Task 6.2 Common metrology and Best Practices

Nutrients and oxygen sensor observations

Institut français de Recherche pour l'Exploitation de la Mer

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The workshop planned within the framework of the Atlantos project WP 6.2 “Common metrology and Best Practices” was postponed at the end of 2018 in the form of joint elements to other European consortia.

Under the auspices of the European Commission, Jerico NEXT, EMSO ERIC, ENVRIPLUS and AtlantOS, are participating to the international effort to harmonize the practices in Environmental Monitoring and to push up the interoperability technologies for sharing ocean instruments.

1. On the occasion of the Sea Tech Week 2018 in Brest (France) (www.seatechweek.eu), EMSO ERIC, JERICO-RI, ENVRIPLUS and AtlantOS are jointly proposing a 3-day workshop for technical and scientific staff, aiming to increase the level of marine observation practices (Program in Annex 1).

   The objectives will be to promote Best Practices and to develop synergies around these widely used categories of data, between EMSO, Jerico NEXT, ENVRIPLUS and AtlantOS communities, and between users of seafloor and water column data.

   A position paper on “Dissolved oxygen measurements: scientific needs, sensors accuracy and synthesis of Best Practices recommendations” for a better use of oxygen sensors in order to improve the quality of the oxygen data for scientific exploitations is planned (Deliverable 1) at the end of the workshop. The final version will be provided at the end of January 2019 for free on-line dissemination.

2. The ATLANTOS project and the JERICO-RI consortium are jointly organizing a workshop in December in Brest, with the aim of increasing the level of interoperability for nutrient and chlorophyll-fluorescence observations (Program in Annex 2).

   A position paper on sustaining ocean Best Practices (sharing experience on nutrient measurements in the lab and *in situ*) from feedback on the use of the various sensors nutriments *in situ* available on the market or developed by research institutes is planned (Deliverable 2) at the end of the workshop. The final version will be provided at the end of February 2019 for free on-line dissemination.

Gantt chart of deliverables

	2018			2019	
	October	November	December	January	February
Workshop on Interoperability Technologies and Best Practices in Environmental Monitoring	Brest 10-12 October				
White Paper final version				Deliverable 1: Dissolved oxygen measurements: scientific needs, sensors accuracy and synthesis of Best Practices recommendations	
Workshop on Interoperability of Technologies and Best Practice : Application to *in situ* nutrients and phytoplankton fluorescence measurements			Brest, 3-7 December		
White Paper final version					Deliverable 2: Position paper to express the expectations and a roadmap for future on nutrients measurements

Annex 1

EU Coastal and Open Sea Observatories

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Workshop on Interoperability Technologies and Best Practices in Environmental Monitoring

Brest, 10-12 October 2018

(Registration deadline: 5th September)

Long-term *in situ* marine observation, be it coastal or open sea, seafloor or water-column, is achieved by a variety of devices and systems operated by a number of teams meeting different demands in multiple contexts. In spite of this diversity, operators and users are facing a set of common constraints and have obvious benefits in sharing practices and means. Under the auspices of the European Commission, JERICO-RI, EMSO ERIC and AtlantOS, are participating to the international effort to harmonize the practices of this domain and to push up the interoperability technologies for sharing ocean instruments:

- The Joint European Research Infrastructure Network For Coastal Observatories (JERICO-RI, www.jerico-ri.eu) is a solid and transparent European network dedicated to provide operational services for the timely, continuous and sustainable delivery of high quality environmental data and information products related to marine environment in European coastal seas.
- The European Multidisciplinary Seafloor and water-column Observatory European Research Infrastructure Consortium (EMSO ERIC, www.emso-eu.org) is a distributed Research Infrastructure of marine observatories addressing natural hazards, climate change and marine ecosystems in the service of science researchers, marine technology engineers, policy makers, and the public.
- AtlantOS (Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems, www.atlantos-h2020.eu) is a Blue Growth research and innovation project that proposes the integration of ocean observing activities across all disciplines for the Atlantic, considering European as well as non-European partners.

On the occasion of the Sea Tech Week 2018 in Brest (France) (www.seatechweek.eu), EMSO ERIC JERICO-RI and AtlantOS are jointly proposing a 3-day workshop for technical and scientific staff, aiming to increase the level of marine observation practices.

Building on the results of previous similar interoperability workshops[1], the event will focus on:

- Sensor Web Enablement implementation.
- Cabled coastal observatories operations
- Metrology of dissolved oxygen, pCO_2 and pH in marine environment
- Dissolved oxygen and temperature: seafloor and water column data, from sensor to users.

Organisers: **Ifremer**: Jérôme Blandin, Ingrid Puillat, Laurent Delauney, Virginie Thierry, Chantal Compère; **HCMR:** George Petihakis, Manolis Ntoumas; **OGS:** Rajesh Nair; **HZG:** Wilhelm Petersen; **GeoMar:** Eric Achterberg; **CNRS:** Mathilde Cannat, Déborah Chavrit, **UPC:** Joaquin del Rio

[1] - WS on Interoperability Technologies for sharing ocean instruments and real-time data, AtlantOS - EMSO ERIC, OI London March 2018.
- WS on Best practices, EMSO ERIC, Rome, October 2017.
- WS on Cable Observatories, JERICO-NEXT, Barcelona 2016.
- WS on Harmonizing New Network Sensors, JERICO NEXT, Paris December 2016.

Agenda/content:

Wednesday 10th october 08:30-09:00 (Chamber of Commerce and Industry, Brest)

Welcome of participants

Wednesday 10th october 09:00-12:00 (Chamber of Commerce and Industry, Brest) - Sensor Web Enablement implementation - Chair: Eric Delory (PLOCAN) (TBC) and Jay Pearlman (IEEE France).

1) **Introduction** - Objectives of the session – 10'

2) Debriefing on **"Interoperability technologies for sharing ocean instruments and real-time data"**, AtlantOS - EMSO ERIC Workshop at OI-2018 London (15th march 2018) – 30'

3) **Industrial experiences of SWE implementation** (effort, difficulties, results) – 90'

- SWE implementation of the MiniFluo instrument on the ALSEALMAR glider – Laurent Beguery (TBC) – 15'
- SWE implementation of the TriOS MatrixFluo instrument (EU NeXOS project) - TriOS representative (TBC) – 15'.
- SWE implementation of acoustic sensors on the NKE Provor Float – Yves Degre (TBC) – 15'.
- SWE implementation tools – 52 North (TBC) – 15'.
- SWE implementation on observatories: EGIM – Bertrand Moreau (TBC) – 15'.
- SWE implementation on observatories: OBSEA – Joaquin del Rio (TBC) – 15'.

4) **Discussion**

- How to implement interoperability technology for on the shelves instruments (O_2, CO_2 Optode, pH sensors, etc.) and platforms (Gliders, Floats, USV, etc.)?
- How long will be the race to achieve the full chain to produce traceable measurements in databases, from sensor construction to measurement production at sea?
- How efficient is the actual situation when the components are fully interoperable?
- What is the European situation versus the other continents?
- Is the research community ready for such interoperability practices?
- R&D needed for smart sensors?

Wednesday 10th october 14:00-18:00 (Chamber of Commerce and Industry, Brest) - Cabled coastal observatories operations – Chair: Joaquin del Rio (UPC)

1) **Introduction** - Objectives of the session – 10'

From the operational experience of each presented observatory, this session aims to propose solutions likely to enhance operations on most cabled coastal observatories.

2) Debriefing on "**JERICO-NEXT Cabled Observatories"** Workshop, UPC Vilanova i la Geltrú, Barcelona 2016 – 30'

3) Six **case studies**: 90'

- OBSEA: Joaquin del Rio Fernandez, Marc Nogueras, Universitat Politècnica de Catalunya
- SmartBay: Alan Berry, Marine Institute
- EMSO Nice/Molène: Nadine Lantéri, Xavier Bompais, Ifremer
- Utö: Lauri Laakso, Finnish Meteorological Institute
- LoVe : tba
- UNH/UNS: tba

4) **Discussion:** 60'

- What is most critical in running a coastal cabled observatory?
- What are the operational issues that need most urgent improvement?
- How to decrease access costs while maximizing availability of coastal cabled observatories?

Thursday 11th october 09:00-12:00 (Chamber of Commerce and Industry, Brest) – Metrology of dissolved oxygen, pCO_2 and pH in marine environment – Chair: Laurent Delauney (Ifremer)

1) Introduction - Objectives of the session – 10'

2) Debriefing on "**JERICO-NEXT Harmonizing New Network Sensors"** Workshop, Paris December 2016 – 30'

3) **Oxygen metrology**: present situation for the marine community – 20' (F.Salvetat)

4) **CO_2 metrology**, present situation for the marine community – Arne Körtzinger or Björn Fiedler (TBC) - 20'

5) **pH metrology**, present situation for the marine community - Socratis Louciades, NOCS – or Mario Esposito, GEOMAR (TBC) – 20'

6) **Discussion**

- Interoperability and metrology, what does it mean?
- Metrology tools, laboratory or/and on board equipment and protocols?
- Metrology for carbon fluxes and acidification, are absolute *in situ* measurements achievable?
- Metrology for carbon fluxes and acidification, is traceability a dream?
- R&D needed for sensors?

Thursday 11th october 14:00-17:00 (Ifremer Brittany Center) – Metrology facilities and dissolved oxygen sensor calibration. Chair: Florence Salvetat (Ifremer)

- Presentation of the Ifremer calibration facilities all along a demonstration of a O2 reference calibration experiment at the Ifremer metrology laboratory.
- Demonstration of the EMSO O2 calibration bench under development.
- Traceability management, explanation and discussion.
- Round table on possibilities and performance of the EMSO O2 calibration bench and associated best practices that could be proposed.

2 groups. Maximum: 8 Persons each group.

Friday 12th october 09:00-17:00 (Ifremer Brittany Center) – Dissolved oxygen : seafloor and water column data, from sensor to users. Chairs : M. Cannat (CNRS-IPGP), Virginie Thierry (Ifremer)

This two half-day session will bring together producers and users of dissolved oxygen from seafloor and water column sensors, in deep sea and coastal environments. The objectives will be to promote Best Practices regarding the acquisition, qualification, distribution of dissolved oxygen data and to develop synergies around these two widely used categories of data, between EMSO, JERICO-RI and AtlantOS communities, and between users of seafloor and water column data. After a brief update on the scientific objectives specific to each community, the session will focus on the practical aspects of time series data production in each context, from sensors characteristics, acquisition parameters, quality control and calibration procedures, to data processing and interpretation.

1) Introduction - Objectives of the session – 10’
2) Presentation of the scientific issues and corresponding needs (spatial coverage, accuracy, data availability, etc..) associated with dissolved oxygen data for each community
    a) Seaflor data - Pierre-Marie Sarradin (20’)
    b) Water column data - Laurent Coppola (20’)
3) Data acquisition, state of the art of sensor knowledge, implementation and recommendations

a) Oxygen optodes - Henry Bittig (20')
b) Moorings : known issues, recommendations for implementation and qualification - Dominique Lefèvre (20')
c) Autonomous platforms (Argo and gliders) : known issues, recommendations for implementation and qualification - Henry Bittig (20')
d) O2 data acquired from SBE43 sensor during an hydrographic casts: known issues, recommendations for implementation and qualification - Laurent Coppola (20')
e) The case of very low oxygen concentration area - Aurélien Paulmier (tbc) (20').
f) Presentation of the White Paper on Best Practices prepared for OceanObs19 par Jay Pearlman (tbc) (20')

4) Data management: Dissolved oxygen data in the Coriolis Data Base - V. Racapé (20')
5) Practical session on best practices regarding data analysis (1h)
6) Final discussion and synthesis of best practice recommendations (45")

Registration:

The organising committee will select applications according to the relevance of the applicants experience to the conference and according to the availability of seats and rooms.

Pre-registrations are open on the following link: Registration_Form.

The deadline for pre-registration is on the wednesday 05th of september 2018.

The final approved participant list will be established for the 10th of september 2018.

Main sponsors: EMSO ERIC – JERICO-NEXT – AtlantOS - ENVRIplus

VENUE

On 10th and 11th morning at the Chamber of Commerce and Industry in Brest

1 Place du 19eme Régiment d'Infanterie
29200 Brest
In the city center near train station

From the airport: the best is to take a taxi or take airport shuttle service :

https://www.brest.aeroport.bzh/transports-en-commun

Taxi Brestois: +33 298 801 801

In the city center - Take public transport services
http://www.bibus.fr/


Parking Q-Park Brest Liberté
Liberté Immo Brest
Rue Yves Collet
Cercle de la Marine
Office Tourisme Brest Metropole
Rue Branda
Hôtel Vauban
Rue Marie Leneru
Rue de la République
sariat de Police
Le Quartz
Le Ruffé
Boulevard Gambetta
Rue du Château
Avenue Georges Clemenceau
Boulevard Gambetta
CIRFA
Gare de Brest
Rue du Château
Rue Colbert
2 min
110 m
Sentier du Merle Blanc
Rue de Lyon
Avenue Amiral Réveillère
Rue Poullic al Lor
Chambre de commerce et d'industrie de BREST
Rue Benjamin Delessert
Rue Voltaire
Au Fil des Crêpes
Rue Guy Ropartz
Rue Foy
Avenue Salaün Penquer
Rue Jurien de la Gravière
Tribunal d'Instance
Tamia - IDLangues Brest
Sous-préfecture de Brest
Randstad
Proman Brest
La Carène
Rue de l'Elorn
Rue Saint-Yves
Tribunal de grande instance
Cours Dajot
Avenue Salaün Penquer
Rue de Bassam
Rue de l'Elorn
Google

1625 Route de Sainte-Anne, 29280 Plouzané

<u>From the airport</u>: the best is to take a taxi - Taxi Brestois: +33 298 801 801

<u>From the City Center</u>:

Walk to Place de la Liberté

You have to go to Liberté Tramway station - Take line A: Direction Porte de Plouzané, stop at Fort Montbarey or Porte de Plouzané.

You now have to take the bus number 13 at Fort Montbarey or Porte de Plouzané, direction Plouzané Mairie (attached map) and stop at Piccard. Cross the street, walk down to the roundabout and find Ifremer gate on the right hand side.

<u>Schedules:</u>
http://www.bibus.fr/imprimez-fiches-horaires.aspx

<u>Plans</u>
***Tram ligne A*:**
http://www.bibus.fr/wpFichiers/1/1/Ressources/file/Plans%20r%C3%A9seau%202017_2018/BIBUS%20

TOTEM%20TRAM%202016-VF.pdf
Bibus ligne 13:
http://www.bibus.fr/wpFichiers/1/1/Ressources/file/Plans%20r%C3%A9seau%202017_2018/BIBUS-Ligne%2013-2016.pdf

List of hotels in the city center

Name of the hotels	Address	Phone number	Website
Oceania Centre	82 rue de siam	02.98.80.66.66	http://www.oceaniahotels.com/oceania-brest-centre.php
L'Amirauté	41 rue de Branda	02.98.80.84.00	https://www.oceaniahotels.com/h/hotel-l-amiraute-brest/presentation
Les voyageurs	2 rue Yves Collet	02.29.61.09.09	https://www.accorhotels.com/fr/hotel-A4A5-hotel-mercure-brest-centre-les-voyageurs/index.shtml
Bellevue	53 rue Victor Hugo	02.98.80.51.78	http://www.hotelbellevue.fr/
Kyriad	157 rue Jean Jaurès	02.98.43.58.58	http://www.kyriad-brest-centre.fr/fr
La Gare	2 Bd Gambetta	02.9844.47.01	http://www.hotelgare.com/
Hôtel le continental	41 rue Emile Zola	02.98.80.50.40	https://www.oceaniahotels.com/h/hotel-le-continental-brest/presentation
Abalis	7 av Clémenceau	02.98.44.21.86	http://www.abalys.com/
Hôtel de la rade	6 rue de Siam	02.98.44.47.76	http://www.hoteldelarade.com/
Hôtel St Louis	6 rue Algesiras	02.98.44.23.91	http://brest-hotel.com/
Agena	10 Frégate la Belle Poule	02.98.33.96.00	http://agena-hotel.fr/

Hôtel Vauban	17 av Clémenceau	02.98.46.06.88	**http://www.hotelvauban.fr/**

Annex 2

From Coastal to Open Sea observations

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Workshop on Interoperability of Technologies and Best Practices:

Application to in situ nutrients and phytoplankton fluorescence measurements

Brest, 3-7 December, 2018

Phytoplankton are the main primary producers in the marine food web, and they fuel the higher trophic levels with carbon and nutrients. Thus, reliable phytoplankton and nutrient data are prerequisites for a trustworthy assessment of the trophic state of marine systems, and relative evaluations of "good ecological status". Due to their fundamental role, significant effort has gone into developing techniques and methodologies aimed at assessing phytoplankton distribution, biomass, composition and productivity. However, nowadays, even if developments and researches are still expected to progress further ahead, it has become obvious we are facing diversity in the techniques and methodologies to quantify the nutrient concentrations and the phytoplanktonic biomass. With growing use of in situ sensors, quality control and calibrations in accordance to reference lab methods are essential.

Aware of these needs, the marine community has already progressed in the first steps towards harmonization of technologies and operating practices relating to similar measurements, partly thanks to several workshops and projects.

In this context, the ATLANTOS project and the JERICO-RI consortium are jointly organizing this workshop, with the aim of increasing the level of interoperability for nutrient and chlorophyll-fluorescence observations. The workshop builds on the results of previous interoperability workshops.

It is organized in 2 parts, the first one dealing with nutrient sensors, (reference lab methods and *in situ* sensors), and the second one with chlorophyll fluorescence. The event will focus on:

- Sharing experience on nutrient measurements in the lab and *in situ*, Best Practices measurements (Part 1)
- Automated chlorophyll fluorescence observations: needs of reference for metrology purposes, harmonized archiving and flow of the data towards EU channels (Part 2)

Expected outcomes

Part 1: Best practices for nutrients measurement

- Review of Best Practices in terms of reference measurements (in lab) and in terms of *in situ* measurements with nutrient sensors
- Position paper on sustaining ocean Best Practices from feedback on the use of the various *in situ* nutrients sensors available on the market or developed by industry and research institutes;

Part 2: Best practices for chlorophyll fluorescence observations

A white paper including:

- Fluorometer characteristics and their primary calibration: what are the primary optical properties the different sensors are detecting, how the sensors should be calibrated, how comparable data is obtained with sensors having different optical designs? Status, needs and gaps
- Steps in quality control of the in situ measurements: synthesis of the gaps and needs in QC, field validation and metrology, with special focus on the need of reference materials
- Harmonization of the optical biological data flow: the state of the art of the optical biological data flow through the European channels (EMODNET BIO, EurOBIS, SeaDATAcloud): Practices and how to, gaps and needs, strategy on short, medium and long term.

Total number of targeted attendees in plenary parts

- **Participants : maximum 40/ maximum 20 to each part**
- **Academic researchers, engineers and SMEs**

Organisation

This workshop is jointly organised by:

- The Joint European Research Infrastructure Network for Coastal Observatories (JERICO-RI, www.jerico-ri.eu) is a solid and transparent European system of systems dedicated to provide operational services for the timely, continuous and sustainable delivery of high quality environmental data and information products related to marine environment in European coastal seas.
- ATLANTOS (Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems, https://www.atlantos-h2020.eu/) is a research and innovation project that proposes the integration of ocean observing activities across all disciplines for the Atlantic, considering European as well as non-European partners.

Organisers: Ingrid Puillat, Laurent Delauney, Anne Daniel, Agathe Laes-Huon, Chantal Compere, **Ifremer**; Rajesh Nair, **OGS**; Wilhelm Petersen, **HZG.**

Scientific Committee for the nutrient Session (part 1) organised by ATLANTOS: Naomi Greenwood**, CEFAS,** Eric Achterberg, **GEOMAR**, **Atlantos Partners**.

Scientific Committee for the phytoplankton session (part 2) organised by JERICO-NEXT: Jukka Seppälä, **SYKE;** Felipe Artigas, **CNRS-LOG** or Alain Lefebvre (Ifremer), Klaus Simon, **VLIZ**, Naomi Greenwood**, CEFAS** …. to be confirmed

Program and agenda

Part 1: Nutrient measurements: how to implement lab good practices to the in situ sensors utilisation?

Objective: The aim of this workshop is to review the best practices applied to the nutriment measurements in the laboratory so as to determine what applies to the in situ instrumentation. This workshop suggests learning on quality procedures implemented for the lab reference methods to extract elements essential to the qualification of the *in situ* nutrient data sets. The goal is to propose a method which can be easily used and adopted by several organizations.

Tuesday 4th December

Morning session (9:00 13:30): Presentation of CFA reference method and best practices implemented for the nutrient measurements in the lab

Chair person Eric Achterberg (Geomar) and Agathe Laes-Huon (Ifremer)

1) Welcome, introduction, objectives, logistics 5 minutes
2) Chemical principles and performances of the nutrient CFA reference method (Ifremer and others?)Methodological limitations : sample storage, contaminations, salt effect (Ifremer + K. Bakker NIOZ, 15 mins
3) Use of SCOR-JAMSTEC CRMs to properly guarantee comparability of data from different laboratories and revision of the GO-SHIP nutrients manual (Malcolm Woodward PML) 15 mins

Coffee Break 30 mins

4) European intercomparison exercises by Quasimeme (Quasimeme representative M. Knockaert or K. Parmentier, to be confirmed) 15 minutes
5) Protocol for the method performance assessment and the uncertainty determination in the laboratory ; experience feedback on the normative aspects and accreditation (Anne Daniel , Dominique Munaron) 15 mins
6) Requirements for reporting of nutrient meta data (Atlantos partners) *In situ* monitoring of nutrients concentrations in rivers and lakes : european performance assessment standardization (AQUAREF, N. Guigues or B. Lepot) 15 mins

Afternoon session (14:30-17:30): Reference lab methods "practices"

Measurements of nutrients in labs (Ifremer) 2 groups, Maximum : 8-10 persons each group. Preparation of calibration solutions, use of CRMs, control charts, determination of blank values, etc..

Wednesday 5th December

Morning session (9:00-13:00): *In situ* nutrient measurements "protocols presentation".

Chairperson Rajesh Nair (OGS), Naomi Greenwood (CEFAS)

1) *In situ* measurements of nutrients (Agathe Laes_Huon Ifremer) 10 mins
2) Flash presentations of nutrient sensors commercially available or developed for research projects: (measurement principle, figures of merits, interferences size, power supply, deployment feedback) 7 mins per speakers

P. Claquin, Caen University Fr, Wiz sensor (SME Systea);

D. Munaron, LER Ifremer Fr, Chemini sensor (Ifremer),

A. Beaton, M. Mowlen NOCS, UK Lab-on-a-Chip sensor (NOCS), to be confirmed,

H. Claustre, LOV Fr SUNA sensor (SME, Satlantic),

C. Barus Legos Fr, ANESIS sensor

Coffee Break 30 minutes

Topic review:

3) Pre and Deployment experience: types of environment, mode, length of deployment, sampling frequency, self-calibration life, maintenance, biofouling, reagent storage, other…(Facilitators P Worsfold, C Barus) – 40 mins
4) Post-deployment phases: data transmission (real time…), signal treatment, interoperability, post maintenance, quality control (all sensors users) Facilitator F. D'ortenzio, 40 mins
5) How to select the right sensor and for which application? TRL, technical barriers to advancement or modification, multiple plug and play sensors, next generation of sensors (Facilitator Paul Worsfold UOP to be confirmed) - 40 mins

Afternoon session (14:00-17:30): *In situ* nutrient measurements "Practices"

Chairperson Anne Daniel , Agathe Laes-Huon

Use of several nutrient sensors (Chemini, WIZ, SUNA, NOCS Lab on Chip (to be confirmed), ANESIS, …) : pre-deployment deployment of sensors and post-deployment – 2 groups 8-10 persons each group only workshop participants

Thursday 6th December

Morning and afternoon (9:00-16:00): ***In situ* nutrient measurements, discussion**.

Chairperson : Atlantos Jerico Next leader work package + other partners

Taking into account input of sessions of Tuesday and Wednesday, Preparation of a draft white paper to express the expectations and a roadmap for future

Part 2 – Chlorophyll fluorescence observations

Wednesday afternoon

Session 1: Instrument characteristics and their primary calibration (2h)
Objective: Provide a description of the different technologies and sensors and which optical properties they are detecting. Discuss how the sensor primary calibration should be conducted, to obtain as comparable data as possible, when using different technologies. Discuss the pros-and cons of the different calibration protocols. Preparation of a draft white paper

PI: Laurent, Daniella or Florence...preparation of the synthesis and presentation

+ presentations of the instrument characteristics by providers (short)

1) Introduction to JericoNEXT and Atlantos – 10'
2) Introduction to session- Objectives – 10'
3) State of the art: Synthesis presentation (PI)- 20'
4) Presentation of some sensors characteristics (3 private companies?) 3x15'
5) Discussions 30'

Session 2: Steps in quality control of the in situ representativeness of the measurements (2h)

PI: Jukka Seppälä, SYKE

Objective: Provide an outline for QC actions for in situ measurements. Discuss which types of reference materials may be used in in situ QC. Discuss why the reference materials are needed in field quality control. What are the specific needs of each technology? How the QC of sensors will help in field validation of data. Discuss on expectation versus possibilities.

1) Introduction - Objectives of the session – 10'
2) State of the art: Synthesis presentation (PI)- 20'
3) Discussion and preparation of a white paper: expectation versus possibilities, the provider position (1h30)

Thursday Morning

Session 3: Harmonisation of the optical biological data flow
PI: To be confirmed

Objective: **Taking into account input of sessions 1 and 2, how to improve the harmonization of the optic biological data and metadata flow? Needs of the users: expectation from the modeling community and from the satellite one**. Preparation of a draft white paper to express the expectations and a roadmap for future

1) Introduction - Objectives of the session – 5'
2) Optic biological data flow: status of the harmonization and gaps : Synthesis presentation (PI)- 20'
3) Needs from the scientists: 20'
4) Discussion to write a white paper: Technical possibilities, pitfall and way forward (VLIZ , MIO et al.): 1h30'

Thursday afternoon…until 4pm

PIs: To be confirmed

Session 4: Writing the white paper, by gathering input from sessions 1-3. 4 pages max each section, in parallel or in serial sessions