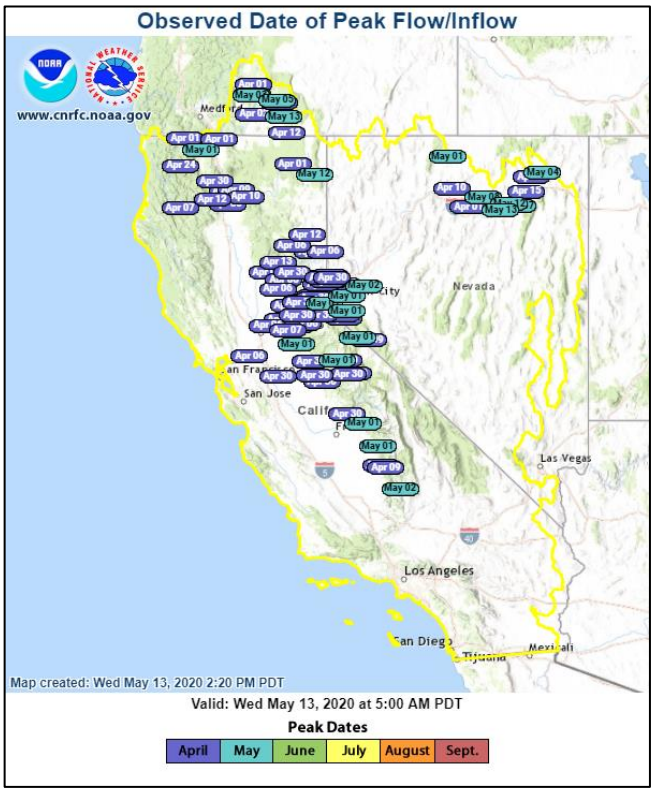
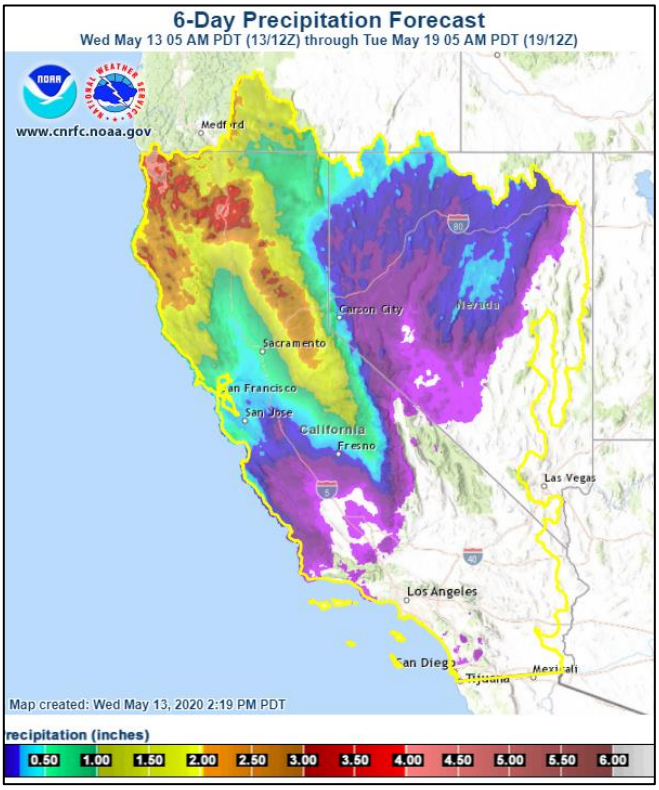
WY2020 Water Resources Update – May 13, 2020

Summary:

- Snowmelt peaks came early this year : April 29th – May 1st for most CA basins.
- Repeat of mid-May precipitation - could see some good rises early next week (May 17-19).
- Some thoughts on HEFS forecast uncertainty (it's far too confident this time of year).
- CA Water Resources showing little change in WY totals.

Details:





Source of graphics: https://www.cnrfc.noaa.gov

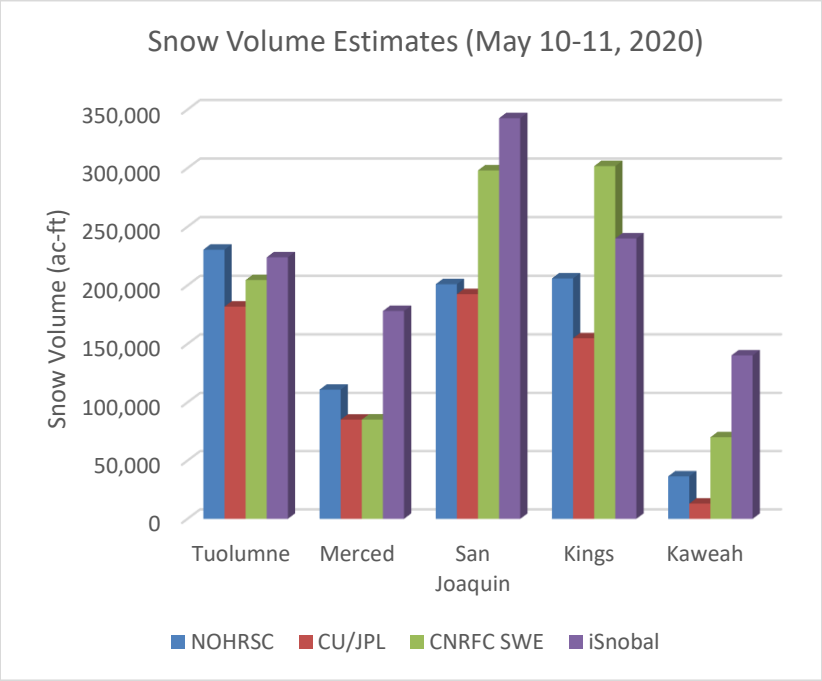
In below normal snowpack years, it's quite common for the snowmelt peak to arrive early. With the near record heat that arrived in late April, most watersheds in California had snowmelt peaks around April 29-30th. Some very high elevation basins (thinking here of the Kern River and Walker River watersheds) could still see an additional peak when we move into truly summertime heat, where melt of the high elevation snowpack (above 10,000 ft.) really gets going.

That's not to say we might still see some additional rises on rivers in May. With a significant dip in the jet stream coming this weekend, rainfall enhanced runoff could bring some watersheds a second peak even higher than the snowmelt peak. Since much of the rainfall is expected to fall in the Northern third of CA, the Feather, Yuba, and American watersheds are currently expected to have peak daily FNF inflows higher than in later April.

HEFS and Uncertainty

Recently I have been asked why the HEFS output from the CNRFC has such high forecasts, particularly on the low end of the uncertainty range. Most of our HEFS products display not just the most expected forecast value (the median or 50% exceedance value), but also the 10% and 90% exceedance values. The 90% exceedance is what one would expect to happen 9 times out of 10.

At this point in the development of HEFS, the **only** uncertainty that HEFS uses to determine the 90% exceedance is **meteorological uncertainty**. In the early months of the water year, this is huge - no one knows if the coming months will be wet or dry. So early on we have a large uncertainty in the output from HEFS. It makes sense. But as we move into Spring, the amount of additional rainfall we can expect goes down rapidly. At this time of the year, other elements of uncertainty should be included in the HEFS output, but they are not.



Snowpack uncertainty

Despite all our snow course measurements, snow pillows, satellites, and lidar flights, there still exists uncertainty in the amount of snow in the mountains. Even now in mid-May there can be differences as large as 150,000 ac-ft. when comparing various methods of estimating the volume of water in the snowpack (see graph). We know there is uncertainty in the amount of snow we are using to simulate runoff using HEFS. But HEFS does not have a rigorous way of quantifying it. HEFS assumes we have the snowpack exactly correct, down to the last patch of snow – alas, we're not that good.

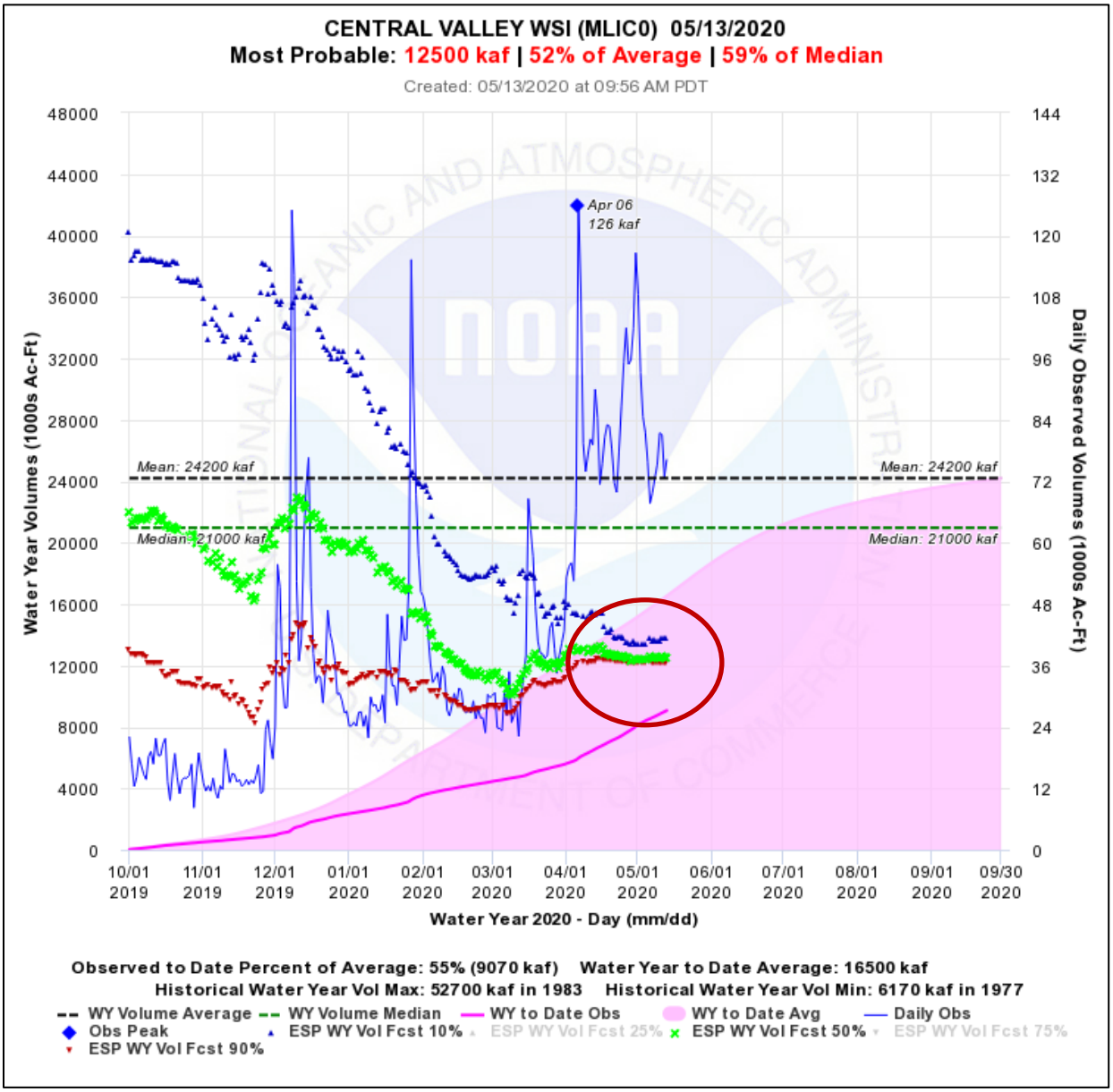
Soil moisture uncertainty

The HEFS snow model (SNOW-17) is coupled with a solid model (SAC-SMA). The "SMA" in SAC-SMA stands for "Soil Moisture Accounting." So SAC-SMA runs continuously, trying to keep track of the soil moisture in different layers of the soil column. However, this accounting is an estimate and can be thrown off by errors in the precipitation forcing, or in the assumptions about evapotranspiration. When landscape changes occur (think large wildfires), the calibrated soil parameters may no longer be representative of the soil moisture characteristics in the watershed. Long-term drought can dry soils beyond the scale of the model. While the uncertainty in the soil model may not be as large as the snowpack, it can be significant. After the drought of 2013-2015 ended, many of our models over-simulated the April-July runoff in WY2016 due to an overestimation of the soil moisture.

Model uncertainty

No model is perfect. Besides the soil and snow state parameters, other model components may introduce uncertainties as well. In some basins the HEFS model tries to account for undocumented diversions from rivers, but the amounts of these diversions can change from year to year and over time. Once again, HEFS does not consider model uncertainty in its 10-90% exceedance spread.

Water Year Runoff Projection



Source: https://www.cnrfc.noaa.gov/ensembleProduct.php?id=MLIC0&prodID=9

CNRFC water supply forecasts have been holding steady over the past few weeks. While the San Joaquin River basin forecast has been dropping slightly, the Sacramento River basin forecast has been rising, leading to a fairly flat outlook overall. As the storm for the coming weekend gets closer, there may be some small increases. But this late in the season, much of the precipitation will simply go to replenishing soil moisture and not very much is expected to runoff.

As mentioned above the difference between the 50% exceedance and 90% has shrunk down to about 200 KAF, which is far too small given the uncertainties in the model. In reality the uncertainty is likely 3-4 times as much.

Conclusion:

We're definitely on the tail end of the water year now, and experiencing yet again a mid-May return to storminess. However, last year's rain events were much larger and gave a significant boost to water supply. But with much of the region already drying out, this year's May rain doesn't look to have a large impact on water supply.

While May through September precipitation only amounts to less than 10% of the average water year, late season storms like we're expecting next week have many benefits, even if the runoff is not significant. Wetting the soils and vegetation will certainly help delay the fire season a bit longer. Also, the last remainder of high elevation snow will be sticking around later in the season. So it's all good!

A reminder:

We are still under "stay at home" orders. So our office is mostly teleworking, with two operational staff coming into the NWS office each day to forecast the precipitation and produce river forecasts. You can reach someone at our office 7 days a week (before 2 p.m.). If you'd like to reach me by phone, my cell is 916-281-6519.

Hope all are staying well.