

Artificial Windshielding of Precipitation Gauges in the Arctic

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INTRODUCTION

Precipitation gauges can provide good measurements of the water equivalent of snow precipitation, provided the gauge is protected or shielded from wind effects. Unfortunately, there are no standards for collecting snow precipitation. Gauges located in exposed and windy areas may be totally unshielded, partially shielded by one or more buildings, or equipped with one of several types of artificial shields. The various shielding options in common use, therefore, produce a wide range of gauge catch efficiency. Also, the various studies of artificial shields in the United States and Canada have produced a wide range of results. This must be, in part, due to the wide range of weather conditions under which the various studies have been conducted. A lingering problem is applying the results to the local conditions of Alaska's tundra regions.

METHODS

A study of the windshield alternatives, under the unique conditions of Alaska's arctic coastal region, was set up at the CMDL Barrow facility during September 1989. Snowfall catches from four installed precipitation storage gauges were compared with that from an existing storage gauge protected by a Wyoming shield [Hanson, 1988]. Two of the four gauges were shielded, one with a Nipher shield [Goodison *et al.*, 1983] and the other with an Alter shield [Alter, 1937], and two were unshielded. One of the unshielded gauges was serviced on an event basis, the same as the three shielded gauges. The other unshielded gauge was treated as if it were a remote gauge, allowing rime to build up and dissipate naturally to see what effects rime had on the overall catch. The four gauges are each 20.3 cm in diameter \times 100 cm tall, mounted with the orifice 2 m above the normal ground surface. The existing Wyoming-shielded gauge is 30.5 cm in diameter \times 2 m tall and is equipped with a Leupold-Stevens water-level recorder. Because the anchors melted out in the permafrost, the 1993 wind storms blew over the Wyoming wind shield. This was an unusual wind event for that time of year. The gauge was not rebuilt.

RESULTS

Six winter seasons of total precipitation are available for comparison of the four gauges in Table 1.

The results continue to confirm the catch of the Alter shield is 37 to 58% of the Nipher shield with the unshielded gauges ranging from 10 to 36% of the Nipher shielded precipitation gauge.

TABLE 1. Comparison of Total Precipitation of the Four Remaining Gauges

	Nipher	Alter	Unshielded Serviced	Unshielded Unserviced
Oct. 5, 1993- June 1, 1994	76.2 mm	38.1 mm	no record	23.9 mm
% of Nipher		50%		31%
Oct. 1, 1994- June 17, 1995	104.6 mm	54.6 mm	36.3 mm	37.3 mm
% of Nipher		52%	35%	36%
Oct. 3, 1995- June 3, 1996	84.1 mm	49.3 mm	28.7 mm	23.9 mm
% of Nipher		58%	34%	28%
Oct. 3, 1996- June 5, 1997	80.8 mm	30.0 mm	10.4 mm	7.9 mm
% of Nipher		37%	13%	10%
Oct. 1, 1997- June 2, 1998	89.4 mm	45.5 mm	18.3 mm	29.5 mm
% of Nipher		51%	20%	33%
Oct. 1, 1998- June 2, 1999	113.8 mm	59.9 mm	36.6 mm	38.9 mm
% of Nipher		53%	32%	34%

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