WEATHER@HOME

The 'weather@home' project for Australia and New Zealand – providing very large datasets of climate prediction information for the region.

How are these data providing useful information for water engineers and planners? There are currently two main ways:

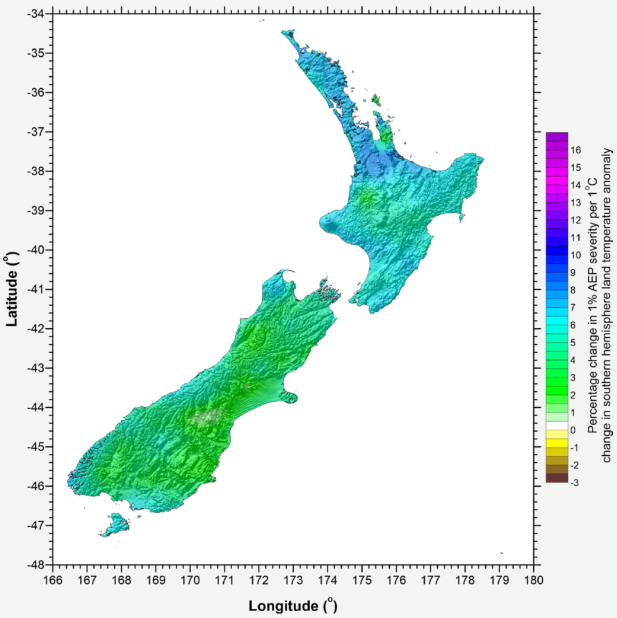
1. **Augmenting the climate change estimates in HIRDS – supplying more evidence about the regional variations in expected changes to rainfall. [Deep South National Science Challenge].**
2. **Providing a large dataset of river discharge information via input to hydrological modelling – this is involving the development of an adequate bias correction. [MBIE Endeavour project 'Whakahura' - 'Extreme Events and the Emergence of Climate Change'].**

New Zealand's primary tool for estimating extreme rainfall amounts around the country is HIRDS (High Intensity Rainfall Design System). Using observations from several hundreds of observing sites all around the country, HIRDS uses extreme value statistical fitting to estimate extreme rainfall amounts at any location. HIRDS' projections of how these will change with climate change employ a uniform multiplying factor across the whole country (for each rainfall duration and rarity).

Ongoing research is attempting to refine these estimates by adding information about the regional variation of projected changes to rainfall extremes. It is doing this using the unusually large amount of regional climate model data produced by the 'weather@home' project for the Australia-New Zealand region ('w@h/ANZ'). These many thousands of model simulations enable us to have more statistical confidence, particularly around rare events like climate extremes, whilst recognising that these thousands of simulations are of only the one model – the ideal would be this many simulations of all climate models!

The figure shows an example of the sort of regional information we are obtaining about changes to extreme rainfall with climate change. It shows the % change in the 1-in-100-year rainfall amount per degree of warming (defined as over Southern Hemisphere land). Absolute differences are fairly subtle, but some fairly coherent patterns of change are evident at the regional scale. The biggest changes appear to be in Northland – with extreme rainfall up to about 8% heavier per degree of warming - while the South Island shows an influence of the Southern Alps, with larger changes on the West Coast and smaller changes in the East. We are currently in the process of comparing these preliminary results with some from other models.

It is important to be aware of the limitations, as well as the usefulness, of the data in the figure. The grid size of w@h/ANZ is 50km, meaning it cannot capture the detail of processes operating on scales smaller than this. In particular, it cannot explicitly model the convective processes that can be important for large rainfalls in New Zealand.



Plot credit: Greg Bodeker, Bodeker Scientific

The related MBIE Endeavour project 'Whakahura' ('Extreme Events and the Emergence of Climate Change') is exploring using the 'w@h/ANZ' climate model data as input to the 'TopNet' hydrological model. A bias correction is being developed to optimise the uptake of these large datasets.

Additionally, 'Whakahura' has developed a new version of 'weather@home' that shrinks the domain to focus on New Zealand, modelling it in more spatial detail (25km instead of 50km). This is likely close to the highest spatial detail we can achieve with this particular model; however, it should enable some new insights into rainfall extremes, such as the representation of tropical cyclone-like systems similar to Cyclone Gabrielle that devastated parts of the North Island in February 2023.