Commercially available instrumentation for CO_2 analyses

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Two Primary Classes of Instrument exist

For laboratory measurements

- Primarily discrete samples (some flow-through)
- Usually, aim to achieve low uncertainty for the results
- QA/QC strategies exist

For *in situ* measurements

- Autonomous systems
- Often, uncertainty is not well known
- QA/QC still needs work

On occasion $[CO_3^{2-}]$ is estimated from its effect on the spectrum of lead in seawater

Usual parameters measured

- Total dissolved inorganic carbon

$$C_T = [CO_2] + [HCO_3^-] + [CO_3^{2-}]$$

- Total hydrogen ion concentration (pH)

$$pH = -\lg [H^+]$$

- Partial pressure of CO_2 (in air in equilibrium with sea water)

$$p(CO_2) = x(CO_2)\, p = [CO_2] / K_0$$

- Total alkalinity

$$A_T = [HCO_3^-] + 2[CO_3^{2-}] + [B(OH)_4^-] + [OH^-] - [H^+]$$

	Advantages	Disadvantages
C_T	*T, p* independent Unambiguous interpretation of changes	Needs care with sample handling No autonomous system available
pH	Autonomous systems available Master variable?	Function of *T, p* Needs care with sample handling Interpretation problems
$p(CO_2)$	Autonomous systems available	Function of *T, p* Changes not easy to interpret
A_T	*T, p* independent Often possible to interpret changes	No autonomous system available Harder to interpret in some systems

Key Questions

1. What is the overall uncertainty of the measured value?
2. Does it provide the quality I need?
3. What does the method cost to use?
4. How does the method work?
5. Can I maintain the system?
6. How is it calibrated?
7. How does one achieve effective QA/QC?

Instruments and Sensors Directory

This directory provides information about sensors and instruments developed and used by the ocean carbon research community. We try to list hardware that is available "off the shelf". Occasionally we decide to list instruments / sensors that are not yet commercially available but underwent substantial tests and can be obtained from developers. Information provided by developers and commercial partners might sporadically become out-dated. Please contact us with suggestions for updates. IOCCP does not, in any way, "endorse" hardware listed below. To add a sensor or instrument to this directory, please contact Maciej Telszewski at m.telszewski@ioccp.org.

Douglas Connelly
Responsible
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Dissolved Inorganic Carbon | Alkalinity | pCO_2 | pH | Particulate Carbon

IAEA

Ocean Acidification
International
Coordination Centre

OA-ICC

Instrument and sensor reports

http://www.ioccp.org/instruments-and-sensors


0.0000 mL
MUX
OHM

	Commercial lab systems	Commercial *in situ* systems
C_T	Marianda VINDTA (3D, 3C, 4) Marianda Airica Apollo Scitech AS-C3	–
pH	Sunburst Sensors AFT-pH (*for flowing stream)*	Sea-Bird SeaFET / SeapHOX Sunburst Sensors SAMI-pH
$p(CO_2)$	Sunburst Sensors Super-CO_2 Apollo Scitech AS-P2 **+ *others*** (*for flowing stream)*	Battelle Seaology pCO_2 Monitoring System Sunburst Sensors SAMI-CO_2 **+ *others***
A_T	Marianda VINDTA (3S, 3C) Apollo Scitech AS-ALK2 Scripps TA titration system Contros Hydro FIA-TA analyzer	–

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We shall discuss this more in the next presentation

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"We are stuck with technology when what we really want is just stuff that works."

Douglas Adams, The Salmon of Doubt

GOA-ON

Global Ocean Acidification Observing Network