Turbidity vs Laser Diffraction – why LD is better

Last updated: 11 May 2016

Turbidity as a surrogate for suspended sediment concentration (SSC) is commonly used and deeply established in practice. The shortcomings of turbidity as a surrogate for SSC are:

- The calibration changes with grain size;
- The calibration changes with sediment color; and
- Turbidity offers no information on sediment grain size distribution.

We see numerous publications where strong correlations are presented; often discrading inconvenient 'outliers' as simply 'bad' points. This dependence of calibration on grain size and color is well known. It was published by Sutherland, Lane, Amos and Downing in a landmark article in Marine Geology v.162, 2000, pp 587–597. [The last of these authors invented the first turbidity meter, the OBS.] Their key results are presented in the figure on right (figure reproduced with permission). We demonstrate this change in calibration of turbidity in a video at the bottom of this article.

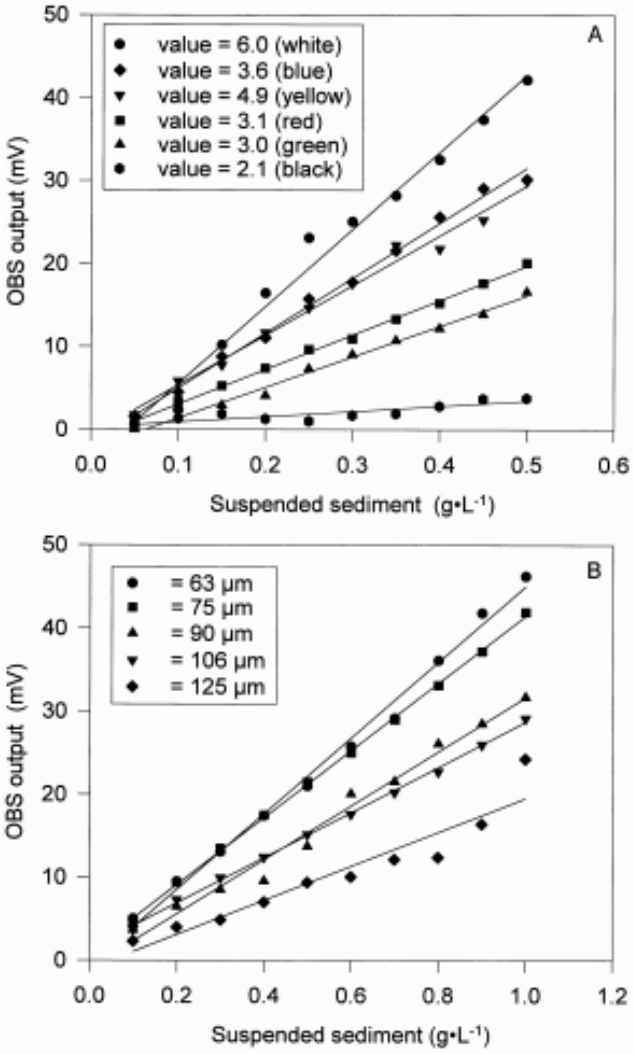

Fig. 6. The OBS calibration results of OBS output vs. suspended sediment concentration for various sediment colours (A) and of OBS output vs. suspended sediment concentration for various sediment sizes (B). The sediment grain size of the coloured sediment was 90 µm.

In contrast, laser diffraction (LD) measures the *grain size distribution*, i.e. concentration in each of multiple size classes (or size bins). Typically, all our instruments output such concentrations in 32 size classes, except the new LISST-200X which outputs 36, and the LISST-Portable|XR which outputs 44 size classes. The sum of the concentrations in all size classes provides the total concentration, SSC. This calibration is fixed.

The calibration for our laser diffraction instruments is constant for life as the built-in software compensates for changes in laser output over life.

[Changes in calibration occur only when particle size is outside the measurement range, e.g. < 1 or >500. See article The Influence of particles Outside the Size Range of the LISST