

Coastal changes worsen nuisance flooding on many US shorelines, study finds

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High-tide flooding in Norfolk, VA, in April/May 2017. Credit: Tal Ezer, Old Dominion University

Nuisance flooding has increased on U.S. coasts in recent decades due to sea level rise, and new research co-authored by the University of Central

Florida uncovered an additional reason for its added frequency.

In a study appearing today in the journal *Science Advances*, researchers show that higher local [tide](#) ranges, most likely from human alterations to [coastal areas](#) and estuaries, has increased the number of nuisance flooding days in many coastal locations in the U.S.

Coastal nuisance flooding is considered to be minor flooding from the seas that causes problems such as flooded roads and overloaded stormwater systems, which can be major inconveniences for people and provide habitat for bacteria and mosquitoes.

Changes to local tide range often occur in coastal areas and estuaries when channels are dredged, land is reclaimed, development occurs, or river flows change. This can cause tide ranges, defined as the height difference between high tide and low tide, to increase in some areas and decrease in others.

The study found that out of the 40 U.S. National Oceanic and Atmospheric Administration tidal gauge locations used in the study that dot the continental U.S. coastlines, nearly half had more nuisance flooding days because of higher local tide ranges.

"It's the first time that the effects of tidal changes on nuisance flooding were quantified, and the approach is very robust as it is based purely on [observational data](#) and covers the entire coastline of the U.S. mainland," says study co-author Thomas Wahl, an assistant professor in UCF's Department of Civil, Environmental and Construction Engineering.

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Department of Commerce and Labor
COAST AND GEODETIC SURVEY
Form No. 302

TIDES: HOURLY READINGS.

Station, *Wilmington N C* Year 1910 Long. Lat.
Chief of Party, Tide Gauge No. Scale
Tabulator, Readings are reduced to Staff.
Kind of time used,

Day of Month.	14	15	16	17	18	19	20	
Day of Series.	1384	1385	1386	1387	1388	1389	140	
Hour.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	
0	5.1	4.1	3.2	2.3	2.4	2.8	2.9	22.8
1	5.5	4.7	3.9	3.1	2.3	2.5	2.5	24.5
2	5.5	5.0	4.5	3.7	3.2	2.3	2.3	26.5
3	5.1	5.0	5.0	4.3	3.9	2.8	2.2	28.3
4	4.6	4.6	5.0	4.8	4.5	3.6	3.1	30.2
5	4.2	4.1	4.6	4.8	4.9	4.1	3.7	30.4
6	3.8	3.7	4.1	4.5	5.0	4.4	4.2	29.7
7	3.5	3.3	3.7	4.0	4.7	4.4	4.5	28.1
8	3.1	2.9	3.5	3.6	4.2	4.0	4.5	25.6
9	2.8	2.6	2.9	3.2	3.8	3.6	4.1	23.0
10	2.8	2.4	2.6	2.8	3.4	3.1	3.6	20.7
11	3.4	2.2	2.3	2.5	3.0	2.8	3.2	19.4
NOON.	4.3	2.9	2.2	2.2	2.7	2.5	2.9	19.7
				2.1	2.4	2.1	2.6	20.3

A picture of one page that includes historic water level information from the tide gauge of Wilmington from the year 1910. Credit: Stefan Talke, California Polytechnic State University, San Luis Obispo

The researchers performed the study by using tidal gauge data at 40 locations along the Atlantic, Gulf and Pacific coasts spanning at least 70 years of data. They compared water levels at the locations based on two different scenarios—one in which tidal range never changed and one where it did.

This allowed them to see how often nuisance floods occurred or were prevented over time because of tidal changes.

They found that nuisance flooding increased because of tidal changes in

about half the locations, decreased in a fourth of the locations, and was not changed in the remaining quarter of locations.

For example, in 2019, Cedar Key, Florida, received about 23 additional nuisance flooding days because of increased tidal range, while Washington, D.C., had about 52 fewer due to decreased tidal range.

"Seeing how many nuisance flooding events occurred in the past and are happening today simply because of tidal changes should be motivation for us to keep alterations to sensitive estuarine systems at a minimum as to not further exacerbate the problem, which we already face because of sea level rise," Wahl says. "We should at least be aware of these potentially negative impacts in the planning phase of alteration projects, and it might even be possible to reverse some of the [negative impacts](#) from past decisions."

"While a few individual instances of these minor flooding events do not cause too many impacts, the cumulative impacts of frequent events can become very large," Wahl says. "Hence, understanding what drives the changes in nuisance flooding is very important."

The study's lead author, Sida Li, is a visiting student in UCF's Department of Civil, Environmental and Construction Engineering and the National Center for Integrated Coastal Research.

More information: S. Li et al., "Evolving tides aggravate nuisance flooding along the U.S. coastline," *Science Advances* (2021). [advances.sciencemag.org/lookup...1126/sciadv.abe2412](https://advances.sciencemag.org/lookup?...1126/sciadv.abe2412)

Provided by University of Central Florida

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