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Quantification and characterization of sediment transport using acoustic backscatter data

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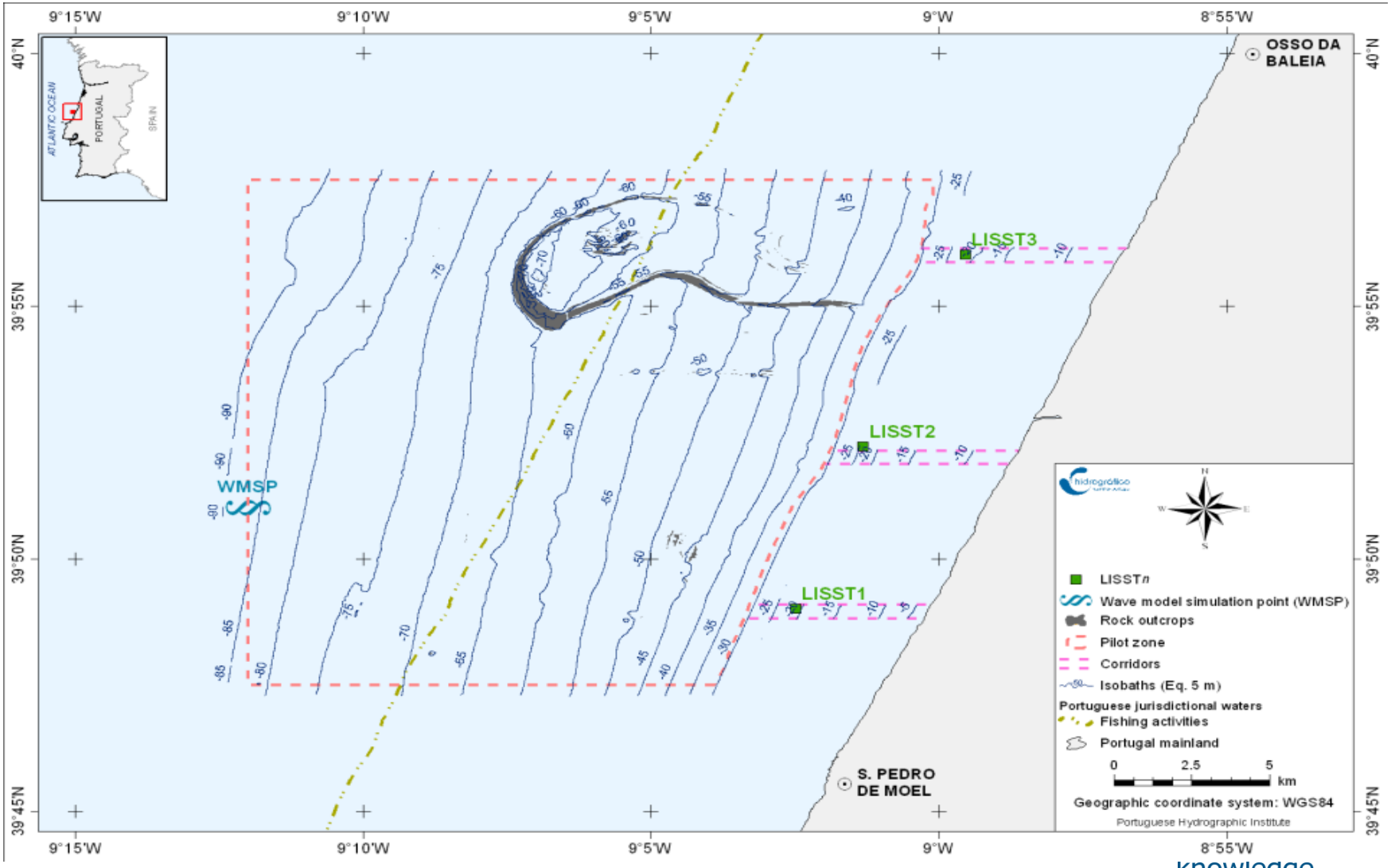
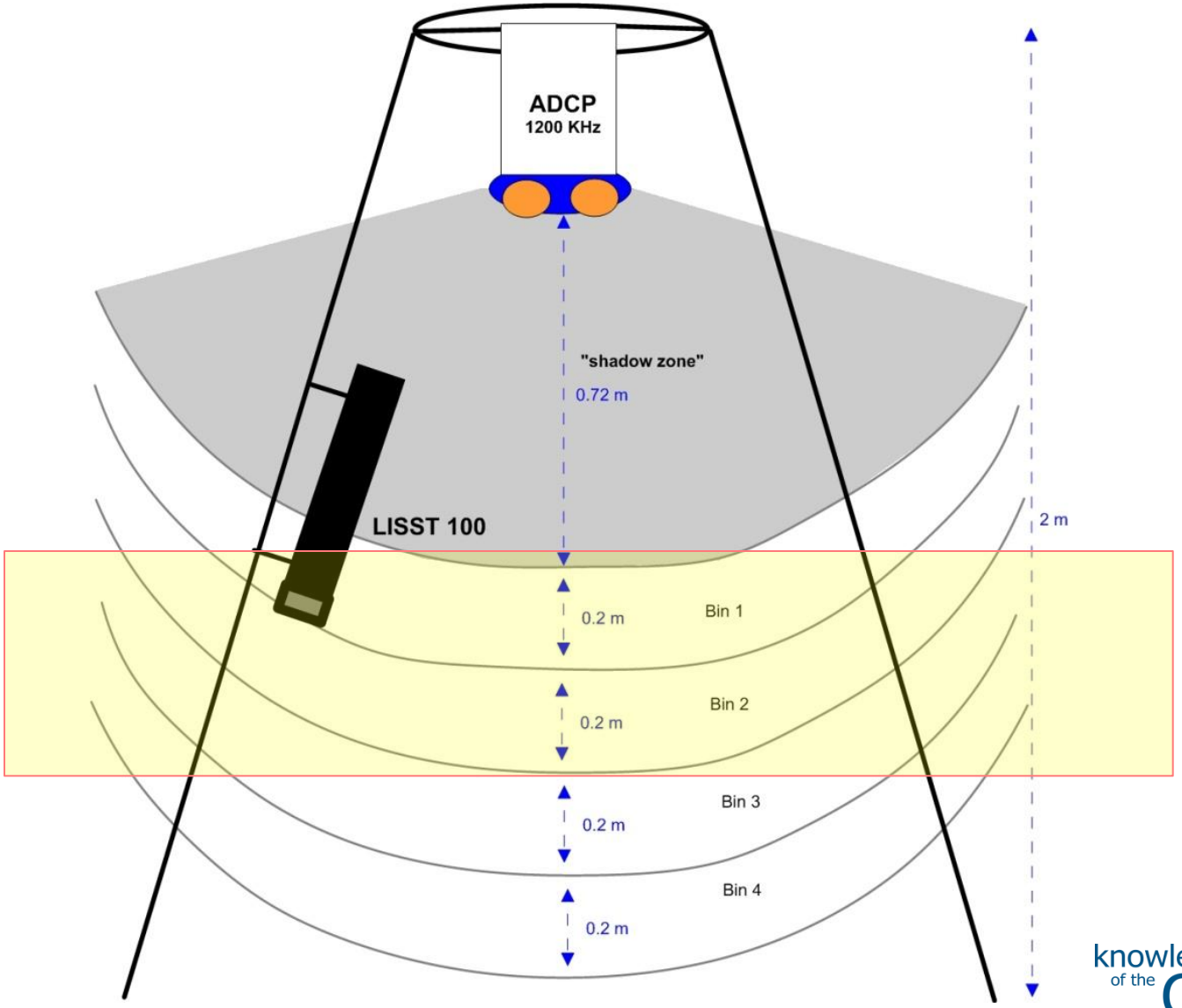
Pilot Zone (PZ) for Renewable Energy Experiments

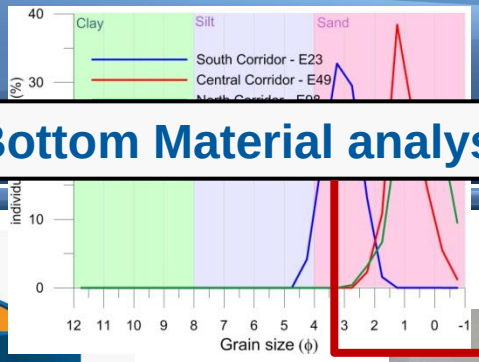


knowledge of the Ocean

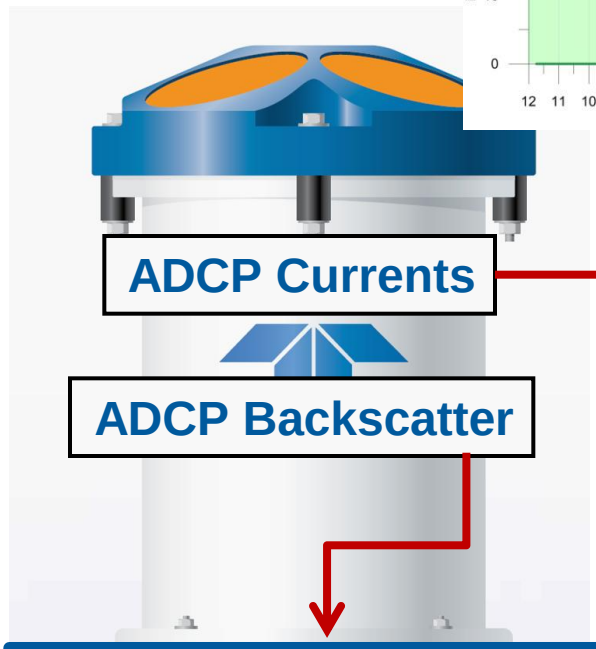
LISST-ST


ADCP
1200 KHz
"shadow zone"
0.72 m
LISST 100
2 m
0.2 m
Bin 1
0.2 m
Bin 2
Bin 3
0.2 m
Bin 4
0.2 m

Objectives



Bottom Material analysis



ADCP Currents

ADCP Backscatter

LISST Grain Size

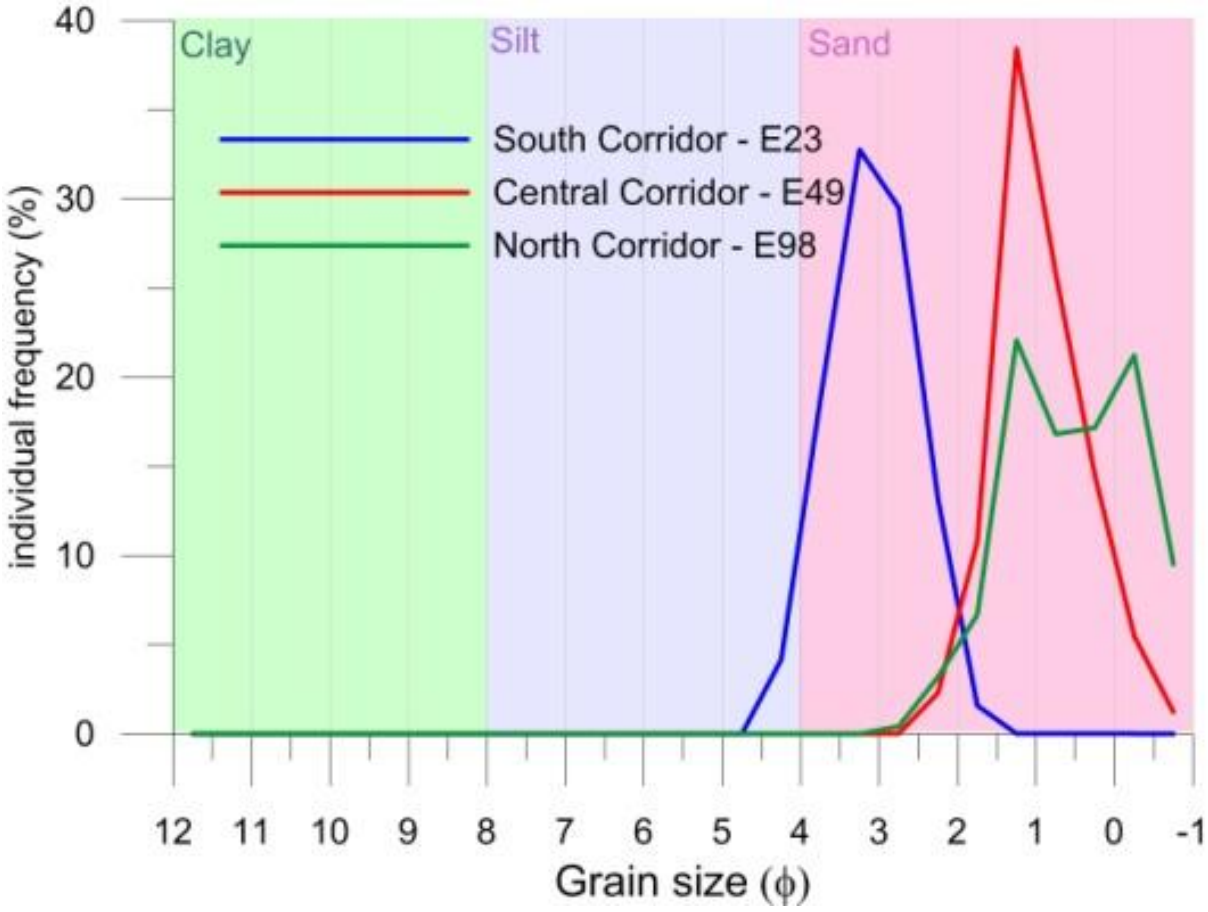
LISST Volumetric Concentrations/ Mass concentrations

1. Determine SPM characteristics in the study site

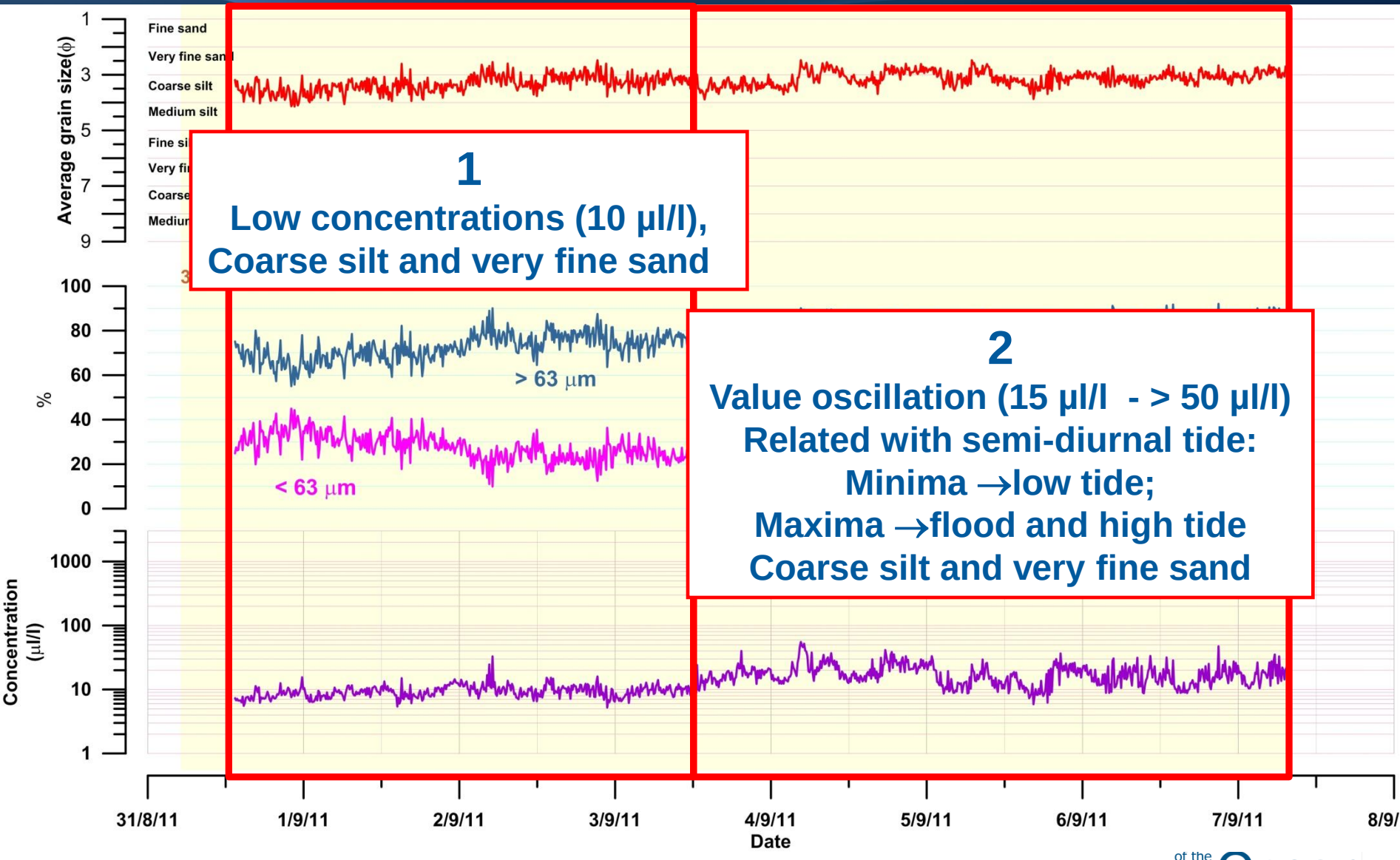
2. Correlate LISST time series with ADCP backscatter data (Gartner, 2004)

3. SPM data can be inferred from backscatter time series and considerations are made about sediment transport processes in the study site.

Bottom material



SPM Characterization: South Corridor



1

Low concentrations (10 µl/l), Coarse silt and very fine sand

2

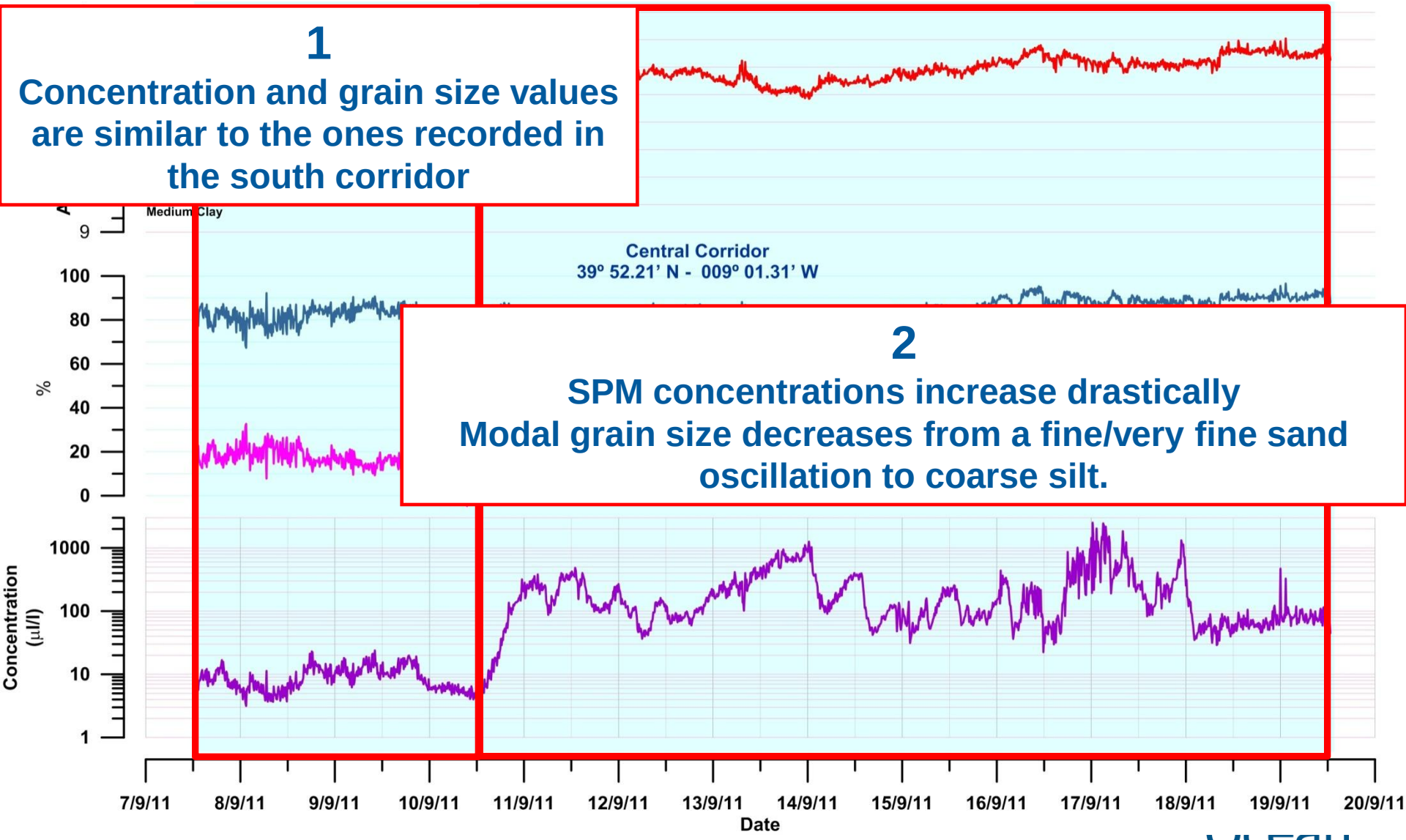
Value oscillation (15 µl/l - > 50 µl/l)
Related with semi-diurnal tide:
Minima →low tide;
Maxima →flood and high tide
Coarse silt and very fine sand

of the Ocean

SPM Characterization: Central Corridor

1

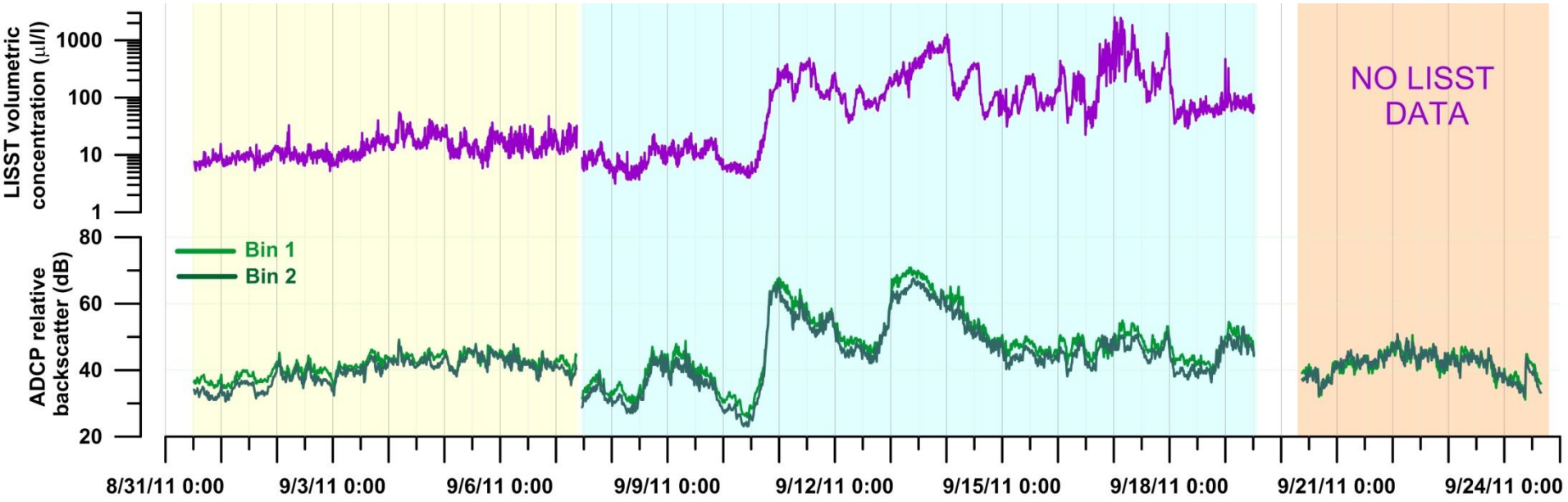
Concentration and grain size values are similar to the ones recorded in the south corridor



2

SPM concentrations increase drastically
Modal grain size decreases from a fine/very fine sand oscillation to coarse silt.

ADCP acoustic backscatter

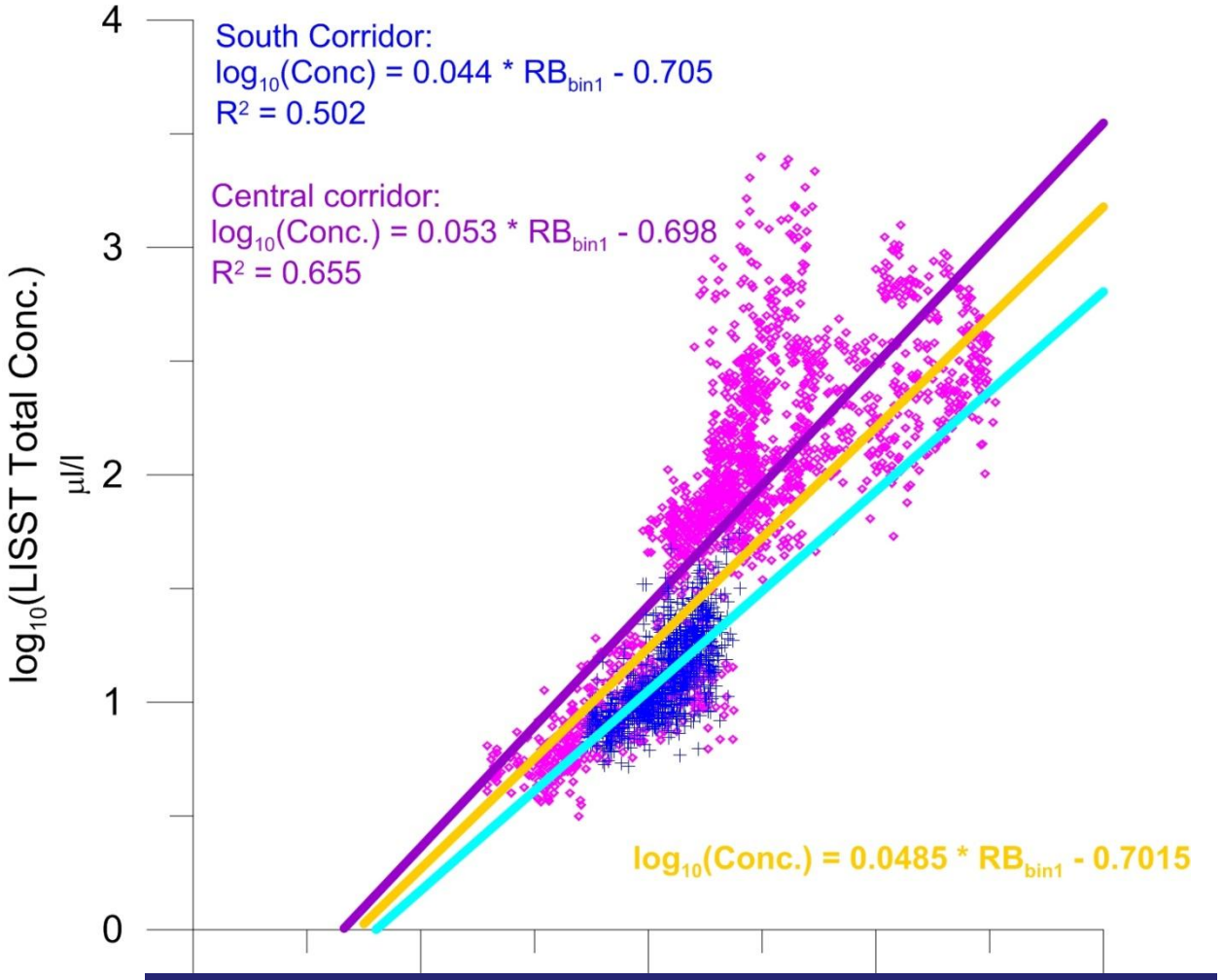


- **RB reveal a very close relationship to LISST volumetric concentrations → allow the same conclusions about SPM variations**
- **In the North corridor RB values are similar to those registered in the southern corridor, even though during this third mooring period the wave regime was significantly more energetic**
- **In the North corridor no fine sediments were available for resuspension, since bottom sediment cover in this site is coarser than in the previous two sites, and there is no close fluvial discharge**

Relative backscatter transformation
Gartner (2004)

1. Determining the **base line** for ADCP time series (RSSI level);
2. Calculating the **sound absorption factor in the water column** (α - depends both on environmental conditions in the water column as well as on ADCP measurement configuration);
3. Determination of the **transition radius between near and far field** for ADCP transducers (Rcrit);
4. **Distance correction** to the point of measurement for transducer angle;
5. **Two-way transmission loss** calculation, for each of the measuring bins (2TL);
6. **Attenuation loss determination due to SPM concentration → this step can be skipped since SPM concentrations measured in this site were about 2 orders of magnitude lower than those used by Gartner in his original study**

Linear correlations



$$SPM_{est} = 10^{(0,705+0,0495RB_{bin1})}$$

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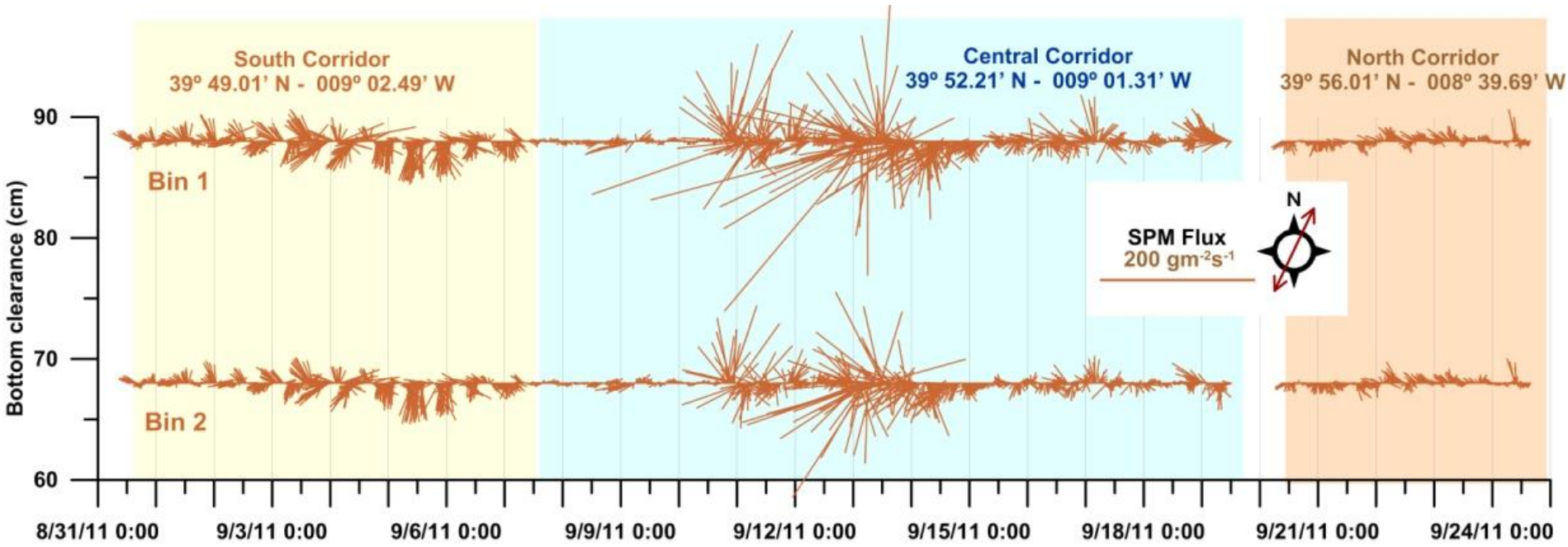
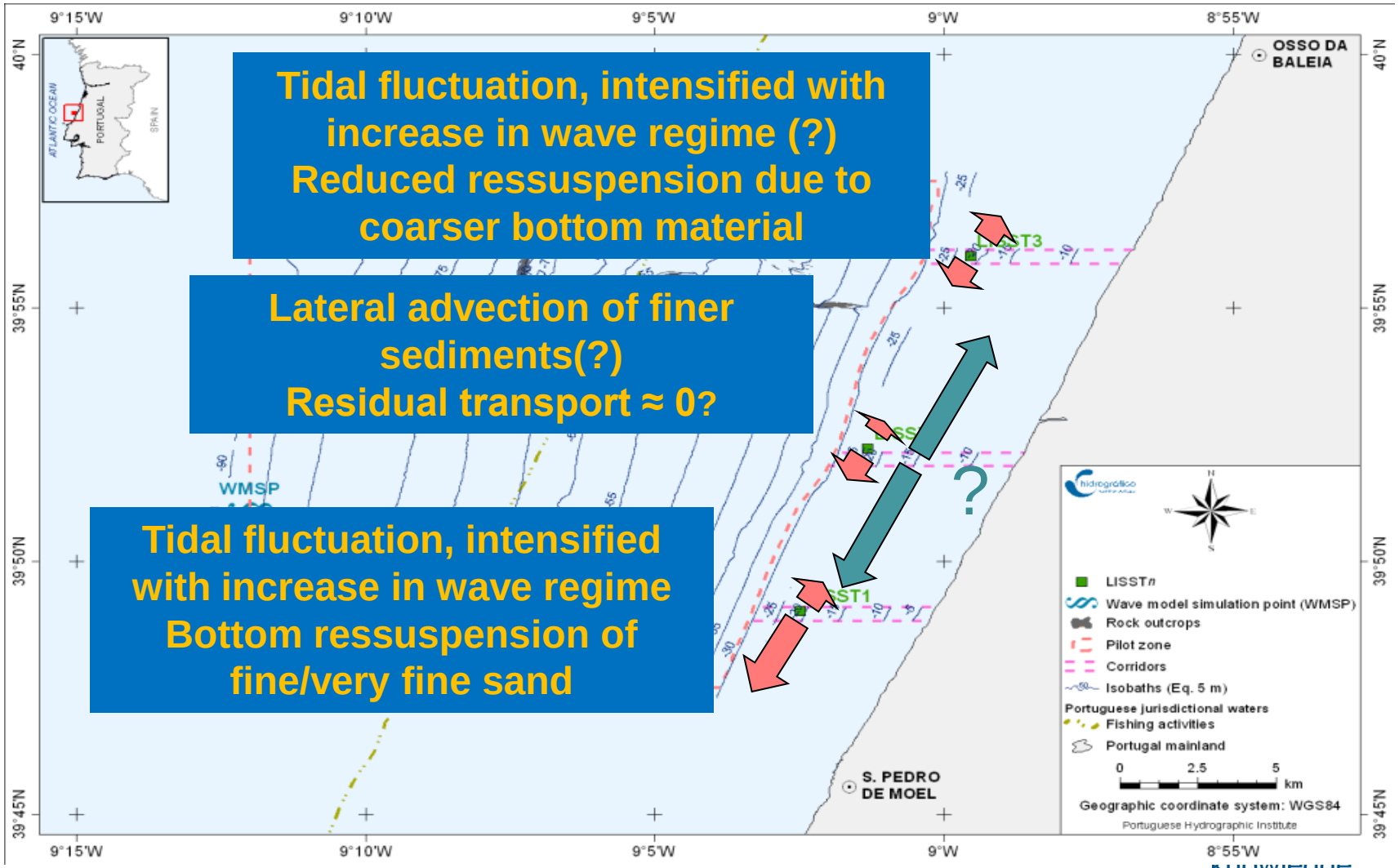


Mass Conc $_{mg/l}$ x Curr $_{mm/s}$ x $\vec{Dir}$ = SPM $\vec{Flux}$ $_{g/m^2s}$

Conclusions



Thak you for your attention!

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