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The impact of temporal aggregation of solid precipitation measurements on the correction for wind-induced undercatch.

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Solid precipitation measurements are affected by systematic wind-induced errors, due to the aerodynamic response of catching type gauges. The snowflakes deviate from their undisturbed trajectories due to the alteration of the airflow field around the body of the gauge and the corresponding developed turbulence. The resulting effect consists in a certain degree of undercatch, which is a function of the undisturbed wind velocity.
The correction of wind-induced errors has been addressed in the literature from the conceptual, numerical and experimental point of view. The Collection Efficiency (CE) curve of a single gauge, i.e. the relationship between the expected undercatch and the undisturbed wind speed, is derived from CFD simulations or field test studies (Colli et al., 2015; Wolff et al., 2015). This is used to apply a suitable transfer function (TF) to correct the wind-induced errors in real world measurements.

Snowfall depth and wind speed measurements are commonly recorded at a temporal resolution in the order of 30-60 minutes, although the effect of wind bursts can affect the measurements at a much higher resolution. In this work, we investigate the impact of the aggregation scale on the accuracy of snowfall data when corrected by using the transfer function. From the WMO SPICE (Solid Precipitation Intercomparison Experiment) field campaign, we selected a number of snowfall events recorded at the Marshall Field test site (Colorado, USA) during the winter seasons from 2013 to 2015. We used three Geonor weighing type gauges with different configurations: unshielded, Single Alter shielded (SA) and the Double Fence Intercomparison Reference (DFIR). Both precipitation and wind speed data are quality controlled and provided with the time resolution of one minute.

The Transfer Function has been derived from the selected number of snowfall events by comparison with the field reference (DFIR). Starting from the reference snowfall measurements and the wind speed values recorded at the resolution of 1 min, we reconstructed synthetic sequences of wind-affected snowfall rates using the collection efficiency evaluated at the highest time resolution, for both the Unshielded and SA gauges.
Using the TF, the synthetic dataset has been corrected operating at different aggregation intervals (5, 15 and 30 minutes). It is observed that, by increasing the aggregation interval of both snow and wind data, the efficacy of the correction decreases, indicating that high resolution snowfall and wind measurements are essential to ensure high quality snowfall measurements.