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Snow micro-structure at Kongsvegen glacier, Svalbard

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Measurements of physical snow properties have been performed at several sites at Kongsvegen glacier, which is a key Arctic glacier in western Spitzbergen (79N, 13E). The data were collected at six locations along the flow line of the glacier at different elevations (161 to 741m asl.) and describe snow that was deposited during winter 2010/11. We basically consider the vertical profiles of snow temperature, density, hardness, grain size and crystal shapes derived from standard stratigraphic methods (snow pits)and measurements using advanced instruments like Snow Micropen® and NIR imagery. Some parameters were measured repeatedly and with different instruments which proves a high quality as well as long-term and spatial representativeness of the data.

The general snow conditions at the end of winter are characterized by a linear increase of snow depth and water equivalent with elevation. Snow hardness also increases with elevation while density remains remarkably constant. At most sites the snow temperature, density, hardness and grain size increase from the surface towards the snow-ice interface. The surface and the bottom layers stand out by specific changes in snow signature (crystal types) and delineate the bulk of the snow pack which itself features a rather complex layering.

Comparison of the high-resolution profiles measured at different elevations at the glacier suggests some principal correlations of the signatures of hardness, grain size and crystal type. Thus, some major features (e.g. particularly hard layers) can be traced along the glacier, but the high-resolution layering can not straightforwardly be related from one site to the other. This basically reflects a locally different history of the snow pack in terms of precipitation events and post-depositional snow metamorphism. The issue is investigated more quantitatively by enhanced statistical processing of the observed signatures and simulation of the history of individual layers. These studies are supported by meteorological measurements at the snow observation sites.