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Development and evaluation of a 1-D snowpack model for estimating energy fluxes and mass balance changes of polythermal glaciers on the Tibetan Plateau

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Glaciers are sensitive to changes in climate and evolve accordingly. Currently, there exists a large number of approaches to study the energy and mass balance at the surface of glaciers. There also exist extensive modeling approaches for examining the evolution of snowpacks. These however, are greatly detailed and require an exhaustive set of parameters as inputs.

In the present study, our effort is to create a point-model of the mass and energy balance especially designed for polythermal glaciers with an overlying seasonal snowpack. The relative importance of incorporating the snow-melt refreezing has been estimated and further studies have been carried out to estimate the sensitivities of different model setups as well as input parameters.

The evolution of the snowpack is estimated using physically based approaches making use of a small number of parameters. Attempt has been made to account for the refreezing of the snow melt inside the snow pack and its subsequent influence on the glacier. The model has been validated with data sets from the Zhadang Glacier in the Nyainqentanglha Range on the Tibetan Plateau. The snowpack model has also been validated under assumed optimal conditions from data obtained from the Black Forest Low Mountain Range in Germany. Ultimately, the model will be applied on the whole glacier using downscaled data from various sources such as WRF model runs.