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Singapore

NTU study forecasts global sea level rise of up to 1.9m by 2100, far exceeding UN's projection

The high end of the sea level rise projection range from the new study exceeds the latest UN global projection by around 90cm.

File photo of Singapore's East Coast in 2020.

Koh Wan Ting

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SINGAPORE: A Singapore-led team of researchers has found that global sea levels could rise up to 1.9m by 2100, higher than what was previously projected.

The researchers from Singapore's Nanyang Technological University (NTU) and The Netherlands' Delft University of Technology projected in a study that if the rate of global carbon emissions continues to increase, the sea level would very likely rise between 0.5m and 1.9m by the end of the century, under a high carbon emissions scenario.

The high end of the projection's range exceeds the United Nations' latest global projection by about 0.9m.

In the Intergovernmental Panel on Climate Change (IPCC) sixth assessment report, the UN projected that the global mean sea level will likely rise by between 0.63m and 1.01m by 2100 under the highest emissions scenario.

The NTU study, titled “Fusion of Probabilistic Projections of Sea-Level Rise”, was published in scientific journal Earth's Future on Dec 11, 2024.

The "very likely" range - which has a 90 per cent probability - reported by the team complements sea level rise projections by the IPCC, which assessed the probability of projections up to a "likely" range - with a 66 per cent probability - said NTU in a news release on Monday (Jan 27).

THE NEW "FUSION" APPROACH

To address the uncertainties in current sea level rise projections, NTU researchers developed a new, improved method which combines the advantages of existing models with expert opinions, the release stated.

"Current climate models and ice sheet models are very good at simulating well-understood processes. However, the models often neglect poorly-understood processes that could cause the ice sheets to melt much faster than we expect," said the NTU study's lead author, senior research fellow Benjamin Grandey.

"In contrast, experts can estimate the likelihood of these unlikely possibilities. Therefore, the models and experts offer complementary information."

Current sea level projections had relied on a range of methods to model climate processes, with some incorporating known factors such as melting glaciers and others, more uncertain events such as abrupt ice shelf collapse.

As a result, the models produce varying projections, making it difficult to estimate reliable extreme sea level rise, the release said.

The ambiguity in projections has prevented the IPCC from providing forecasts of a higher probability, termed the "very likely" ranges for sea level projections.

Scientists from the new study used data from established projections in the IPCC’s sixth assessment report, which simulate potential future scenarios under different emissions pathways to varying degrees of confidence.

The team combined different classes of projections from the IPCC report, incorporating both "medium confidence" and "low confidence" projections, supplemented by expert assessments, to account for the poorly-understood extreme processes, such as sudden shifts in ice sheet behaviour.

The team then applied a weighting system, prioritising more reliable medium-confidence data while still including lower-confidence projections to address uncertainties.

With the approach, researchers found that under a low emissions scenario, global mean sea levels are very likely to rise between 0.3m and 1m by 2100.

The IPCC’s "likely range" had projected global mean sea level to rise by 0.32m to 0.62m.

The broader ranges indicated by the NTU model suggest that previous estimates may have understated the potential for extreme outcomes, the release said.

Dr Grandey, who is from NTU's School of Physical and Mathematical Sciences, said the new approach addresses the uncertainty in sea level science.

"By combining these different approaches into a single fusion projection, we can estimate the uncertainty associated with future sea-level rise and quantify the very likely range of sea level rise," he said.

He added that the high-end projection of 1.9m underlined the need for critical infrastructure to be planned accordingly, and the importance of climate mitigation measures to reduce greenhouse gas emissions.

The study's co-author, Professor Benjamin Horton, the director of the Earth Observatory of Singapore at NTU, said: “This NTU research represents a significant breakthrough in sea-level science. By estimating the probability of the most extreme outcomes, it underscores the severe impacts of sea-level rise on coastal communities, infrastructure, and ecosystems, emphasising the urgent need to address the climate crisis.”

SEA-LEVEL RISE

Global mean sea-level rise is driven by two main factors caused by rising temperatures - the thermal expansion of ocean waters and mass loss of ice sheets.

However, relative sea-level changes around the world are not uniform due to additional factors such as ocean circulation patterns, density changes and vertical land movement.

Accurate projections of sea-level rise help governments and urban planners prepare for what could be a threat to coastal cities.

More than 410 million people could be at risk of rising sea levels by end-century, with current data showing that global sea levels have already risen by more than 10cm over the last decade, according to the World Economic Forum.

Ice sheets in Greenland and Antarctica are melting at an accelerated rate, and communities located along shorelines risk losing property and livelihoods due to coastal flooding.

As an island city, Singapore is vulnerable to rising sea levels, with around 30 per cent of the land lying less than 5m above the mean sea level. These are mainly coastal areas such as Changi, Tuas and East Coast.

According to Singapore's third National Climate Change Study, published in January last year, mean sea levels in the country could rise by 0.23m under the low-emissions scenario - the best possible scenario - or up to 1.15m under the high-emissions scenario, by 2100.

Extreme weather events such as high tides and storm surges could spike sea levels by a further 4m to 5m, placing low-lying areas at risk of being inundated by seawater.

In response to CNA's queries on what the study meant for Singapore's sea level, Dr Grandey said that the new study was not focused on local or regional sea-level rise, but that the method used could be applied to future studies on the country's sea-level rise, especially in determining the "very likely" range of sea-level projections.

"We are now working on regional projections, including projections for Singapore, and will be engaging Centre for Climate Research Singapore to explore collaboration. We plan to publish these regional projections in a future study," added Dr Grandey.

Singapore's government has taken measures to protect its shorelines through a mix of man-made and natural features, and further plans are in the works.

Source: CNA/wt(sn)