Control of sediment transport on an alpine catchment basin for the safe application of smart storage operations on an run-off-river HPP

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Objectives

Smart storage operations (SSO) have been implemented on an alpine run-off-river HPP (case study: KW Gletsch-Oberwald HPP) in order to enhance the flexibility of the power plant (ref. poster SmallFlex). SSO operations consist on the use of available space underground, such as the settling basin, in order to store the water, particularly in periods of the year with low inflow, which can afterward be used for energy production when the demand and the remuneration tariffs are higher and at a discharge close to the optimum of the turbines to have the best efficiencies.

The aim of efficiently implementing the SSO operations on the setting basin requires sediment management in order to assure a safe use of this part of the system whose function is temporarily changed. In order to understand the amount of sediment inflow into the settling basin, the following actions were undertaken:

• Determine the amount of potential mobilized sediments at the catchment scale with the use of Beyer-Portner (1998) and Gavrilovic (1990) formulas;

• Determine the maximum sediment transport capacity of the river Rhone upstream the intake with the use of Beyer-Portner (1998) formula.

This will allow to verify in which periods of the year the sediment basin can be used for water storage with no risk related with sediment conveyance into the waterways and therefore at the turbines.

Study Area

Gletsch catchment:

• Surface area: 40.34 km²
• Average altitude: 2691m a.s.l.
• River principal watercourse length: 3450m
• River secondary watercourse length: 3870m
• River discharge: 2.93m³/s
• Average slope along the course: 13.7%
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Procedure

Soil coverage analysis

The map was created to display the land use of the case study. The values produced for calculating the erosion models and sediment transport model.

Land use:

• Vegetation: 5.1 km²
• Open spaces with little or no vegetation: 15.9 km²
• Lakes and rivers: 0.2 km²
• Glaciers and pergelacial snow: 18.6 km²
• Artificial surfaces: 0.3 km²
• Erodible soils: 15.5 km²

Pebble count

Count and collect data for different locations on the bank. Repeat the counting petulant method for at least samples.

Withen Pebble Count Method

Mark the location with the transect line. The transect line should be parallel to the flow of the water and end on the bank.

Write Pebble Count Method

Measure the size of the pebbles along the flow line with the petulant method.