

THE  
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# HOW OCEANS RISE AND DIE ON A WARMING PLANET

By Carolyn Kormann 11:44 A.M.



*Flooding in Houston, Texas, after Hurricane Harvey. A new report from the I.P.C.C. is the first to comprehensively tie together ocean acidification, glacial collapse, and sea-level rise.*

Photograph by Eric Thayer / NYT / Redux

**I**n a Park Hyatt hotel ballroom in midtown Manhattan, on Wednesday, Greta Thunberg, the sixteen-year-old climate activist, stood before world leaders and delivered a goosebump-inducing speech. The occasion was the release of “The Ocean and Cryosphere in a Changing Climate,” a major scientific report by the U.N.’s Intergovernmental Panel on Climate Change, which concluded that human activities have made the oceans increasingly inhospitable to marine life and have caused glacial melt and sea-level rise to happen at an even faster rate than scientists had previously projected. The effects—already well under way, with some locked in over the next century—pose an immediate threat to the survival of certain island nations and high-alpine communities, as well as hundreds of millions of other

coastal inhabitants and many of the world's fisheries. "The reason we have taken to the streets is because of science," Thunberg said, after thanking the U.N. scientists who authored the report. "This is about an existential crisis for the biosphere and for humanity." On the projection screen behind her was a seal stranded on a tiny iceberg in a big blue ocean. "Our main enemy now is physics. We can still fix this, it is still possible, but not if we continue like now." She concluded, "We must listen to the scientists."

The report, which is based on nearly seven thousand peer-reviewed studies, was prepared and written by a hundred and four scientists from thirty-six countries. It was the latest addition in a dire trilogy of I.P.C.C. special reports, which previously included studies on the extreme risks of even 1.5 degrees Celsius of warming and on the impacts of climate change on land. (Additionally, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, a U.N.-backed body, released a report in May on the accelerating rate of widespread extinction across species.) Wednesday's report took a similarly comprehensive approach to studying climate change's impact on ice formations, sea level, and the planet's oceans.

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"The ocean today is higher, warmer, more acidic, less productive, and it holds less oxygen," Jane Lubchenco, a former administrator of the U.S. National Oceanic and Atmospheric Administration, said. As a result, coral reefs are bleaching a ghostly white, and, although some can recover, others are dying at a rapid rate. Monster storms are persistent. Marine heat waves—projected to increase fiftyfold if current trends continue—are depleting fisheries. Ocean acidification is severely harming all sorts of species, which then harms people, too, since many of these species are critical to local economies. Glaciers are melting faster with consequences for people in the mountains and on the coasts alike. On Tuesday, just two hundred and sixty miles from Monaco, where I.P.C.C. scientists and government representatives were negotiating the report's final language, Italian authorities in the town of Courmayeur closed roads and evacuated homes after warning that the Mont Blanc

glacier was on the brink of collapse. “This phenomenon once again testifies that the mountain is in a phase of strong change due to climatic factors, therefore it is particularly vulnerable,” the town’s mayor said.

One major new development in the report is the elevation of the coastal-flood risk. By 2050, in many places globally, the current hundred-year flood will occur every year, even if we cut emissions to the lowest levels considered achievable, putting megacities (with populations greater than ten million), including Jakarta, Manila, Bangkok, Surabaya, and parts of Los Angeles, at serious risk. For some areas, the hundred-year-flood level is not much higher than the current water level, meaning it may be a more manageable problem. For other areas, the hundred-year level is a couple of feet above high tide. These places will require either very expensive adaptation measures or abandonment. “If the hundred-year event turns into an annual event, that means the three-hundred-year, five-hundred-year, and currently less frequent events also occur more often,” Michael Oppenheimer, one of the report’s authors and a professor of geosciences and international affairs at Princeton University, said. “On small islands, a couple feet is the difference between existing and non-existing.”

According to the report, by 2100, even in the best-case emissions scenario—meaning we surpass the targets of the Paris Agreement—the global mean sea level will still rise by about one and a half feet, relative to its average levels at the turn of this century. If we continue emitting greenhouse gases at current rates, however, it could rise much more rapidly, reaching nearly three feet of sea-level rise by 2100 (and an unimaginable eighteen feet over the next few centuries). These, of course, are global averages; along certain coasts, owing to sinking lands from human development, as well as other geologic causes, sea-level rise will be higher. “The ocean is already rising, rising faster than we had predicted, it will continue to rise, and that only serves to underscore the emergency we are confronted with now, the urgency of reducing carbon emissions as rapidly as possible,” Lubchenco, the former NOAA administrator, said.

The rise will come primarily from the melting of the Antarctic and Greenland ice sheets. Theories about the potential for warming to destabilize Antarctica’s ice were first posed in the late seventies by an eccentric glaciologist from Ohio State University named John Mercer. In 1978, he published a paper in *Nature* called the “West Antarctic Ice Sheet and CO<sub>2</sub> Greenhouse Effect: A Threat of Disaster.” He predicted that the warming atmosphere could melt the ice sheet from underneath,

causing sections to rapidly break away and raise sea levels. He was labelled an alarmist, and had difficulty finding research funding in the years that followed. Even in 1990, many scientists still believed that the ice sheet in Antarctica would be stable for thousands of years, even with large amounts of warming. Today scientists are clear that Mercer was right.

The deliberations in Monaco took place while more than four million people took to the streets globally, led by Thunberg and young students, in the largest climate protest in history, on Friday, and then heads of state met at the United Nations, for the so-called Climate Action Summit, convened by Secretary-General António Guterres, on Monday. The summit resulted in little promise of action. President Trump made a brief visit, and listened to remarks by Prime Minister Narendra Modi, of India, and Chancellor Angela Merkel, of Germany—but skipped the rest, including an electrifying speech by Thunberg in which she, yet again, called out the unforgivable behavior of the world's leaders in failing to make the changes that scientists say we need. A summit attendee posted a video, which immediately went viral, showing Trump's arrival, with Mike Pence in tow and Thunberg behind both of them, glaring at their backs.

Lisa Speer, the director of the Natural Resources Defense Council's International Oceans Program, was in Monaco. "Sitting through this meeting was alternately incredibly tedious, riveting, and profoundly depressing," she told me. "When they were talking about these really harrowing effects, I couldn't help but think, We're all going to be in the *cryosphere*." She laughed. "You need a little humor to get through it." She noted the linkages that this report establishes—how ice melt sends increasing amounts of freshwater into the ocean, causing a phenomenon of layering, or stratification, in which the freshwater acts as a kind of lid, preventing the ocean from maintaining the oxygen levels that marine life needs to survive. Or how the warming ocean causes more intense storms, and how the rising ocean causes the impact from storm surge to have that much more power to do damage.

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VIDEO FROM THE NEW YORKER

Greta Thunberg Leads the World Climate Strike

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Despite the grim picture, there is still time to stop emissions and prevent the kind of annihilating sea-level rise and species extinction from which there is no recovery. Another major report, released this week by the High-Level Panel for a Sustainable Ocean Economy (consisting of heads of government from fourteen countries), and written by a group of experts and scientists, laid out the ocean's vast potential for mitigating climate change. The solutions it put forth could provide up to a fifth of the emissions cuts needed by 2050 in order to keep global temperature rise below 1.5 degrees Celsius. They offered five areas: offshore renewable energy (primarily wind, as well as floating solar, wave, and tidal power); ocean-based transport-efficiency measures (better hull design, and the decarbonization of coastal ferry fleets and ports); marine conservation and restoration of ocean-based carbon sinks (mangroves, seagrass beds, and salt marshes); improved reliance on fisheries (through better management of wild stocks, the expansion of sustainable aquaculture, and dietary shifts to low-carbon marine foods, including seaweed, kelp, and shellfish); and, most controversially, the unproved potential of carbon storage in the seabed. But, as Wednesday's I.P.C.C. report makes clear, the window for implementing any of these solutions is closing fast. "The risk is growing faster than our current ability to handle the situation," Michael Oppenheimer told me. "It may become unmanageable over coming decades, so time is of the essence."



*Carolyn Kormann is a staff writer at The New Yorker. [Read more »](#)*

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## Video

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### *Greta Thunberg Leads the World Climate Strike*

*Three days before the United Nations Climate Action Summit, in New York City, millions around the world join the teen-age activist Greta Thunberg in a climate strike.*

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