RECLAMATION

Managing Water in the West

Federal Interagency Sedimentation Project 2017

Research and Development Office
Science and Technology Program
Final Report ST-2017-1709 -01

U.S. Department of the Interior
Bureau of Reclamation
Research and Development Office

September 2017

Mission Statements

Protecting America's Great Outdoors and Powering Our Future

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

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Cover photo: Multi-frequency side looking acoustic Doppler velocity meter installed on the Clearwater River. Photo courtesy of Molly Wood (https://id.water.usgs.gov/studies/Central/ClearwaterSnakeRivers-SurrogateTechnology/.)

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14. ABSTRACT ***(Maximum 200 words) The Federal Interagency Committee is an interagency committee made up of Federal agencies that have an agency interest in the source and fate of fluvial sediment. The committee regulates sediment measurement equipment, procedures, and guidelines to provide a consistency among all sediment researchers, Federal or otherwise. The committee was formed in 1939 over concerns that inconsistencies in sediment data collection and processing techniques were leading to erroneous data. Moreover, it is important that sediment data can be collected in such a way that comparisons can be made over spatial and temporal scales. For the past two decades the FISP committee has been funding research to improve and develop surrogate technologies for sediment measurement. Surrogate technologies can improve the frequency (temporal resolution) at which sediment data are measured and reduce the medium and long term cost of the data collection.***		

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Notices

Reclamation's Science and Technology Program has funded the Agency's participation in the FISP for more than two decades. However, the S&T Program will no longer be providing this funding. Beginning in FY2018 the Agency's contribution to the FISP will be funded by Reclamation's Policy Office.

Acronyms and Abbreviations

ABS – Acoustic Back Scatter

ADCP – Acoustic Doppler Current Profiler

ADVM – Acoustic Doppler Velocity Meter

ARS – Agricultural Research Service

BLM – Bureau of Land Management

BOR – Bureau of Reclamation

CSU – Colorado State University

CUAHSI – Consortium of Universities for the Advancement of Hydrologic Science, Inc.

EPA – U.S. Environmental Protection Agency

FISP – Federal Interagency Sedimentation Project

HIF – Hydrologic Instrumentation Facility (USGS)

LISST – Laser In Situ Scattering and Transmissometry (measures SSC and particle size)

NMFS – National Marine Fisheries Service

NWIS – National Water Information System (USGS database)

OBS – Optical Back Scatter

QA/QC – quality assurance / quality control

SAID – Surrogate Analysis and Index Developer

SSC – Suspended Sediment Concentration

T&M – Technique and Methods manual

TVA – Tennessee Valley Authority

USACE – U.S. Army Corps of Engineers

USFS – U.S. Forest Service

USFWS – U.S. Fish and Wildlife Service

USGS – U.S. Geological Survey

Executive Summary

Background

The Federal Interagency Sedimentation Project (FISP) is the national leader in the identification, evaluation, and development of standardized, calibrated equipment and methods for consistent, accurate quantification and analysis of sediment characteristics and transport in surface waters, which support the proper characterization and management of natural resources. The FISP was created in 1939 by the following agencies: the U.S. Department of Agriculture, the Bureau of Reclamation, the Office of Indian Affairs, the U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), and the Tennessee Valley Authority (TVA). The FISP was created to unify the research and development activities of Federal agencies involved in fluvial-sediment studies.

Currently, the FISP is headed by the US Geological Survey and the chief is Dr. Mark Landers. Other partner agencies include the Bureau of Reclamation, U.S. Forest Service, Agricultural Research Service, U.S. Army Corps of Engineers, USEPA, and Bureau of Land Management. The committee interacts with other organizations including federal agencies, academia, and private industry for research and development of standardized, calibrated equipment, and methods to allow consistent and accurate quantification of sediment characteristics and transport in surface waters. FISP activities focus on the measurement and analysis of suspended sediment, bed load sediment, bed material, bed topography, adsorbed constituents, and sediment characteristics using physical samplers and surrogate technologies.

The FISP meets twice each year, once in the fall and again in the spring. The location of these meetings is typically co-located with a current or past FISP-funded project or other location relevant to sediment measurement. The fall meeting is when research proposals are reviewed, judged, and awarded. During the spring meeting presentations are provided by each funded researcher as a progress update. Regular FISP business is conducted at both meetings. The FISP is funded by partner agency contributions and from the sale of sediment sampling equipment developed by the FISP. The Hydrologic Instrumentation Facility (HIF), located at Stennis Space Center in Mississippi, handles the sales and oversight (QA/QC, etc.) of FISP sediment measurement equipment.

FISP activity can be tracked on the FISP website.

Project Update

Fall meeting 2016

The fall FISP meeting was held in Traverse City, MI, November 9-10, 2016. Attendees included Dr. Mark Landers (USGS FISP Chief), Dr. Roger Kuhnle (ARS representative), Dr. Molly Wood (USGS representative), Dr. Jim Selegean (USACE representative), and Robert Hilldale (BOR representative). The highlights of this meeting include:

- Discussed increasing the number of member agencies (NMFS, BLM, USFS). The USFS has a representative and they're working at becoming active again. We haven't had as much luck with the BLM and NMFS. The NMFS has never been a member of the FISP.
- Johnny Wheat discussed the HIF sales of FISP equipment, of which the FISP receives 25%.
- Mark Landers (FISP Chief) discussed the FISP budget for FY2016 and proposed budget for FY2017.
- Discussed the Operational Continuous Suspended Sediment Methods T&M and its merits. The SAID tool computes SSC from ADVM (surrogate) and physical measurements. Currently this tool is written in Matlab but is being re-written in Python for easier and wider distribution.
    - This tool includes both single and dual frequency calculations.
- Discussed the LISST-ABS (new device manufactured by Sequoia Scientific). Landers made physical measurements for comparison to the backscatter instrument. Some of the results were promising.
    - The manufacturer is working on some details and has managed to fix temperature sensing issues noted in the previous meeting.
    - Sequoia Scientific is manufacturing a combined OBS and ABS (combining optical and acoustic backscatter in one device). The expected improvement is detection of a wider range of suspended sediment sizes.
- A FISP funded project to examine down-looking ADCPs for measurement of SSC was discussed. Tests were performed on the Missouri River to compare physical measurements of SSC to that computed by the ADCP.
    - Dr. Wood gave a presentation of the Stationary Time Series Analysis – a tool that allows the user to input stationary ADCP velocity and backscatter data for visualization. This tool is expected to become a processing tool as well as a visualization tool.
    - Dr. Kuhnle initiated a discussion of the various ways in which fine suspended sediment is measured with surrogates.
- Funded partners presented their research:
    - Dr. Kristin Bunte (CSU) presented progress of her FISP funded research. She is testing the hydraulic efficiency of various pressure difference samplers with various sizes of netted mesh in a flume.
    - Update by JR Rigby (ARS) on sound propagation in a fluvial environment. This research has yet to be funded by the FISP. Difficulties have been encountered transferring funds from the USGS to the ARS.
    - John Gray (USGS retired) updated the committee on his progress on calibrating pressure difference samplers from tests done in 2007.
    - Jeb Brown (USGS) updated the FISP on his efforts to test the limits of a densiometric meter to measure high concentrations of suspended sediment. The goal here is to determine the lower limit of this method. His field work was inconclusive after a year of low discharges on the Rio Grande (where the instrument is installed). Brown had relocated his instrument in such a way that it will be inundated at lower river discharges.

    - David Varyu (BOR) presented his work to instrument an ephemeral tributary to the Rio Grande. He plans to use multiple surrogates to measure suspended and bed load. This work has not been funded by the FISP.
- Dr. Landers presented lab-measured SSC data for the purpose of a discussion on uncertainty as measured by USGS sediment labs. The FISP committee is working to support the sediment labs in any way we can.
- Dr. Landers' continuing work on a FISP memo for SSC sampler nozzles and bag samplers. Draft memos for FISP committee review are expected soon.
- The FISP committee visited the Boardman River, where two dams have been removed, to observe the recovery of the system from a sediment transport perspective.

Spring Meeting 2017

The spring FISP meeting was held in Sacramento, CA May 2-3, 2017. Attendees included Dr. Mark Landers (USGS FISP Chief), Dr. Roger Kuhnle (ARS representative), Dr. Molly Wood (USGS representative), Dr. Jim Selegean (USACE representative), and Robert Hilldale (BOR representative). The highlights of this meeting include:

- Dr. Landers presented Johnny Wheat's HIF sales of FISP equipment, of which the FISP receives 25%.
    - P6-200 efficiency testing in the flume at HIF was discussed
    - Estimation of uncertainty in sediment predictions was discussed
- Interim budget review
- LISST-ABS discussion – testing has taken place in the Missouri River, Rio Grande, Colorado River and in the San Francisco Bay delta. It has been noted that there is a strong size dependency with this instrument. These implications are being evaluated.
- Updates on FISP funded projects:
    - John Gray (USGS retired) presented more of his findings on the calibration of pressure difference bed load samplers
    - Dr. JR Rigby and Dr. Daniel Wren (ARS) presented work on sediment generated noise as recorded with a hydrophone for the purpose of measuring coarse bed load.
    - Dr. Kristin Bunte (CSU) presented the results of her FISP funded research. She provided valuable data on the hydraulic efficiency of various pressure difference samplers with various sizes of netted mesh in a flume. She plans to publish these results in a peer reviewed journal and has shared her results with the committee.
- The committee discussed the bag sampler memo Dr. Landers was working on. The committee will review this memo ahead of its release. The memo contains details about sampler efficiency in cold temperatures.
- The committee discussed a WRR paper on sediment samplers and sampling. The committee will review and consider a formal response.
- The committee discussed replicate (A and B) SSC samples – whether or not two passes are required.
    - The USGS is planning to clarify this procedure. The FISP will weigh in on this.
    - Proper coding (by USGS) will be needed for entering in NWIS

    - Field person should evaluate the sample for a large presence of coarse material in suspension, consider a second sample if a large amount of sand is in the sample
- Dr. Kate Norton (USGS Cascade Volcano Observatory sediment lab) led a discussion on analytical uncertainty for sediment samples evaluated in the lab.
- Discussion of paired ADCP/SSC samples. Dr. Wood (USGS) presented an update on this work such that the ADCP can be used to determine SSC
- The committee discussed emerging sediment surrogate technologies
- The committee discussed upcoming sediment-centric conferences
- Expanding FISP membership
    - Dr. Dan Cenderelli (USFS) is working on getting USFS funding to the FISP once again.
    - Dr. Matt Collins (NMFS) may be a possible new member – they're interested
    - Molly will talk with Tim Mayer (USFWS)
- The committee discussed the possibility of another CUAHSI workshop on sediment surrogates.

Data Sets that Support the Final Report

The FISP maintains a website containing all FISP reports, minutes, research, etc. The website is https://water.usgs.gov/fisp/