

## **Water resources and flooding: Anticipating the effects of climate change- SLMACC Project 408657**

### **Key points:**

1. Soil conditions are projected to become drier over much of the country during spring and summer, and wetter during winter.
2. River flows are on average projected to increase in the west and south of the South Island and decrease in the east and north of the North Island.
3. Low river flow conditions are expected to become even lower and occur sooner after the wet season over most of the country, with the exception of the west of the South Island.
4. River flow reliability – the proportion of time water may be abstracted from a river under low flow conditions – will generally decline across the country.
5. Floods are projected to become larger everywhere, particularly in the south.
6. The hydrological effects of climate change tend to become more extreme towards the end of the century and under less ambitious global efforts to reduce greenhouse gas emissions.

### **Climate Change**

Air temperatures across New Zealand are expected to increase this century, in line with global changes. How much warming occurs depends largely on international efforts to mitigate climate change by curbing greenhouse gas emissions. For New Zealand, the national average increase in temperature could range between 0.2°C and 1.7 °C by 2040 and between 0.1°C and 4.6 °C by 2090.

Linked to these changes in global and local air temperatures are shifts in rainfall – in terms of local averages, variability, and seasonality. Stronger westerlies in the winter and spring are expected to bring more rainfall to the west of the country and less to the east and north. During summer it is likely there will be more rainfall in the east of both islands, while evaporation will also be higher.

Extreme rainfalls are likely to become even more extreme in most places with the largest increases expected where average rainfall conditions are increasing. The severity of droughts is also expected to increase in many parts of the country.

### **Our Changing Water Cycle**

Changes in temperature and rainfall this century will lead to changes in New Zealand's water cycle, affecting soil moisture, river flows, floods, and other components of the freshwater system. But the complexity of the changes outlined above means these effects will vary among regions and even between neighbouring catchments.

### ***Soil moisture***

Soil moisture conditions during spring, summer and autumn are expected to remain about the same or become slightly wetter by mid-century under concerted reductions in global greenhouse gas emissions. With less climate change mitigation, soil moisture conditions are expected to become drier in the North Island and in inland South Canterbury, Otago and Southland, but increase in coastal South and North Canterbury.

Soils are expected to dry out sooner following the wet season for most of the country, and increasingly so towards the end of the century and under weaker climate change mitigation efforts.

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Soils will also be drier for longer periods of time in the northern and eastern North Island, Tasman, Marlborough and western Canterbury, but wetter for the West Coast and parts of eastern Canterbury.

### ***River flows***

Average river flows are expected to decrease in the Northland and Auckland regions and the east coast of the North Island, Marlborough and inland Canterbury, with less clear changes elsewhere. The changes become more pronounced towards the end of the century and under weaker climate change mitigation efforts.

The mean annual low flow (MALF) is generally expected to decrease for much of North and South islands.

Low flow conditions are expected to be reached sooner after winter for much of the North Island and eastern South Island, increasingly so towards the end of the century and with weaker mitigation efforts.

River flow reliability – the proportion of time water may be abstracted from a river – is generally expected to decrease, but shows substantial variability across the country.

### ***Flooding***

The magnitude of annual floods is projected to increase over the century and with weaker climate change mitigation efforts, in line with increasing rainfall intensities. These increases are generally most pronounced in the southern end of the South Island and western part of the North Island.



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Credit: Alan Blacklock, NIWA



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