

Underway pCO₂ System Description

Laboratory: University of Hawaii, Hawaiian Ocean Time-series (HOT)

Name/Vintage: Chris Winn, 1996.

Reference: Brief system description at <http://hahana.soest.hawaii.edu/hot/methods/pco2.html>

Where installed: Currently shore-side. Previously deployed on the R/V Moana Wave during HOT cruises HOT-76 (October, 1996) through HOT-93 (May, 1998)

Location of Data: Contact John Dore, jdore@soest.hawaii.edu or Dan Sadler, sadler@hawaii.edu.

Analyzer: LICOR 6251 infrared detector.

Method of analysis: Differential analyses relative to a reference gas (349.0 ppm). The bow and equilibrator air streams are dried before entering the detector. Flow is stopped during the measurement.

Drying method: The gases pass through a naphthyon tube dryer and a magnesium perchlorate scrubber before entering the detector.

Equilibrator (setup, size, flows): Small shower head designed after Goyet. Water flow rate of 8 L/min and air circulation of 500 mL/min.

Standards (number, concentrations, frequency): Three standards (278.5 ppm, 355.76 ppm, 398.4 ppm) were measured at system startup and approx. every 2.5 hours.

Source of calibration and accuracy: The standards are from Scott Specialty Gases and calibrated at SIO against WMO primary standards.

Standard consumption: Not recorded

Operating cycle: Equilibrated gas and bow air are each sampled every 10 minutes. The reference chamber is purged after every 3 cycles.

Parameters recorded/frequency :

Hardware details

Temperature measurements: An OMEGA ON-920 thermistor measures the temperature of the water inside the equilibrator.

Pressure measurements: SETRA Model 270 pressure transducer

Circulation pathway: Two Barnant diaphragm pumps are used to circulate air. One draws bow air to the system and another circulates air through the equilibrator. Both provide flow the LICOR sample chamber. A third pump provides dry air to the naphthyon dryers. A 12 position VICI valve switches the source of flow to the detector between bow air, equilibrator air, reference gas and the 3 standard gases.

Operating software: GWBASIC

Computer interface boards and sensors read:

Boards: Strawberry Tree data acquisition card.

Sensors:

Approximate Size and Footprint: The equilibrator stands about 18" high on a 6"x6" base. The metal frame holding the detector, pumps and VICI valve is approximately a 2'x2'x2' cube. Space is also required for 4 gas cylinders, a desktop computer and monitor.

“Unique” Hardware or operating principles worth highlighting:

What improvements would you incorporate in this system?

Would consider a different type of pump, as the diaphragms were prone to breakage and the flapper valve leaked due to salt build-up. Would also look into other equilibrator designs as the small water:air volume ratio may not be ideal.