

Instrumenting our oceans for better observation: a training course on a suite of biogeochemical sensors

June 10-June 19, 2019

Sven Lovén Center for Marine Sciences (Kristineberg, Sweden)

Draft Course Agenda

During hands-on sessions, participants will be divided into **4 groups of 7 participants**. Each group will have 1-2 instructor(s) dedicated to the group. Groups will take turns in exchanging sensors used in the practical sessions of the course. Ultimately and regardless of prior experience with any or none of the sensors, each participant will receive basic training for sensors for all four parameters that the course focuses on.

As preparation for the course, participants are requested to familiarize themselves with the 2017 IOCCP guide, which was an outcome of the first international IOCCP sensors summer course:

<http://www.ioccp.org/images/09SummerCourse2015/A-users-guide-for-selected-autonomous-biogeochemical-sensors.pdf>

MONDAY, JUNE 10, 2019

Morning

Welcome and introduction

[Course Organisers]

Course objectives, expected outcomes, logistics and format of the course

[Course Organisers]

Session 1: **Scientific importance of instrumenting our oceans**

[Lecture by Maciej Telszewski]

Session 2: **Key oceanographic characteristics that will determine what sensors can be used where**

[Lecture]

12:00-13:00 Lunch

Afternoon

Session 3: **Sensors – inside out (Part 1)**

[Lecture on sensor 1 (oxygen) by Henry Bittig & Craig Neil;

Lecture on sensor 2 (bio-optical) by Nathan Briggs & Giorgio Dall’Olmo]

Evening

Session 4: **Flash (2-min) presentations by participants and lecturers**

TUESDAY, JUNE 11, 2019

Morning

- Session 5: **Sensor deployment:** *Participants familiarize themselves with the sensors and deploy their sensors (1 & 2) off the pier.*
[Sensor 1: oxygen – Instructors: Henry Bittig & Craig Neill
Sensor 2: bio-optical – Instructors: Nathan Briggs & Giorgio Dall’Olmo]

13:00-14:00 Lunch

Afternoon

- Session 6: **Sensors – inside out (part 2)**
[Lecture on sensor 3 (pH) by Dariia Atamanchuk & Phil Bresnahan;
Lecture on sensor 4 (pCO₂) by Ingunn Skjelvann and Craig Neill;
Lecture on the theory of NO₃ measurements by Henry Bittig.]

WEDNESDAY, JUNE 12, 2019:

Morning

- Session 7: **Sensor deployment:** *Participants familiarize themselves and deploy their sensors (3 & 4) off the pier.*
[Sensor 3: pH – Instructors: Dariia Atamanchuk & Phil Bresnahan
Sensor 4: pCO₂ – Instructors: Ingunn Skjelvann and Craig Neill.]

13:00-14:00 Lunch

Afternoon

- Session 8: **Interfacing sensors**
[Lecture by Craig Neill]
- Session 9: **Calibration and validation: what are the needs? Part 1**
[1/3 lecture focused on general perspectives by TBC;
1/3 lecture focused on oxygen sensors by Henry Bittig;
1/3 lecture focused on bio-optical sensors by Nathan Briggs/Giorgio Dall’Olmo.]

THURSDAY, JUNE 13, 2019:

Morning

- Session 10: **The Carbon system: assessing and controlling measurement uncertainty in estimating the seawater CO₂ system**
[Lecture by Andrew Dickson]

Session 11: **Calibration and validation: what are the needs? Part 2.**
*[1/2 lecture focused on pH sensors by Phil Bresnahan;
1/2 lecture focused on pCO₂ sensors by Ingunn Skjelvann/Meike Becker]*

12:00-13:00 Lunch

Afternoon

Session 12: **Equilibrator-based surface measurements**
*[Lecture on xCO₂ and N₂O by Gregor Rehder;
Practicals by Gregor Rehder & Craig Neill.]*

FRIDAY, JUNE 14, 2019:

Morning

Session 13: **Recovery of sensors 1 & 2 (raw data)**
*[Sensor 1 (oxygen) – Instructors: Henry Bittig & Craig Neill;
Sensor 2 (bio-optical) – Instructors: Nathan Briggs & Giorgio Dall’Olmo]*

12:00-13:00 Lunch

Afternoon

Session 14: **Theory of data processing (oxygen and bio-optical)**
*[Lecture on oxygen data processing by Henry Bittig;
Lecture on bio-optical data processing by Nathan Briggs & Giorgio Dall’Olmo]*

Session 15: **Practicals of data processing (oxygen and bio-optical)**
*[Oxygen - Instructors: Henry Bittig & Craig Neill;
Bio-optical – Instructors: Nathan Briggs & Giorgio Dall’Olmo]*

SATURDAY, JUNE 15, 2019:

Morning

Session 16: **How to choose the right sensor depending on your circumstances?**
[Lecture by TBC.]

Session 17: **How to derive meaningful biogeochemical quantities from bio-optical sensors?**
[Lecture by Nathan Briggs/Giorgio Dall’Olmo]

Afternoon

Field trip / social activities

SUNDAY, JUNE 16, 2019:

Morning

- Session 18: **Recovery of sensors 3 & 4 (raw data)**
*[Sensor 3 (pH) – Instructors: Dariia Atamanchuk & Phil Bresnahan;
Sensor 4 (pCO₂) – Instructors: Meike Becker & Craig Neill.]*

12:00-13:00 Lunch

Afternoon

- Session 19: **Theory of data processing (pH and pCO₂)**
*[Lecture on pH data processing by Dariia Atamanchuk/Phil Bresnahan;
Lecture on pCO₂ data processing by Meike Becker.]*
- Session 20: **Practicals of data processing (pH and pCO₂)**
*[pH - Instructors: Dariia Atamanchuk & Phil Bresnahan;
pCO₂ – Instructors: Meike Becker and Craig Neill.]*

MONDAY, JUNE 17, 2019

Morning

- Session 21: **Modelling for best observation design**
[Lecture by Véronique Garçon.]

- Session 22: **How to take care of data?**
[Lecture by Meike Becker.]

13:15-14:00 Lunch

Afternoon

- Session 23: **Combining remote sensing and in situ biogeochemical observations**
[Lecture by Giorgio Dall’Olmo]
- Session 24: **Smart data extrapolation**
[Lecture by Peter Landschützer.]

TUESDAY, JUNE 18, 2019

Morning

- Session 25: **From surface measurements to fluxes (FluxEngine toolbox)**
*[Lecture by Jamie Shutler;
Practical by Tom Holding and Ian Ashton]*

13:00-14:00 *Lunch*

Afternoon

Session 26: **All I always wanted to know about sensors**
[Presentations by manufacturers and hands-on Question & Answer session with experts and manufacturers. Multiple types of sensors for each parameter.]

Evening

Session 27: **Short presentations by sponsors and manufacturers**

WEDNESDAY, JUNE 19, 2019

Morning

Session 28: **Emerging technologies**
[Lecture by Doug Connelly and Véronique Garçon.]

Session 29: **Biofouling: issues and solutions**
[Combined lecture from a few experts, followed by an open discussion.]

Afternoon

[Time to fill out evaluations]

[Time to give feedback on the 2015 IOCCP users guide to selected autonomous biogeochemical sensors.]

Course ends this evening after a nice dinner.

THURSDAY, JUNE 20, 2019

DEPARTURE