

MEETINGS

Advancing Hydroacoustic Technologies for Sedimentology Research and Monitoring

Joint USGS-CUAHSI Workshop on Sediment Hydroacoustic Techniques for Rivers and Streams; Shepherdstown, West Virginia, 20–22 March 2012

Hydroacoustics is a compelling technology that can provide surrogate measurements of suspended-sediment concentration (SSC) with improved spatial and temporal resolution, after calibration to physically sampled concentrations in rivers and streams. The advantages of hydroacoustic metrics as surrogates of suspended sediment—compared to today's manually intensive techniques, which originated in the 1940s—include large sample volumes, potential for simultaneous velocity measurements, and environmental robustness. However, consensus has yet to be derived on standard protocols for determining acoustic attenuation, adjusted backscatter amplitude, and sediment-size effects. Hydroacoustic technologies for bed load lag

those for suspended sediment but are no less compelling. Hydroacoustic technologies for bed material characterization are relatively mature and commercially available.

The Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI); U.S. Geological Survey (USGS); Subcommittee on Sedimentation, Advisory Committee on Water Information; and Federal Interagency Sedimentation Project convened this workshop at the National Conservation Training Center to (1) promote information exchange among scientists, manufacturers, and managers and (2) provide a forum for those working in different environments and disciplines to share experiences and evaluate opportunities to advance the

technology and its application to research and broad-scale operational use.

Presentations addressed the physics, methods, and examples of passive and active hydroacoustics for quantifying sedimentologic and related hydrodynamic properties of rivers and streams. More than 60 participants shared examples of operational projects estimating SSC, sediment flux, bed load, and bed material characteristics. They discussed instrument development needs, metadata requirements, and standardized protocols development. While fluvial environments were the focus, discussions included the relevance of this technology to lakes, reservoirs, estuaries, and the coastal zone.

The workshop clearly demonstrated the potential to estimate selected sedimentary characteristics from calibrated acoustic backscatter and attenuation. This was evident not only in proven physics and example projects but also in the near-ubiquitous usage of acoustic instruments for stream-flow velocity measurement. The workshop also showed that methods and acoustic metrics for characterizing sediment are inconsistent between different studies and instruments. Questions remain about how acoustic backscatter should be normalized

to isolate the effects of sediment and how acoustic attenuation should be determined.

Participants advanced ideas for more systematic research into how sediment and hydrodynamic (including turbulence) quantities can be determined from hydroacoustics. They stressed that physical sampling remains essential for sediment characterization. Better communication with instrument manufacturers and more complete and detailed metadata also are essential to resolving inconsistent acoustic metrics and signal processing. Participants agreed that with systematic research, continued communication, and interim guidance, this potential can quickly move into broad-scale operational use for estimating sediment characteristics from acoustic metrics.

Presentations are available at <http://www.cuahsi.org/ws-hydroacoustics.html>.

Along with the authors, Jim Chambers (University of Mississippi), Dave Mueller (USGS), Marian Muste (University of Iowa), and Peter Wilcock (Johns Hopkins University) organized the workshop and contributed to this report.

—MARK LANDERS, U.S. Geological Survey (USGS), Atlanta, Ga.; JENNIFER ARRIGO, Consortium of Universities for the Advancement of Hydrologic Science, Inc., Boston, Mass.; E-mail: jarrigo@cuahsi.org; and JOHN R. GRAY, USGS, Reston, Va.