



## Sea level rise and coastal flood risk: Summary for 33141, FL

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*This document is meant as a one-stop summary and brief guide that integrates key findings, methods, interpretation and links from Climate Central's [Surging Seas Risk Finder](#) into one narrative. It stands alone or as a jumping-off point.*

### Sea level rise and flood forecast

Even small amounts of sea level rise make rare floods more common by adding to tides and storm surge. Climate Central has estimated risk by combining local sea level rise projections with historic flood statistics from the NOAA water level station at Vaca Key, FL, 99 miles from the center of 33141. For reference, our extreme values analysis indicates that the "100-year" flood height, given sea level in 2012, is 2.6 feet above local Mean Higher High Water (high tide line)<sup>1</sup>. The highest observed flood at this location, in records from 1979 to 2013, reached 5.8 feet MHHW in 2005. These values suggest that floods above 3 feet likely pose significant concerns.

Based on the U.S. Army Corps of Engineers mid-range sea level rise projection, [we project 3.4 feet of rise locally](#) by 2100, from a 2012 baseline. Our analysis translates this to 17 percent [cumulative risk](#) of at least one flood exceeding 3 feet by 2030, a 49 percent risk by midcentury, and a 100 percent risk by 2100. Under the Corps's high-end projection, these chances [increase](#) to 19, 71, and 100 percent, respectively, and we compute a 100 percent risk of at least one flood [exceeding 6 feet](#) by the end of the century.

Climate Central's [online forecast tool](#) allows exploration of a wide range of other flood heights (1-10ft), risk statistics (annual flood risk; how climate multiplies risks), and localized sea level projections (with choice of scientific models and climate pollution scenarios). See Methods section below for more discussion of the research approach used and important guidance on how to interpret results.

### Map and exposure analysis

Understanding exposure to sea level rise and floods requires a good map. Climate Central combined tidal elevation models and lidar-based (laser-based) elevation data supplied by NOAA, plus levee location data from FEMA, to identify both fully exposed and potentially protected land less than 1-10 feet above the local high tide line.

Climate Central's [interactive, embeddable online map](#) shows exposed areas and how they intersect with [population density](#), [social vulnerability](#), [property value](#), and more.

Climate Central's [online analysis tool](#) shows exposure at each water level for dozens of variables, based on data from over ten federal agencies. Here are a few examples of exposure in 33141 on land below 3 feet MHHW, in total and excluding land that may be protected by levees or isolation<sup>2</sup>:

Variable	Total Exposure	Excluding isolated areas
Acres of land	713	697
Population	19,783	19,464
High social vulnerability pop.	15,023	14,856
Housing units	11,221	10,917
Property (\$ millions)	2,370	2,290
Road miles	34.0	33
EPA-listed sites	7	7
Schools	5	5

At 6 feet, 33,750 people (95.7 percent of the total population in 33141) and \$4,714 million are exposed in total.

The tool offers comprehensive downloads of exposure tables as well as lists of facilities that may be affected, and data sources and methods descriptions for each variable. See Methods section below for more discussion of the general research approach used and important guidance on how to interpret results.

## Comparison

Threats vary from place to place. With heat maps and rankings, Climate Central's [online comparison tool](#) supplies wider regional context for exposure of each variable analyzed, and at any water level.

For example, 33141 is second out of all Zip Codes in Miami-Dade County for total exposure of homes on land below 3 feet. 33141 is first if ranked by its *percentage* of homes exposed, and it is second if all Zip Codes are ranked by exposure after excluding areas that appear isolated or protected.

The comparison tool simply offers a different presentation of exposure analysis. Therefore the same methods and interpretative notes apply.

## Methods and interpretation

### Sea level rise and flood forecast

The projections described here and in the tool are based on analysis specific to a selected water level station site. They may or may not indicate nearby area risks, such as a specific location in 33141. Local sea level rise projections are generally similar across neighboring areas. Flood risks can more easily vary across short distances, due to details of local topography and bathymetry and typical storm paths. The tool includes a Location tab to allow comparison of results across multiple regional water level stations, to check for general consistency or differences.

The basic methods for this analysis follow Tebaldi et al (2012), plus simple extensions for [computing cumulative flood risk](#) and for [estimating how much climate-driven sea level rise multiplies risk](#).

Furthermore, the current analysis improves local accuracy by employing all verified historic hourly water level data available at each [NOAA water level station](#) through 2013, instead of limiting inputs to a standard 30-year period as in Tebaldi et al.

Note that our analytic approach assumes that the storms of the future will resemble the storms of the past. However, much research suggests that intense storms and surge will become more common, possibly rendering the flood risk estimates here too low.

## Map and exposure analysis

The basic methods for this analysis follow Strauss et al (2012), but using updated elevation data and incorporating levees. Flood maps are based on NOAA-supplied lidar elevation data and achieve near-perfect consistency with NOAA's Sea Level Rise and Coastal Flooding Impacts Viewer over the two products' shared elevation range (1-6 feet MHHW). Climate Central's analysis adds elevation data from USGS to fill rare gaps or to make rare updates after newer lidar data become available. We also supplement FEMA's Midterm Levee Inventory, the best available national dataset but known to be partial, with local data where possible.

Exposure values indicate what sits on land below the selected water level (elevation), computed both with and without accounting for potential protection. They aim to illustrate general exposure to future sea level rise and coastal flooding -- not specify actual impacts or damages, or precisely "what will flood." Complicating factors include:

**Protection.** Levees, walls, dams, ridges, or other features may protect or isolate some areas, e.g. block hydrologic connectivity, especially at lower elevations, e.g. 10-year flood heights. Data limitations, such as incomplete levee data, and elevation data too coarse to capture narrow seawalls, make assessing protection difficult. However, click on any tile in the analysis tool for estimates of exposure after accounting for protection using the data available. In assessing protection, we assumed levees are always sufficiently tall and strong, because data on height and condition were not available. Unmapped culverts, sewer lines, other connectivity, or rainwater unable to drain during coastal storm events, may also compromise apparently protected areas. Total and unprotected exposure values likely bracket the actual exposure from sea level rise and coastal flooding at any given water level.

**Bathtub method.** Employing elevation relative to local high tide lines (MHHW), this analysis uses near-flat water surfaces statewide to compare exposure. Actual storms create uneven flooding in limited areas.

**Elevation error.** The laser-based "lidar" elevation data used in this tool includes error. In rare cases, localized error may make large low-lying areas appear mistakenly connected to -- or isolated from -- the ocean at a particular water level.

**Dynamics.** This analysis does not account for future erosion, marsh migration, coastal development, coastal defense, or other dynamic factors that may affect exposure.

**Feature representations.** Available data represent most features (e.g. schools, roads) using simple point or line coordinates. Most exposure assessments thus cannot account for full structure or site footprints. Available data represent density variables (e.g. population) as totals within minimum Census

units (e.g. blocks). The analysis treats each unit's total as spread out evenly within the unit's dry land area. Methods notes for each tile in the online analysis tool provide further detail.

## Citation

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- Download from: [ssrf.climatecentral.org/#p=L&state=Florida&location=FL\\_Zip\\_1233141](http://ssrf.climatecentral.org/#p=L&state=Florida&location=FL_Zip_1233141)

## Footnotes

1. All elevation and flood height values in this document and the tool are given in reference to Mean Higher High Water (informally, the “high tide line”) -- the average of each day’s higher high tide over the most recent “tidal epoch,” a standard multiyear period (defined by NOAA as 1983-2001 in most locations; more recent in the western Gulf of Mexico).
2. The default view in the tool shows total exposure; click on a tile to see how much might be protected by levees or isolation.

## Main references

Strauss, B. H., Ziemiński, R., Weiss, J. L., & Overpeck, J. T. (2012). “Tidally adjusted estimates of topographic vulnerability to sea level rise and flooding for the contiguous United States.”

*Environmental Research Letters*, 7(1), 014033. [Link](#)

Tebaldi, C., Strauss, B. H., & Zervas, C. E. (2012). “Modelling sea level rise impacts on storm surges along US coasts.” *Environmental Research Letters*, 7(1), 014032. [Link](#)

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