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Postglacial hillslope development in paraglacial tributary catchments (ESF-NFR SedyMONT-Norway Project, SedyMONT, Topo-Europe)

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Topography and landforms of different spatial scales are generated by different operating processes and are characterized by different variables, evolved over different time periods. Changes in climate affect Earth surface systems and shapes Earth surface processes around the world and seem to have major impacts on sediment dynamics, especially in cold climate environments. Understanding climate and landform development from a Holocene to contemporary time perspective can contribute to document change of the Earth surface systems as well as to detect responsible processes for climatic and topographic change.

Analyzing postglacial hillslope development and studying sediment transport within two small deglaciated, subarctic valley systems in Western Norway will improve the understanding of the complex response of mountain landscape formation. The innovative approach of this PhD research project is the combination of knowledge on Holocene process rates with data on subrecent to contemporary sedimentary fluxes, -budgets and process rates using different advanced methods and techniques. The PhD project is part of the NFR funded SedyMONT-Norway Project within the ESF EUROCORES TOPO-EUROPE SedyMONT (Timescales of sediment dynamics, climate and topographic change in mountain landscapes) Programme. Research is carried out within the Erdalen and Bødalen catchments of the Nordfjord valley-fjord system (inner Nordfjord, Western Norway). Both valleys can be described as steep U-shaped and glacier-fed tributary valleys. The runoff regime is complex with a high variability of discharge over the year. Instrumentation in both catchments includes an automatic weather station as well as five stationary stations for continuous and year-round monitoring of runoff, fluvial suspended sediment and solute transport.

The main aims of the PhD project are to analyse (i) the spatial distribution of hillslopes, their contemporary structure, controls and current process rates, (ii) the quantification of slope storage volumes, (iii) the identification of sediment sources and (iv) delivery pathways/hillslope-channel coupling over Holocene to contemporary timescales.

Sediment storage and hillslope-channel coupling are important factors that influence sediment delivery through catchments. A process-based approach is used to assess the role of these factors by quantifying the various components within the catchment sediment transfer system. Appropriate hillslope test sites are selected for monitoring present-day rates of slope processes as well as for geophysical investigations. Advanced techniques for bed load monitoring (including impact sensors and pit tags) and different dating techniques (lichenometry and dendrochronology) are used. Geophysical methods (georadar, seismic refraction surveys), high resolution digital elevation model (DEM) data and GIS techniques provide new possibilities for the quantification of sediment storage volumes.

This research on current complex slope processes, sediment storage volumes and contemporary sediment transfer rates contributes to a better understanding of postglacial landscape evolution as well as the prediction of possibly future trends of landform development.