Geophysical Research Abstracts
Vol. 20, EGU2018-16870, 2018
EGU General Assembly 2018

Contribution of numerical modeling to improve morphological monitoring of rivers: an example of the river Saalach

Felix Beckers, Markus Noack, Stefan Haun, and Silke Wieprecht

University of Stuttgart, Institute for Modelling Hydraulic and Environmental Systems, Department of Hydraulic Engineering and Water Resources Management, Stuttgart, Germany (felix.beckers@iws.uni-stuttgart.de)

The lower River Saalach, located at the border between Germany and Austria, represents one of the heaviest modified rivers in the Alps. River course straightening and the development of hydropower during the last decades have changed the natural morphodynamic equilibrium of the river into an erosion regime. Thus, the River Saalach requires sediment management strategies to avoid further bed degradation between km 20.69 and km 0.0. One example is the artificial sediment feeding at km 20.69 that started in 1985 to counteract the ongoing riverbed deepening. Since 1999, a total amount of 50,000 m^3 is annually fed to the river.

For an integrated assessment of the morphodynamic development under the current conditions, a 2D sediment transport model (Hydro_FT-2D) is applied to study i) the long-term riverbed development of the River Saalach (approximately 80 years) and ii) the bedload input into the downstream located River Salzach. To consider river morphology and sediment characteristics as accurate as possible, the software uses multiple layers to implement riverbed stratification and 8 grain size classes. Bedload transport is calculated by using the formula of Meyer-Peter and Mueller. The model is calibrated and validated using cross section measurements, which are available with a regular spacing of 200 m for the periods 1999-2009 and 2009-2013, respectively. In addition 11 measurements of the initial grain size distribution of the riverbed are available from the year 2000. The upstream sediment input and its sediment grading is given with 50,000 m^3/a (artificial sediment feeding at km 20.69). However, sediment transport measurements as well as information regarding intermediate grain size compositions are not available for additional model verification. Therefore, ongoing morphological monitoring is advisable to gain additional knowledge and to further improve model reliability.

To enhance the monitoring strategy, a numerical first-order second-moment analysis is applied in this study to identify the most critical model- and river-specific parameters and to point out sensitive regions within the river. The results show, that the transport rates and transported grain size classes show a high degree of uncertainty along with the grain roughness of the riverbed. Sensitive regions can be found in close vicinity to weirs and lateral structures. Moreover, a numerical study is conducted to determine the bedload relevant discharge threshold that is found to be 150 m^3/s.
This targeted model application helps to narrow down the variety of potentially monitored parameters to the most relevant ones. In addition, it helps to identify sensitive regions that should be described more clearly. For the River Saalach this means, that bedload traps during peak events, a more distinct description of grain size distributions at sensitive regions as well as a survey of the bedload relevant discharge threshold would considerably improve the model‘s reliability.
Because of that, the contribution of numerical modeling should be exploited early on to improve morphological monitoring and vice versa the reliability of morphodynamic studies. Thus, the use of these synergy effects is highly advisable to deepen the understanding of any morphodynamic system.