

VELOCITY MEASUREMENTS IN AN ALPINE RESERVOIR TO DETERMINE DENSITY CURRENTS

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This study describes velocity measurements in an alpine reservoir conducted by means of a 3-D ultrasonic probe. Situated in the heart of the alpine region, the Margaritze reservoir is part of the Kaprun Hydro Power Scheme. Its major water inflow area lies at the foot of a glacier. These inflows exhibit average annual sediment concentrations of 40,000 m³. As a consequence of the increasing sediment deposition in the reservoir, two phenomena can be observed. On the one hand, its storage capacity – and at the same time its benefit for power economy – decreases. On the other hand, sedimentation tends to cause problems in the mechanical equipment parts. In order to keep reservoir facilities in full operation, incoming sediment loads have been removed since the late nineties. By means of a submersible pump, glacial silt is dredged from the gorge section and conveyed to the shallow portion of the reservoir, where it is deposited under certain conditions. So far it is unclear why parts of the sediment load which have been moved to the shallower section of the basin are later on remobilized and at an average 10 to 20 % of the transferred material gets back to the gorge section of the basin.

Moreover, the question remains to be answered, as to whether sediment conveyance back to the gorge portion is probably already happening during ongoing excavation works. Water level fluctuations inside the reservoir as well as hydraulic inflow fluctuations and sediment flows already during dredging works, respectively, may cause a continuous sediment transfer.

The 2004 measurement campaign is aimed at explaining all relevant details regarding the reservoir flow situation. In addition to this, a possible change in current conditions during the dredging process is to be investigated. Apart from a 3-D velocity probe (Aquadopp[®] Profiler), a density current probe as well as a temperature and a conductivity probe were employed for the measurements at Margaritze reservoir in August 2004.

The employment of the probes mentioned above required particular adaptations. The 3D – velocity probe was fastened to a measuring device, which had been exclusively manufactured for this measuring campaign. The device comprised four floats and an aluminium framework, to the latter of which the Aquadopp[®] Profiler had been secured in a

45° angle. This “pontoon” was fastened to a guide rope which was stretched along the profile all across the artificial water basin. In this way, the measuring device was gradually drawn over the cross-section while measurements were conducted at intervals ranging from 4 to 12 meters. While velocity measurements were taking place, also temperature and conductivity measurements were carried out. The respective measuring devices were again fixed to the meter-marked rope and then submerged meter after meter at every single measuring point.

The results gained in all these measurements clearly reflect a connection between the sediment transport at the bottom of the basin and the operation of the submersible pump. During dredging operations, a suspended sediment load accumulated in the bed of the shallow portion of the reservoir, which then flowed at a speed of about 0.1 m/s and a concentration of approx. 1 g/l towards the gorge section.

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