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Measuring velocity profiles above different substrates on the Glinscica stream

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The measurements of the velocity profiles above different substrates were done on the Glinščica stream in the summer 2010. Our main aim was to measure the velocities so close to the riverbed as possible, because we were interested in the velocities in the places where the most of water organisms, especially macroinvertebrates, actually live. As the majority of these organisms live on the bed surface, we have to measure velocities so close to the bottom as possible to investigate the circumstances they are exposed to in their life cycle. The velocities are not heterogeneous only in their vertical extension, but also in all directions over the bed surface, due to the morphology of the riverbed and especially due to the substrate. Large spatial and temporal heterogeneity of the velocities is the reason for measurement of near-bottom velocities being very difficult. Invention of new technologies for velocity measurements, such as laser Doppler anemometry and hot-film velocimetry, in the last three decades has enabled velocity measurements near the bed surface. Many measurements were done in the last few decades under controlled conditions in laboratories, but not many have been done in the field.
The instrument used for the velocity measurements was acoustic Doppler velocimeter, which is not the most appropriate for near-bottom measurements, but it has some other advantages: you can measure velocities on different heights above the bed surface and you can also measure discharge with it. Six measuring sites were chosen on differently regulated reaches of the Glinščica stream and each of them was composed of different number of profiles, depending on characteristics of each site. On each profile, we selected at least three points, on which we measured velocities on different depths. We were measuring velocities just under the water surface, on 2/10 of water depth, on 6/10 of water depth, on 8/10 of water depth and near the bed-surface. Velocity near the bed surface was measured on the height 1,6 cm above the bed surface, which is the closest to the bed-surface that can be measured by using the wading rod. If the water was not too deep, we repeated the near-bottom measurement without the wading rod, so that we held the probe in the hand on the bed surface. In this case the sampling volume was approximately 0,5 cm above the bed surface. The measuring interval on each measuring point and each depth was 60 seconds, except in some cases at the high discharges, when we hurried to measure on different profiles or even different measuring sites at the same conditions, and we shortened the record length to 40 seconds.
We compared the velocity profiles across the river cross-section, the velocity profiles above different natural substrates or above concrete channel and the velocity profiles at the same point at different water stages. We have found out, that the velocities at the same height above the bed surface are higher above the concrete channel in comparison to natural substrate and that they are higher at higher water stage. Beside the velocity analyses, we have also made a comparison between the stage-discharge curves above the pure concrete channel and above the concrete channel, overgrown with macrophytes. We have found out, that at the same discharge the water stage is higher and the mean stream velocity is lower at the cross-section with overgrown concrete channel in comparison to pure concrete channel.