Geophysical Research Abstracts
Vol. 15, EGU2013-4450, 2013
EGU General Assembly 2013

Airborne Hydromapping - How high-resolution bathymetric surveys will change the research and work focused on waterbody-related topics

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Repetitive surveying of inshore waters and coastal zones is becoming more and more essential in order to evaluate water-level dynamics, structural and zonal variations of rivers and riparian areas, river degradation, water flow, reservoir sedimentation, delta growth, as well as coastal processes. This can only be achieved in an effective manner by employing hydrographic airborne laser scanning (hydromapping). A new laser scanner is introduced, which has been specifically designed for the acquisition of high-resolution hydrographic data in order to survey and monitor inland waters and shallow coastal zones. Recently, this scanner has been developed within the framework of an Austrian research cooperation between Riegl LMS and the Unit of Hydraulic Engineering at the University of Innsbruck.

We present exemplary measurement results obtained with the compact airborne laser-scanning system during our project work. Along the Baltic Sea coast northeast of Kiel city, northern Germany, we obtained measurement depths up to 8 m under clear-water conditions. Moreover, we detect underwater dune-structures and the accumulation of sediment within groin structures. In contrast, under turbid water conditions we obtained depths of approximately 3 m along the Rhine River at Rheinfelden, German-Swiss border east of Basel city. Nevertheless, we were able to map small-scale and complex morphologic features within a fish ramp or bedrock cliffs. The laser data had been combined with sonar measurements displaying the bathymetry at depths of ca. 2-25 m in order to document comprehensively the actual hydrographic setting after the new construction of the hydropower plant Rheinfelden.

In summary, a high-resolution spatial view on the ground of various waterbodies is now possible for the first time with point densities in the usual range of approximately 10-20 points/m^2. However, the combination of these data with high-resolution aerial (approximately < 5 cm/pixel) or spectral images offers a variety of new opportunities for further analysis. Lastly, the combined datasets - all of them captured during a single flight including topography, bathymetry, aerial and spectral pictures - provide a comprehensive and homogeneous database for the detailed and precise description of river- or coastal-bed hydraulic, morphologic and ecohydraulic processes. The high density and accuracy (less than 10 cm) of information offer the extended possibility for monitoring and supervisory purposes.