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SCIENTISTS LOOK AT LONG-TERM SEA-LEVEL RISE: MORE THAN 7 FEET OVER SEVERAL THOUSAND YEARS

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A new study estimates that global sea levels will rise about 2.3 meters, or more than seven feet, over the next several thousand years for every degree (Celsius) the planet warms.

This international study is one of the first to combine analyses of four major contributors to potential sea level rise into a collective estimate, and compare it with evidence of past sea-level responses to global temperature changes.

Results of the study, funded primarily by the National Science Foundation and the German Federal Ministry of Education and Research, are being published this week in the Proceedings of the National Academy of Sciences http://www.pnas.org/

“The study did not seek to estimate how much the planet will warm, or how rapidly sea levels will rise,” noted Peter Clark, an Oregon State University paleoclimatologist and author on the PNAS article. “Instead, we were trying to pin down the ‘sea-level commitment’ of global warming on a multi-millennial time scale. In other words, how much would sea levels rise over long periods of time for each degree the planet warms and holds that warmth?”

“The simulations of future scenarios we ran from physical models were fairly consistent with evidence of sea-level rise from the past,” Clark added. “Some 120,000 years ago, for example, it was 1-2 degrees warmer than it is now and sea levels were about five to nine meters higher. This is consistent with what our models say may happen in the future.”

Scientists say the four major contributors to sea-level rise on a global scale will come from melting of glaciers, melting of the Greenland ice sheet, melting of the Antarctic ice sheet, and expansion of the ocean itself as it warms. Several past studies have examined each of these components, the authors say, but this is one of the first efforts at merging different analyses into a single projection.

The researchers ran hundreds of simulations through their models to calculate how the four areas would respond to warming, Clark said, and the response was mostly linear. The amount of melting and subsequent sea-level response was commensurate with the amount of warming. The exception, he said, was in Greenland, which seems to have a threshold at which the response can be amplified.

“As the ice sheet in Greenland melts over thousands of years and becomes lower, the temperature will increase because of the elevation loss,” Clark said. “For every 1,000 meters of elevation loss, it warms about six degrees (Celsius). That elevation loss would accelerate the melting of the Greenland ice sheet.”

In contrast, the Antarctic ice sheet is so cold that elevation loss won’t affect it the same way. The melting of the ice sheet there comes primarily from the calving of icebergs, which float away and melt in warmer ocean waters, or the contact between the edges of the ice sheet and seawater.

In their paper, the authors note that sea-level rise in the past century has been dominated by the expansion of the ocean and melting of glaciers. The biggest contributions in the future may come from melting of the Greenland ice sheet, which could disappear entirely, and the Antarctic ice sheet, which will likely reach some kind of equilibrium with atmospheric temperatures and shrink significantly, but not disappear.

“Keep in mind that the sea level rise projected by these models of 2.3 meters per degree of warming is over thousands of years,” emphasized Clark, who is a professor in Oregon State University’s College of Earth, Ocean, and Atmospheric Sciences. “If it warms a degree in the next two years, sea levels won’t necessarily rise immediately. The Earth has to warm and hold that increased temperature over time.

“However, carbon dioxide has a very long time scale and the amounts we’ve emitted into the atmosphere will stay up there for thousands of years,” he added. “Even if we were to reduce emissions, the sea-level commitment of global warming will be significant.”