A new approach to determine the bathymetry in a very shallow environment using the SHOALS 3000T signal.

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Airborne Laser Bathymetry systems (ALB) are a very precise new tool for surveying coastal regions between -30 m and –2 m. In this paper we analyze the data obtained by SHOALS-3000T system from Optech in a very shallow environment.

The core of SHOALS operations is a double pulsing laser. Each laser pulse is composed of light at two wavelengths: 1064 nm (Infrared) and 532 nm (blue-green). But in very shallow water (less of 1,5 m) this system has difficulty to separate the return signal of the two original laser pulses. The aims of this work are to develop a new algorithm to solve this problem and to extend the capability of the SHOALS-3000T mapping in the very shallow water zones between 2 m and 0.25 m.

This algorithm is based on the asymmetrical Gaussian analysis of the laser pulse. In a first time we tested the Gaussians Mixture model developed for the tree and house measurements by terrestrial LiDAR and the non-linear least squares method developed by Levenberg-Marquardt. These two approaches are not adapted in this very shallow marine environment because the surface peak and the bottom peak are so close that the resulted signal present only one Gaussian population. But in this case, the Gaussian population is not symmetrical.

For this reason we test a new approach based on the Skewness intensity variation of a Gaussian population. We demonstrate that the positive values variation of the Skewness is correlated with the water depth variation (r^2= 0.73 and 0.88).

We test this approach in five different types of environments of North shore of the Chaleur Bay, Gulf of St-Lawrence: a beach environment with a nearshore sand bar system and a sand spit environment of Paspebiac, a gravely coast and a *Zostera maritima* field of Bonaventure and an shallow internal estuary of Bonaventure river. This approach works well in sedimentary environment cases, but not in a marine biological environment case like in the *Zostera maritima* field because in this type of environment the height of the *Zostera* is function of the sea level height. Especially if the water column height is under the maximum height of Zostera stems.

Further work concerning Shallow Survey 2008 will be conducted specially to determine the limit of this approach in different environment i.e. *Posidonia oceanica* fields in Mediterranean Sea and eel grass fields in Gulf of St-Lawrence. In this further work we will correlated the SHOALS data with some field data obtained by new fields laser equipment (i.e. MAPLE) developed by INRS-ETE in collaboration with the INO.