Ministry for the Environment
Manatū Mō Te Taiao

FACT SHEET 7

This is one of a series of fact sheets developed to accompany *Preparing for coastal change*, and provide further information on elements of coastal processes.

Sea-level rise

This fact sheet provides additional information on **sea-level rise***: what has happened so far, and what may happen in future.*

Sea level has changed in the past

Global sea level has fluctuated considerably over many thousands of years. When the climate was warmer about 125,000 years ago, it was a few metres higher than today's sea level. During the last *glacial maximum*, when the ice sheets were at their greatest extent (about 20,000 years ago), the sea's level was more than 120 metres lower than today.

After at least a thousand years of little change, sea level around the world began to rise around the latter half of the 19th century, and increased at a rate of around 1.7 millimetres a year during the 20th century. Since satellite measurements began in 1993, the global average sea level has risen more quickly, at 3.3 millimetres a year. The increase is due partly to natural climate variability, and partly to warming of the atmosphere and oceans.

There are two main drivers of the global rise in sea level:

- rising temperatures, which warm ocean waters and make them expand
- more water is being added to the oceans from melting of land-based ice in glaciers and ice sheets, as well as increased runoff of freshwater.

Global may be different to local

Local sea-level change may be different from the global average, because winds and currents may change, and because the meltwater added to the oceans is not distributed evenly around the world.

If the land is rising or falling, this also changes the sea level in that place. The term *relative sea-level* change describes the combined movement of both water and land. That is, even if sea level was constant there could still be changes in relative sea levels – rising land would produce a relative fall in sea level, while sinking land would produce a relative rise in sea level.

The New Zealand story

Across New Zealand, over the 100 years up to 2015, the average relative sea-level rise was around 1.8 millimetres a year (see figure 1). This is based on 10 sites around the coast where sea level is measured. It differs from the global average.

What we do to adapt to sea-level rise needs to be based on what will happen here – not the global average rate. For New Zealand, that means using sea-level rise projections for the south-west Pacific (which indicate about an additional 0.05 metres above the global average by the 2090s), plus any local uplift or subsidence of the land, which can be measured by continuous GPS recorders.

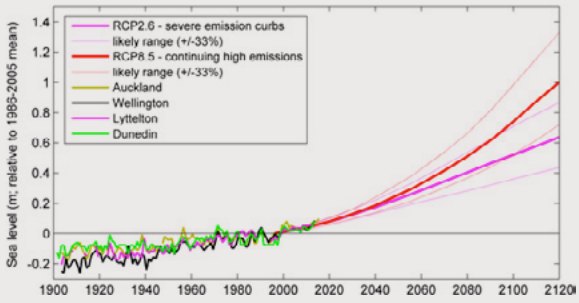

Figure 1: Relative sea-level rise for New Zealand's four main ports since 1900. Also included are sea-level rise projections from two scenarios adopted by the Intergovernmental Panel on Climate Change (IPCC) to describe possible climate futures, depending on how much greenhouse gas is emitted in the years to come. RCP2.6 represents severe emissions curbs, and RCP8.5 represents a scenario of continuing high emissions (IPCC, AR5).

The global story

In its most recent report released in 2014, the Intergovernmental Panel on Climate Change[1] (IPCC) projects that global sea-level rise by 2100 will be between around 0.3 metres and 1.0 metre above the 1995 level, depending on the amount of future greenhouse gas emissions. Over a shorter time frame, up to 2060, there is less uncertainty, and the IPCC projects a narrower range of sea-level rise – 0.2–0.4 metres.

In the more distant future, it is virtually certain that sea-level rise will continue for many centuries, well beyond 2100, as rising temperatures warm the oceans and make them expand. Sustained global warming of 2–4°C could lead to the near complete loss of the Greenland ice sheet over a thousand years or more, causing a global average sea-level rise of about 7 metres. It is also possible that sustained global warming may cause ice sheets in Antarctica to irreversibly collapse, raising sea levels.

1 The Intergovernmental Panel on Climate Change (IPCC) is the international body for assessing the science related to climate change. It was set up in 1988 to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adapting to it and reducing its severity (mitigation).

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