

CO₂ measurements at the land-ocean interface

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INTRODUCTION

The transition between land and ocean is currently a less well-studied aspect of the global carbon cycle. Estuaries net heterotrophic and release CO₂ to the atmosphere. Still, salt marshes, which are typical components of temperate estuaries, are considered blue carbon ecosystems that have the potential to permanently store organic carbon. Coastal zones, particularly those receiving run-off from estuaries, tend to seasonally alternate between CO₂ uptake from and release to the atmosphere. Due to the high spatial heterogeneity and complex interactions between components, understanding and quantifying the role of these transitional ecosystem in the global carbon budget is not a straightforward task.

VLIZ is seeking to expand its activities from the coastal zone into the Schelde estuary to better cover this land-ocean gradient.

MONITORING @ Zwin

Currently, a monitoring scheme has been installed at the nature reserve, Zwin. Within the framework of the BERNARDO project, three stations (Fig. 1) are visited on a monthly basis to measure the key components of the carbonate system and inorganic nutrient concentrations (Fig. 2). When the weather permits, the same sampling is done by boat at a fourth station in the mouth. Samples are taken at low and high slack water.



Fig. 1: Sampling locations (Bridge I, Bridge II, Mudflat) at the Zwin nature reserve. A fourth station in the mouth was added but can only be visited by boat (RIB) when the weather permits.

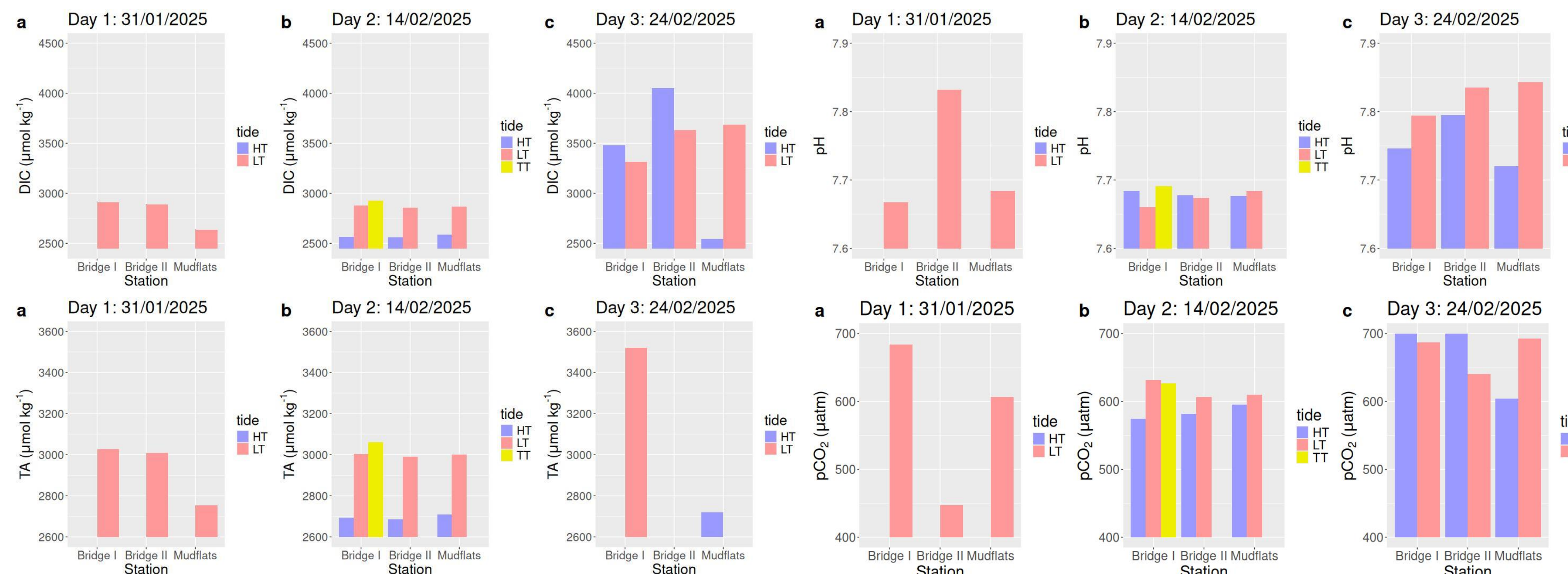


Fig. 2: First results from the exploratory campaigns at Zwin for dissolved inorganic carbon (DIC), total alkalinity (TA), pH, and calculated pCO₂ from DIC and pH. Samples were taken at high water (HT) and low water (LT). One set of samples was taken between LT and HT (indicated with TT =tidal transition)

EDDY COVARIANCE @ Zeebrugge

An eddy covariance system (Li-7200) will be installed at the western harbor head of the port of Zeebrugge, facing westward over the sea (Fig. 3). It will add to and be supported by a instrumentation already present at the location.

Initial goals:

- Determine useful wind sector and testing the limitation of the location.
- Comparison with other flux determination techniques using RV Abbe Mann.
- Obtain flux measurements of the surf zone and neighboring coastal sea.

For the near future we plan the purchase of a mobile Carbon Node (Fig. 4) to start exploring the salt marshes of the Belgian coast and Schelde estuary.



Fig. 3: Overview of the eddy covariance setup at the port of Zeebrugge. The setup will be installed on the western harbor head in collaboration with Flemish Hydrography, who manages the bridge structure (upper left inset). The sensor and gas intake will be installed 1-1.5 m outside of the bridge (lower left inset) at a height of ~15 m above the sea surface.

ECOSYSTEM MODELING

The Scheldt estuary is a well-studied ecosystem. The existing data and modeling systems can already be used to answer research questions, specifically about carbonate chemistry and carbon flows.

In collaboration with University of Antwerp, VLIZ is already involved in managing the data from the OMES program and maintaining the 1D ecosystem model.

Currently, there is no focus on carbonate chemistry. We intend to explore the possibility of adding this to the current model version.

Fig. 5: Schema of the spatial and conceptual configuration of the OMES model in its current form. It consists of an extended NPZD (nutrient-phytoplankton-zooplankton-detritus) model embedded in a 1D grid with 75 segments, extending from the weir near Ghent to the mouth near Vlissingen. It resolves a nitrogen cycle and carbon cycle, linked through fixed stoichiometric relations. The OMES monitoring data, together with the MWTL data (The Netherlands) presents an extensive data set to calibrate and drive the model.

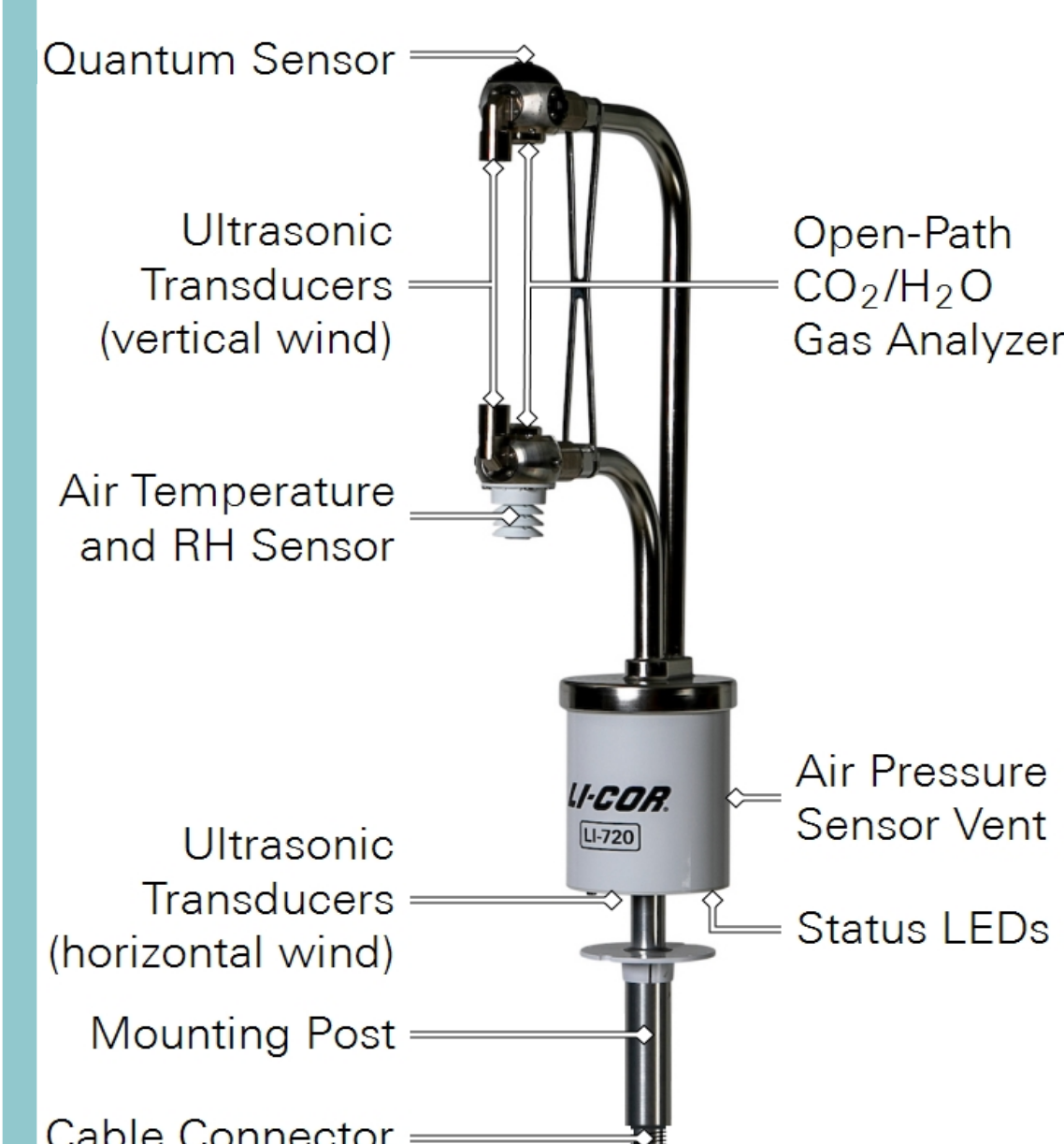
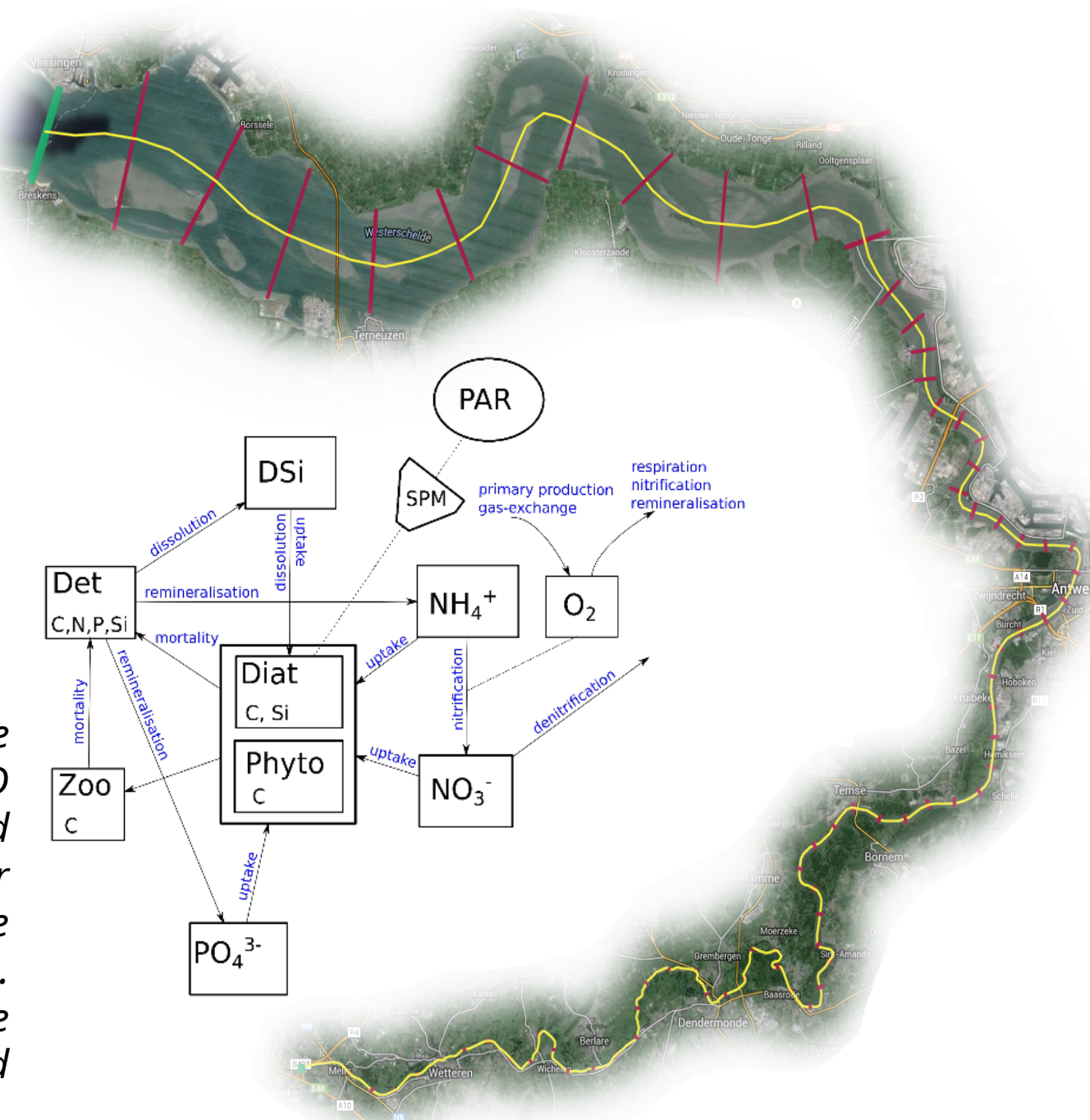


Fig. 4: Sensor head of the Carbon Node, a mobile eddy covariance system that we would like to use, mainly in salt marsh areas (Source: Li-Cor)

SUMMARY

VLIZ is always keen on working together with partners in Belgium and abroad to expand our knowledge on coastal and estuarine ecosystem functioning.

Feel free to contact us if you see common grounds for collaboration.

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