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New study triples global estimates of population threatened by sea level rise

Research finds hundreds of millions more people than previously known live on land at risk from coastal flooding linked to climate change; largest vulnerable populations concentrated in Asia

Princeton, NJ--Oct. 29, 2019--By 2050 sea level rise will push average annual coastal floods higher than land now home to 300 million people, according to a Climate Central study [published today in *Nature Communications*](#). And high tide lines could permanently rise above land occupied by some 150 million, including 30 million in China. Without existing, augmented or new coastal defenses, populations in these areas may face regular flooding or permanent inundation within 30 years.

These findings are based on CoastalDEM, a new digital elevation model developed by Climate Central. Researchers used machine learning methods to correct for systematic errors in the principal elevation dataset used until now for international assessment of coastal flood risks, NASA's Shuttle Radar Topography Mission (SRTM). CoastalDEM-derived estimates of the global population at risk are three times greater than values produced using SRTM elevation data.

CoastalDEM is not the most accurate source of elevation data for the U.S. Climate Central has previously published more accurate [risk zone maps](#) for U.S. coastal locations based on publicly accessible, lidar-derived elevation data.

The [published study](#) as well as a [research brief](#) from Climate Central detail findings from individual assessments of 135 countries across multiple climate scenarios and years. Climate Central also used its new elevation data to produce [interactive maps](#), enabling neighborhood-level exploration of threatened areas around the world.

Asian countries see biggest increases in threatened land

Assessments based on improved elevation data find that even with moderate reductions in greenhouse gas emissions, areas within six Asian countries (China, Bangladesh, India, Vietnam, Indonesia, and Thailand) where 237 million people live today could face annual coastal flooding threats by 2050, roughly 183 million more than assessments based on prevailing elevation data:

People on land at risk of annual coastal flooding by 2050 (moderate emissions reductions)		
Ranking	Country	Assessment based on CoastalDEM vs. prevailing elevation data
1	China	93 million vs. 29 million
2	Bangladesh	42 million vs. 5 million
3	India	36 million vs. 5 million
4	Vietnam	31 million vs. 9 million
5	Indonesia	23 million vs. 5 million
6	Thailand	12 million vs. 1 million

By 2100, if these assessments factor-in unchecked emissions and the potential for early-onset ice sheet instability, they find that in those six countries, land where 250 million now live will fall below the high tide line, almost five times more than assessments based on prevailing elevation data:

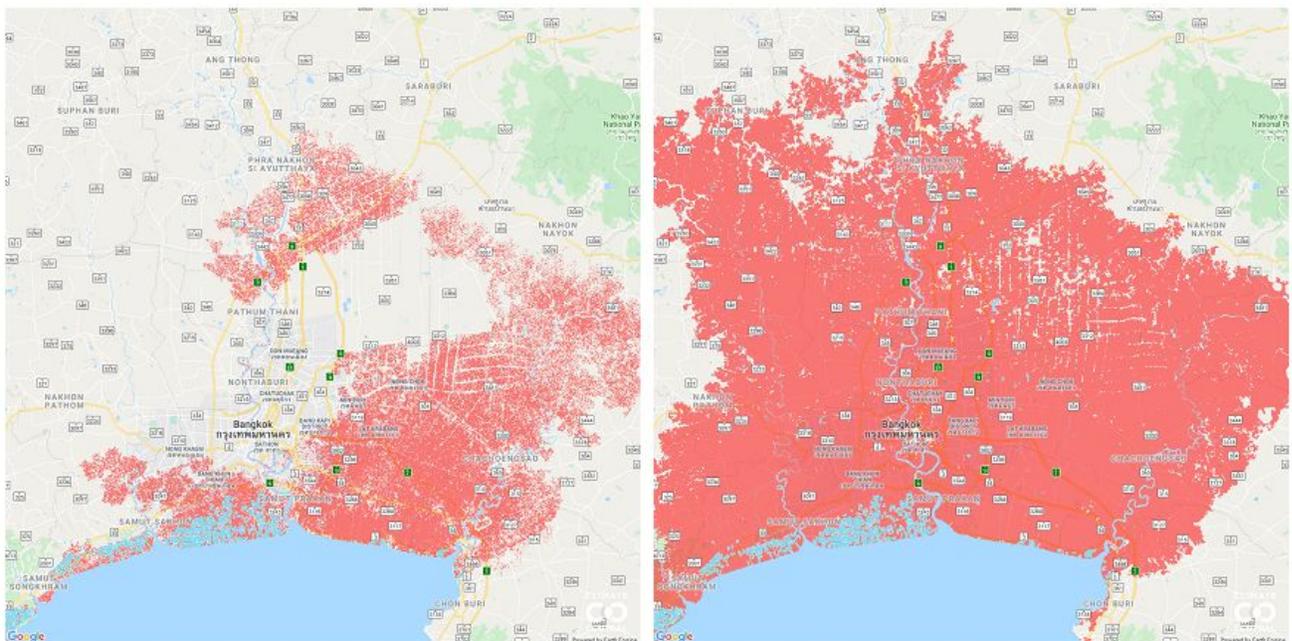
People on land at risk of falling below high tide lines by 2100 (unchecked emissions)		
Ranking	Country	Assessment based on CoastalDEM vs. prevailing elevation data
1	China	87 million vs. 26 million
2	Bangladesh	50 million vs 6 million
3	India	38 million vs. 6 million
4	Vietnam	35 million vs. 13 million
5	Indonesia	27 million vs. 6 million
6	Thailand	13 million vs. 2 million

“These assessments show the potential of climate change to reshape cities, economies, coastlines, and entire global regions within our lifetimes,” said Dr. Scott Kulp, a senior scientist at Climate Central and lead author of the study. “As the tideline rises higher than the ground people call home, nations will increasingly confront questions about whether, how much, and how long coastal defenses can protect them.”

Some of the vulnerability revealed by Climate Central's research already exists today, as sea walls, levees, and other coastal defenses allow as many as 110 million people to live on land below the high tide line. The study did not account for the impact of current or potential future defenses due to lack of data.

How CoastalDEM Identifies a Greater Threat

The main elevation dataset used for global coastal research, SRTM, measures elevations of surfaces closest to the sky, such as treetops and rooftops whenever they block the ground. As a result, it overestimates coastal elevations by more than two meters (six feet) on average, and more than four meters (13 feet) in high-density urban areas, indicating false safety from floods and sea-level rise. CoastalDEM reduces these errors to the vicinity of ten centimeters (four inches) on average.



Improved elevation data from CoastalDEM significantly expands the area around Bangkok, Thailand (in red) expected to experience, on average, once-a-year coastal flooding by 2050

A handful of nations have collected and published more precise elevation data, generally based on airborne lidar; CoastalDEM was calibrated and validated using mainly these data.

“It turns out that for most of the global coast, we somehow didn’t know the height of the ground beneath our feet,” said Dr. Benjamin Strauss, chief scientist and CEO of Climate Central and co-author of the study. “We were shocked to find how much more vulnerable our coasts are than researchers had previously thought. But this also means there are much greater benefits to reducing climate pollution and slowing sea level rise.”

Threat Level Depends Upon Carbon Emissions

By the end of this century, assessments based on CoastalDEM find that without defenses, land now home to as many as 420 million people worldwide could be vulnerable to annual coastal floods, even if moderate cuts to carbon emissions are achieved. The estimates summarized here are likely to be conservative because they are based on standard sea-level projections and reductions in carbon emissions roughly in line with 2015 Paris Agreement targets, which worldwide efforts to date are not on track to achieve. Estimates based on unchecked emissions and the potential for early-onset ice sheet instability project that sea level rise could threaten areas where as many as 630 million people now live--340 million of whom are on land forecast to fall below the high tide line by 2100.

About Climate Central

Climate Central is a non-profit science and news organization providing authoritative information to help the public and policymakers make sound decisions about climate and energy. Climate Central is making a version of CoastalDEM freely available for noncommercial use including research and humanitarian efforts.

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