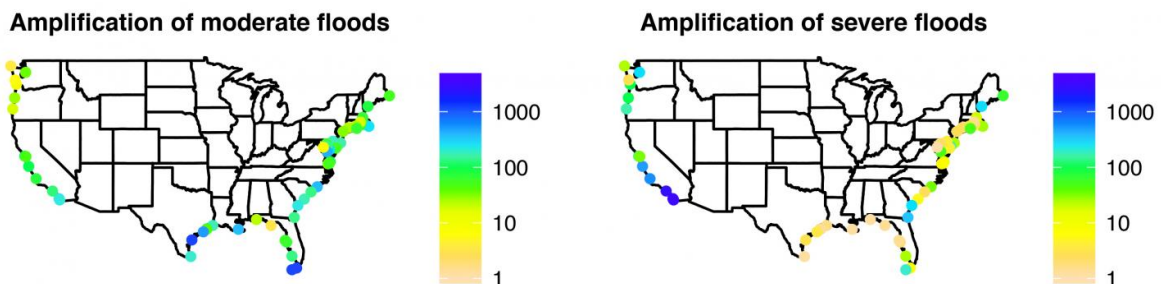


# Rising sea levels will boost moderate floods in some areas, severe floods in others

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Researchers at Princeton and Rutgers universities found that sea-level rise will boost the number of moderate and severe coastal floods by different amounts based on the location around the country. In the image, which predicts flooding levels 50 years from now under a scenario with no serious reductions in greenhouse gas emissions, the beige and yellow colors mean little amplification of existing flooding episodes, while blue and purple colors mean hundreds to thousands of times more floods. The southeastern city of Charleston, South Carolina, which is subject to more frequent and severe floods than the northwest, will see an increase in the number of moderate floods as shown in the left panel by the green dot, but a smaller increase in the number of severe floods as shown in the right panel by the yellow dot. The northwestern city of Seattle, which currently experiences few severe floods, will experience little amplification of moderate floods as shown in the left panel by the yellow dot, but a larger amplification in severe floods, as shown in the right panel by the green dot.

Credit: Maya Buchanan, Princeton University

Rising seas are making flooding more common in coastal areas around the country. Now, a new study finds that sea-level rise will boost the occurrence of moderate rather than severe flooding in some regions of the United States, while in other areas the reverse is true.

The study by researchers at Princeton and Rutgers universities found that along the southeastern coast, where severe flooding due to hurricanes is relatively frequent, cities such as Charleston, South Carolina, will see a disproportionate increase in moderate flooding. However, areas that have little history of severe flooding, such as Seattle, are likely to experience a greater uptick in the number of severe, or even historically unprecedented, floods.

The study, published June 7 in the journal *Environmental Research Letters*, looked at how climate-driven [sea-level](#) rise is likely to amplify coastal flooding—which already costs municipalities along the East and Gulf coasts \$27 billion annually—over the next 50 to 100 years.

Improving the accuracy of flooding estimates is important as coastal cities and states take actions to protect themselves against future storms, according to Michael Oppenheimer, Princeton's Albert G. Milbank Professor of Geosciences and International Affairs. "To make these decisions, local governments need an understanding of the frequency with which extreme floods will return in the future," Oppenheimer said. "A key element is getting the science right, and that was our main objective in this study."

The researchers sought to improve the accuracy of a set of [flood](#) predictions included in a 2013 Intergovernmental Panel on Climate Change (IPCC) report. That analysis did not consider the possibility that sea-level rise might amplify some levels of flooding more than others.

"Treating the change in flood risk due to sea-level rise as the same at all

levels of flooding oversimplifies the flood hazard characterization and could lead to costly policy missteps," said Maya Buchanan, the first author on the study and a doctoral student in Princeton's Woodrow Wilson School of Public and International Affairs.

The new study combined historical data on flood-heights collected at tide gauges with estimates of local sea-level changes developed previously by study co-author Robert Kopp, professor of earth and planetary science at Rutgers, and other colleagues.

Sea level is an important factor in the frequency and amount of [coastal flooding](#) because even modest increases can cause floods to inundate larger areas of land, or submerge areas more deeply. "For example, to produce a six-foot flood," Kopp said, "if the ocean is a foot higher, you only need as much storm surge as you would have previously needed to produce a five-foot flood."

The researchers calculated the "amplification factor"—the amount by which a given rise in sea level drives the increase in the number of floods—for numerous locations around the country. "The amount of sea-level rise that occurs will change the number of both moderate and severe floods," Buchanan said. "Climate change-driven sea-level [rise](#) is usually thought of as slow and steady, but actually a relatively small amount of increase in sea level can amplify the flood level significantly."

The study suggests that cities like Seattle will need to prepare for largely unprecedented, severe flooding, while other areas may need to prepare especially for more common but less severe events. For example, if current carbon emissions continue, by 2050 a moderate flood—of the size that historically has occurred approximately every ten years—would recur 173 times more often in Charleston but only 36 times more often in Seattle. A severe flood, defined as occurring about once every 500 years, would happen six times as often in Charleston but 273 times as

often in Seattle.

"We hope that this study provides additional information that cities and municipalities can use to start planning the defense against [climate change](#) and [sea-level rise](#)," said Oppenheimer, who serves as an adviser on the New York City Panel on Climate Change. "This is especially important as federal programs for planning for climate adaptation are on the chopping block." Oppenheimer and Kopp were also authors of the most recent report of the IPCC.

**More information:** Maya K Buchanan et al, Amplification of flood frequencies with local sea level rise and emerging flood regimes, *Environmental Research Letters* (2017). [DOI: 10.1088/1748-9326/aa6cb3](https://doi.org/10.1088/1748-9326/aa6cb3)

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