23rd Annual

State of the Shore

Media Event **Asbury Park** **May 22, 2025**

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Break out the flip-flops, dust off those beach chairs, and get ready to soak up some sun—summer has officially arrived in New Jersey! And this year, we're kicking off the season with some especially sunny news: the state's beaches are looking better than ever. Thanks to a mild winter with minimal storms, most of the coastline has held up beautifully, with wide beaches and healthy dunes welcoming locals and visitors alike. Communities like Seaside Heights, Ocean City, and Cape May have even received a fresh dose of sand courtesy of the U.S. Army Corps of Engineers, setting the stage for a strong start to the season.

While other parts of the Atlantic coast faced more severe impacts this past winter, New Jersey got a much-needed break—coastal flooding and erosion were limited, and beach nourishment projects have helped reinforce vulnerable areas. Of course, it's not all smooth sailing: the forecast for the 2025 hurricane season is calling for above-average activity, and experts are urging residents to stay prepared.

But for now, there's plenty to enjoy. The beaches are open, the boardwalks are buzzing, and the only thing rising faster than the temperature is the excitement. Just remember to swim safely—early season sandbars can create strong rip currents—and always follow lifeguard instructions. Welcome to summer at the Shore!

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State of the Shore Report

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This summer, New Jersey's beaches will benefit from an extremely mild winter storm season that has left many of them in good shape heading into the Memorial Day weekend. Major beach nourishment projects led by the U.S. Army Corps of Engineers have added sand in a number of communities including Seaside Heights, Ocean City, and Cape May. In communities that did experience erosion, it was mostly minimal and limited to the flat portion of the beach or berm. Most of this sand remains in the system and will likely work its way back onshore over the summer. While New Jersey experienced a bit of a reprieve this past winter, we need only look south to the devastating impacts caused by Hurricanes Helene and Milton to appreciate the importance of maintaining wide beaches and healthy dunes. This emphasizes the importance of continuing to maintain our beaches through state programs like the Shore Protection Fund.

Coastal Flooding

In terms of coastal flooding, this winter was unusually mild. Although on average water levels throughout the winter were elevated, relatively few storms exceeded the local flood thresholds determined by the National Weather Service (NWS). The NWS defines local thresholds for minor, moderate, and major flooding based on expected impacts. To analyze coastal flooding, the Stevens Coastal Engineering Research Group (CERG), analyzed tide gauge data from both Sandy Hook and Atlantic City.

The NOAA tide gauge at Sandy Hook didn't record a single moderate flood event this past winter and only recorded six minor flood events (Figure 1). Overall, water levels were only elevated above the minor flood threshold for a total of 54 hours between September and April. The highest water level of the was recorded in mid-September, and peaked at 7.6 ft, just inches below the moderate flood threshold. The elevated water levels weren't caused by an individual storm, but rather a persistent pattern of easterly winds that caused minor coastal flooding, frequent rip currents, and foggy conditions, along much of the New Jersey coast from mid-September through early October. On September 22nd a small coastal storm coinciding with spring tide and this regional atmospheric pattern caused water levels to peak. Although the magnitude of the flooding was not extreme, the unusual atmospheric conditions contributed to back-bay flooding during 20 of 26 high tides between September 18 and 30. The second largest highest water level of the season at Sandy Hook was recorded on November 15th. Similar to the event in September, the high-water levels were related to a combination of spring tides and strong onshore winds that persisted for several days. Both of these high-water events were the result of small-moderate storms coinciding with elevated spring tides. The largest storm surge of the season - 2.48 ft - was measured in late November on the 22nd. The storm surge is more reflective of storm intensity since it is a measure of the deviation from the predicted tides. The storm on the 22nd occurred during a period of lower tides, therefore peak water levels were lower than what was measured a week earlier, in spite of the storm being more intense. The only other storms to exceed the minor flood threshold at Sandy Hook occurred in mid-October, mid-February, and late March, with the latter two only exceeding the minor threshold by a few inches.

The NOAA tide gauge at Atlantic City only measured water levels above the moderate flood threshold once this past winter (Figure 2). This was during the same event that generated the peak water level at Sandy Hook. The peak water level at Atlantic City was nearly half a foot less than what was measured at Sandy Hook (7.11 ft vs 7.6 ft); however the threshold for moderate flooding at Atlantic City is also lower (7 ft vs 7.7 ft). In mid-October and mid-November two other events approached the moderate flood threshold but peaked just under it. In both cases the elevated water levels were more related to the timing of the events during periods of elevated tides than the actual intensity of the storms. The largest storm surge of the season at Atlantic City was relatively small and only measured 2.4 ft. This was associated with the same storm that produced the largest surge at Sandy Hook. The impact of the storm was mitigated somewhat by the fact that it occurred during a period of relatively modest tides. Had the storm occurred just a week prior during the November spring tide, the total water level would have been over a foot higher, which would have resulted in several hours of moderate flooding. Between January and April, a series of smaller storms pushed the water levels in Atlantic City near the minor flood threshold; however, none of the events exceeded the threshold.

A phenomenon of note which has been consistent over the last several years is that peak water levels are more frequently associated with small-moderate sized storms occurring at spring tide than they are with large storms. This highlights the importance of storm timing and duration with respect to the tides in determining the severity of coastal flooding. The fact that water levels peaked during the fall is not unusual. This past year, Leonia high school senior Marcel Astrakhan worked with the Stevens CERG and found that the majority of flooding events occur during the fall and that the number of hours of flooding are increasing in most months (October and June are the exception).

Coastal Erosion

While coastal erosion is more common during periods of coastal flooding, there are additional factors that determine the amount of erosion that occurs during a storm. The three factors that are typically associated with erosion are elevated water levels (flooding), elevated wave heights, and storm duration. Elevated water levels provide the platform on which waves capable of chewing up the beach ride, while the storm duration regulates how much time the waves spend attacking the beach. The impacts of coastal erosion can range from small and temporary to dramatic and long lasting. To more accurately estimate erosion potential, the Stevens CERG supplements the tide gauge data with wave observations recorded and maintained by NOAA as part of their National Data Buoy Center (NDBC). Overall, the wave heights measured off the New Jersey coast this past winter were smaller than usual.

Waves measured at NOAA buoy 44009 off the coast of Cape May are shown in Figure 3. Only five storms breached the 10-foot threshold which is commonly used to define small to moderate storms. For comparison, last year three 15-foot plus events were measured, and 11 storms exceeded the 10-foot threshold. This year, the largest waves peaked at 12.1 ft which is one of the smaller maximum wave heights recorded over the past decade. This storm occurred in early March and was more notable for the flash flooding it caused inland, than coastal erosion. The storm dumped more than 5 inches of rain on parts of the state and wind gusts reached up to 69 mph. The second largest waves of the season were measured in early December, peaking at 11.7 ft during a storm that brought freezing temperatures along with rain, snow and sleet. The other three wave events that exceeded the 10-foot threshold occurred in mid-October, mid-February, and mid-April and were associated with smaller storm events.

Oftentimes the wave climate along the central and northern New Jersey coast differs from that off the southern coast due to the sheltering effect of Long Island. The two northernmost gauges in the state had incomplete winter datasets, therefore buoy 44091 was used to evaluate the wave activity of the central/northern New Jersey coast (Figure 4). Buoy 44091 recorded four storms with waves over 10 ft this past winter, the largest of which peaked at 13.8 ft in mid-April and was associated with a coastal storm that brought widespread rainfall, strong winds, and unseasonably cool temperatures to the state. This system was part of a larger low-pressure area off the mid-Atlantic coast that impacted much of the Northeast, delivering 1 to 2 inches of rain from Virginia through New Jersey and into New England. The second largest wave event recorded at buoy 44091 occurred in early March, during the same storm that created the largest waves off the southern New Jersey coast. Waves during the storm peaked at 12.6 ft.

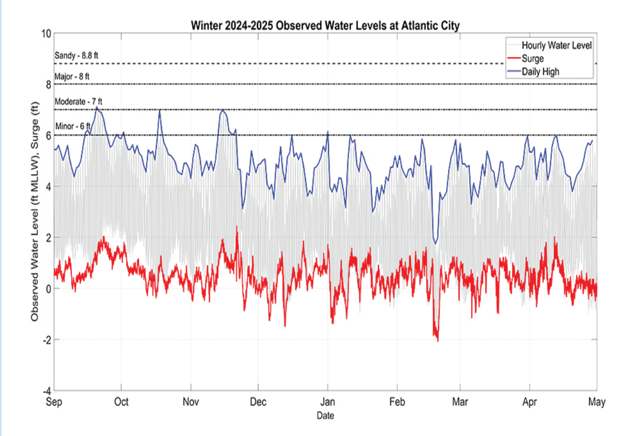


Figure 1. Winter observed Water Levels at Sandy Hook.

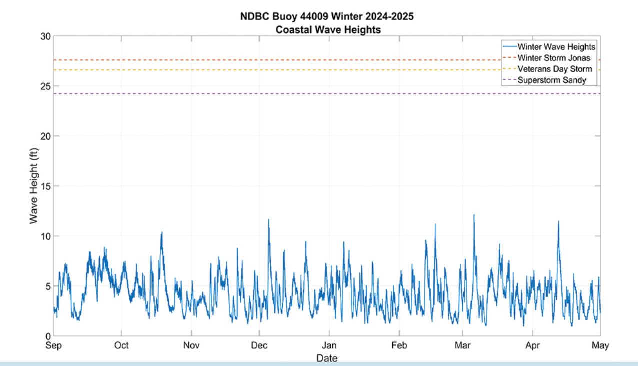


Figure 2. NDBC Buoy 4409 Winter 2024-2025 Coastal Wave Heights

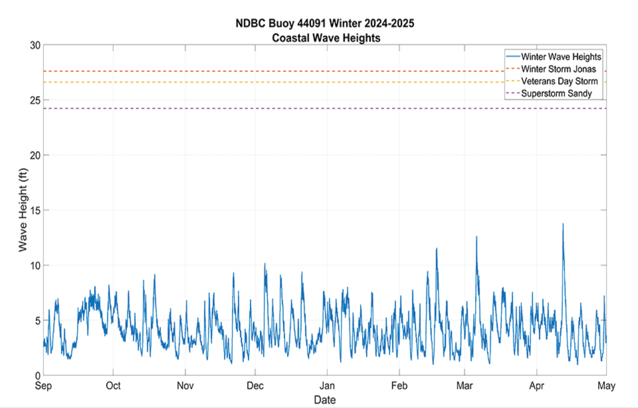
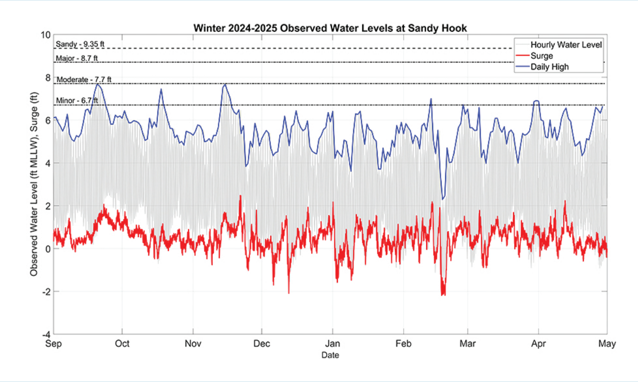


Figure 3. NDBC Buoy 44091 Winter 2024-2025 Coastal Wave Heights



Winter 2024-2025 Observed Water Levels at Sandy Hook.

Overall, New Jersey was extremely fortunate to experience a very mild winter in terms of both coastal flooding and wave activity. The net impact is that coastal erosion was limited to what can be called nuisance events. Nuisance events are low impact, high frequency events that when considered individually only cause minimal damage. Unlike nuisance flooding, nuisance erosion however has the potential to cause more extensive damage due to the inability of the system to fully recover between events. This past winter, the frequency of these nuisance erosion events was such that even the cumulative impacts were limited. This is in contrast to the past several years where many beaches in New Jersey experienced significant damage as a result of these nuisance events.

Tropical Outlook

The 2025 Atlantic hurricane season, spanning from June 1 to November 30, is forecasted to be significantly more active than average. Colorado State University (CSU) predicts 17 named storms, nine hurricanes, and four major hurricanes (Category 3 or higher), while The Weather Company expects 19 named storms, nine hurricanes, and four major hurricanes — both projections surpassing the 1991–2020 historical averages. AccuWeather forecasts 13 to 18 named storms, including 7 to 10 hurricanes, with 3 to 5 expected to become major hurricanes, and anticipates 3 to 6 direct U.S. impacts, particularly along the Gulf Coast, Florida Panhandle, Carolinas, and Atlantic Canada. Researchers from the University of Arizona, using a combination of dynamic models and machine learning techniques, predict 19 named storms, 10 hurricanes, and 5 major hurricanes, further emphasizing the likelihood of a hyperactive season. Driving this heightened activity are unusually warm Atlantic sea surface temperatures and a transition to neutral El Niño–Southern Oscillation (ENSO) conditions, both favorable for storm formation.

Table 1: Comparison of early season hurricane forecasts.

SOURCE	NAMED STORMS	HURRICANES	MAJOR HURRICANES
COLORADO STATE UNIVERSITY	17	9	4
UNIVERSITY OF ARIZONA	15	7	3
THE WEATHER COMPANY	19	9	4
ACCUWEATHER	13-18	7-10	3-5
HISTORICAL AVERAGE	14.4	7.2	3.2

Closer to home, the forecasts indicate New Jersey faces a 28% chance of experiencing at least one named storm, a 9% chance of a hurricane, and a 1% chance of a major hurricane (Category 3 or higher). These probabilities reflect the potential for a storm to pass within 50 miles of the coast and are slightly above the historical averages. In spite of these relatively low probabilities, New Jersey residents are urged to remember that it only takes a single storm to create catastrophic impacts. Hurricane Ida is the most recent example. Although originally a major hurricane, Ida weakened to a tropical depression by the time it reached New Jersey, yet the storm still caused billions of dollars of damage and tragically resulted in 30 deaths. New Jersey residents are urged to heed the advice of the National Weather Service and State and local officials when a storm is approaching. Information on hurricane preparedness can be found on the NJ Office of Emergency Management website at: http://www.ready.nj.gov/plan-prepare/hurricanes.shtml.

Current Conditions

The current condition of New Jersey's beaches is generally pretty good. The combination of an extremely mild winter with the sustained commitment of local, state, and federal officials to enhancing our beaches, has resulted in wide beaches and robust dunes in many communities. Several other communities will receive sand in the coming weeks. While New Jersey benefited from a winter without a major storm and a reduced number of nuisance erosion events, it continues to count on such fortune. A recent study conducted by Stevens CERG graduate student Audrey Fanning suggests that by 2050 the number of cumulative storm hours resulting in nuisance erosion will triple and that by 2100 the number of hours capable of producing minor dune erosion will increase by a factor of seven. These impacts suggest that maintaining funding and support for shore protection during the periods between large storm events will only become more critical in the futureIn the short term, many of New Jersey's beaches will be accessible and open for business beginning this weekend. Early season swimmers are urged to use caution as large sand bars generated over the winter are still present in many locations. These sand bars can lead to the formation of dangerous rip currents. Swimmers are urged to never swim alone and only swim when lifeguards are present.

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Cover Photo - Benita Battaglia The Roar of the Ocean