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Title: *Snow cover modelling at the Polish Polar Station Hornsund*

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Snow and ice cover most of the tundra in the surroundings of the Polish Polar Station throughout the year. Snow usually lasts from the end of September till the beginning of June. Two different approaches to snow cover modelling were applied due to high interseasonal variability in snow depth and water equivalent. In the first approach we apply physically-based Utah Energy Balance Snow Accumulation and Melt Model (UEB). 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 in 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 (STF) 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. Both models perform well in describing the snow cover evolution during accumulation and melting seasons. The STF models give better results at calibration and validation stages, however snow cover characteristics, such as timing and rate of accumulation and ablation of snow cover are better described by the UEB models.