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Liftable Bedload Trap for Large Alpine Gravel-Bed Rivers - Experiences and Goals

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The aim of the work is to figure out the bedload transport processes for the free flowing reach of the Drau River in Dellach, Drau Valley, amongst other measurement techniques also under the use of a recently invented liftable bedload trap.
In general, there are some techniques for measuring transported debris in natural streams; we use collecting moving particles (Birkbeck-type traps, Large Helley Smith sampler) and indirectly determining transport intensity (geophones) at the study sites in Austria. In addition hydrological, geological, meteorological and other related data are collected.
Two further almost fully equipped measurement stations in Lienz at the Drau River and its most important tributary Isel River, both large Alpine gravel-bed rivers, situated in the south western part of Austria are completing the integrative and innovative bedload measurement system.
Former measurements in the study reach were performed also using mobile bedload samplers and fixed bedload samplers. Individually they all are adequate bedload measurement instruments - used in combination they are complementing one another, whereas each applied separately leads to specific deficits.
In general the investigation pays special attention on results out of the geophone installations. The spatio-temporal distribution of the transported bedload material, its amount and the transport processes itself could be figured out. But for calibration purposes direct moving particle sampling is essential.
Compared to Large Helley-Smith sampling fixed bedload traps are flood protected and robust to withstand the strain during flood conditions and so are capable to take bedload samples of e.g. a flood peak. The disadvantage of this type of direct bedload measurement is that in perennial alpine rivers the only chance to empty them and analyze their content is during the wintertime at very low water stages.
Therefore a liftable bedload trap was installed direct downstream the geophone installation into the river bed of the Drau River in Dellach, Drau Valley, in 2008 as an enlargement of the since 2006 built bedload measurement system.
The 1.6 m long and 0.5 m wide slot opening is held close in between measurements while the trap remains in zero position even with the river bed. During a flood event the slot can be opened unlocking the closure hydraulically. Transported bedload material is now able to enter the inner trap positioned on a balance to measure the increase of mass. The detected data is stored automatically in a computer device. Between flood events the water stage lowers and the bedload movement decreases; now it is possible to empty the trap for several times in a summer period. The trap is elevated over the water level, the cover will be dismounted and the inner trap removed with a crane for analyzing the traps content. After this the trap is inserted again and lowered ready for the next measurement.
As a result it could be shown that the counted number of geophone impulses per unit time and its associated flow discharge is proportional to the trapped sediment volume.
Measurements take place during the rainfall and snow melting season from May to August, and sometimes due to heavy rainfall in November.
Furthermore, the assumed spatial and temporal variability of the bedload movement could now be proven. In addition it could be shown, that commonly used bedload predictors underestimate the measured bedload transport.
In conclusion the results of the investigation are showing new aspects for understanding bedload transport processes, the installed traps will help to clarify the transport processes during flood events. The installed bedload measurement system will be improved and enlarged year by year. For further investigations there is a chance to test new measurement techniques under well known boundary conditions at the fully equipped gauging stations.