



Warming to Cause Catastrophic Rise in Sea Level?

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Most scientists agree that global warming presents the greatest threat to the environment.

There is little doubt that the Earth is heating up. In the last century the average temperature has climbed about 0.6 degrees Celsius (about 1 degree Fahrenheit) around the world.

From the [melting of the ice cap](#) on Mount Kilimanjaro, Africa's tallest peak, to the loss of coral reefs as oceans become warmer, the effects of global warming are often clear.

However, the biggest danger, many experts warn, is that global warming will cause sea levels to rise dramatically. Thermal expansion has already raised the oceans 4 to 8 inches (10 to 20 centimeters). But that's nothing compared to what would happen if, for example, [Greenland's massive ice sheet were to melt](#).

"The consequences would be catastrophic," said Jonathan Overpeck, director of the Institute for the Study of Planet Earth at the University of Arizona in Tucson. "Even with a small sea level rise, we're going to destroy whole nations and their cultures that have existed for thousands of years."

Overpeck and his colleagues have used computer models to create a series of maps that show how susceptible coastal cities and island countries are to the sea rising at different levels. The maps show that a 1-meter (3-foot) rise would swamp cities all along the U.S. eastern seaboard. A 6-meter (20-foot) sea level rise would submerge a large part of Florida.

Uncertainties

Just as the evidence is irrefutable that temperatures have risen in the last century, it's also well established that carbon dioxide in the Earth's atmosphere has increased about 30 percent, enhancing the atmosphere's ability to trap heat.

The exact link, if any, between the increase in carbon dioxide emissions and the higher temperatures is still under debate.

Most scientists believe that humans, by burning fossil fuels such as coal and petroleum, are largely to blame for the increase in carbon dioxide. But some scientists also point to natural causes, such as volcanic activity.

"Many uncertainties surround global warming," said Ronald Stouffer at the U.S. National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey. "How much of it would still occur if humans were not modifying the climate in any way?"

The current rate of warming is unprecedented, however. It is apparently the fastest warming rate in millions of years, suggesting it probably is not a natural occurrence. And most scientists believe the rise in temperatures will in fact accelerate. The United Nations-sponsored Intergovernmental Panel on Climate Change reported in 2001 that the average temperature is likely to increase by between 1.4 and 5.8 degrees Celsius (2.5 and 10.4 degrees Fahrenheit) by the year 2100.

The climate change is likely to impact ecosystems, agriculture, and the spread of disease. An international study published in the science journal *Nature* earlier this year predicted that climate change could drive more than a [million species towards extinction](#) by the year 2050.

"Global warming is a serious threat to biodiversity," said Jay Malcolm, a forestry professor at the University of



Toronto. "As climates warm, more southerly species will begin appearing further north, and species that occur at lower altitudes will start showing up at higher altitudes ... species will find themselves in habitats where they don't belong."

Underwater

Glaciers and sea ice in both the Northern and Southern Hemispheres are already melting at a rapid pace, placing animals like polar bears at risk.

"Polar bears are entirely dependent on sea ice," Malcolm said. "You lose sea ice, you lose polar bears."

So far, the rise in sea level is because warmer water takes up more room than colder water, which makes sea levels go up, a process known as thermal expansion.

"The real question is what's going to happen to Greenland and Antarctica," Stouffer said. "That's where the bulk of all the fresh water is tied up."

A recent *Nature* study suggested that Greenland's ice sheet will begin to melt if the temperature there rises by 3 degrees Celsius (5.4 degrees Fahrenheit). That is something many scientists think is likely to happen in another hundred years.

The complete melting of Greenland would raise sea levels by 7 meters (23 feet). But even a partial melting would cause a one-meter (three-foot) rise. Such a rise would have a devastating impact on low-lying island countries, such as the Indian Ocean's Maldives, which would be entirely submerged.

Densely populated areas like the Nile Delta and parts of Bangladesh would become uninhabitable, potentially driving hundreds of millions of people from their land.

A one-meter sea level rise would wreak particular havoc on the Gulf Coast and eastern seaboard of the United States.

"No one will be free from this," said Overpeck, whose maps show that every U.S. East Coast city from Boston to Miami would be swamped. A one-meter sea rise in New Orleans, Overpeck said, would mean "no more Mardi Gras."

Other scientists emphasize that such doomsday scenarios may be hundreds of years in the future.

"You can't say with any certainty that sea level rises are going to have a huge impact on society," Stouffer said. "Who knows what the planet will look like 500 years from now?"

Future Generations

Most climate scientists, however, agree that global warming is a threat that has gone unchecked for too long.

"Is society aware of the seriousness of climate warning? I don't think so," said Marianne Douglas, a geology professor at the University of Toronto. "If we were, we'd all be leading our lives differently. We'd see a society that embraced alternative sources of energy, with less dependency on fossil fuels."

Overpeck says passing on the problem of global warming to future generations is like ignoring a government budget deficit. "Except with the deficit, there are economic mechanisms that could be put in place to get out of the large deficit," he said. "With sea level rise, there's really no technological way to put the ice back on Greenland."

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