

Special Report on Sea Level Rise

by Judith Curry, 2018

The complete report can be downloaded here [Special Report- Sea Level Rise \(3\)](#).

Why have I devoted so much time to the sea level?

Why do I think an independent assessment of the sea level rise issue by yours truly is needed, given the plethora of international and national assessment reports? My clients are concerned about the alarmist predictions they have encountered. I have seen various ‘experts’ make public statements projecting 21st century sea level to be as high as 9 m [30 feet]. My clients are looking for someone that they trust to provide an objective assessment that focuses on their issues of concern.

The alarm over sea level rise

The public discourse on the threat of sea level rise is typified by these dire statements from climate scientists:

“That’s the big thing – sea-level rise – the planet could become ungovernable.” – Dr. James Hansen, former Director, NASA GISS

“We’re talking about literally giving up on our coastal cities of the world and moving inland.” – Dr. Michael Mann, Penn State

The alarm over sea level rise is not so much about the 7-8 inches or so that global sea level has risen since 1900. Rather, it is about projections of 21st century sea level rise from human-caused global warming. According to the IPCC, the projected 21st century sea level rise depends on the amount of greenhouse gas emissions. The likely range of projected sea level rise by the end of the 21st century is from 0.26 to 0.82 m [10 to 32 inches], depending on the emissions scenario.

The primary concern over future sea level rise is related to the potential collapse of the West Antarctic Ice Sheet, which could cause global mean sea level to rise substantially above the IPCC’s likely range in the 21st century. The IPCC AR5 has medium confidence that this additional contribution from the West Antarctic ice sheet would not exceed several tenths of a meter [less than a foot] of sea level rise during the 21st century.

Conclusions

Mean global sea level has risen at a slow creep for more than 150 years; since 1900, global mean sea level has risen about 7-8 inches. The implications of the highest values of projected sea-level rise under future climate change scenarios are profound, with far reaching socioeconomic and environmental implications. However, these projections are regarded as deeply uncertain and the highest of these projections strain credulity.

The IPCC and other assessment reports are framed around providing support for the hypothesis of human-caused climate change. As a result, natural processes of climate variability have been relatively neglected in these assessments. Arguments have been presented here supporting the important and even dominant role that natural processes play in global and regional sea level variations and change.

With regards to the four issues raised in the Introduction:

1. *Is the recent sea level rise (since 1993) of magnitude 3 mm/year unusual?*

No, although this conclusion is conditional on the quality of the global sea level data. The available evidence shows the following:

- Sea level was apparently higher than present at the time of the Holocene Climate Optimum (~ 5000 years ago), at least in some regions.
- Tide gauges show that sea levels began to rise during the 19th century, after several centuries associated with cooling and sea level decline. Tide gauges also show that rates of global mean sea level rise between 1920 and 1950 were comparable to recent rates.
- Recent research has concluded that there is no consistent or compelling evidence that recent rates of sea level rise are abnormal in the context of the historical records back to the 19th century that are available across Europe.

2. *Has recent global sea level rise been caused by human-caused global warming?*

Identifying a potential human fingerprint on recent sea level rise is confounded by the large magnitude of natural internal variability associated with ocean circulation patterns. There is not yet convincing evidence of a fingerprint on sea level rise associated with human-caused global warming:

- The slow emergence of fossil fuel emissions prior to 1950 did not contribute significantly to sea level rise observed in the 19th and early 20th centuries.
- The recent acceleration in mean global sea level rise (since 1995) is caused by mass loss from Greenland that appears to have been larger during the 1930's, with both periods associated with the warm phase of the Atlantic Multidecadal Oscillation.

3. *To what extent is local sea level rise influenced by global sea level rise?*

In many of the most vulnerable coastal locations, the dominant causes of local sea level rise are natural oceanic and geologic processes and land use practices. Land use and engineering in the major coastal cities have brought on many of the worst problems, notably landfilling in coastal wetland areas and groundwater extraction.

4. *How much will sea level rise in the 21st century?*

Local sea level in many regions will continue to rise in the 21st century – independent of global climate change.

Further, these values of sea level rise are contingent on the climate models predicting the correct amount of temperature increase. There are numerous reasons to think that the climate models are predicting too much warming for the 21st century, and hence the more extreme values of sea level rise (above 1 m) are arguably too high. Kopp et al. (2017) state:

“The breadth of published projections, as well as of remaining structural uncertainties, highlight the fact that future sea-level rise remains an arena of deep uncertainty.”

“Despite considerable progress during the last decade, major gaps remain in our understanding of past and contemporary sea level change and their causes. These uncertainties arise from limitations in our current conceptual understanding of relevant physical processes, deficiencies in our observing and monitoring systems, and inaccuracies in statistical and numerical modelling approaches to simulate or forecast sea level.”

“A significant part of this large uncertainty arises from inappropriate (or sometimes missing) model representations of some physical processes that affect sea level and needs to be reduced for more accurate sea level projections.”

“Improved sea level predictions/projections, particularly over the next decades, are critically dependent on understanding observed natural variability, accurately reproducing it in models, and mapping its future behavior under climate change.”