LISST-25 Deployment at Cape Fear, NC

Report submitted to

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Section 1: Introduction

This work is part of a Cooperative Research and Development Agreement (CRADA) entered into by the USACE and Sequoia Scientific, Inc.. The object of the CRADA is to evaluate the performance of Sequoia's LISST-25 instrument for monitoring suspended sediments. This sensor uses shaped focal-plane sensors that yield constant calibration estimates of suspended sediments, and a Sauter Mean Diameter (SMD, defined as the ratio volume/area concentration) The specific objectives are:

- Comparison of LISST-25 suspended concentration estimates with in-situ samples;
- Provision of new data, not available from prior sensors, on suspended particle Sauter Mean Diameter.

The work reported here is an early report of studies conducted in support of an ongoing investigation of sediment dispersal and evolution of a mixed-sediment disposal mound. The studies are being carried out by the US Army Corps of Engineers (USACE).

Section 2: Methods

A LISST-25 was mounted onto the Virginia Institute of Marine Science (VIMS) profiling pump sampler package. The package was profiled through the water column. Water samples were taken at roughly 1-meter increments. These samples were processed by the VIMS staff to obtain mass concentrations. The mass concentration was used to compare against the LISST-25. The plots showing the comparison of the LISST-25 and water samples are presented. Plots of the Sauter Mean Diameter are also included.

Section 3: Results

LISST-25 profile data was obtained on July 24-27, 2001 from the R/V Langley. The data were synchronized with the water samples obtained by Grace Battisto of VIMS. These data were obtained at: the River2 Mound, Bald Head, Channel near Bald Head, and again at the River2 site.

The water sample data was used to calibrate the LISST-25 output. By using a single sample, a correction factor was calculated and applied to all of the LISST-25 data presented. The correction factor includes issues such as flocculation, random shapes, and *in-situ* density variations. The correction factor was determined to be about 7.8. Figure 1 and 2 show the LISST-25 data with the grab sample values overlaid.

Figures 1 shows excellent agreement between the LISST-25 and the water samples. The corresponding SMD is shown in Figure 3. The early part of the plots show a consistent match between in-situ samples and LISST-25 estimates, despite a 2:1 decline in sediment SMD. This is the essential result confirming the constant calibration of the LISST-25.

The agreement in figure 2 is also excellent, except for a pronounced disagreement at hours 14 to 15. The excellent agreement everywhere else between LISST-25 and *in-situ* samples leads us to suspect that there may, in fact, be an experimental error in the grab sample estimates in this short segment. The first section of data in Figure 2 is from the river channel

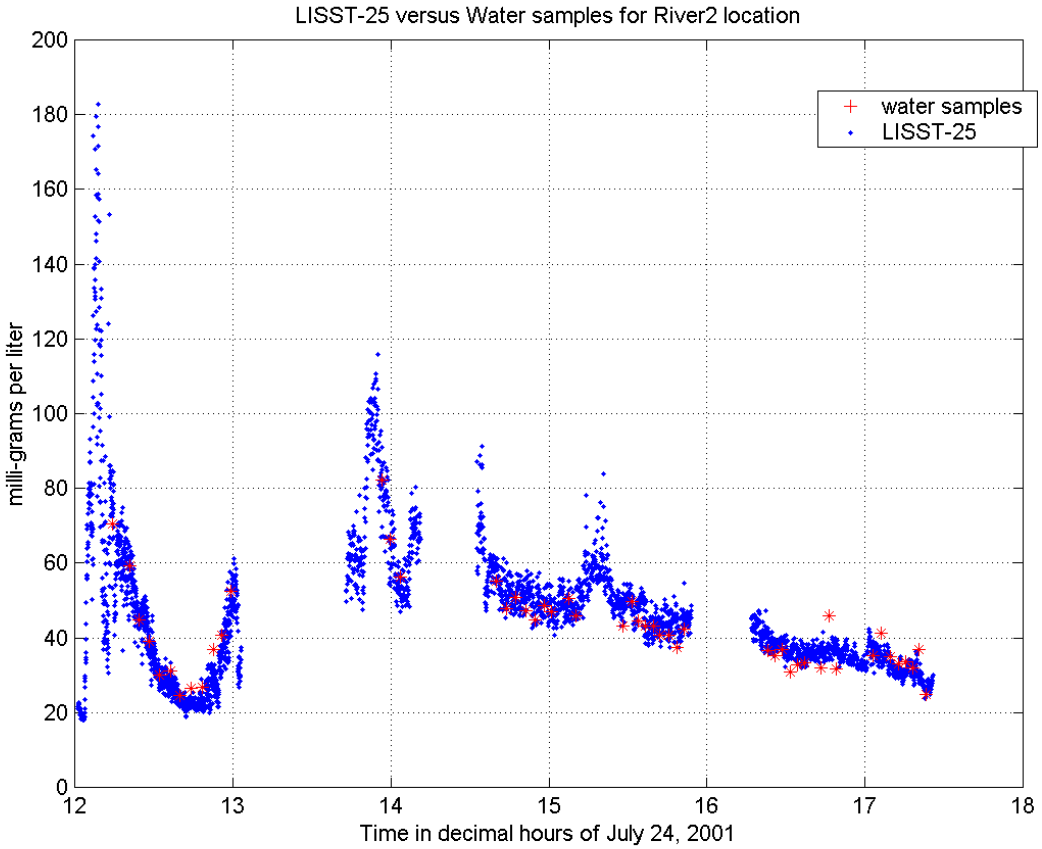
near Bald Head. Three profiles were obtained at this location over a period of 90 minutes. The LISST-25 data show similar values for each depth for the three profiles. The grab sample data show large increases in concentration during the third profile, in contradiction with the consistent steady decline reported by the LISST-25. The water samples appear to have large variability over the 1-meter increments, which is physically unlikely, and thus indicates that the grab sampling may have experimental errors.

Figures 3 and 4 show the Sauter Mean Diameter of the sediment. There is no comparison data for SMD from the grab samples. In all the data of figures 3 and 4, the relatively large SMD values suggest that these sediment particles are flocculated material, as the turbulence was not vigorous enough to support sand grains of that size over the range of depths where observations were made. The presence of flocs is consistent with the correction factor 7.8 estimated in para 2 of this section.

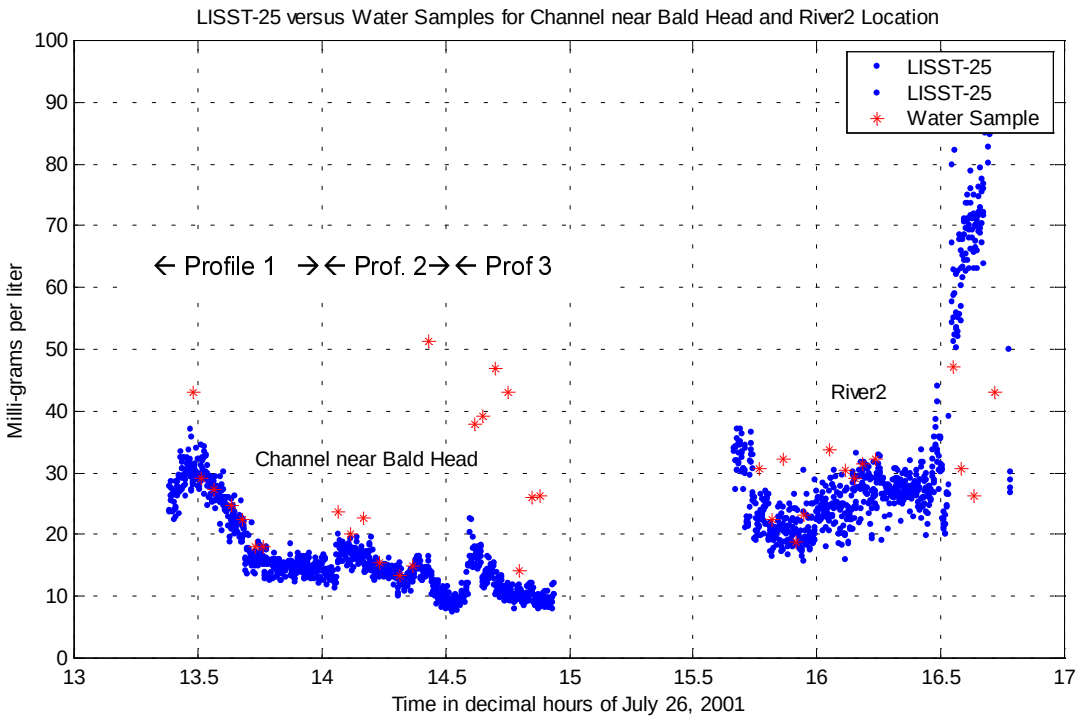
A final remark concerns the large increase in concentration and SMD at the tail end of figure 2 and 4. It is not clear what produced this artifact; a possible explanation may be the blockage of the laser beam by floating weeds or some such material.

Section 4: Conclusion

Using a single correction factor from grab samples, the LISST-25 is able to deliver constant calibration estimates of suspended sediments. Furthermore, the sensor also provided data on SMD that were not available from prior technology sensors.



Figures 1 and 2: Comparison of calibrated LISST-25 Concentration values and water samples. Figure 1 (above) is data taken at the River2 site on July 24 2001. Figure 2 (below) shows data taken at the Channel near Bald Head and again at the River2 site.



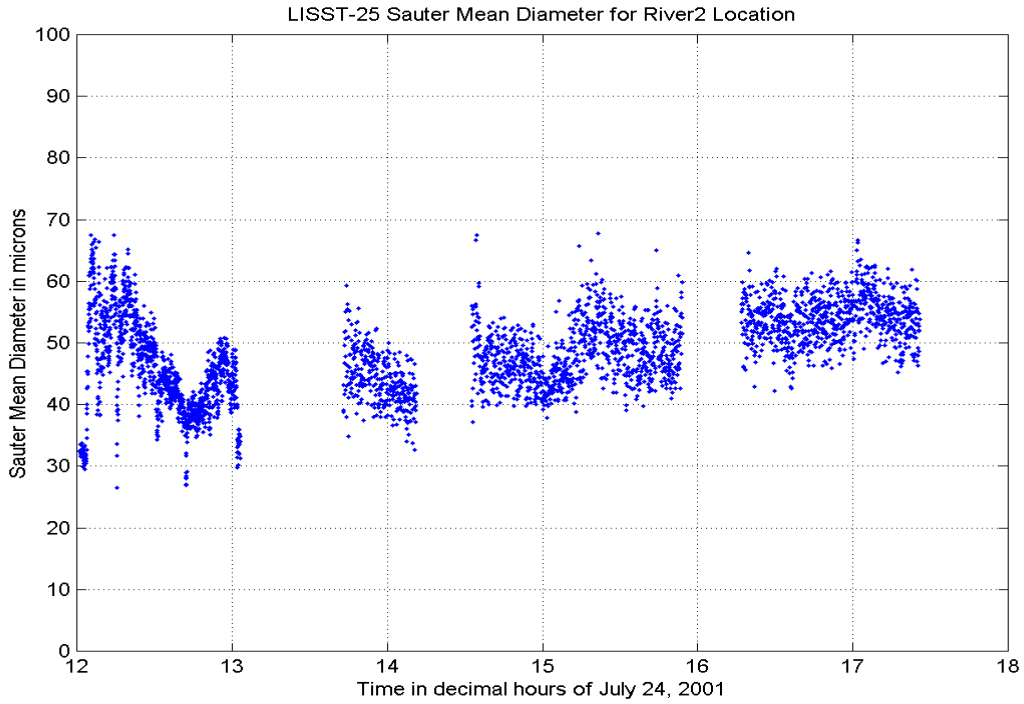


Figure 3 and 4 : Sauter Mean Diameters for River2 and Channel Near Bald Head. Figure 3 (above) shows the Sauter Mean Size for the River2 site on July 24, 2001. The data is syncronized with the Mass concentration data shown in Figure 1. Figure 4 (below) is the Sauter Mean diameter for the Channel near Bald Head and the River2 site on July 26, 2001. The data is syncronized with the mass concentration shown in Figure 4. Note the large change in the SMD around hour 16.5. This is a indicator that something was blocking the beam or very large particles were passing through the laser beam.