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)

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Draft Course Agenda

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During hands-on sessions, participants will be divided into **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 all four sensors 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

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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 TBC]

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: TBC]

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 (pCO_2) by Ingunn Skjelvann and Craig Neill;
Lecture on the theory of NO_3 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: pCO_2 – 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 TBC.]

THURSDAY, JUNE 13, 2019:

Morning

Session 10: **The Carbon system: assessing and controlling measurement uncertainty in estimating the seawater CO_2 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 pCO_2 sensors by Ingunn Skjelvann/Meike Becker]

12:00-13:00 Lunch

Afternoon

Session 12: **Equilibrator-based surface measurements**
[Lecture on xCO_2 and N_2O 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: TBC]

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 TBC.]

Session 15: **Practicals of data processing (oxygen and bio-optical)**
[Oxygen - Instructors: Henry Bittig & Craig Neill;
Bio-optical – Instructors: TBC.]

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 TBC.]

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 (pCO_2) – Instructors: Meike Becker & Craig Neill.]

12:00-13:00 Lunch

Afternoon

Session 19: **Theory of data processing (pH and pCO_2)**
[Lecture on pH data processing by Dariia Atamanchuk/Phil Bresnahan;
Lecture on pCO_2 data processing by Meike Becker.]

Session 20: **Practicals of data processing (pH and pCO_2)**
[pH - Instructors: Dariia Atamanchuk & Phil Bresnahan;
pCO_2 – 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 TBC.]

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 TBC.]

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