

Underway pCO₂ System Description

Laboratory: WHOI/AOPE

Name/Vintage: Martha's Vineyard Coastal Observatory (MVCO)

Reference Systems deployed on coastal, estuarine, open-ocean expeditions

Where installed: To be installed permanently on the MVCO Flux Tower.

Location of Data: Data to be provided in JGOFS convention: www.whoi.edu/mvco

Analyzer: Licor-7000 NDIR analyzer.

Method of analysis: Differential analyses relative to a reference zero gas. Measures dried equilibrator headspace gas. Low regulated gas flow prior to IR readings.

Drying method: The water-side pCO₂ measurements are obtained from the headspace gas of an equilibrator. Equilibration of the sample gas with ocean water is done by continuously pumping and draining seawater into an enclosed chamber. Gas is pumped from the headspace of the chamber, through a condenser (some designs) that removes approximately 90% of the H₂O. Atmospheric and headspace gases pass through a Mg(ClO₄)₂ drier and then through the detector. The output from the detector is corrected for the effects of pressure, temperature, and any remaining H₂O on the measured CO₂ concentration.

Equilibrator (setup, size, flows): Showerhead equilibrator with 0.3 liter water reservoir and 1.0 liter gaseous headspace. Water flow rate: ~3 L/min. Headspace recirculation rate: 500 ml/min.

Standards (number, concentrations, frequency): Three standards are used with concentrations depending on environmental system: 300 ppm, 2000 ppm, and 6000 ppm for estuarine/coastal work. All three standards are run once every four hours.

Source of calibration and accuracy: The standards come from CMDL and Scott Marrin.

Operating cycle: Calibration every 4 hours, air/water cycling every 10 minutes.

Hardware details

Temperature measurements: Thermocouples in air/water. Seabird thermistor insitu water.

Pressure measurements: Setra for system. Vaisala for atmospheric pressure measurements.

Operating software: Lab-windows, Labview, QuickBasic.

Computer interface boards and sensors read: see www.whoi.edu/mvco

Approximate Size and Footprint: Outside enclosure holding system: 1meter x .3 meter x .5 meter.

“Unique” Hardware or operating principles worth highlighting:

- Weather-proof enclosed system: it can be put outside.
- 8 port valve for 1um filter and magnesium perchlorate carousel for autonomous maintenance.
- Thermoelectric temperature control for constant Temp operation.
- Li-7000 optics can be cleaned in field.

What improvements would you incorporate in this system?

Constant air and water pCO₂ values for high frequency coastal processes.