NIWA Media Release

12 December 2011

New Zealand's rain falls mainly in the ~~plains~~ mountains.

Most of New Zealand's rain doesn't fall in the plains, but in the mountains, particularly the Southern Alps.

Dr Tim Kerr is a NIWA mountain rainfall specialist. He's been working high in the Southern Alps with 10 new rain gauges, to better understand where the rain is falling and in what quantities. One of the things he wants to find out is how temperature affects where mountain rain falls.

The total amount of water that falls on New Zealand each year is about 560,000 million cubic metres, including rain and snow. That's enough to cover the whole country 2.1 metres deep. Fortunately for city dwellers, most of it falls in the mountains. The Cleddau Valley to the west of Milford Sound, with an estimated average annual rainfall of 13.4 metres, is one of the wettest places in the world! Another example of the wet mountains is the Cropp River in the Hokitika River catchment, which in one year got 18.4 metres. By comparison Wellington and Auckland average 1.2 metres; Dunedin averages 0.8 metres and Christchurch averages a mere 0.6 metres.

Of course, while we all live in the drier areas, the nation's economy is highly dependent on this surplus of water. Any insight into the processes that affect the amount and distribution of our mountain's 'water towers' has far-reaching implications.

"I try to figure out exactly what causes the rain to fall where it does," Dr Kerr explains.

Measuring the precipitation levels in the Southern Alps benefits the economy.

"The area I am working in is to the west of the Lake Pukaki catchment, which is one of the most important water storage areas for the hydro-electricity industry." This work helps to shed light on the factors that determine security of supply for electricity consumers.

Past research has indicated there is a relationship between temperature and the amount of precipitation that spills over the mountains into the headwaters of the major South Island hydro-storage catchments. The colder it is, the greater the 'spillover' precipitation. This effect is generally attributed to the greater distance a cold snowflake will drift in the wind compared to a warm rain drop.

The headwaters of the Lake Pukaki catchment are considered to be particularly susceptible to this effect, as a large proportion of precipitation there falls as snow.

Much climate change research assumes that there will be generally more rain falling as the world warms up. "But in some locations," says Dr Kerr, "there will be less. To date the assumption has been that in a warmer climate the hydro lakes will get more rainfall, but if this temperature-spillover relationship is significant, the hydro lakes may actually get drier – that means more expensive electricity. By the same token, and more importantly from a hazard management point of view, West Coast villages like Franz Josef may end up with an even greater likelihood of flooding.

“My job is to figure out just how important this effect is, and if it will be noticeable in the greater scheme of things.”

The 10 new rain gauges have been located in places right in the thick of the high rainfall zone. They also happen to be in the middle of nowhere, requiring helicopter access to check them every few months. To add to the difficulty, they’re in places where snowfall occurs in the winter, so a standard rain gauge is of no use. “The rain gauge I use, or more correctly the precipitation gauge, looks something like a crashed space ship.”

Dr Kerr works with weather forecasting systems – but not for forecasting. By inputting data from weather events that have already occurred, he can see when the systems were wrong. “I try to figure out why. From a science perspective it feeds into improving the systems, and eventually, improving weather forecasting,” he says. The main use of the models, though, is to simulate hotter and colder climates and see how it affects the rainfall output. “I basically ask the system to tell me where the rain would fall if the atmosphere was two degrees warmer.”

Dr Kerr hopes he will find that the temperature-spillover relationship is not significant, so that electricity prices won’t go up and the residents of Franz Josef can sleep a little easier! If the opposite is true, well, at least he would have given us some warning.

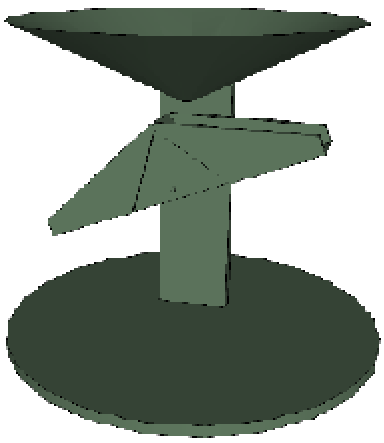
Dr Kerr has just started the second year of his three-year post-doctoral study.

This work is funded by the Ministry of Science and Innovation.

Background

Think Wellington – Cuba Street – the bucket fountain

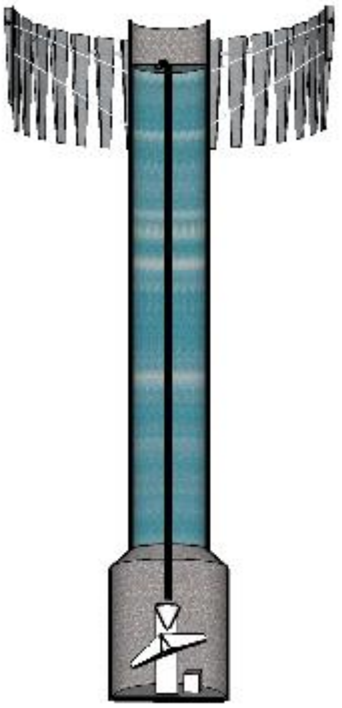
These are no ordinary rain gauges.



A standard rain gauge is made up of a funnel that guides rainfall onto one of two small buckets on either end of a see-saw.

Like the well-known Cuba Street buckets, when a known amount of water falls into one of the buckets, the see-saw drops and empties the bucket at the same time as raising the other bucket up into line with the funnel.

Every time the see-saw tips a small switch closes, which enables an electronic recorder to keep track and timing of the tips. This works well for rain, but If you put this type of gauge somewhere where it may snow, then the funnel clogs and nothing is measured, or worse still, the entire gauge gets buried. The solution is to add a two metre high bucket full of antifreeze with an overflow tube to the gauge,



The gauges consist of two-metre high pipe filled with mono-propylene-glycol (an agricultural food supplement that also works as an antifreeze!). An overflow tube runs from the top of the pipe down to the base where it feeds into a normal rain gauge.

Using this system, if it snows or rains, the level of the fluid in the main pipe rises and pours through the overflow tube to the tipping-bucket mechanism and a measurement is made. The height of the gauge helps prevent it from being buried by snow but has the draw back that it is susceptible to stronger wind, which is known to reduce the amount of snow or rain that falls into the gauge (under-catch). To get around this, the top of the gauge is surrounded with a circle of metal slats called an Alter Shield. Even an Alter Shield is not perfect, so a temperature and wind speed sensor have been installed near each gauge. Using the measurements from these devices a correction for any extra under-catch can be made. The whole thing looks a bit like a crash landed space ship!

The gauges were installed at the end of March 2011. When last checked, they were measuring from between 1.4 times (at the Lower Spencer Valley site) to 2.2 times (at the Upper Callery site) the amount that was measured at the Franz Josef Village airport (the nearest long-term NIWA rain gauge site). The Franz Josef airport has an estimated average annual precipitation of 4 metres, so the Upper Callery is certainly a bit damp. After two years of measurements at these sites, some much-needed extra detail will be known about the distribution and magnitude of rainfall in the area. It will then be time to move on to the next blind spot on the rainfall map.

For comment, contact:

Tim Kerr
NIWA Hydrology Scientist
Tel: +64 3 343 7802

For logistics, contact:

Jayne Cooper-Woodhouse
Media Advisor NIWA
Tel: 64 4 382 1621
Mob: 027 705 8577