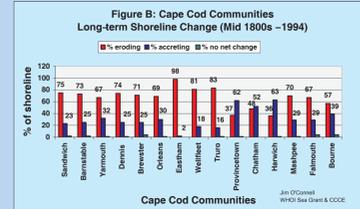
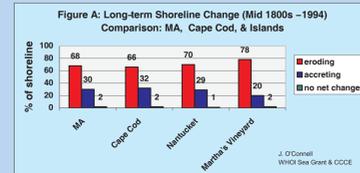


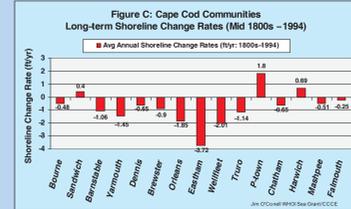
Regional Hazard Risk (Map I), Cape Cod, Massachusetts

- Landslide Susceptibility
- Long -Term Shoreline Change Susceptibility
- Historic Tornado Activity
- Historic Earthquake Activity



* Cape Cod has 586 miles of tidal shoreline of which 238 miles of primarily ocean-facing shore were analyzed for shoreline change trends (O'Connell, et al., 2002; Thieler et al., 2001). The long-term shoreline change rate for all Cape Cod communities combined is -0.68 ft/yr, slightly higher than the statewide average: 0.6% (157 miles) of the Cape Cod shoreline shows long-term erosion. Twelve of the 15 Cape Cod communities exhibit a long-term erosion trend, while only 3 exhibit long-term accretion.

The shoreline change data on this map were generalized from 27 individual shoreline change maps covering Cape Cod. The original data were blocked and averaged in groups exhibiting similar shoreline change trends along the shore. Therefore, there may be small, localized areas that are opposite the shoreline change trend shown on this map. Refer to the original maps and data tables for more detail (Thieler et al., 2002; O'Connell, et al., 2002). Data analysis for this map was conducted by Jim O'Connell, WHOI Sea Grant and Cape Cod Cooperative Extension.



Shoreline Erosion Susceptibility *

Shoreline Change Index

- Erosion > 2 feet per year
- Erosion 1 - 1.99 ft/year
- Erosion .01 - .99 ft/year
- Accretion .01 - .99 ft/year
- Accretion 1 - 1.99 ft/year
- Accretion > 2 feet per year
- No Data

Landslide Susceptibility

- Combination - High
- Incidence - High
- Incidence - Low
- Susceptibility - High
- Susceptibility - Moderate

Tornadoes (Fujita Scale)

- F0, Gale Tornado (Light Damage)
- F1, Moderate Tornado (Moderate Damage)
- F2, Significant Tornado (Considerable Damage)
- F3, Severe Tornado (Serious Damage)
- F4, Devastating Tornado (Devastating Damage)

Tornado Density (# of Tornadoes/20 miles)

- 0 - 16
- 16 - 32
- 32 - 48
- 48 - 64
- 64 - 72

Earthquake Magnitudes (Richter Scale)

- 1's
- 2's
- 3's Generally not felt, but recorded
- 4's Often felt, but rarely causes damage
- 5's Can be destructive in areas approx. 100 km where people live
- 6's Major earthquake, can cause serious damage
- 7's Major earthquake, can cause major damage

Fault Lines

- Fault
- Normal Fault
- Thrust Fault

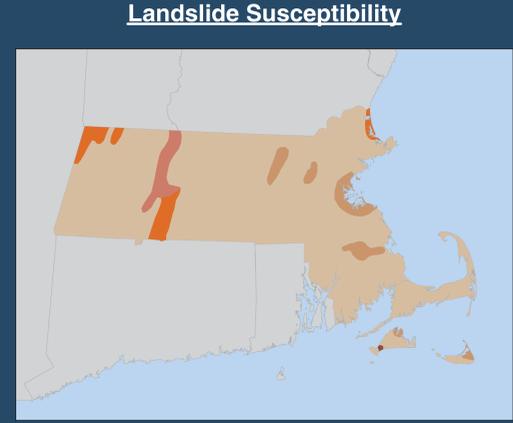
Peak Ground Acceleration

- 1 - 3 % Light shaking, no damage
- 4 - 5 % Moderate shaking, no damage
- 6 - 7 % Moderate shaking, light damage
- 8 - 10 % Strong shaking, light damage

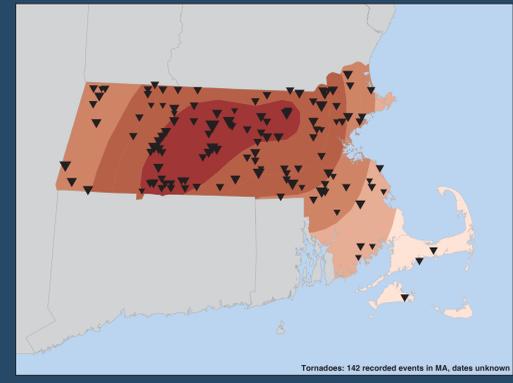
Notes:

** SLOSH Zones (Sea, Lake, and Overland Surges from Hurricanes) depicted here are areas of inundation modeled to occur from wind and pressure forces of hurricanes. Inundation areas reflect "Worst Case" combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. The SLOSH zones shown here have been georeferenced for this project and are originally found in the publication "Southern Massachusetts Hurricane Evacuation Study Inundation Map Atlas, December 1994" by the US Army Corp of Engineers. "Worst Case" hurricane surge elevations are given in the surge tide profiles provided on Plate II of that publication.

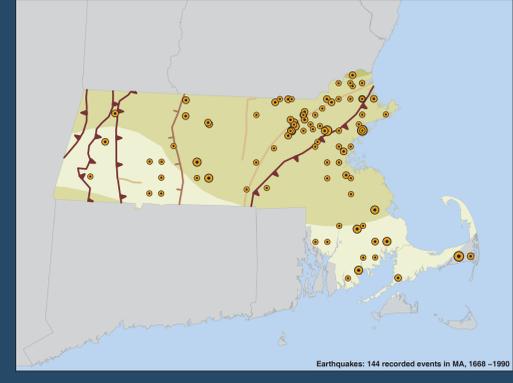
*** Ocean-facing shores where data are not represented have extremely complex shoreline changes due to barrier beach breaching and migration. Historic shorelines are available. However, shoreline change data are not available for bay and estuarine areas (See references).



Historic Tornado Activity



Historic Earthquake Activity



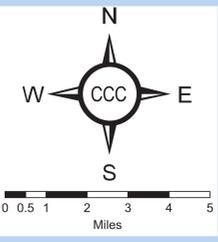
F0

3.1, 1977DEC20

4.2, 1947AUG08

2.8, 1976MAR14

Vineyard Sound



NOTE AND CAUTION: The shoreline change data on this map were generalized from 27 individual shoreline change maps covering Cape Cod. The shoreline change data span approximately 150 years (mid 1800s to 1994) with an uncertainty range of +/- 1.4 feet per year. The original data were blocked and averaged in groups exhibiting similar shoreline change trends along the shore. Therefore, there may be small, localized areas that are opposite the shoreline change trend shown. Furthermore, caution should be used when interpreting any shoreline change data as recent trends in shoreline movement may have changed as a result of natural causes or, importantly, human activities, such as seawall/revetment, jetty or groin construction. It is important to analyze the short-term shoreline change data that were used to calculate the long-term rates of change to identify recent changes in shoreline movement that may be more applicable for planning purposes. For case examples, see O'Connell, et al., 2002 & 2003, and Thieler, et al., 2002 listed in the references below. Data tables and maps can be viewed at www.state.ma.us/cvz/cm.htm.

Data Sources:
 Northeast States Emergency Consortium (NESCE) www.nesec.org; Massachusetts Executive Office of Environmental Affairs, "Coastal Erosion on Cape Cod: Some Questions and Answers" (<http://woodshole.er.usgs.gov/staffpages/boldale/capecod/>); Federal Emergency Management Agency (FEMA); and the Cape Cod Commission's Geographic Information System Database.

References:
 IPCC, 1995. Second Assessment - Climate Change 1995: A Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.
 O'Connell, J.F., 2003. New Shoreline Change Data Reveal Massachusetts is Eroding. WHOI Sea Grant and Cape Cod Cooperative Extension, Marine Extension Bulletin, March, 2003.
 O'Connell, J.F., Thieler, E.R., and Schupp, C., 2002. New Shoreline Change Data and Analysis for the Massachusetts Shore, with Emphasis on Cape Cod and the Islands: Mid-1800s - 1994. Environment Cape Cod, Vol. 5, No. 1.
 Thieler, E.R., O'Connell, J.F., and Schupp, C., 2002. The Massachusetts Shoreline Change Project: 1800s - 1994. Technical Report, U.S.G.S. Administrative Report, Woods Hole, MA.

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