

The impact of a windshield in a tipping bucket rain gauge on the reduction of losses in precipitation measurements during snowfall events

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The amount of snow available controls the ecology and hydrological response of mountainous areas and cold regions and affects economic activities including winter tourism, hydropower generation, floods and water supply. An accurate measurement of snowfall accumulation amount is critical and source of error for a better evaluation and verification of numerical weather forecast, hydrological and climate models. It is well known that the undercatch of solid precipitation resulting from wind-induced updrafts at the gauge orifice is the main factor affecting the quality and accuracy of the amount of snowfall precipitation. This effect can be reduced by the use of different windshields.

Overall, Tipping Bucket Rain Gauges (TPBRG) provide a large percentage of the precipitation amount measurements, in all climate regimes, estimated at about 80% of the total of observations by automatic instruments. In the frame of the WMO-SPICE project, we compared at the Formigal-Sarrios station (Spanish Pyrenees, 1800 m a.s.l.) the measured precipitation in two heated TPBRGs, one of them protected with a single alter windshield in order to reduce the wind bias. Results were contrasted with measured precipitation using the SPICE reference gauge (Pluvio2 OTT) in a Double Fence Intercomparison Reference (DFIR).

Results reported that shielded reduces undercatch up to 40% when wind speed exceeds 6 m/s. The differences when compared with the reference gauge reached values higher than 70%. The inaccuracy of these measurements showed a significant impact in nowcasting operations and climatology in Spain, especially during some heavy snowfall episodes. Also, hydrological models showed a better agreement with the observed rivers flow when including the precipitation not accounted during these snowfall events.

The conclusions of this experiment will be used to take decisions on the suitability of the installation of windshields in stations characterized by a large quantity of snowfalls during the winter season and which are mainly located in Northern Spain