Abstract

This thesis aimed at investigation of the snow conditions observed at different sites at Kongsvegen glacier at the end of winter 2010/11. The glacier is located in northwest Spitzbergen (Svalbard) and extends from sea level to approximately 750 m a.s.l., covering an area of ca. 100 km^2. Kongsvegen is one of the Arctic benchmark glaciers where long-term mass balance investigations are performed. Knowledge about the snow conditions is of essential interest in this context, too. This work mainly investigates structural characteristics of the vertical profiles of snow properties analyzed from data collected in a snow pit located in the accumulation area of the glacier. The local meteorological conditions during winter are strongly determined by a katabatic regime which is frequently interrupted by synoptic events often inducing pronounced warming events. There about 2 m of snow are accumulated, which is characterized by a pronounced increase of temperature, density and hardness towards the bottom of the seasonal (winter) snow pack. Profiles of the latter are characterized by significant structural variability. High-resolution snow hardness measurements provided most valuable data in this context, which were also used to test the skill of a recently developed method to derive high-resolution snow density profiles. Inter comparing layer-averaged density data derived from alternative methods served for validation and quantification of the accuracy of snow density measurements. These data also served to validate output from a snow model in which context the implementation of a wind and temperature dependent parameterization of fresh snow density was an important aspect. Focussing on exemplary layers relatively close to the surface, the nature of significant structural features in the observed hardness and density records was studied. Thus also employing relevant output from the simulations, key snow and atmospheric parameters were backtracked through the lifetime of exemplary layers displaying pronounced differences at their upper and lower boundaries. Analysis of the combined and modeled data revealed e.g. that the mentioned structural differences were strongly related to the conditions during and immediately after the deposition of respective layers. The importance of effects related to wind conditions, surface temperature, melt water production and absorption of solar radiation are discussed. Some results and interpretations derived from this part of the work remain preliminary and require reconsideration upon e.g. the availability of improved simulations and evaluation tools. They may give valuable directions for future research, though.