Monte Carlo simulations of a snow model coupled to a distributed energy and mass balance model

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In this study we apply a multilayer snow model coupled to a distributed energy and mass balance model to a High Arctic glacier Ariebreen, located in the southern part of Svalbard. Ariebreen is a small valley glacier with area of approx. 0.36 km^2, is situated at elevation 250-550 m a.s.l. and the ELA is ranging from 420 to 480 m a.s.l.

Such a sophisticated snow model gives an opportunity to conduct a detailed study of snowpack properties and mass balance components, including formation of superimposed ice and the internal accumulation. However, it requires a broad set of meteorological input data, has many parameters and is computationally demanding, making it difficult to apply it for a detailed long term mass balance studies. Sensitivity analysis can provide us with valuable information about the significance of the parameters and processes associated with them.

The model is calibrated using global optimization procedure, to fit the data collected at the ablation stakes during mass balance season 2007/2008 and is validated for season 2006/2007. Input data was collected at the meteorological station in Polar Polish Station Hornsund. Monte Carlo simulations are run in order to estimate uncertainties and the sensitivity of the model.