Sea Level Rise - Expectations

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http://ccdatacenter.org/documents/SeaLevelRiseExpectations.pdf

- We should expect an equilibrium sea level rise of about 30 feet if the Earth's average temperature increases 1°C and about 60 feet for 2°C, although it will likely take a thousand years or so to reach equilibrium[1,2]
- We could have between one and two meters of sea level rise by 2100[3,4,5], but the sea level will continue to rise well after 2100 before reaching equilibrium
- Sea levels will rise by different amounts in different parts of the world[4]
- We won't be able to get a good estimate on the expected sea level rise for 2100 until after 2050[3]
- We might consider planning for an average sea level rise of 0.5-1.3 feet by 2050[3], with the amount to plan for varying considerably in different parts of the world
- Flood losses in major coastal cities around the world may exceed $1 trillion dollars per year as a consequence of sea level rise by 2050[6]
- Catastrophic sea level rise is expected over next 20 years[7]
- The coastal property bubble must burst sometime in the not-too-distant future[8,9,10,11]

SL1
A

Sea Level Versus Temperature

L. David Roper 04-Apr-2016

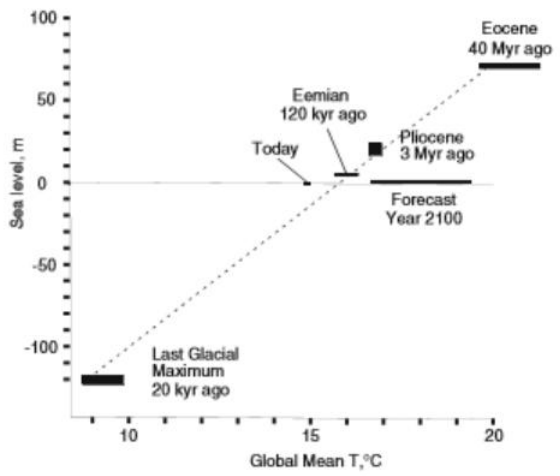
There is a time lag (response time) of up to a thousand years after a temperature change before the equilibrium sea level is reached. The time lag may vary depending on the environmental situation.

Formula for equilibrium sea level change:
L = T (0.54 T2 + 0.39 T + 7.7)

Temperature Change (°C)	0	1	2	3	4	5	6
Sea Level Change (m)	0	9	21	41	72	116	177

http://www.roperld.com/science/sealevelvstemperature.htm

SL1 B



(Figure 3 in "The millennial atmospheric lifetime of anthropogenic CO2" by David Archer & Victor Brovkin - Climatic Change (2008) 90:283–297; https://geosci.uchicago.edu/~archer/reprints/archer.2008.tail_implications.pdf)

There is a clear and strong correlation between long-term global average temperature and sea level in the geologic record. Sea level has the potential to change much more than is forecast for the coming century, and it has done so in the past. The slope of covariation from the geologic record has been 10–20 m/°C. (*Horizontal axis is atmospheric temperture in degrees C)*

Figure 2 "The relationship between sea level and temperature on geologic time scales. Data from (Alley et al. 2005)"

SL1 C

The following table specifies the sea level relative to today for several time periods in the past.

Years before present	Geologic Era/epoch	CO2	Temp relative to 1870 (pre-industrial)	Notes	Sea Level relative to today
54-34 million	Eocene	Thousands - 760PPM	6-14° C warmer	Antarctic ice free	70 meters higher
34 million	End of Eocene	760PPM	6-8° C warmer	Antarctic ice free	70 meters higher
34 million	Start of Oligocene	600PPM	4-6° C warmer	Start of Antarctic glaciation	70 meters higher
130,000-115,000	Eemian	300 PPM	2-3° C warmer		4-6 meters higher
18,000	Last Glacial Maximum	180PPM	8° C cooler		130 meters lower

http://ccdatacenter.org/documents/Sea Level Rise.pdf

SL1 D

Time Period	**Description**
20,000 -8,000 Years ago	From maximum ice extent in last ice age to about when the seas stopped rising
Last 7,000 years	Starting when the climate and sea level became relatively stable
Last 140 years	When CO2 concentrations began rising (also the first year on the chart for sea level rise)
Last 22 Years (1993-2015)	Reasonably accurate data is available from satellite observations

	20,000 -8,000 Years ago	**Last 7,000 Years to 1850**	**Last 140 years**	**Last 22 Years (1993-2015)**	**If all ice melts**
Sea Level Rise (SLR)	120 meters 400 feet	4 meters	230 mm 9 inches	70 mm 2.76 inches	70 meters 220 feet
Temperature Increase	8° C 14° F	0	1.0° C 1.8° F	0.25° C 0.45° F	6°C 11°F
SLR per degree	15 meters/°C 30 feet/° F	N/A	N/A	N/A	11 meters/°C 20 feet/° F
Average SLR/Year	10 mm	0.57 mm	1.8 mm	3.38 mm	

	.39 inches	0.02 inches	0.07 inches	0.133 inches		
Temp increase/ 100 years	0.075 °C 0.135 ° F	-0.1 °C	0.71° C 1.28° F	1.5° C 2.7° F		
CO2 Concentration Change	100 PPM (180-280) (55% increase)	20 PPM (260-280)	125 PPM (275-400) (45% increase)	43 PPM (357-400)		
CO2 Average change/100 years	< 1 PPM < 1%	.29 PPM	90 PPM 32%	195 PPM 55%		

http://ccdatacenter.org/documents/Sea Level Rise.pdf

SL2

At Least 20-75 Feet of Sea Level Rise Already Locked In? Putting Climate Central's Surging Seas Into Context

"There are some recent modeling efforts that now show you could get a section of the Antarctic ice sheet, several meters worth of sea level rise, to go in a decade. We used to think it was centuries." — Andrea Dutton Geochemist at the University of Florida.

Recent reports out from Climate Central and supported by the work of experts show that a sea level rise of at least 6 meters could already be locked in.

water in a 6 meter rise to set off a mass migration of hundreds of millions away from the world's coasts (just 1.1 meters is enough to flood out 150 million people)

we find that this year peak monthly CO2 levels hit near 404 parts per million. It's a value fast approaching the top of this key greenhouse gas's range during the Pliocene around 3.5 million years ago. A time when temperatures were 2-3 degrees Celsius hotter and sea levels were between 25 and 75 feet higher than they are today.

As a result of this additional accumulation of methane and other gasses, this year's atmosphere is a closer allegory to past atmospheres containing an equivalent of about 484 parts per million CO2 (CO2e). Such times, occurring 15-25 million years ago, hosted sea levels that were more than 100 feet (and possibly as much as 200 feet) higher than today. [A possible analogy if we stopped burning coal and unleashed 1DC being masked by aerosols]

Due to the long term warming impact of CO2 and other greenhouse gasses on the climate system in total, each 1 C worth of warming this Century implies about 2 C worth of warming long term (ESS sensitivity). So hitting the 2 C target by 2100 gets you to 4 C after many Centuries. And hitting a 550 parts per million CO2e threshold means about 2.7 to 2.9 C 21st Century warming and 5.5 to 5.8 C long term warming. An upper range that is nearly enough to melt all the land ice on Earth and raise sea levels by nearly 240 feet.

https://robertscribbler.com/tag/catastrophic-sea-level-rise/

SL3

Scientists can't tell whether sea-level rise will be bad or catastrophic
by Sarah DeWeerdt | Dec 19, 2017

But we won't have a good idea of just how much the waters will rise for another few decades.
The researchers, led by Robert Kopp of Rutgers University, calculated how the retreat of Antarctic ice sheets might affect global sea level rise through the year 2300 given different levels of carbon emissions.

Global average sea level could rise over two meters by the year 2100 with continued high carbon emissions, and over a meter and a half with moderate emissions, the researchers found.

But keeping carbon emissions in check could prevent catastrophic breakup of Antarctic ice sheets from inundating the rest of the planet. The new study's estimates of sea-level rise under a low-emissions scenario are similar to those of past analyses.

Therefore, there isn't much correlation between sea-level rise in the early decades of the 21st century and sea-level rise at century's end. Finding that we seem to be on a trajectory of moderate sea-level rise in the near future doesn't exclude the possibility of extreme sea-level rise later on.

"There's a lot of ambiguity in post-2050 projections of sea-level rise and we may have to live with that for a while," says Kopp. "We could end up with 8 feet of sea level-rise in 2100, but we're not likely to have clear evidence for that by 2050."

Their calculations suggest that sea-level rise will be a lot worse than past studies have estimated, especially in high- and moderate-emissions scenarios. The difference is due largely to loss of Antarctic ice sheets.

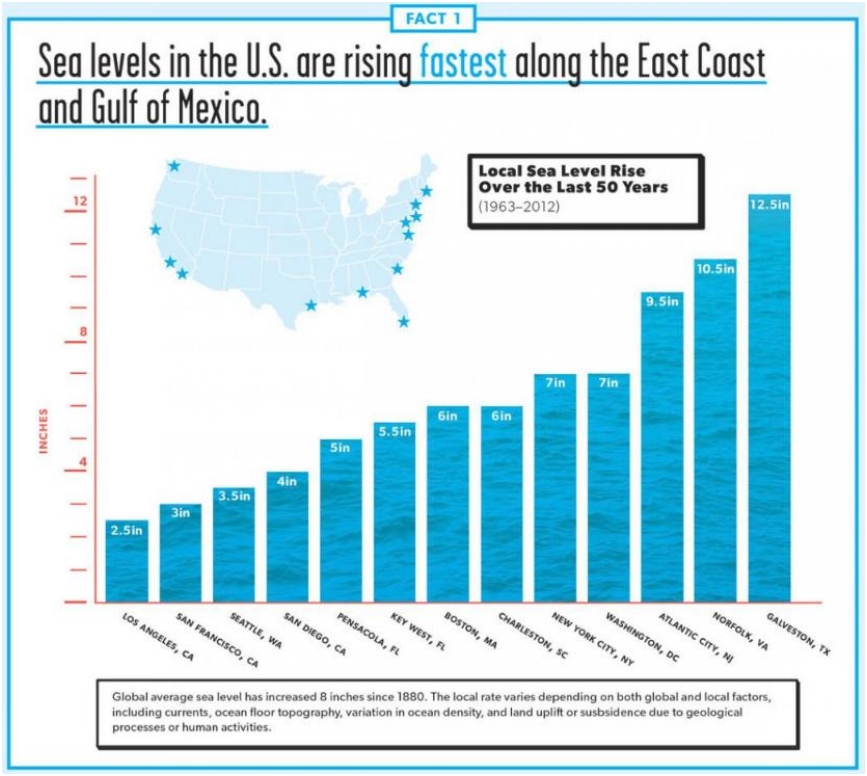
in the new model, the effects of Antarctic ice sheet loss don't really kick in until after 2050

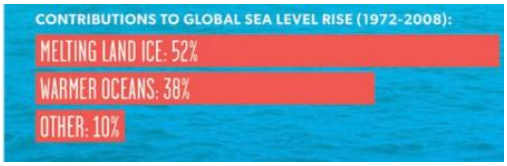
But the new study suggests that we may not have such warning when it comes to sea-level rise. A few decades is close to instantaneous from the perspective of human infrastructure: By the time we know how many feet of water are coming, there may not be time enough for us to adapt.

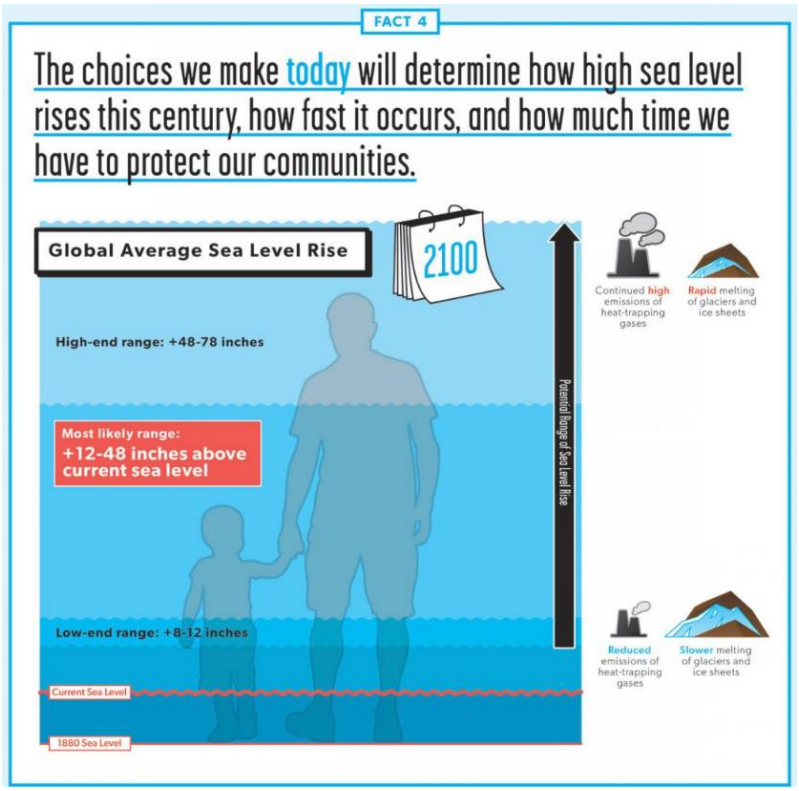
The researchers suggest what Kopp terms a "flexible approach" to sea-level rise: "building for the half foot to 1.3 feet of sea-level rise that are likely by 2050, while plotting out options that will depend on what we learn in the next few decades and how sea level rises beyond that."

http://www.anthropocenemagazine.org/2017/12/scientists-cant-tell-whether-sea-level-rise-will-be-bad-or-catastrophic/

SL4







https://www.ucsusa.org/global_warming/science_and_impacts/impacts/infographic-sea-level-rise-global-warming.html#.W0YabdVKiUk

SL5	**Climate Science Special Report** Fourth National Climate Assessment (NCA4), Volume I Chapter 12: Sea Level Rise **Key Finding 1** Global mean sea level (GMSL) has risen by about 7–8 inches (about 16–21 cm) since 1900, with about 3 of those inches (about 7 cm) occurring since 1993 *(very high confidence).* Human-caused climate change has made a substantial contribution to GMSL rise since 1900 *(high confidence)*, contributing to a rate of rise that is greater than during any preceding century in at least 2,800 years *(medium confidence)*. **Key Finding 2** Relative to the year 2000, GMSL is very likely to rise by 0.3–0.6 feet (9–18 cm) by 2030, 0.5–1.2 feet (15–38 cm) by 2050, and 1.0–4.3 feet (30–130 cm) by 2100 *(very high confidence in lower bounds; medium confidence in upper bounds for 2030 and 2050; low confidence in upper bounds for 2100)*. Future pathways have little effect on projected GMSL rise in the first half of the century, but significantly affect projections for the second half of the century *(high confidence)*. Emerging science regarding Antarctic ice sheet stability suggests that, for high emission scenarios, a GMSL rise exceeding 8 feet (2.4 m) by 2100 is physically possible, although the probability of such an extreme outcome cannot currently be assessed. Regardless of pathway, it is extremely likely that GMSL rise will continue beyond 2100 *(high confidence)*. **Key Finding 3** Relative sea level (RSL) rise in this century will vary along U.S. coastlines due, in part, to changes in Earth's gravitational field and rotation from melting of land ice, changes in ocean circulation, and vertical land motion *(very high confidence)*. For almost all future GMSL rise scenarios, RSL rise is likely to be greater than the global average in the U.S. Northeast and the western Gulf of Mexico. In intermediate and low GMSL rise scenarios, RSL rise is likely to be less than the global average in much of the Pacific Northwest and Alaska. For high GMSL rise scenarios, RSL rise is likely to be higher than the global average along all U.S. coastlines outside Alaska. Almost all U.S. coastlines experience more than global mean sea level rise in response to Antarctic ice loss, and thus would be particularly affected under extreme GMSL rise scenarios involving substantial Antarctic mass loss *(high confidence)*. **Key Finding 4** As sea levels have risen, the number of tidal floods each year that cause minor impacts (also called "nuisance floods") have increased 5- to 10-fold since the 1960s in several U.S. coastal cities *(very high confidence)*. Rates of increase are accelerating in over 25 Atlantic and Gulf Coast cities *(very high confidence)*. Tidal flooding will continue increasing in depth, frequency, and extent this century *(very high confidence)*. **Key Finding 5** Assuming storm characteristics do not change, sea level rise will increase the frequency and extent of extreme flooding associated with coastal storms, such as hurricanes and nor'easters *(very high confidence)*. A projected increase in the intensity of hurricanes in the North Atlantic *(medium confidence)* could increase the probability of extreme flooding along most of the U.S. Atlantic and Gulf Coast states beyond what would be projected based solely on RSL rise. However, there is low confidence in the projected increase in frequency of intense Atlantic hurricanes, and the associated flood risk amplification and flood effects could be offset or amplified by such factors as changes in overall storm frequency or tracks
SL6	**What is the Cost of One Meter of Sea Level Rise?** SEAN VITOUSEK, GUEST COMMENTARY, | JULY 19, 2017, 9:48 AM EDT Sea level rise will: • Challenge the very existence of low-lying island nations throughout the world • Dramatically increase the frequency of both nuisance and extreme flooding • Create widespread beach and cliff erosion, damaging coastal property and infrastructure • Make flood insurance unaffordable and unviable • Lead to salt-water intrusion in coastal aquifers, accelerating corrosion of waste- and storm-water drainage systems and affecting water quality and water resources In the executive summary of the 2014 Risky Business report, Michael Bloomberg writes, "With the oceans rising

	and the climate changing, the Risky Business report details the costs of inaction in ways that are easy to understand in dollars and cents—and impossible to ignore." This report finds that the clearest and most economically significant risks of climate change include: • Climate-driven changes in agricultural production and energy demand • The impact of higher temperatures on labor productivity and public health • Damage to coastal property and infrastructure from rising sea levels and increased storm surge For example, the report finds that in the US by 2050 more than $106 billion worth of existing coastal property could be below sea level. Furthermore, a study in Nature Climate Change found that future flood losses in major coastal cities around the world may exceed $1 trillion dollars per year as a consequence of sea level rise by 2050. https://blog.ucsusa.org/guest-commentary/what-is-the-cost-of-one-meter-of-sea-level-rise
SL7	**Catastrophic Sea Level Rise Expected Over Next 20 Years** by Bob Frerck Millions face risk from catastrophic sea level rise that is predicted to inundate coastal areas around the world over the next twenty years. In Asia alone, over 150 million persons could be displaced while Africa could witness 34 million fleeing the threat of floods. Smaller island nations may simply disappear under the waves. A study by the Potsdam Institute for Climate Impact Research predicts that the numbers could be even higher if population growth is included. Plans to boost coastal flood defenses are urgently needed, however many of the most effected populations are from poor countries that do not have adequate resources. (photo – Reuters) https://blueocean.net/catastrophic-sea-level-rise-expected-over-the-next-20-years/
SL8	**The trillion-dollar coastal property bubble is ready to burst, per new study** JOE ROMM APR 23, 2018, 2:02 PM We are now seeing "a pricing signal from climate change" in the relatively depressed prices for the coastal property most at risk for flooding, as Harvard real-estate professor Jesse Keenan told the Wall Street Journal Friday. A second, broader study, "Disaster on the Horizon: The Price Effect of Sea Level Rise," found that "Homes exposed to sea level" are being priced 7 percent lower than homes that are the same distance from the beach, but that are less exposed to flooding. A 2014 Reuters analysis of this "slow-motion disaster" calculated there's almost $1.25 trillion in coastal property whose value is being propped up by the National Flood Insurance Program's below-market rates. Sean Becketti, the chief economist for mortgage giant Freddie Mac, warned in 2016 that the coastal property bubble will burst sooner than expected: "Some residents will cash out early and suffer minimal losses. Others will not be so lucky." As Bloomberg put it last April, "Demand and financing could collapse before the sea consumes a single house." The studies discussed above make clear that process may already be starting. Given that the coastal property bubble must burst sometime in the not-too-distant future — and that the early sellers of overpriced coastal property will do a lot better than the later ones — the initial deflation we're now seeing may well hasten the inevitable sell-off. https://thinkprogress.org/rising-seas-hit-u-s-coastal-property-values-a-pricing-signal-from-climate-change-848bf4e7443b/
SL9	**South Florida's Real Estate Reckoning Could Be Closer Than You Think** By Chrstopher Flavelle December 29, 2017, 4:00 AM EST

	But it's not hurricanes that have Kipnis worried about the local real estate market. Rather, it's the seemingly endless construction—elevating roads, installing new stormwater drains, and other projects—designed to lessen the impact of sea-level rise. And then there are the property taxes required to pay for all that work: Miami Beach's plans are set to cost as much as $500 million. Slap said the increase in his business shows that buyers are starting to become more aware of the problem—and as that happens, housing values will fall. And he said it's only a matter of time before real estate agents are required by law to reveal those flood risks, noting that the U.S. House of Representatives passed a bill to that effect in 2017. The Senate has yet to take it up. The alternative is a housing market kept afloat by "systemic fraudulent nondisclosure," Slap said. "Which is pretty much what we have now." The noise and inconvenience of that work pushed Kipnis to try to sell his house. But he worries that the same things which make him want to leave are also scaring off buyers. After 18 months on the market, and despite dropping the price by more than one-third from $3.2 million, Kipnis still hasn't sold his home https://www.bloomberg.com/news/features/2017-12-29/south-florida-s-real-estate-reckoning-could-be-closer-than-you-think
SL10	**Coastal Cities Are Increasingly Vulnerable, and So Is the Economy that Relies on Them** Gregory Unruh / Harvard Business Review SEPTEMBER 07, 2017 [M]any of our great, low-lying coastal cities are what we call "stranded assets." GreenBiz founder Joel Makower defines a stranded asset as "a financial term that describes something that has become obsolete or nonperforming well ahead of its useful life, and must be recorded on a company's balance sheet as a loss of profit." When the irrational exuberance about the value of coastal real estate pops and thousands of buyers collectively mark down those assets, it will make the housing bubble of ten years ago look like a small blip. And it's not alone: Reuters estimates at least $1.4 trillion in property is sitting within 700 feet of the U.S. shoreline, but the number is much probably larger. The consequences will reverberate through the economy, through society and through the political landscape. Depending on what Hurricane Irma does, we could get a sobering preview of what that will look like. We have already seen the devastation caused by Hurricane Harvey in Houston, a city that was also built on the flawed founding assumption of permanence. Houston's city planners and businesses also ignored warnings as far back as 1996 that climate change would bring exactly the kind of disaster they city is currently suffering today. It's hard to blame them. We've all ignored the warnings. We can't anymore. Business leaders and politicians need to begin wrapping their heads around the big idea that climate change may mean huge financial losses in the world's great coastal metropolises. https://hbr.org/2017/09/coastal-cities-are-increasingly-vulnerable-and-so-is-the-economy-that-relies-on-them
SL11	**The coastal mortgage time bomb** Experts worry that if insurers start to pull out of flood-prone seaside communities, it could cause a crisis worse than 2008 BYBRYAN WALSH DEC 18, 2017 Rising seas, looming crisis A growing number of experts fear that sea level rise and flooding will devastate coastal real estate values, which in

turn could cause the U.S. housing market to suffer a crash worse than 2007-2008 financial crisis.

As seas continue to rise — with levels projected to increase by as much as six feet by the end of the century — flooding will become more common and more devastating. (A recent Zillow report found a six-foot rise in sea level by 2100 would likely submerge 1.9 million homes.)

Eventually insurers could begin to pull out of coastal markets altogether, as could lenders who fear that homes won't be able to retain their value through the lifespan of a 30-year mortgage. Unable to get insurance to repair their repeatedly flooded properties — and tired of navigating the now constant risk of water–homeowners might end up desperate to sell, only to find that no one wants to buy.

The result would be a wave of defaults — while homeowners tried to keep paying their mortgages when their homes were financially underwater during the crisis, they're more likely to give up if their home is actually underwater. They would know that there would be no hope their flooded homes would ever regain value.

"All of a sudden we're going to reach a tipping point and no one will touch these mortgages," says Edward Golding, a fellow at the Urban Institute and the former head of the Federal Housing Administration. "At some point it becomes undesirable risk and people start pulling out from entire regions."

When that happens, coastal communities will enter a death spiral, as property taxes vanish even as the cost associated with responding to ever more frequent floods rises. "You don't need to be too smart to figure out how this affects your tax base," says Philip Stoddard, the mayor of South Miami. "No one is going to buy or invest in the community after that. This is not going to be pretty."

We can't say we haven't been warned. According to Zillow's recent report on sea level rise, in Miami alone, 30 percent of the city's homes could be underwater — sinking over $16 billion property value.

And the impacts of sea level rise would be felt far earlier than the end of the century — a recent study by the Union of Concerned Scientists (UCS) estimates that the number of communities facing chronic inundation from rising seas will nearly double in some 20 years — less than the lifespan of most mortgages. (The environmental group classified "chronic inundation" as flooding that occurs at least 26 times a year over 10 percent or more of a community's usable, non-wetland territory.)

No less than Freddie Mac's chief economist Sean Becketti raised the alarm in 2016 with an article raising concerns that the housing market wasn't prepared for the day when rising seas would puncture a coastal real estate bubble. "We can see this coming and take steps to make sure it's not a crash," says Rachel Cleetus, a senior economist at UCS. "But we have to stop putting our heads in the sand and pretend this isn't coming."

Yet that's exactly what's happening. Despite the warnings about sea level rise — and the object lessons of Hurricanes Harvey, Irma and Maria — coastal real estate is still hot, and the number of Americans living on the coast has increased nearly 45 percent since 1970.

A recent report by Attom Data Solutions found that the riskiest 20 percent of U.S counties have the most homes, the highest average home values and the greatest price appreciation in recent years. Since the end of 2010 media home prices in and around Miami have risen 120 percent, three times the national rate. Nor is this merely a matter of sunny Floridian optimism. New York City, which is just coming off the fifth anniversary of the devastating Superstorm Sandy, has welcomed continued development along its vulnerable waterfront.

Never mind that a recent study projects that within the next three decades, New York could be experiencing Sandy-like flooding every five years. "In general we underestimate the risk from sea level rise even when we can calculate it," says David Titley, director of the Center for Solutions to Weather and Climate Risk at Penn State

University and a former rear admiral in the U.S. Navy.

The difficulty of risk-assessment in coastal regions

It doesn't help that it's difficult for ordinary homebuyers to properly calculate the future risks from flooding and sea level rise. The Federal Emergency Management Agency (FEMA) maintains flood insurance rate maps, and if a property falls within what FEMA defines as a high-risk area for floods, a mortgage borrower must obtain a flood insurance policy — most likely one administered by FEMA itself under the National Flood Insurance Program (NFIP). (Most private insurers do not offer flood insurance, and many coastal communities would already be in dire financial straits without the net of subsidized government flood insurance, which is already billions of dollars in debt.)

But as a recent investigation by Bloomberg showed, many of FEMA's maps are woefully out of date. That's one of the reasons why less than 20 percent of Hurricane Harvey victims had flood insurance, even though the region had been repeatedly pummeled by tropical storms.

Sellers may be motivated to hide past flooding on a property or community — disclosure laws vary from state to state, but the National Association of Realtors (NAR), the nation's largest real estate trade group, says that brokers and agents should disclose "actual knowledge" of previous property flooding or flood insurance purchases to buyers.

In any case, the very nature of climate change means that the past is no longer a reliable guide to future risk. "The Realtors get paid at closing and the builders get paid at closing, but the tail risk is with the homeowner who has equity in a property," says Golding.

But even if richer cities can try to spend enough to protect themselves, that will still leave countless poorer communities in harm's way. The Zillow study that looked at sea level rise found that a third of the homes that would be underwater by 2100 would be valued in the bottom third nationally. These are homes in often sprawling suburban and rural communities that lack the tax base now to pay for meaningful sea level rise defenses — let alone after constant flooding eats away at property values.

"You can easily use up every municipal budget doing the upgrades that need to be done," says Stoddard, the mayor of South Miami. These are the homes that will wash away — and with them, the equity and dreams of hundreds of thousands of Americans.

It's worth noting that in Florida, median home prices with the highest flood risk have risen more slowly over the past five years than those in cities with the lowest flood risk. But for now, the draw of the sun and the ocean will be enough to keep Americans living on the coast — and keep attracting more of them.

While mortgages may be for 30 years, the average home buyer only stays put for 13 years, which means that even if a homeowner is aware of the coming risk from sea level rise, they may believe they'll have moved on by the time the water comes. But even if that's true, the risk is merely being moved around, a shell game with the multi-trillion dollar housing market.

"It's this slow moving disaster," says Cynthia McHale, the director of insurance at Ceres, a sustainability nonprofit that works with investors. "No want wants to be left holding the bag. They want to party up until the ball drops on midnight." But all indications are the party is coming to an end — soon.

https://www.inman.com/2017/12/18/coastal-mortgage-time-bomb/

Abrupt Sea Level Rise Looms As Increasingly Realistic Threat
BY NICOLA JONES • MAY 5, 2016

When the Intergovernmental Panel on Climate Change (IPCC) put out its last report in 2013, the consensus was for under a meter (3.3 feet) of sea level rise by 2100. In just the last few years, at least one modeling study suggests we might need to double that.
Eric Rignot at the University of California, Irvine says that study underscores the possible speed of ice sheet melt and collapse. “Once these processes start to kick in,” he says, “they’re very fast.”

“Today, we’re struggling with 3 millimeters [0.1 inch] per year [of sea level rise],” says Robert DeConto at the University of Massachusetts-Amherst, co-author of one of the more sobering new studies. “We’re talking about centimeters per year. That’s really tough. At that point your engineering can’t keep up; you’re down to demolition and rebuilding.”

These uncertainties make Rignot think that estimates of Greenland’s melt — contributing as much as 9 inches of global sea level rise by 2100, according to the 2013 IPCC report — have been far too conservative. Assuming that the Greenland ice sheet’s demise “will be slow is wishful thinking,” Rignot says.

For the Pliocene era 3 million years ago, for example — when seas were dozens of feet higher than today — older models estimated that a partially melting Antarctic added about 23 feet to global sea level rise. The new model increased Antarctica’s contribution to sea level rise during the Pliocene to 56 feet.

Turning their model to the future, DeConto and Pollard project more than three feet of sea level rise from Antarctica alone by 2100 — assuming growing greenhouse gas emissions that boost the planet’s temperature by about 4 degrees C (7 degrees F).

Even DeConto admits that, under the model used in his paper, the timing and pace of Antarctica’s ice loss is “really uncertain” — it could be a decade or two, or three or four, before these dramatic processes start to kick in, he says. “The paper just shows the potentials, which are really big and really scary,” says DeConto. But Scambos and other observers call DeConto’s numbers “perfectly plausible.”

For a better analogue of what’s going on today, researchers often look to the last interglacial period, about 120,000 years ago, when temperatures were about a degree warmer than pre-industrial levels and seas were 20 to 30 feet higher than today. Ice cores from Greenland have suggested that much of that water must have come from the Antarctic.

James Hansen, a climatologist at Columbia University, summarized the evidence for rapid sea level rise in a recent controversial paper, raising some eyebrows at its stark warnings of catastrophe. Though many researchers have taken issue with the dramatic tone and specific details of that paper, its conclusion — that multi-meter sea level rise is possible in the next 50, 100, or 200 years — does not seem so alarmist in the face of other recent work.
https://e360.yale.edu/features/abrupt_sea_level_rise_realistic_greenland_antarctica

New Research Confirms 'Catastrophic' Climate Threat: Global Sea Levels Could Rise 174 Feet From Melting East Antarctic Ice Sheet

This vast mass holds enough water to raise sea levels by 53 meters (approximately 174 feet) worldwide. And researchers have confirmed that one stretch of the southern polar coastline has melted many times in the past: by enough to raise sea levels by three to five meters (approximately 10 to 16 feet).

A rise of just one meter would render at least 100 million coast dwellers homeless.

And a second, separate study has shown that—whatever happens in Antarctica—humanity is unlikely to be able to

	make any accurate guess before midcentury. That is because a second study, in the journal Earth's Future, led by scientists from New Jersey and Massachusetts, reported that estimates of future change are likely to stay uncertain until around 2060. "There's a lot of ambiguity in post-2050 projections of sea-level rise and we may have to live with that for a while," said Robert Kopp, director of the department of earth, ocean and atmospheric sciences at Rutgers University. "We could end up with 8 feet of sea level-rise in 2100, but we're not likely to have clear evidence for that by 2050." https://www.ecowatch.com/global-sea-level-rise-projections-2518388362.html
	A Radical New Scheme to Prevent Catastrophic Sea-Level Rise A Princeton glaciologist says a set of mega-engineering projects may be able to stabilize the world's most dangerous glaciers. ROBINSON MEYER JAN 11, 2018 For the past two years, Wolovick has studied whether a set of targeted geo-engineering projects could hold off the worst sea-level rise for centuries, giving people time to adapt to climate change and possibly reverse it. He is exploring whether building underwater walls at the mouth of the world's most unstable glaciers—huge piles of sand and stone, stretching for miles across the seafloor—would change how those glaciers respond to the warming ocean and atmosphere, dramatically slowing or reversing their collapse. If they work as planned, these large walls could make glaciers last as much as 10 times longer than they otherwise would. In rudimentary simulations, the walls make a glacier that would collapse in 100 years last for another millennium. Though Wolovick has spent two years studying his proposal at Princeton, his ideas remain hypothetical. They will need years of further study before they become feasible. And even if his proposal seems to work, it will not reduce humanity's need to reduce greenhouse-gas emissions. Slowing the rise of global sea levels will not alter other consequences of climate change, like deadly heatwaves, decade-long mega-droughts, or the widespread destruction of coral reefs. It would just buy us some time to slow the rising seas. But for the more than 150 million people who live on land less than five feet above sea level, that may be enough. https://www.theatlantic.com/science/archive/2018/01/a-new-geo-engineering-proposal-to-stop-sea-level-rise/550214/
	Seas May Rise 2.3 Meters per Degree C of Global Warming: Report Sea levels could rise by 2.3 meters for each degree Celsius that global temperatures increase and they will remain high for centuries to come Global average surface temperatures have risen by 0.8C (1.4F) since the Industrial Revolution and the IPCC has said temperatures are likely to be 0.4 to 1.0 degrees Celsius warmer from 2016-35 than in the two decades to 2005. Some scientific studies have projected sea level rise of up to 2 meters by 2100 Vaughan told Reuters the biggest impact rising seas will have is that storms will be more destructive in the near future. "It's not about chasing people up the beach or the changing shape of coastlines," he said. "The big issue is how the storms will damage our coasts and how often they occur. That'll increase even with small levels of sea rise in coming decades." https://www.scientificamerican.com/article/seas-may-rise-23-meters-per-degree/
	Global Temperature Increase of 1 Degree Caused Sea Level Rise of 6 Meters sea levels have risen by 6 meters (20 feet) multiple times in the past, and this increase was prompted by a rise in global mean temperatures of only 1–2oC.

	http://www.iflscience.com/environment/global-temperature-increase-1-degree-caused-sea-level-rises-6-meters/
	Responding to the Threat of Sea Level Rise National Academy of Sciences Ten percent of the world's approximately 7.5 billion people live within 10 meters of sea level, and many more live at higher elevations but close to coastlines. Protecting people, structures, and property as sea level continues to rise in the years ahead will be one of the great mega-engineering challenges of the 21st century and beyond, said Robert J. Nicholls, professor of coastal engineering at the University of Southampton, during the 2016 annual meeting of the National Academy of Engineering. Sea level rise has complex interrelated impacts, Nicholls explained. To begin with, it makes extreme events more extreme. Storms can cause higher levels of inundation both from surging ocean waters and from inland flooding. Erosion, sediment supply, flood management, and reclamation can all affect storm surges, while catchment management and land use can affect flooding. Sea level rise can also cause wetland loss and change, saltwater intrusion into surface waters or groundwater, and higher water tables that impede drainage—and these impacts can be interconnected. For example, changes in coastal ecosystems such as mangrove forests and coral reefs can affect wave action, storm surges, and erosion. Coastal development increases vulnerability to sea level rise. The population living at or near sea level has grown dramatically, with an associated increase in infrastructure. In many places, such as the East and Gulf coasts of the United States, nuisance flooding has become much more common because of the combination of sea level rise and development. https://www.nap.edu/read/24847/chapter/2