Geophysical Research Abstracts
Vol. 18, EGU2016-1967, 2016
EGU General Assembly 2016

Integrated analysis of environmental drivers, spatiotemporal variability and rates of contemporary chemical and mechanical fluvial denudation in selected glacierized and non-glacierized cold climate catchment systems

Achim A. Beylich
Geological Survey of Norway, Geo-Environment Division, Trondheim, Norway (achim.beylich@ngu.no)

There is, by today, an impressive number of quantitative process geomorphic studies presenting contemporary chemical or mechanical fluvial denudation rates from a wide range of cold climate catchment geo-systems worldwide. However, the number of quantitative studies that actually considers and includes all three main components of fluvial transport, i.e. solute transport, suspended sediment transport and bedload transport, is actually rather small. Most of the existing studies include one or, at best, two of these main components. At the same time, it is generally accepted that a knowledge of the quantitative shares of fluvial solute, suspended sediment and bedload transport of the total fluvial transport, together with detailed information on sediment sources and sediment storage, is needed for the reliable quantitative construction and understanding of present-day sedimentary budgets.

In this contribution, results from longer-term process geomorphic work conducted in selected glacierized and non-glacierized high-latitude and high-altitude cold climate catchment systems in Norway, Iceland, Sweden and Finland are compared. The size of the six studied catchment geo-systems ranges from 7.0 km2 to 79.5 km2. Contemporary chemical and mechanical fluvial denudation rates measured in the defined catchment systems with different cold climates, varying degrees of glacier coverage, different lithologies and general sediment availabilities, different catchment morphometries, and varying degrees of vegetation cover are presented. By direct comparisons between the six different catchments environmental controls of the computed annual denudation rates are detected and the spatial variability of the contemporary chemical and mechanical fluvial denudation rates found across the different cold climate catchment systems is explained.

Annual fluvial denudation rates generally increase with increasing topographic relief, increasing mean slope angles, increasing annual precipitation and increasing glacier coverage, and generally decrease with increasing vegetation cover in areas with sedimentary covers. Lithologies with low weathering resistance lead to higher fluvial denudation rates than lithologies with high weathering resistance. General sediment availability is another key factor controlling fluvial denudation rates.

The presented approach of analyzing and integrating comparable datasets on fluvial solute and sediment transport collected from different defined cold climate catchment geo-systems with varying environmental conditions and characteristics is found to be useful for the quantitative analysis of environmental drivers and the spatiotemporal variability of contemporary solute and sedimentary fluxes, yields and denudation rates in cold climate environments. In addition, this approach can also serve to improve possibilities of modeling possible effects of climate change by applying the Ergodic principle of space-for-time substitution.