

## Sea Level and Storm Trends, Harpers Ferry National Historical Park

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February 19, 2015.

### Sea Level Summary

Historical tide gauge data from the Washington D.C. tide gauge show that sea level near Harpers Ferry National Historical Park (HAFE) is rising (IPCC 2013; NOAA tides and currents 2012; Figure 1). HAFE has only been directly in the path of one hurricane-strength storm over the last century (hurricane Hazel in 1954); however, given its location between the Potomac and Shenandoah Rivers a storm surge from a hurricane could reach the park. Storms are expected to intensify over the next century. At least one Saffir-Simpson category 1 hurricane storm surge should be expected to travel up to HAFE by 2100.

**Table 1.** Historical and projected sea level and storm trends for Harpers Ferry National Historical Park.

Sea Level and Storm Surge Trends, Harpers Ferry		2050 <sup>2</sup>	2100 <sup>3</sup>
Historical sea level trend, 1924–2013	+0.13 in/yr		
Number of tropical storms, depressions and subtropical storm paths within 10 miles of Harpers Ferry, 1842–2011	7		
Estimated storm surge height <sup>1</sup> (Category 1, mean tide), 2014	No data		
Estimated storm surge height <sup>1</sup> (Category 4, mean tide), 2014	No data		
<b>Low Emissions Scenario</b> (RCP 4.5) Projected sea level		+0.87 ft	+2.08 ft
<b>Intermediate Emissions Scenario</b> (RCP 6.0) Projected sea level		+0.91 ft	+2.16 ft
<b>High Emissions Scenario</b> (RCP 8.5) Projected sea level		+0.88 ft	+2.58 ft

<sup>1</sup>Storm surge heights are projected on top of current mean sea level. It should be expected that potential storm surge heights will change over time based on changes in mean sea level.

<sup>2</sup>Calculated by Caffrey and colleagues using IPCC data for Washington D.C.

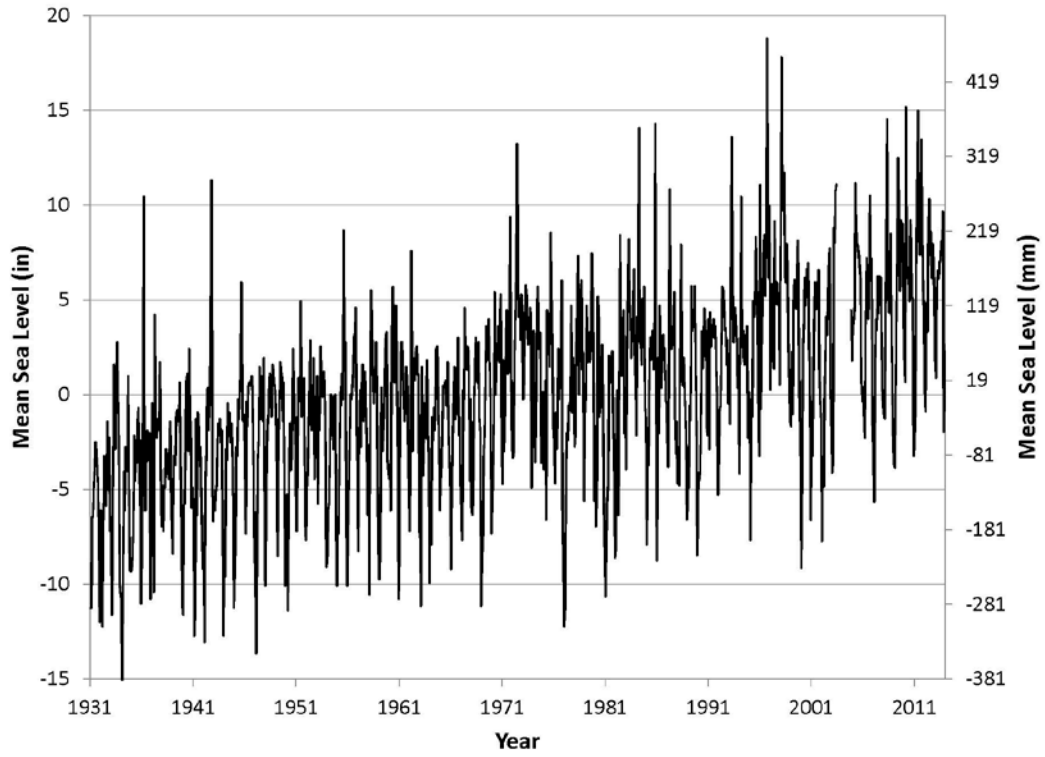
<sup>3</sup>Ensemble mean for Washington D.C. based on data used for figure 13.20 by the IPCC (2013).

### Sea Level Change and Storm Surge Vulnerability at Harpers National Historical Park

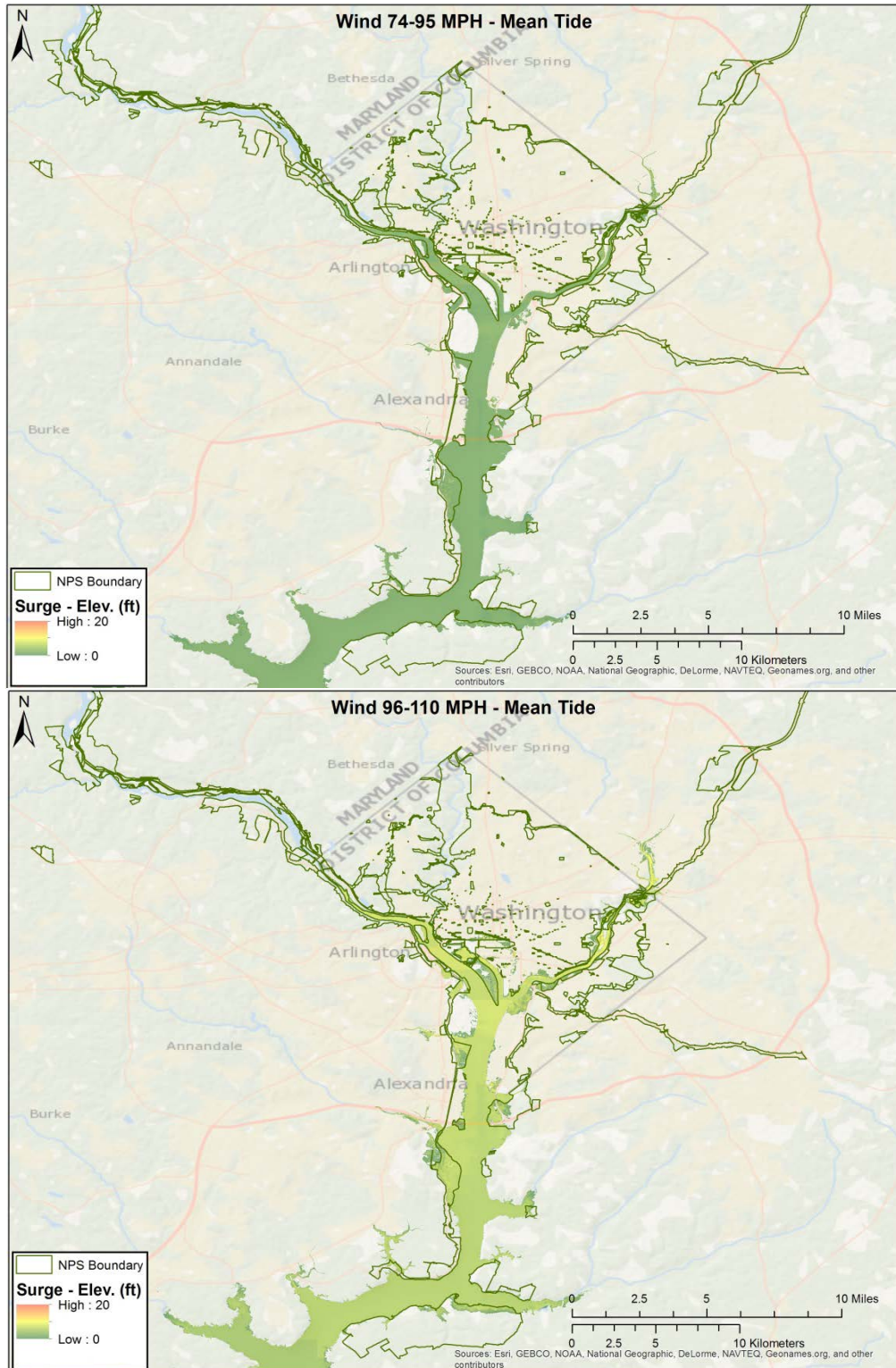
- Increasing sea levels may lead to loss of land and critical habitat.
- Increased erosion and/or accretion across the coastline by storms coupled with shorelines adjusting to new mean sea levels.
- Rising groundwater tables and possible salt water intrusion due to rising sea levels.
- Increased risk of high intensity storm events.
- Potential loss of nearby freshwater ecosystems as sea levels rise.

### References for Additional Sea Level and Storm Surge Information

- Intergovernmental Panel on Climate Change: <http://www.climatechange2013.org/report/>
- USACE Sea Level Calculator: <http://www.corpsclimate.us/ccaceslcurves.cfm>
- NOAA Tides and Currents: <http://tidesandcurrents.noaa.gov>
- NPS Storm Surge Mapping: <http://mariacaffrey.com/storms>
- NOAA Historical Storm Data: <http://www.ncdc.noaa.gov/ibtracs/>



**Figure 1.** Sea level trends, Washington D.C. tide gauge, 1931–2014.



**Figure 2.** Potential storm surge height and extent of a Saffir-Simpson category 1 hurricane (top) versus a Saffir-Simpson category 2 hurricane (bottom) striking during mean tide.