

UAF/Frontier Snowfall/Blowing Snow Observations at Barrow CMDL: Research Plan and Preliminary Result

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Systematic errors caused by wind-induced undercatch, wetting, and evaporation losses in precipitation measurement have long been recognized as affecting all types of precipitation gauges. The need to correct these biases, especially for solid precipitation measurement, has now been more widely acknowledged as the magnitude of the errors and their variation among gauges became known and their potential effects on regional, national, and global climatological, hydrological, and climate change studies were recognized. To assess the national methods of measuring solid precipitation, the World Meteorological Organization (WMO) initiated the Solid Precipitation Measurement Intercomparison Project in 1985. Thirteen countries participated in this project and the experiments were conducted at 20 selected sites in these countries from 1986/1987 to 1992/1993. Methods of bias-correction have been developed for many national precipitation gauges commonly used in the Northern Hemisphere. Test implementations of the MWO correction procedures have been made to the archived precipitation data in some regions/countries. The bias corrections have increased the winter and annual precipitation amounts by up to 50-100% in the high latitude regions. These results clearly show that precipitation amounts in these regions are much higher than previously reported. This points to a need to review our understanding of fresh water balance and the assessment of atmospheric model performance in the Arctic regions.

The Arctic climate is characterized by low temperature, generally low precipitation, and high winds. Arctic precipitation events generally produce small amounts but they occur frequently and often with blowing snow. Because of the special condition in the Arctic, the systematic errors of gauge-measured precipitation and factors such as wind-induced undercatch, evaporation, and wetting losses, underestimates caused by not accounting for trace amount of precipitation and over/under measurement because of blowing snow are enhanced and need special attention. This issue has been a considered in WCRP projects, such as ACSYS and GEWEX. It is recommended that an intercomparison experiment be conducted to further test the national precipitation gauges commonly used in Arctic regions and to evaluate the existing bias correction procedures.

Recognizing the importance of the precipitation data quality in cold region hydrological and climatic investigations, the Japan Frontier Research System for Global Change and the Water and Environmental Research Center (WERC) and the University of Alaska Fairbanks (UAF) have collaboratively undertaken a gauge intercomparison experimental study at Barrow, Alaska. Last winter reference gauges (Wyoming snow fence system) and various national standard gauges commonly used in the Arctic regions were installed. An automatic weather station for blowing/drifting snow observations in winter months was also installed to investigate blowing snow mass flux as functions of wind speed, air temperature, and height, and to evaluate their impact on gauge snowfall observations. This presentation will describe the research plan and present preliminary results of gauge snowfall observations at Barrow CMDL. It will also present several interesting examples of blowing/drifting snow events observed by our automatic snow particle counter system.