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Impacts of hydro-climatically varying years on ice development in a subarctic river

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The response of high-latitude rivers to global warming will be manifested through changes in discharge magnitudes, sediment transport and channel morphology. These are ultimately controlled by the ice characteristics of the system, which will be affected by future reductions in the duration of the frozen period, earlier ice break-up, changes to the distribution of seasonally frozen ground, and increasing freeze-thaw cycles. Studies examining the effects of the cold winter season (e.g., freezing temperatures, river ice, ice-covered flow) on channel changes and seasonal feedbacks of sediment transport remain limited in comparison to those undertaken on temperate and tropical river systems. Before being able to predict the future changes in river ice development and its impacts on seasonal sediment transport of high-latitude rivers, present river ice cover growth processes are first needed to be examined more in-depth.

Therefore the aims are to investigate, 1) whether the existing ice growth thickness and layering models are good in predicting reality at present, and 2) what are the impacts of hydro-climatically varying years on river ice development in a subarctic meandering river. The ice thicknesses have been measured manually in cross-sections from a meander bend during the mid-winters of 2014-18. Different ice growth equations are applied for estimating the river ice growth during those years of varying hydro-climatic conditions (i.e. from mild to severe winters). These modelled results are tested and verified against the field observations. Air temperature (including freeze-thaw days), precipitation, ice thickness, snow depth, flow velocity, water depth and bathymetry data are available. The preliminary results determined based on the data gathered at Pulmanki River are presented. Based on the results, further studies of the impacts of river ice on hydro- and morphodynamics can be performed for present and future hydro-climatic conditions.