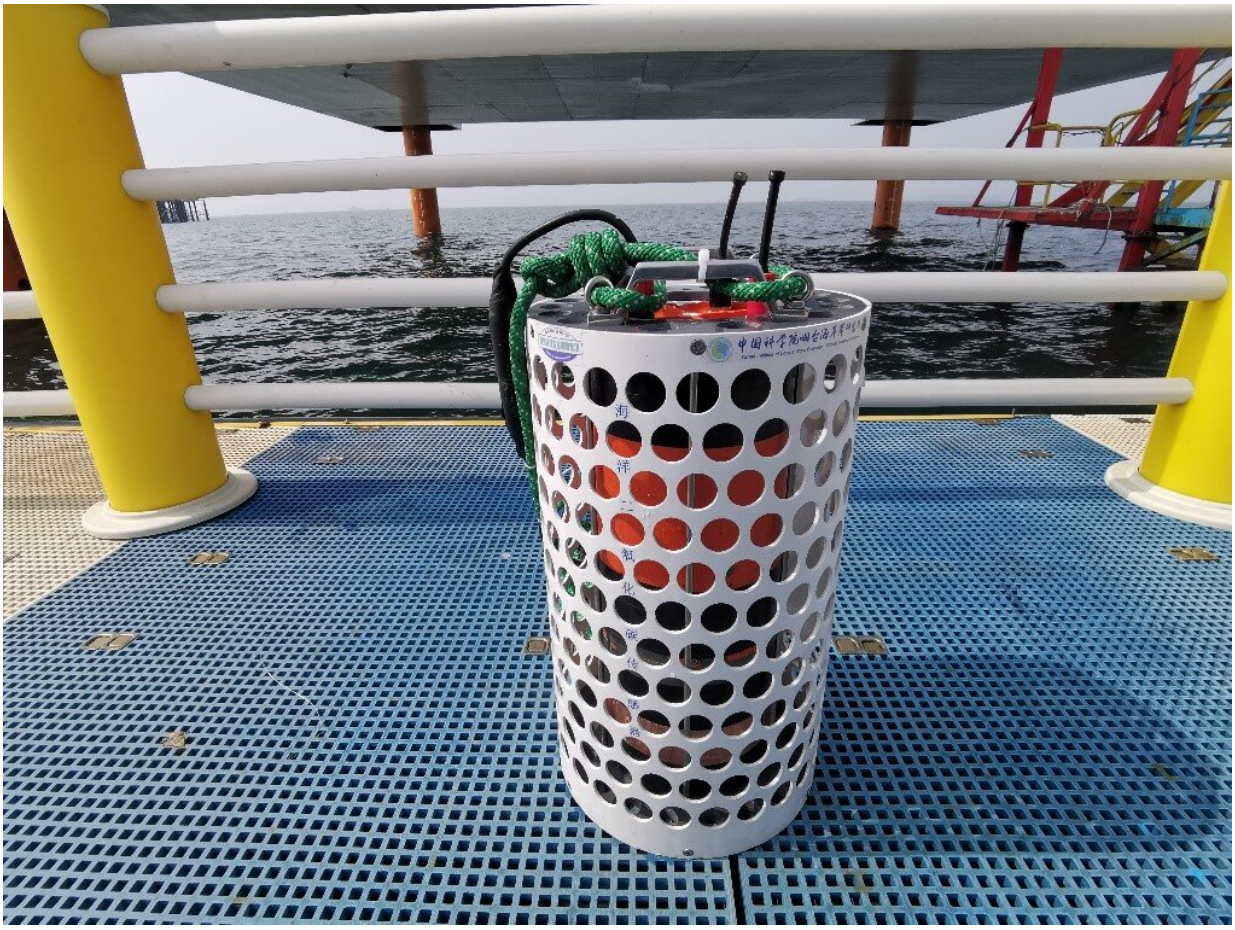
Researchers develop rapid in-situ monitoring system of dissolved CO2 in seawater

March 28 2022, by Li Yuan



Marine carbon dioxide monitoring system based on electrochemical sensing. Credit: YIC

A research group led by Qin Wei from the Yantai Institute of Coastal Zone Research (YIC) of the Chinese Academy of Sciences has developed a marine carbon dioxide (CO_2) monitoring system based on electrochemical sensing for the rapid in-situ profiling of dissolved CO_2 in seawater.

The increasing atmospheric CO_2 output from anthropogenic perturbations can cause remarkably increased oceanic uptake for CO_2. This could further result in a reduction of seawater pH and pronounced changes in the chemical balance of the marine carbonate cycle, with a potential influence on marine biota and the ocean ecosystem.

To accurately understand the impact of these changes on the marine carbon cycle, it is necessary to quantify the dissolved CO_2 variability in seawater with high temporal and spatial resolution.

Since the changes in sample can occur during sampling, sample transport and measuring procedures due to the re-equilibration between the seawater sample and the atmospheric CO_2, in-situ measurements of dissolved CO_2 is significant.

The monitoring system consists of probes for seawater parameters (i.e., pH, conductivity, temperature), an electrochemical sensing unit based on ion-selective electrode for selective carbonate detection, a control system for sensor calibration, autonomous sample analysis and salinity impact correction, as well as a flow system for the injection of calibration solutions or seawater samples.

"The salinity correction can offer an improved detection accuracy in a high salinity background, making the proposed CO_2 monitoring system suitable for marine monitoring," said QIN.

The researchers checked the functioning of the dissolved CO_2 detection

system via long-term monitoring in three different sea areas of China, the Bohai Sea, the Yellow Sea and the South China Sea.

They found that this system offered a response time of 40 s, a reproducibility of 0.3% and a detection accuracy of 95% compared to the reference technique (water vapor separation-nondispersive infrared spectroscopy analysis) for real-time monitoring of dissolved CO_2 in the Bohai Sea.

The monitoring system worked properly during the testing time. Obtained results indicated its capability to autonomously operate with routines for seawater analysis, sensor calibration, data storage and transmission.

Such a submersible monitoring system may provide new opportunities for obtaining rapid and accurate information about the carbon cycle in a marine system without the requirement of sample pretreatment.

Provided by Chinese Academy of Sciences

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