Hi Folks,

The forecast for the past seven days verified nicely with lots of precipitation and snow down to lower elevations. Figure 1 shows the National Weather Service California Nevada River Forecast Center's map of observed precipitation for the past seven days. As with all extreme events there are consequences with road closures, avalanches and power outages challenging small mountain communities. Phone line issues and spotty cell service can complicate communications with people who are currently isolated. In coastal areas, streams and creeks have been observed to exceed their banks leading to localized flooding issues which are handled by the Counties and local jurisdictions.

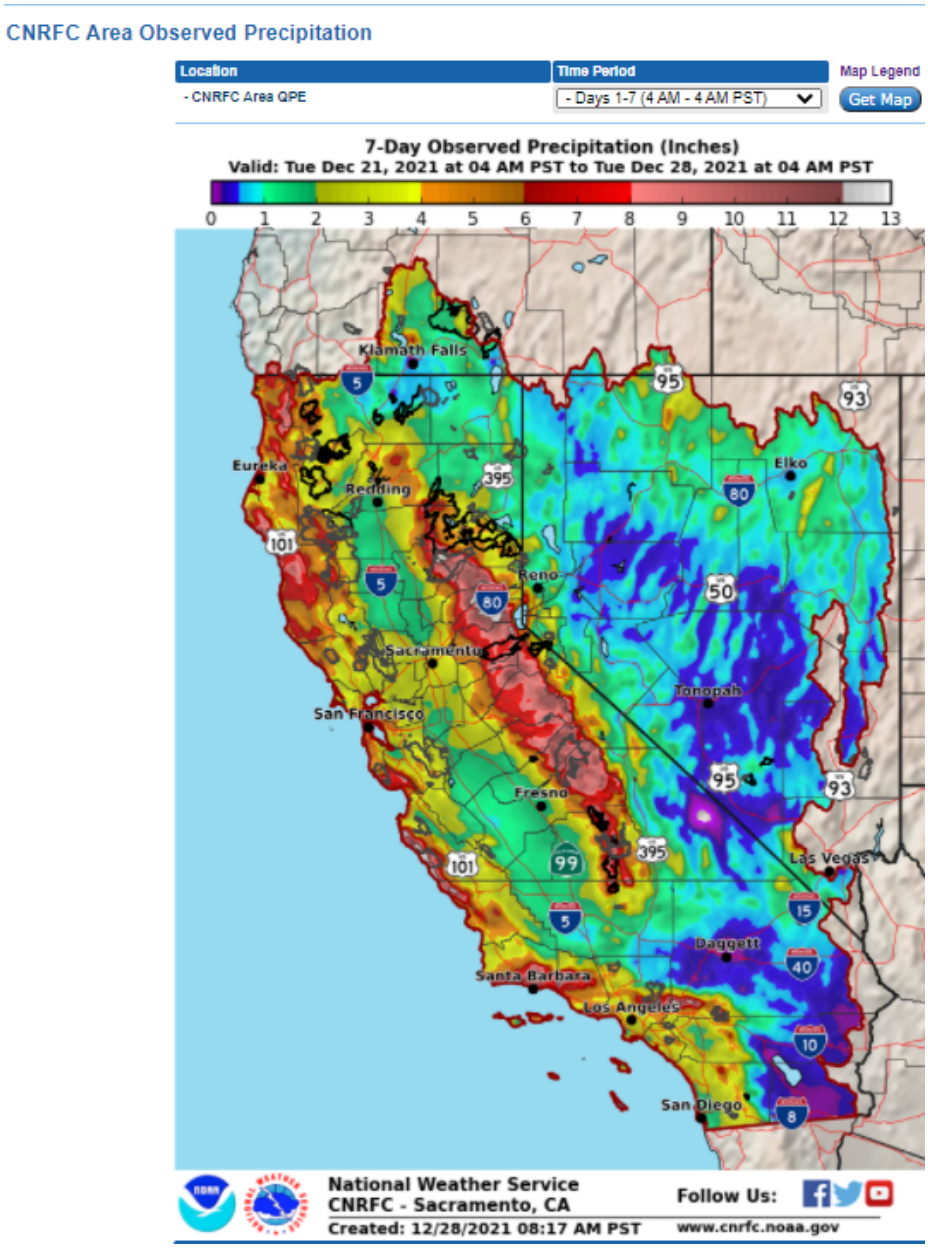

Figure 1. CNRFC map of observed precipitation for the past week.

One way to observe the drought relief of the storms is to look at streamflow patterns. Figure 2 from the CNRFC web page shows an example from the Napa River at St. Helena. With each pulse of rain, we see the rise in the river, but in the dry forecast, we see the river continue to recede down to lower levels. This is an indication for this watershed that subsurface conditions are still dry and there is little baseflow support. Another example is shown in Figure 3 for the Russian River at Healdsburg.

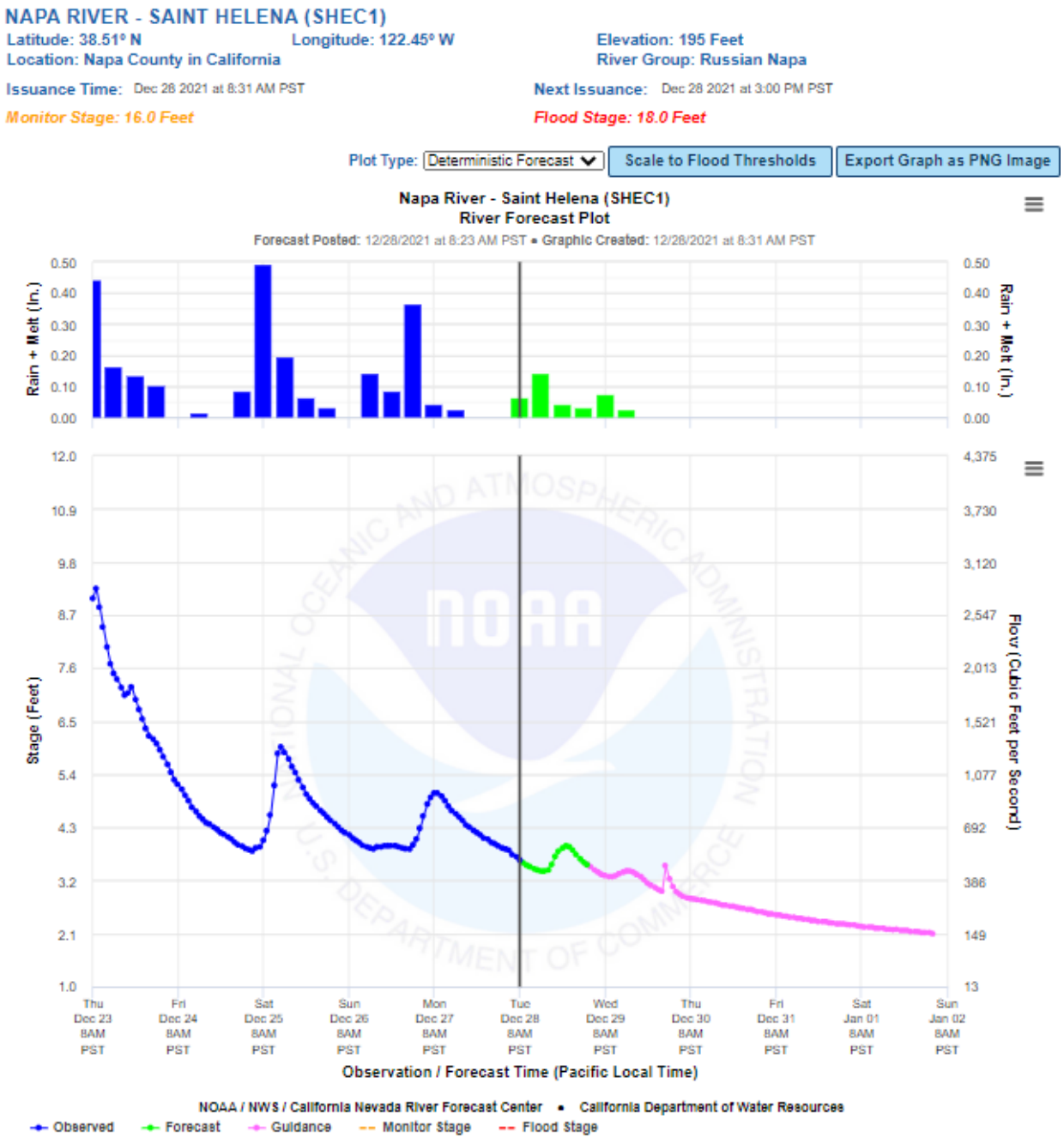

Figure 2. CNRFC plot of flows observed and forecast for the Napa River at Saint Helena.

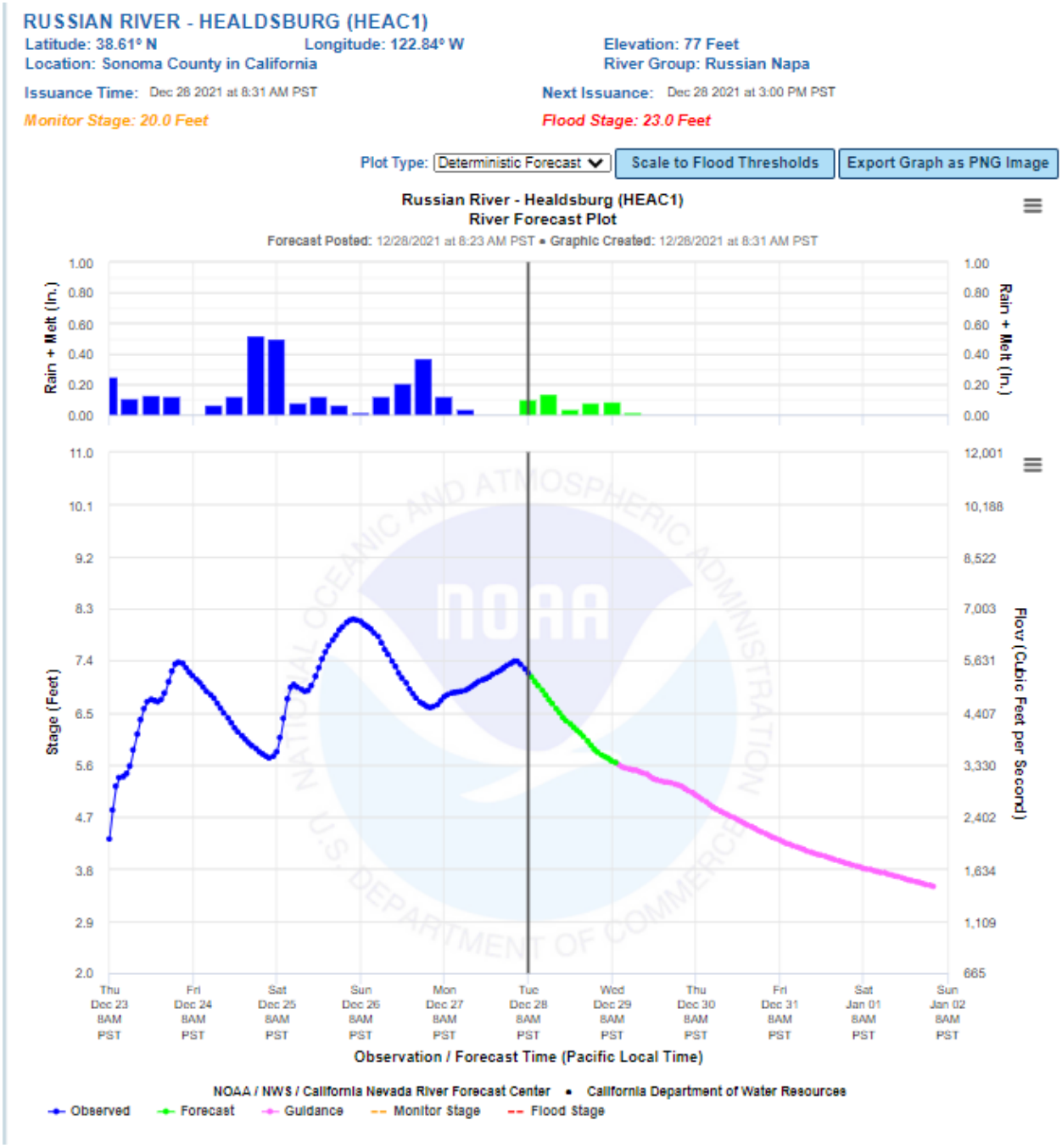

Figure 3. CNRFC map of observed and forecast streamflow for the Russian River at Healdsburg.

For the Russian River we see more sustained flows through the precipitation, but the same falling levels when dry weather appears. This is an indication that while December has been a fantastic month offering some relief from the record dry conditions, more is needed to more fully alleviate the accumulated impacts in the watersheds. Each watershed is different and needs to be evaluated for its own conditions. Now to the forecast.

Over the next week which takes us into the first days of 2022, we see one last storm to top off December. A map of the six-day forecast precipitation accumulation from the CNRFC is shown in Figure 4. The focus of this storm is in Southern California which is consistent with last week's forecast of where the moisture would be.

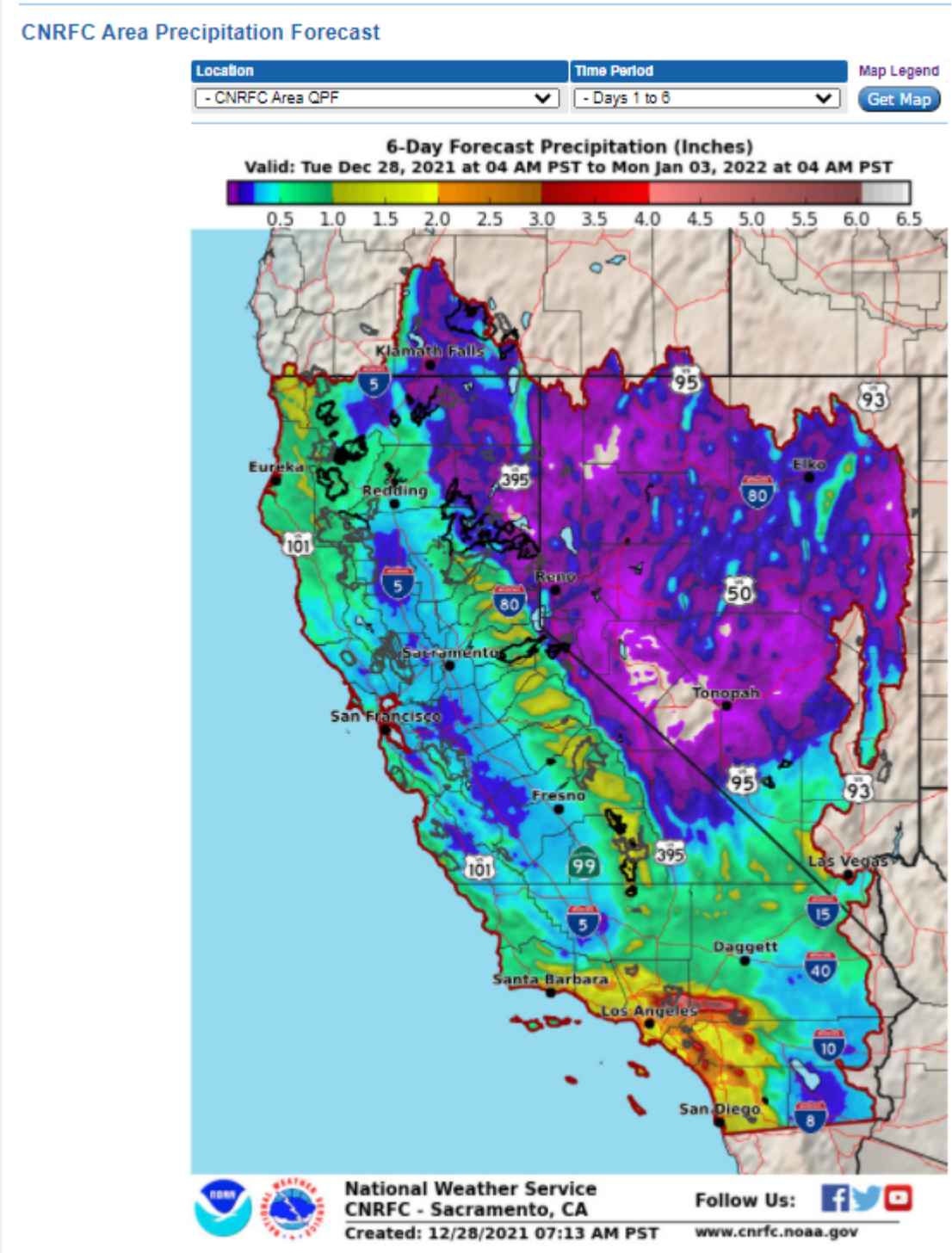

Figure 4. CNRFC map of forecast precipitation for the next six days.

The heaviest day of precipitation is forecast for tomorrow, Wednesday the 29th and extending into Thursday the 30th. New Year's Eve has some scattered showers and New Year's Day is forecast to be dry. January 2nd shows the next storm system dropping into the North Coast region. Looking to week 2, we can use the atmospheric river (AR) landfall tool from the Center for Western Weather and Water Extremes (CW3E) which shows landfalling AR potential north of Santa Barbara between January 4 and January 7 before the storms retreat back up into Oregon.

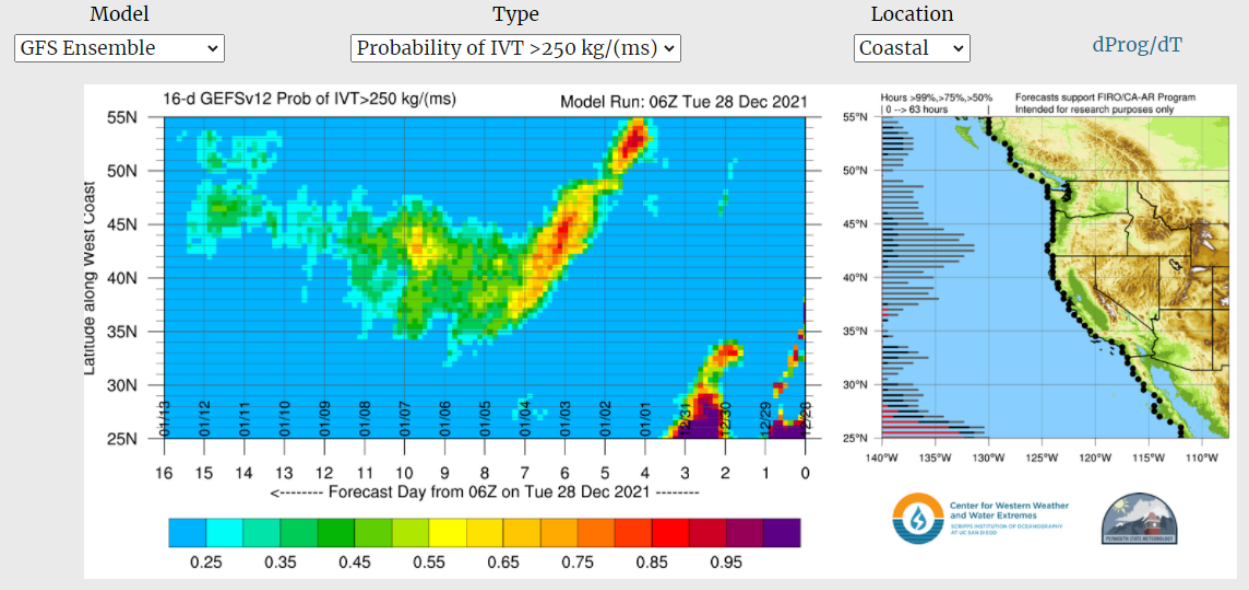

Figure 5. CW3E AR Landfall tool showing percent of forecasts with AR conditions reaching coast.

Looking at Figure 5, it would seem to me that t there are two potential landfalling ARs: the first impacting California January 2, 3 and 4 as the storm slides south and then another forming January 6, and 7. After that dry conditions return to CA. The question is for how long?

Earlier in the water year, the seasonal outlooks showed strong agreement for January through March to be drier than average for all of California. Figure 6 shows the 3-month precipitation outlook from the Climate Prediction Center which shows a drier than average outlook for areas south of Santa Barbara but a lack of a clear signal (equal chances) for areas north. Figure 7 shows the temperature outlook which shows a continuation of cold air in northern California indicating storms continuing (if they do) to come out of the Gulf of Alaska.

Another source of seasonal outlook information is from the NWS Climate Prediction Center's National Multi-Model Ensemble (NMME) which looks at multiple computer models forecasting out 8 months. The mid-December projection for January/February/March for precipitation is shown in Figure 8. It shows a dry outlook for California which is consistent with earlier forecasts. This information suggests that while December has met the mark of helping alleviate drought conditions, by itself it is not enough to get to normal conditions and more above average conditions will be needed in the New Year.

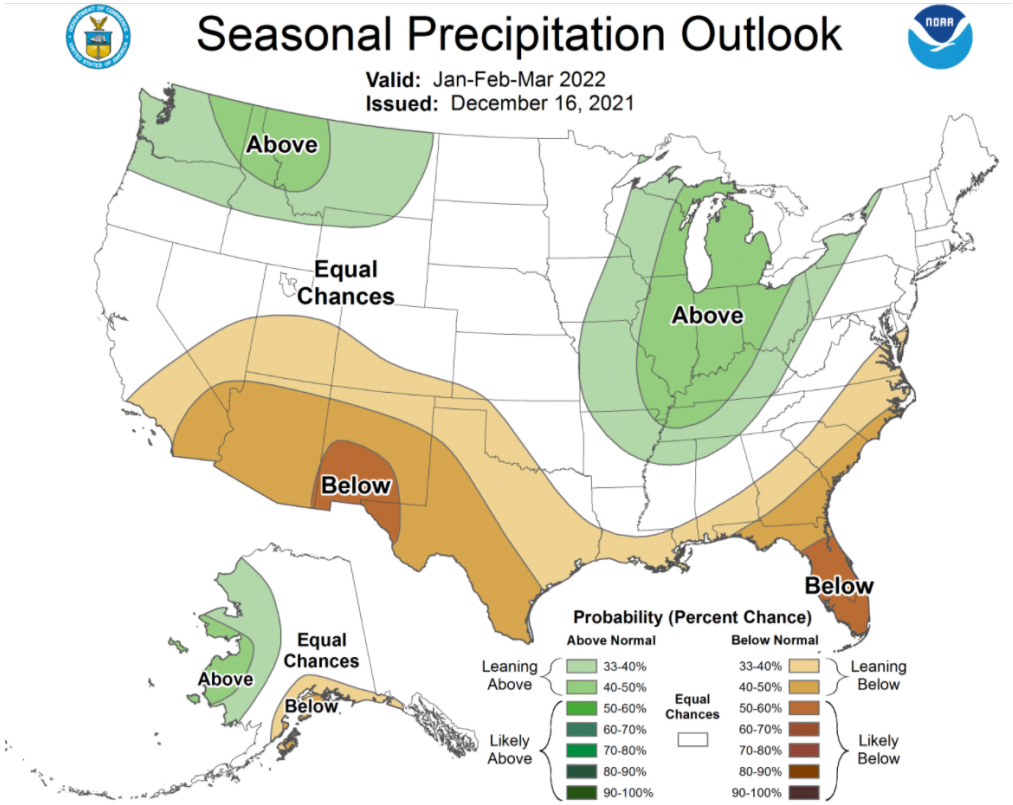

Figure 6. NWS Climate Prediction Center 3-month precipitation outlook for January through March.

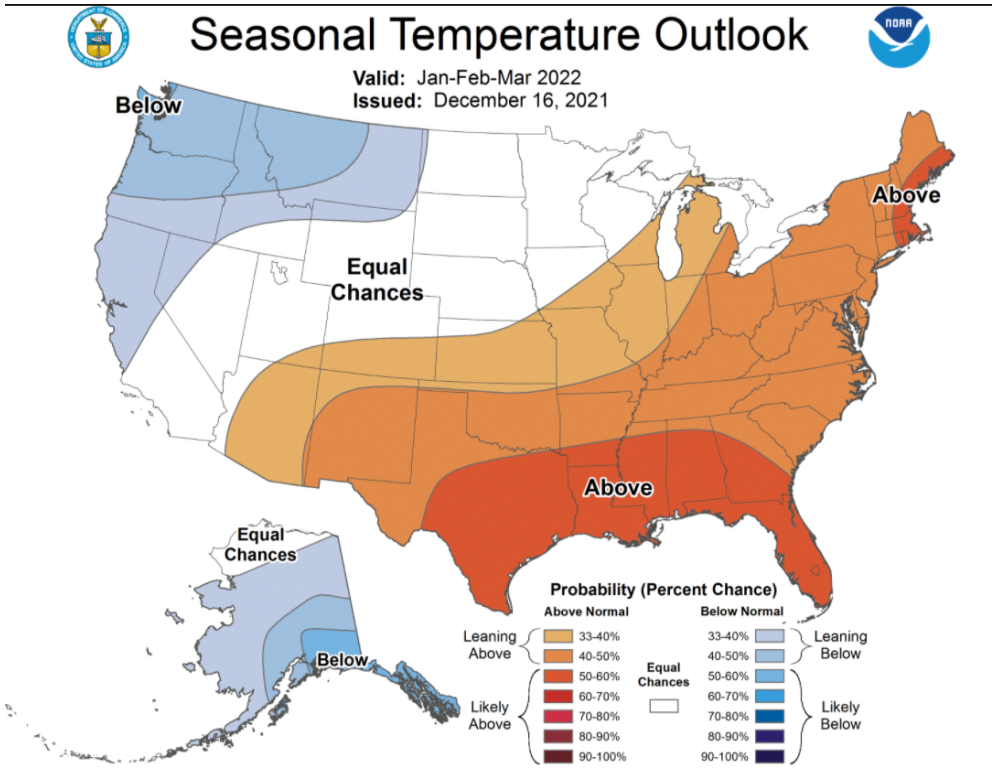

Figure 7. NWS Climate Prediction Center 3-month temperature outlook for January through March.

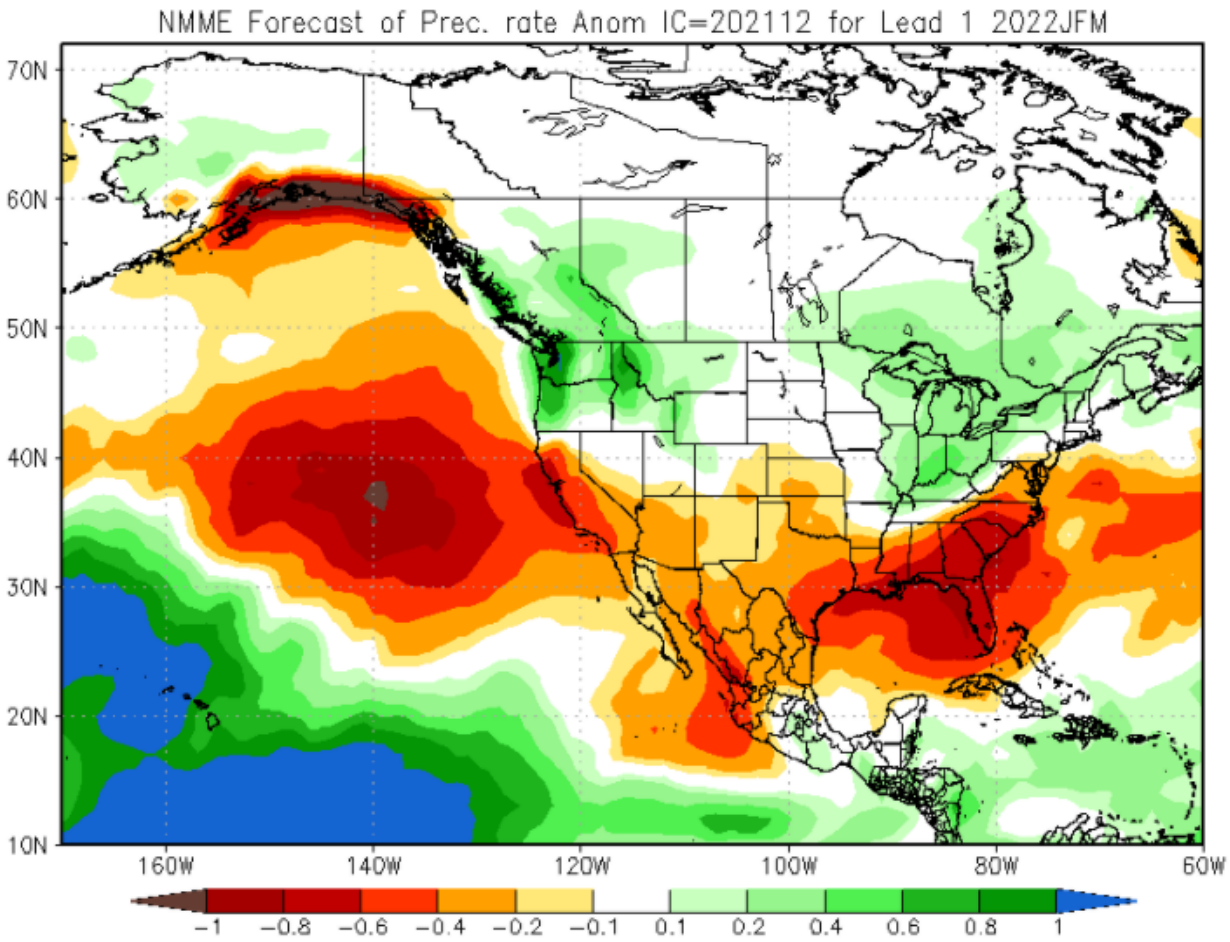

Figure 8. Climate Prediction Center's NMME 3-month precipitation forecast for December through February. Red indicates drier than average outcomes.

As for climate signals, La Nina is showing signs of peaking with an expectation of a return to ENSO neutral (eastern tropical Pacific sea-surface-temperatures between half a degree Celsius below normal and half a degree Celsius above normal) sometime in the April-June time period. The Madden Julian Oscillation which is a strong sub-seasonal climate driver was very strong in December in a region that enhanced odds for favorable precipitation outcomes. Its evolution is on a period of 30 to 60 days and is currently in that same phase. However, that same phase shifts from being a positive influence in December to a drying influence in January as the rest of the global circulation evolves with the seasons. Remember we are now past the winter solstice and heading towards the spring equinox. In the arctic region there have been atmospheric blocking events over Greenland and the Bering Sea which act to increase the persistence of conditions in the middle latitudes. If it is wet, it tends to stay wet and if it is dry, it tends to stay dry. The evolution of those conditions with the New Year will be important in how the weather patterns over California evolve in the next three months. Part of that evolution is the location and strength of the Pacific high-pressure system that is currently near the International Date Line which has enabled cold storms to drop out of the Gulf of Alaska and bring the abundance of snow. If that high-pressure system moves back into the eastern Pacific, conditions dry out as they were in November. Such an evolution would explain the outcome hinted at by the NMME shown in Figure 8

where the big red spot of dry conditions in the eastern Pacific would be consistent with that high-pressure moving into that region.

Best wishes as we head into calendar year 2022. Please let me know if you have any questions.

Mike