APPLICATION NOTE A2.6:

Using Sensors to Monitor the Ocean

INTRODUCTION

Oceans cover about 70% of the earth's surface and provide many essential ecological services. They play a crucial role in storing heat, providing oxygen, taking up anthropogenic CO_2, and supporting a diverse range of organisms. Additionally, oceans are a primary source of food in many coastal communities.

Programs to monitor the ocean have been ongoing for decades, with at least one monitoring station in every major ocean basin. These monitoring stations generally measure key parameters such as temperature, salinity, dissolved oxygen (DO), pH, the partial pressure of CO_2 (pCO_2), and various meteorological measurements.

Figure 2. CTD Rosette. Image from: https://www.mbari.org/technology/ctd-rosette/

PRO OCEANUS

Dissolved Gas Sensors

HISTORY OF OCEAN OBSERVATION

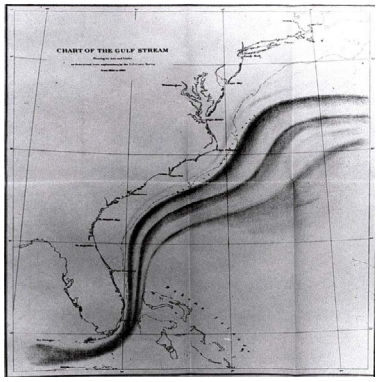

Figure 1. 1860 chart of the Gulf Stream Image from: NOAA Photo Library

For decades, humans have been exploring the ocean in an attempt to understand the underlying mechanisms at work. Oceanographers of years past were restricted by having to physically be at sea to collect and analyze water samples for their research. Around the mid-twentieth century, the development of oceanographic sensors allowed for a rapid expansion of monitoring capabilities. Today, oceanographers all over the world use sensors for their research. This can range from a single CTD being deployed over the side of a fishing vessel, to a fully autonomous buoy with a suite of sensors.

MONITORING THE OCEAN

A good case study of ocean monitoring is the CERC.Ocean lab buoy (Fig 3.) currently deployed in Halifax, Canada. Deployed in 2024, the buoy is a joint collaboration between Dalhousie University, Planetary, and Pro-Oceanus. The purpose is to “address an important technology and knowledge gap” that is prevalent in marine carbon dioxide research.

The buoy, located downstream of the Tufts Cove power plant where Planetary has been conducting Ocean Alkalinity Enhancement field trials, is equipped with a variety of sensors including the Pro-Oceanus CO_2-Pro CV. Data is available nearly instantaneously through an online interface and can communicate to the user when identified thresholds are close to being met.

Overall, having a cohesive understanding of the way the ocean is changing, whether from anthropogenic causes or through natural seasonal cycles, is an important oceanographic tool. Using autonomous measuring equipment such as sensors and buoys help to ease the burden of having to physically be at sea to collect measurements.

Figure 3. Dalhousie CERC.Ocean buoy in the Halifax Harbour. Image from: Dariia Atamanchuk

APPLICATION NOTE A2.6:

Using Sensors to Monitor the Ocean

MEASUREMENT OF DISSOLVED CO_2 AND THE CARBONATE SYSTEM

Taking measurements of dissolved CO_2 is an essential part of any monitoring system. Making continuous in situ dissolved CO_2 measurements, in conjunction with one other carbonate parameter, can give a complete picture of the carbonate system.

Dissolved CO_2 can be measured in a number of ways, including chemical laboratory analysis of water samples, using a liquid indicator dye that is monitored spectrophotometrically, and in situ measurement via diffusion across a membrane into an infrared gaseous CO_2 detector. Water sampling and laboratory analysis is labor intensive and generates a substantial time lag between the sampling time and the measurement results. Pro-Oceanus pCO_2 sensors utilize infrared detection and provide continuous long-term in situ measurements that allow for real-time monitoring changes in CO_2.

DISSOLVED CO_2 SENSORS

Pro-Oceanus offers several models of pCO_2 sensors for ocean monitoring systems, including the Mini CO_2, CO_2-Pro FT, CO_2-Pro CV, and CO_2-Pro CV Atmosphere. Pro-Oceanus sensors utilize an advanced flat membrane technology that allow for the sensors to be continuously deployed for extended periods of time. This leads to less equipment downtime and less maintenance, resulting in better reliability and lower cost of ownership.

The sensors can be standalone with internal logging and battery power or they can be easily integrated into automated systems with feedback control with 4-20 mA, 0-5 V and RS-232 outputs. Flow-through and in-line adaptors are also available for simple integration into water monitoring systems. The right equipment choice is easy with consultation from Pro-Oceanus' Scientific Team.

Pro-Oceanus
Mini CO_2 (Top) and
CO_2-Pro CV (Bottom)

PRO OCEANUS Dissolved Gas Sensors

80 Pleasant Street,
Bridgewater, Nova Scotia
Canada B4V 1N1

Phone +1-902-530-3550
sales@pro-oceanus.com
Pro-Oceanus.com