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Rising sea levels: A tale of two cities

By Michael Hirst in Rotterdam and Kate McGeown in Maputo

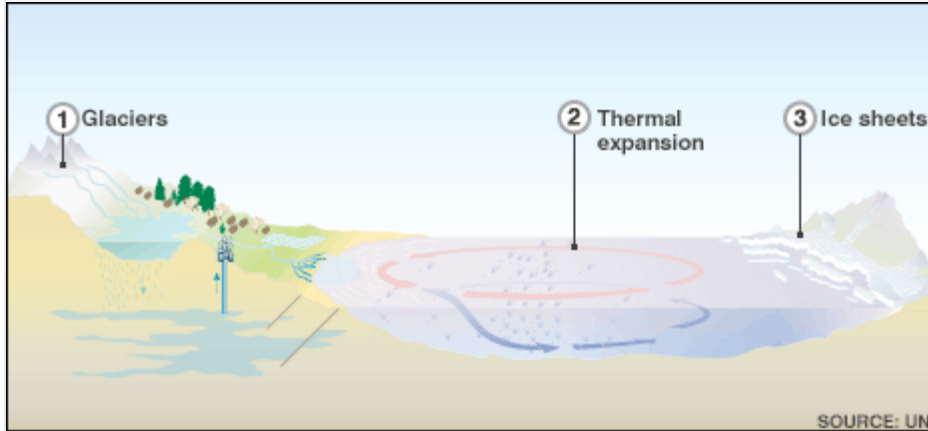


When people talk about the impact of rising sea levels, they often think of small island states that risk being submerged if global warming continues unchecked.

But it's not only those on low-lying islands who are in danger. Millions of people live by the sea - and are dependent on it for their livelihoods - and many of the world's largest cities are on the coast.

By 2050 the number of people living in delta cities is set to increase by as much as 70%, experts suggest, vastly increasing the number of those at risk.

To shed light the impact of rising sea levels, we are taking a close look at two very different cities, [Rotterdam](#) and [Maputo](#) , and their varying responses to the problem.



Glaciers: If the world's mountain glaciers and icecaps melt, sea levels will rise by an estimated 0.5m

Thermal expansion: The expansion of warming oceans was the main factor contributing to sea level rise, in the 20th Century, and currently accounts for more than half of the observed rise in sea levels

Ice sheets: These vast reserves contain billions of tonnes of frozen water - if the largest of them (the East Antarctic Ice Sheet) melts, the global sea level will rise by an estimated 64m

Much of Rotterdam - Europe's busiest port city - lies several metres below sea level, and this vulnerable position has led it to develop some of the best flood protection in the world. As the capital of Mozambique - one of the world's poorest countries, and one that is already feeling the effects of climate change - Maputo is struggling to provide cost-effective measures to mitigate the effects of the rising waters. Authorities in both cities know urgent action is needed to protect their populations, and both are trying to rise to the challenge.

Weaker Gulf Stream

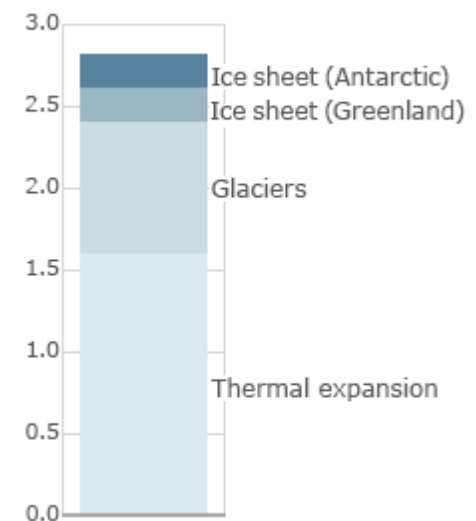
A rise in temperatures around the world due to carbon emissions since the industrial revolution means many icecaps and glaciers are steadily melting.

Rising temperatures have also caused ocean waters to expand - the main cause of sea level rise in the 20th Century.

The 2007 [Intergovernmental Panel on Climate Change \(IPCC\)](#) projected a likely sea level rise of 28-43cm this century, but it acknowledged that this was probably an underestimate, as not enough was known about how ice

What causes rising waters?

Annual sea-level rise (mm) 1993-2003



Error margin: ± 0.7 mm

Source: IPCC

behaves.

"The fact that sea levels are rising is a major reason for concern and it's a combination of the global average rise together with the natural variability leading to larger regional rises," said Dr John Church, from Australia's government-funded science and research body, the CSIRO.

The weakening of the Gulf Stream coupled with the gravitational effects of being closer to the North Pole mean waters in the northern hemisphere are experiencing the biggest rise.

Off the Netherlands, for example, sea levels rose by some 20cm in the last 100 years. But the country's national Delta Commission predicts they will increase by up to 1.3m by 2100 and by as much as 4m by 2200.

"There is a problem and we have to find an answer," said Rotterdam's Vice-Mayor Lucas Bolsius.

"We need to invest. If we don't put money into this issue we'll have a problem surviving."



Rotterdam is promoting the use of green roofs to collect rain water

Cyclones

The Dutch drew this conclusion from a massive storm surge in 1953, which caused widespread flooding and killed nearly 2,000 people.

They set about defending populated areas with a massive network of dykes and dams, and experts now estimate the country is protected from all but a one-in-10,000-year event.

The story is very different in Mozambique.

Already buffeted by regular floods and cyclones, the problem of rising sea levels is one the authorities in Maputo could do without.

But Mozambique has been identified as one of the countries likely to be affected most by climate change, and the issue will not go away.

While scientists cannot give an exact figure of how much the sea has already risen in Mozambique, the effects are already obvious.

"I went to the beach a lot as a child, and I've noticed things are changing," said 34-year-old Jose, who lives in Maputo.

"The water is eating the land - little by little it's eating the land."



Much of what Mozambique would like to do is deemed too expensive

Mozambique has compiled an action plan, and has been offered help from the World Bank, UN agencies and a plethora of other aid agencies.

But so far little has been done, and much of what the country would like to do is beyond its budget.

"I think people are still at the stage of 'Oh my God - what are we going to do?'" as environmentalist Antonia Reina puts it.

Mozambique will be going to the Copenhagen summit as part of a united African delegation, to ask for help from richer countries - like the Netherlands.

Africa argues that climate change - including rising sea levels - is a global problem, and demands a global response.

While most would agree with that sentiment, the reality is that every country has its own battles to face - and in this series of articles we examine how our two cities are coping, both at an individual and a municipal level, as the waters rise.