

## Don't be alarmed, it's the natural rhythm JUDITH CURRY



Illustration: Sturt Krygsman

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“Antarctica meltdown could double sea level rise”; “The planet could become ungovernable”: such headlines reflect the growing alarm over sea level rise.

The alarm is not so much about the 20cm or so that global sea level has risen since 1900. The average yearly rate of global sea level rise is 3mm.

Rather, the alarm is driven by predictions of sea level rise from human-caused global warming. There are concerns that Antarctic ice sheets could collapse into the ocean, increasing sea level in the 21st century by up to several metres.

Are these extreme scenarios of 21st-century sea level plausible? Or even possible? To put these alarming predictions into context of the scientific evidence, I have recently written an independent assessment report, *Sea Level and Climate Change*, which draws the following conclusions.

At least in some regions, sea level was higher around 5000 to 7000 years ago. After several centuries of sea level decline following the Medieval Warm Period (about 1000 years ago), global sea levels began to rise in the mid-19th century.

Rates of global sea level rise between 1920 and 1950 were comparable to recent rates. Recent sea level rise is therefore within the range of natural sea level variability across the past several thousand years.

The slow build-up of fossil fuel emissions before 1950 did not contribute significantly to 19th and early 20th-century sea level rise.

There is not yet any convincing evidence of a human fingerprint on global sea level rise because of the large changes driven by natural variability.

An increase in the rate of global sea level rise since 1995 is being caused by ice loss from Greenland. Greenland ice loss was larger during the 1930s, which also was associated with a warm phase of the Atlantic Ocean circulation pattern.

The main causes of local sea level rise in many locations are ocean circulation patterns and local sinking of the land. Landfilling in coastal wetland areas and the withdrawal of groundwater have caused many of the worst local sea level rise problems.

The local sea level in many regions will continue to rise in the 21st century, independent of global climate change.

The 2013 Report from the Intergovernmental Panel on Climate Change predicted a likely range of sea level rise by the end of the 21st century to be from 26cm to 82cm, depending on the scenario for greenhouse gas emissions.

The highest of these emissions scenarios, RCP8.5, more than doubles atmospheric CO<sub>2</sub> concentrations from current values by the end of the 21st century, and is based on several extremely unlikely assumptions.

Since the 2013 report, scientists have published several worst-case scenarios for global sea level rise. Estimates of the maximum possible global sea level rise by the end of the 21st century range from 1.6m to 3m, and even higher. These extreme values of sea level rise, driven by the extremely unlikely RCP8.5 emissions scenario, are regarded as extremely unlikely or even impossible. Nevertheless, they are driving policies and local adaptation plans.

These predictions of sea level rise depend on climate models to predict the correct amount of warming. However, there are reasons to think that the climate models are predicting too much warming, such as:

- Observed warming for the past two decades is smaller than the average warming predicted by climate models.
- When compared with observations across the past 150 years, climate models produce too much warming in response to increasing atmospheric carbon dioxide.
- Climate model predictions consider only human-caused warming and neglect changes in natural climate processes, such as variations in the sun's output, volcanic eruptions and long-term changes to ocean circulations. These natural processes are expected to have a cooling effect in the 21st century.

Predictions of 21st-century sea level rise higher than 60cm are increasingly weakly justified, even if the predicted amount of warming is correct. Predictions higher than 1.6m require a cascade of extremely unlikely to impossible events, using simplistic models of poorly understood processes.

Additional sea level rise of 60cm or less across a century can be a relatively minor problem if it is managed appropriately. Mistakenly assuming that all of the problems of local sea level rise are caused by human-caused global warming distracts from improving land use policies and coastal engineering practices that could diminish the local impacts of rising sea levels.

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