

Tampa Bay, Florida: Area at Risk of Inundation from a 1-Meter Rise in Sea Level and Highest Observed Storm Surge

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Abstract

The map depicts vulnerability to a 1-m sea level rise with additional storm surge in the Tampa Bay/St. Petersburg, Florida area. The uncertainty associated with the underlying elevation data is captured in the range of inundation shown. Storm surge was based on the average highest observed water levels (HOWLs; 92 cm) from historic tide records at the nearest tide gauges.

The sea level rise scenario shown reflects areas at risk of inundation based on modeled elevation alone and does not take into account adaptation measures such as shoreline armoring that may prevent some low-lying areas from being flooded.

Because the elevation data are based on computer models as opposed to survey data, there is an inherent amount of uncertainty associated with the "true" elevation at any particular location (Gesch et al., 2002; Gesch, 2007). Additionally, the accuracy of the elevation value varies spatially depending on the quality of the source datasets used to generate the elevation models. The ranges of inundation shown on the map reflect this uncertainty in the underlying elevation data but do not portray a probability, i.e., the low, central, or high estimates are of equal likelihood.

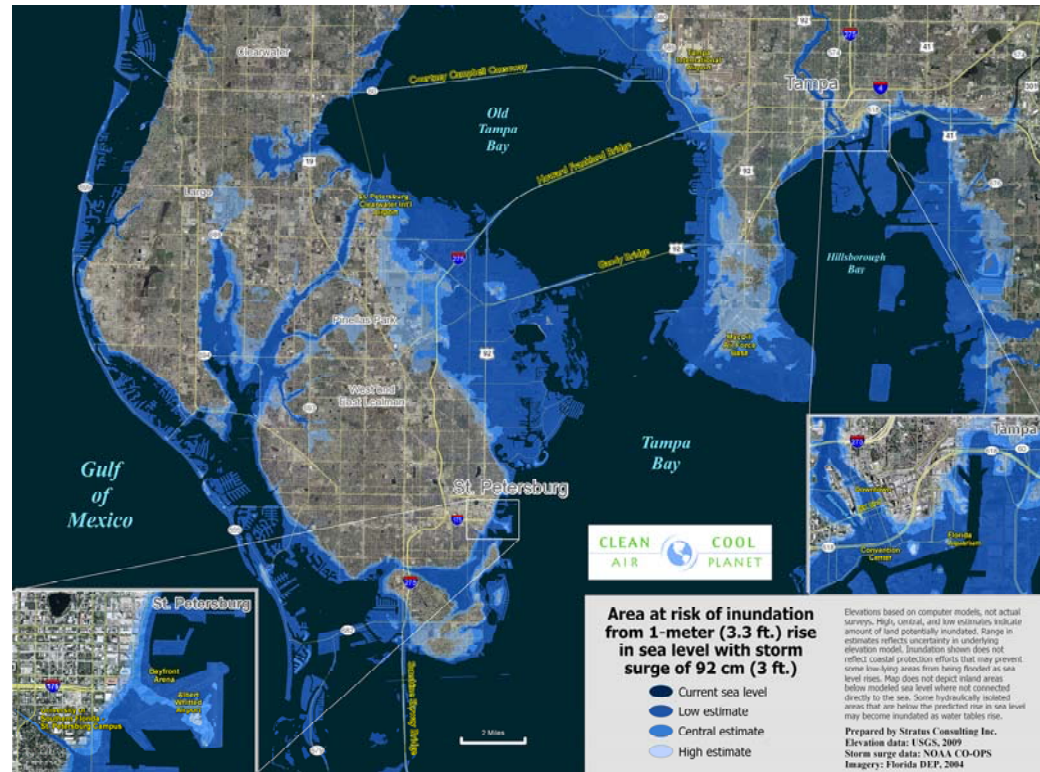
Sea level rise scenarios are relative to the spring high water (SHW) elevation. This value was used because it represents the highest elevation regularly inundated on a monthly basis. SHW elevation was derived from tide gauge data and represents the monthly high tides averaged over either the tidal epoch (1983–2001), if available, or the period of record for the nearest tide gauge. Storm surge was based on the average of the HOWLs (92 cm) over the period of record at the nearest gauges with high water data. These events were Hurricane Elena (1985) and the "Storm of the Century" (1993) for this region.

Methods

- Download tiles of best available elevation data from the U.S. Geological Survey seamless data Web site (10 m as of August 2009) and combine into a seamless elevation layer (USGS, 2009).
- Determine elevation uncertainty for elevation tiles based on the source and processing methods used to derive digital elevation data that are provided with the elevation metadata.
- Generate "low estimate" and "high estimate" elevation surfaces based on the elevation uncertainty.
- Download tide station data from the National Oceanic and Atmospheric Administration – Center for Operational Oceanographic Products and Services Web site for St. Petersburg, Florida (Station ID: 8726520; NOAA, 2003a), and Clearwater Beach, Florida (Station ID: 8726724; NOAA, 2003b), and calculate SHW elevation relative to North American Vertical Datum of 1988 (NOAA, 2008; Figure 1).
- Adjust upland elevation layers to be relative to SHW elevation.
- Using tide station data, calculate average height of HOWL relative to SHW as a surrogate for storm surge (NOAA, 2008).
- Run inundation model for 50 cm (20 in), 1 m (3.3 ft), and 2 m (6.6 ft) above SHW and with additional storm surge of 92 cm (3 ft), taking into account connectivity of inundated surface with open sea. Repeat analysis with "low" and "high" elevation datasets.
- Download digital orthophoto tiles for background imagery and compile into seamless layer (USGS, 2004).



Figure 1. Differences in elevations between tidal and geodetic vertical datums for St. Petersburg, Florida, and Tampa Bay, Florida, tide station 8726520 (NOAA, 2008).



References

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