

Hydrology Histories: Cropp Catchment

The Upper Cropp River Catchment (12.2 km²) is the wettest catchment near the West Coast, within the transect of raingauges that spread from Mt Hutt in the east to Fergusons Farm in the Waitaha Valley on the West Coast. Extreme precipitation dominates the basin hydrology, development of soils, vegetation and geomorphology.

The basin was a superb laboratory for studying processes of natural events, providing information on this extreme environment for use in hydrological earth-science models, engineering design, and to enable forecasts from this previously unmonitored hydrological region. It was studied by the Alpine Processes Group of the Ministry of Works and Development in the late 1970s and early 1980s.

The Cropp flows into the Whitcombe River, a major tributary of the Hokitika River. The upper basin ranges in elevation from 865 metres at Cropp Hut to Mt Beaumont 2140 metres.

Severe storms

The Cropp Hut received some upgrades in July 1979 to make the accommodation for Canterbury University students more comfortable. A shower was added as an extension on the wall facing the helicopter (Figure 1), and the roof was lined with batts and enclosed by a layer of plywood. We noticed the hut had once blown over and been resurrected and guyed to the ground. Unfortunately, none of the framing was square, adding difficulty when fitting the sheets of ply lining.

It is unnerving to recall that the hut housed six students during a storm on 3 December 1979. The river reached the terrace where the hut was located. A field visit by helicopter eight days later witnessed that the storm had rolled two swing bridges across the Whitcombe River around themselves. The students were still getting over the magnitude of the event, as well as catching up on sleep because the loud punch tape recorder housed in the hut recorded every 0.5 mm of rainfall.



Figure 1: Cropp Hut, 1979. The Cropp Hut automatic raingauge and three-metre storage gauge were installed on 12 July 1979 out of shot, but just to the left of the hut.

Murray Hawke was surveying mass movement of sediment within the Cropp Catchment, which involved painting large boulders bright red, some as large as cars. After this flood, no red rocks could be found.

While 524 mm of rainfall was recorded at Cropp Hut, it was obvious from the flood magnitude that the upper catchment received a larger amount, and that another raingauge was required near the top of the catchment..

Another large storm over 21–23 December 1995 (545 mm) triggered the partial collapse of Remarkable Peak, 2.5 km upstream, and material tumbled down the valley. This followed the wettest 48-hour period on record: 1049 mm rainfall over 11–13 December 1995 when the Cropp Hut raingauge was damaged by a flash flood, along with the Hut itself, which was turned around and off its piles, with 30 cm of sand inside

December 1995 still is the wettest month on record, with 2926 mm of rainfall.

The mean annual rainfall, over 42 complete years, for the Waterfall site is 11,364 mm. Storms occur every 8 to 9 days. A one-day storm total in excess of 200 mm occurs, on average, a staggering 11 times per year.

The mean annual rainfall for Cropp Hut is 10,257 mm.

	Cropp River at Waterfall	Cropp Hut
Duration	Maximum recorded rainfall (mm)	Maximum recorded rainfall (mm)
1 hour	134	104
3 hours	243	190
6 hours	366	292
12 hours	500	435
1 day	868	701
3 days	1137	1034
Month	2926	2459
Year	16616	14346

Table 1: Cropp River at Waterfall and Cropp Hut maximum recorded rainfall for different durations

Rainfall and rainguages

Short-term and long-term raingauge sites were used to identify the most likely wettest rainfall locations. The Tuke catchment (Table 2) is also very wet.

The first raingauge installed in the Cropp was the Beaumont Basin (three-metre storage) raingauge in 1977. This later proved to be unreliable for total precipitation measurement due to being buried in snow during good snow years. It was closed and removed in April 1980.

The Cropp River at Waterfall storage raingauge was installed on 4 January 1980, and upgraded to an automatic gauge on 13 June 1982. This gear was lost in a slip in 2000. The site shifted by 100 metres and 15 metres higher in altitude on 31 August 2000. On 6 November 2009, NIWA added satellite telemetry. It is used today by Westland Regional Council for flood warning.

The Westland Regional Council installed a radio telemetered raingauge called Base on 2 May 2012. It was located on a flat above the location of the second Cropp Hut raingauge site, which was relocated 330 metres northeast of the original site on 24 February 1996, following the December 1995 flood events.

Today both the Cropp River at Waterfall and Cropp Hut raingauges have satellite telemetry, and are maintained by the NIWA Field Team in Greymouth, led by John Porteous.



Figure 2 (left): Beaumont Basin raingauge, 14 June 1978. Graeme Horrell reading the rainfall total since the previous visit. Figure 3 (right): Cropp River at Waterfall raingauge. Hydrological Society Conference field trip on 20 November 2008. (Later, between 22–25 November, 991 mm rain was recorded.) From left: Bob McDavitt, Mathirimangalam Srinivasan (MS), Suzanne Poyck and Graeme Horrell.

Raingauge name	Catchment	Period of measurements	Estimated mean annual rainfall (mm)
Remarkable Peak*	Cropp	Short-term	11,854
Cropp Upper * ²	Cropp	Became long-term	11,364
Beaumont Basin	Cropp	Short-term	10,842
Cropp Hut #	Cropp	Became long-term	10,257
Cat Creek Shelf	Whitcombe	Short-term	7971
Cat Creek Hut	Whitcombe	Short-term	7334
Noisy Creek	Noisy Creek	Short-term	9883
Cropp Junction	Whitcombe	Short-term	8855
Dickie Spur	Tuke	Short-term	8290
Tuke Spur 1	Tuke	Short-term	10209
Tuke spur 2	Tuke	Short-term	9455
Tuke Hut	Tuke	Became long-term	9769
Tuke Basin	Tuke	Short-term	9346
Tuke Ledge	Tuke	Short-term	8958
Ivory glacier	Waitaha	Short-term	9201
Rapid Creek	Hokitika	Existing automatic raingauge from 1964	7438
Prices Flat	Whitcombe	Existing automatic raingauge from 1971	7543

* 300 m higher than Waterfall, on a steep slope
 *² Renamed Cropp River at Waterfall
 # Since records began 1979

Records since 1980

Table 2: Raingauges used to identify the wettest catchment.

Helicopter flights

The regular raingauge site visits by helicopter were undertaken by Dr Mauri McSaveney, Graeme Horrell and Ian Whitehouse. In those early days, we never got over the uncanny feeling of climbing a three-metre raingauge, to find the water level depth since our last visit was equivalent to being over our heads. Raingauges were visited every four to six weeks. If left for eight weeks, they risked overflowing, losing the rainfall total.

Interpretation of weather analysis maps became key to successful helicopter flights that allowed all raingauges of the transect to be read in one day. Any sign of a northwest wind delayed flights. Over time, calibrating weather forecasts to rainfall, we learned some northwesterners are actually dry, most are wet and some very wet. An extremely wet northwesterly was concerning if the storage gauges had not been emptied for four or five weeks, risking overflow.

These extremely wet events were appropriately described by our colleague Trevor Chinn and named “conveyer belts of moisture”. Today they are called “atmospheric rivers”.

In the early years, we used Goodwin McNutt’s Winged Hunters FH1100 helicopters based in Fox Glacier, and were picked up at Glenfalloch in the Rakaia. In 1981, the helicopter funding for Alpine Processes was withdrawn. Friendly helicopter pilots, DOC and Forest Service were approached, and some sites were visited including the Cropp, Tuke and Ivory Glacier. The Tuke trip involved a flight into the Tuke Basin with cans of paint. As payment, I painted Tuke Hut and walked out. Ralph Dickson and I walked to the Cropp via Noisy Bivy, to find it had very recently blown flat. We crawled in, sheltered for the night, and the next day walked on to Cropp Hut and out to Hokitika Gorge.

These recollections from Graeme Horrell are part of a New Zealand Hydrological Society [series](#) that documents the times and memories of New Zealand's senior hydrologists.