Times Standard

Not My Fault: Putting the November 2024 storms in perspective

Lori Dengler for the Times-Standard

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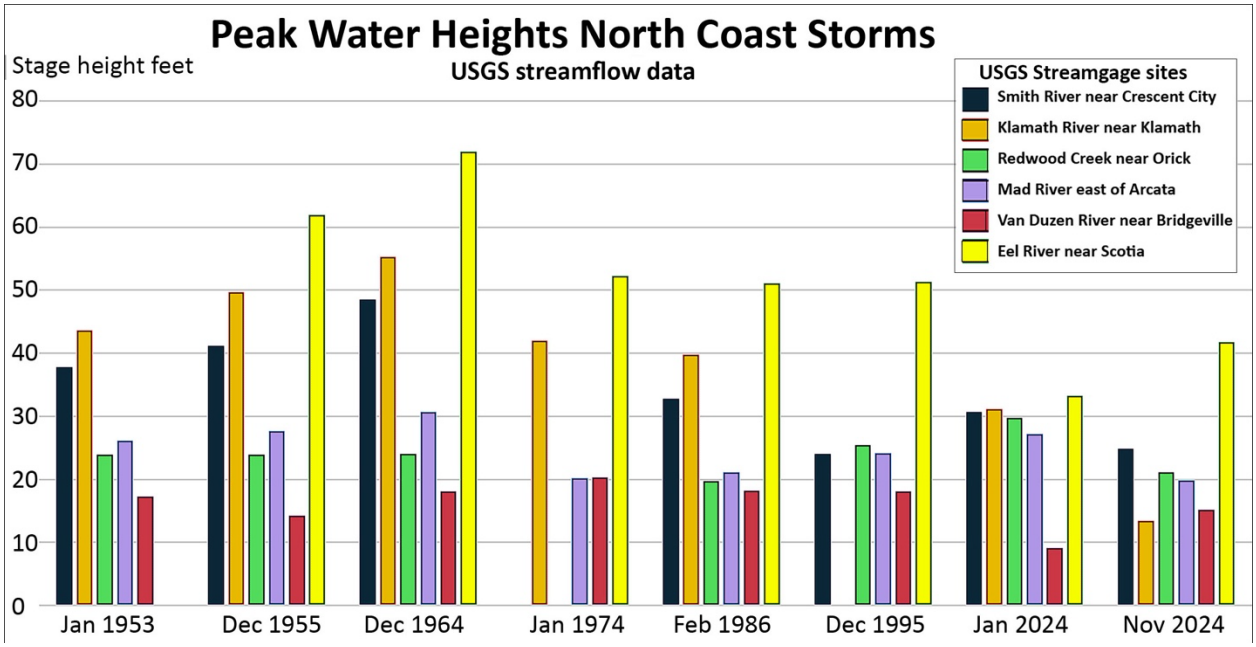

Peak water heights for six significant North Coast flood events at six streamgage sites on mainstem rivers. The two 2024 highest flow events are shown for comparison. Water heights are a rough proxy for discharge, the volume of water flowing across the instrument site per unit time. If there is no bar for a particular storm, data was unavailable at the time specified.

November was wet. We had over nine inches of rain last week at our house in McKinleyville and nearly 16 inches for the month of November, our highest November total in at least 20 years. It wasn't just our unofficial tally that was high. According to the Eureka NWS Office, the Eureka average for November is 4.65 inches and this November dropped a whopping 10.85.

As impressive as the numbers may seem, it really wasn't a month for the record books, and only gave us a small taste of the impacts bigger storms have had. According to Ed Swafford at the NWS Eureka forecast office (a former student of mine many years ago) this November only ranks 11th on the leader board of wettest Novembers, far behind the 16.58" of 1973. Our storm did make for two daily records for Ukiah on November 21st and 22nd when rain hit 3.27 and 3.66 inches respectively.

Big storms and heavy rainfall pack a punch. We saw some of those impacts in the last two weeks – high winds causing power outages, road blockages from downed trees and small landslides, and elevated river levels causing some flooding. Big winter storms have occurred

anywhere from November through March but historically December has caused our highest rainfall and the most significant floods.

Since record keeping began in Eureka in 1850, December stands out. Our wettest month on record was 2002 when over 23 inches fell in December, just under 7 inches falling in a 24-hour period on December 27 – 28th which stands as the single wettest day. But as high as those rainfall totals were, the regional river response was only modest and none of them reached flood stage.

As I write on the eve of December 2024, it's a good time to put our recent wet spell in context. Our two most significant floods occurred at the same time of year, nine years apart. The December 1955 flood spanned three days beginning on December 21 and the Christmas floods of 1964 lasted more than a month, beginning on December 19th. It's an auspicious time to look more closely at what causes floods, and compare what we just experienced to the 1955, 1964, and other larger flood events of the past.

Floods are the result of several factors: drainage basin size, rainfall duration and intensity, regional geology, ambient weather/ground water conditions, and water control structures such as dams. Drainage basin is the area from ridge crest to ridge crest where a drop of rain will eventually make it into a particular river. The North Coast features many rivers and streams from the mighty Klamath with a 12,000 square mile drainage area to basins such as Jacoby Creek at just over 17 square miles and even smaller urban creeks.

The most important factor in flooding is the amount and intensity of rainfall in the drainage basin. The rock and soil types in that basin can modulate how quickly that rain gets into the river. The Smith River in northern Del Norte County flows through the Josephine Ophiolite with very low permeability rocks. It's a very flashy river with rainfall quickly travelling over the rock surface and causing the river levels to rise and fall rapidly. The Eel in contrast has a mix of rock types and thicker soil horizons allowing for much more water storage in soil and a slower but steadier supply to the river. Early in the season when soil is dry, much of the rainfall is absorbed in the soil. Once soil is saturated, more of the rainfall is likely to flow on the surface. Temperatures and rain falling on snow can affect how much and how quickly water reaches the rivers. Dams, levees and other water control structures also play a role in flooding.

How to measure the size of a flood? Economic impacts, lives lost, area flooded/duration, have all been used to rank how big a flood is. The largest flood in California's written history occurred in the winter of 1861 – 1862 when much of the Central Valley turned into a large lake, Sacramento had to be abandoned as the State capital for 18 months, and as many as 4000 lives were lost. The flood was caused by an atmospheric river that began on Christmas eve 1861 and continued to produce heavy rainfall for 43 days almost unabated. This scale of flood is the model for the USGS ARk-storm scenario (Atmospheric River times 1000) study (https://www.usgs.gov/programs/science-application-for-risk-reduction/science/arkstorm-scenario).

Our storms of 1955 and 1964 rank second and third on most lists of great naturally caused California floods. The 1955 flood doesn't get as much press coverage as 1964, but it was the deadlier of the two, killing 74 people, many along the Feather River where a dam/levee break near Yuba City inundated the valley. The 1964 flood was larger in aerial extent affecting an area

the size of France, killing 47, and inflicting an estimated $4 billion in damages in California, Oregon, Idaho, Washington, and Nevada.

The standard physical measurements for flood size are water volume and duration. The USGS began installing instruments throughout the Unites States on larger "mainstem" rivers in 1889. These streamgages measure water elevations at specific locations. Water height (stage elevation) is easy to visualize and is a rough proxy for the size of a flood. Perhaps you have seen some of the 1964 high water signs along the Eel. But stage heights are much higher in narrow channels than in broad open valleys and height alone gives an incomplete picture.

A better measure flood of size is discharge – the volume of water traveling across the river cross section per unit time. It's difficult to measure directly, especially during big storm events, but scientists can use the stage height to calculate the volume through the use of rating curves. By measuring actual flow under different water levels at streamgage sites every few years, one can extrapolate discharge for larger events.

I've spent much of the last week pounding my head against USGS and NOAA river data repositories looking for patterns and trying to understand how our larger North Coast rivers have responded to significant rainfall events. I picked six of the larger historic flood events, six coastal mainstem rivers and a streamgage site nearest the downstream end of the basin. I chose the Scotia site on the Eel rather than Fernbridge as I wanted to separate the contribution from the Van Duzen. I included the two recent storm events of 2024 – January 13, and November 22 for comparison.

Several things jump out – the Eel consistently produces the highest water and the largest discharge, even though its drainage basin is only about a quarter of the size of the Klamath. I've only reproduced the stage heights in the accompanying graph as they are easier to visualize. The discharge numbers show an even larger contrast – in 1964 the Eel flow at Scotia was 135% of the Klamath value. My husband Tom Lisle studied rivers throughout his career and describes the Eel drainage basin as a lot "juicier" than the Klamath where much of the area is relatively dry.

The Klamath is usually in second place with the Smith following – but not always. 1995 was a more southerly storm. Big storm systems don't produce uniform rainfall. This is even more evident in the two most recent storms of 2024. January 2024 was an odd one where rainfall was most concentrated in the Mad River drainage basin.

I enjoy watching high flows from a safe place. We've been fortunate to have had nearly 30 years without a significant flood event and it is easy to forget the scale of disruption they can cause. I'll be revisiting our December behemoths in more detail in the next month.

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-Standard's. All Not My Fault columns are archived online at
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