaching 1000 kg m^{-1} s^{-1} near the Washington–Oregon border (Figure B)
- The GFS IWV analysis at 5 PM PT 26 Sep shows a long, narrow plume of moist air (IWV > 30 mm) extending from the subtropical North Pacific to the U.S. West Coast (Figure C)
- At this time, IWV values were approaching 40 mm along the Oregon coast

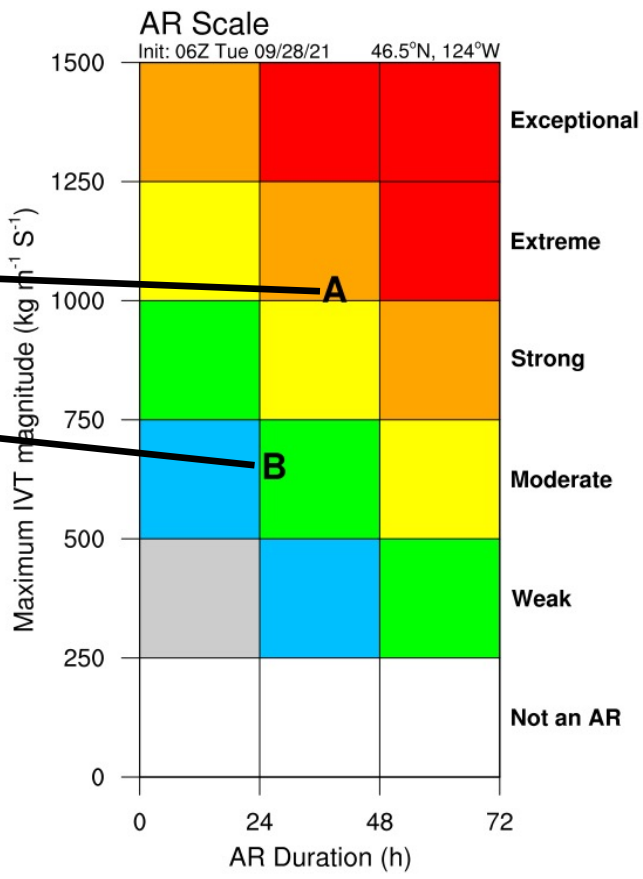
Event Summary: 26–28 Sep 2021

For California DWR's AR Program

GEFS AR Scale & IVT Analyses







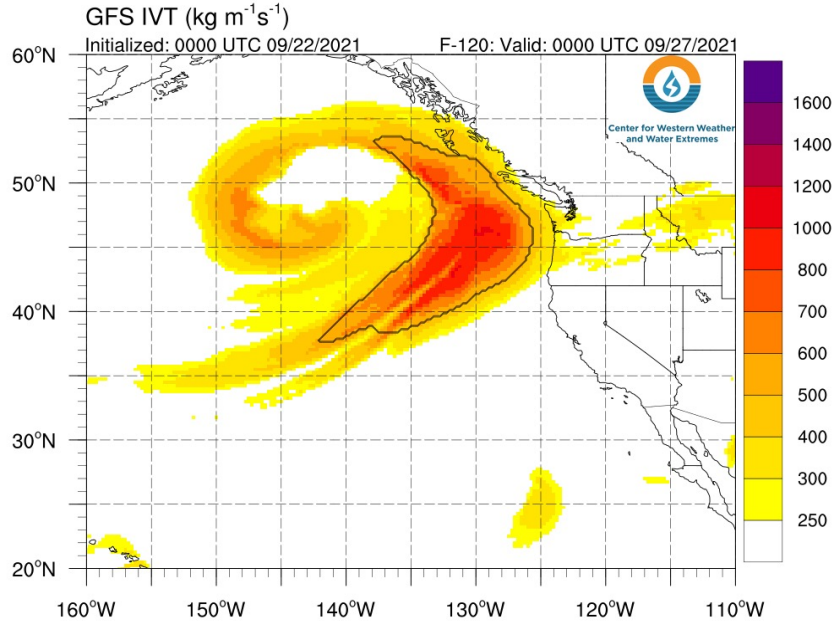
- This AR produced AR 4 conditions (based on the Ralph et al. 2019 AR Scale) near the Oregon–Washington border
- A maximum IVT value of 1024 kg m^{-1} s^{-1} and an AR duration of 39 hours were observed at 46.5°N, 124°W (Pacific County, WA)
- The next AR is currently forecasted to produce AR 2 conditions at this location

Event Summary: 26–28 Sep 2021

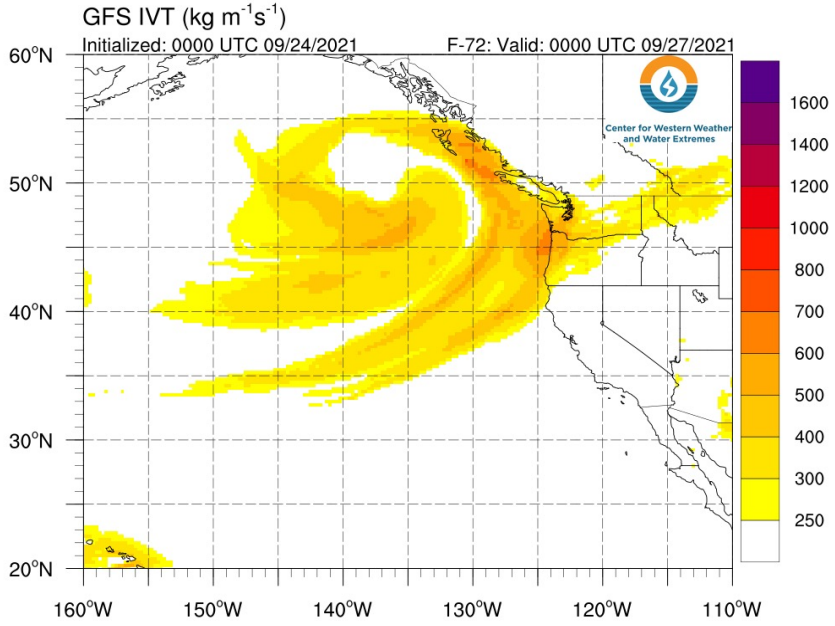
For California DWR's AR Program

GFS AR/IVT Forecast Verification

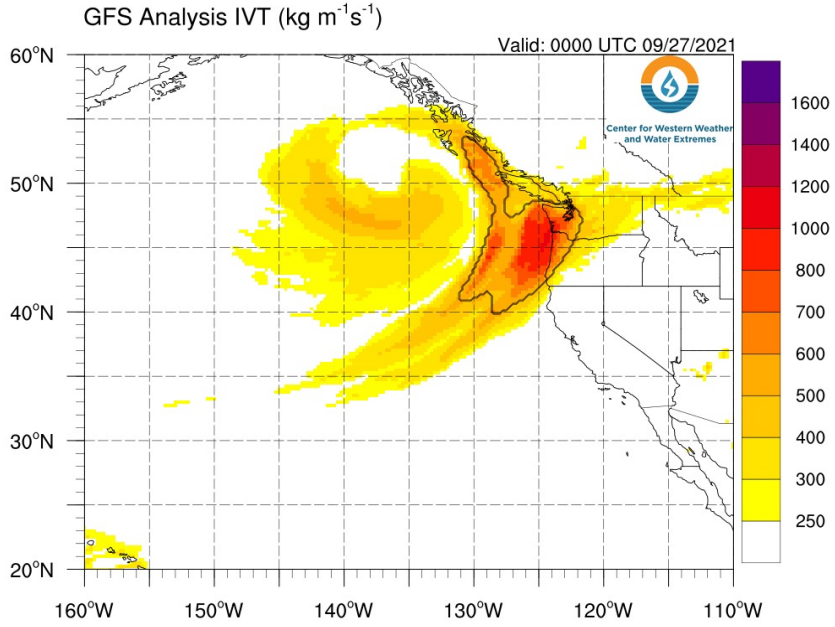
GFS 120-h IVT Forecast
Initialized: 5 PM PT 21 Sep 2021



GFS 72-h IVT Forecast
Valid: 5 PM PT 23 Sep 2021



GFS IVT Analysis
Valid: 5 PM PT 26 Sep 2021

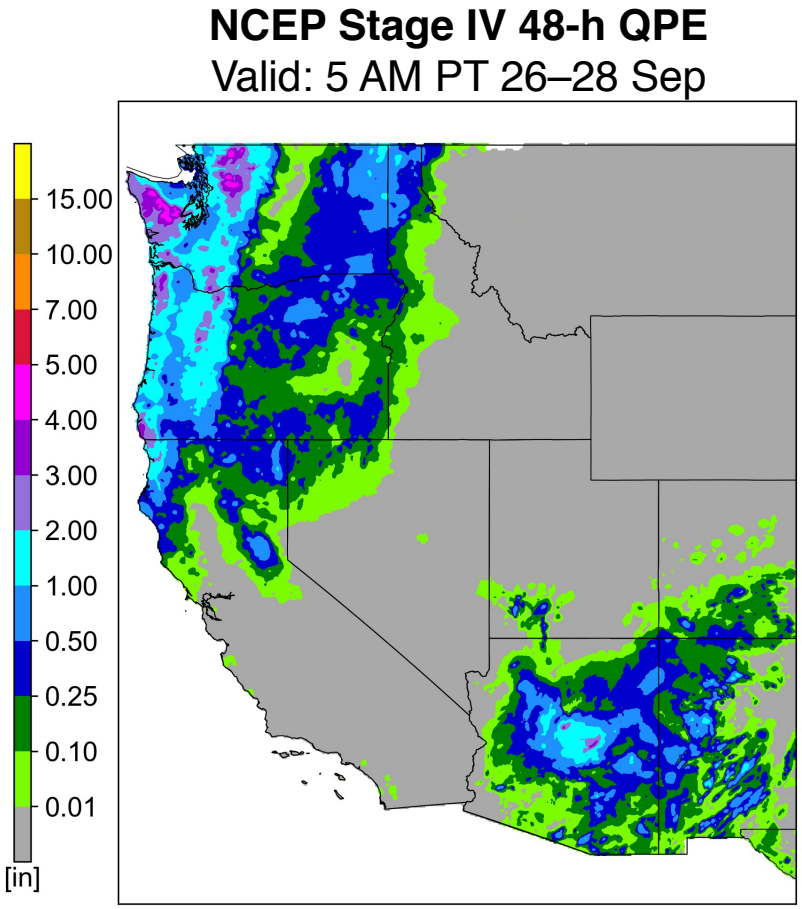


- The overall structure of the AR was captured by the GFS model at a 5-day (120-hour) lead time, but the forecasted AR was too far west, and the region of moderate AR conditions (IVT > 500 kg m^{-1} s^{-1}) was too large
- The timing of the AR was well-forecasted by the GFS model at a 3-day (72-hour) lead time, but the forecasted IVT magnitude was too weak

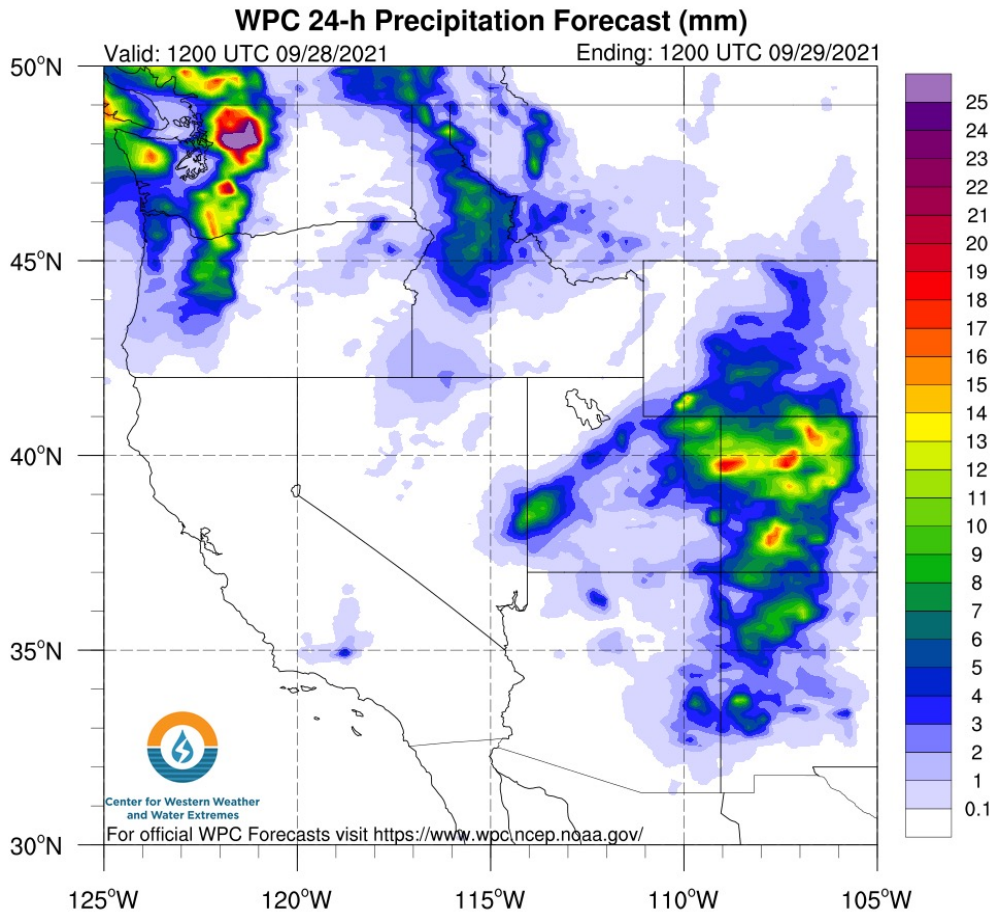
Contours = forecasted/observed AR objects (IVT > 500 kg m^{-1} s^{-1})

Event Summary: 26–28 Sep 2021

For California DWR's AR Program



AMBASSADOR™ WRN WEATHER-READY NATION



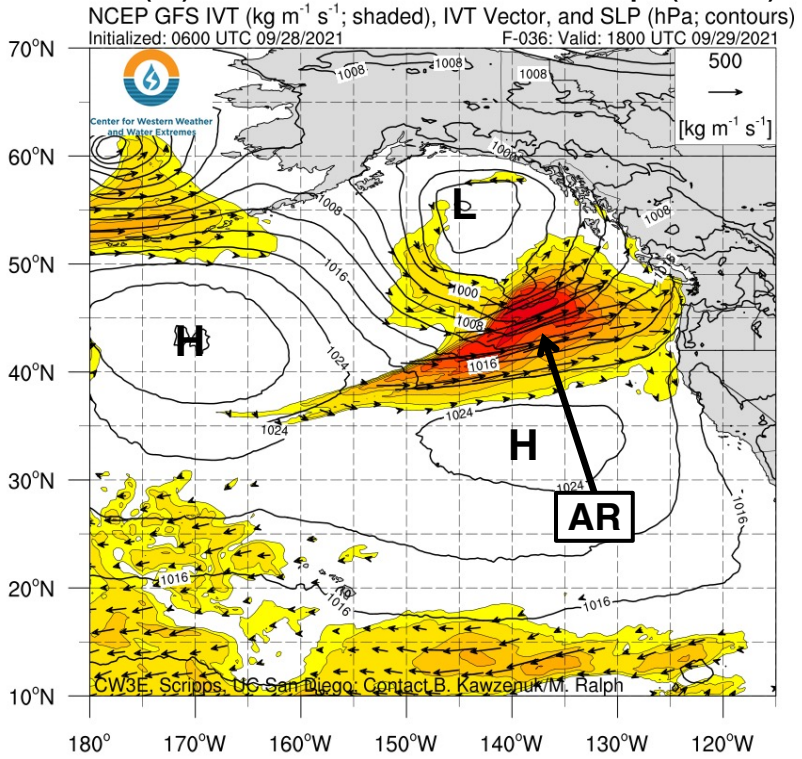
- Similar to the previous event, this AR produced at least 1–3 inches of precipitation across western Washington, western Oregon, and far northwestern California
- The heaviest precipitation (3–5 inches) occurred on the windward side of the Olympic Mountains and North Cascades
- Although the AR has already dissipated, continued upslope flow and synoptic-scale forcing for ascent will produce additional precipitation today, with more than 0.5 inches possible in the Olympic Mountains and Cascades

AR Outlook: 28 Sep 2021

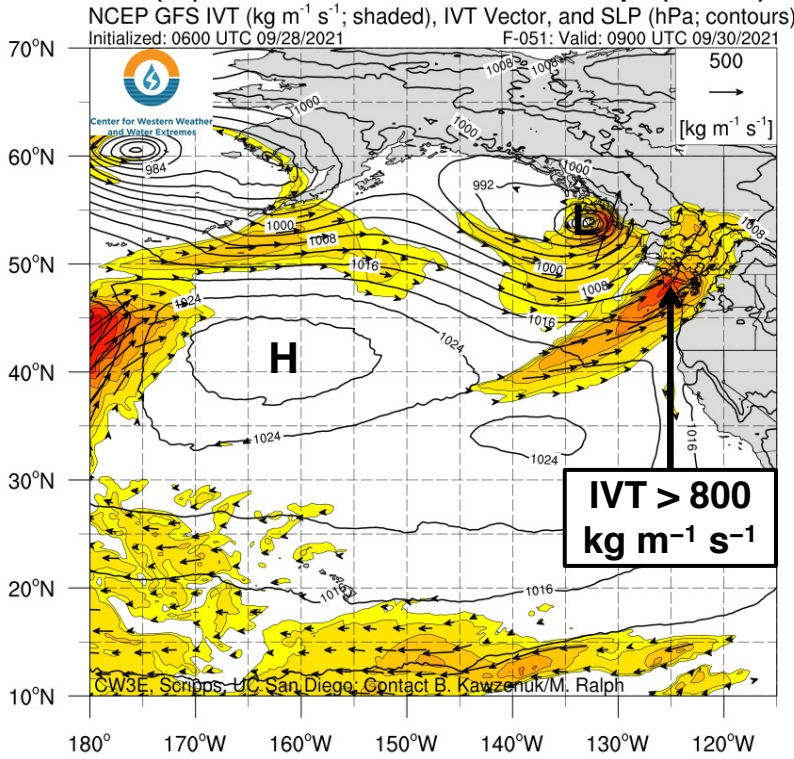
For California DWR's AR Program

GFS IVT & SLP Forecasts

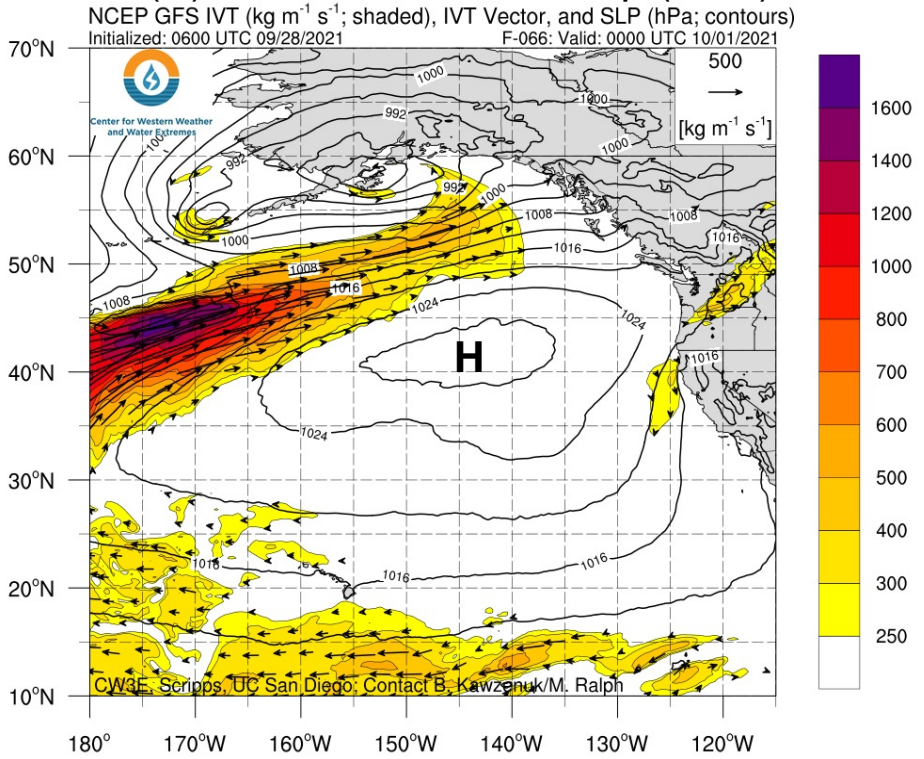
(A) Valid: 11 AM PT 29 Sep (F-36)



(B) Valid: 2 AM PT 30 Sep (F-51)



(C) Valid: 5 PM PT 30 Sep (F-66)

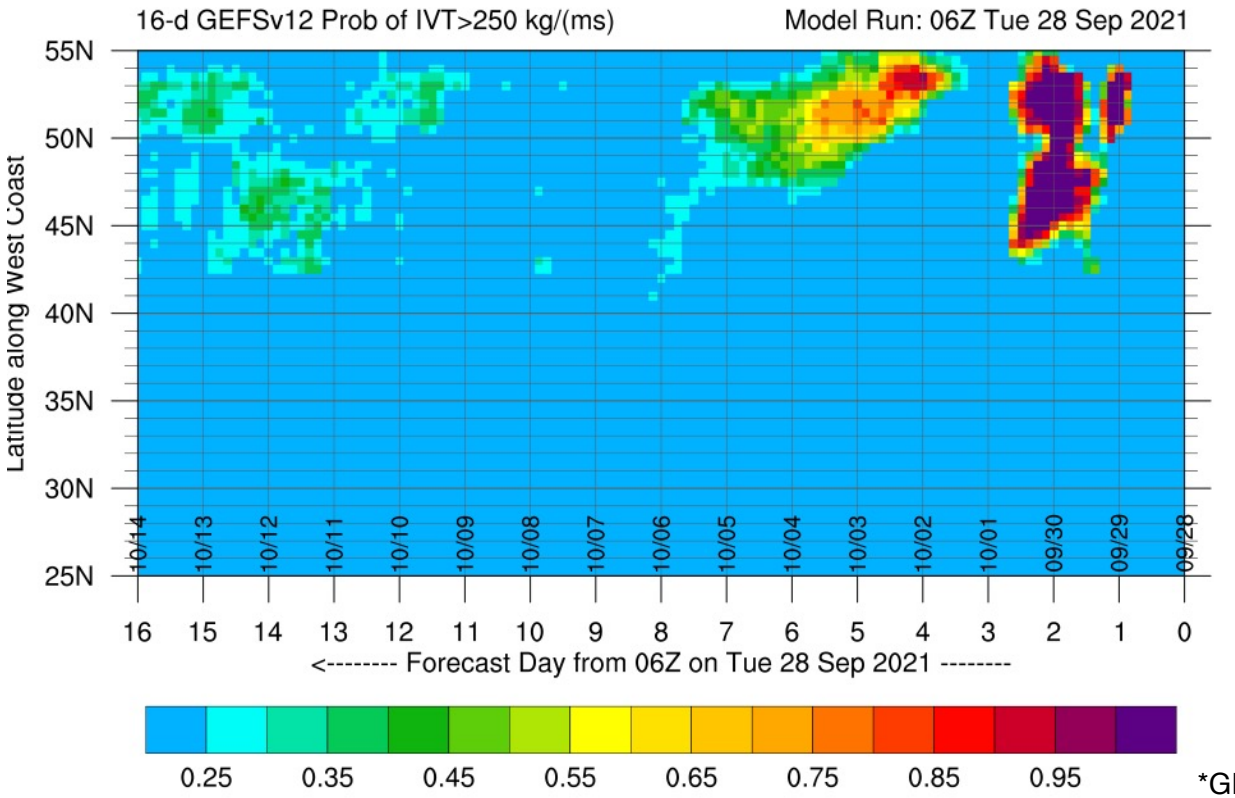


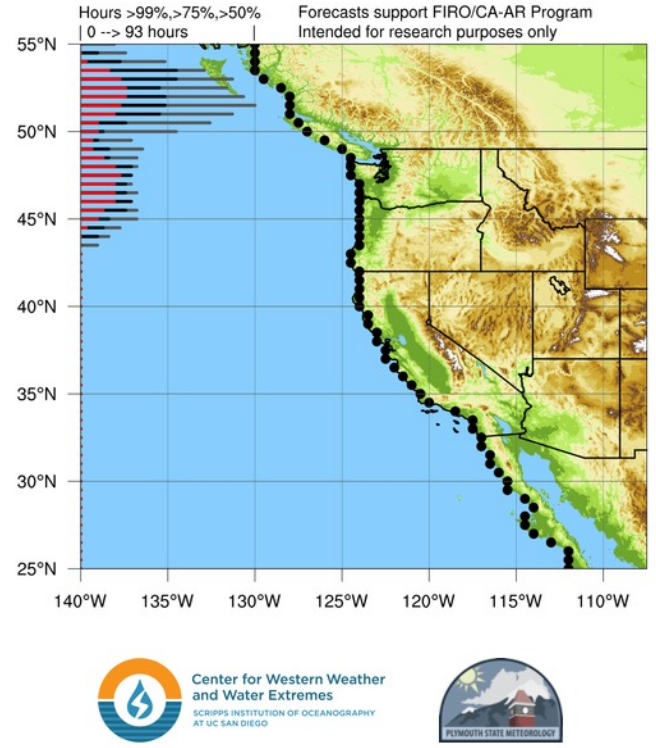
- The 06Z 28 Sep deterministic GFS forecast shows an AR making landfall over the Pacific Northwest around 11 AM PT 29 Sep (Figure A)
- The strongest moisture transport is forecasted to occur over the Olympic Peninsula around 2 AM 30 Sep, with IVT values exceeding 800 kg m^{-1} s^{-1} (Figure B)
- As the AR dissipates, weak surface high pressure is forecasted to build offshore, pushing landfalling AR activity northward into southeastern Alaska and British Columbia (Figure C)

AR Outlook: 28 Sep 2021

For California DWR's AR Program

Probability of AR Conditions Along Coast

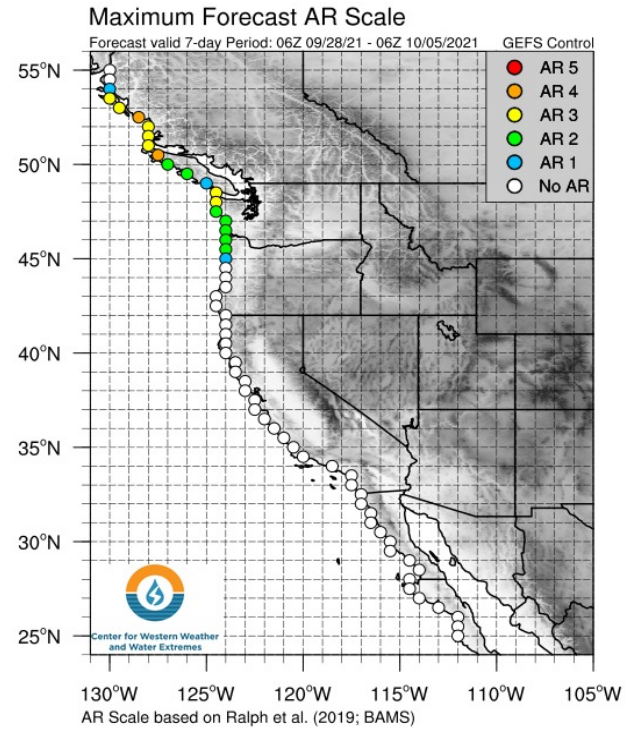




Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

PLYMOUTH STATE METEOROLOGY

AR Scale



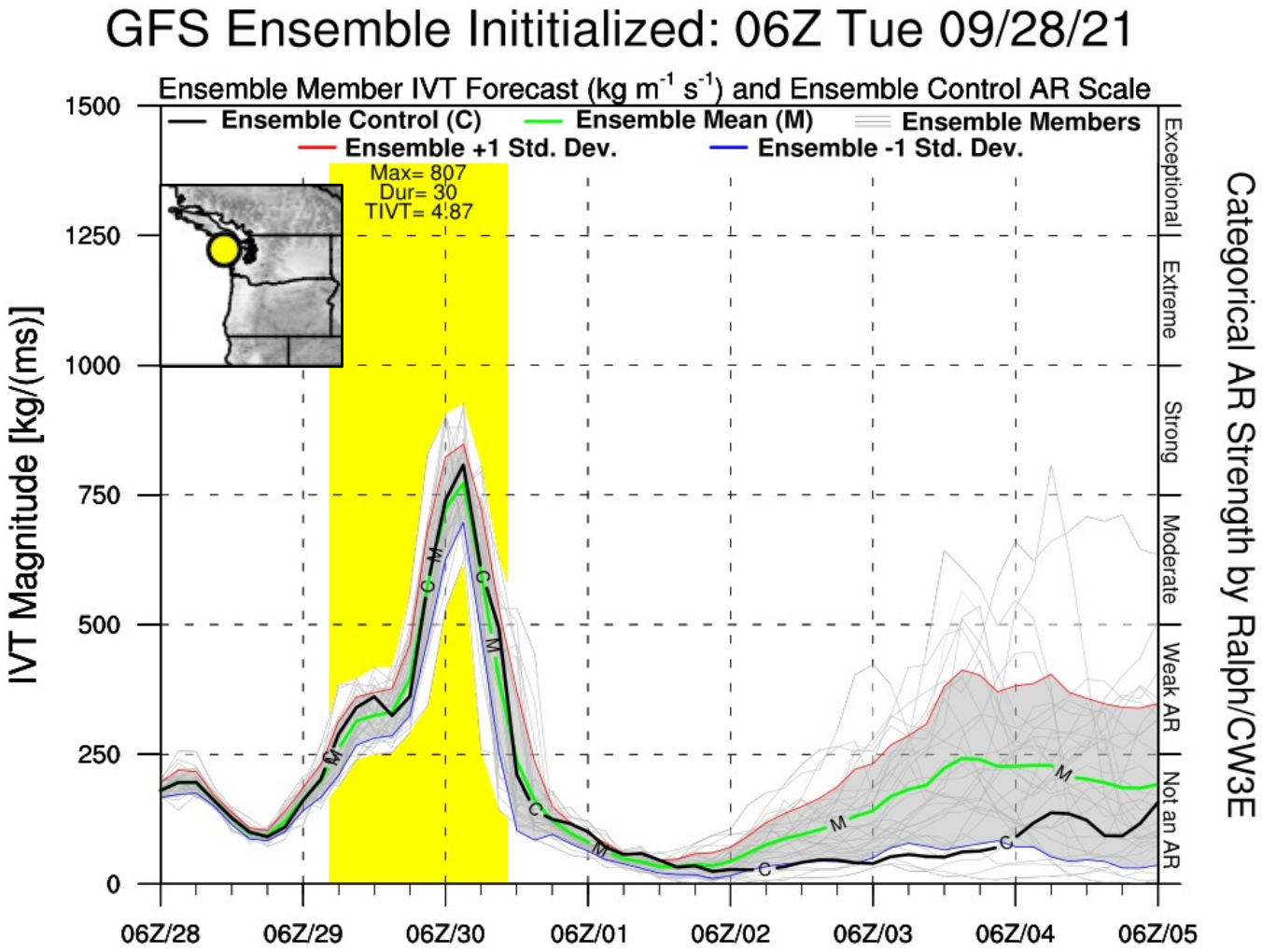
*GEFS = NCEP **G**lobal **E**nsemble **F**orecast **S**ystem (United States)

- The 06Z GEFS is showing very high confidence (> 95% probability) in a period of AR conditions (IVT > 250 kg m^{-1} s^{-1}) over coastal Washington and Oregon during 29–30 Sep
- AR 2/AR 3 conditions (based on the Ralph et al. 2019 AR Scale) are currently forecasted in costal Washington and northern coastal Oregon
- Another round of AR activity is likely (> 70% probability) over British Columbia during 1–3 October, but the probability of AR conditions in the contiguous U.S. is low (< 50%) at this time

AR Outlook: 28 Sep 2021

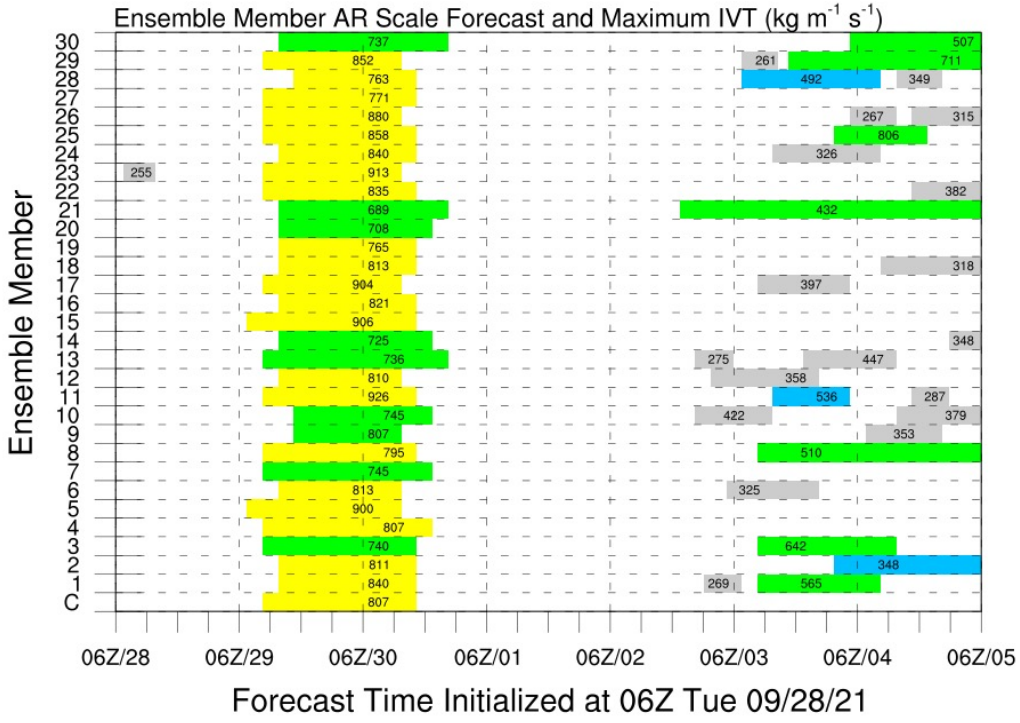
For California DWR's AR Program

GEFS AR Scale and IVT Forecasts



AR 1 AR 2 AR 3 AR 4 AR 5

- The 06Z GEFS control run is forecasting an AR 3 at 48°N, 124.5°W (near Quillayute, WA) based on the Ralph et al. 2019 AR Scale
- 22/31 (71%) ensemble members are forecasting AR 3 conditions
- There is some uncertainty in the maximum IVT, but the ensemble members generally agree on the timing and duration of AR conditions

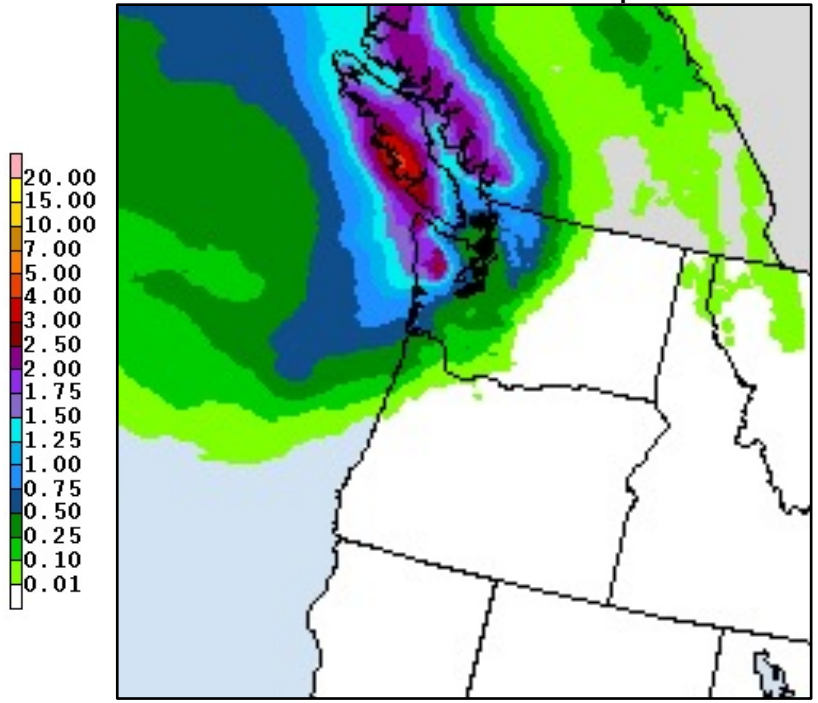


AR Outlook: 28 Sep 2021

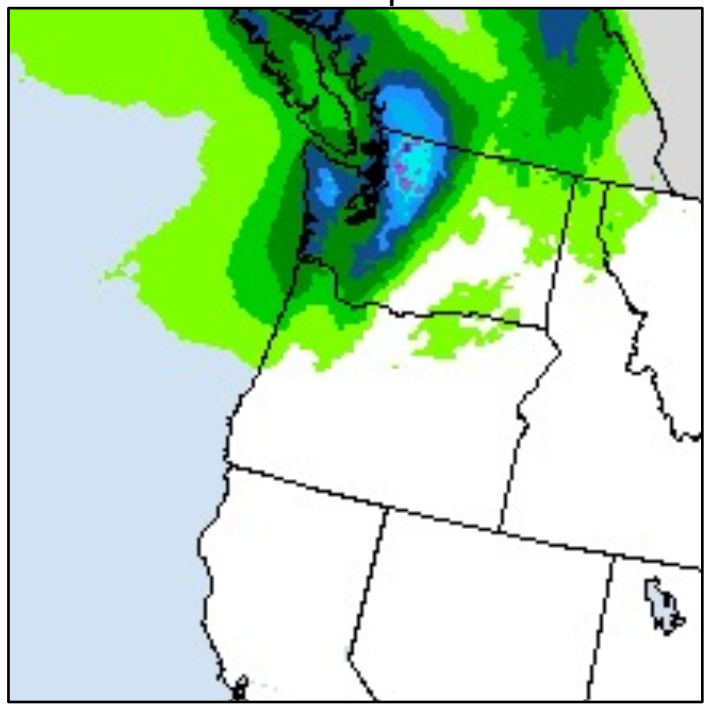
For California DWR's AR Program

Precipitation Impacts

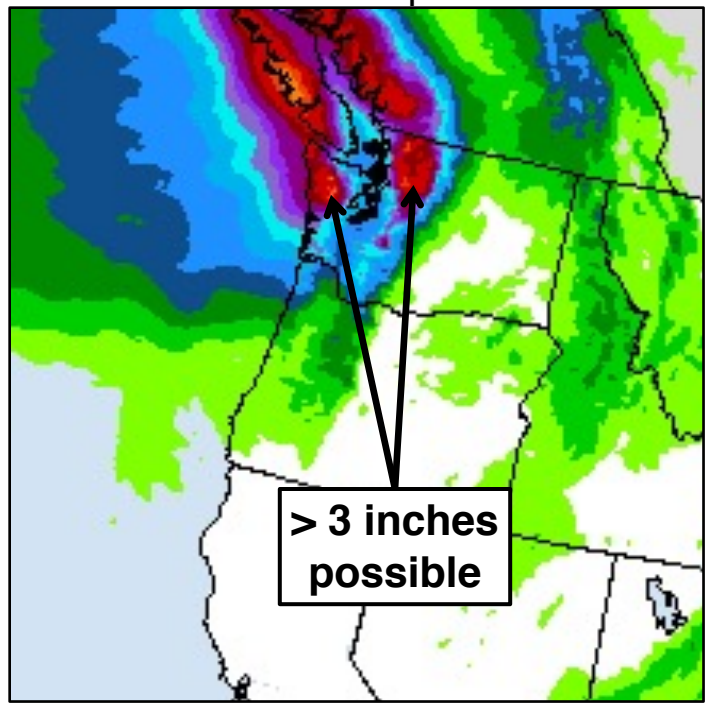
WPC 24-h QPF
Valid 5 AM PT 29–30 Sep 2021



WPC 24-h QPF
Valid 5 AM PT 30 Sep – 1 Oct 2021



WPC 72-h QPF
Valid 5 AM PT 28 Sep – 1 Oct 2021



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

- The NWS Weather Prediction Center (WPC) is currently forecasting at least 1–3 inches of total precipitation across western Washington by Friday morning, with higher amounts likely in the Olympic Mountains and North Cascades
- The heaviest precipitation in the Olympic Peninsula is forecasted to occur during the 24-hour period ending 5 AM PT 30 Sep
- The heaviest precipitation in the Cascades is forecasted to occur during the 24-hour period ending 5 AM PT 1 Oct