

SEA LEVEL RISE IS CERTAIN

Relevant for: Environment | Topic: Environmental Degradation - GHGs, Ozone Depletion and Climate Change

The recently published Intergovernmental Panel on Climate Change (IPCC) Assessment Report from Working Group I — [‘Climate Change 2021: The Physical Science Basis’](#) — is [a clarion call for climate action](#). It provides one of the most expansive scientific reviews on the science and impacts of climate change.

The report discusses five different shared socio-economic pathways for the future with varying levels of greenhouse gas (GHG) emissions. The scenarios illustrated are the following: very low and low GHG emissions, where emissions decline to net zero around or after the middle of the century, beyond which emissions are net negative; intermediate GHG emissions; high and very high emissions where they are double the current levels by 2100 and 2050, respectively. Even in the intermediate scenario, it is extremely likely that average warming will exceed 2°C near mid-century. The average global temperature is already 1.09°C higher than pre-industrial levels and CO₂ concentration in the atmosphere is currently 410 ppm compared to 285 ppm in 1850.

The message from the IPCC report

Over 200 experts working in several domains of climate have put the report together by assessing the evidence and the uncertainties. They express their level of confidence (a qualitative measure of the validity of the findings) ranging from very low to very high. They also assess likelihood (a quantitative measure of uncertainty in a finding) which is expressed probabilistically based on observations or modelling results.

Close to 700 million people worldwide live along the coast and there continue to be plans to expand coastal cities. Therefore, understanding the risks involved from climate change and sea level rise in the 21st and 22nd centuries is crucial. Sea level rise will continue after emissions no longer increase, because oceans respond slowly to warming. The centennial-scale irreversibility of sea level rise has implications for the future even under the low emissions scenarios.

Sea level rise occurs mainly due to the expansion of warm ocean waters, melting of glaciers on land, and the melting of ice sheets in Greenland and Antarctica. Global mean sea level (GMSL) rose by 0.2m between 1901 and 2018. The average rate of sea level rise was 1.3 mm/year (1901-1971) and rose to 3.7 mm/year (2006-2018). While sea level rise in the last century was mainly due to thermal expansion, glacier and ice sheet melt are now big contributors.

Threat of climate change looms over Vizag, Kakinada, Masula

In the low emissions scenario, GMSL is expected to be 0.19m in 2050 and 0.44m by 2100. In the very high emissions scenario, GMSL is expected to be about 0.23m in 2050 and 0.77m in 2100. These increases are relative to 1995-2014 and do not include uncertainties in ice sheet processes.

Scientists rely on ice sheet models to estimate future glacier melt. While these models have improved over the years, there are shortcomings in the knowledge and representation of the physical processes.

Ice sheets can destabilise rapidly as the water gets warm (marine ice sheet instability or MISI). Ice cliffs can collapse swiftly in a related process, leading to rapid sea level rise; this is marine ice cliff instability (MICI). Such changes are difficult to model and MICI events are not included in

the sea level projections mentioned above.

Kochi vulnerable to extreme climate events, say experts

As Siegert et al. indicate, changes in ice-ocean interactions can cause extensive and rapid sea level rise. This happens from mass loss of ice shelves (ice that flows into cold oceans while attached to the land), which may disintegrate suddenly. Under strong warming scenarios, ice shelves become vulnerable and lead to MISI. In the very high emissions scenario, with low confidence (and in the 17th-83rd percentile range), sea level rise can be as high as 1.61m by 2100.

Using ice sheet models coupled with ocean models to create probabilistic scenarios for the future is therefore tricky. The models do not capture the abrupt and non-linear dynamics of changes that take place. The report has a high-end storyline that includes processes where there is uncertainty. The main uncertainty lies in 'when' rather than 'if' the high-end scenario occurs. Projections based on 'structured expert judgments' indicate that sea level rise as high as 2.3m by 2100 cannot be ruled out.

Also read

IPCC Report 2021: Climate change is very real

According to the UN Environment Programme Emissions Gap Report, the world is heading for a temperature rise above 3°C this century, which is double the Paris Agreement aspiration. And there is deep uncertainty in sea level projections for warming above 3°C.

Communities along the coast in India are vulnerable to sea level rise and storms, which will become more intense and frequent. They will be accompanied by storm surges, heavy rain and flooding. Even the 0.1m to 0.2m rise expected along India in the next few decades can cause frequent coastal flooding. A speculator might think that if less than a metre sea level rise by 2100 is the likely scenario, they have another 60-80 years to continue developing infrastructure along the coast. That would not, however, be the right way to interpret the IPCC data.

Explained | Where will climate change strike?

The uncertainty regarding a metre or more of sea level rise before 2100 is related to a lack of knowledge and inability to run models with the accuracy needed. Low confidence does not mean higher sea level rise findings are not to be trusted. In this case, the low confidence is from unknowns — poor data and difficulty representing these processes well in models. Ignoring the unknowns can prove dangerous.

Also read | [IPCC report forecasts a future of severe weather](#)

Adaptation to sea level rise must include a range of measures, along with coastal regulation, which should be stricter, not laxer, as it has become with each update of the Coastal Regulation Zone. The government should not insure or bail out speculators, coastal communities should be alerted in advance and protected during severe weather events, natural and other barriers should be considered in a limited manner to protect certain vulnerable areas, and retreat should be part of the adaptation strategies for some very low-lying areas.

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To reassure Indian Muslims, the PM needs to state that the govt. will not conduct an exercise like NRC

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