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Re-suspension of sediment in the HOAL catchment – results from a flushing experiment

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In stream monitoring of suspended sediment concentration (turbidity) is often used as a proxy for the evaluation of field site erosion. Unfortunately, at present a gap of knowledge and data availability between on site erosion rates and in-stream sediment concentrations exists and the link from plot scale to the catchment scale is hard to obtain. One reason for this is the – usually – unknown amount of re-suspension in streams during evens. As an example it is frequently observed that during single hydrograph peaks, sediment concentration peaks may appear twice. Is this caused by re-suspension from deposited sediments from earlier events?

To evaluate the amount of re-suspension in the streambed we artificially flooded the HOAL Petzenkirchen (64 ha) stream. We monitored flow and water quality parameters at 3 sites along the stream in high temporal resolution and used Bromide as tracer to distinguish between wave celerity and transport velocity. Samples of the stream bed and of the transported sediments were analyzed for grain size distribution. The same experiment was repeated after 3 days to test our hypothesis that the sediment exported from the catchment during the flushing experiment origins from the tailing limb of a previous event.

The measurements revealed a significant loss of water volume and sediment along the stream for both experiments. Only a small part of the re-suspended sediment load was transported out of the catchment. Sediment transport was capacity limited and declined according to the flow rate. Suspended sediment concentrations exhibited both clockwise and counterclockwise hysteresis at the different observation points. Sediment concentrations and therefore also sediment loads were smaller for the second experiment. The bromide analysis exhibited a big difference between wave celerity and transport velocity.

As an additional experiment we tested the influence of measuring turbidity in the large pool directly after the weir compared to the results of simultaneous measurements in the stream directly ahead of the weir. Results revealed that measurements directly after the gauging weir in the pool cause high suspended sediment concentrations at the beginning of an event due to immediate re-suspension of easily available sediment from the pool.