INSTRUMENTS AND METHODS

RADIO-ISOTOPE SNOW GAUGE

METEOROLOGISTS and hydrologists, who have long felt the need for continuously recording the water equivalent of the snow cover in remote places, will be interested to read a report of the successful practical development of the radio-isotope snow gauge. Full details of the equipment are given in a paper* published by the Corps of Engineers, U.S. Army, South Pacific Division. With the aid of this report, some electronic gear, and sufficient funds, similar installations can be made elsewhere with a good prospect of satisfactory unattended operation of the gauge for periods of 8 months over airline distances of some 20 miles (32 km.). A brief account of the equipment and its operation has been extracted from the publication and some comments added.

The equipment, as at present developed, comprises three separate installations linked by V.H.F. radio:

(1) a snow-field measuring and transmitting station,
(2) a relay station for line-of-sight transmission,
(3) a base receiving station.

At the snow-field station gamma radiation is provided by two 20 millicurie units of cobalt 60, which are placed in a lead collimator and set in a concrete block flush with the ground surface. The radiation is directed upwards to a Geiger-Müller detector suspended 15 feet (4·6 m.) overhead. Snow lying between the isotope and the detector attenuates the radiation logarithmically (reduces the detector pulse rate) according to its water equivalent. The detector pulses are amplified, divided in number by 8, and fed into a frequency-modulated radio transmitter with a $\frac{1}{4}$ watt output. A high-gain directional aerial is used. This installation is battery driven and is capable of sustained unattended operation for 8 months. Intermittent transmissions are controlled by an electrically wound, spring-driven clock.

The relay station is only necessary where direct transmission is impossible, and this is frequently the case in mountainous country where line-of-sight transmission is usually impossible. This station, which is also operated by batteries and controlled by time switches and a squelch circuit, picks up the signals from the snow-field with a non-directional aerial and beams them to the base station by a transmitter identical to that at the field station.

The receiver at the base station feeds the signals to a teledecoder and on to an electro-mechanical counter with a timing device. The rate at which the pulses are received is then translated into the water equivalent of the snow cover.

The above description neglects the various complicating factors such as cosmic radiation, decay of radioactive source, collimation of radiation, radio noise and adequate power supplies, all of which are discussed in detail.

Up to about 40 inches (100 cm.) of water equivalent can be measured to an accuracy of 2 or 3 per cent and satisfactory comparisons are obtained with direct snow density measurements through several seasons. Measurement of only moderately larger quantities of water requires very much more intense sources of gamma radiation and very careful consideration of the risks to human health.

Measurement of dirty snow by this method may present some difficulties and the concrete block may disturb the thermal transmission at some sites.

Several suggestions for improvements are given.

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* *Development and Test Performance of Radioisotope Radiotelemetering Snow-gage Equipment*. Corps of Engineers, U.S. Army, South Pacific Division, Civil Works Investigation Project CWI-170, April 1956, 47 pages, 37 text-figures, 5 tables, Appendix on wind chargers, 26·5 × 20 cm.