Do we have to correct winter precipitation for nowcast applications?

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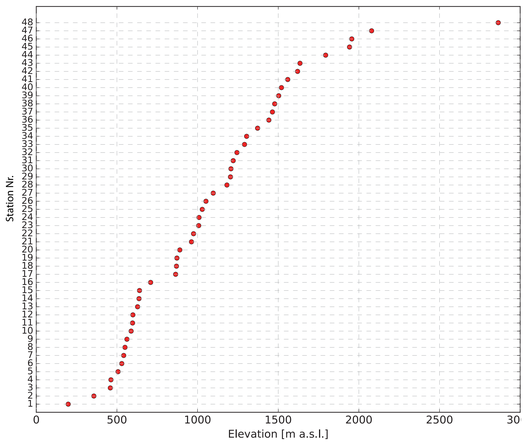
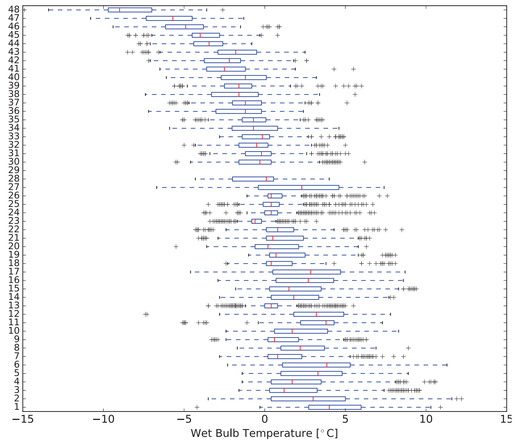
Motivation

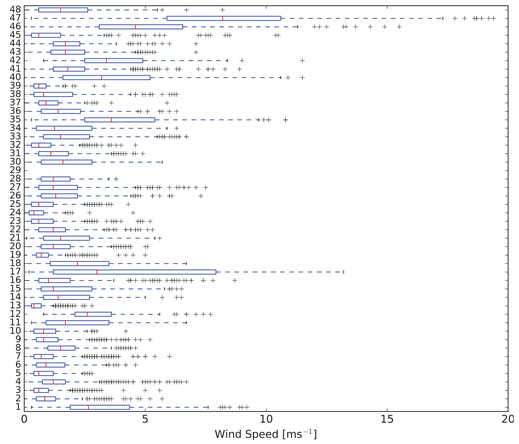
In mountain regions like the Alps, there is an increasing demand for high-quality analysis, nowcast and short-range forecasts of snowfall. In cold and windy conditions over complex terrain, conventional rain gauge measurements are prone to large errors when snow passes the rain gauge and sublimation occurs at heated devices. The recently started project **pluSnow** aims to combine snow depth measurements and precipitation data to minimize the error of gauge undercatch on the basis of snow depth data from automatic weather stations.

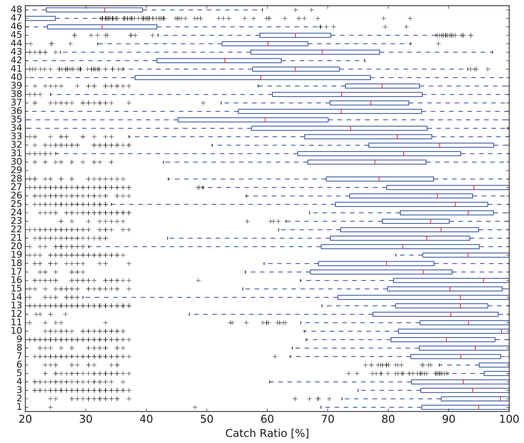
Potential Undercatch

Empirical correction formulas are given by the WMO to compensate the precipitation undercatch using temperature and wind data (Goodison et al., 1998). The following figures show station elevation, wet bulb temperature, wind speed and the calculated catch ratio at 48 automatic weather stations in Austria equipped with Hellman rain gauge. Data of all precipitation events in the period of Jan/Feb/Mar 2014 are used (10 minute average values).



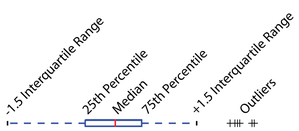




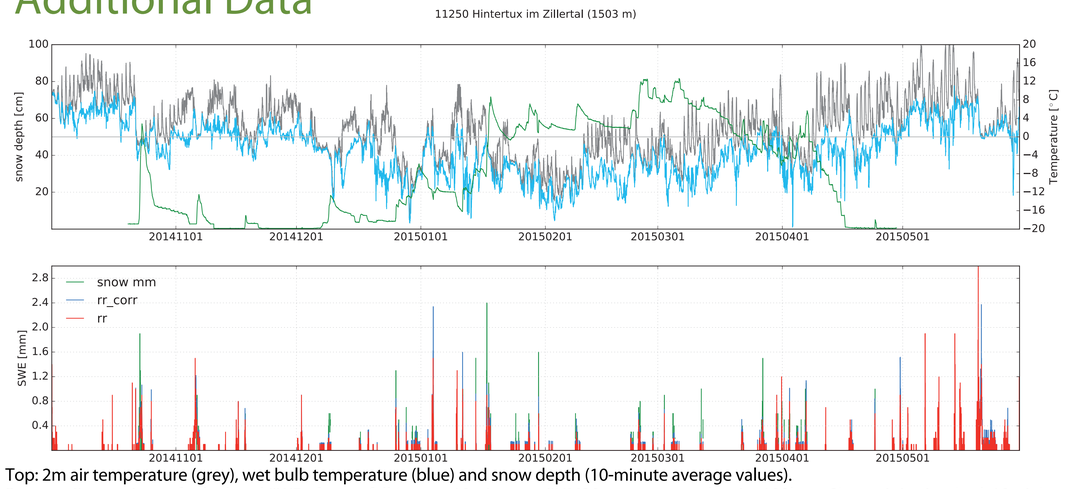


uncertain:

Transferability of correction for undercatch over time scales?



Additional Data

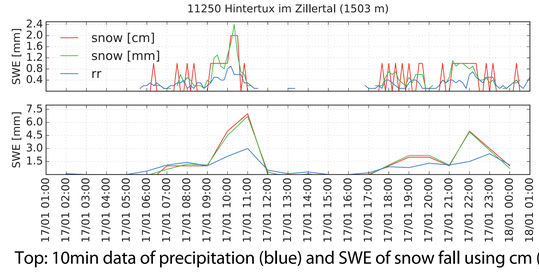


Top: 2m air temperature (grey), wet bulb temperature (blue) and snow depth (10-minute average values).
Bottom: Comparison of calculated SWE of snow fall (green; 10min, mm, SHM30 sensor,snow density 100kgm-3), precipitation (red, 10min) and corrected precipitation (blue) using temperature and wind speed data according to Goodison et al. (1998).

Optical techniques measuring snow depths enable the comparison of precipitation rates and SWE of snowfall in sub-hourly time resolution to locate potential undercatch (left figure). In contrast to ultra-sonic snow depth sensors, the opto-electronic distance sensor of the SHM30 (LUFFT) measures snow depth on the millimetre scale independent of meteorological conditions. Aggregation of snow depth changes to hourly data is required to achieve comparable rates using snow depth changes in an accuracy of 1 centimetre without averaging or smoothing of data (lower right figure).

Prospect

Operational use of high precision snow depth data to analyse and correct precipitation undercatch on the sub hourly time scale.



Top: 10min data of precipitation (blue) and SWE of snow fall using cm (red) and mm (green) resolution.
Bottom: Aggregation of precipitation and SWE of snow fall to hourly time steps.

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