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High Arctic avalanche climate in Central Svalbard

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Seven major avalanche cycles were identified during three years of intensive observations (2007-2009), around Svalbard's main settlement Longyearbyen. Most avalanches in these cycles were of a direct-action type, as they were triggered during or directly after a snowstorm. The main avalanche type was the cornice fall avalanche, due to the combination of a prevailing winter wind direction from SE over the study area and plateau mountain topography with cornices accumulating on the west facing crests.
Additionally a study of natural dry slab avalanching, the second most occurring avalanche type, was carried out in the study area. We aimed to link the major meteorological variables wind, precipitation, air temperature and the subsequent layering of the snow pack in the snow seasons 2007/2008 and 2008/2009 to the avalanche fracture determining forces in the snow pack. Thus we obtained an insight into the timing/dynamics of natural dry slab avalanches showing that the solar cycle plays an important role as well as the occurrence of persistent weak layers in the snow pack. Meteorological threshold values that determine whether a direct action or a climax slab avalanche releases are suggested for the Svalbard landscape. Nearly 50 % of all slabs can be classified as direct action-snow-wind avalanches that released after snow storms with an average of 12 cm snow precipitation and on average 11 m/s wind velocity per day.
Furthermore a first systematic classification of the Arctic snow pack in central Svalbard as a snow climate is presented, based on field observations from the three years (2007-2009). Snow pits were quantitatively analyzed in terms of grain shapes, grain sizes and hand hardness of every snow layer. Special emphasis was given to the occurrence of weak layers inside the snow pack. The parameters were used to define the high Arctic snow pack as a very thin and cold snow pack, with a basa layer of depth hoar and the occurrence of ice layers, which indicate a maritime influence.
This data, collected on the 70 km most used snow mobile route around Svalbard's main settlement Longyearbyen, builds the basis for depicting the characteristics of a High Arctic avalanche climate as a new additional avalanche climate to the present classification scheme. This basic knowledge is important for future avalanche forecasting in the Longyearbyen area, since fatal accidents in the last years demand the necessary background data for such a service to be collected allowing for its development to start.