

Discussion Notes

Overview of USGS SSC~Hydroacoustics & Discussion

Jan 10, 2012, USGS National Center and Web-Ex

This meeting (agenda attached) provided an overview of recent and ongoing USGS applications of hydroacoustics to estimated suspended sediment concentration in streams in NY, ID, IL, WA, GA, AZ, and CA. These presentations demonstrate the viability and growth of these methods, as well as the methods diversity and needs for research. Perspectives from OSW, the Mid-West Area, and the FISP were also provided. Summary results of the meeting include:

- Suspended sediment concentration and loads can be estimated using acoustic surrogates of backscatter and attenuation with high temporal resolution, improved accuracy, and reliable results for a wide range of sediment and hydraulic conditions.
- The potential for adding SSC estimates at locations of existing index-velocity stations is high.
- The keys to a substantial increase in sediment monitoring are: (a) increased perception of sediment monitoring as critical to resources assessment, management, and protection; (b) research and analysis to resolve key questions about best methods; and (c) software, guidance, and support to enable generalized applications of these methods.
- While this meeting focused on SSC estimated from fixed-location ADVs, we discussed the additional steps and potential for SSC from mobile ADCP measurements. Dr Szupiany and others have demonstrated successful SSC estimation from ADCP results.
- The growing interest and application of these methods warrants a revival of the Sediment Hydroacoustics Work Group.

The discussion after the presentations identified some key areas where work is needed to advance these technologies. These would be part of the 'mission' of the SHAWG in coming months. The discussion notes, not fully 'cleaned up' are presented here.

Key Differences in Methods / Areas to Focus and Define Methods [ADVMS]

- Whether to account for instrument noise; use raw backscatter; SNR; or raw adjusted for recorded noise.
 - Sontek only transmits SNR via SDI-12
 - Advantages to SNR: it is auto accounting for this
 - Disadvantages: Noise may vary in unusual? cases for reasons unrelated to SSC
 - *This will be a key topic of discussion with manufacturers*
- Should we limit ourselves (or develop a 'track' for) SDI-12 Com?
 - Can we work w/ specific data logger vendors to develop program to collect (via RS-232) the detailed data and transmit (via phone)?
 - Could standard SDI-12 set up and number of data elements work to transfer multi-cell data adequate to compute adjusted backscatter and attenuation?

- Measurement / Computation of Sediment Attenuation (Topping et al method)
 - Negative attenuation:
 - Filter out or not? Or what is the deciding factor to filter or not?
 - What does it mean? (it is theoretically unreasonable)
 - How many bins and over what range? (required assumption of spatially uniform SSC)
- Use Near Field Correction or not? If so, what method?
 - Depends on cell size & blanking distance vs near field distance
 - Review and evaluate methods of computation
 - Gary Wall noted use with/without led to only about 1%
 - Need to know from manufacturers whether each includes this correction now.
- What are the acoustic surrogate metrics or explanatory variables that should be considered?
 - Adjusted Backscatter
 - Acoustic Attenuation due to sediment
 - Velocity (perhaps as an indicator of varying PSD)
 - Other: such as a measure of flow from different sources
 - Temperature

What are the environmental (sediment, hydraulic characteristics) Limitations?

- Depths for uplookers as low as 1 foot
- Usable for ephemeral streams?
- Spatial mixing considerations same as for any sediment monitoring
- Range of sand concentrations (backscatter maxing out)
- Range of silt/clay concentrations (signal drops to noise level)

Where do we need to concentrate for calibration data sets?

- Sites with wide range of PSD
- This should be determined after general summary of currently available data sets

What research is needed?

- Move forward with automated processing software
 - This benefits consistency and program development
- A laboratory calibration facility: measuring instrument and SSC and acoustic variables
- Site selection guidance (index velocity guidance great starting place)
- A calibration data base. Compilation of existing data. Extending to Additional Sites/ data sets
- Define data gaps
- Define understanding / methods gaps

What is the best timeline for providing USGS guidance?

- Interim Guidance – the stuff we know to do/ not do; and what we don't know
- A 'State of Practice' document

- Detailed technical description & results coming out of GC AZ work.

What additional needs to be done to develop ADCP ~ SSC methods?

- Evaluation of methods to estimate acoustic attenuation due to sediment when operating with a vertical profile (typically unable to assume uniform concentration along beam)
- Computation of estimated cross section average SSC from completed transect
- Combination with cross section discharge to produce instantaneous flux

Agenda

Brief Overview of USGS Sediment Hydroacoustic Activities

Estimation of sediment characteristics from metrics measured using acoustic velocity meters holds significant promise. The advantages of hydroacoustic metrics as surrogates of suspended sediment include greater accuracy due to high temporal resolution, a large sample volume, environmental robustness, a technology that is now ubiquitous in streamflow monitoring, and simultaneous velocity measurement. However, best methods have not been broadly discussed or agreed upon for measuring acoustic attenuation, adjusted backscatter amplitude, and sediment-size effects. This meeting will focus on suspended sediment characteristics by fixed-place acoustic doppler velocity meters. It is intended to provide a brief overview and help identify the status and key issues in monitoring suspended sediment using hydroacoustics.

This meeting will provide USGS HQ and field personnel with a brief overview of:

- Current examples and methods for Suspended Sediment estimates from Acoustic Metrics
- Differences in methods, results, and limitations
- Research focus areas
- Steps to advance methods and practice to support broad scale application
- Potential for broad program development effort/ initiative

When: January 10, 2012, 1pm – 5:00 EST (following the a.m. Seminar by Dr Ricardo Szupiany on Sediment Bed Sediment Concentration by ADCPs)

Where: USGS, Reston, room **5B227**, and **WEB-EX**

Agenda

1pm-2:30pm

Brief Overview of Field Activities in Sediment Hydroacoustics

Introduction and 7 presentations of 6-10 minutes each on field examples, experiences, and perspectives regarding sediment hydroacoustic methods (focus on suspended sediment).

- 1 – Gary Wall –New York
- 3 – Mark Landers – Georgia
- 4 – Molly Wood – Idaho
- 5 – Tim Straub – Illinois
- 6 – Chris Magirl– Washington
- 2 – Scott Wright – Arizona GC results
- 7 – Scott Wright – California

2:30-2:50

Area and OSW Perspectives and Roles

Presentations (6 minutes each)

- 8 – Jeff Stoner & Chris Ellison – MWA Sediment and Nutrient Modeling Initiative
- 9 – Robert Mason & John Gray – OSW
- 10 – Mark Landers – FISP (FISP priorities, roles)

2:50-3:50**Research and program support needs (directed discussion)**

What are the significant differences in methods, environments, procedures?

What is needed to move forward toward broader application?

What are the priorities?

What are the roles of OSW, Areas, NRP, FISP, WSCs, other groups?

3:50-4:00 Break**4:00-5:00****Revival of Sediment Hydroacoustic Workgroup**

Charter, Goals, Membership, Frequency & Format for Meetings, other Communication

>Kevin Oberg/ Dave Mueller – HaWG perceptions and suggestions

>John Gray – OSW (initial SHAWG charter & goals)