



Spatio-temporal variability of chemical and mechanical denudation in glacier-fed mountain catchments in Nordfjord, western Norway

Achim A. Beylich (1,2), Susan Liermann (1,2), Katja Laute (1,2)

(1) Geological Survey of Norway (NGU), Quaternary Geology & Climate group, Trondheim, Norway

(achim.beylich@ngu.no), (2) Norwegian University of Science and Technology (NTNU), Department of Geography, Dragvoll, Trondheim, Norway

High-resolution surface process monitoring and analysis in the glacier-fed Erdalen and Bødalens catchments, situated in the steep fjord-landscape of western Norway (Nordfjord), show that there are significant intra- and inter-annual variations with respect to fluvial sediment transport rates and sediment yields. The ongoing sampling and monitoring programme (started in 2004) includes five hydrological stations (continuous and year-round monitoring of runoff, suspended sediment transport and solute transport) installed at different channel locations (in different sub-systems) within each of the two catchments as well as meteorological stations and the use of eight impact-sensors for bedload transport monitoring.

Three different periods with a high frequency of major runoff events can be identified over the year, with these three periods showing a relevant inter-annual variability. High runoff in spring (April - June) is mainly caused by snowmelt whereas major discharge events in summer (July - August) are due to thermally caused glacier melt. In autumn (September - November), major runoff events are associated with heavy rainfall events. Autumn appears to be the most important period with respect to fluvial sediment transport and catchment-wide fluvial sediment yields.

The intensity of fluvial transport in autumn and over the entire year depends in both catchments strongly on the annual number of heavy rainfall events that trigger transfers of sediments from slopes into channels via saturation overland flow with connected slope wash and debris flow events. Annual suspended sediment yields are about two times greater than annual solute yields corrected by atmospheric inputs. Bedload transport rates are altogether smaller than suspended sediment transport rates. The spatial variability of chemical denudation within the catchments is mainly controlled by regolith thicknesses. Suspended sediment concentrations in glacier melt water vary significantly between different outlet glaciers within the catchments which indicates a variable sediment availability in different outlet glacier systems. Ongoing glacier retreat seems to increase suspended sediment concentrations in glacier melt water and suspended sediment yields from the sub-systems being connected to outlet glaciers of the Jostedalsbreen ice cap. Altogether, the slope systems within the catchments, with slope material being mobilised during heavy rainfall events, appear to be the most important sediment source which indicates that remobilisation of slope material seems to be more important than sediment delivery by the active outlet glaciers for catchment-wide denudation rates.

The annual sediment yields in Erdalen and Bødalens are lower than in many other glaciated catchments worldwide. Fluvial sediment transport and sediment yields are altogether supply-limited which is explained by the high resistance of the gneisses dominating the bedrock in the inner Nordfjord and by the low amounts of loose sediments that are found within the steep mountain catchments.