Long-term suspended sediment monitoring in upper Kaunertal, Austria: Examining trigger mechanisms of high transport events

Diana-Eileen Kara[1], Toni Himmelstoss[1], Sarah Betz-Nutz[1], Moritz Altmann[1], Jakob Rom[1], Florian Haas[1], Tobias Heckmann[1], Michael Becht[1]

[1]*Department of Physical Geography, Catholic University of Eichstätt-Ingolstadt, Germany*

Understanding suspended sediment transport in high Alpine catchments is essential due to its significant implications, including reservoir sedimentation. Heavy precipitation events, snow melt, and glacier melt can lead to high annual sediment yields, even though the peak of sediment transport may have already been passed in some alpine catchments (Schmidt et al. 2023).

This work includes the differentiation of events with high suspended sediment load based on their specific triggering mechanism and the quantification of the amount of suspended sediment supplied by the sub-catchments. Suspended sediment concentration data with a high temporal resolution of 15 minutes, were analysed at the Gepatschalm gauge station for the years 2012-2022 on the river Fagge at the Upper Kaunertal catchment in Tyrol, Austria. This time series was analysed alongside discharge and meteorological data, to assess the processes leading to high suspended sediment load. Additionally, in-situ measurements (Fig. 1) were carried out under various hydrometeorological conditions at multiple strategic stations. These measurements concentrate on snowmelt, glacier melt, and precipitation events. To categorise the high-transport events, we follow the approach described by Skålevåg et al. (2024). Furthermore, multi-temporal Digital Elevation Models (Fig. 2), based on UAV and airborne laser scanning, were used to correlate suspended sediment load with the observed changes in sediment storages.

These insights provide a comprehensive understanding of the mechanisms driving suspended sediment transport in the high Alpine regions. The findings underscore the importance of continuous, spatially distributed monitoring, which also facilitates the development of predictive models.

***Figure 1**: Water sampling for suspended sediment concentration measurement at Kauner Valley (Tyrol, Austria). Foto by: Kara, D.-E. 2023*

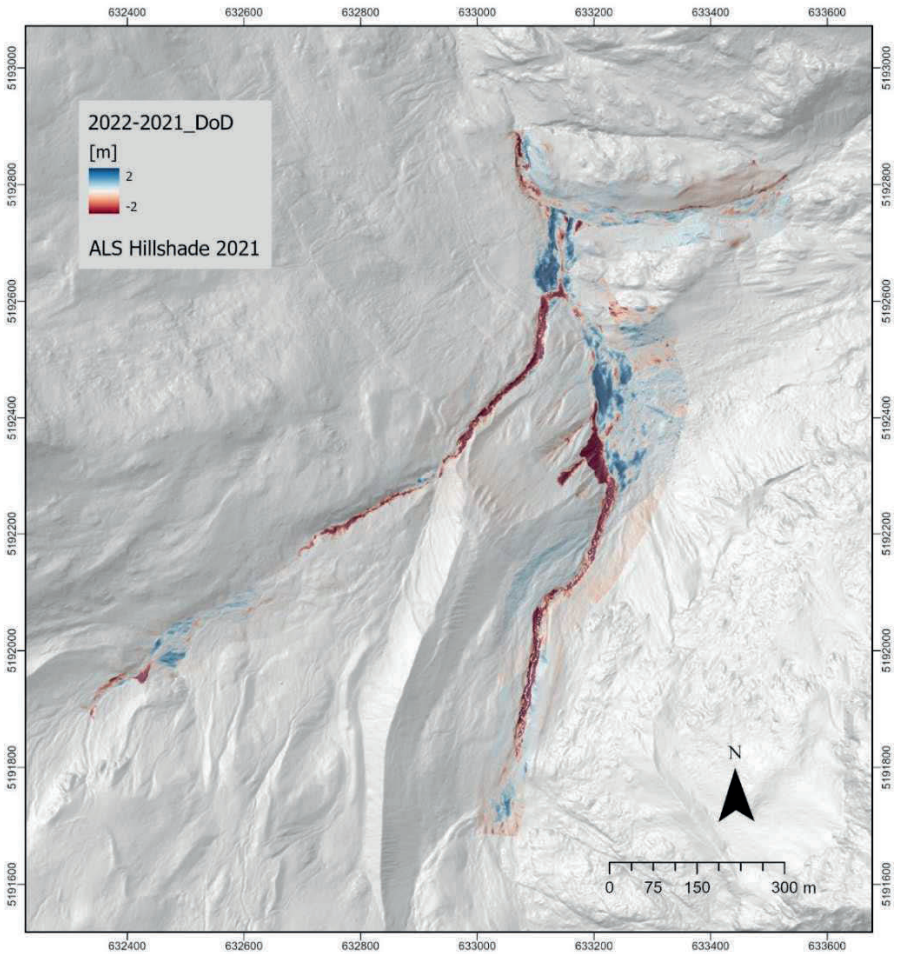

***Figure 2**: DoD 2022-2021 showing changes at Münchener Abfahrt on top of Hillshade (ALS-DHM 2021).*

Schmidt, L. K.; Francke, T.; Grosse, P. M. & Bronstert, A. (2023). Projecting sediment export from two highly glacierized alpine catchments under climate change: Exploring non-parametric regression as an analysis tool. In: Hydrology and Earth System Sciences. 28, 139-161.

Skålevåg, A.; Korup, O.& Bronstert, A. (2024). Inferring sediment-discharge event types in an alpine catchment from sub-daily time series. In: Hydrology and Earth System Sciences Discussions, in review.