**The impacts of ice-covered and open-channel flow on sediment load at sub-arctic river – One-dimensional modelling approach using photogrammetrically enhanced sediment transport calibration data sets**

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Climate change will be pronounced in higher latitudes. Consequently, shorter ice-cover period and increased precipitation, and subsequently amplified discharge are expected to occur. These hydroclimatic changes are prone to have an impact on sediment transportation in northern rivers. The study on spatial and temporal variation of the processes in low flow open-water and ice‐covered conditions is crucial as it improves the understanding of future changes. The investigation of under-ice conditions has been challenging, and thus, new developments in study methods are much needed. We analyzed the spatial sediment transport in low flow autumn open-channel and winter ice-covered flow conditions in meandering subarctic river with one-dimensional (1D) morphodynamic models with photogrammetrically enhanced sediment transportation data sets. A low-cost shallow-water-AUV (Autonomous Underwater Vehicle) is used for photogrammetric analyses of ice-covered and open-channel forms and sediment transport to enhance the model. The model was further tested against the traditional mechanic model (i.e. Helley-Smith), and applied at minimum and maximum ice-cover conditions. Simulations showed a considerable flow-driven decrease of sediment transport and erosion in ice-covered conditions, when compared to open-water conditions. The simulated increase in ice thickness resulted in increased bedload as thicker ice narrowed substantially the river channel causing flow velocity and shear forces to increase. Photogrammetrically enhanced sediment data set enabled more reliable model calibration in ice-covered conditions than did the calibration data derived by mechanistical sediment samplers. This encourages further testing and developing the photogrammetrical methods for sediment transport estimations, especially in ice-covered conditions. In the future, changes in river-ice can be expected to increase annual sediment loads. The increase in the summative sediment transport of small arctic and subarctic rivers can have significant consequences on the downstream waterbodies.