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A comparison of two approaches to modelling snow cover dynamics at the Polish Polar Station at Hornsund

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We compare two approaches to modelling snow cover dynamics at the Polish Polar Station at Hornsund. In the first approach we apply physically-based Utah Energy Balance Snow Accumulation and Melt Model (UEB) (Tarboton et al., 1995; Tarboton and Luce, 1996). The model uses a lumped representation of the snowpack with two primary state variables: snow water equivalence and energy. Its main driving inputs are: air temperature, precipitation, wind speed, humidity and radiation (estimated from the diurnal temperature range). Those variables are used for physically-based calculations of radiative, sensible, latent and advective heat exchanges with a 3 hours time step.
The second method is an application of a statistically efficient lumped parameter time series approach to modelling the dynamics of snow cover , based on daily meteorological measurements from the same area. A dynamic Stochastic Transfer Function model is developed that follows the Data Based Mechanistic approach, where a stochastic data-based identification of model structure and an estimation of its parameters are followed by a physical interpretation.
We focus on the analysis of uncertainty of both model outputs. In the time series approach, the applied techniques also provide estimates of the modeling errors and the uncertainty of the model parameters. In the first, physically-based approach the applied UEB model is deterministic. It assumes that the observations are without errors and that the model structure perfectly describes the processes within the snowpack. To take into account the model and observation errors, we applied a version of the Generalized Likelihood Uncertainty Estimation technique (GLUE). This technique also provide estimates of the modelling errors and the uncertainty of the model parameters. The observed snowpack water equivalent values are compared with those simulated with 95% confidence bounds.

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