Geophysical Research Abstracts
Vol. 18, EGU2016-3328, 2016
EGU General Assembly 2016

Characteristics of wind-induced loss of solid precipitation derived from a Norwegian field study

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Solid precipitation measurements are known to be plagued by under-catch in windy conditions. Adjustment techniques, either based on a dynamic relationship between under-catch and measured determinants or static corrections, are then typically invoked. Such adjustment procedures, especially if the adjustment algorithm is unfit, introduce notable uncertainties that impact hydrological modelling in snow-dominated regions.

In 2010, a test-site was established at a mountain plateau in Haukeli, Telemark, Southern Norway. Precipitation data of automatic gauges were compared with a precipitation gauge located in a Double Fence Inter-comparison Reference (DFIR) wind shield construction that served as the reference. A large number of sensors were additionally monitoring supportive meteorological parameters.

The study presented in this poster considers data from three winters that were used to study and determine the wind-induced loss of solid precipitation. A general model framework was proposed, and Bayesian methods were used to objectively choose the most plausible sub-model to describe the loss ratio – wind speed – temperature relationship from the Haukeli data. The derived adjustment function is continuous and accounts for measurements of all types of winter precipitation (from rain to dry snow).

The analysis shows a non-linear relationship between the loss ratio and wind speed during significant precipitation events, and there is a clear temperature dependency, believed to be mostly related to the precipitation type. The data also displayed a distinctive scatter that is believed to be an artefact mainly caused by neglecting the varying aerodynamic characteristics of the precipitation particles (for a given temperature) as a determinant. The adjustment formula allowed for the first time to derive an adjustment function with a data-tested validity beyond 8-9 m/s and proved a stabilisation of the wind-induced precipitation loss for higher wind speeds. Preliminary tests of the adjustment function show promising results when adapting to different time periods: 1, 12 and 24 hours, which is data resolutions commonly used in hydrological applications.