Tides may regularly swamp many U.S. cities as sea levels climb, even Washington, D.C., could see more frequent and more widespread flooding at high tide

by Sid Perkins - January 23, 2015

Strong storms and high winds sometimes bring floods to coastal areas. But more and more often, cities and towns along the U.S. East Coast are flooding even in calm, sunny weather. At Maryland's capital — Annapolis, tourists must sometimes wade through water flooding downtown streets surrounding the harbor.

All are suffering from a simple evolving trend — normal high tides stacked atop an ever-rising sea level. Sea level has climbed, on average, about 20 centimeters (8 inches) over the past 135 years. And a sharp increase in tidal flooding is one of the more visible impacts affecting many coastal areas, notes William Sweet. He's an oceanographer with the National Oceanic and Atmospheric Administration, or NOAA, in Maryland.

He and his co-workers recently analyzed data from 45 tide gauges along U.S. coasts. These sensors record the ever-changing heights of tides as they rise and fall. From these data, Sweet's team tallied the number of "nuisance floods" in various coastal cities. These floods, Sweet explains, typically occur when water level is about 1 foot above the historic level of the highest high tides. In June 2014, the team reported finding a growing rise in these flooding events. Annapolis saw a big increase. From 1957 to 1963, Annapolis nuisance floods hit that city roughly 3.8 days per year. From 2007 to 2013, the yearly average was 10 times higher — a whopping 39.3 days.

And this trend is growing. Over the next few decades, climate change is poised to drive sea levels even higher, Sweet says. So today's flooding problems promise to become only more widespread and more frequent. Sooner or later, says Sweet, nuisance floods "are something that all coastal communities are going to have to deal with."

Get ready

Sea level is rising for two main reasons. Both relate to climate change. To start, as global temperatures have been rising, ice sheets and glaciers worldwide have, on average, tended to melt faster than they're growing. The resulting meltwater has been flowing downhill into the oceans. Secondly, the oceans are growing warmer. And water expands as it warms.

Scientists disagree about how much our planet will warm in coming years. That means there are a range of estimates for how much and how quickly sea level will rise. For their new report, Spanger-Siegfried picked a mid-range estimate to use in their calculations. According to that scenario, sea level will rise, on average, about 5 inches by 2030. Fifteen years later, global average sea level could be around 11 inches higher than it is today. But the water won't rise equally everywhere. In some coastal areas, the steady upward creep of sea level will seem to rise faster. That's because some coastal areas are sinking. The scientific term for this is *subsidence*.

"Several decades ago, flooding at high tide was simply not a problem," says Melanie Fitzpatrick. But these days, she notes, flooding at high tide has become common. When flooding closes a road, it can keep people from their homes, schools, offices or stores. This may not be life-threatening, but can disrupt the life of a city.

Tides are caused by the gravitational pulls of the moon and the sun on the ocean's water. Twice each day, most coastal sites experience a high and a low tide. But high tides don't always rise to the same height. The biggest occur on days near the new and full phases of the moon. That's when the sun, moon and Earth are most closely aligned.

Eight of the 52 communities that the team studied already experience more than two dozen tidal floods each year. Within 15 years the team expects 30 of the locales will see tidal flooding at least twice a month. A handful of sites will see 100 or more high-tide floods per year. That comes to roughly two nuisance floods per week!

Class Set – Do Not Remove

Thirty years from now, tidal flooding will be widespread, both new studies predict. Fully half of the cities and towns studied will average 100 tidal floods per year. Worse, nine of the locales — including Washington, DC, Wilmington, NC, and Atlantic City, NJ — will see a whopping 240 or more tidal floods per year. That comes, on average, to almost 5 floods a week!

Adapt or retreat

There's no way around it, coastal locations will experience more flooding with each passing year. So, what can these areas do to cope? The proposed solutions can be quite costly and may not even work. And where they do, they may stop working after only a few years.

Charleston, for example, is spending hundreds of millions of dollars to improve drainage along its Market Street. It's in the city's historic district, which attracts many tourists. The city also is building a multimillion-dollar seawall. City officials are banking that it will help protect against future high tides. But seawalls also can prevent rainwater from draining *out* of the city. Such a solution, therefore, might simply trade one type of flooding for another.

New York City has begun work on a $23 million project to improve drainage along three major streets in its Broad Channel neighborhood. That community sits near Jamaica Bay, in the borough of Queens. This area was heavily damaged by Hurricane Sandy. But parts of the neighborhood are prone to flood even in sunny weather. Some streets there flood often, sometimes twice a month or more. And when that happens, residents have to move their cars to higher ground to avoid saltwater damage. But the new project hopes to fix Broad Channel's water **woes**. Construction workers will install a new sewer system. It will include a special drainage system to carry water to the nearby bay. Engineers also will raise the streets, so they flood less often.

Tybee Island is a small community on a low island near Savannah, Ga. Tybee is spending about $450,000 over three years to protect its water-treatment plant. Tybee will raise pumps at the plant, as well as the electronic equipment needed to control those pumps. This should better protect the devices from floods, he said. Engineers also are adding special valves in the pipes that carry treated water to the sea. Those valves will keep seawater from flowing backward during flood events so that they no longer can enter pipes to the treatment plant. Other plans for Tybee Island include raising roads and bridges, and maybe even lifting houses onto stilts.

Many other cities and towns are considering equally drastic solutions to address their own problems. In some places, engineers are considering large gates to help hold the highest floods at bay. In other areas, cities are building large pools to hold water during tidal floods. Such pools would decrease flooding by temporarily storing rainwater runoff during and after large storms. (That also would prevent water — and any pollutants it picks up as it travels over streets and the ground — from entering rivers and other drinking-water sources.)

Eventually, of course, rising seas will likely overcome all short term projects designed to protect coastal areas. Indeed, scientists estimate that by 2100, sea levels will rise anywhere between 45 centimeters and 1.92 meters (18 in. and 6.3 feet). While many researchers look for ways to slow climate change, no one yet has come up with a solution to the worst of the flooding expected to accompany it.

COMPLETE THE FOLLOWING IN YOUR SCIENCE NOTEBOOK!

Directions: Answer the following questions in your notebook in complete sentences.

1. What is the title, author and date of the article?
2. On average, how high has the seal level risen over the past 135 years? What does this mean for the rate of floods?
3. Describe the two main reasons for why the sea level is rising.
4. When do the tallest/biggest ocean high tides occur?
5. Describe one way that coastal locations can respond to the threat of increased floods.

Bonus Question

6. Referring to the water cycle and ground water, explain how seawalls can actually cause flooding while trying to prevent tidal flooding.

Finished Early? Ask Mrs. Feldmann for a copy of a puzzle related to this article!