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Numerical Modelling of Gravel Transport during Flushing Processes in an Alpine Reservoir

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Sedimentation processes are in a “dynamic balance” in most natural rivers, but the construction of dams and reservoirs influences these natural conditions. The flow velocities, turbulences and bed shear stresses in reservoirs are reduced compared to free flow conditions, which lead to the deposition of the transported sediment particles. As a further consequence the sediment depositions reduce the storage volume by “filling up” the reservoir. This “reservoir sedimentation” is a problem in several Alpine reservoirs.

In the case of Alpine reservoirs with a small storage volume compared to the annual inflow, such as reservoirs of run-off river power plants, the water depth are usually lower than in reservoirs of storage and pump-storage hydro power plants. A larger part of the suspended sediments is thus transported through the reservoir and deposition of bed load fractions is the main problem. The deposition of coarse sediments at the head of the reservoir may cause problems regarding flood protection by raising the bed level and thus, raising the water level too.

This contribution focus on the bed load transport processes during a flushing event in an Alpine reservoir. The reservoir is approximately 1 km long with an initial storage volume of about 250.000 m^3. The annual bed load input is rather high, thus the remobilization of the sediment in the reservoir in case of flood events was investigated.

An open source three-dimensional numerical model with an internal coupled hydrodynamic and morphological part was used to simulate the flushing process. The calibration of the hydrodynamic model was done using ACDP measurements performed at the prototype to calibrate the roughness at the river bed. Additionally an extensive sensitivity analysis was carried out and several sediment transport formulae were tested.