Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11145, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11145
EGU General Assembly 2008

Impact of submerged groynes on the flow field – results from a field experiment at the river Spree, Germany

C. Anlanger (1), A. Sukhodolov (2), I. Schnauder (2), W.S.J. Uijttewaal (3), H. P. Rauch (1)

(1) Institute of Soil Bioengineering and Landscape Construction, University of Natural Resources and Applied Life Sciences, Vienna, Peter Jordan-Strasse 82, A-1190 Vienna, Austria (hp.rauch@boku.ac.at / Fax: +43/1/476547349 / Phone: +43/1/47654/7304

(2) Department of Ecohydrology, Leibnitz Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany

(3) Environmental Fluid Mechanics Section, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Postbox 5048, 2600 GA Delft, The Netherlands

Submerged groynes are often constructed as near nature restructuring elements in river engineering projects to improve the aquatic habitat conditions. Although hydrodynamics and exchange processes between the main flow in a river and groyne fields has been a topic of intensive research over the last decade, only a few studies addressed the issue on a field scale. Moreover, available data sets are scarce in details and limited to particular case studies only.

In this study, seven groynes were constructed along the right riverbank of a straight reach of the Spree River in Germany. The river was about 20 m wide and 1.1 m deep during the experimental period. The groynes were about 7 m long and spaced 9 m apart from each other. The initial height of the groynes was 0.7 m, thus enabling experiments under submerged conditions. The experimental measurement program comprised of point measurements with acoustic Doppler velocimeters. An experimental run typically consisted of around 420 point measurements (12 cross-sections, 5 vertical profiles and 7 points in each vertical profile). Data was sampled for 4 minutes in each point at a data rate of 25 Hz. A staggered distribution of verticals assured a uniform

spatial resolution of the groyne fields. Additionally, zones of the flow upstream and downstream of the groynes and in the outer flow in the main channel were covered.

Post-processing of the data provided maps of the mean velocity vectors, shear stresses, and turbulent kinetic energy for different horizontal planes relative to the river bed (15%, 50% and 90% of the water depth). The obtained flow and turbulence patterns were compared to the results of previous laboratory investigations of Uijjtewaal et al. (2001). The submerged case was highly three-dimensional due to the vertical recirculation bubble developing leeward of the groyne tip. A particular consequence of the three-dimensionality was the substantial increase of flow velocity near the river bank in the submerged case. This distinctive feature of the flow shed light on the mechanisms of groyne failure which are commonly observed along trained river reaches.

The obtained data set represents detailed information on various important characteristics of the flow, including the effective roughness and deformations of the river bed. Furthermore, information on turbulence characteristics and length scales allows the examination of turbulence closure schemes in numerical models and provides better understanding on how boundary conditions should be specified in numerical computations. Further work with this field experimental data set will focus on a detailed examination of the flow features, particularly turbulence and its relevancy to exchange processes, and to an accurate numerical modeling of recirculating flows.