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3D numerical modeling of sediment handling techniques in a hydro power reservoir

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Sedimentation of small as well as large water storage reservoir has become a major issue. Due to the fact that we observe a 1% decrease of reservoir volume every year due to sedimentation and that the largest part of the reservoirs have been built between 70 and 40 years ago, many HPPs are confronted with the threatening scenario that soon the active storage and therefore their lifetime is dramatically diminished. Due to the above mentioned combination, active and sustainable sediment management has become the last option to retain or preferable enlarge the left-over reservoir volume. There are several options for a sustainable sediment handling, each for a different boundary condition, which must be evaluated carefully in order to be successful. For a successful choice, design and conduction of a sediment handling technique, usually a physical scale model will be conducted. Physical scale model have the advantage that there is a lot of experience in conducting these models and that they are illustrative. The disadvantage of scale models is that there are restrictions in the use of certain sizes of sediments due to scaling issues and that they are rather expensive.

This study attempt to use a 3D numerical model to overcome the above mentioned disadvantages and to serve as an additional source of alternatives in finding the right sediment handling techniques in reservoirs with high discharges of suspended and bed load. The goal is to simulate several flood events in order to gain insights in the current situation as well as to have a better understanding of the physical processes in the reservoir. This will support and positive influence the sustainable design of sediment handling techniques. The numerical model will be verified with flow measurements a physical model study and with bathymetry measurements from field observations. Based on the actual deposition pattern and the given input data, different sediment handling techniques are planned and conducted by means of the numerical model. The results show that the 3D numerical model is able to simulate sediment transport deposition pattern, bed load guide vane structures, as well as bed load diversion structures.