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Contemporary denudation rates in undisturbed and anthropogenically modified surface areas of the boreal mountain basin of a regulated lake system in central Norway

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Denudation, including both chemical and mechanical processes, is controlled by a range of environmental drivers and is in most environments and landscapes worldwide significantly affected by anthropogenic activities. In the boreal mountain environment of central Norway the regulated lake Selbusjøen, situated at ca. 160 m a.s.l. with an area of 58 km^2 and connecting the upstream main mountain river Nea and the downstream main river Nidelva, forms a significant sink for sediments being transferred from its drainage basin area of in total 2876 km^2. The significant sediment trapping efficiency of lake Selbusjøen is causing a sediment deficit and locally increased fluvial erosion and down-cutting in the downstream river Nidelva which drains into the Trondheim fjord.

This ongoing GFL research on contemporary denudation rates in undisturbed and anthropogenically modified surface areas of the boreal mountain basin of lake Selbusjøen builds on year-round process geomorphological field work including high-resolution monitoring of runoff, solute and sediment fluxes in selected catchments or drainage areas draining into Selbusjøen. The selected catchment or drainage area systems are characterized by high shares of surface areas with a nearly closed and continuous vegetation cover mostly composed of boreal forests and bogs, and represent a range of different catchment sizes, catchment morphometries, orientations/aspects, and sediment sources and sediment availabilities. Different types and intensities of direct anthropogenic impacts like, e.g., agriculture, forestry, and modifications of natural stream channels (e.g., dams, steps, bank protection) and channel discharge for water power purposes are found in the different selected catchments.

Runoff is occurring year-round and the natural runoff regime is clearly nival. Most fluvial transport is occurring during peak-runoff events generated by snowmelt, rainfall events or combinations of snowmelt and rainfall. Altogether, chemical denudation is moderate but dominates clearly over mechanical fluvial denudation. While chemical denudation is not significantly affected by anthropogenic impacts, mechanical fluvial denudation shows significantly higher rates in surface areas that are modified by anthropogenic activities like agriculture and forestry. At the same time, anthropogenic stream channel and channel discharge modifications are leading to reduced fluvial bedload transport rates into lake Selbusjøen.

Ongoing and accelerated climate change with the related changes of the current wind, temperature and precipitation regimes are expected to increase fluvial denudation and sediment transport rates into lake Selbusjøen, particularly in surface areas that have been modified by anthropogenic activities.