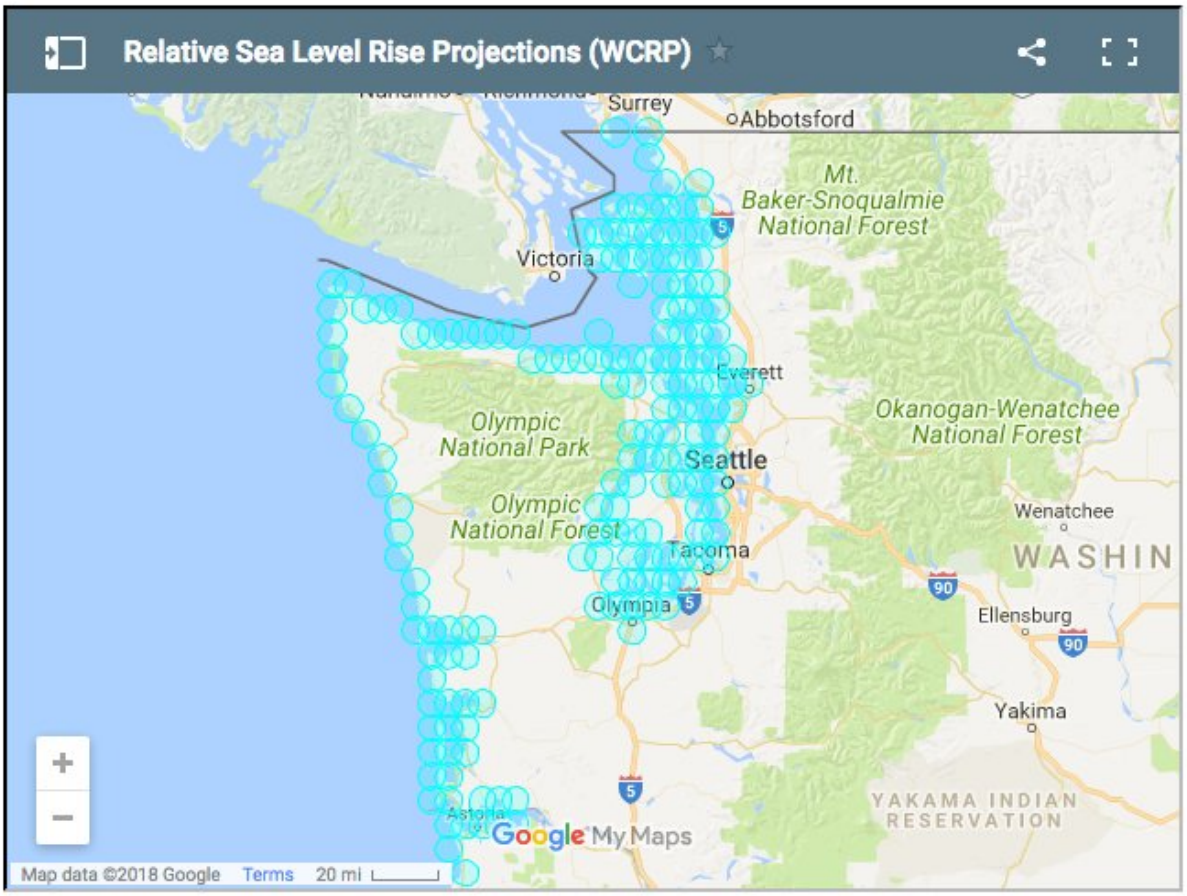
Sea-level rise report contains best projections yet for Washington's coasts

July 31 2018, by Hannah Hickey



The new report combines sea-level rise projections with specific geologic land motion at 171 sites along Washington's coast.Projected Sea Level Rise for Washington State - 2018 Assessment. Credit: University of Washington

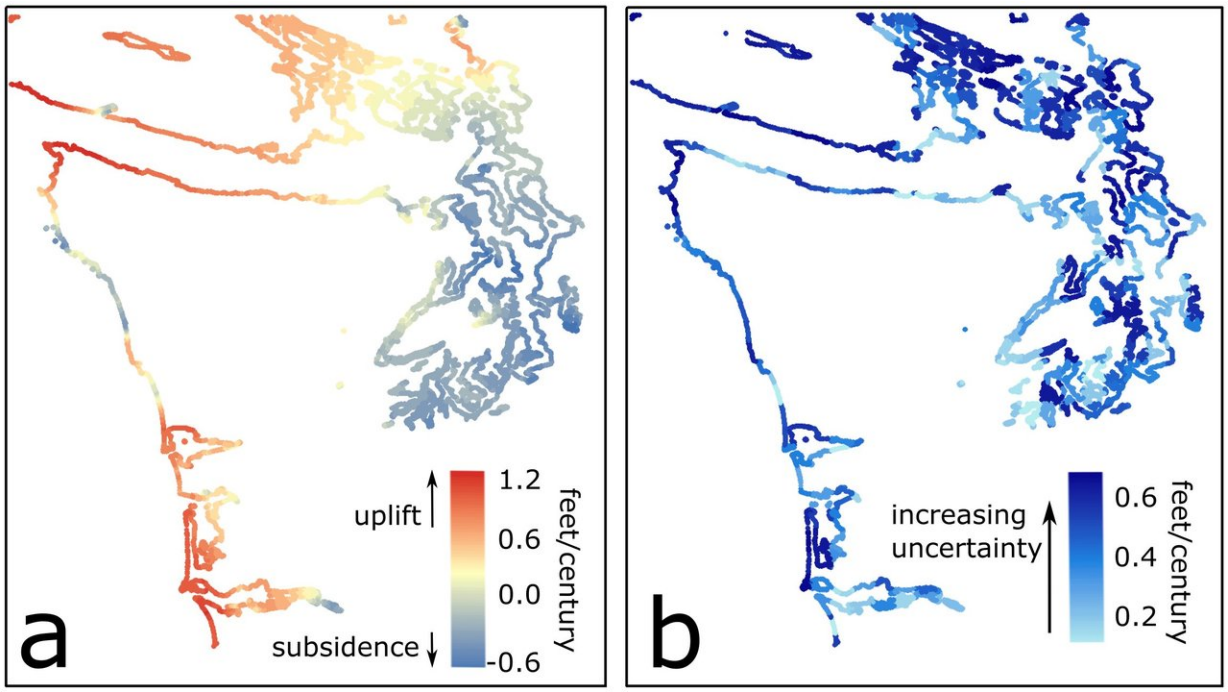
One certainty under climate change is that global ocean levels are rising. A new report led by Washington Sea Grant and the University of Washington's Climate Impacts Group provides the clearest picture yet of what to expect in Washington state.

The report includes projections for more than 150 different sites along the Washington coastline, from all marine shorelines in Washington state. It incorporates the unique geology-driven land motion, with uplift at Neah Bay and sinking in Seattle. And it provides the latest, probabilistic estimates to let planners weigh the risks of different scenarios.

The projections, posted online July 30, include an embedded Google map where anyone who is involved with planning projects along the coast can download estimates for their location.

"One of the things we've heard from the planners we have shown it to so far is 'Hey, for the first time we have something that we feel is actionable,'" said first author Ian Miller, a coastal hazards specialist at Washington Sea Grant. "I hope we're going to hear that more, and that these projections will find their way into planning processes at the community scale."

The new report provides probabilistic estimates for 171 coastal sites each decade from now until 2150. The analysis follows two previous assessments of sea-level rise in the state: the 2012 national report for sea-level rise in Washington, Oregon and California, and a 2008 report led by the UW Climate Impacts Group. In addition to updating the science, the new report offers more detail on what to expect at specific locations.



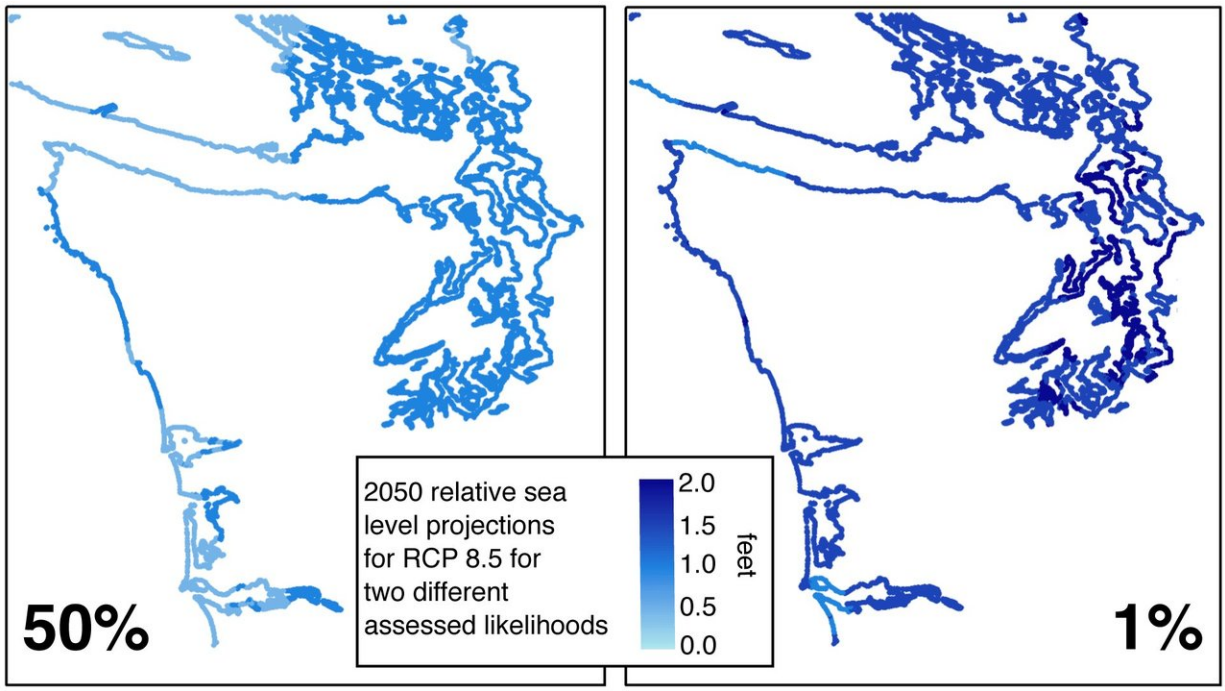
The left panel shows where Washington's coast is rising (red) or sinking (blue) due to geologic activity. The right panel shows the amount of uncertainty in that estimate, which affects the certainty of predicting the effects of rising seas. Credit: Projected Sea Level Rise for Washington State - 2018 Assessment

The study follows a 2015 UW report on how climate change will affect Puget Sound. This new study provides much greater detail about sea-level rise, both in Puget Sound and along the coast.

"Previous assessments were zoomed out, and were not fine-scale enough to capture the variations in land movement along the coastlines," said second author Harriet Morgan, a research consultant with the UW Climate Impacts Group. "Neah Bay is rising, and south Puget Sound is sinking. That up and down movement has a pretty big influence on how far the ocean will be able to travel inland."

The numbers also offer the first probabilistic projections for sea-level rise in Washington state. Instead of just giving low, medium and high estimates, the authors applied a recently developed method that calculates the percent chance that a given water level will be exceeded, allowing planners to decide how they want to respond to, for instance, a water level with a 1 percent chance of occurring by a given year.

"There are two factors that determine what steps a community might take to adapt, and both really need to be decided at the local level. First, what is the context—is it a hospital or other piece of critical infrastructure, or is it a park? That's your risk tolerance. And second, what is your value judgment of the amount of risk that's acceptable?" said third author Guillaume Mauger, a research scientist at the Climate Impacts Group.



When factoring in geologically-driven vertical land motion, the projected sea-level rise in Washington state by 2050 with higher future emissions shows

differences depending on the location. The left panel shows the central estimate, with a 50 percent probability that seas will meet or surpass this level, and the right panel is the 1 percent probability scenario. Credit: Ian Miller/Washington Sea Grant

The new report is part of the Washington Coastal Resilience Project, a three-year effort funded in 2016 by the National Oceanic and Atmospheric Administration. The larger project includes collaborations with partners at Island County, which covers Whidbey Island and Camano Island, and the City of Tacoma to incorporate climate change in coastal plans.

Report authors have been working with governments to incorporate these new numbers into their coastal plans, and with other state and environmental groups to consider sea-level rise projections in their coastal restoration projects.

Overall, the new report gives a statewide estimate for about 1.5 feet of sea-level rise by 2100 if we manage to limit future greenhouse emissions. The upper bound for 2100, with emissions reductions, is about 7 feet, incorporating the latest science on Antarctic glaciers that increases the amount of possible sea-level rise under certain scenarios.

Future sea-level rise is inevitable from the amount of greenhouse gases already emitted, but longer-term estimates depend on how much we will be able to limit future emissions. On top of these big-picture uncertainties, Washington state's complex coastline and geologic activity create more unknowns for coastal communities.

PROJECTED RELATIVE SEA LEVEL CHANGE FOR 2100
(feet, averaged over a 19-year time period)

Location	Vertical Land Movement Estimate	Greenhouse Gas Scenario	Central Estimate (50%)	Likely Range (83-17%)	Higher magnitude, but lower likelihood possibilities		
					10% probability of exceedance	1% probability of exceedance	0.1% probability of exceedance
Tacoma (47.3N, 122.4W)	-0.5 ± 0.2	Low	2.1	1.5-2.7	3	4.6	7.9
		High	2.5	1.9-3.3	3.6	5.3	8.8
Neah Bay (48.4N, 124.6W)	1.1 ± 0.3	Low	0.5	-0.1 - 1.2	1.5	3.1	6.3
		High	1	0.3 - 1.7	2	3.8	7.4
Taholah (47.4N, 124.3W)	0.3 ± 0.5	Low	1.3	0.6-2.1	2.4	3.9	7.1
		High	1.7	1.0-2.6	2.9	4.6	8.1

This table shows the projections for feet of sea-level rise by 2100, taking into account geologically-driven vertical land motion, at three locations on Washington's coasts: Tacoma, Neah Bay and Taholah on the Quinault River. The white rows are for lower future emissions, and the yellow rows are for higher future emissions. Columns on the right are less likely, but still possible, scenarios, with the percent chance that each one could occur. Credit: Projected Sea Level Rise for Washington State - 2018 Assessment

When working with the Jamestown S'Klallam Tribe on coastal planning, Miller saw some of the frustrations of working with low, medium and high projections while not knowing how to weigh the various risks. Communities on the coast are also aware that the land is being pushed up by the offshore geologic fault, but were unsure how much that would counteract rising seas.

"People in our coastal communities are aware that we have vertical land movement, and that has led to misconceptions about whether we need to worry about climate-driven sea-level rise," Miller said. "It's important to include, because if you don't, it leaves that lingering possibility in people's minds."

Provided by University of Washington

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