

Global sea levels may rise by up to 1.9m by 2100, exceeding earlier projections: NTU study



According to Singapore's third national climate change study published in 2024, mean sea levels could rise by 23cm in the best possible scenario, or by 1.15m in the worst-case scenario, by 2100. PHOTO: ST FILE



Shabana Begum

SINGAPORE – The global sea-level rise due to climate change could be up to 90cm higher than earlier estimates by the end of the century, new research by NTU has found.

The UN climate science body had previously estimated that sea levels could go up by between 0.6m and 1m by 2100 if no action to reduce greenhouse gas emissions was taken.

But NTU's new study showed that under such a scenario, the projected sea-level rise is between 0.5m and 1.9m instead.

The researchers developed a new forecasting method that combines complementary data from various sea-level projection models with expert opinions. This "fusion" approach provides a clearer, more reliable picture of future sea-level rise, said NTU on Jan 27.

NTU researchers, in collaboration with scientists from the Netherlands' Delft University of Technology, estimate that under the low-emissions scenario, where global warming is estimated to be around 1.8 deg C, sea levels are very likely to rise between 0.3m and 1m.

In comparison, the UN Intergovernmental Panel on Climate Change (IPCC) had put the figure at up to 0.6m.

The findings were published in the scientific journal *Earth's Future* in December 2024.

NTU's Dr Benjamin Grandey, who led the study, said: "Our new approach tackles a key issue in sea-level science – different methods of projecting sea-level rise often produce widely varying results."

The team noted that its broader sea-level rise ranges suggest that previous estimates may have understated the potential for extreme scenarios.

Current sea-level projections rely on a range of methods to model climate processes.

Climate models and ice sheet models are very good at simulating well-studied phenomena like the melting of glaciers. But they often neglect poorly understood processes that could cause ice sheets to melt much faster than expected, such as the abrupt collapse of an ice shelf.

In contrast, experts can better estimate the likelihood of these rare possibilities, explained Dr Grandey, a senior research fellow at the NTU School of Physical and Mathematical Sciences.

The research team also noted that not all models take uncertain events into account, resulting in varying projections that make it difficult to estimate extreme sea-level rise.

Due to this ambiguity in projections, IPCC's projections are based on a 66 per cent chance that future sea-level rises will fall within the range it stated.

But the NTU team's calculations are based on a 90 per cent probability, meaning they are more confident that future levels will fall within their predicted range.

“By combining the different approaches into a single fusion projection, we can estimate the uncertainty associated with future sea-level rise,” Dr Grandey said.

“The high-end projection of 1.9m underscores the need for decision-makers to plan for critical infrastructure accordingly,” he added.

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Sea-level rise is caused by the melting of land ice at the poles and the expansion of warmer seawater – both driven by global warming. Ice sheets in Greenland and Antarctica are melting at an accelerated rate.

Dr Hari Vishnu, senior research fellow at the Acoustic Research Laboratory in NUS, pointed out that there is still uncertainty over the different components of ice loss – for example, at glaciers which meet the ocean.

“Recently, it has been found that the contribution of underwater melting (at these glaciers) was underestimated or under-predicted. In many places such as Greenland, underwater melting is speeding up the overall ice loss. This calls for

more accurate measurements of ice loss at these glaciers, cross-verified through multiple means,” said Dr Vishnu.

Rising seas, combined with high tides, storms and coastal flooding, are an existential risk, particularly for coastal and island communities. Coasts will be battered by erosion. Seawater can also intrude into freshwater bodies, affecting drinking water supply and agriculture.

In extreme cases, storm surges caused by cyclones and hurricanes can worsen coastal flooding and destroy houses and infrastructure in its path.

The researchers believe that their new method provides valuable information for urban planners and governments, helping them plan and implement measures to protect vulnerable communities.

Associate Professor Justin Dauwels from Delft University of Technology, who co-authored the study, noted that their fusion method of projecting can also be applied to forecasting coastal flooding, infrastructure vulnerability and economic impacts caused by climate change.

The study was supported by the National Research Foundation and the National Environment Agency (NEA) under the National Sea Level Programme funding initiative.

Around 30 per cent of Singapore’s land area is less than 5m above mean sea level.

According to the Republic’s third national climate change study published in 2024, mean sea levels could rise by 23cm in the best possible scenario, or by 1.15m in the worst-case scenario, by 2100. If fossil-fuel use accelerates, sea levels around Singapore could rise by around 2m by 2150.

Singapore’s sea levels could further jump by 4m or 5m when sinking land, storm surges and daily tidal activity are taken into account.

Dr Grandey said NTU is now working on regional projections, including for Singapore, and may collaborate with NEA’s Centre for Climate Research Singapore on this front.

NEA’s Climate Science Research Programme Office said: “The (NTU study’s) method could be applied in the development of Singapore’s future studies on sea-

level rise, especially in determining the very likely range of local sea-level projections.”

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