

## Development of novel *en-route* measuring system for continuous measurements of pCO<sub>2</sub> in the surface water

JAN F. HARTMANN<sup>1,2</sup>, SÖREN KRÄGEFSKY<sup>2</sup>, JULIAN ESCHENRÖDER<sup>1</sup>, TORBEN GENTZ<sup>2</sup> AND MARGOT ISENBECK-SCHRÖTER<sup>1</sup>

<sup>1</sup> Institute of Earth Sciences, Heidelberg University, Im Neuenheimer Feld 236, 69120 Heidelberg, Germany

<sup>2</sup> Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven, Germany

High resolution measurements of the different components of the carbon cycle are critical for an understanding of local and large scale processes determining global carbon fluxes. Therefore, a new prototype for *en-route* measurements of carbon dioxide (CO<sub>2</sub>) concentration and its stable carbon isotope values ( $\delta^{13}\text{C-CO}_2$ ) in surface water was developed, aiming on further improving the performance, maintainability and field of application of measuring systems currently used on research vessels.

The novel method bases on the extraction of gases from water by the application of a membrane gas/liquid exchange module. The permeated gases were measured by a portable cavity ring-down spectroscopy analyser (Picarro® G2201-i).

The system was calibrated and characterised for concentration and the  $\delta^{13}\text{C}$  composition of CO<sub>2</sub> using synthetic water standards at different ambient air and water temperatures in the laboratories. Reference samples for validation measurements were analysed with gas chromatography (GC) and mass spectroscopy (GC-C-IRMS). All results show good correlations for CO<sub>2</sub> concentration and stable carbon isotopic composition.

This novel method was successfully tested during a RV POLARSTERN cruise. The work on-board included various comparative tests with the *en-route* pCO<sub>2</sub> measuring devices and equilibrators currently used on board Polarstern as well as subsamples taken from a bypass for later analysis in the laboratories of the *Alfred-Wegener Institute* in Bremerhaven (Germany).

All tests performed suggest that the setup is suitable for the simultaneous determination of dissolved CO<sub>2</sub> concentration as well as  $\delta^{13}\text{C-CO}_2$  values in ocean surface water.