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# On improving rainfall and solid precipitation weighing-gauge measurements using laboratory experiments

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Short interval snowfall, drizzle and light rainfall events can be hard to measure with precipitation gauges due to sampling limitations, wind effects, and noise. The noise observed in the data sampling can often be greater than the detectable signal from a real precipitation event. In addition wind effects can induce differential air pressure on the measurement devices inside the gauges increasing the signal noise.

Various algorithms have been devised to help reduce noise and other unwanted effects in precipitation gauge measurements. Most of these algorithms have focused on the removal of wind effects, while others have focused on reducing temperature dependencies. Recent laboratory testing has demonstrated the ability to reproduce some of these anomalies observed in precipitation measurements during field trial campaigns. Assessing the factors contributing to these anomalies is required to accurately simulate these conditions in the laboratory. It is also important to understand these factors to support the selection of the appropriate natural conditions to be simulated in the laboratory environment.

This work details the wind-free laboratory testing of some of the above-mentioned effects in order to develop a measurement interpretation algorithm capable of improving the accuracy of the Geonor T-200B vibrating wire gauge and the OTT Pluvio2 weighing gauge. Specifically, these experiments will examine the effects of temperature oscillations on the various gauge components, as well as snow capping and the potential heat-plume problem associated with heating the gauge orifices. These experiments use an artificial snow-generation machine: a snowflake simulation system in which snowflake sizes and snowfall rates can be controlled in a wind-free environment. The positive outcome of this preliminary phase would result in the transfer of the tested methodologies to the on-going WMO Solid Precipitation InterComparison Experiment (SPICE) campaign.

The laboratory experiments are complemented by a preliminary analysis of the Marshall experimental site measurements (taken just outside of Boulder, Colorado, USA). The benefit achieved by applying the selected correction methodologies to real world observations will also be discussed.