

Acoustic classification of fine-scale sediment variability and interconnection with benthic habitats of the Eckernförde Bay, Kiel

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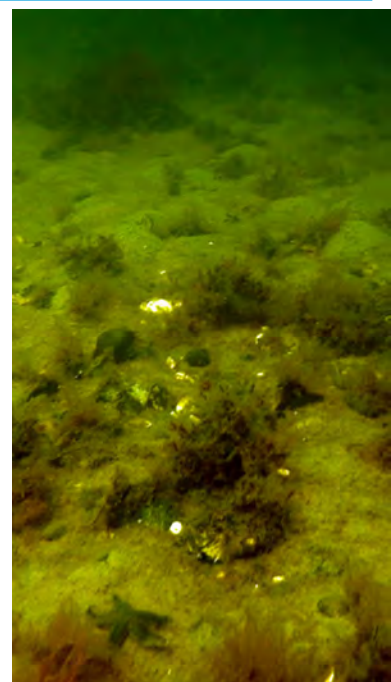
Motivation



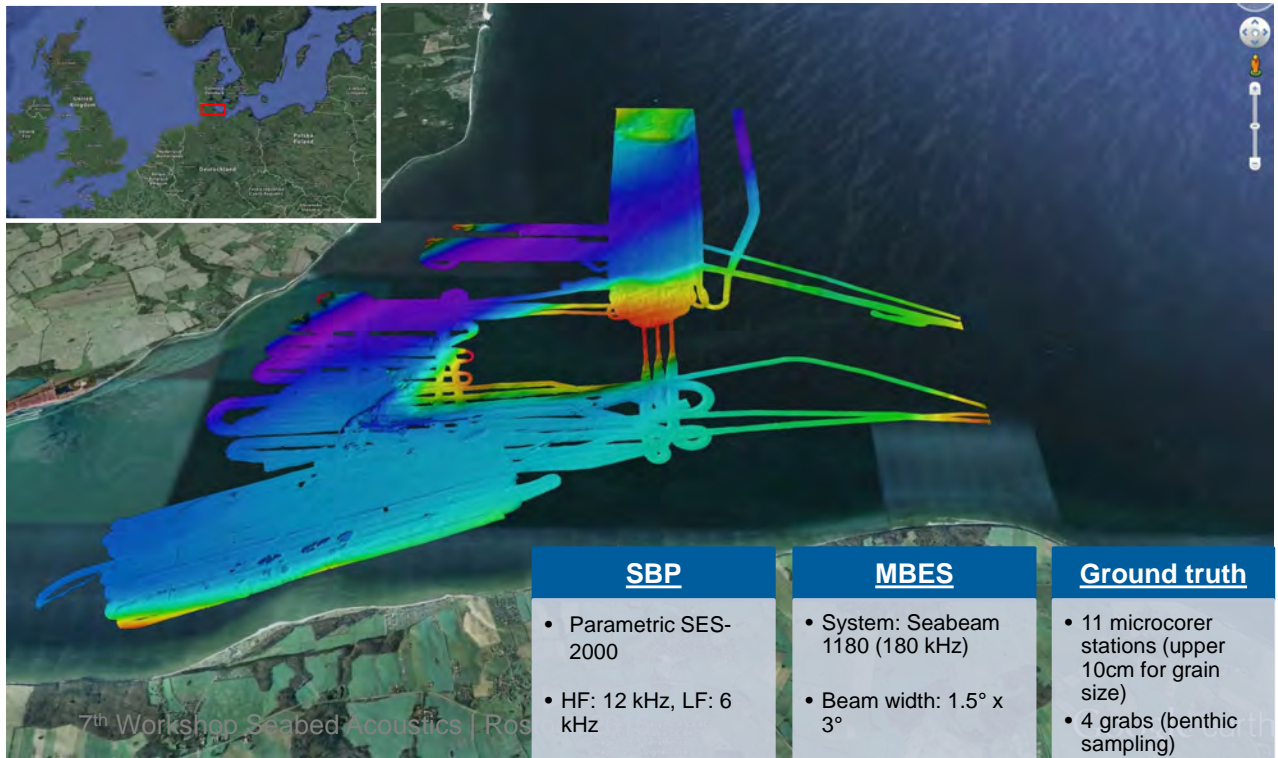
Combine the results of acoustic MBES classification with SBP acoustic stratigraphy of the wider Mittelgrund area with regards to:

- Seafloor sediment characterization
- Benthic habitat mapping

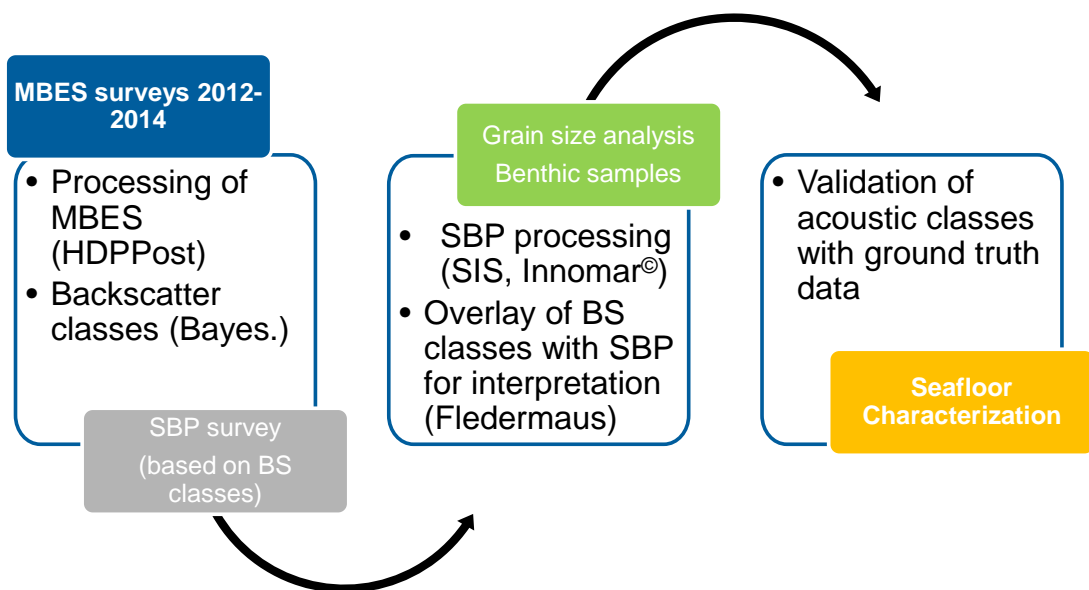
The Eckernförde Bay is recognized as Site of Community Importance (SCI) by Natura 2000 habitats directive (13/11/2007)



Study area



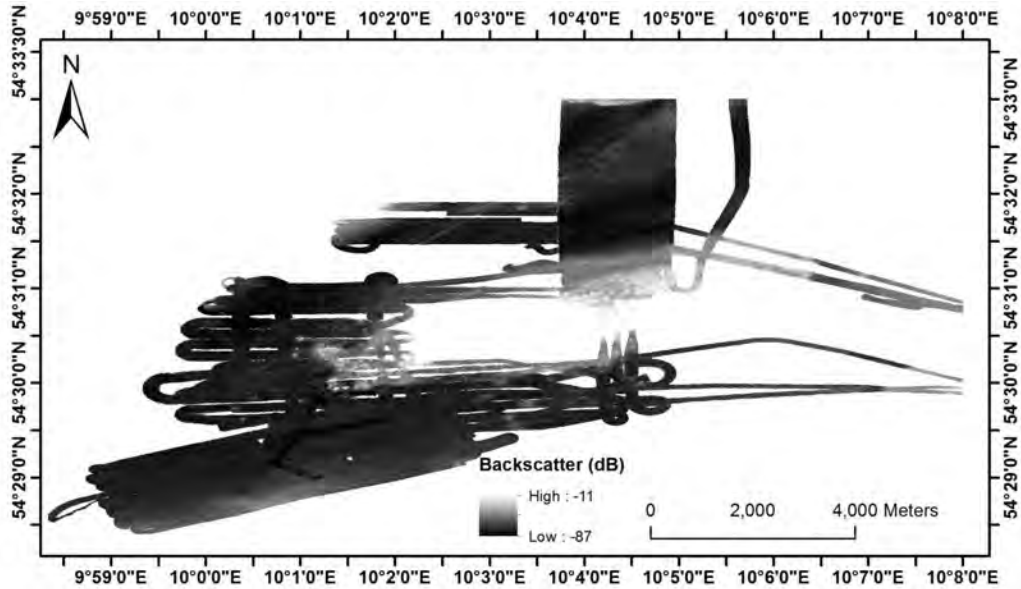
Methodology



Processing & Results



MBES & BS (ELAC Seabeam 1180, 180 kHz)



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Processing & Results

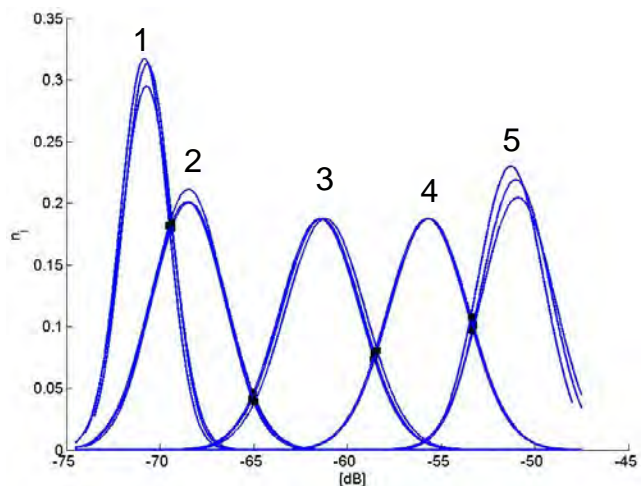


Backscatter classification

Based on *Simons & Snellen (2009), Amiri-Simkooei et al. (2009)*. The central value theorem is the core assumption of the method.

1. Fitting of Gaussian curves to the histogram of dB values from certain beams.
2. Evaluation of curve fitting with χ^2 criterion.
3. Reference beams: mean dB value and standard deviation for each class \rightarrow class assignment to all beams.

- No need for sensor calibration.
- Accounts for ping-to-ping variability.
- Resolves along-swath seafloor variations.
- Performs statistical control on optimal number of classes.



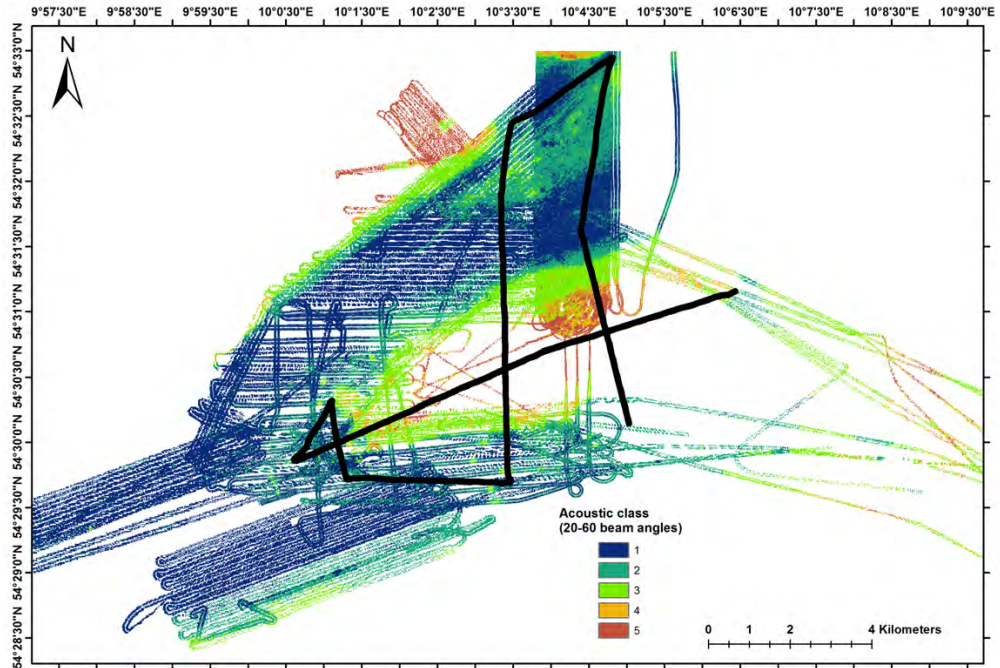
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Processing & Results



Acoustic classes & SBP survey (SES-2000)



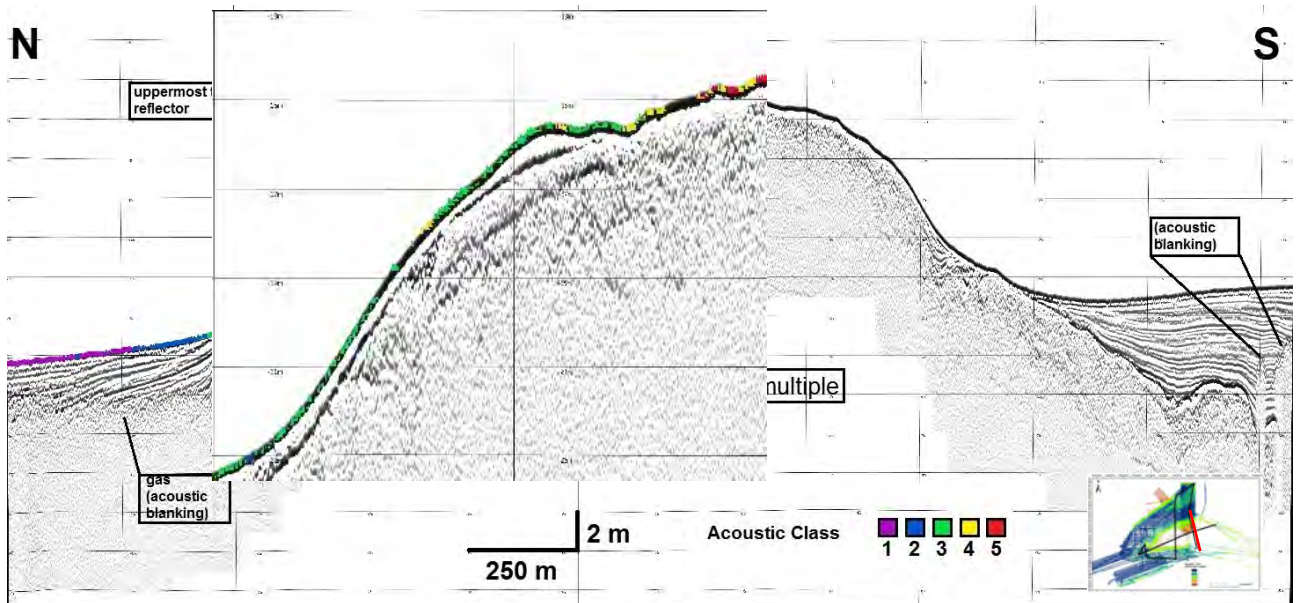
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Processing & Results



SBP interpretation



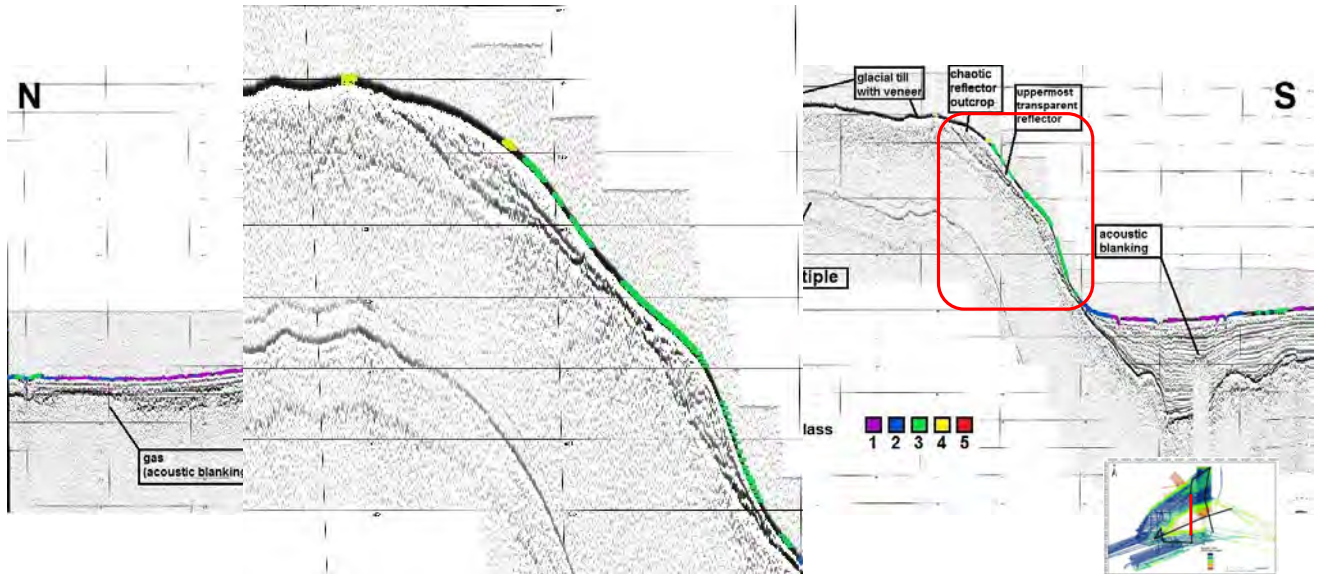
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Processing & Results



SBP interpretation



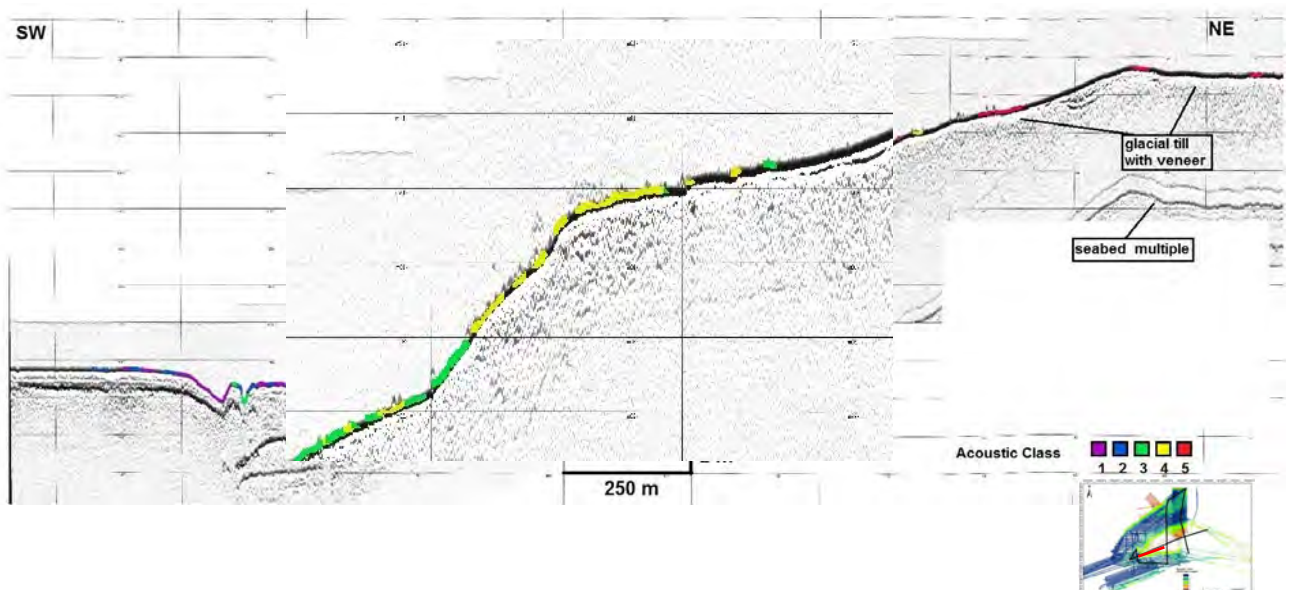
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Processing & Results



SBP interpretation



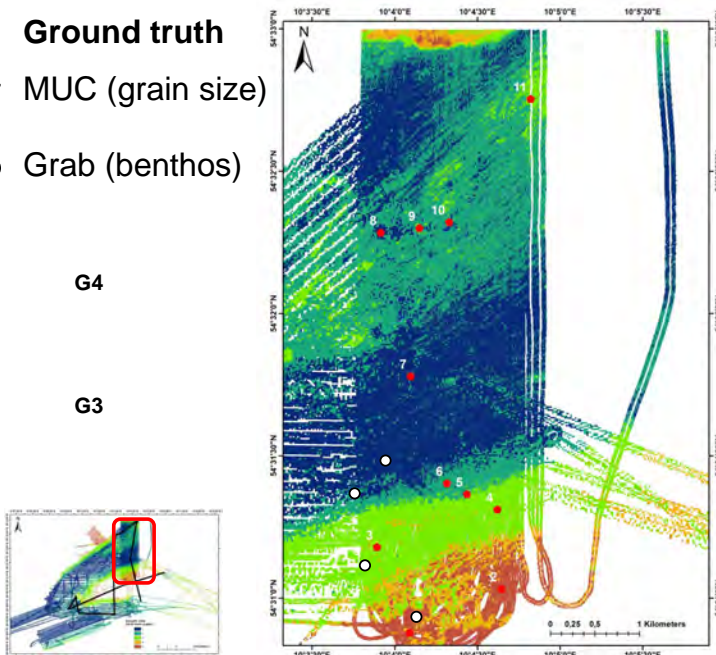
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Processing & Results



- Ground truth**
- ◆ MUC (grain size)
 - Grab (benthos)

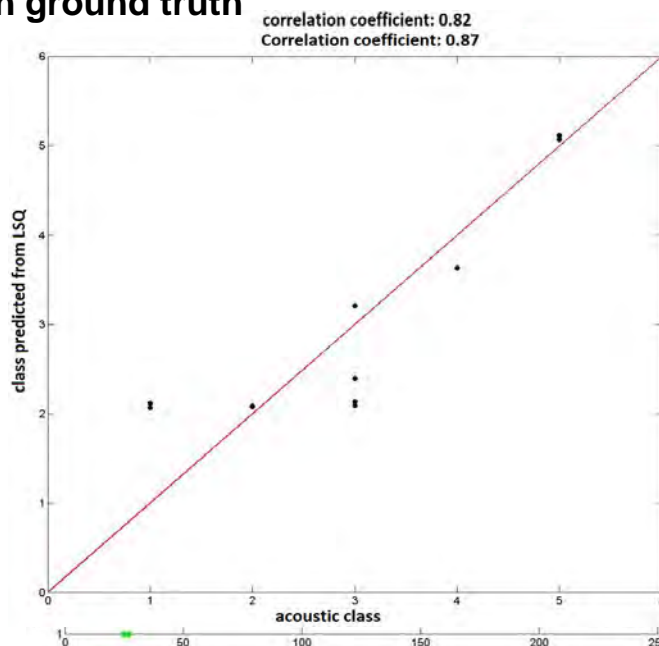


Discussion



Comparison with ground truth

$$\text{Class} = 1.93 + 0.03(\text{Coarse}\%) - 0.012(\text{mean}) + 0.018(\text{median})$$



Discussion



Comparison with ground truth

Acoustic class	Central dB value	Backscattering factors	SBP units	% Coarse (>500µm)	Jensen et al., (2002)	Depth of acoustic basement (m)
1	-70.3	grain size	-	-	Littorina mud (with gas)	>>2
2	-68	grain size	-	<=1	Littorina mud (with gas)	>>2
3	-61	grain size, shells	uppermost transparent layer	1 - 4.1	Littorina mud	0.5 - 2
4	-55.9	grain size, epibenthos, seafloor roughness, shells	outcropping chaotic layer, hyperbolae	15	Late Glacial sand OR Ancylus (early Littorina deposits)	0 - 0.5
5	-50.9	grain size, epibenthos, shells	acoustic basement	55 - 68.8	Exposed: Littorina sand & gravel / Till	0 (or few cm)

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Discussion

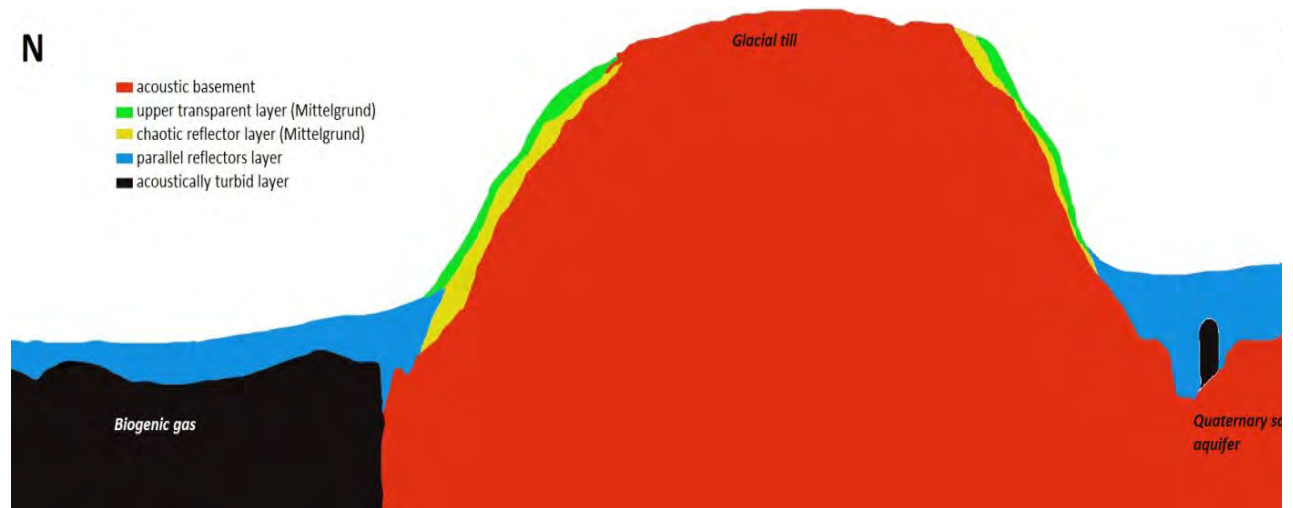


Implications for seafloor classification

- Acoustic classes tightly related to mean and median grain size of the fine fraction (< 500 µm) and percentage of the coarse fraction (> 500 µm) . Depth of acoustic basement also relates with acoustic classes
- Exposed sub-bottom layers of the Mittelgrund correspond with acoustic classes
- Affiliation of macrobenthic fauna with specific acoustic classes hence, with specific grain sizes
- Ground truth assisted characterization of seafloor assigned with the same acoustic class

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Conclusions



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- Eric Steen (ELAC)
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Thank you very much!

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