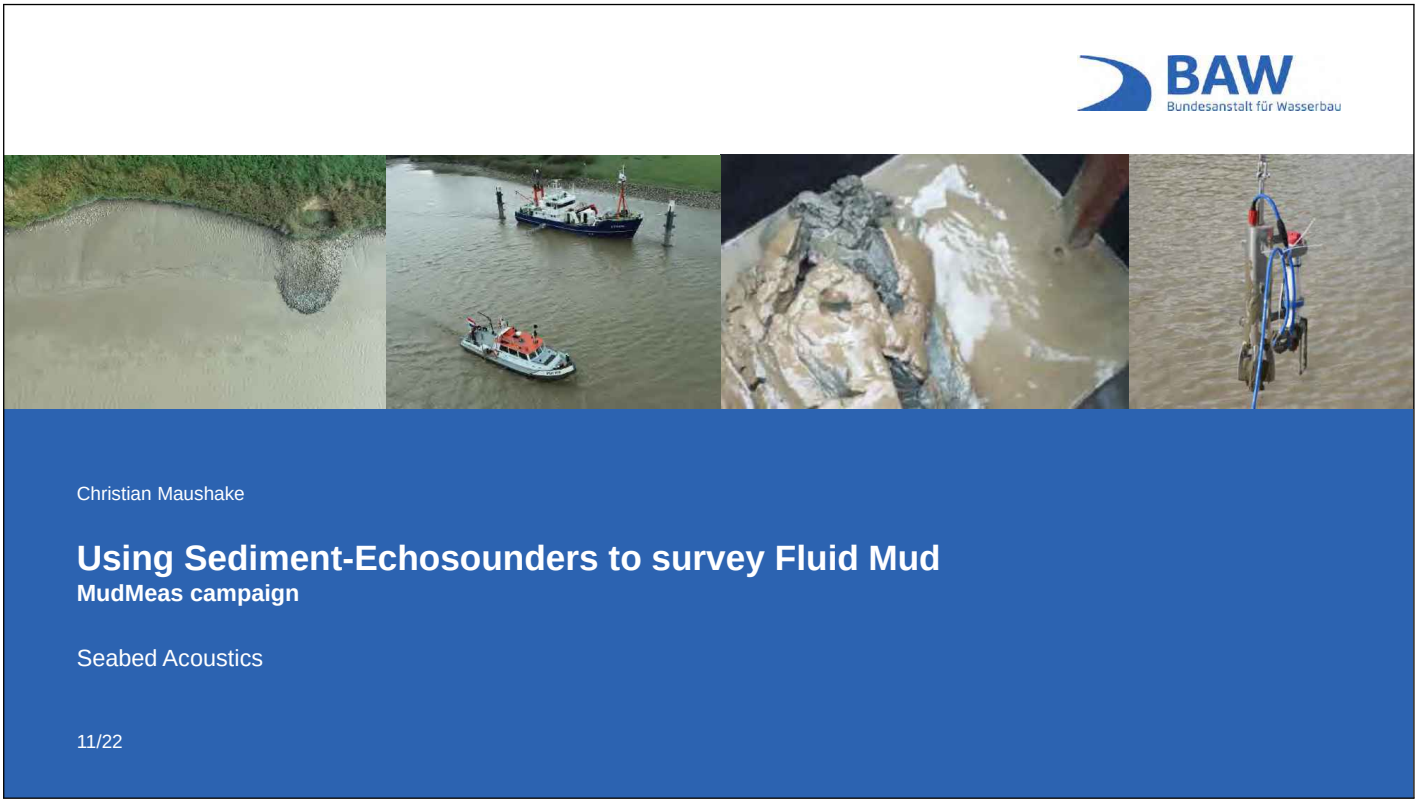
Proceedings of the 10 th Workshop "Seabed Acoustics", Presentation P06:

Using a sediment echo sounder to survey fluid mud

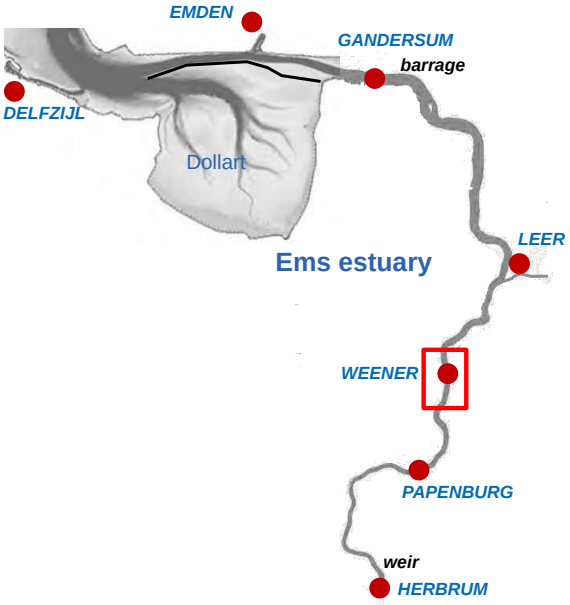
Christian Maushake
Federal Waterways Engineering and Research Institute (BAW), Germany

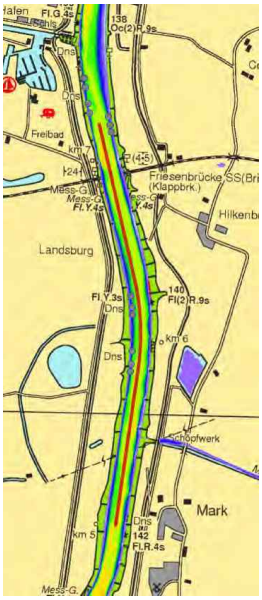
10 th November 2022



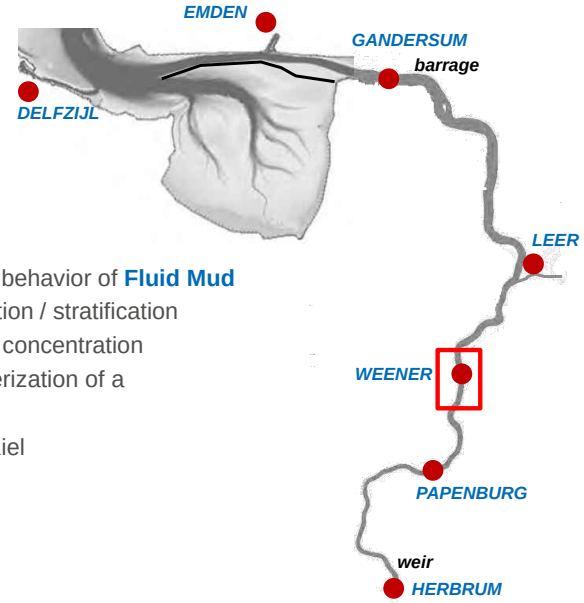
MudMeas: study area

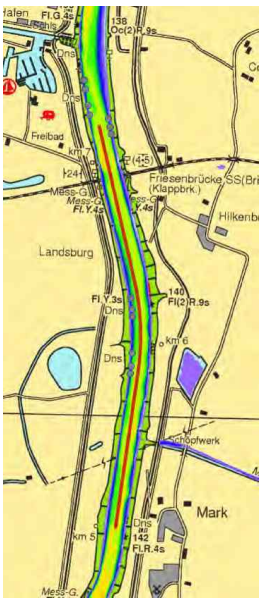






MudMeas: study area





Research Project
MudMeas (MudEms)

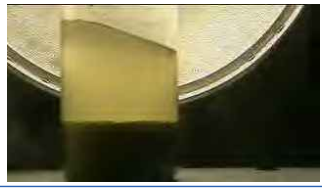
- Physical **properties** and behavior of **Fluid Mud**
  - turbulence / dissipation / stratification / density / sediment concentration
- **Validation** and parameterization of a **simulation model**
- Cooperation with CAU, Kiel

(Fluid) Mud







MudMeas: cooperation CAU (Kiel university) / BAW

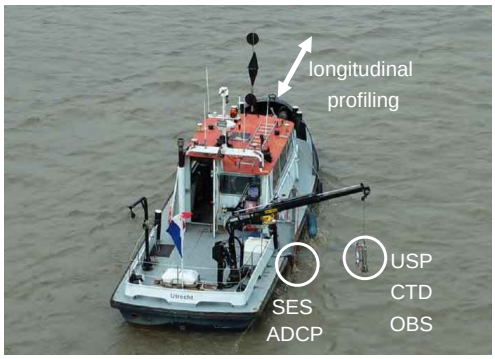
CAU (Littorina):

- **High resolution stationery measurements**
- several tidal cycles
- focus:
  turbulence / dissipationrates / stratification

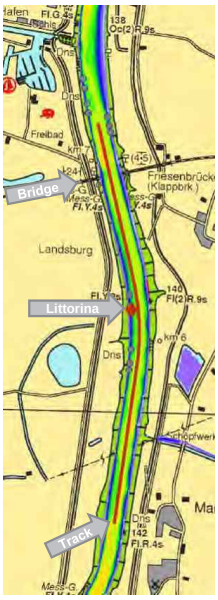
BAW (Potvis):

- **Longitudinal SES (ADCP) surveys around CAU position (+/- 1km)**
- several tidal cycles
- Fluid-Mud inventory (Intratidal)
- stationery vertical profiling with density probe / CTD / OBS
- watersamples for calibration

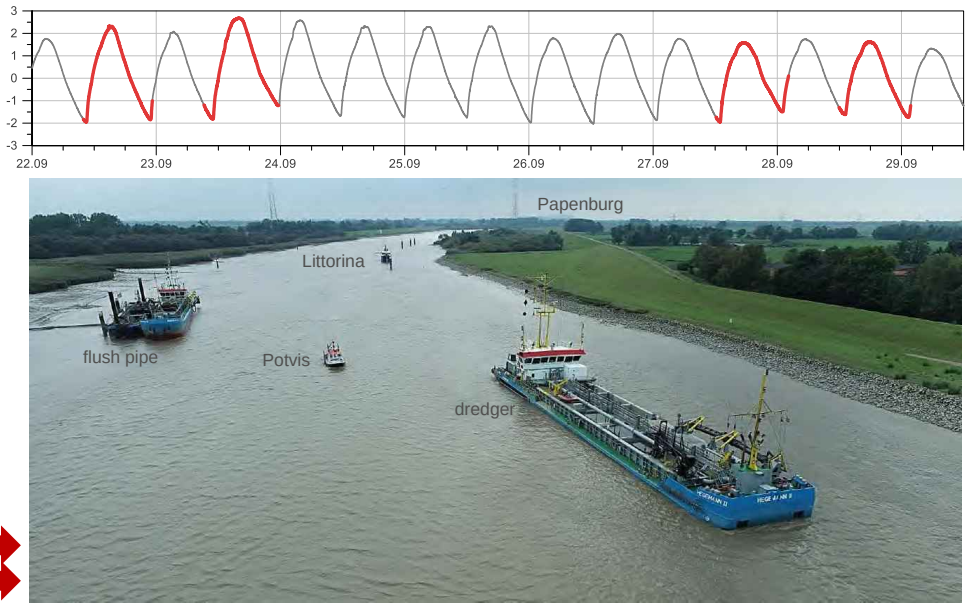




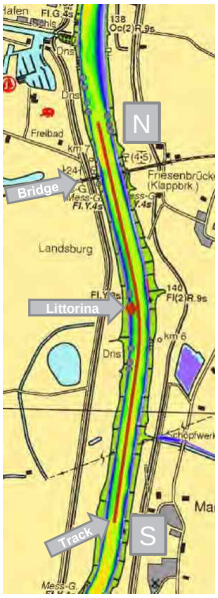
MudMeas: study area



Littorina
Potvis



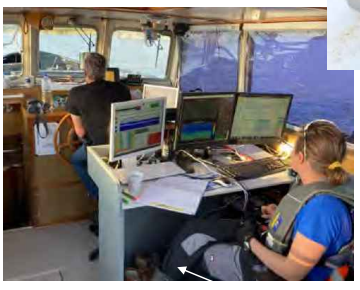
MudMeas: instrumentation







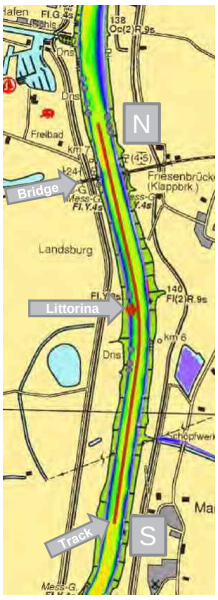


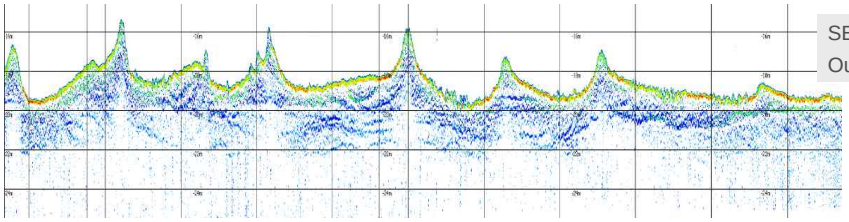




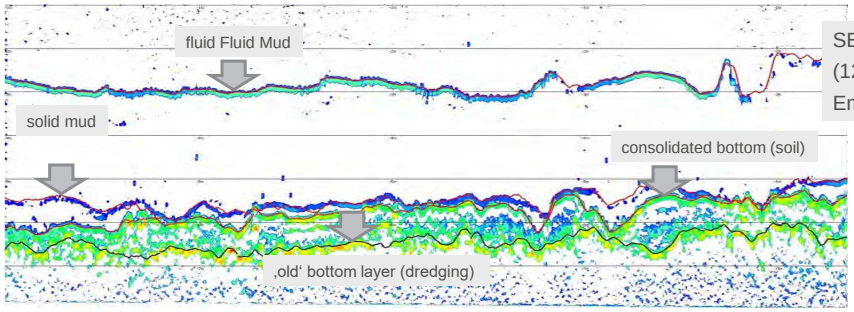


MudMeas: SES - Profile 22./**23.**/27./28.09.2021





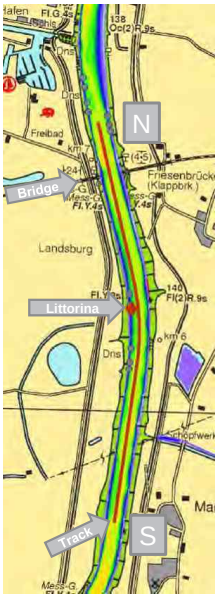
SES-Longitudinal
Outer Weser estuary

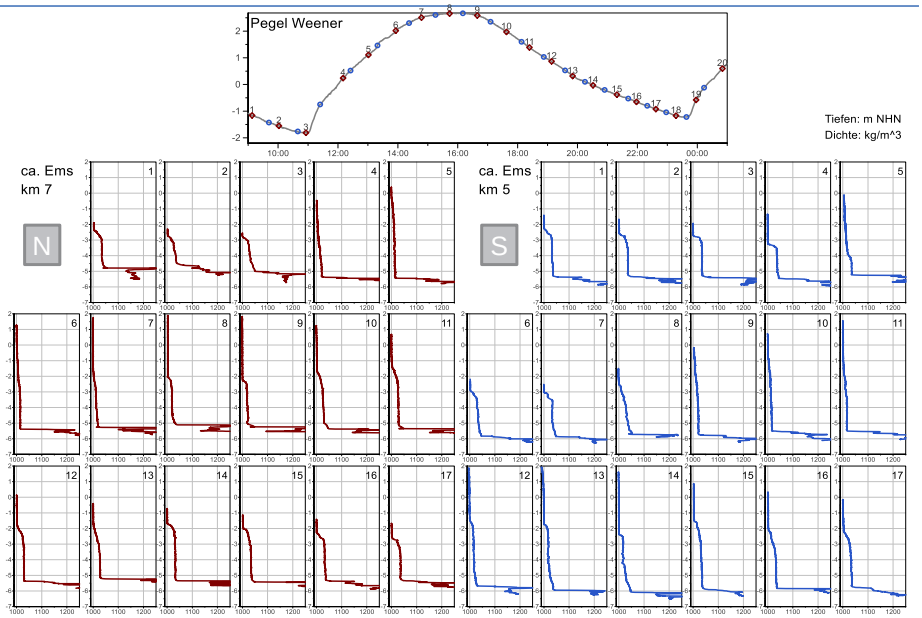


SES-Longitudinal:
(12Khz)
Ems (Weener)

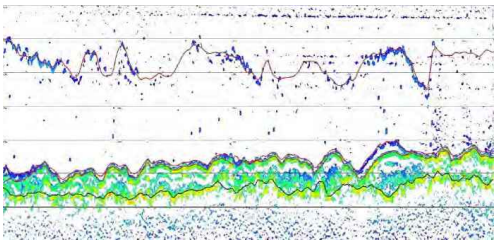
Ani

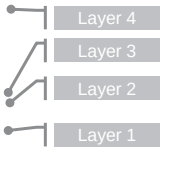
MudMeas: USP- vertical Densityprofiles 23.09.2021

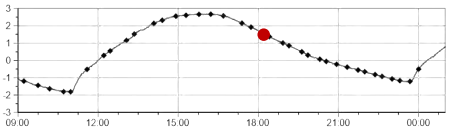


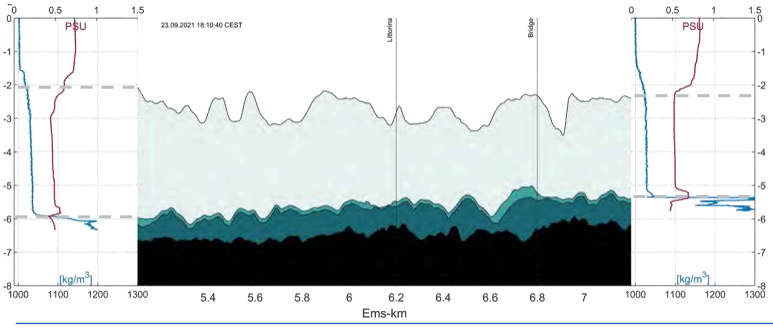


MudMeas: georeference SES-data and combine with density





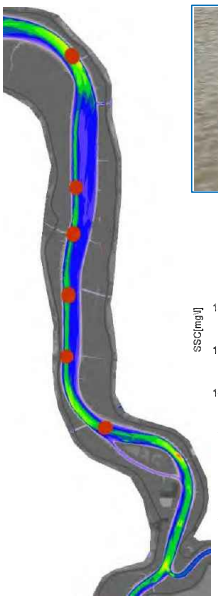




1. Digitzing layers (semi-automatic, Innomar ISE)
2. Georeferencing (East/North/NHNDepth/Ems-km)
3. Combining with vertical USP density profiles

Ani

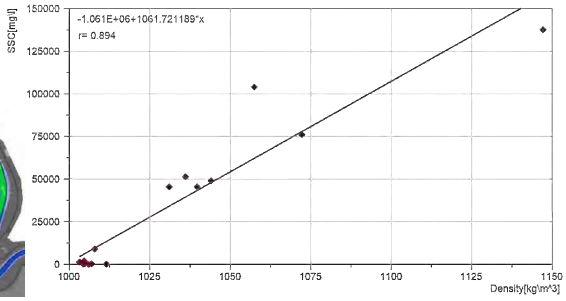
MudMeas: calibration (bulk-)density / SSC





density measurements are **bulk** (water & salinity & sediment)

- ➢ calculation = tricky [$f_{(\rho,Vol.)}$]
- ➢ calibration



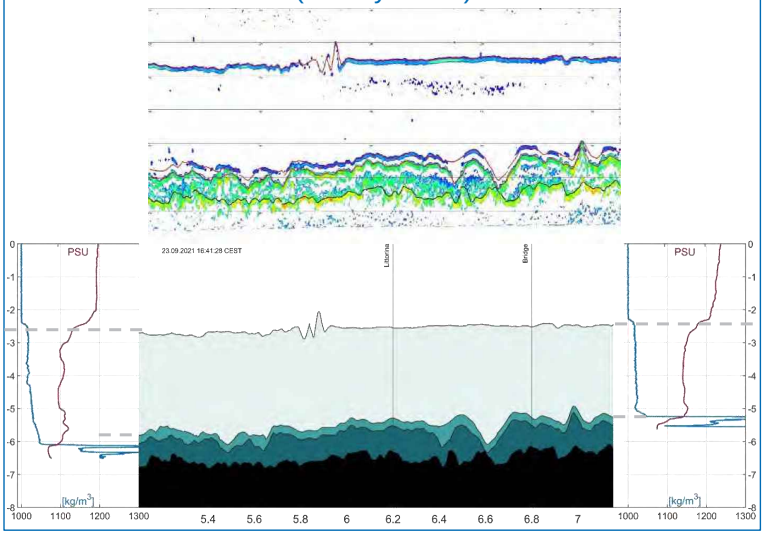
	SSC [mg/l]	Depth [mNHN]
1	1371	-7.44
2	51408	-7.70
3	500	-7.39
4	49075	-7.30
5	444	-7.29
6	37695	-7.37
7	**76241**	-7.56
8	228	-7.15
9	2178	-7.20
10	**104309**	-5.98
11	244	-6.95
12	45703	-6.33
13	**137899**	-6.05
14	103	-10.42
15	9190	-10.62
16	45521	-10.95



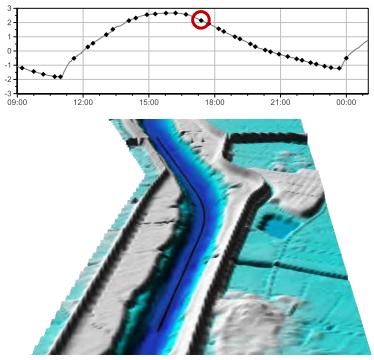
MudMeas: mass / volume calculation

Attach physical properties to acoustic layers

(density / SSC)



mass- / volume calculation

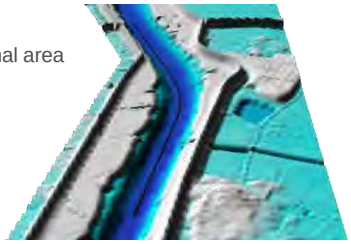


Example:

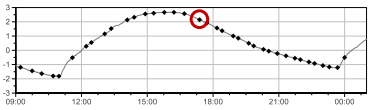
1.75 Mio m³ @ waterlevel 2m

MudMeas: mass / volume calculation

Assumption: mass-calculation by extrapolating longitudinal transect data into the river crossectional area



Example @ highwater 2m NHN

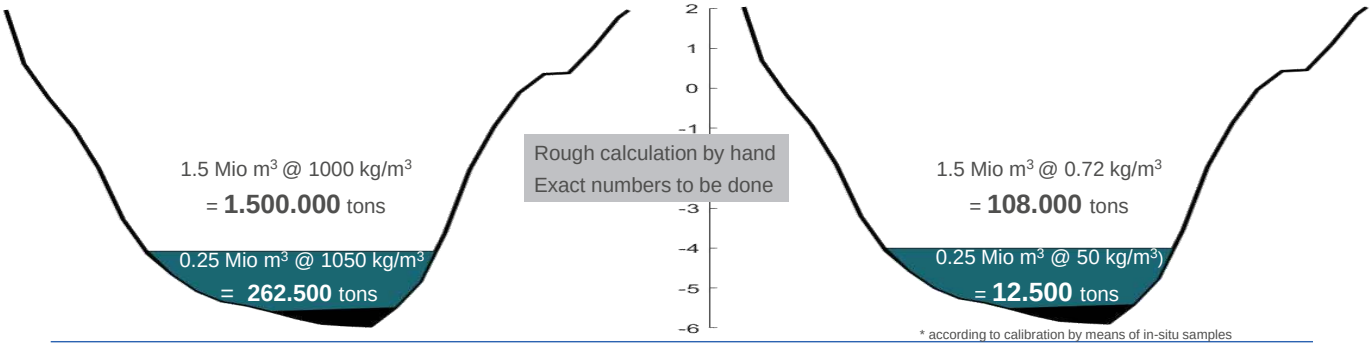


water mass

(bulk)

sediment

(SSC)

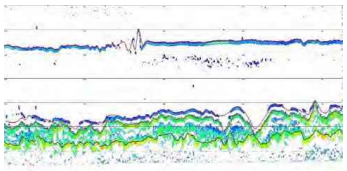


* according to calibration by means of in-situ samples

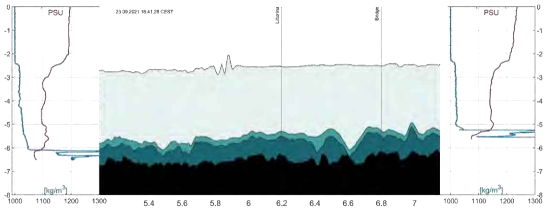
MudMeas: conclusion

All results presented are work in progress

- **Intratidal variability** of Fluid Mud dynamic could be shown
- Repeated measurements over 4 full tidal cycles are showing comparable results
- **Strong flood** current gradient **mixes** up the water column
- **Weak ebb** current is **not** able to **dissolve** stratification



- **Physical properties could be attached to acoustic layers as detected by an SES**
- Data could be transformed to SSC (and sediment mass)
- Mass and volume calculation could be derived
- Results are extremely sensitive (small changes → great effect)
- SSC-calibration is crucial



➢ **Valubale input for our numerical model**

➢ **Important data to cross check stationery measurements of Littorina**