RESEARCH WITH WINDSHIELDS FOR PRECIPITATION GAGES*

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IN many regions of the western United States it is important to obtain precipitation records at high-altitude locations. This information is of primary importance in run-off forecasting to insure proper regulation and utilization of river flow and reservoir storage on irrigation projects and hydro-electric developments, as well as flood control works. Because most of the precipitation over the mountainous regions falls in the form of snow, the problem of obtaining a consistent measurement of precipitation is complicated by the action of wind. Deficient catch in gages exposed to winds and difficulty of maintaining the gages pointed up the need for a study which was begun in 1948

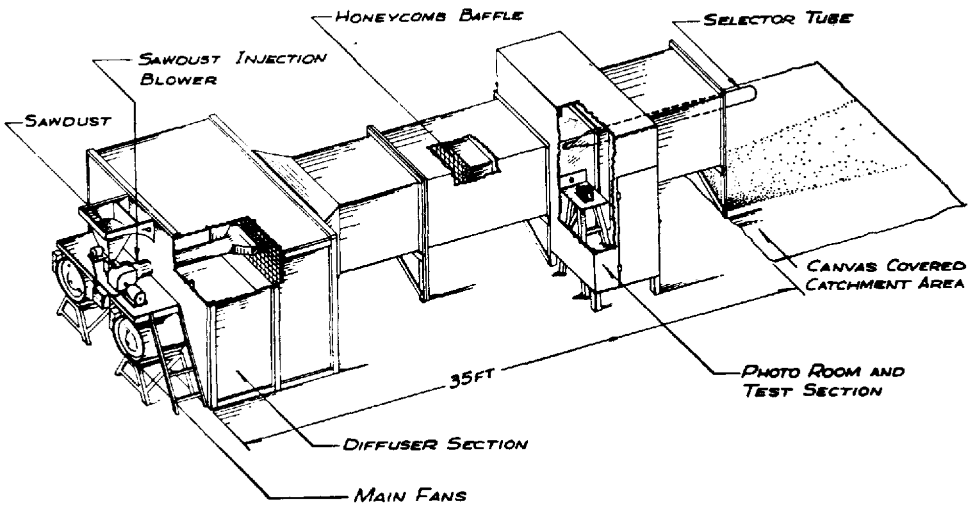

Fig. 1. Schematic drawing of low-speed wind tunnel used to study model precipitation gages under simulated snow-storm conditions

by the Engineering Experiment Station of the University of Idaho in cooperation with several federal agencies. The study has been concerned with the development and use of high-altitude precipitation gages and windshields for these gages.

Research work on this project has consisted of a laboratory study of scale models and shapes in a low-speed wind tunnel and field tests at two remote mountain locations. Fig. 1 (above) shows a diagram of the wind tunnel developed for making the investigations. In the wind tunnel air-flow patterns around and over various model gages were studied. Then the catching characteristics of model gages were tested under simulated snowstorm conditions using a fine sawdust for snow. Fig. 2 (p. 394) shows a gage with shield being tested, while Fig. 3 shows the adverse updrafts caused by winds as found by photographing a model unshielded gage during a simulated snowstorm.

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Special photographic techniques were used to evaluate theoretical true catch. Various types of shielding were tried on several different gages until a shield design was arrived at that gave an improved consistency of catch. The basic type of shielding tested was the hanging-baffle type, of which the Alter shield is typical. Other shapes and combinations, including the Nipher shield, were studied; but the functional requirements in the case of measuring snowfall required that the shield enable the gage to be operative at all times and aid in freeing the gage from being capped over with rime and encrusted snow.

Prototype gages, with and without windshields, of the types used in the wind tunnel were tested at remote mountain stations where records were kept of variations in catch, wind velocities and snow condition. Most of the gages used were of the storage type. A later phase of the work has dealt with a radio-reporting gage which uses a truncated intake tube projecting from the shelter house. Pilot installations of these gages are being investigated by the U.S. Bureau of Reclamation in California.

Definite improvements in catch were obtained, working with models in the tunnel. Under a velocity of 20 m.p.h., unshielded gages caught about 30 per cent of the theoretical true catch while the gages equipped with the best shields caught over 70 per cent of the theoretical true catch. Photographs illustrating the improvement of air flow over the gages further illustrate the value of shielding precipitation gages (see Figs. 2 and 4). Results from field tests showed definitely greater catch in shielded gages, and the improvements were similar to those found in the wind tunnel but of less magnitude. Shielding requirements were found to vary with various types of gages. The larger the gage the greater the disturbance from wind and thus the need for larger shields. Development work has concentrated on making the shield more easily maintained and capable of keeping it and the gages free from encrusted snow.

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