



Mass balance 1959-2002 of Laika Glacier, Canadian Arctic

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Laika Glacier is a small ice cap situated on Coburg Island, Canadian Arctic. It is characterized by relatively high precipitation sums due to its vicinity to the North Water Polynya. In the 1970s comprehensive field campaigns were carried out on Laika Glacier. Climate variables were recorded at a weather station, winter and net mass balance of Laika Glacier was measured at stakes, high accuracy mappings (1959 and 1971) of the glacier surface were performed and boreholes were drilled to the glacier bed. We assess the changes of Laika Glacier in the period 1959-2002. We combine field data, satellite imagery and mass-balance modeling. Two Landsat TM images provide the glacier outlines of 2000 and 2002. A temperature-index mass-balance model is applied to calculate seasonal mass balances and their spatial distribution. The model is calibrated using the observed ice volume change 1959-1971 and measured winter and net balances of five subsequent years. The evolution of the glacier surface geometry is calculated using a glacier retreat model coupled to the mass-balance model. The model results are validated with Icesat GLAS Altimeter data and the glacier outlines of 2000 and 2002. The tongue of Laika Glacier retreated considerably during the last four decades and seems to be in a state of disintegration. Strongly negative glacier mass balances caused a mean ice thickness loss of more than 20 m WE since 1959. Our results correlate well with the mass-balance time-series of the nearby Devon Ice Cap. However, we find a largely enhanced rate of mass loss owing to a greater sensitivity of Laika Glacier to climate change.