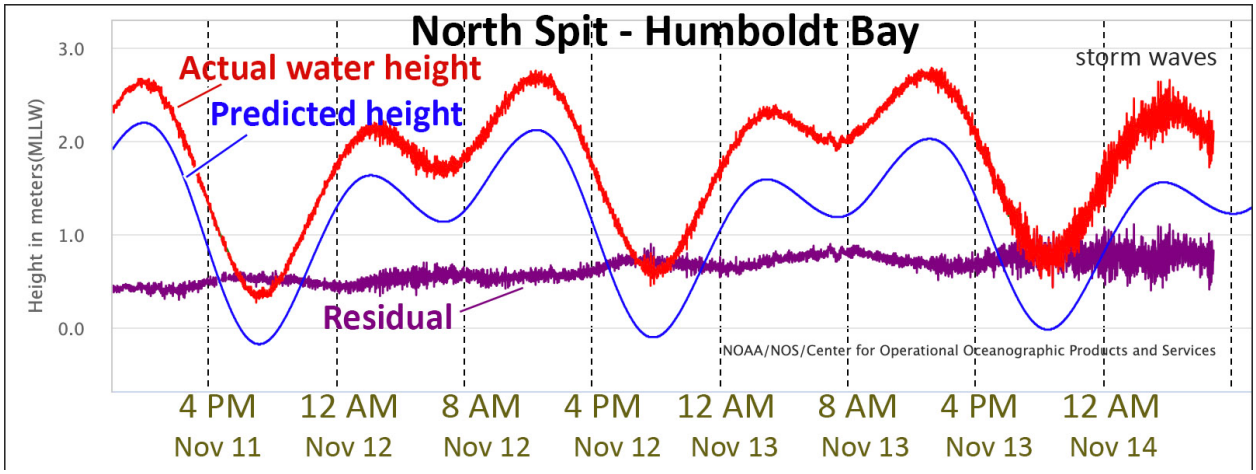
Times Standard

Not My Fault: Atmospheric rivers arrive with higher sea levels

Lori Dengler for the Times-Standard

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This graphic shows the water height measured at NOAA's North Spit tide gauge near the Coast Guard Station on Humboldt Bay over the last three days. The red lines are the actual measured water levels. The blue lines are the predicted water level due to the tides. The purple line at the bottom is the residual, the difference between the actual water height and the predicted. This year, the much warmer ocean water has caused the base sea level to rise by over a foot. The current storm system has caused the high-frequency oscillations and has further amplified the water height by pushing more water toward the coast.

The first significant storm of the season arrived on Friday, bringing wind, high surf, and heavy rainfall. Called an atmospheric river, we experience several storms of this scale most winters. The only difference is that this fall, the average sea level is higher than in the past and storms like this one are more likely to cause coastal flooding that they have in previous years.

The water level at any location along the coast depends on many variables and can change both rapidly and very slowly. The water heights you are seeing today are primarily driven by the tides, the current storm system, and the El Niño-driven warmer-than-average ocean temperatures.

The gravitational pull of the sun and the moon produce the steady and predictable pattern of twice-daily high and low tides. The long-term average of the lowest tides is called Mean Lower Low Water (MLLW) and in the U.S. provides our ocean base level. MLLW is the zero line on any tide chart and high/low tides are given in feet relative to it. This weekend, the moon is in a Waxing Crescent phase which means the celestial angle between the sun and moon is increasing. On November 17th, the angle between the

two will reach 90° when their combined pull is the weakest, causing the monthly lowest or neap tides.

The timing of the current storm is fortunate because the background tidal pulse is only moderate. Instead of riding atop 8+ foot high tides, the current astronomical tides are only about 6.5 feet. But even without extreme tides, the wind-driven waves and swells have impact. A high surf warning is in effect this weekend. Buoys off our coast were measuring waves of over 12 feet Saturday morning and could reach 25 feet on Sunday. Ocean waves increase in height as the seafloor shallows and NWS is forecasting that coastal surges could reach 40 feet.

These large waves differ in several ways from the normal ocean waves that you are likely familiar with. They break much further offshore and your eyes may give you a false perception of size. The period between waves is longer and that extra time when the water is receding may give you a false impression of the hazard. The volume and speed of the incoming surge is much greater and even seasoned beach goers can be surprised by how far inland the water can reach. The water often contains logs and other debris that may be obscured by the waves. Just stay off the beach until this storm has passed and the NWS Beach Hazards alert has been canceled.

A storm system doesn't just produce large waves. The lower atmospheric pressure causes the sea surface to rise. Southerly and westerly winds amplify the rise by pushing water towards the coast. You can see this effect on the North Spit tide gauge. NOAA's instrument is a marigram and records water levels as a function of time. It is located near the Coast Guard Station just inside Humboldt Bay and bounces an acoustic signal off the water inside a protective tube to give a water measurement every minute.

All of the NOAA coastal tide gauges can be accessed at https://tidesandcurrents.noaa.gov/tsunami/#. The graphical displays show three color-coded lines. Red is the actual measured water height, blue is the predicted astronomical tide level for this location, and the purple line at the bottom is the residual or difference between the two. If the measured water height followed the prediction, the residual values would be near zero.

The North Spit gauge for the last three days shows the characteristic tidal oscillations that mimic the blue astronomical forecast but deviates from the predication in a couple of ways. The actual signal is much noisier. This should be no surprise as wind and tidal pulsing causes a variety of short period waves that aren't predicted by the astronomical estimate. This noise increases with the onset of the storm, becoming much higher amplitude on Friday evening.

The smoother trend between the actual water height and the prediction is more interesting to me. The two lines were offset by a whopping 2.5 feet around 8 AM Friday morning. Six years ago, there was almost no gap between the two and most California tide gauges closely followed the long-term average. But the ocean has been warming,

and warmer water expands. The arrival of the Kelvin wave (Not My Fault 9/19/26) caused by this year's El Niño have further boosted temperatures. The North Spit gauge temperature is currently 7.4°F above the November average and has pushed our base sea level about 15 inches above our long-term average.

El Niño alone can't account for all of the rise of the past few days. If you look at the marigram, notice the slow upward trend of the residual (purple) line on Thursday and Friday. This is the result of the combined storm effect of low pressure and wind and added over another foot to our base ocean level. All of these factors contributed to a high tide that reached just under 9 feet on Friday, more than 2.5 feet higher than the astronomical prediction. I expect to see this additional storm 'bulge' drop over the next few days as the atmospheric river abates, but the Kelvin wave bulge will continue until at least February of next year.

By my casual observation, this week showed the largest deviation between actual water levels and the astronomical prediction at the North Spit site in its nearly fifty years of operation. But we haven't hit an absolute highest water height. We can thank the moon phase for falling short. On the morning of January 3, 2026, the North Spit gauge reached 10.37 feet, a record for the North Spit and coastal flooding was significant. The culprit was king tides and a warmer ocean. The residual was about 18 inches last January, enough to boost the water level into record territory without an additional storm boost.

The North Coast isn't alone in recording unusually high-water levels this fall. San Diego, San Pedro, La Jolla, and Santa Barbara all set all-time records between October 24 – 30, around the time of the last full moon. Slow pulses of warm Kelvin waves will persist at least through February 2027, and more records could be set with the king tides of the next few months.

Last January demonstrated that we don't need a big storm to break sea level records and this week showed us that the waters can be high even without a king tide boost. The highest king tides California for are forecast for November 24 – 26, December 22 – 25, and January 20 – 23. I'm crossing my fingers that our next atmospheric storm misses those windows, but we all need to be prepared for prolonged power outages and coastal flooding. Please make sure you are signed up to receive county emergency notifications, have food, water, medicines on hand for at least two weeks, and never drive through a flooded road. More tips at https://www.dds.ca.gov/wp-content/uploads/2026/10/ElNinoPreparednessFactSheet.pdf

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