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# Analyzing the performance of temperature-index snowmelt modelling on Nordaustlandet (Svalbard)

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The arctic environment of Nordaustlandet (northernmost Svalbard) provides extraordinary challenges for temperature-index snowmelt modelling. To illustrate and analyze these challenges, data of three automatic weather stations installed on Vestfonna and De Geerfonna Ice Caps covering the ablation season of summer 2008 were used to calibrate a temperature-index snowmelt model extended by a solar radiation module.
During calibration procedure it became obvious that dimension and accuracy of the calculated degree-day factor distinctly varies with different kinds of input data processing. Traditionally, degree-day factors are computed from measurements of daily melt and means of daily air temperature. In the high arctic, where air temperature often fluctuates around the freezing point over much of the ablation season, this method proved to be unsatisfactory. Near-zero daily air temperature means are not at all able to represent existing positive degree-day amounts resulting from positive values over part of the day. Hourly instead of daily measurements were used to analyse this problem in detail by using positive degree-days calculated from hourly air temperature data while neglecting subzero parts of the day. Moreover, daily snowmelt data are classified according to minimum numbers of hours with occurred melt.
Degree-day factors were then calibrated repeatedly for the different classes of snowmelt. Results vary between 4.4 and 5.4 mm/K/day. The coefficients of determination as well as the standard errors and the dimension of the confidence intervals of calibrated degree-day factors show partly different trends. This analysis suggests that melt rate calculation from air temperature data near freezing point must account for non-linear effects to improve overall results.
As snowmelt is strongly influenced by solar radiation, the temperature-index melt model is extended by a radiation module parameterizing the measured fraction of short wave radiation absorbed by the snow pack. The radiation module is set up to compensate for the residuals of the regression analysis of conventional degree-day modelling. It is thus calibrated as an add-on to the standalone temperature-index model. The use of the extended model based on air temperature and solar radiation yields a distinctly higher accuracy than the simple model.