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Estimation of permafrost thawing rates in a sub-arctic catchment using recession flow analysis

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Abstract. Permafrost thawing is likely to change the flow pathways taken by water as it moves through arctic and sub-arctic landscapes. The location and distribution of these pathways directly influence the carbon and other biogeochemical cycling in northern latitude catchments. While permafrost thawing due to climate change has been observed in the arctic and sub-arctic, direct observations of permafrost depth are difficult to perform at scales larger than a local scale. Using recession flow analysis, it may be possible to detect and estimate the rate of permafrost thawing based on a long-term streamflow record. We demonstrate the application of this approach to the sub-arctic Abiskoajokken catchment in northern Sweden. Based on recession flow analysis, we estimate that permafrost in this catchment may be thawing at an average rate of about 0.9 cm/yr during the past 90 years. This estimated thawing rate is consistent with direct observations of permafrost thawing rates, ranging from 0.7 to 1.3 cm/yr over the past 30 years in the region.

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