Shifting Sands

Speakers:
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Overview of Trends in Beach Profiling Data, by Steve Dickson

Classic Seasonal Beach Profile
Sand migrates onshore in summer, offshore in winter.

Willard Beach, South Portland
WI03 profiles. Data is limited in the online database but what is shown is consistent with earlier years. The profile is centrally located near the bath house recreation area and is sinusoidal in shape. Seasonal variability from winter to summer is small compared to many other beaches. The Patriots' Day Storm impacted the dune severely.

Higgins Beach, Scarborough
HI03 profiles. Near the spit platform at the NE end of the beach, there is considerable variability in beach elevations through the years and seasons. Over 8 years, the lower profile built up over a meter in elevation. Overall the beach is getting higher - seems to be collecting sand. The sand source is from longshore drift (from the SW) and possibly offshore.

Scarborough Beach, Scarborough
SC02 profiles. Loss in 2007 includes the Patriots' Day Storm and is the lowest level recorded. The summer berm shows a higher mean in the upper profile. Winter bar variability leads to a large envelope on the lower profile. This is a fairly undeveloped beach with an intact frontal dune. The beach is eroding with pressure to migrate landward.

Western and Ferry Beaches, Scarborough
WS03 Back Stake profiles. The upward trend in annual beach elevation is due to beach nourishment in December, 2005 by sand dredged from the Scarborough River federal navigation channel and anchorage. This area was nourished by the Army Corps of Engineers. There is no significant difference in shape between summer and winter profiles.

East Grand Beach, Scarborough
EG01 profiles. A very continuous data set documents the growth and slight landward migration of the frontal dune ridge from 1999 to 2007 and a general trend of seaward accretion of the beach until 2006. This is one of longest data sets in the program. Upbuilding of frontal dune has been seen over time. There is even more frontal dune growth farther up the beach to the northeast beyond where the profiles are taken.

Kinney Shores Beach, Saco

KS01 profiles. With a very complete series since 1999, this is one of the best data sets in Maine. The upper profile shows accretion in recent years that ended in 2006-2007 when the profile lowered. The winter and summer profile shapes are similar. The berm in summer causes more variability in the beach elevation (as expected) than in winter. There is some upbuilding. Berm development is stable, to somewhat accreting.

Ferry Beach, Saco

FE03 Back Stake profiles. The dune crest gained in elevation but receded landward. Winter and summer profiles are very similar with a linear profile and very little vertical variation in any season. The front stakes were lost so more erosion has taken place here than is shown in these graphs. The shoreline is migrating landward and the frontal dune is getting lower because erosion has removed the highest part of the frontal dune.

Fortunes Rocks Beach, Biddeford

FR03 profiles. Berm growth was strong from 1999 through 2002. By 2006 the berm area had lowered about a meter. The outer profile in 2006 remained above the 1999 level. The winter mean profile shows more sand on the lower profile than in summer while the upper profiles are very similar.

Goose Rocks Beach, Kennebunkport

GR01 profiles. Near the Batson River, the lower profiles show a large variability due to sandbar migration on the ebb-tidal delta of the river. Winter and summer mean profiles are very similar showing the beach remains generally the same shape in both seasons. Profiles near the center of the beach are quite stable compared to the inlet areas.

Goochs Beach, Kennebunk

GO02 profiles. A long time series shows net lowering of the profile by 2007. There is berm growth in summer as shown by a higher mean summer profile. Overall, the beach profile remains similar in shape over the years. This is a closed cell system.

Laudholm Beach, Wells

LH02 profiles. The highest beach profile was reached in 2003 and lowest in 2007. The upper profile appears to be erosional since 2003. The seasonal averages show summer berm formation and winter sand storage on the lower profile as is typical of most beaches. There are clues that beach is eroding since one of the site marker stakes needed to be relocated in 2006 and another one was lost this year.

Drakes Island Beach, Wells

DI04 profiles. This is a location at the middle of the beach. Accretion from 2001 to 2003 was followed by erosion through 2005. In 2006 accretion resumed. The summer mean shows more sand on the whole profile than in winter as is expected.

Wells Beach, Wells

WE02 profiles. This profile is just north of Casino Point. Profiles start from a high in 2003 and settle to a common lower elevation from 2005 through 2007. The seasonal means show a higher summer beach, particularly in the berm area and upper profile. The lower profile is similar in winter and summer. Higher profiles appear to be lowering over time.

Ogunquit Beach, Ogunquit

OG03 profiles. The beach profile was highest in 2003 and has subsequently been eroding. There is a slight gain in elevation in 2007 (with less than a year of data) compared to 2006. A typical summer berm and mean summer profile are present with more sand on the lower profile in the winter. More recently, May 2005 northeasters severely impacted beach with erosion that have lowered the beach profile and eroded the frontal dune. Although not in this analysis, the 2007 Patriots' Day Storm also caused severe frontal dune erosion.

Long Sands Beach, York

LS04 profiles. The beach has gained in elevation from 2002 through 2007. Most of the accretion was between 2002 and 2004. Seasonally, the summer profile is higher and the winter profile shows more variability in elevation, as expected. The beach appears to be growing in LS04 section of the beach, though this is not consistent over the length of Long Sands Beach based on other profile measurements.

Trends in Maine's Beaches

The annual trend describes the overall trend for several locations on the beach. Sometimes there are significant differences from one end of the beach to another. Areas with good seasonal behavior exhibit profile gains in summer and losses in winter. This sand exchange and reservoir is a good sign of beach health. Beaches with relatively little seasonal change are rated as fair. Beaches that rated poorly in the Patriots' Day storm included information collected by MGS from site visits and shoreline measurements in addition to volunteer profile data. Scarborough Beach and Ferry Beach (Saco) are the areas of greatest erosional concern based on profile data. Many other profiles locations show a trend toward lower beaches in the last few years.

Inundation Mapping, The Patriot's Day Storm, and the Maine Beach Monitoring Program, by Peter Slovinsky

GIS-based inundation mapping was used to simulate the potential impact of a 2-foot static sea level rise on Maine's beaches. Base topographic data utilized was Light Detection and Ranging (LIDAR) data, which allows for a 2-and-3-dimensional representation of ground topography. LIDAR data allowed for simulations of existing flooding conditions under highest annual tide (HAT), in addition to future sea level rise and the Patriots' Day Storm of 2007. Inundation simulations allow for evacuation route planning and identification of at-risk property (roads, structures, etc.).

Patriots' Day Storm, April 16, 2007 - could be used to predict future?
This was "a pretty potent storm." Over a period of a couple of days, waves exceeded 3 meters. Observed tides reached 2.48 m NAVD, which was the highest recorded tide since 1990. This level was about 0.75 m above predicted tide levels, indicating a substantial storm surge. This storm surge level was almost equivalent to HAT + 2-feet sea level rise, which was simulated as part of inundation mapping. If a storm with a surge similar to the Patriots' Day Storm of 2007 occurred at highest annual tide after 2-ft of sea level rise, extensive back-barrier flooding could be expected.

The Maine Beach Monitoring Program (MBMAP) is meant to compliment the SMBPP with accurate surveys of alongshore shoreline features. It uses Real Time Kinematic Global Positioning System (RTK-GPS) technology that has the capability of horizontal and vertical accuracies on the order of +/- 2 cm. Survey results from the Patriots' Day Storm indicated that Drakes Island Beach in Wells saw roughly ~15 ft erosion. At Scarborough Beach, overwash penetrated the dune system up to around 150 ft overwash or more during the Patriots' Day Storm. At Goose Rocks Beach, in the period from 2003-2007, there was 10-40 feet of dune erosion, while Ferry Beach in Saco has seen up to 50 feet of erosion since 2004. Willard Beach in South Portland saw an average of 23 feet of dune recession from the Patriots' Day Storm. The goal of the MBMAP is to overlap datasets (beach profiles and shoreline surveys of the dune edge) to create a better spatial and temporal dataset.

Question:
What is the State of Maine's policy on beach nourishment?
Answer by Steve Dickson:
Beach nourishment is an option for highly erosional areas. Some beaches would require 100,000s of cubic yards of sand. Because the cost per cubic yard for nourishment is high, these projects would costs multimillions. Harbor dredges when sand is clean can be a sand source and beach disposal is often a least-cost alternative to disposal of dredged material. The Army Corps of Engineers so far has paid for 100% nourishment costs - the State of Maine does not yet financially support or cost-share beach nourishment projects.