2011 New Jersey State of the Shore Report

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New Jersey residents may remember this past winter for the extraordinary amount of snow that was dumped throughout the state; however they will not remember it as a winter that battered the coast. Despite receiving over twice the average amount of snowfall, the beaches of New Jersey held strong. This reprieve was fortunate since it came on the heels of one of the most damaging winters in recent memory in 2009-2010.

Coastal Storm Activity

Winter storm activity was analyzed using data collected from wave and water level gauges maintained by the National Oceanographic and Atmospheric Administration (NOAA). Two 3-m discus buoys located offshore of Cape May and Sandy Hook provide wave information, while a tide gauge located on the seaward end of the Steel Pier provides water level information. The water level data for September through April is shown in Figure 1, where the dashed line represents the water level with a two-year return period (water level that has a 50% chance of being exceeded in any given year). Figure 2 shows the same information for the wave heights measured at NDBC buoy 44025, while Figure 3 shows the surge, or difference between the astronomically predicted water levels and those recorded by the tide gauge.

Hurricane Earl threatened to get the winter storm season off to a rough start. Although the hurricane passed 100 miles off shore in September, it caused tropical force winds and high waves. These high waves combined with elevated water levels caused some beach erosion, especially in the Atlantic City region. The month of October got off to a stormy start when a low pressure system passed offshore close to the time of the new moon. Fortunately, the maximum surge associated with this storm which was nearly 2.5 feet occurred at low tide, reducing its impact. In spite of the fact that the storm peaked during low tide, the elevated water levels and high waves caused some

Figure 1

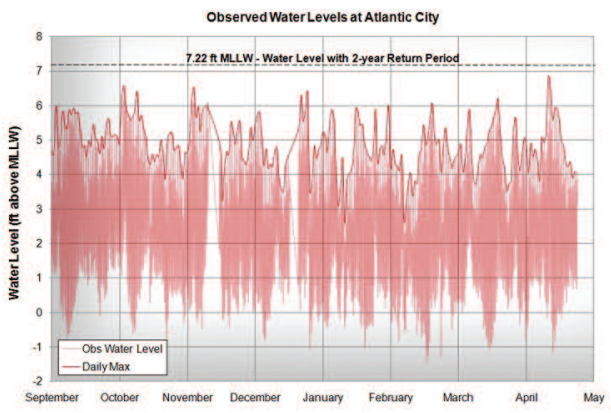
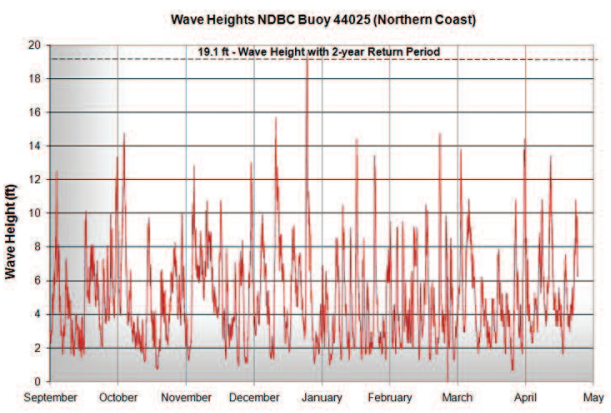


Figure 2

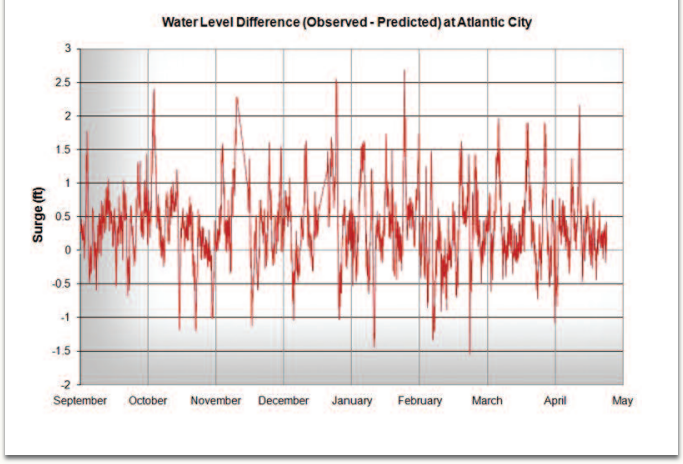


waves caused some coastal flooding in the southern part of the state. Throughout the remainder of October the weather remained fairly calm. Moving into November, a small low pressure system at the beginning of the month resulted in a moderate storm surge; however due to the timing of the event, coinciding with the new moon, water levels approached those seen during the October storm. The waves associated with this less intense storm were relatively small, and as a result only scattered reports of small amounts of beach damage were received.

After almost two months of calm weather, the Christmas Blizzard of 2010 swept through New England, dumping record amounts of snow on the 26th and 27th of December. In much of New Jersey, snow amounts equaled the average snow for an entire winter. The storm also brought high winds and higher than average water levels. The surge reached a maximum of 2.5 feet; however it peaked at low tide and during a period when water levels were lower due to the astronomical position of the moon, so the maximum observed water level during the storm was only 6.2 feet MLLW. Due to the large waves generated during the storm (which exceeded the two-year return period), the Christmas Blizzard still caused significant damage to the coast, in spite of the fortunate timing of the peak surge. Erosion and dune loss was reported in several communities in Atlantic and Cape May Counties.

January, February, and March saw several more significant snowfall events, eventually making this past winter one of the snowiest in the state's history. Fortunately, the tracks taken by these storms were such that they did not bring significant winds, waves or storm surges to the New Jersey coast and therefore coastal erosion was minimal. In mid-April, a storm system that brought heavy rain to the state, also generated the highest water levels of the year at Atlantic City. Similar to the early November storm, the high water levels had more to do with the timing of the storm than anything else. During the storm a moderate storm surge combined with higher than normal tides to elevate water levels along the coast; however the wave activity during the storm was relatively benign. As a result, beach erosion during the storm was minimal.

Figure 3

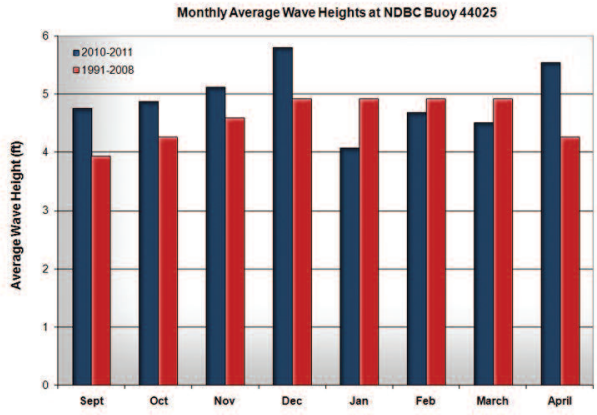


Overall, the winter season was relatively mild and a welcome respite after last year's damaging storms. With the exception of Hurricane Earl and the Christmas Blizzard, the winter storms of 2010 and 2011 inflicted minimal damage to the shore. Unfortunately, communities along the southern coast suffered disproportionately during these two events with the heaviest damage being reported in Atlantic and Cape May Counties.

Historical Context

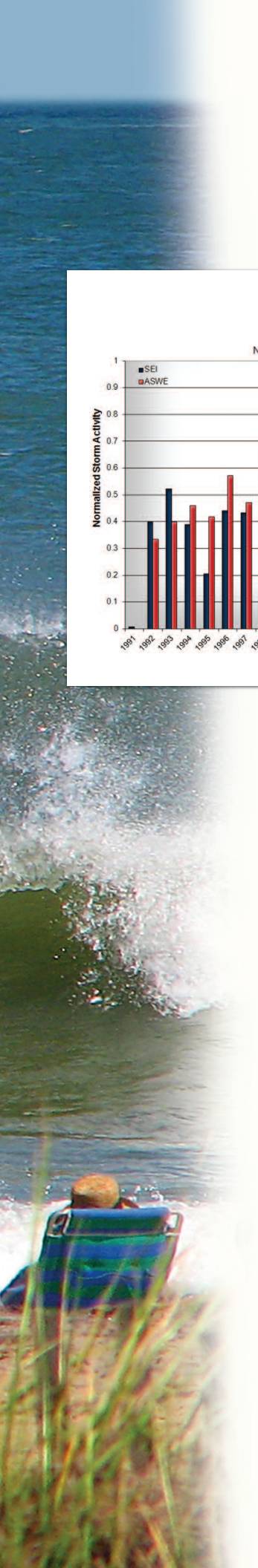
Last year, two storms produced water levels in excess of the two-year return period, and eight storms resulted in at least 2.5 feet of storm surge. This year, the highest water level achieved fell nearly half a foot below the two year level, and only 2 storms produced surges in excess of 2.5 feet. As far as wave heights go, Figure 4 shows a comparison of the monthly average wave heights reported at buoy 44025 this year with the long term averages. From

Figure 4



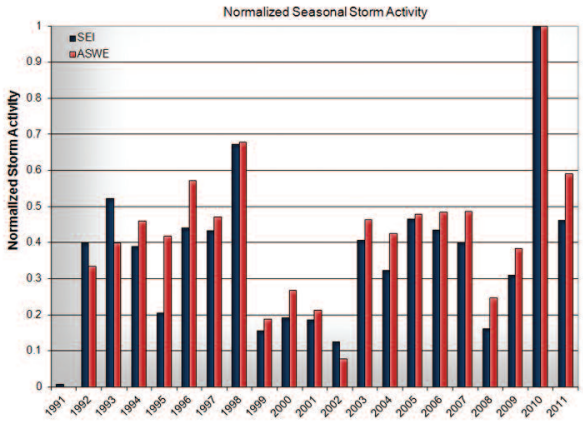
September through December, the wave heights this past year averaged 0.72 feet higher than the historical average; however in January through March they averaged 0.5 feet lower. The average for the entire winter at buoy 44025 was approximately 0.33 feet higher than the historical average.

While wave heights and water levels during a storm play a significant role in determining its impact, it is the combination of the two acting over the duration of the storm that ultimately determines its influence on the coast. For the past several winter Stevens has been using the



newly developed Storm Erosion Index (SEI) to account for all of these factors and place storms and storm seasons in historical perspective. Cumulative totals

Figure 5



(July through the following June) of the SEI and a second parameter called the Accumulated Storm Wave Energy (ASWE) are plotted in Figure 5, where the values have been normalized (divided) by the total from 2010. Both parameters suggest this past winter was about half as stormy as last year, and on par with the relatively mild winters of the past decade. It should be noted however, that the 2011 dataset is still incomplete, as all of the other totals run through June.

Summer Storm Outlook

The Tropical Meteorology Project at Colorado State University released their most recent Extended Range Forecast of Atlantic Seasonal Hurricane Activity on April 6th. Their report predicts a very active hurricane season with a well above average number of storms expected. They call for 16 named storms, 9 hurricanes, and 5 major hurricanes (category 3, 4, or 5). This is compared to the average number of 9.6 named storms, 5.9 hurricanes, and 2.3 major hurricanes for the last fifty years. The Tropical Meteorology Project states that this significant rise in activity is due to a combination of factors which includes a strong thermohaline circulation (THC), weakening La Niña conditions in the Pacific, and above average sea surface temperatures in the tropical Atlantic. According to the forecast, the probability of a hurricane making landfall along the U.S. coast is 72%, which is considerably above the average of 52%. The probability of one of these hurricanes making landfall in New Jersey however, remains extremely low (about 2%). The likelihood that New Jersey experiences tropical storm force winds related to one of these storms however is much higher at approximately 7%.

Conclusion

New Jersey was fortunate to escape this past winter without the occurrence of a major storm or series of storms. Twenty years ago, the "Perfect Storm" or "Halloween Storm" of 1991 ushered in a 15 month period of extraordinarily stormy weather that battered the New Jersey Coast. Several of the storms during this period are counted among the most significant of the past half century. Fortunately, the powerful storms of last winter were preceded by a decade of average or below average winter storm activity, making the beaches of New Jersey primed and ready to absorb such a significant blow. The mild conditions this past winter should allow New Jersey's beaches to continue to recover through both natural and anthropogenic processes. With the onset of the typical late spring and early summer conditions, New Jersey's beaches should continue to build reaching a maximum in mid- to late summer.

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This publication is the result of [work, research] sponsored by the New Jersey Sea Grant Consortium with funds from the National Oceanic and Atmospheric Administration (NOAA) Office of Sea Grant, U.S. Department of Commerce, under NOAA grant number NA10OAR4170075 and the NJSGC. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the NJSGC or the U.S Department of Commerce. NJSG-11-795