Relationship between depth measurement uncertainty and seafloor characteristics in Airborne Lidar Bathymetry systems

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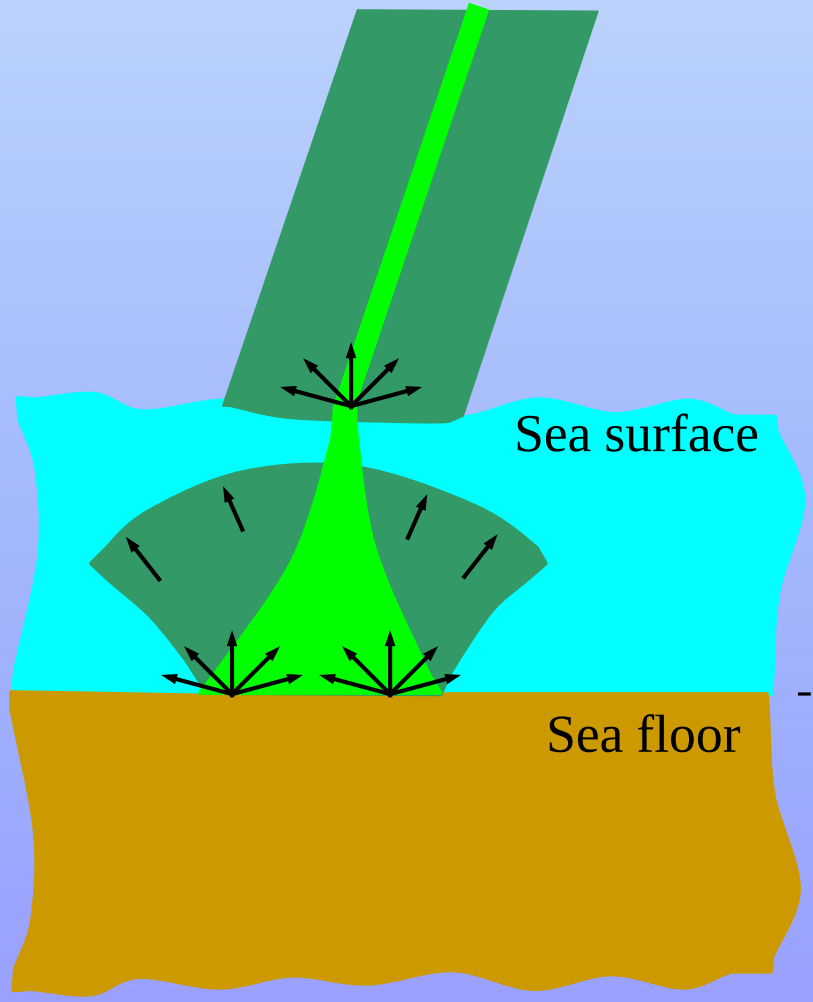
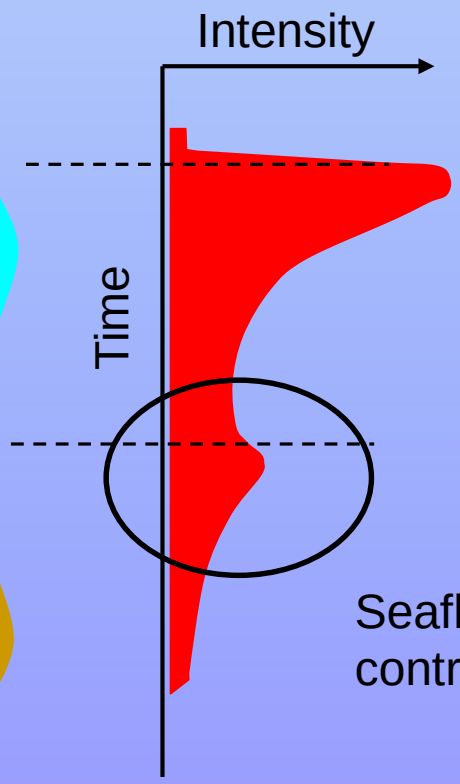
Airborne Lidar Bathymetry (ALB)



Waveform
(function of time)

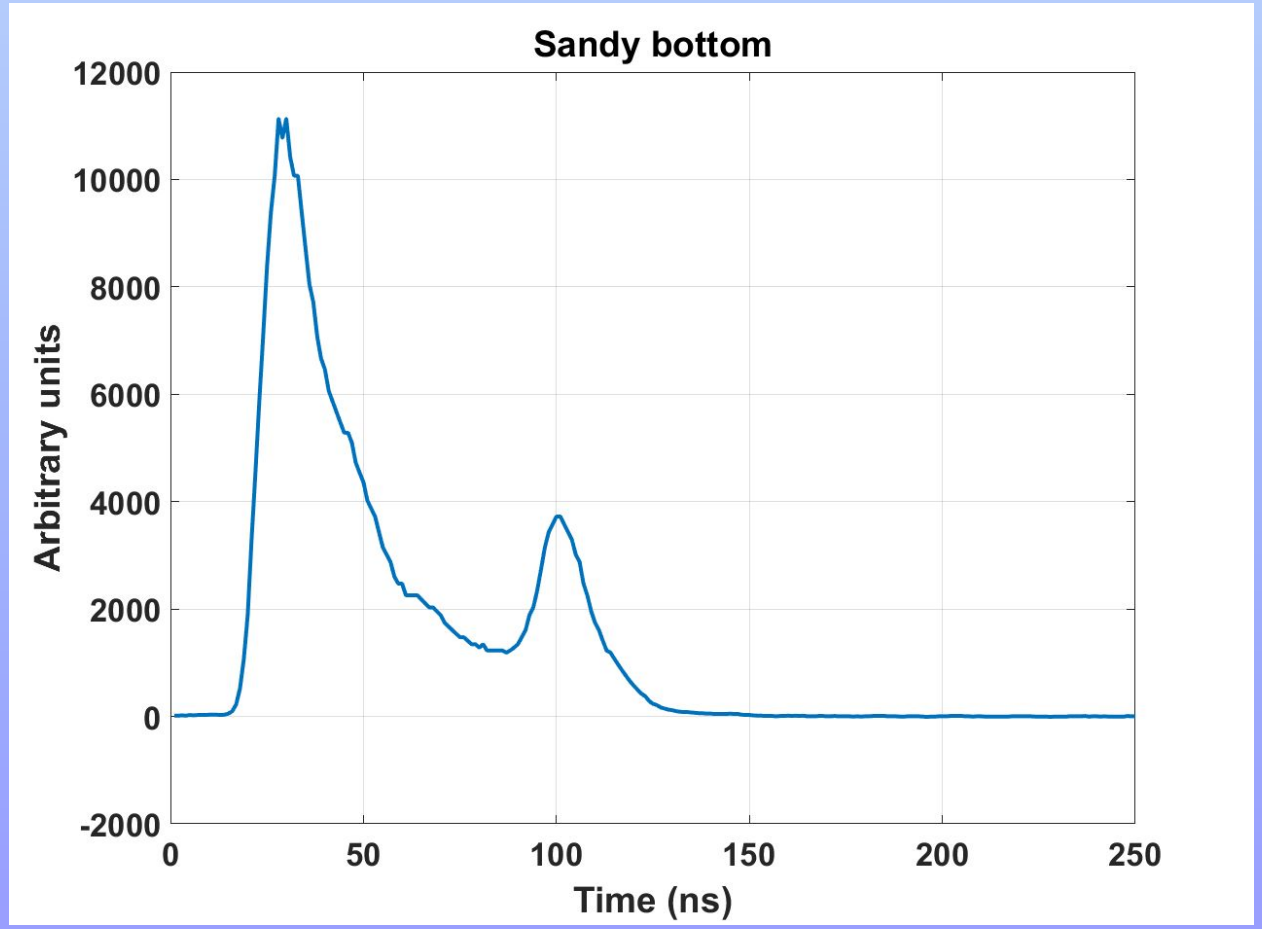


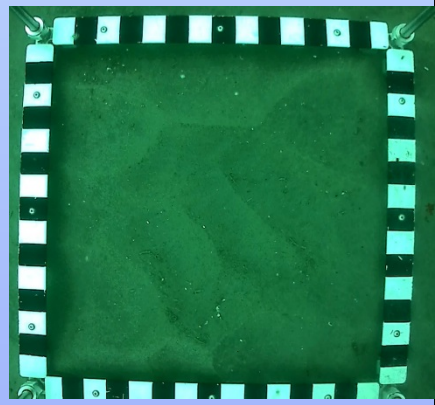
Seafloor
contributions

Speed of light (C):

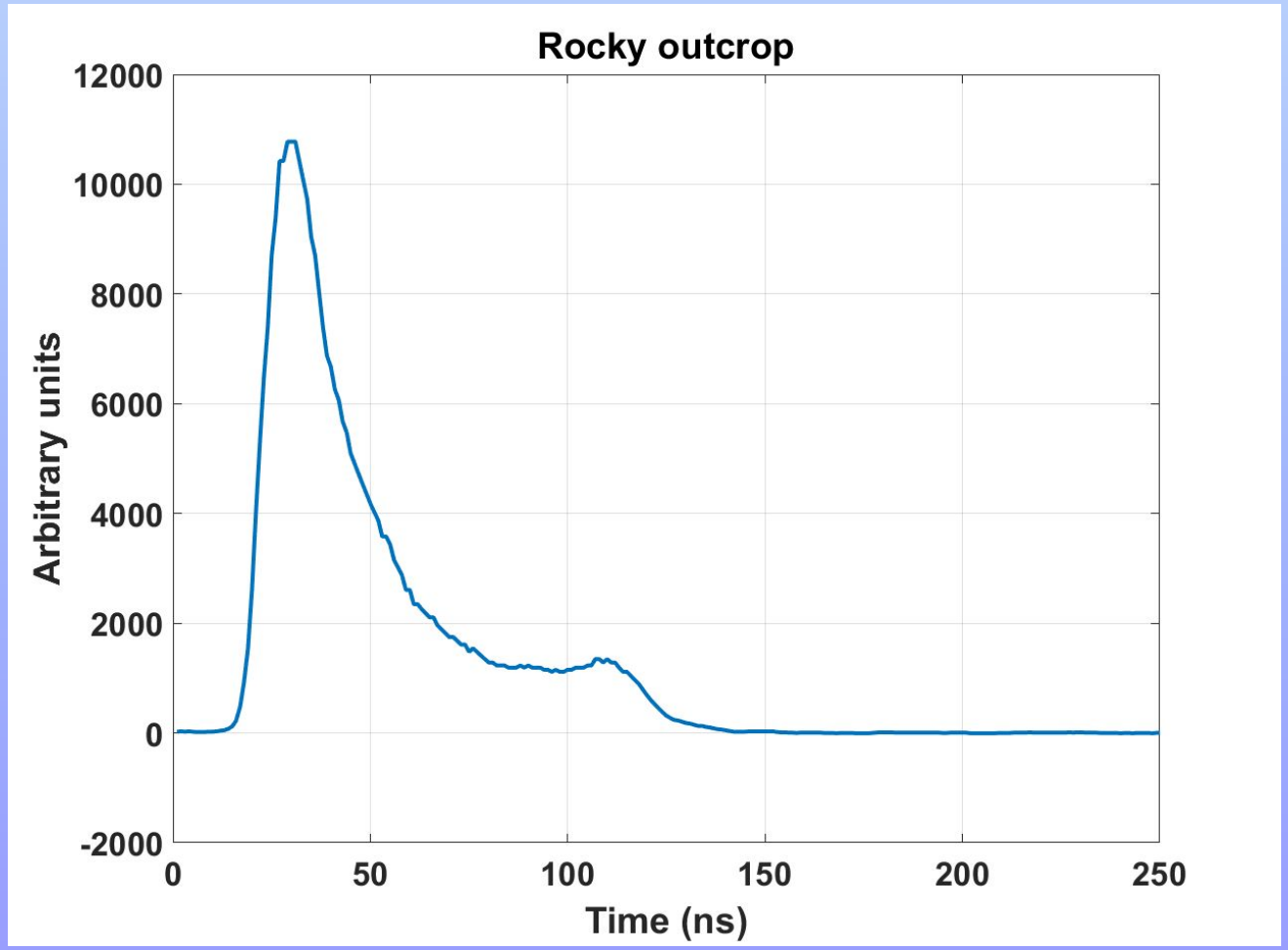
Air
1 ns = 30 cm
Underwater
1 ns = 22. 5 cm

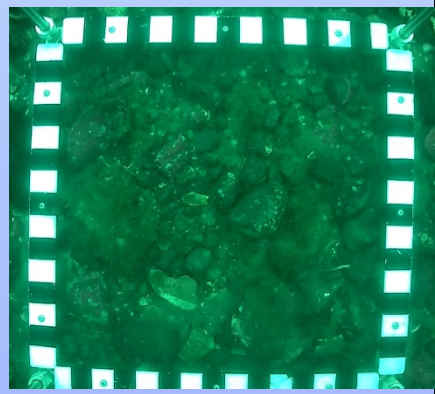
Waveforms for different bottom textures



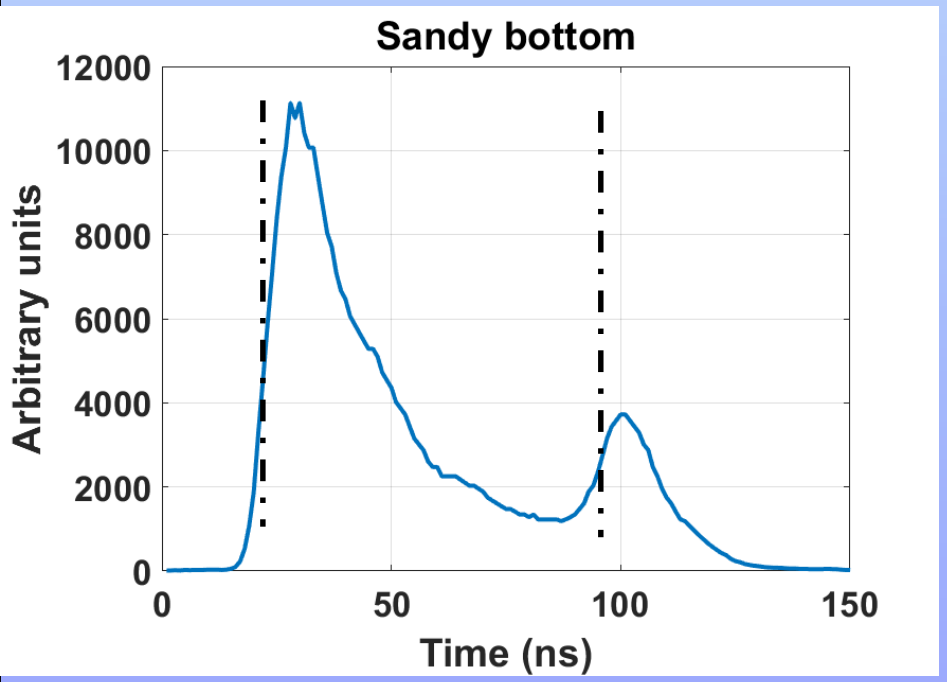


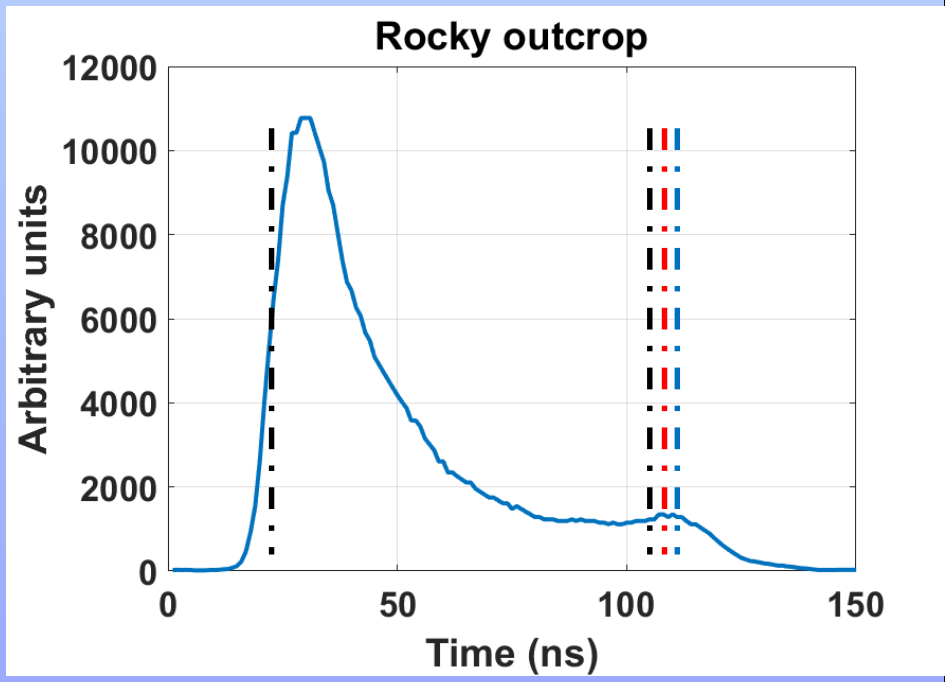
Waveforms for different bottom textures





Calculating water depth





Δt

Δt

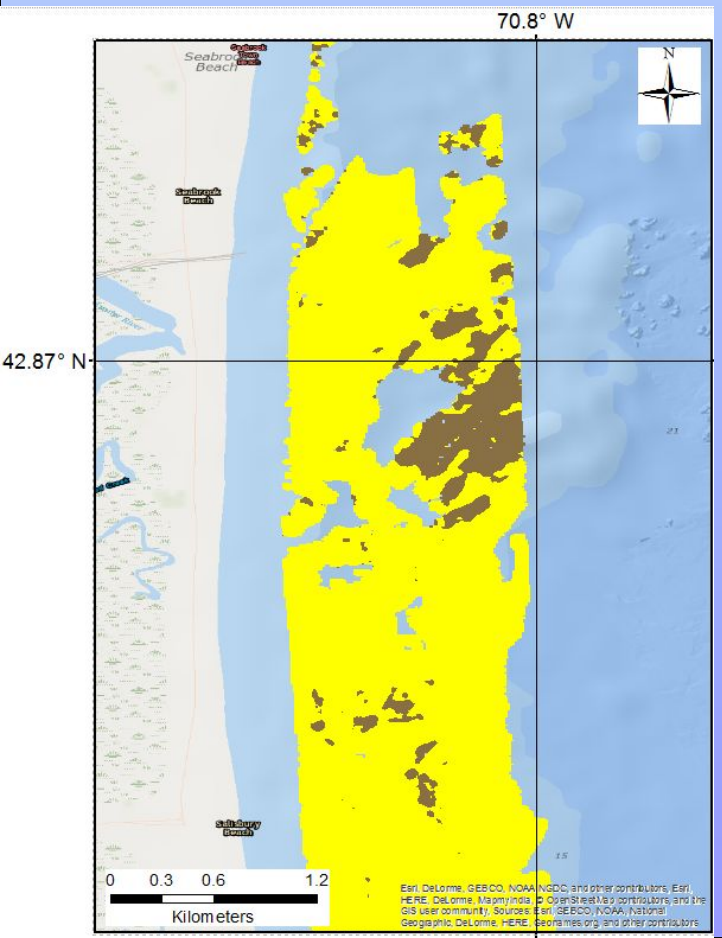
Δt ?

Δt ??

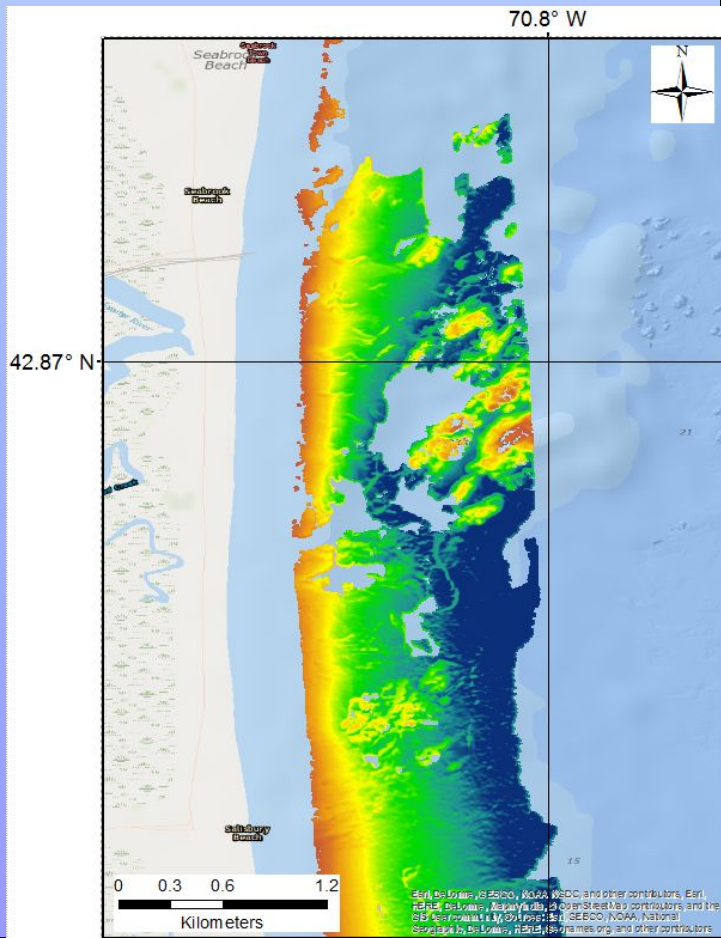
Goals

Bottom characteristics

Depth uncertainty



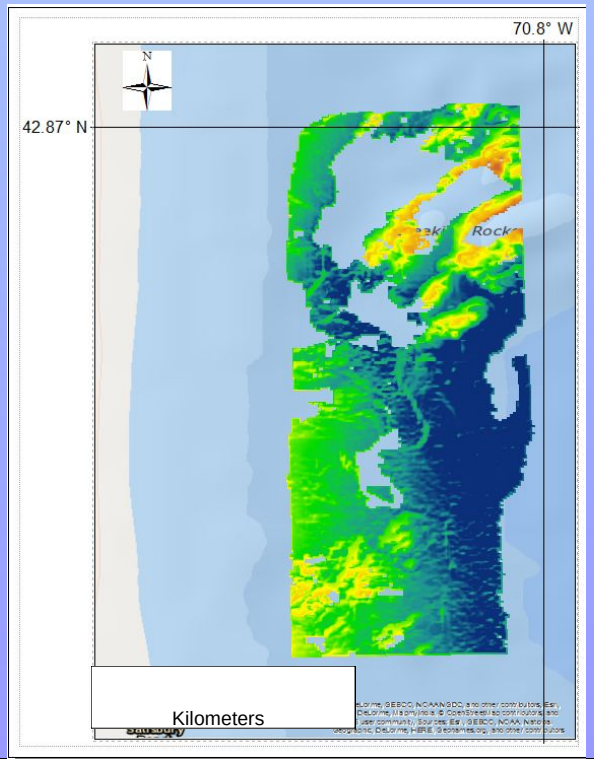
Sand



ALB and MBES bathymetry

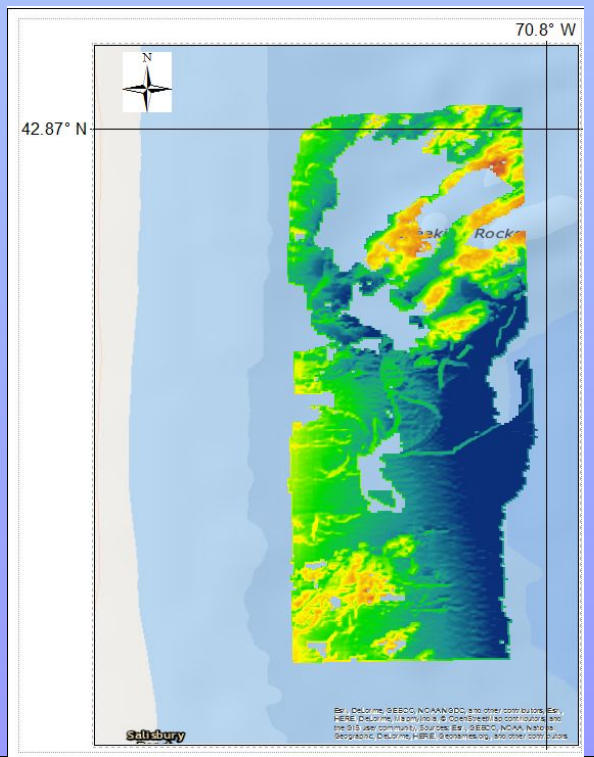
- ALB and multibeam data collected in Merrimack River Embayment Gulf of Maine
- Assess the depth variation between ALB and multibeam

ALB derived depth



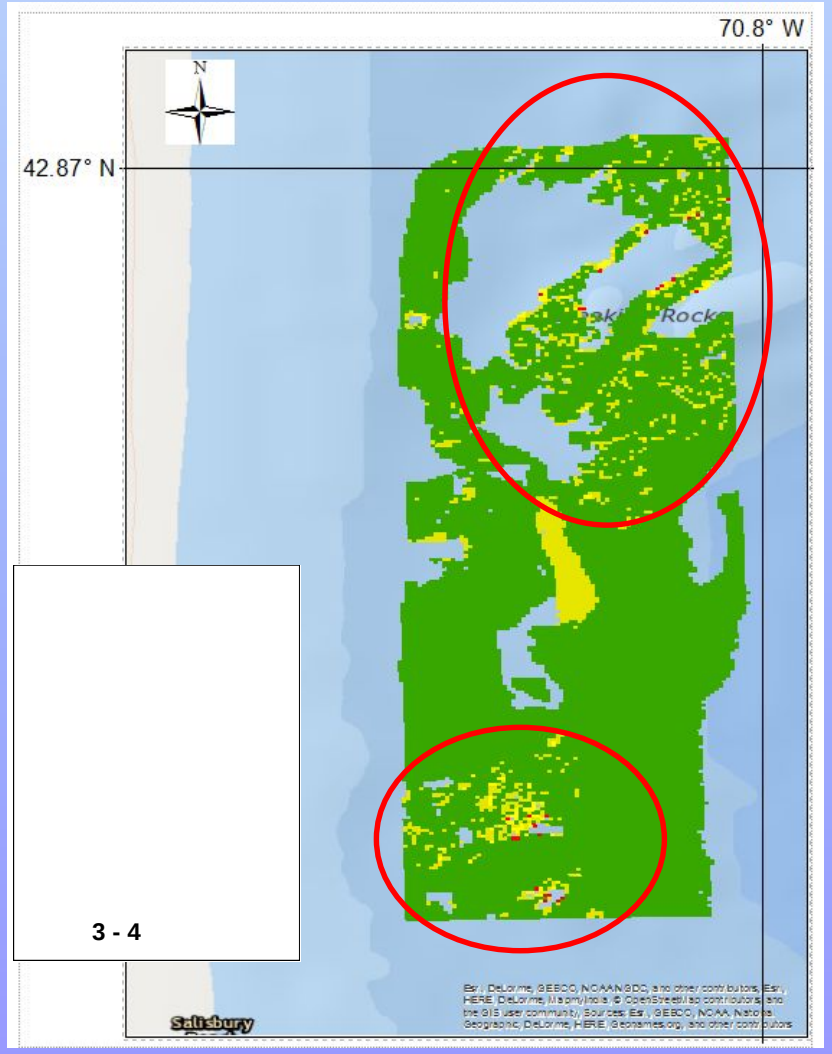
Low : 3

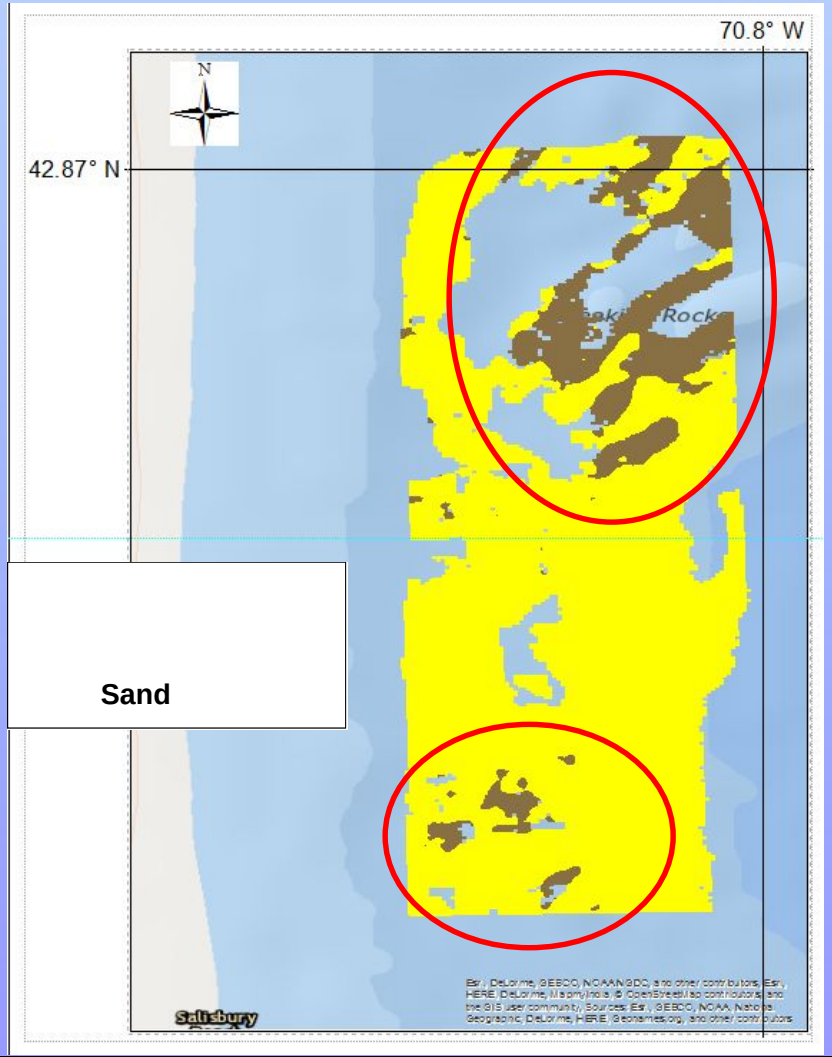
MBES derived depth



ALB and MBES bathymetry

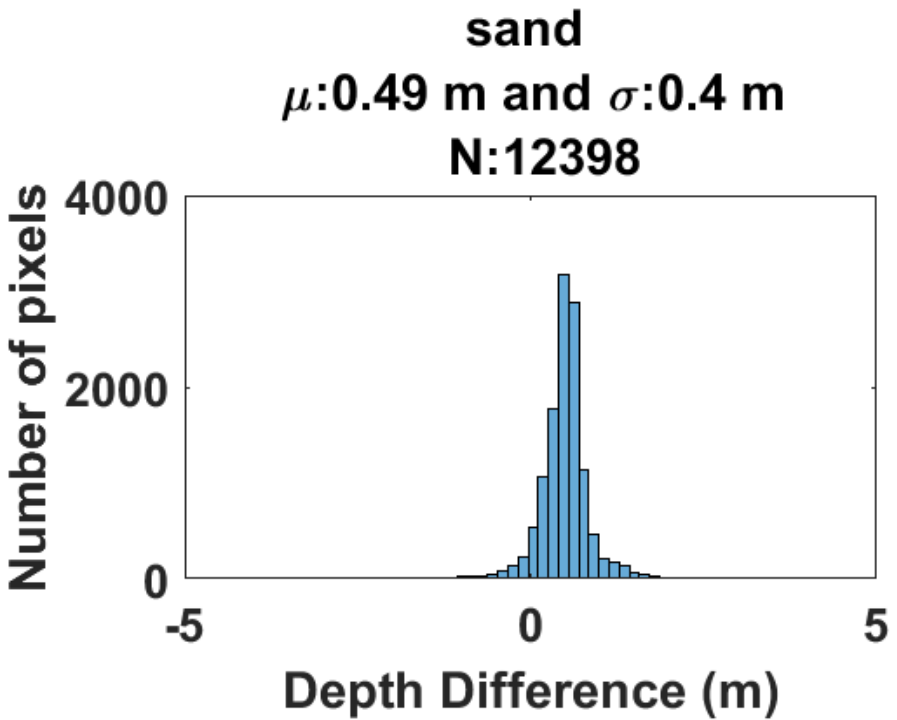
Difference map vs. ALB bottom characterization

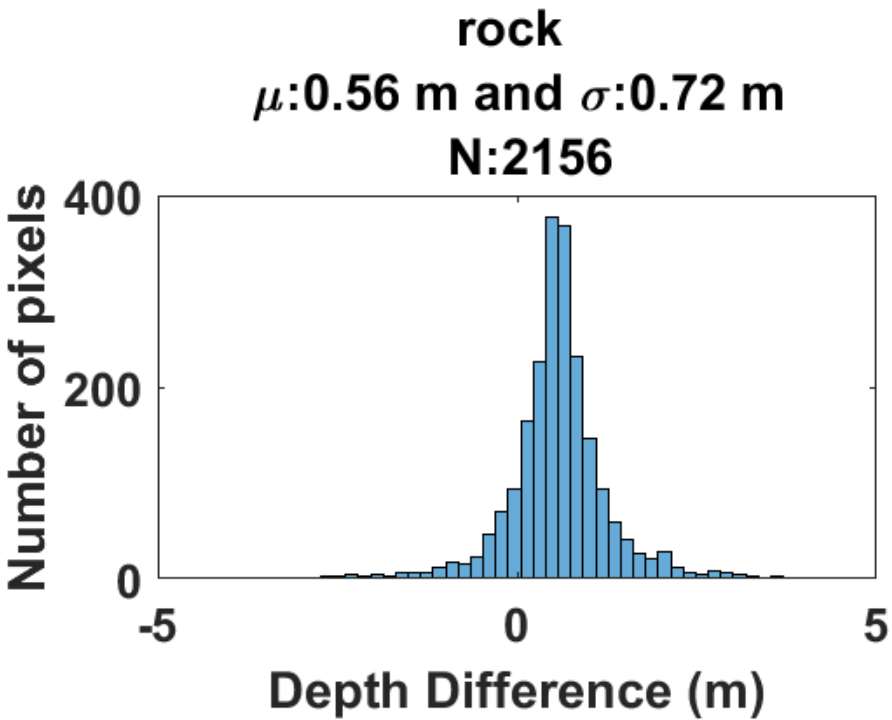




ALB-MBES depth difference histograms

	± Error	
Bottom types	**σ (m)**	**2σ (m)**
Sand	0.4	0.8
Rock	0.72	1.44





Conclusions

- ALB Bottom classification from the same data set
- Depth difference variation in Rock class are larger than Sandy class
  - $\sigma_{Rock} \approx 2 * \sigma_{sand}$
- Bottom characterization may be used in ALB Total Propagated Uncertainty (TPU) calculations.
- Additional surveys with different bottom types and ground truth

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