

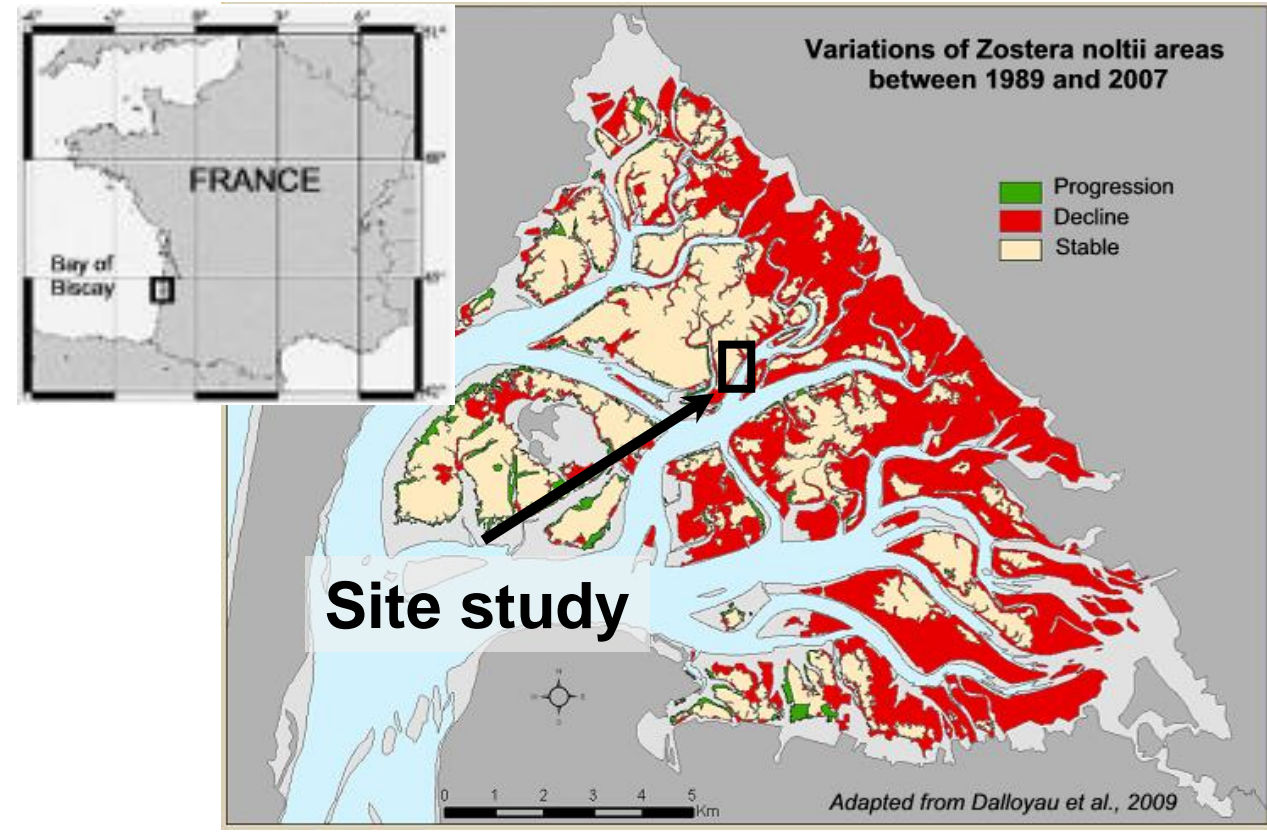
Sediment dynamics of intertidal flats colonized by seagrass meadows (*Zostera noltii*).

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The Arcachon lagoon (Aquitaine coast)

- Extensive seagrass beds (*Zostera noltii*) on intertidal flats.
- Important regression of meadows : -33% between 1988 and 2007 (Plus *et al.*, 2010).
- Infilling of Eastern shallow channels.



→ What are the consequences of *zostera* regression on sediment dynamics?

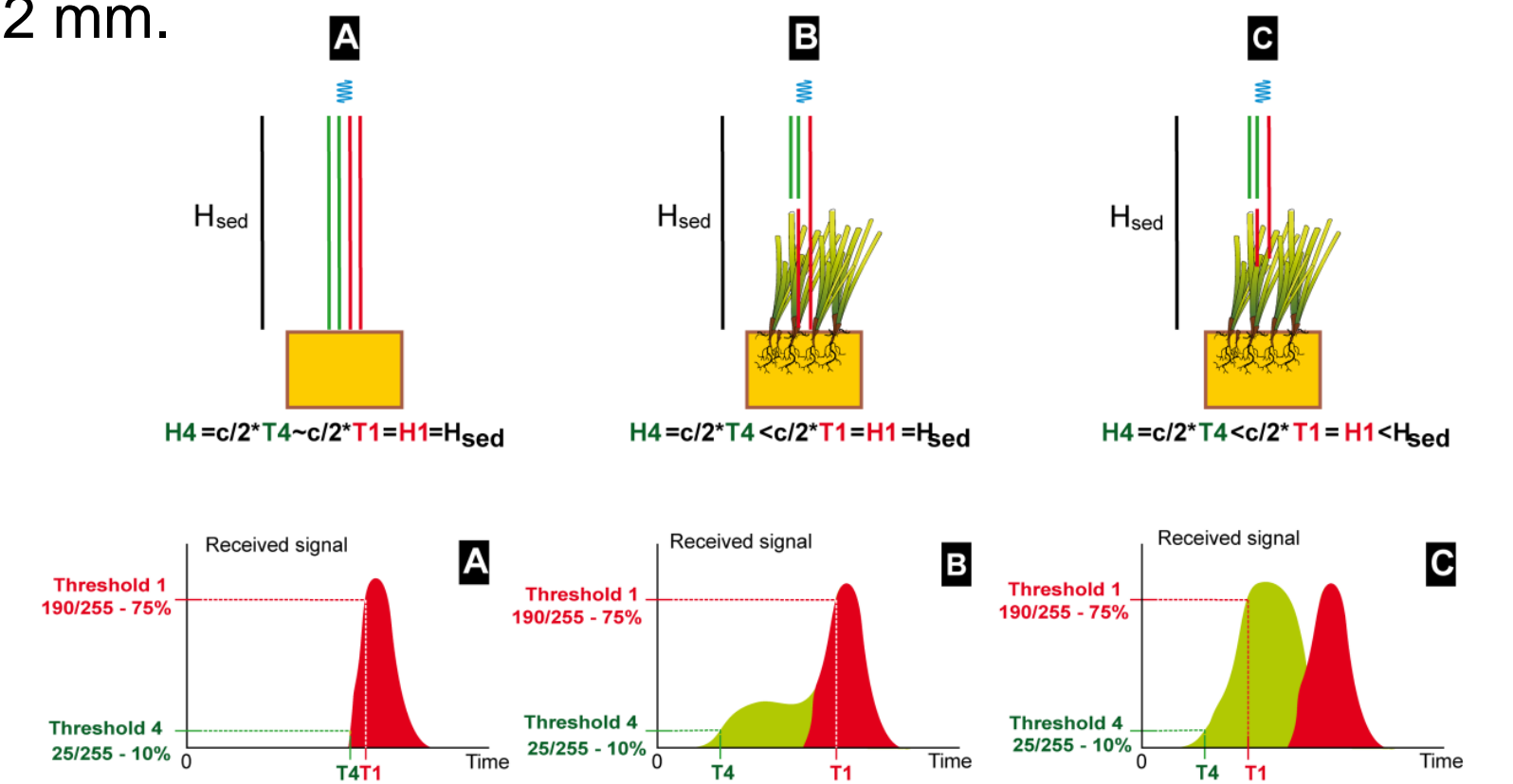
→ How seasonal variation in *zostera* meadows can influence colonized tidal flats sediment dynamics ?

Fine scale field survey

- High frequency velocity and turbulence (ADV).
 - Grain size analysis in the water column (LISST).
 - Velocity profiles (ADCP high resolution).
- Neap-Spring tide cycle (16 days) in highly dense meadow and unvegetated mud simultaneously (August 2009, February 2010).

Seasonal field survey

- Monthly *zostera* sampling for biometric analysis (Shoot density, leaf length, Leaf Area Index).
- Monthly superficial sediment sampling for grain size and water content analysis.
- High frequency sediment level measurements and waves: ALTUS altimeter (Bassoullet *et al.*, 1998) ; resolution : 0.41 mm, accuracy : 2 mm.



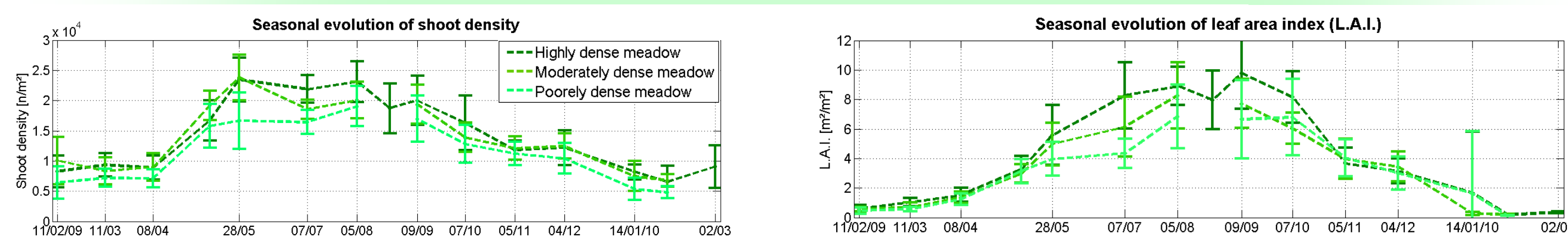
13 months, 3 stations in meadows of contrasted densities, 1 station in unvegetated mud.

Sites \ Sediment Budget	From the 11/02/09 to the 09/09/09	From the 09/09/09 to the 10/02	TOTAL 1 year (11/02/09 to the 10/02/10)
Highly dense	+ 41 mm	- 9 mm	+ 32 mm
Moderately dense	+ 16 mm	- 6 mm	+ 10 mm
Poorely dense	+ 15 mm	- 7 mm	+ 8 mm
Unvegetated	+ 3 mm	- 54 mm	- 51 mm

- For both vegetated sites :
 - ✓ Strong accretion during the growth period (from the 11/02/09 to the 09/09/09).
 - ✓ Significant erosion during the degeneration period (from the 09/09/09 to the 11/02/10), corroborated with increasing wind-induced wave energy.
 - ✓ Positive annual sediment balance.
- For unvegetated mud :
 - ✓ No significant trends during the growth period.
 - ✓ Strong erosion during the degeneration period with storm events.
 - ✓ Negative annual sediment balance.

- Why erosion in colonized sites seems to be stopped despite of continuous storm events ?
- How sedimentary processes interplay with meadows at short scale ?

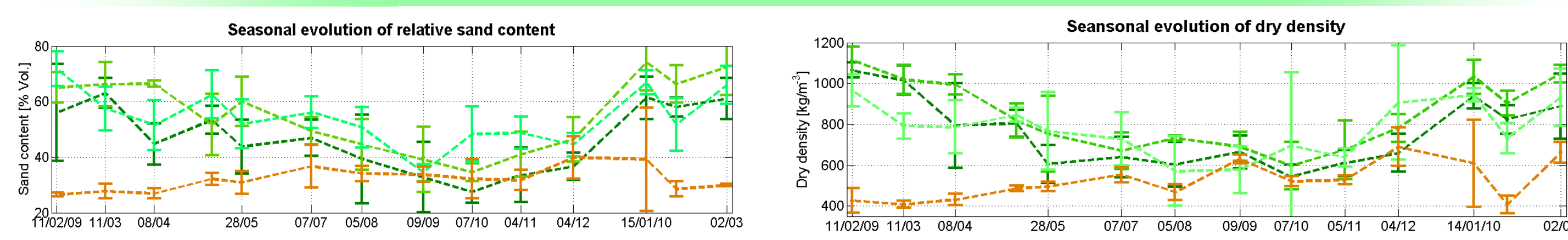
The seasonal growth dynamics of *Zostera noltii*



- L.A.I. depends on shoot density, leaf length/width, number of leaves per shoot.
- Significant seasonal variation for both parameters according to Auby and Labourg (1996).
- Maximum development: July to September ; minimum development: January to march

➢ How seasonal dynamic can affect superficial sediments ?

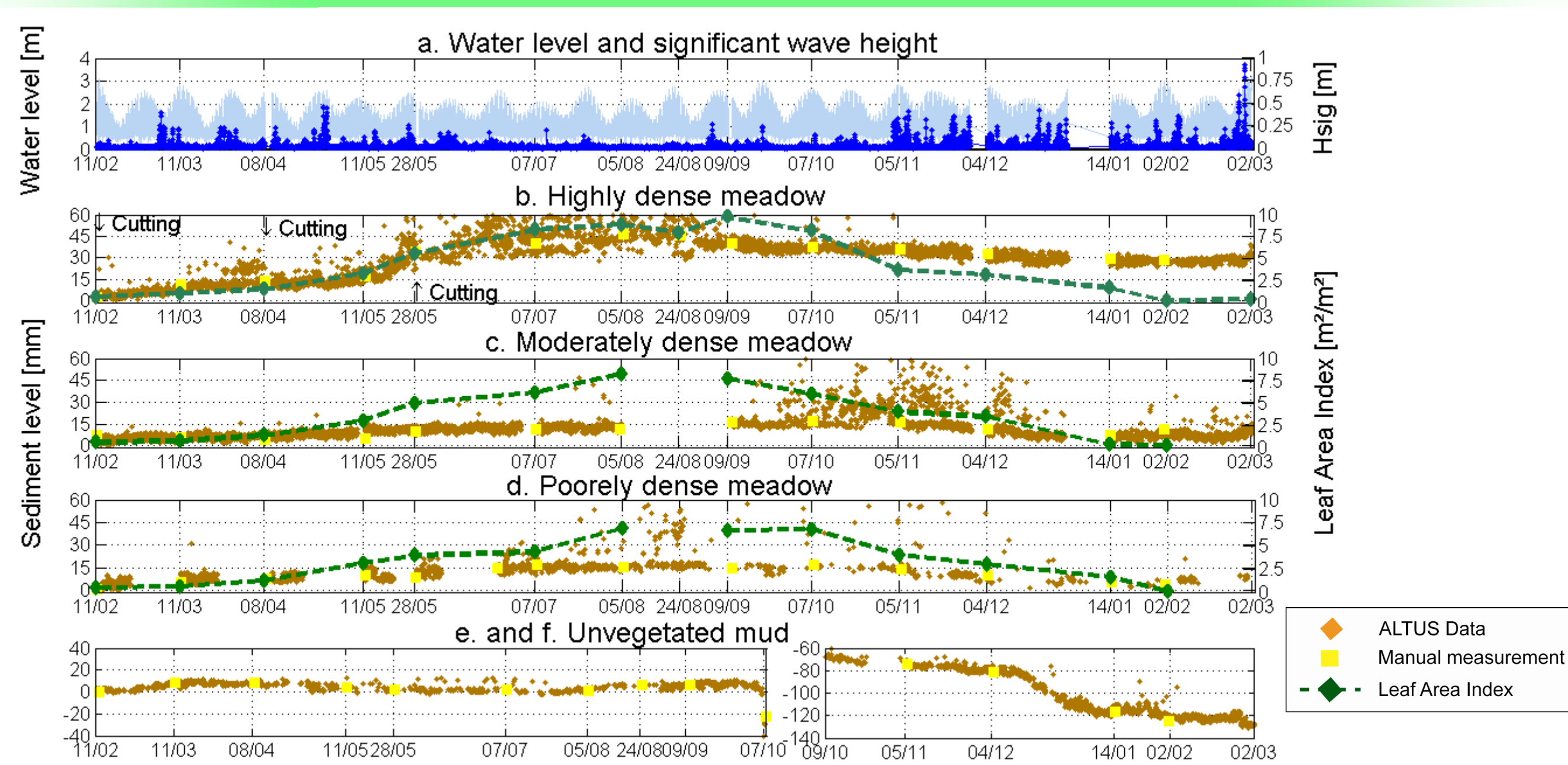
The seasonal dynamics of superficial sediments



- Significant differences between colonized sediments and bare mud for both relative sand content and dry density.
- Significant seasonal variations for both sediment parameters inversely correlated with *zostera* growing stage.

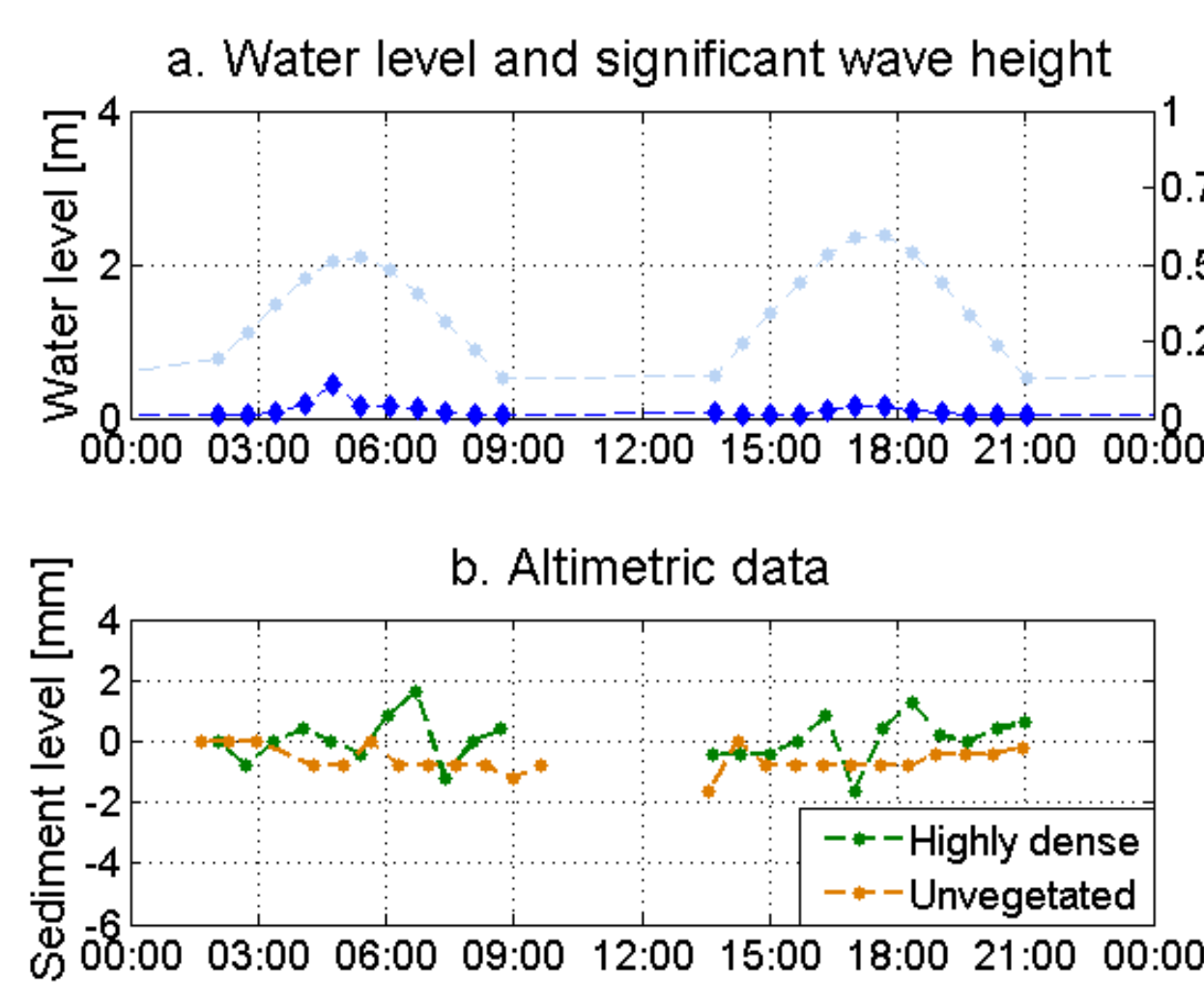
➢ The decrease of both sand content and dry density during the growing period suggests deposition of fresh muddy sediments in vegetated sites.

The seasonal sediment dynamics

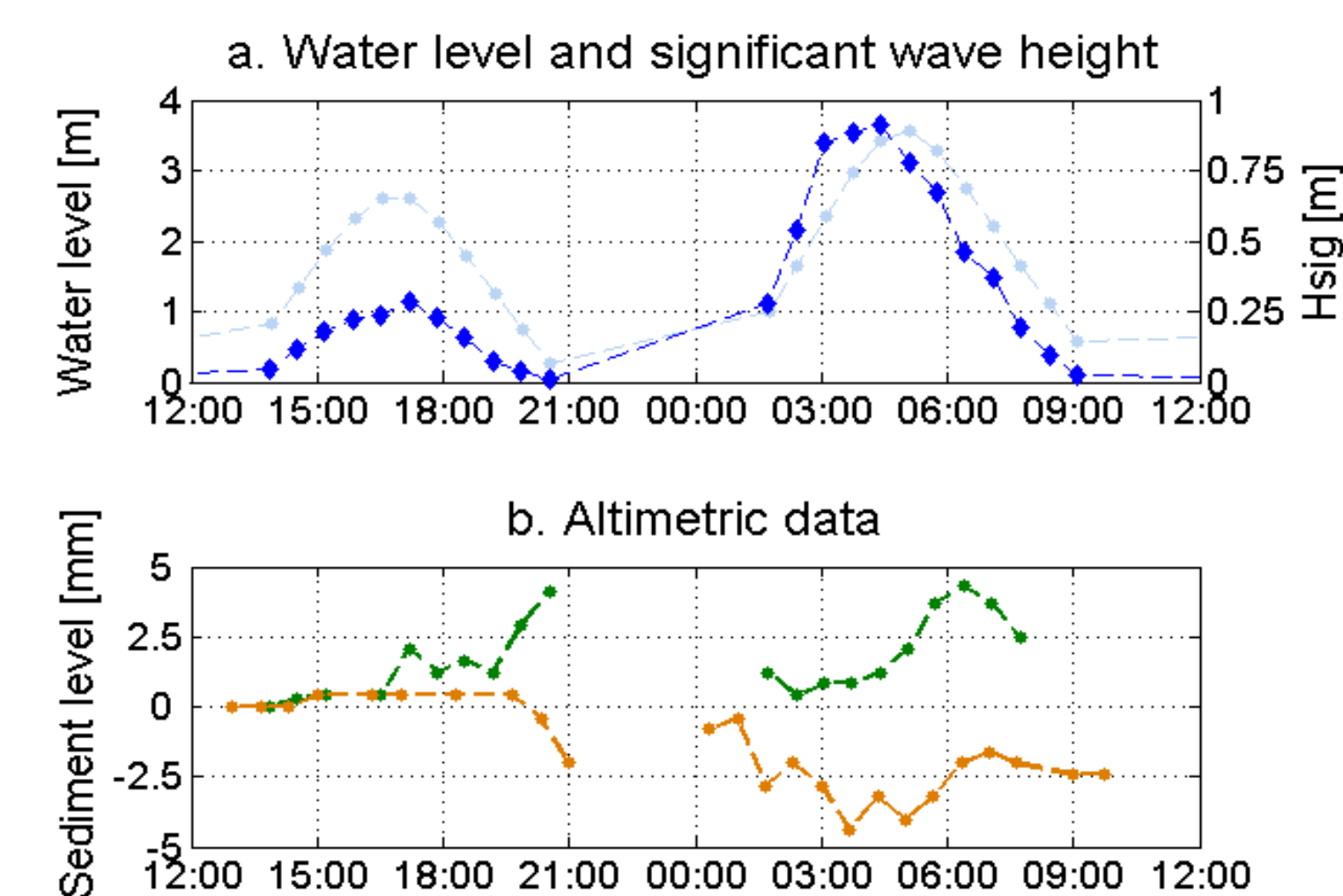


Tidal scale evolutions of sediment levels

Fair weather (ex : 5th September 2010, tidal range = 3 m)



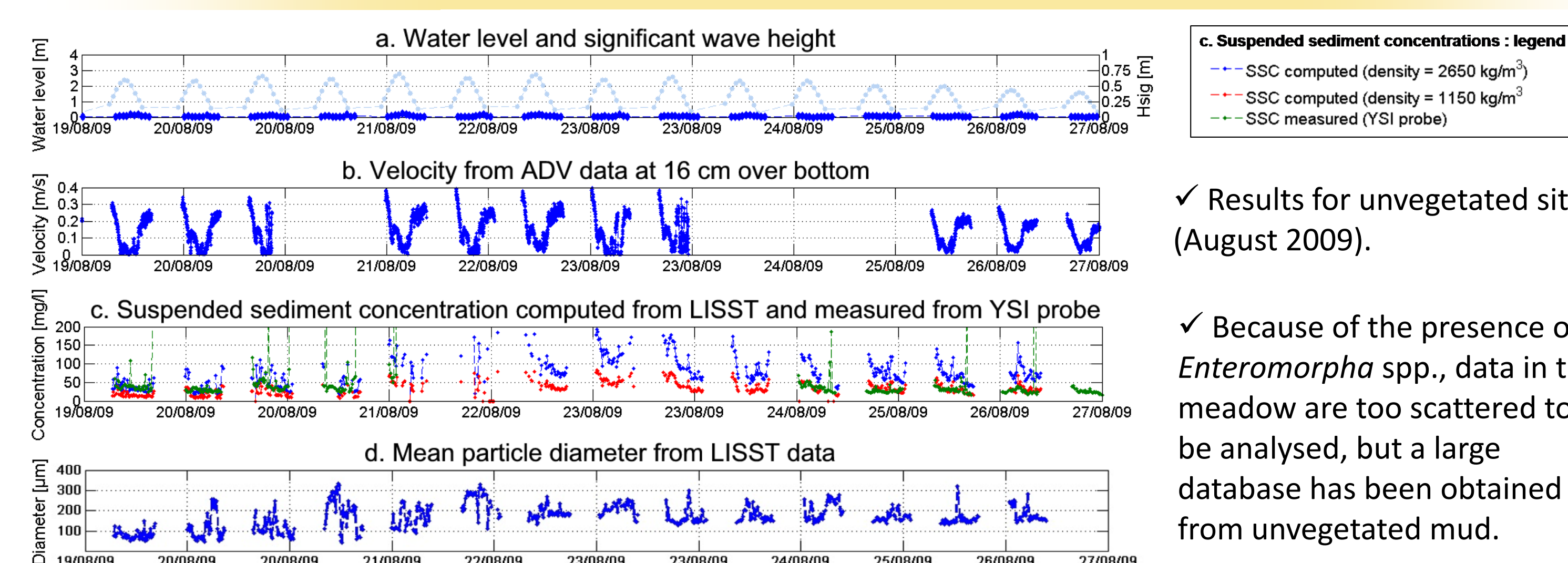
Storm event (ex : 27-28 February 2010)



- ✓ Scattered signal in vegetated sites. Trend to small deposition during fair weather and moderate accretion during storm events.
- ✓ Clean signal in bare mud. Trend to stability during fair weather and erosion during storm events.

- Meadows prevented from wave resuspension and enhance accretion.
- More sediment were trapped by meadows during storm events because of higher suspended sediment concentration induced by resuspension in bare mud.
- How *zostera* meadows could alter hydrodynamics and suspended sediments dynamics at fine scale ?

First results of fine scale field survey

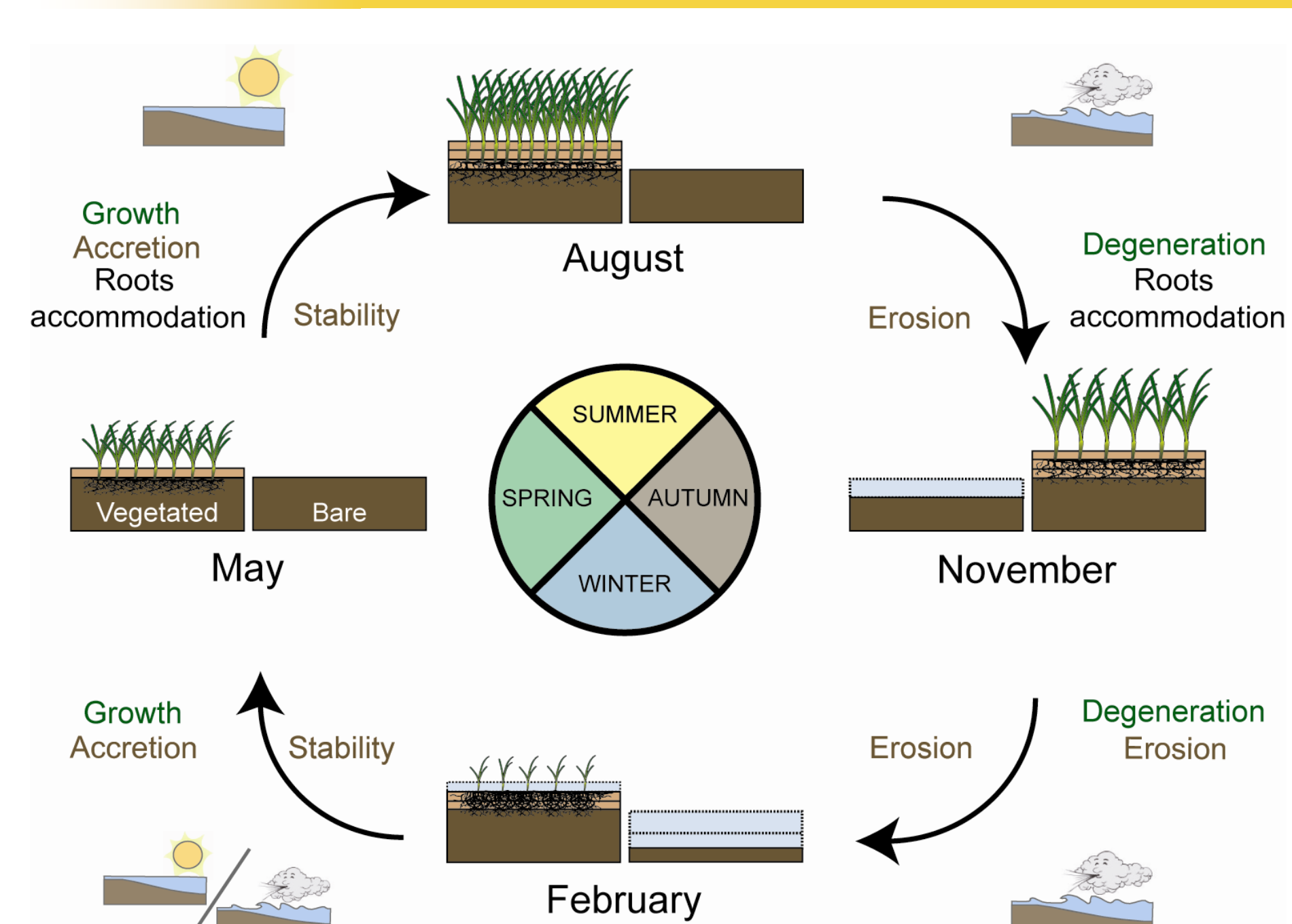


✓ Results for unvegetated site (August 2009).

✓ Because of the presence of *Enteromorpha* spp., data in the meadow are too scattered to be analysed, but a large database has been obtained from unvegetated mud.

- Higher concentrations of finer and heavy sediments (fine sand) in spring tides ; lower concentrations of mud flocs in neap tides.
- Further investigations are required to compare measurement in meadow with simultaneous measurements in unvegetated mud at contrasted growing stages.

Conclusion



Field measurements will be completed by laboratory flume experiments which will provide parameterizations for hydrodynamic and sediment processes. These will be integrated in a mixed sediment transport numerical model to evaluate consequences of *Zostera noltii* decline on sediment dynamics in the Arcachon lagoon.

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