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Applicability of the Vectrino profiler to study fluid flow in the close vicinity of the sediment-water interface

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The interaction of bottom currents with the sediment surface is the main driving force for the generation of turbulence in the bottom boundary layer of lakes and estuaries. As a consequence, these currents are an important factor for the exchange of solutes across the sediment-water interface. Close to the sediment, turbulent fluctuations are dampened and flow gradually becomes laminar. In this transition zone, momentum transfer is governed increasingly by viscosity and solute transfer is increasingly controlled by to molecular diffusion. Despite of its importance, this zone extends only a few cm above the sediment, while the laminar zone, which is generally called the viscous boundary layer, extends only over a few mm. Thus, velocity measurements at mm resolution are necessary to investigate the fluid dynamics at the sediment-water interface. Due to the fine resolution required and the difficulty to deploy and operate suitable instruments in the field, these measurements were mainly conducted in the laboratory and only a few attempts have been made to study these processes in-situ. Recently, a novel acoustic Doppler profiler has become commercially available which allows the recording of flow profiles with a spatial resolution of 1 mm and a measurement frequency of 100 Hz. We tested this device in the laboratory as well as in a run-of-the-river hydropower reservoir. We found that average velocities were determined adequately by the profiler, while the characterization of turbulent quantities suffered from noise as well as from signal decorrelation. This contribution will illustrate the potential of the device for studies close to the sediment-water interface and discuss data correction schemes we developed which allow the accurate determination of turbulent quantities.