PROTECTION OF RAINGAUGES FROM FREEZING

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SUMMARY

The heat of the soil three or four feet below the surface is used to prevent freezing of water in raingauges.

INTRODUCTION

An investigation into the behaviour of octapent raingauges in regions where winter ground surface temperatures were frequently as low as 10° or 20° F., revealed the fact that, where raingauges had been correctly installed, no freezing of the contained water in these gauges had been experienced.

There is no measurable diurnal change in temperature at distances of one metre below the surface in the Wairakei-Taupo area in New Zealand, and seasonal change is very small. (Thompson 1960).

Damage occurs to containers in manual raingauges when freezing temperatures occur in winter, and under such conditions severe damage can occur to the floats and float chambers of recording raingauges. Such damage causes loss of valuable records and expensive repair bills.

In the winter of 1961, an endeavour was made to use the heat from a few feet below the ground surface to keep a Casella natural siphon raingauge from freezing. Results were encouraging.

OCTAPENT RAINGAUGES

The octapent raingauge is a long term manual raingauge, originating from the combination of an eight inch raingauge body with a five inch collecting funnel, and having a collecting can capacity of either 27 or 50 inches of rainfall.

It is generally similar to a standard manual raingauge, except that it has a larger capacity, has an inner can with a narrow neck at the top covered by a sliding washer through which the tube of the funnel passes, and has a rubber hose pipe inserted through an aperture in the top of the inner can.

The hose is expected to collapse with pressure of ice if the contained water freezes, and thus protect the can from damage.

The top of the hose in the older types of gauge, was covered by a copper lid, which frequently did not fit well, but in the later types the hose is expanded by a brass tapered plug to make it a tight fit in the aperture when installed.

The water in the inner collecting can is exposed to the exterior air only through the funnel tube, provided the washer covers the neck of the container and the copper lid, or brass plug, is properly installed.

The cavity between the inner can and outer can contains air which cannot interchange with the outside air and is kept warm by conduction from the warm soil.

This air acts as a blanket to keep the water in the inner can from freezing under conditions normally experienced in New Zealand at altitudes up to 4,000 ft. in inland localities.

It is essential that the raingauge be buried properly in the soil, so that the base is at least one foot below ground level.

EXPERIMENT AT KAINGA, CHRISTCHURCH.

Two similar Casella weekly recording natural siphon raingauges were installed on 8 July 1961 with good exposure, about ten feet apart, and with their rims at equal heights above ground surface.

Minimum thermometers were installed internally, in similar positions, close to the float chamber of each instrument.

One of the raingauges had a 44 gallon tar drum buried in the ground beneath it in the manner shown in the accompanying diagram except that no insulation was used around the raingauge. (Diag. on p.9).

Thermo-siphon circulation of air within the raingauge and the drum, transfers heat from the ground to the interior of the raingauge.

Casella recording raingauges were used for the experiment because they were particularly suitable on account of their open base requiring no modification, and this type of instrument was readily available at the time.

Results:

Apart from the thermometer readings, the visual results were spectacular, as on mornings of heavy frosts the control instrument was always white with frost all over its exposed surface, while the protected instrument was gleaming polished copper.

The lowest recorded minimum temperature in the control instrument was 22° F., while that in the protected instrument did not descend below freezing point.

Application:

A Casella natural siphon raingauge at Cora Lynn, near Arthurs Pass, which, despite the use of a kerosene heater and a layer of insulating material installed around the body of the instrument, has given trouble with burst floats due to freezing. This had a 44 gallon drum placed beneath it on 16 August 1961. The insulating material was retained, but the heater was abandoned.

Since installation of the drum, minimum air temperatures have, on a number of occasions, been down to 16° F., while the minimum temperature recorded on the

outside of the float chamber was 27½° F. No freezing of the water in the float chamber occurred.

Early in 1962 a similar Casella raingauge was installed with a 44 gallon drum protection in the Mt. Cook region, but has not yet encountered sufficiently low temperatures to warrant comment.

REFERENCE

Thompson, G.E.K. 1960: Shallow Temperature Surveying in the Wairakei-Taupo Area. N.Z. J. Geol. Geophys. 3: 553.

OVERSEAS HYDRO-METEOROLOGICAL PRACTICE

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Paper presented at the Hydrology Symposium, Annual Conference of the Meteorological Service, 2 November 1961.

SUMMARY

The determination of the probable maximum flood involves essentially two phases. The first is a study of the hydro-meteorological conditions leading to maximum runoff. The second is the conversion of these conditions into runoff, in the form of a hydrograph. This paper is concerned principally with the first phase, and the probable maximum runoff-producing meteorological conditions are described with some detail in the case of precipitation and in outline only in the case of snowmelt.

INTRODUCTION

The paper describes in general terms the application of hydro-meteorological principles to determine probable maximum precipitation (PMP) in an area where original hydrological and meteorological data (especially upper atmosphere data) are scarce. Reference is also made to the estimation of maximum snowmelt rates.

The hydro-meteorological methods described are those evolved by the United States Weather Bureau and are applicable to any area where the necessary topographic, precipitation, streamflow, dewpoint and wind data can be obtained or simulated.

PURPOSE

The need to establish design criteria for flood protection measures and especially the desirability of establishing conformable sizes of flood discharge for spillway design on a series of dams in the same