Melting ice the greatest factor in rising sea levels

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Scientists have a better understanding of the contribution of melting glacier and ice sheets to sea level rise, but much remains uncertain. Flickr/ChrisGoldNY

Melting glaciers and ice sheets have contributed more to rising sea levels in the past decade than expansion from warming water, according to modelling in the latest report by the Antarctic Climate and Ecosystems (ACE) Cooperative Research Centre.

Before 2000 thermal expansion was the biggest factor in rising sea levels.

The shift was “a fairly sure sign that you’re getting out of the normal balance”, said report author Dr John Hunter, an oceanographer and expert in rising sea levels at the ACE.

Report Card: Sea Level Rise 2012 provides a summary of the past decade of peer-reviewed scientific research into sea-level rise, and is the most recent update since a report in 2008.

During the 20th century sea levels rose at a rate unmatched for 6,000 years, the report says. Satellite measurements have confirmed the global average rise of 1.9mm a year, as measured in tide gauges. “This present sea-level rise is due to a combination of thermal expansion of a warming ocean and the melting of glaciers and ice sheets.”

Dr Hunter explained that modelling had improved since the last update, at which time the contribution to sea levels from melting glaciers and ice sheets was not well understood.

“We’ve been better able to match up two things: observed sea level rises – which we get by looking at tide gauges until about 20 years ago, then after that tide gauges and also records from satellites – and estimates of sea level rises, which we get by looking at ocean temperatures and observing ice on land, the two biggest components, among other things,” Dr Hunter said.

“If we can get those estimates to agree with the observations from tide gauges and satellites, then we have a good understanding of sea level rise. At the time of the last assessment, that wasn’t all that well done, and we didn’t know very much about ice. We’ve got a better understanding now.”

But estimating the future rate of ice loss from the Greenland and Antarctic ice sheets remained the largest uncertainty in projecting sea-level rise over the next century, he said.

From 1993 to 2009, reconstructed tide-gauge data shows a rise of 2.8mm per year and satellite data shows a rise of 3.2mm per year.

Since 1972, thermal expansion contributed about 45% to total sea level rise, glaciers and ice caps another 40%, with most of the remainder from the ice sheets, the report says. Since 1993 the contribution of the ice sheets to sea-level rise has increased to about 30%.

The Intergovernmental Panel on Climate Change has estimated that projected sea level rise over the next century could vary from about 10-20cm to about 80cm.

Dr Hunter said it was "only just about now that we're starting to observe melting from ice is starting to overtake thermal expansion. If you disturb the earth, the first thing that happens is that you just get thermal expansion from the heating of the water, and there's quite a lag before melting from the ice starts to kick in, and eventually the ice becomes a greater contributor. This is always a fairly sure sign that you're getting out of the normal balance."

The two biggest impacts of the rising sea level will be flooding from inundation along hard shoreline, and coastal recession along soft shoreline, the report says. A relatively modest increase in mean sea level of 50cm will increase the frequency of flooding by a factor of roughly 300.

"In Australia we're reasonably lucky in that the projections for inundation are pretty close to the global average," Dr Hunter said, meaning sea level would be around 38cm higher in 2090 than in 1990. "On the east coast, where the water is warmer, the rise will be slightly greater than on the west coast – by 10cm to 20cm – by the end of the century."

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