JOURNAL OF HYDROLOGY (N.Z.) Vol. 10, No. 2, 1971

EVALUATION OF RAINFALL DATA FROM PLASTIC AND COPPER RAINGAUGES

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ABSTRACT

Comparative data are presented from two plastic Marquis 1000 raingauges and a standard 5-inch copper raingauge. The data were collected at the climate station on Puketurua Experimental Basin as part of a wider investigation into raingauge efficiency. The data available show that on average, over a 19-month period, the two plastic gauges caught 9.66% and 8.51% more moisture, respectively, than an adjacent copper gauge. Lower wetting losses on the plastic gauges are thought to account for much of the difference in catch.

INTRODUCTION

The data were collected at Puketurua Experimental Basin, 32 km north-west of Whangarei, as part of a project of the Water and Soil Division, Ministry of Works. This project was established to evaluate the relative merits of various types of raingauges in common use with the Hydrological Survey of the Ministry of Works.

In Northland plastic Marquis 1000 raingauges are widely used on farms, as daily manual gauges in representative basins, and in special investigations – for example, interception studies on experimental basins. Some knowledge of their performance, when compared with a standard copper 5-inch manual gauge, seemed highly desirable.

EXPERIMENTAL SITE

The Puketurua climate station is located on a narrow spur near the centre of the 248-ha catchment. The station is 67 m above sea level in a catchment ranging from 19 m to 151 m. The climate station, although well exposed, is not in an extreme ridge-top location. Up to February 1971 the climate station was surrounded by manuka scrub vegetation. The vegetation was burned on 11 February 1971, and by May 1971 all standing stems had been

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removed by discing of the land. The change in exposure at the climate station, in effect making the spur narrower and steeper, does not appear to have had any marked effect on the rainfall catch. All gauges in the trial would be equally affected by the change in exposure.

The two plastic Marquis 1000 gauges were located on either side of the standard 5-inch copper gauge. One gauge (A) was 3.82 m from the copper gauge, while the other (B) was 6.06 m away in the opposite direction. All three gauges were exposed with the orifice 305 mm (1 ft) above the ground. The plastic gauges have an orifice diameter of 101.6 mm (4 inches) compared with 127 mm (5 inches) for the copper gauge.

DATA COLLECTION

The gauges were read at 0900 hours each day, and on days with no rain any moisture in the central measuring flask of the plastic gauges was emptied. Northland frequently has heavy dew at night, and on numerous occasions up to 0.25 mm (0.01 in.) was present in the measuring flask when no rain had fallen. Examination of the copper gauge would reveal no sign of moisture, or occasionally a single unmeasurable drop of water in the bottom of the copper collecting bucket. The data presented in Table 1 do not include the dew emptied from the gauges after fine days. On days when rain fell in the early morning after heavy dew, the dew would be included in the rainfall total, as this is unavoidable.

TABLE 1 — Comparative catches, of a standard copper raingauge (5-inch diameter) and two plastic Marquis 1000 raingauges, shown on a seasonal basis. Catches of each Marquis gauge are expressed also as percentage increases of the copper gauge catches.

Period	*Copper gauge (mm)*	*Marquis gauge A (mm)*	*Increase (%)*	*Marquis gauge B (mm)*	*Increase (%)*
1970:					
May	82.6	90.9	10.15	90.7	9.84
Jun–Aug	426.5	463.3	8.63	458.5	7.50
Sep–Nov	422.9	453.9	7.33	452.6	7.02
1970–71:					
Dec–Feb	353.8	387.3	9.47	378.9	7.09
1971:					
Mar–May	383.2	422.8	10.33	418.4	9.19
Jun–Aug	496.9	558.5	12.49	551.8	11.05
Sep–Nov	341.2	372.6	9.20	369.5	8.29
Total:	2507.1	2749.3	9.66	2720.4	8.51

RESULTS OF TRIAL

The data are presented in Table 1 both in absolute amounts and as a percentage of the catch in the copper gauge. The data have also been broken into three-monthly seasonal periods. As the table shows, the plastic gauges caught consistently more moisture than the copper gauge. Over a 19-month period the plastic A and B gauges, respectively, caught 9.66% and 8.51% more moisture than the copper gauge.

DISCUSSION

Field observations at Puketurua indicate that the smooth plastic orifice and funnel of the Marquis 1000 gauge transmit water droplets into the gauge much more readily than the copper orifice and funnel of the standard gauge. The amount of dew collected in the plastic gauges lends support to these observations, although condensation within the plastic gauge could be a factor in dew collection.

With much of the rainfall in Northland occurring as showers, the difference in wetting loss on the orifice and funnel surfaces of the copper and plastic gauges must have a significant effect on the total rainfall recorded over a period. The lower wetting loss on the plastic gauges is thought to be the main reason for the difference in catch shown in Table 1. No experimental work has been carried out to verify this observation.

The seasonal rainfall data lend some support to the observation outlined above. For example, in wet periods such as June–August 1971 when there was above-average rainfall occurring on 55 raindays and numerous rain showers, the percentage difference in catch increased to 12.49% (A gauge) and 11.05% (B gauge). Similar wet periods occurred in March–May 1971 and September–November 1971. In all these wet periods the number of wetting cycles was considerably higher than in a dry period such as that from December 1970 to February 1971 when there were only 34 raindays.

CONCLUSIONS

1. In the field trial at Puketurua climate station, the plastic Marquis 1000 gauges caught consistently more moisture than a standard 5-inch copper gauge. The difference in catch appears to be largely due to the difference in wetting loss on the two types of gauge.
2. The difference in catch becomes more marked in wet periods with a high number of raindays.

3. The use of mixed raingauge networks in hydrological investigations, for example in representative basins, is clearly undesirable.
4. The use of the relatively inexpensive plastic gauges for comparative studies is quite satisfactory. For example, in determining throughfall in interception studies where pairs of gauges are used at each investigation site; obviously, the use of one plastic and one copper gauge in these conditions would give misleading results.

ACKNOWLEDGMENTS

The assistance of hydrological field staff in collecting the data, and of Miss P. A. McManus in particular in preparing and checking the data, is gratefully acknowledged.

Publication of this report is authorized by the Commissioner of Works.