CSA OCEANS 2
JPI Oceans support action

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3.2

Report on the workshop with research performing organisations (RPOs)

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CONTEXT

This deliverable 3.2 is a report of the workshop held in Brest, France 2016 as part of the developing JPI Oceans action 'European Marine Sensors Calibration Network' (EMSCN)

It is presented in the context of CSA Oceans 2 work package 3, task 3.2 'interactions with Research performing organisations' which over the three years of the project foresees three workshops with research performing organisations around topics of interest to RPOs in the context of the JPI Ocean Strategic Research and Innovation Agenda. At the JPI Oceans Management Board meeting/CSA2 Steering committee meeting held April 2016 it was decided that the first of these workshops would be on the subject of the need for a European Marine Sensor Calibration Network (EMSCN). This decision was taken based on specific pre-identified opportunity to move this specific RPO based action forward, in conjunction with the BREST Seatech meeting at which a number of the key RPOs were expected to be present.

The Management Board will be asked to give a steer on the future exploratory workshop themes in the autumn 2017. A paper with some suggestions for cross cutting actions, which might be facilitated under CSA Oceans 2 task 3.2, was presented to the Management Board in March 2017. The Board was invited to discuss, and if appropriate suggest areas where preparatory work might be undertaken, perhaps through the CSA Ocean 2 project work package 3 (networking of research performing organisations). The Board will be asked to consider this again in at its autumn meeting in October 2017 and the outcome of these discussions will inform future workshop themes for this work package.

THE JPI OCEANS EUROPEAN MARINE SENSOR CALIBRATION NETWORK (EMSCN) ACTION

The idea for a European Marine Sensor Calibration Network (EMSCN) was an outcome of the FP 7 JERICO project, which gave the opportunity to the marine sensor calibration community to come together and identify the relevant needs. The main objective of the action is to work towards metrologically sound measurements, and instruments that operate within known specifications at all times despite prolonged deployment in harsh conditions.

Within JPI Oceans, the action was proposed by Greece for the first time during the 9th Management Board (MB) meeting, which was held during 12-13 November 2015 in Brussels. Eight countries support the action at the moment, namely, Germany, Greece (Lead), France, Finland, Italy, Norway, Spain, and Sweden. During the 10th MB Meeting on 21 April 2016, the MB approved supporting the action through the CSA Oceans 2. Since then, two expert group meetings have taken place:

· 1st Meeting on the EMSCN (June 15 2016, Brussels). In this preparatory meeting, the participants agreed that the first main step should be to hold a meeting alongside “Sea Tech Week” in Brest, France, with the involvement of the most important stakeholders (research community, National Metrology Institutes (NMIs), industry).

· 2nd Meeting on the EMSCN (October 13 2016, Brest). Basic outcomes: Regarding oceanographic data/measurements, although a few recognized standards are in place, no certified reference material is available. To give an example, the impact of seawater on the sensors is not known. As a result, the oceanographers face great difficulties when it comes to ensuring reliable data acquisition,

with inevitable consequences on the quality of the research they conduct. The NMIs confirmed that manufacturers seem limited by the fact that they do not have reference material available. Therefore, one of the thrusts for this action is to ensure manufacturers follow a standard calibration procedure to ensure QA/QC (quality assurance/ quality control) of the products delivered to the field – a process that could follow the form of a certification procedure. To this end, the NMIs can contribute by helping the oceanographers and manufacturers to establish validated metrological procedures. The NMI representatives consider this a novel and interesting message, i.e. that a bottom-up initiative results in NMIs involvement with the main goal being to address a societal need. More details can be found in the meeting report (Annex I).

This CSA Oceans 2 supported meeting of the EMSCN followed directly after a JERICO NEXT WP2 workshop on the 11th and 12th October, also held in Brest, France under the wider aegis of the Seatech meeting. The JERICO NEXT workshop was much more technical and as such after an introduction on what happened during JERICO FP7, it focused on specific parameters which were not handled during the previous project.

The CSA workshop, supported by CSA Oceans 2 work package 3.2 had a completely different aim, to bring the wider calibration community together in one network which will include, oceanographers, metrologists, developers etc. Unlike JERICO NEXT where the people involved were only those partners running calibration labs, the CSA meeting targeted three different sectors; operational oceanography, national metronomy institutes and the industry. The CSA funds went towards the hire of specific meeting room for the 13th October (charged by IFREMER) together with the travel and subsistence costs for the identified external experts. The staff effort to organise the workshop was provided by the lead country, Greece, and staff of the JPI Oceans Secretariat. The costs for the attendance of 'nationally nominated experts' were met by the participating countries.

NEXT STEPS

Four factsheets for four variables (salinity, pH, fluorescence, pCO2) and one white paper (summarizing the outcomes of JERICO on calibration) have been developed and are being used as the basis for determining the next steps. Additional partners have also been identified. These documents were presented to the JPI Oceans Management Board at its meeting on 20 March 2017. A dialogue with the Management Board will start in summer 2017 so as to define priorities before the action enters its implementation phase.

REPORT OF THE 2ND MEETING ON THE EUROPEAN MARINE SENSORS CALIBRATION NETWORK (EMSCN)

Date/Location: 13th October 2016 (09:00-17:00) / CCI, Brest, France

PARTICIPANTS:

Name	Organisation	Country
Delauney, Laurent	IFREMER	FR
Del Rio, Joaquin (morning)	UPC	ES
García Izquierdo, M. Carmen	CEM	ES
Lawrence, Nathan	ANB Sensors	UK
Lekkas, Anastasios	JPI Oceans	BE
Le Menn, Marc	SHOM	FR
Nair, Rajesh	OGS	IT
Ntoumas, Manolis	HCMR	GR
Peruzzi, Andrea	VSL	NL
Petihakis, George	HCMR	GR
Salvetat, Florence	IFREMER	FR
Sega, Michela	INRiM	IT
Seppälä, Jukka	SYKE	FI
Sparasci, Fernando	LNE/CNAM	FR
Stoica, Daniela	LNE	FR
Talbi, Chiraz (morning)	IFREMER	FR
Wehde, Henning	IMR	NO

Excused: Kai Sørensen (NO), Anders Tengberg (SE), Richard Williams (UK)

PRESENTATIONS

The meeting started with a number of presentations from the scientists, the National Metrology Institutes (NMIs) representatives, and the industry representative.

George Petihakis gave an overview of JPI Oceans and the history of the action. The need to calibrate the sensors measuring marine quantities was recognized by the oceanographers who participated in

the JERICO (FP7) project. As a long-term and holistic approach was deemed necessary, a relevant action was proposed to the JPI Oceans Management Board (MB) and is currently supported by 7 countries (Finland, France, Germany, Greece, Italy, Norway, Sweden)[1]. George described a possible way to implement the European marine sensor calibration grid (involving a two-level process), and also highlighted the potential impacts of the action and the added value of JPI Oceans.

Florence Salvetat started with the activities of the metrology laboratory at IFREMER, which is dedicated to a number of physical and physico-chemical parameters. Then she gave a description of the current state-of-play and calibration-related challenges for a number of quantities (temperature, pressure, oxygen, practical salinity, pH, turbidity, fluorescence, and current). The fundamental issues are the lack of representativeness, relation to SI units, and that there is no universal methodology w.r.t. the different technologies. To this end, it is necessary to define reference materials and methods. Collaboration among oceanographers, NMIs, and the industry is essential in order to achieve progress and the group should feel free to explore new ideas.

Rajesh Nair elaborated on why a marine sensor calibration network is necessary. Although sensors are getting better all the time, the quality of the resulting data is not necessarily the desired one. The purpose of calibration is to quantify the level of uncertainty, ensure traceability to recognized reference material, and ensure comparability of measurements over time and across technologies. At the moment, only temperature and pressure measurements satisfy these requirements. In order for the EMSCN to tackle this problem, it should involve the NMIs, the industry and the marine research institutes. Rajesh also explained why such involvement would be beneficial for all the aforementioned actors.

Fernando Sparasci presented the NMI point-of-view on measuring physical parameters, such as temperature, in the oceans. He explained how metrology is moving from artefact-based measurement standards to new standards based on fundamental constants and measurement of thermodynamic properties. The collaboration between NMIs-Oceanographers is necessary due to the high accuracy and traceability required in the field. LNE is working towards this direction with a) seawater *temperature,* by modifying their acoustic gas thermometer to receive SBE35 and b) *salinity,* by developing a calibration facility for the NOSS sensor by *NKE Instrumentation*.

Daniela Stoica (in a joint effort with Michela Sega and Steffen Seitz, PtB) presented the NMI point-of-view on measuring physico-chemical parameters, such as practical salinity, pH, and pCO2. Reliable data acquisition requires calibrated, well-qualified and validated tools. NMIs can support the oceanographic institutes move towards that direction. The project ENV05, led by PtB, is dedicated to metrology of ocean salinity and acidity. Daniela mentioned the three pillars of metrology (traceability, validated procedures, uncertainty) and focused on presenting in detail the traceability framework for practical salinity, pCO2 and pH. She concluded by describing how the individual actors (NMIs, industry, research community, international organisations) can interact for a successful outcome.

Nathan Lawrence gave an overview of the sensors designed by *ANB Sensors* and the industry considerations when it comes to such products. He explained the particularities and needs of chemical sensors and pointed out that, among the limited number of commercial sensors, few are

[1] Since the meeting Spain has also joined the action

rated for oceanographic deployment. Moreover, Nathan described the calibration-less techniques implemented by *ANB Sensors* in order to achieve more consistent measurements, while at the same time stated that not everything can be done in this way and a reference system is necessary.

DISCUSSIONS

The participants raised a number of topics during and after the presentations, presented here in no particular order of importance:

- Although a few recognized standards are in place, no certified reference material is available. To give an example, the impact of seawater on the sensors is not known. As a result, the oceanographers face great difficulties when it comes to ensuring reliable data acquisition, with inevitable consequences on the quality of the research they conduct. The NMIs commented that manufacturers seem limited by the fact that they do not have reference material available. Therefore, one of the thrusts for this action is to ensure manufacturers follow a standard calibration procedure to ensure QA/QC (quality assurance/ quality control) of the products delivered to the field – a process that could follow the form of a certification procedure. To this end, the NMIs can contribute by helping the oceanographers and manufacturers to establish validated metrological procedures. The NMI representatives consider this a novel and interesting message, i.e. that a bottom-up initiative results in NMIs involvement with the main goal being to address a societal need.

- The differences between ITS-90 and the Thermodynamic Temperature Scale (TTS) were discussed. Some experts supported the adoption of the TTS as a necessary means to reduce uncertainties already present in ITS-90 and achieve higher accuracy; an important prerequisite when it comes to measuring anthropogenic global mean changes, such as greenhouse gas increases. A counterargument was that using the TTS is not a necessity and calibration is not the most important factor in reducing uncertainty; that is, even if an instrument is perfectly calibrated in the lab, its uncertainty will be significantly increased when the instrument is exposed to the ocean environment.

- One of the most important issues is biofouling, which is a highly-nonlinear phenomenon and often in-situ measurements are required in order to compensate for its effects. Although this is a recognised problem to all those who have practical experience, very small investments have been allocated to address it.

- The structure and hierarchy under which the NMIs operate was discussed. BIMP coordinates the NMIs at international level and organises joint activities, such as comparisons. Euramet is the coordinator at EU level. Both institutes have a number of committees and subcommittees dealing with different quantities. There is a trend now for the NMIs to work for societal needs and, as a result, participation in programmes like EMPIR is a goal the NMIs normally go after. Regarding the EMSCN action, the participants concluded that other ways to access funding should be sought since a) a long-term approach is needed and the duration of EMPIR-based projects typically does not allow this, b) although Euramet has a working group on environment, there is no dedicated group for oceanography; a future goal could also be to expand the scope of such groups so as to make them relevant for

oceanography too. In addition, the EMSCN group could act as an advisor toward such organisations in the future.

- The consortium must try to identify the relevant needs for this type of applications very carefully, since often needless activities take place. Moreover, there are many fragmented actions in a large number of projects. The group ought to try to create its own dynamics. The oceanographic community tended to be more uncoordinated compared to others, but now there is a joint effort towards a European Ocean Observing System (EOOS), whose exact role will be determined after the ongoing consultation. EOOS will act as a general umbrella in the field and the EMSCN could be one of its pillars that provides services and also does research.

- An overview of a few ongoing JPI Oceans actions (microplastics, deep sea mining) was given and the participants were encouraged to think outside the box (not only seek for funding in the conventional ways) and come up fit-for-purpose activities that will help the action achieve substantial progress. The CSA Oceans 2 project can provide a small push of approximately 10.000 Euros for this action.

- The participants agreed that it is best to identify a few parameters of wide importance and for which some work has been done already, so as to avoid splitting the group and losing momentum. To this end, it will be useful to correlate Technology Readiness Levels (TRLs) with current calibration practice. Starting from the quantities where more mature work has been conducted will allow the group to demonstrate results within a reasonable time frame.

- Daniela Stoica informed the group about the existence of white papers (plus an overview paper) on three key climatological observables, namely, *oceanic salinity*, *seawater pH*, and *atmospheric relative humidity*. These papers will be distributed to the group. During the discussion that followed the participants agreed to focus initially on *pH*, *salinity*, and *fluorescence*.

Short-Term Assignments

- George Petihakis will prepare a white paper based on the JERICO (FP7) project deliverables that dealt with calibration. The new document will summarise the information on the essential ocean variables (OEVs), including current practices in the laboratories and test sites within the countries participating in the action. The summary must be short enough to make it practical to be presented to the JPI Oceans Management Board during its next meeting, which will take place in Berlin between 12-13 December 2016.

- The following group members will prepare (by November 10) three versions of the JPI Oceans factsheet, one for each of the three[2] agreed parameters:

    1. Marc Le Menn – salinity
    2. Daniela Stoica – pH
    3. Jukka Seppälä – fluorescence

[2] Since the meeting a 4th factsheet, for pCO2, has also been developed

The three factsheets will then be merged in one single document.

- Based on the collected information above, the group will identify how the NMIs together with the industry can create some study cases in the existing oceanographic platforms. It is worth noting that the NMIs have not used a similar site for this purpose before. An additional useful outcome for the oceanographers is to show that oceanographic infrastructure attracts transnational access.

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