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Environmental controls and spatiotemporal variability of contemporary chemical and mechanical denudation in the cold climate mountain environment of the upper Driva drainage basin in central Norway

Achim A. Beylich and Katja Laute
Geomorphological Field Laboratory (GFL), Selbustrand, Norway (achim.beylich@geofieldlab.com)

The upper Driva drainage basin in central Norway (Oppdal) is situated in a cold climate and mountainous environment and ranges with a total drainage basin area of 1630 km^2 from 220 to 2286 m a.s.l. The mean annual air temperature at Oppdal (545 m a.s.l.) is 4.3°C, and mean annual precipitation at Oppdal amounts to 532 mm. The lithology in the drainage basin is complex and varied, and is clearly dominated by metamorphic rocks (mostly gneisses and shists). Vegetation cover varies between tundra vegetation in the high and rather flat areas of the uppermost drainage basin area, situated at elevations around 900-1200 m a.s.l., tree vegetation (mostly birch and pine) in the lower parts of the incised tributary valleys of the Driva main river and grasslands in the agriculturally used areas close to the lower sections of the main river Driva. Relevant geomorphological processes include chemical and mechanical weathering, rockfalls, snow avalanches, debris flows, slides, wash processes, fluvial erosion, fluvial streambank erosion and down-cutting, and fluvial solute, suspended sediment and bedload transport.

This ongoing GFL research on controls and spatiotemporal variability of contemporary chemical and mechanical denudation includes detailed field and remotely sensed geomorphological mapping, permafrost mapping, and computing of morphometric catchment parameters combined with the detailed statistical analysis of high-resolution meteorological and ground temperature data, and the continuous observation and year-round monitoring of sediment transfers, runoff and fluvial solute and sediment transport using a range of different techniques. Specific focus is on six selected tributary systems (Svone, Kaldvella, Stølåa, Tronda, Vinstra, Ålma) of the upper Driva drainage basin system. Stationary hydrological stations are monitoring continuously and year-round runoff, fluvial solute and suspended sediment transport. The analysis of fluvial bedload transport includes the application of different tracer techniques together with underwater video filming and Helley Smith and impact sensor measurements. Discharge in the upper Driva drainage basin occurs year-round with a nival runoff regime and a mean annual runoff of 576 mm. The temporal variability of sediment transfers, runoff and fluvial transport are largely controlled by thermally and/or pluvially determined events. The selected tributary systems display varying solute and sediment yields which is explained by different lithologies, valley morphometries and sediment availabilities. The activation of sediment sources and mechanical denudation are strongly determined by thermally and/or pluvially induced events. The highest share of annual sediment transport occurs during the snowmelt period in spring. Altogether, drainage-basin wide chemical denudation dominates over drainage-basin wide mechanical fluvial denudation.