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Abstract

Alpine rivers are part of the life-supporting ecosystems in the world. Methods to quantify the ecological responses to hydro-morphological changes are the basis to evaluate the aquatic habitat situation. In order to capture the geometric situation in detail, strategies to extensively survey the riverbed, shorelines and parts of the inundated riverbanks are necessary. The continuous progress in remote sensing technologies enable river bathymetry surveys to a high degree of detail. Thereby, water-penetrating laser systems using the green region of the electromagnetic spectrum (wavelength = 532 nm) can provide valuable information. The laser scanners can be carried by aircrafts (Airborne Laser Bathymetry – ALB) to deliver large-scale high-resolution bathymetric survey data. Depending on the conditions, ALB-data achieve up to 20 - 40 survey points per square meter with accuracy in the range of 10 cm. Further developments in size and weight of the water-penetrating laser scanners, now even allow an unmanned aerial vehicle (UAV)-operated bathymetric survey. First results promise increased point densities and higher precision, however come with the drawback of lower spatial extension due to battery capacities.

The collected high-resolution bathymetric data builds the basis for multi-dimensional hydrodynamic-numerical and sediment transport models, which help to understand morphological processes and the related eco-hydraulic responses. Besides replicating status-quo of alpine waters to localize structural deficits, effects of restoration and renaturation measurements can also be pre-examined. The model output, such as flow variables, are used to identify and evaluate suitable habitat characteristics and aquatic living conditions.

The technology of Airborne Laser Bathymetry offers the opportunity to efficiently and repeatedly collect data of difficult to access alpine waters. As a result, the high-resolution survey data are able to form the basis for status-quo analysis and moreover, long-term monitoring of structural diversity and changes in aquatic environments. In order to create sustainable management solutions for stressed mountain aquatic ecosystems, high-resolution surveying data support identifying the drivers of eco-hydraulic changes in alpine waters.