New Jersey State of the Shore REPORT 2009

May 21 Sandy Hook, NJ

Welcome to the 7th Annual State of the Shore Media Event

The New Jersey Marine Sciences Consortium/New Jersey Sea Grant Program (NJMSC/NJSG) and Stevens Institute of Technology are pleased to present the 2009 State of the Shore Report, which is produced annually and traditionally presented the week before Memorial Day weekend to the press, invited guests and the public at a special pre-summer media event.

With 127 miles of coastline and 17 of 21 counties bordering on salt-water, New Jersey is truly a coastal state. New Jersey boasts some of the finest beaches in the nation and the "Jersey Shore" provides a recreational outlet for the nearly 30 million residents of the region who live within a two-hour drive of the coast.

But there's more to this priceless resource than sunbathing and recreation: New Jersey's inshore waters underpin the state's nearly $50 billion coastal economy, a vast economic engine that supports tourism, fisheries and aquaculture, and port commerce. One out of every six jobs in New Jersey is related, in some fashion, to the coastal zone, making coastal revenues the state's largest economic sector.

As we welcome the summer of 2009, NJMSC/NJSG is ready to do its part and renew it commitment to contributing solutions to coastal issues by promoting balanced growth with environmental stewardship.

Coastal Changes

Coastal Storm Activity

New Jersey's coastal communities can once again breathe a collective sigh of relief, having escaped the September-April winter storm season without being impacted by a major coastal storm. This year marked the 7th relatively mild winter in a row, and the 17th since New Jersey has experienced the type of coastal devastation experienced during back-to-back years in 1991 and 1992. Although the season got off to an inauspicious start as the remnants of Hurricanes Hanna and Kyle skirted the New Jersey coastline, the remainder of the winter season was more of a lamb than a lion. A recurrent theme from the last several years was the importance of timing, as the largest coastal storms of the season once again did not coincide with the highest astronomical tides, lessening their overall impact.

JON K. MILLER PH.D.
Stevens-NJ Sea Grant Coastal Processes Specialist

Coastal Storm Activity

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As in past years, winter storm activity was analyzed using a series of real-time wave and water level gauges maintained by the National Oceanographic and Atmospheric Administration (NOAA) and Stevens Institute of Technology. Water levels recorded by the NOAA tide gauge at Atlantic City are representative of those along much of New Jersey's open ocean coast and are used to identify flooding and storm surge. The wave data used in the analysis consist of deep-water information collected and archived by NOAA as a part of the National Data Buoy Center (NDBC) program, and nearshore data collected and stored by Stevens Institute of Technology.

Water levels measured by the NOAA tide gauge at Atlantic City between September 1, 2008 and April 30, 2009 are shown in the upper panel of Figure 1. Hourly observations are plotted in green, with a thicker blue line used to identify the maximum daily water level. Also included is a dashed line which indicates the water level corresponding to a 2-year return period, or the water level that has a 50% chance of being exceeded in any given year. The surge or difference between the predicted (astronomic) and observed water levels is plotted separately in the lower panel of Figure 1. Unlike the total water surface elevation, the surge is a property of an individual storm and is independent of when a storm occurs within the tidal cycle. The fact that the majority of the peaks on the upper and lower panels do not line up illustrates the importance of timing.

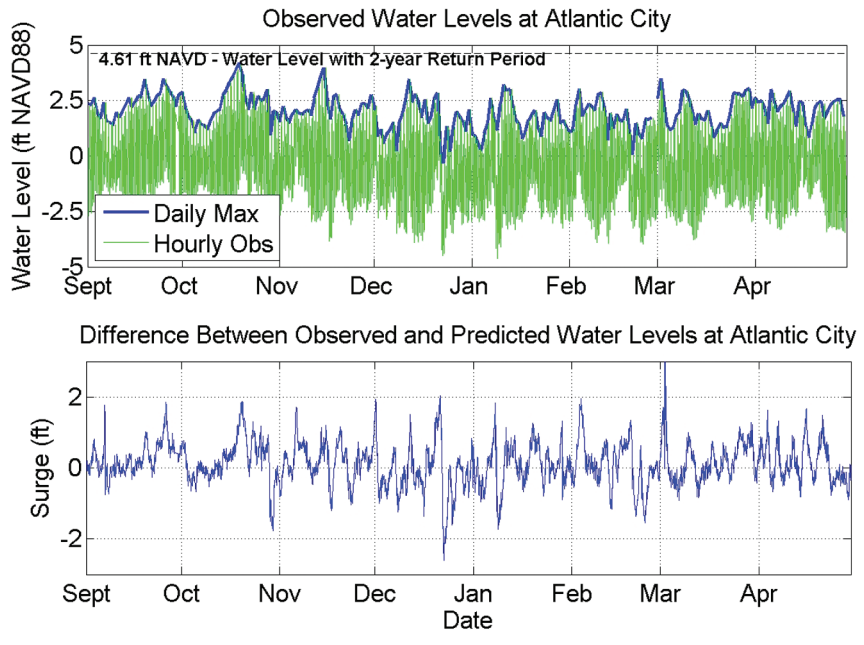

Figure 1: Measured water levels and water level differences at Atlantic City between September 1, 2008 and April 30, 2009

In terms of maximum water levels, the two most significant storms of the season occurred on October 19th and November 15th. The storm on the 19th was significant in that it was the climax of an event that elevated water levels over a period of approximately two weeks. The maximum water elevation reached during the height of the storm was 4.18 ft. NAVD, giving it an approximate return period of 1.25 years, or an estimated annual likelihood of exceedence of 80%. In terms of timing, the peak surge during the storm occurred as the tide was falling and as the tide was approaching neap (lower than normal) conditions.

The event in mid-November provided another clear example of the importance of timing within the astronomical cycle. In spite of the fact that the surge values through much of November were less than 1.5 ft., the second highest water level (3.97 ft. NAVD) of the season was recorded on November 19th. A closer examination of the event reveals that although the storm surge itself was minor (1.2 ft.), it occurred during a period of higher than normal tides related to the full moon on November 13th. Had a similar storm occurred during a period of neap tide, it would have been unremarkable.

On the opposite end of the spectrum is the storm which occurred on March 2nd. Although

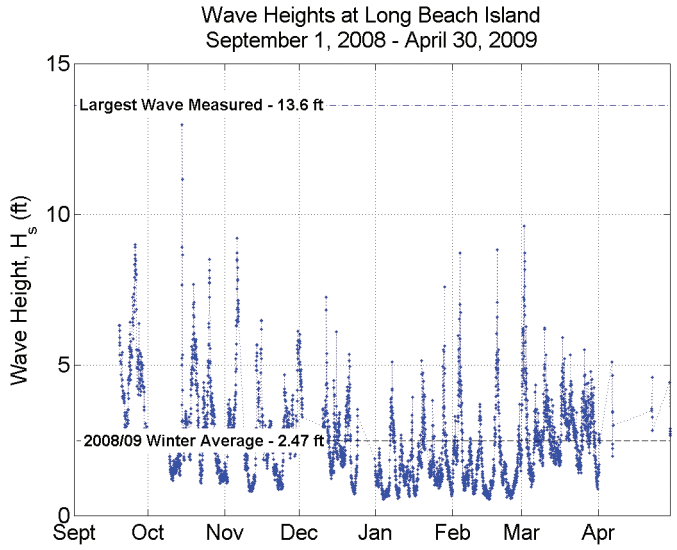

Figure 2: Significant wave height measured by the Stevens Coastal Monitoring Network (CMN) gauge at Long Beach Island between September 1, 2008 and April 30, 2009.

more noted for the intense snowfall it produced, it was also responsible for generating the largest storm surge of the season at 3.38 ft. Fortunately, the surge during the storm peaked rapidly and at low tide and occurred during a period of extremely low astronomic tides. Had the storm occurred a week earlier or later it easily would have qualified as a 5-10 year storm based on water level.

While water levels provide one means of assessing a storm's strength and impact along the coast, wave heights are also important. Beach erosion and storm damage are typically greatest when large waves are coincident with elevated water levels. Figure 2 shows the wave heights measured in approximately 20 ft. of water off the coast of Long Beach Island, by the Stevens Coastal Monitoring Network (CMN) gauge at Brant Beach.

Overall, the average wave height recorded by the CMN station at Long Beach Island this past winter (2.47 ft.) was on par with the long term average. The largest wave recorded topped out at 12.96 ft. which was just shy of the record (13.6 ft.) for the station. Although the wave was measured in mid-October, it was not coincident with the storm(s) that resulted in the elevated water levels shown in Figure 1. The wave itself was in fact somewhat freakish in nature, in that none of the other gauges operating at the time captured it. The second largest individual wave and perhaps the most significant wave event of the season occurred during the previously discussed March snowstorm. Numerous waves measuring in the 6-10 ft. range and topping out at 9.6 ft. were measured over a 24 hour period during the peak of the storm. Given the surge and wave energy associated with the storm, it is safe to conclude that had the storm not occurred during a period of extremely low astronomical tides, it would have caused significant flooding and beach erosion.

While nearshore gauges such as those within the Stevens CMN network provide the best means for evaluating local wave activity, the difficulty of maintaining them within such an energetic environment leads to shorter, more spotty records. To provide an indication of the historic context, monthly average wave heights in deep-water off the northern (44025) and southern (44009) New Jersey coast were compared with their long-term averages. The results are shown in Figure 3, where the blue bars represent the

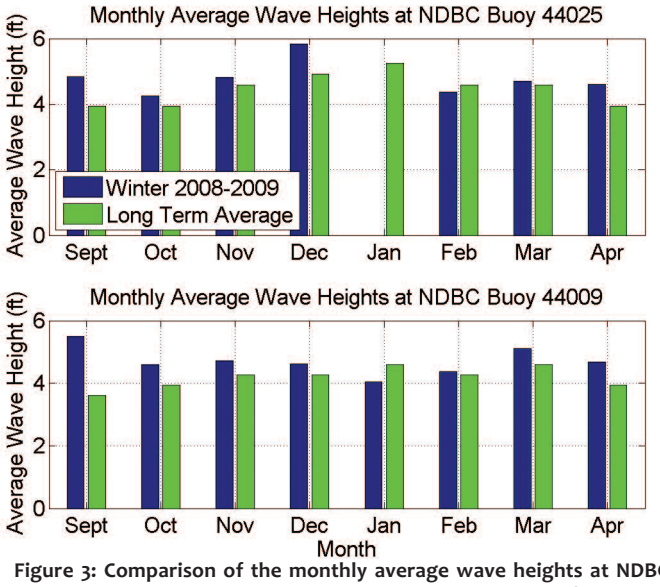

Figure 3: Comparison of the monthly average wave heights at NDBC Buoys 44025 and 44009 observed during the winter of 2008/2009 with the long term historical averages.

values measured this past winter and the green bars represent the long term averages. The trends at both gauges are relatively consistent, with the monthly average wave heights measured this past year exceeding the long term average during each month with the exception of January and February. These results are consistent with several more detailed studies being conducted at Stevens and elsewhere that show a progressive increase in wave heights off the New Jersey coast.

Summer Storm Outlook

The most recent (April 7, 2008) extended range forecast released by the Colorado State University, Tropical Meteorology Project calls for an average 2009 hurricane season, with a total of 12 named storms, 6 hurricanes, and 2 intense (Category 3 or higher) hurricanes. These numbers are roughly consistent with the long term averages of 9.6 named storms, 5.9 hurricanes, and 2.3 intense hurricanes, and are a departure from the above average April forecasts issued over the past several years. Factors contributing to the reduction in storm activity predicted compared to the early December forecast include weakening La Niña conditions over the eastern and central tropical Pacific, and an anomalous cooling of sea surface temperatures in the tropical Atlantic. Consistent with the prediction of an average hurricane season is the predicted likelihood of an intense hurricane strike along the U.S. east coast of 54%. While a direct impact from an intense hurricane remains fairly unlikely in New Jersey (<0.1%), the probability of experiencing damaging tropical storm force winds (40-75 mph) is much higher. Based on the latest forecast, the probability of tropical storm force winds affecting the southern New Jersey Counties of Cape May, Atlantic, and Cumberland is 4.6 % (down from an average of 8.6% over the last three years), while the northern New Jersey counties of Ocean, Monmouth, and Burlington have a slightly higher probability of being impacted at 5.9% (down from an average of 11.0% over the last three years).

Coastal Assessment

After getting off to a bit of a rough start in September and early October, this winter quickly settled into a pattern reminiscent of the past several years where only a relatively few storms of consequence impacted the coast. New Jersey was once again fortunate, that the largest storm of the season occurred during a neap tide period, and peaked at low tide, significantly lessening its impact. The cumulative effect of numerous back to back, relatively mild winters means that the beaches in most communities should be in relatively good condition heading into the summer months. While the beaches will undoubtedly appear narrower heading into the Memorial Day weekend compared to their late summer peak, the nature of this past winter's storms was such that the majority of the sand most likely remains within the littoral system, as a series of offshore bars. Given an extended period of calm late spring/early summer weather, this sand should work its way back on shore by the height of the summer tourism season, and let beachgoers claim their own piece of paradise.

Future Outlook

Once again a prevalent theme in this year's State of the Shore report was timing and good fortune. The two are intricately linked and while New Jersey was once again spared the brunt of Mother Nature's fury, New Jersey should remain mindful of the not too distant past. The damage and destruction caused by winter storms in 1962, 1991, and 1992 should remind us of just how vulnerable New Jersey's coastal areas are. The tendency to fall into a false sense of security based on the current statistically anomalous period of mild weather should be avoided at all costs. As a state with a coastal tourism economy measured in the billions of dollars, we must respond by pooling resources, working together, and finding innovative and practical means of sustaining one of New Jersey's most valuable resources.