RINGO | Readiness of ICOS

Readiness of ICOS for Necessities of integrated Global Observations

D2.5

D2.5 Organisation of at least three training workshops and summer schools for the ICOS candidate representatives and other participants oriented to the scientific content related to the ICOS research infrastructure establishment and operation.

RINGO (GA no 730944)

Public Document/define level

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1.0			
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Deliverable Review Checklist

A list of checkpoints has been created to be ticked off by the Task Leader before finalizing the deliverable. These checkpoints are incorporated into the deliverable template where the Task Leader must tick off the list.

- Appearance is generally appealing and according to the RINGO template. Cover page has been updated according to the Deliverable details. ☐
- The executive summary is provided giving a short and to the point description of the deliverable. ☐
- All abbreviations are explained in a separate list ☐
- All references are listed in a concise list. ☐
- The deliverable clearly identifies all contributions from partners and justifies the resources used
- A full spell check has been executed and is completed. ☐

DISCLAIMER

This document has been produced in the context of the *project* Readiness of ICOS for Necessities of integrated Global Observations (RINGO). The Research leading to these results has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730944.

EXECUTIVE SUMMARY

The main aim of the RINGO Work Package 2 is to support ICOS ERIC candidate and partner countries with their membership (administrative, managerial support) and their research infrastructure readiness (research infrastructure construction, operation, technical aspects).

The deliverable D.2.5 approach was, compared with the D.2.3 *(Initial joint training (including gender issues related training) for research infrastructure managers (PIs) and other relevant stakeholders of the ICOS candidate countries (M18) and tailor-made trainings for the ICOS candidate countries throughout the project)* that focused on initial training and individual consultancy, to provide knowledge transfer to broader groups rather than one individual country by the ICOS community – especially by UVGZ as RINGO WP2 leader hand in hand with ICOS HO and ICOS thematic centres (ecosystem, atmospheric and ocean) represented in WP2 by UiB (mainly for ocean ICOS agenda), UNITUS (mainly for ecosystem part), UVSQ (covering mainly atmospheric ICOS domain).

The main D.2.5 deliverable activity was the organisation of two summer schools and several training workshops based on the mapped needs of the beneficiaries of the RINGO WP2 - ICOS ERIC candidate and partner countries (INOE representing in RINGO Romania, OMSZ for Hungary, ULPGC for Spain, NOA for Greece, NUID UCD for Ireland, EULS for Estonia, ISA for Portugal, WITS for South Africa, PULS for Poland). The need mapping was carried on mainly via interviews and questionnaires.

The first RINGO summer school was organised in collaboration with ICOS Carbon Portal and the Central Facilities in Finland in Hyytiälä research station 24 May – 2 June 2017. The training participants were mainly PhD students who are involved in the scientific and technical part of the construction and operation of the RI National Networks.

The training workshops “Underway CO2 data and metadata quality control procedures” organised in Sopoty (Poland) on 1.4.- 3.4.2019 and the training workshop “The Instrumenting our oceans for better observation: a training course on a suite of biogeochemical sensors” organised in Kristineberg (Sweden) on 10. – 19.6.2020).

These activities were also open to scientists and technicians from the existing ICOS networks.

UVGZ organised RINGO Brno Summer school 2019 in collaboration with ICOS ERIC Head Office and ICOS Central Facilities (represented in RINGO by UiB, UNITUS, UVSQ) and hosted RINGO summer school from 16th to 20th September 2019. The main goal of the summer school itself was the knowledge transfer to scientists and PhD students in GHG research, and outside the ICOS community.

Series of RINGO training workshops for WP2 members were organised in the ICOS events (e.g. ICOS Science conferences, RINGO General Assemblies) as well.

Provided information and training materials from the D.2.5. activities were uploaded since 2017 using the EMDESK platform for sharing with.

D.2.5 was delivered as planned in the DoW. The main RINGO outcome reached hand in hand with WP2 related activities is, that Spain, Poland and Estonia have announced their intention to join ICOS ERIC in 2020.

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1. Introduction and deliverable aims

To provide effective geographical coverage of ICOS RI it is necessary to ensure the building of a national network in ICOS candidate countries with possible extension of ICOS RI community by fulfilling ICOS RI tasks defined in the ICOS ERIC Statutes. The main related RINGO goals meeting also goals of ICOS community are as follows:

- *To support the countries to become ICOS member and enhance ICOS membership and research infrastructure sustainability by supporting countries interested to build a national consortium (geographical readiness).*

  D.2.5 focuses on providing more general information during the joint trainings organised for several countries (compared with more individually oriented activities such as individual consultations done in D.2.3).

- *To help with promoting ICOS (ICOS provided research services) towards the national stakeholders and potential ICOS research infrastructure users.*

  This was covered mainly by other WP2 deliverables, especially by D.2.1 *(Report on enhancing membership strategy for ICOS ERIC including the online Handbook for Stakeholders)* and D.2.2. *(Concept document on collaboration with countries and stations outside the European Union). However, D.2.5 tackled the issue within more generally oriented trainings.*

- *To receive consultancy, e.g. on possibilities to use EU structural fund to build the infrastructure for ICOS observations.*

  This was mainly covered both by D.2.5. (group/general such as trainings and summer schools) and D.2:3. (individual consultancy provision) deliverables.

- *To receive training to improve the readiness of the scientists to work inside ICOS including joint research projects with ICOS community using ICOS research infrastructure and vice versa to promote already existing research outcomes of the ICOS candidate and partner countries.*

  This was the task of D.2.5 – the organisation of the summer schools and training workshops; it was also the task within the D.2.3 mainly organisation of the individual (bilateral) activities either hosted by ICOS community members (e.g. by UVGZ hosting the guests/trainees from the RINGO participating country) or the organisation of the national RI consortium events within the ICOS candidate and partner countries.

2. Used methods

The deliverable D.2.5 approach was to organise knowledge transfer to broader groups rather than to one individual country. However, even this more “general” approach was based on careful mapping of the RINGO WPs participants´ needs.

Implemented ways of the mapping of the needs:

- RINGO WP2 project preparation
- RINGO Kick of meeting
- Questionnaire
- ICOS events
- Continuous communication with the partners when providing consultancy, implementing joint projects, preparing joint publications during other scientific meetings, feedbacks from organised trainings)

2.1. RINGO WP2 project preparation

With all beneficiaries of the WP2, long-term collaboration and contacts with ICOS community have been arranged previously (before the year 2016). All partners from nine countries (Greece, Romania, Hungary, Poland, Estonia, Spain, Portugal, Ireland and South Africa) had showcased strong interest, will and determination to achieve ICOS RI membership; in case of South African partners it was to increase the partnership with ICOS community.

The outcomes of this preparatory mapping were transformed into the main RINGO WP2 D.2.5 goal that also meets goals of ICOS community:

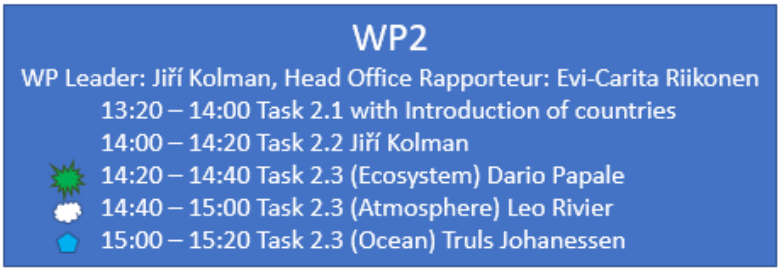
- To receive training to improve the readiness of the scientists to work inside ICOS including joint research projects with ICOS community using ICOS research infrastructure and vice versa to promote already existing research outcomes of the ICOS candidate and partner countries

2.2. RINGO Kick-off meeting

During the RINGO GA Kick-off meeting in Heidelberg, Germany (21. - 23. 2. 2017) the current issues related with development in the ICOS candidate and partner countries including the training needs were discussed in the form of The World Café (TWC) WP2.

In TWC, there were present whole RINGO (ICOS) community representatives (including key ICOS ERIC and ICOS member countries representatives) and discussed possibilities of joint activities and potential training and knowledge transfer needs and support.

See below the TWC scheme:



The main outcomes, compared with the preliminary project expectations, were as follows:

- The preference of the countries to participate in trainings organised not specifically for them but rather where participants from ICOS member countries are as well. This brings the occasions for non-ICOS colleagues to use the opportunities for the future joint research collaborations and networking.
- The need to make a questionnaire addressed to the ICOS candidate and partner countries to help among others with the mapping of the current training needs of the countries´ stakeholders who were not present in the RINGO GA (see more below).
- The wish to receive not only expert scientific training but also technical trainings oriented to, e.g. construction, operation and maintenance of the ICOS research infrastructure.
- Articulated need to have a list of the pros why the country should provide long-term support to the national research infrastructure to become an ICOS member. This issue was included in the RINGO trainings as well and also into the ICOS Handbook (see RINGO D.2.1 Report on enhancing membership strategy for ICOS ERIC including the online Handbook for Stakeholders).

2.3. RINGO Mapping Questionnaires

The need of a questionnaire was identified during the above mentioned TWC. The questionnaires were focused on the training needs of the countries´ stakeholders. The overall organisation of the questionnaires was done by the WP2 package leader UVGZ. For each country, the RINGO WP2 members were responsible for answering the questions: those were as follows: INOE for Romania, OMSZ for Hungary, ULPGC for Spain, NOA for Greece, NUID UCD for Ireland, EULS for Estonia, ISA for Portugal, WITS for South Africa, PULS for Poland.

The questions of the RINGO questionnaires were formulated based on the communication with the RINGO WP2 beneficiaries and ICOS ERIC HO. The questions related to the training needs were as follows:

- *What sort of information and trainings (topics; targeted groups of researchers, administrators ((i.e. project managers, lawyers, and financial experts)), technicians responsible for infrastructure construction and operation, governmental officials responsible for ESFRIs) would you prefer to have within the RINGO project activities, for which target groups especially? Please provide your needs to all three ICOS domains (ecosystem, atmosphere, and ocean) and also whether there is possible financial coverage of the participation of extra non-RINGO participants (i.e. national infrastructural partners, governmental officials) to RINGO events.*
- *How could ICOS and RINGO projects help you with the support to ICOS membership and collaboration at governmental level? (i.e. Which supportive documents would you need to be provided? Invitations to events? Provision of trainings?).*

The questionnaires were sent and collected twice - during summer 2017 and in summer 2019 for updating.

The main questionnaire outcomes of the training needs are as follows:

- Expressed interest to participate in other RINGO events (not only of the RINGO WP2 dedicated to them) and ICOS events (e.g. ICOS monitoring stations assemblies, ICOS scientific conference). This is also helpful for the better knowledge transfer and experience sharing.
- Several countries proposed to provide training/information to national central (governmental) authorities responsible for national research infrastructure roadmap, climate and environmental policies; they also provide supportive information, such as ICOS strategic and business cases, for briefing relevant national authorities.
- Majority of the countries also declared that the RINGO project support is the only support for their participation in the ICOS/RINGO trainings.
- Specifically, in case of the second (2019) questionnaires' outcomes, assurance that there is continuous interest in training topics in all three RINGO training segments (scientific, technical and managerial/administrative) and in all three ICOS domains (ecosystems, atmospheric, ocean).

The above described questionnaire outcomes were presented and discussed:

- During the RINGO initial training in September 2017 (see more info about the training in the D.2.3 report).
- In the RINGO General Assemblies (GA Antwerp 2018, GA Poznan 2020).
- During Summer school Brno 2019

2.4. ICOS events

During the ICOS ERIC GAs that are organised twice a year, there have been presentations of the countries' development presented by the ICOS candidate countries representatives. During these presentations are also discussions with ICOS members about the next countries´ steps that include participation in the ICOS events (such as trainings) and support with the national research infrastructure roadmap evaluations.

ICOS candidate and partners' countries representatives are invited regularly to the ICOS scientific events such as the ICOS thematic centres meetings (general monitoring assemblies) and the ICOS science conferences. Training needs are identified during these events. Naturally they address topics related with the event - usually scientific issues (e.g. technical requirements, scientific protocols) and they are addressed directly to the relevant ICOS representatives such as ICOS thematic centre representatives (thematic centre leaders are members of the RINGO WP2 as well) or ICOS HO.

2.5. Bilateral communication with the partners

Apart above-mentioned mapping activities, there are raised potential training topics and needs during bilateral collaborations among the ICOS candidates and partners and ICOS community members. For example, during joint scientific projects implementation, joint publications preparations or when providing individual consultancy, specific issues appear; later on those ones appear also attractive for other candidate countries.

The main issue that became later on as a part of the training workshop in RINGO GA in Southampton in 2019 was the question of the collocation joint sites of research infrastructures involved in several ESFRIs; for example, collocation of ICOS site with:

- ESFRI ACTRIS - Aerosols, Clouds and Trace Gases
- ESFRI DANUBIUS-RI - International Centre for Advanced Studies on River-Sea Systems
- ESFRI AnaEE - Analysis and Experimentation on Ecosystems
- ESFRI eLTER RI - Integrated European Long-Term Ecosystem, Critical Zone & Socio-Ecological Research Infrastructure

Based on the continuous mapping of the addressed training topics and needs there were organised the summer schools and training workshops as follows:

- The first RINGO summer school, Finland in the Hyytiälä research station, 24 May – 2 June 2017
- The RINGO GA in Southampton in 2019 WP2 training workshop *Funding opportunities for research infrastructures* (covering also issues of RIs collocated sites)
- The training workshop "Underway CO2 data and metadata quality control procedures" organised in Sopot (Poland) on 1. - 3.4.2019
- The training workshop "The Instrumenting our oceans for better observation: a training course on a suite of biogeochemical sensors" organised in Kristineberg (Sweden) on 10. – 19.6.2020)
- The RINGO Brno summer school 2019
- The RINGO GA in Poznan in 2020

3. Implementation and outcomes

3.1. The first RINGO summer school in Finland

The first RINGO summer school was organised in collaboration with the ICOS Carbon Portal and the Central Facilities in Finland in Hyytiälä research station on 24 May – 2 June 2017.

The main topic of the summer school was *Challenges in measurements of greenhouse gases and their interpretation*. The school handled almost all relevant aspects of Carbon Cycle science in the context of global climate change, organized as lectures and practical exercises. One session of two-half days was oriented to practical measurements using relatively simple sensors for measuring temperature, humidity and CO_2 concentrations.

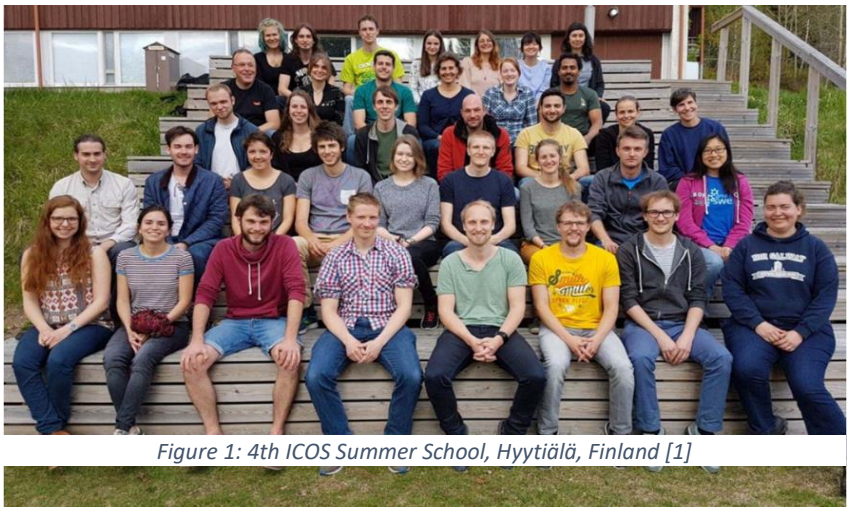


Figure 1: 4th ICOS Summer School, Hyytiälä, Finland [1]

The other session was oriented to handing on experience with (global) transport models.

The school was mainly oriented to PhD students; however, several PhD graduates and master students preparing to start a doctorate were also accepted. These activities have been opened also to the scientists and technicians from the existing ICOS networks and this fact was highly appreciated by the ICOS candidate countries because it brings more experience and knowledge to share and transfer. This type of collaboration ensures effective transfer of the expertise and contributes to the scientific readiness of the ICOS candidate countries and future technical and scientific cooperation.

Application process

The application for the Summer School was received from 70 applicants. The school had only places for 35, so a rigorous selection down to 40 persons was needed. Each candidate had to prepare a document containing the CV, a short description of her / his work and the motivation why to attend this summer school, and a letter of recommendation from his/her supervisor. The selection considered the connection between the candidate's research subject and the ICOS focus.

The students have been scored on

- motivation score based on the written motivation by the student (1-5)
- the quality of the CV and its connection to the course (1-5)
- the strength of the letter of recommendation from the supervisor (1-5)

The score was the calculated as mean score by the tow evaluators. A cut-off at a score of 4.2 resulted in 40 selected students, which all agreed and 37 of which showed up at the summer school.

From the 37 participants there were 18 males and 19 females; 8 participants were from ICOS candidate member countries, 4 from non-ICOS countries.

Training agenda

The lecturers at the summer school were:

- Christoph Gerbig (via Skype)
- Martin Heimann (ICOS Germany)
- Maarten Krol (ICOS the Netherlands)
- Anders Lindroth (ICOS Sweden)
- Greet Maenhout (ICOS Belgium)
- Alex Vermeulen (ICOS Carbon Portal)
- Wouter Peters (ICOS the Netherlands)

- Kadmiel Maseyk (ICOS the United Kingdom)

ICOS Finland colleagues Timo Vesala. Olli Peltola and Elisa Halmeenmäki were important as (local) organisers and assisted the students and teachers during the practical exercises. Aki Tsuruta assisted during the modelling practical on May 31. UVGZ as a RINGO WP2 leader assisted mainly in the part of the dissemination (including promotion and distribution of the summer school invitations to potential participants from RINGO consortium and to the others) and communication with W2 RINGO participants.

Poster abstracts: All students presented a poster and an elevator pitch presentation on the first day.

The poster session was well received and students and lecturers had good and lengthy discussions within the poster boards.

The final Summer School program is attached to D.2.5, Appendix 3

All costs (accommodation, catering, organization and lectures) were covered from the summer school funds (from project ICOS (ERIC, Finland) and RINGO).

Apart RINGO project, the summer school was endorsed by the European projects ENVRIplus and COOP+. This involvement helped to cover participation of non-RINGO participants.

ENVRIplus is a Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe.

COOP+ - Cooperation of Research Infrastructures to address global challenges in the environmental field is also a Horizon 2020 project. COOP+ general goal is to strengthen the links and coordination of the European RIs related to Marine Science (EMSO), Arctic and Atmospheric Research (EISCAT), Carbon Observation (ICOS) and Biodiversity (LifeWatch) with international counterparts (NEON, TERN, AMISR/SRI, CGSM, OOI, INPA/LBA, IMOS, OCN, AMERIFLUX, etc.) and to leverage international scientific cooperation and data exchange with non-EU countries.

Training materials and dissemination

All of the training presentations and training course materials can be downloaded in open access form from the ICOS Summer School website: http://2017.icos-summerschool.eu/main:materials

In collaboration with Carbon Portal partners, training materials related with the school were also published on EMDESK by UVGZ.

The information about the summer school and the outcomes (e.g. training materials, lessons learned) were discussed in the RINGO initial training (see D.2.3 report) and in the RINGO General Assembly in Antwerp in 2018.

The summer school experience within the presentation of the RINGO project was presented at the international conference Day of National Research Infrastructures 2017 (Session II: Long-term sustainability of research infrastructure) on 2.11.2017 in Brno, CZ.

Evaluation feedback and lessons learned

The length of lectures and the length of the modelling exercises were evaluated as nearly perfect. The length of the practical field work was judged as being on the short side.

In previous evaluations the practical modelling work was evaluated as too short and not very clear. The improvements in the current version of the training have clearly paid of as shown in the appreciation by the summer school participants in the evaluation and comments made to the trainers.

In evaluation feedback, the male dominance of the trainers was also pointed out.

In line with mapping of the training needs as described above, there was clarified that in the next version of the ICOS Summer Schools the practical exercises on measurements should receive more attention and are in for significant improvement. The more gender sensitive approach in trainers´ selection will be considered as well.

UVGZ as WP2 together with ICOS HO and central facilities reflected the outcomes of the training school, based mainly on the report of the summer school and discussions with some trained participants and representatives of the participating institutions, for the purposes of the next RINGO trainings and initial RINGO training as well.

3.2. The RINGO GA in Southampton in 2019 WP2 training workshop Funding opportunities for research infrastructures

During the RINGO GA in Southampton (on 20 - 22 March 2019) a specific training workshop for ICOS candidate and partner countries covering the issue Funding opportunities for research infrastructures was provided by Jiří Kolman (UVGZ), and the issue how to support ICOS candidate countries with their ICOS ERIC membership was provided by Emmanuel Salmon (ICOS HO). There were also arranged consultations by the representatives of the ICOS thematic centres (ecosystem, atmospheric, ocean).

Each candidate country is in a different phase of ICOS research development and due to this difference it has different needs. That is why it was good to organise the workshop as a part of RINGO GA, where all relevant colleagues from various countries and background were present: those having their own specific experience (e.g. with specific ICOS station type construction and operation) or specific national infrastructure roadmap evaluation issue.

3.3. Training workshop "Underway CO2 data and metadata quality control procedures" organised in Sopot (Poland) on 1.4.- 3.4.2019

That Sopot training workshop was organised in collaboration with the ICOS Ocean Thematic Centre on 1 April – 3 April 2019 and hosted by the Polish Academy of Sciences (PAS).

The main topic of the training workshop was *Underway and sensor co2 data and metadata quality control procedures*.

The training handled all relevant aspects of developing techniques and methodologies that allow globally coherent quality control of the surface ocean CO_2 data.

Application process

The registration was free and on a "first come – first served" basis to welcome 20 participants at maximum.

From the 14 participants 10 were male and 4 female. 10 participants were from 3 ICOS candidate countries.

Training agenda

The goal of this workshop was to update the participants, especially those who are in the process of establishing ICOS-related activities on those protocols through a series of lectures and practicals given in the context of the most comprehensive surface ocean CO2 data set, the Surface Ocean CO2 Atlas (SOCAT).

The final training program is attached to D.2.5, Appendix 4

The lectures as well as practical training were provided by:

- Siv Lauvset (ICOS Norway)
- Maciej Telszewski (PAS Poland)
- Bernd Schneider from IOW (ICOS Germany)

Apart RINGO project, the training worskhop was endorsed by the European projects BONUS INTEGRAL and AtlantOS. This involvement helped to cover participation of non-RINGO participants.

BONUS INTEGRAL - Integrated carbon and trace gas monitoring for the Baltic Sea is an integrated project funded within the BONUS Blue Baltic Call. BONUS INTEGRAL seeks to demonstrate and exploit the potential added value of the marine stations of ICOS and similar instrumentation for the ecosystem state assessment of the Baltic Sea as an important contribution to a state-of-the-art improved HELCOM monitoring (The Baltic Marine Environment Protection Commission).

AtlantOS - Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources is Horizon 2020 project that proposes the integration of ocean observing activities across all disciplines for the Atlantic, considering European as well as non-European partners.

Training dissemination

The information about the training workshop and the outcomes (e.g. training materials, lessons learned) were discussed in the RINGO General Assembly in Poznan in 2020.

Evaluation feedback and lessons learned

The length of lectures and workshop itself was evaluated positively.

However, the timing (in the middle of the semester in majority of the universities) of the training workshop was rather challenging for potential applicants. This caused quite a low number of applicants than had been expected.

3.4. The training workshop "The Instrumenting our oceans for better observation: a training course on a suite of biogeochemical sensors" organised in Kristineberg (Sweden) on 10. – 19.6.2020)

This Kristineberg training workshop was organised in collaboration with the ICOS Ocean Thematic Centre and IOCCP (International Ocean Carbon Coordination Project – consortium that aims to develop an international ocean carbon observation network and to establish international agreements on observation methods, standards, data management, and data sharing for ocean carbon research) on 10. – 19. June 2020. The training workshop was hosted by Sven Lovén for Marine Sciences (University of Gothenburg).

The overall workshop scope was to help train the new generation of marine biogeochemists in the proper use of a suite of biogeochemical sensors and to assure the best possible quality of the data produced. The main training aims of the workshop were to provide trainings on use of the (extended) ICOS network for biogeochemical sea monitoring and to provide advice for countries with upcoming ICOS infrastructure.

Application process

Figure 2: OCCP BONUS INTEGRAL Summer School, Kristinberg, 2018 [3]

The application procedure was similar to Hyytiälä summer school application process and it was based on pre-set criteria with total of 7 reviewers (reviewing all) 134 applications for 28 spots, 21 picked just from application documents, remaining to accommodate gender and regional bias.

There was strong emphasis to global geographical representation:

Regional distribution of students originally targeted and invited after review

Target	Total Count	Continent/Region
8	8	Europe
6	6	South/Latin America
5	3	Africa
5	7	North America
3	3	Asia
1	1	Australia

There were selected 28 participants (18 females) coming from 19 countries, 6 continents, and representing a total of 26 nationalities. 20 participants were from non-ICOS countries.

Training agenda

The final training program is attached to D.2.5, Appendix 5

The lectures as well as practical training were provided by 19 experts (the main organisators in bold):

Last name	First name	Affiliation	Country
Ashton	**Ian**	University of Exeter	UK
Atamanchuk	Dariia	Ocean Frontier Institute, Dalhousie University	Canada
Becker	Meike	University of Bergen	Norway
Bittig	**Henry**	Leibniz Institut für Ostseeforschung Warnemünde (IOW)	Germany
Bresnahan	Phil	Scripps Institution of Oceanography at University of California, San Diego (UCSD)	USA
Briggs	Nathan	National Oceanography Centre	UK
Connelly	Douglas	National Oceanography Centre	UK
Dall'Olmo	Giorgio	Plymouth Marine Laboratory	UK
Dickson	Andrew	Scripps Institution of Oceanography	USA
Garçon	Véronique	Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS)	France
Holding	**Tom**	University of Exeter	UK
Landschützer	Peter	Max Planck Institute for Meteorology	Germany
Neill	Craig	CSIRO Oceans and Atmosphere	Australia
Palacz	Artur	IOCCP, IO PAN	Poland
Rehder	**Gregor**	Leibniz Institut für Ostseeforschung Warnemünde (IOW)	Germany
Shutler	**Jamie**	University of Exeter	UK
Skjelvan	Ingunn	NORCE Norwegian Research Centre AS	Norway
Telszewski	Maciej	IOCCP, IO PAN	Poland
Ulfsbo	Adam	Gothenburg University	Sweden

Apart RINGO project, as it was in case of above mentioned Sopoty training workshop, the training workshop was endorsed by the European projects BONUS INTEGRAL and AtlantOS. This involvement helped to cover participation of non-RINGO participants.

Training materials and dissemination

Workshop materials might be found on the OceanTeacher Global Academy websites: https://classroom.oceanteacher.org/login/index.php

The information about the training workshop and the outcomes (e.g. training materials, lessons learned) were discussed in the RINGO General Assembly in Poznan in 2020.

Evaluation feedback and lessons learned

The training participants provided overwhelming positive evaluation and they also appreciated gained skills.

Socially strongly connected group of participants, with lots of social media exchange, tours and visits in labs, help on questions, alerting of open positions, safe audience at conferences …

The organisers jointly concluded the long-term preference of high quality rather than high number of training workshops/summer schools might be reasonable for best possible training.

They also pointed out that ICOS and IOCCP are an ideal match bridging US and European initiatives, have similar scopes and need for a certain tribe of scientists.

Based on the Kristineberg training workshop experience it was also concluded that teaching and capacity building is of central importance for ICOS, and ICOS should not restrict itself to Europe here.

3.5. The RINGO Brno summer school 2019

The RINGO Brno summer school was organised and hosted by UVGZ in collaboration with the ICOS Head Office and the ICOS Central Facilities on 16 – 20 September 2019.

Figure 3: RINGO Brno summer school 2019 [5]

The main scope of the summer school was the knowledge transfer in GHG research done by ICOS research infrastructure to scientists and PhD students solely from ICOS candidate countries.

Training agenda

The trainees from Hungary, Poland, Estonia and Slovakia attended trainings about building and operating of an ICOS station, and then about data obtaining and processing.

Another important part of the school were field trainings at ICOS CzechGlobe Atmospheric Station Křešín u Pacova and at ICOS UVGZ ecosystem station floodplain forest Lanžhot. These field trips with hands on trainings were an opportunity to see the ICOS stations in practice.

There was also an excursion to UVGZ laboratories located in Brno.

Apart from these formal parts of the training, there was also time for informal consultations and discussions for the trainees to make contact with each other and with the CzechGlobe scientific community, which will help in the future collaboration.

The lecturers and trainers at the summer school were:

- Jiří Kolman (ICOS Focal Point for Czech Republic, UVGZ)
- Marian Pavelka (ICOS national CZ contact point for ICOS ecosystem stations operated in the Czech Republic, UVGZ)
- Gabriela Vítková (ICOS national CZ contact point for ICOS Atmospheric station operated in the Czech Republic, UVGZ)
- Kateřina Komínková (ICOS Atmospheric station data manager, UVGZ
- Radek Czerný (ICOS ecosystem data operator, UVGZ)
- Natalia Kowalska (PI for ICOS UVGZ ecosystem station floodplain forest Lanžhot, UVGZ)
- Vlastimil Hanuš (technician responsible for construction and operation of the ICOS UVGZ Atmospheric Station Křešín u Pacova, UVGZ)

The final Summer School program is attached in D.2.5 Appendix 3

Training materials and dissemination

The content of the training was during the summer school preparation consulted with colleagues from ICOS ecosystem and atmospheric thematic centres and ICOS HO. In collaboration with Carbon Portal partners the training materials were published by UVGZ on EMDESK and on ICOS websites respectively.

The information about the training workshop and the outcomes (e.g. training materials, lessons learned) were discussed in the RINGO General Assembly in Poznan in 2020. The information about summer school hosting was published by press release on CzechGlobe (UGVZ) websites and on paper and electronic CzechGlobe (UVGZ) Newsletter.

Evaluation feedback and lessons learned

The training participants provided positive evaluation and they also appreciated gained skills. Based on that positive feedback and saved RINGO project resources the host team decided to prepare and organise next September in 2020 another RINGO Summer School. However, due to COVID-19 it had to be cancelled (see below).

After several years of mapping of training needs (see above) it can be concluded that for rather expert scientific trainings there are preferred mixed groups of participants from ICOS and non-ICOS countries. On the other hand, technically oriented trainings (e.g. how to construct and operate ICOS stations similar to the case of the Brno RINGO Summer School) are preferred to be organised for smaller groups from non-ICOS countries.

3.6. Cancelled and postponed RINGO summer schools due to COVID-19

Even though D.2.5 was delivered as planned in the DoW ahead, two more summer schools had been planned for 2020:

- The RINGO ICOS summer school, Finland in the Hyytiälä research station, 6 May – 15 May 2020
- The RINGO Brno Summer school 21 September – 25 September 2020

However due to COVID-19 they were either postponed (ICOS 2020 Hyytiälä Summer School from spring 2020 to May 2021) or cancelled in case of RINGO Brno Summer school 2020.

Regarding the Hyytiälä Summer School, there had already been made, before the COVID-19 cancellation, selection process of the applications (similar to the first RINGO summer school, however with emphasis and encouragement to attract more applications and participants from ICOS candidate and partner countries). A new call for applicants is starting in December 2020, current selected participants who are interested to participate next year will receive a guaranteed placement.

4. Conclusion

The main aim of the RINGO Work Package 2 D.2.5 is to support ICOS candidate and partner countries with their membership (administrative, managerial support) and their research infrastructure readiness (research infrastructure construction, operation, technical aspects) by training provision. All the provided trainings received very positive participants´ feedbacks.

There is obvious interest of the ICOS candidate and partner countries to participate in such activities in the future. However, this is jeopardised by the unsecured funding of the majority of the partners for such activities. This challenge might be partly overcome by the organisation of on-line trainings on specific ICOS related issues.

However, it has limited benefits and some positive aspects of “standard” trainings and summer schools are missing, such as practical hands-on training activities, effective networking and knowledge share among the trained participants.

The other issue that appeared during the D.2.5 implementation was the identified need to provide trainings for the ICOS RI potential users (stakeholders) from the candidate countries (that were from RINGO WP2 participating countries but not from the RINGO WP2 participating institutions) to be better prepared for ICOS RI membership and thus the future ICOS membership be used more effectively. However, this identified potential training target group was not in the scope of the RINGO project and thus it could not be addressed by specific RINGO trainings.

List of appendixes

Appendix 1: List of abbreviations

- **AMERIFLUX** - a network of PI-managed sites measuring ecosystem CO2, water, and energy fluxes in North, Central and South America
- **AMISR/SRI** - Advanced Modular Incoherent Scatter Radar
- **AtlantOS** – Horizon 2020 project for Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources
- **BONUS INTEGRAL** - Integrated carbon and trace gas monitoring for the Baltic Sea is an integrated project funded within the BONUS Blue Baltic Call.
- **CGSM** - Canadian Geospace Monitoring
- **COOP+** - Cooperation of Research Infrastructures to address global challenges in the environmental field is also a Horizon 2020 project.
- **DoW** - Description of Work
- **EISCAT** - European Incoherent Scatter Scientific Association
- **EMSO** - European Multidisciplinary Seafloor and water column Observatory
- **ENVRIplus** - a Horizon 2020 project for creating a cluster of Environmental Research Infrastructures across Europe.
- **ESFRI** - European Strategy Forum on Research Infrastructures
- **ESFRI ACTRIS** - Aerosols, Clouds and Trace Gases
- **ESFRI AnaEE** - Analysis and Experimentation on Ecosystems
- **ESFRI DANUBIUS-RI** - International Centre for Advanced Studies on River-Sea Systems
- **ESFRI eLTER RI** - Integrated European Long-Term Ecosystem, Critical Zone & Socio-Ecological Research Infrastructure
- **ESFRI LifeWatch** - The e-Science and Technology European Infrastructure for Biodiversity and Ecosystem Research
- **EULS** - Estonian University of Life Sciences
- **GA** - General Assembly
- **GHG** - Greenhouse gas
- **ICOS** - Integrated Carbon Observation System
- **ICOS ERIC** - ICOS European Research Infrastructure Consortium
- **ICOS HO** - ICOS Head Office
- **IMOS** - Australia's Integrated Marine Observing System
- **INOE** - Romanian National Institute of Research and Development for Optoelectronics
- **INPA/LBA** - Large-Scale Biosphere–Atmosphere Experiment in Amazonia
- **IOCCP** - International Ocean Carbon Coordination Project
- **ISA** - Institute of Agronomy, University of Lisbon
- **NEON** - National Ecological Observatory Network
- **NOA** - National Observatory of Athens
- **NUID UCD** - University College Dublin, National University of Ireland
- **OMSZ** - Hungarian Meteorological Service
- **OOI** – Ocean Observatories Initiative
- **PAS** - Polish Academy of Sciences
- **PULS** - University of Life Sciences in Poznań
- **RI** – Research Infrastructure
- **SOCAT** - Surface Ocean CO2 Atlas
- **TERN** - Terrestrial Ecosystem Research Network
- **TWC** - The World Café

- **UiB** - University of Bergen
- **ULPGC** - University of Las Palmas de Gran Canaria
- **UNITUS** - Tuscia University
- **UVGZ** - Global Change Research Institute CAS (Ústav výzkumu globální změny AV ČR, v. v. i.)
- **UVSQ** - University of Versailles Saint-Quentin-en-Yvelines
- **WITS** - University of the Witwatersrand Johannesburg

Appendix 2: References

[1] 4th ICOS Summer School: Challenges in measurements of greenhouse gases and their interpretation, Final report, 2017

[2] ICOS Summer School website: http://2017.icos-summerschool.eu/main:materials

[3] Rehderand, G., Bittig, H. OCCP BONUS INTEGRAL Summer School, Delivery report, 2018

[4] IOCCP BONUS INTEGRAL Workshop materials, OceanTeacher Global Academy websites: https://classroom.oceanteacher.org/login/index.php

[5] RINGO Brno summer school 2019, archives of the CzechGlobe

Appendix 3: The final Summer School program of The first RINGO summer school

(Finland in the Hyytiälä research station, 24 May – 2 June 2017)

ICOS Summer school Hyytiälä 2017		Wed 24 May	Thu 25 May	Fri 26 May	Sat 27 May	Sun 28 May	Mon 29 May	Tue 30 May	Wed 31 May	Thu 1 Jun	Fri 2 Jun
Breakfast	07:00-08:30										
Morning 1	08:30-10:00		Intro ICOS - Elevator Pitches	Observations - Gerbig	DATA	FREE	MEAS	Reporting	MODELS Krol+Peters	Reporting	BUS
Break	10:00-10:15										
Morning 2	10:15-11:45		Elevator Pitches	eScience - Vermeulen	Emissions - Maenhout		MEAS	COS & Carbon Cycle - Maseyk	MODELS Krol+Peters	Remote Sensing - Krol	
Lunch	11:45-12:45										
Afternoon 1	13:30-15:00		Cycles of Carbon and Methane in the Earth System - Heimann	Oceans Biogeo-chemistry - Heimann	Excursion	INV Models - Peters	MEAS	Ecosystems - Vesala	MODELS Krol+Peters	Remote Sensing- Krol	
Break	15:00-15:30										
Afternoon 2	15:30-17:00	BUS	Cycles of Carbon and Methane in the Earth System - Heimann	POSTERS	Excursion	INV Models - Peters	MEAS	Boreal and Arctic - Lindroth	MODELS Krol+Peters	Wrap-up	
Dinner	17:30-18:30			PARTY							
Evening	18:30-00:00	Snacks	Relax/Sauna	POSTERS	Relax/Sauna	Relax/Sauna	Movie	Relax/Sauna	Relax/Sauna	Relax/Sauna	

Appendix 4: The invitation with agenda of the training workshop Underway CO2 data and metadata quality control procedures

(Sopoty, Poland , 1. April – 3. April 2019)

Workshop on
"Underway CO_2 data and metadata quality control procedures"

1-3 April 2019
Institute of Oceanology Polish Academy of Science (IO PAN), Sopot, Poland

AGENDA

MONDAY, 1 April 2019

08.30-09.00	*Registration and coffee*
09.00-09.15	**Local logistics, tour de table** *(Maciej Telszewski, IO PAN, Poland)*
09.15-09.45	**Surface carbon observations in a global context - From requirements-driven observations, through high quality data to fit-for-purpose information delivery.** *(Maciej Telszewski, IOCCP Project Director)*
09.45-10.15	**History of the surface ocean CO_2 observations in the Baltic Sea - from Kurt Buch to INTEGRAL** *(Bernd Schneider, IOW, Germany)*
10.15-11.00	**Workshop Session 1 – Logistics, challenges and to-do's of collecting underway CO_2 data and SOCAT-worthy sensors data** *(Siv Lauvset, UiB, Norway, IOCCP Expert for data synthesis products)*
11.00-11.30	*Coffee break*
11.30-13.00	**Workshop Session 2 – Data reduction (QC1) with more common challenges, metadata needs indicating good practice and relevant auxiliary measurements** *(Siv Lauvset)*
13.00-14.30	*Lunch break*
14.30-16.00	**Workshop Session 3 – Data submission to SOCAT. General introduction to SOCAT, automated data submission system (background and hints), automated metadata submission system (background and hints).** *(Siv Lauvset and Maciej Telszewski)*
16.00-16.15	*Coffee break*
16.15-17.30	**Workshop Session 4 – Data quality control (QC2) in SOCAT – background on the efforts, groups behind it, workload, flagging system explained. SOCAT Interactive data viewers, background of usability and uses.** *(Siv Lauvset)*
18.30	*Self-paid group dinner in Sopot (TBC)*

TUESDAY, 2 April 2019

08.30-09.00	*Coffee*
09.00-10.30	**Practical Session 1 - Data reduction in your lab (QC1) with more common challenges, metadata needs indicating good practice (SOCAT flags A and B compatible and good sensor data), auxiliary measurements** *(Siv Lauvset)*
10.30-11.00	*Coffee break*
11.00-12.30	**Practical Session 2 – Data submission to SOCAT, automated data submission system demonstration, automated metadata submission system demonstration.**
12.30-14.00	*Lunch break*
14.00-15.30	**Practical Session 3 – Data quality control (QC2) in SOCAT – demonstration. SOCAT Interactive data viewers - demonstration** *(Siv Lauvset)*
15.30-16.00	*Coffee break*
16.00-17.00	**Practical Session 4 – general Q&A session related to practical aspects of data and metadata collection, reduction, submission and quality control** *(Siv Lauvset)*
17.00	*End of Day 2*

WEDNESDAY, 3 April 2019

09.00-10.30	**Workshop Session 5 – Applications of SOCAT data: global mapping, flux and budget calculations, model validation and evaluation, local and regional process studies.** *(Siv Lauvset, Maciej Telszewski and Bernd Schneider)*
10.30-11.00	*Coffee break*
11.00-12.30	**Future of SOCAT – challenges, opportunities, community needs** *(Siv Lauvset and Maciej Telszewski)*
12.30-13.30	*Lunch and meeting adjourned*

Appendix 5: The invitation with agenda of the training workshop The instrumenting our oceans for better observation: a training course on a suite of biogeochemical sensors

(Kristineberg, Sweden, 10. – 19. June 2019)

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)

****

Course Agenda

(version 7 June 2019)

****

The course will consist of a mixture of lectures and hands-on demonstrations and practical exercises. Majority of sessions, including all lectures, will take place in the "Kristineberg Aula" which is the lecture hall located in "Huvudbyggnaden" (the Main Building with reception). Several other sessions will take place in Rooms 006, 009 and 020 (all downstairs from where the reception is), as well as in the Seminarierum and in the Kurslab (Room 206) - all located in the Main Building as well. A few evening sessions will take place in the Mässen building where the dining facilities are also located.

Please note that from June 9 to June 13 all lunches and dinners will be served in the Gullmarsstrand Hotel, 15 minutes walk from the Lovén Station. Please see the walking directions here.

****

MONDAY, JUNE 10, 2019

07:30-08:30	*Breakfast (Mässen)*
09:00	**Welcome, introduction, housekeeping** *Course Organisers*
09:20	**Course objectives, expected outcomes, logistics and format of the course** *Course Organisers*
09:45	**Session 1: Scientific importance of instrumenting our oceans** *Lecture by Telszewski [60 min]*
10:45	*Coffee break*
11:15	**Session 2: Coordinated global observing networks for marine biogeochemistry** *Lecture by Telszewski [60 min]*
13:00	*Lunch (Gullmarsstrand Hotel, leaving from the Main building at 12.45 sharp)*

13:45 **Session 3: Sensors – inside out (Part 1)**

- *Lecture on oxygen sensors by Bittig [90 min]*
- *Coffee break [30 min]*
- *Lecture on bio-optical sensors by Briggs & Dall'Olmo [90 min]*

17.15 **Overview of the next day**

18:00 Dinner (Gullmarsstrand Hotel, leaving from the Main building at 17.45 sharp)

19:00 **Session 4: Introduction to sensor deployment**

Dall'Olmo, Briggs, Neill, Bittig

TUESDAY, JUNE 11, 2019

07:30-08:30 Breakfast (Mässen)

08:45 **Health and safety training by the Loven Station staff**

09:00 **Session 5: Sensor deployment**

Participants familiarize themselves with the sensors and deploy their sensors (oxygen and bio-optical) off the pier.

- *Oxygen sensors – Instructors: Bittig & Neill*
- *Bio-optical sensors – Instructors: Briggs & Dall'Olmo*

12:30 Lunch (Gullmarsstrand Hotel, leaving from the Main building at 12.15 sharp)

13:30 **Session 6: Sensors – inside out (part 2)**

- *Lecture on pH sensors by Atamanchuk & Bresnahan [90 min]*
- *Coffee break [30 min]*
- *Lecture on pCO_2 sensors by Skjelvan & Neill [90 min]*

17.00 **Overview of the next day**

18:00 Dinner (Gullmarsstrand Hotel, leaving from the Main building at 17.45 sharp)

19:00 **Evening session: Flash (2-min) presentations by participants and lecturers**

WEDNESDAY, JUNE 12, 2019

07:30-08:30 Breakfast (Mässen)

09:00 **Session 7: Sensor deployment**

Participants familiarize themselves and deploy their sensors off the pier.

- *pH sensors – Instructors: Atamanchuk & Bresnahan*
- *pCO_2 sensors – Instructors: Skjelvan and Neill*

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12:45 *Lunch (Gullmarsstrand Hotel, leaving from the Main building at 12.30 sharp)*

13:30 **Session 8: Interfacing sensors**
- *Lecture by Neill [60 min]*

14:30 **Session 9: Calibration and validation: what are the needs? Part 1**
- *Lecture focused on general perspectives by Neill [45 min]*
- *Coffee break [30 min]*
- *Lecture focused on oxygen sensors by Neill [45 min]*
- *Lecture focused on bio-optical sensors by Briggs/Dall'Olmo [45 min]*

17.15 **Overview of the next day**

18:00 *Dinner (Gullmarsstrand Hotel, leaving from the Main building at 17.45 sharp)*

19:00 **Evening session: Optics and oxygen data projects (group work assignment)**

The participants will be split into eight groups working on four different datasets. We will provide two optics datasets (chlorophyll-a and backscatter) collected by autonomous platforms that will allow the participants to experience first hand the fun (and difficulties) of analysing real data. Two other assignments will be related to deriving biogeochemical quantities from oxygen data.

THURSDAY, JUNE 13, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 10: The Carbon system: assessing and controlling measurement uncertainty in estimating the seawater CO_2 system**
Lecture by Dickson [90 min]

10:30 *Coffee break*

11:00 **Session 11: Calibration and validation: what are the needs? Part 2**
- *Lecture focused on pH sensors by Bresnahan [45 min]*
- *Lecture focused on pCO_2 sensors by Skjelvan [45 min]*

12:45 *Lunch (Gullmarsstrand Hotel, leaving from the Main building at 12.30 sharp)*

13:30 **Session 12: Equilibrator-based surface measurements**
- *Lecture on xCO_2 and N_2O by Rehder [60 min]*
- *Practicals by Rehder & Neill [3 h]*
- *Coffee break [15 min] some time during the practicals*

17.40 **Overview of the next day**

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18:00 *Dinner (Gullmarsstrand Hotel, leaving from the Main building at 17.45 sharp)*

19:00 **Evening session: Optics and oxygen data projects**

Complete analysis, summarise results within each group, compare results with other group working on the same dataset and prepare one presentation for all during Session 17.

FRIDAY, JUNE 14, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 13: Recovery of oxygen and bio-optical sensors (raw data)**
- *Oxygen – Instructors: Bittig & Neill*
- *Bio-optical – Instructors: Briggs & Dall'Olmo*

12:30 *Lunch (Mässen)*

13:30 **Session 14: Theory of data processing (oxygen and bio-optical)**
- *Lecture on oxygen data processing by Bittig [30 min]*
- *Lecture on bio-optical data processing by Briggs & Dall'Olmo [30 min]*

14:30 **Session 15: Practicals of data processing (oxygen and bio-optical)**
- *Oxygen - Instructors: Bittig & Neill [2 x 90 min]*
- *Bio-optical – Instructors: Briggs & Dall'Olmo [2 x 90 min]*
- *Coffee break [15 min] some time in between*

17.00 **Overview of the next day**

19:00 ***Kristineberg Station Summer Party (with dinner included)***

SATURDAY, JUNE 15, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 16: How to choose the right sensor depending on your circumstances?**
Lecture by Atamanchuk [90 min]

11:00 **Session 17: How to derive meaningful biogeochemical quantities from bio-optical and oxygen sensors?**
Joint presentation of data analysis results from groups working on the data projects, followed by a discussion.
Issues with biofouling in bio-optical measurements also covered in this session.

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12.25 **Overview of the next day**

12:30 *Lunch (Mässen)*

13:30 **Field trip / social activities**

19:00 *BBQ Dinner*

SUNDAY, JUNE 16, 2019

07:30-08:30 Breakfast (Mässen)

09:00 **Session 18: Recovery of sensors 3 & 4 (raw data)**
- *pH sensors – Instructors: Atamanchuk & Bresnahan*
- *pCO_2 sensors – Instructors: Becker & Neill*

12:30 *Lunch (Mässen)*

13:30 **Session 19: Theory of data processing (pH and pCO_2)**
- *Lecture on pH data processing by Atamanchuk/Bresnahan [30 min]*
- *Lecture on pCO_2 data processing by Becker [30 min]*

15:00 *Coffee break*

15:30 **Session 20: Practicals of data processing (pH and pCO_2)**
- *pH - Instructors: Atamanchuk & Bresnahan [2 x 60 min]*
- *pCO_2 – Instructors: Becker and Neill [2 x 60 min]*

17.30 **Overview of the next day**

17:45 *Dinner (Mässen)*

MONDAY, JUNE 17, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 21: Modelling for best observation design**
- *Lecture by Véronique Garçon [90 min]*

10:30 *Coffee break*

11:00 **Session 22: How to take care of data?**
- *Lecture by Meike Becker [90 min]*

12:30 *Lunch (Mässen)*

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13:30 **Session 23: Combining remote sensing and in situ biogeochemical observations**
- *Lecture by Giorgio Dall'Olmo [90 min]*

15:30 *Coffee break*

16:00 **Session 24: Smart data extrapolation**
- *Lecture by Peter Landschützer [90 min]*

17.30 **Overview of the next day**

17:45 *Dinner (Mässen)*

TUESDAY, JUNE 18, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 25: From surface measurements to fluxes (FluxEngine toolbox)¶**
- *Lecture (remotely) by Jamie Shutler [45 min]*
- *Coffee break [15 min]*
- *Practical by Tom Holding and Ian Ashton* [2.5 h]

12:30 *Lunch (Mässen)*

13:30 **Session 26: All I always wanted to know about sensors**
- *Hands-on Question & Answer session with experts and manufacturers. Multiple types of sensors presented and discussed for each parameter.*

17.30 **Overview of the next day**

17:45 *Dinner (Mässen)*

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

WEDNESDAY, JUNE 19, 2019

07:30-08:30 *Breakfast (Mässen)*

09:00 **Session 28: Emerging technologies**
- *Lectures by Doug Connelly and Véronique Garçon [90-120 min]*
- *Coffee break [30 min]*

11:30 **Session 29: Brief overview of other relevant issues and solutions**
Lecture + open discussion [60-90 min]

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12:30	*Lunch (Mässen)*
13:30	**Session 30: Ocean Best Practices (OBP) Initiative and Repository** *Presentation and demonstration by Telszewski and Palacz [45-60 min]*
14:30	**Course evaluation**
15:30	**Feedback on the 2015 IOCCP users guide to selected autonomous biogeochemical sensors.**
19:00	*Course ends this evening with a dinner party*

THURSDAY, JUNE 20, 2019

07:30-08:30	*Breakfast (Mässen)*
By 10:00	Check-out from rooms

DEPARTURE

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Appendix 6: The agenda of The RINGO Brno summer school 2019

(Brno, the Czech Republic, 16. – 20. September 2019)

RINGO SUMMER SCHOOL IN THE CZECH REPUBLIC
SEPTEMBER 16th - 20th, 2019

Monday 16 September – arrival day, **dinner is arranged at Restaurant Mitrovski**, Veletržní 716/13, 603 00 Brno at 19:00

Tuesday 17 September – CzechGlobe, Bělidla 4a, 603 00 Brno – trainings on topics: how to build and operate ICOS station, meteo measurements, data and consequences

9:00-10:00 – Introduction – CzechGlobe and ICOS

10:30-12:30 – How to build ICOS station

Lunch

13:15-14:30 – How to operate ICOS station

15:00-17:00 Meteo measurements, data and consequences

19:30 – Dinner at Restaurace Baroko, Orlí 469/17, 602 00 Brno

Wednesday 18 September

Field training at ICOS CzechGlobe Atmospheric Station Křešín u Pacova (about 130 Km from Brno; with lunch at 14:00 Klášterní Restaurace Želiv, Želiv 122, 394 44 Želiv)

departure at 8:00 AM Wed. 18 Sept. from CzechGlobe, Bělidla 4a, 603 00 Brno (arrival back to Brno at about 5 PM)

Thursday 19 September

CzechGlobe, Bělidla 4a, 603 00 Brno

9:00 – 11:00 – ICOS data flow – how they are produced and managed

11:00 – 12:00 – excursion to CzechGlobe laboratories + discussion and summer school feedback

12:00 – 13:00 - lunch

13:00 - departure from CzechGlobe to field training at ICOS CzechGlobe ecosystem station floodplain forest Lanžhot (about 70 Km from Brno, arrival back to Brno at about 5PM)

Friday 20 September – individual consultations and departure day