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Advances in the evaluation of wind-induced undercatch using CFD-based simulations of snow gauge performance

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Despite its importance, accurate measurements of precipitation remains a challenge. Measurement errors for solid precipitation, which are often ignored for automated systems, frequently range from 20% to 70% due to undercatch in windy conditions. While solid precipitation measurements have been the subject of many studies, there have been only a limited number of numerical modeling efforts to estimate the collection efficiency of solid precipitation gauges when exposed to the wind, in both shielded and unshielded configurations. The available models use CFD simulations of the airflow pattern generated by the aerodynamic response of the gauge/shield geometry to perform the Lagrangian tracking of solid precipitation particles (Thériault et al., 2012; Colli et al. 2016a and 2016b). Validation of the results against field observations yields similarities in the overall behavior, but the model output only approximately reproduces the dependence of the experimental collection efficiency on wind speed. We present recent developments of such a modelling approach including various gauge/shield configurations, the influence of the drag coefficient calculation on the model performance, and the role of the particle size distribution in explaining the scatter of the collection efficiency observed at any particular wind speed (Colli et al. 2015). Comparison with observations at the Marshall (CO) field test site is used to validate results of the various modelling schemes and to support the analysis of the microphysical characteristics of ice crystals.

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