

## **OceanObs Research Coordination Network Meeting Minutes**

**October 16 2015**

The meeting was held from 10AM to 11AM via Webex. The meeting included three presentations and short descriptions of RCN and Community activities. A partial list of attendees includes:

Simon Allen, Mark Bourassa, Paul Bunje, Francisco Chavez, Eric Delory, Janet Fredericks, Eileen Hofmann, Paul Holthus, Bob Housman, Matt Mowlem, John Orcutt, Jay Pearlman, Francoise Pearlman, Hans-Peter Plag, Sam Simmons, Heidi Sosik, Sandy Williams

### **Agenda**

Lab on a Chip by Matt Mowlem

Ocean Sustainability by Paul Holthus

In situ Sensor advances by Eric Delory

Community Activities:

Bio Sensors - Francisco Chavez

Bio Task Team status - Sam Simmons/Bob Houtman

Blue Planet Initiative – Hans Peter Plag

Meeting in San Francisco December 13

### **Lab on a Chip by Matt Mowlem**

Dr. Matt Mowlem is the head of the Sensors Development Group at the National Oceanography Centre, Southampton, UK. His research focuses on the development of novel biogeochemical sensors, with an emphasis on in situ systems. He contributes to many European observation projects and many innovations in sensor technology.

Dr. Mowlem presented the work of the National Oceanography Centre creating “lab on a chip” for insitu marine observations. The presentation emphasized the developments for biogeochemical sensing, but the applications and capabilities are broader. For example, in the areas of sensor, activities include: Water physics (CTD), Water

chemistry, Water biology, Sediment flow and properties, Wave height/breaking and Sea surface fluxes.

In addition, there is work on samples and the infrastructure that surrounds the sensors from platforms to communications.

- Samplers
  - Continuous water
  - Gas tight water
  - Particles
  - Genomics
- Landers and benthic systems
- Communication systems

Even with the expansion of capabilities, monitoring biogeochemistry on a global level is a significant challenge. ARGO floats present opportunities, but cannot address the full range of chemistry and analytical targets in the ocean. Other platforms could be available also. The key message there are lots of potential platforms and opportunities to measure biogeochemistry but this is not routinely done because of the lack of robust cheap sensor systems with sufficient performance.

For biogeochemistry, Matt noted areas for targeting:

Salinity (microsensors, 0.002psu)

Nutrients (microM coastal / deep, nanoM open ocean)

Trace metals (n -fM)

Gases (n-uM)

Carbonate system (0.001 pH equiv)

Small organics, e.g. PAH, PCBs (f-pM)

Proteins and large organics (copies / L)

Nucleic Acids: organisms, eDNA (copies / L)

Whole cells (cytometry)

Radionuclides.

The sensors needed are quite diverse to achieve these objectives. They also have a wide range of maturities so that a comprehensive set of observations is emerging, but further development is anticipated. Lab on a chip is an interesting way to mature a selected set of measurements and a way to broaden applications. The lab on a chip currently under development at NOC includes the following measurements: Nitrate, Nitrite, pH, Phosphate, Silicate, Iron, Manganese, Total Alkalinity, Ammonia, DOP, Dissolved Inorganic Carbon, ..... . The advantages of lab-on-a-chip are: Small footprint, Low power, Easy to build, Low reagent consumption, No waste

emission. As the technology matures, there are, of course, other advantages in cost, consistency of observations and broad deployment.

Matt gave a number of interesting examples of measurements in deep waters and in estuaries. These included pH, nitrates, nitrites, and macronutrient cycles. Data and sensor images are available in his presentation. The presentation will be available on the RCN website.

There was a question on biofouling of the lab-on-a-chip. Matt related his experience of measurements in estuaries and in surface waters for a year without biofouling issues. There are a number of reasons for this:

The microfluidics operate in a dark environment; there is a 0.4-micrometer filter at the entry to the fluidics section; and the reagents used are aggressive. NOC had expected fouling and was surprised that there was no fouling. There are, of course, cases where fouling could occur such as something getting stuck on the filter and changing its characteristics. There are other projects that are addressing biofouling whose results are being monitored.

Matt pointed out the sensitivity of the sensor system - typically sub two micromole for nitrates,

Heidi asked about calibration of the sensor. Matt said calibration can be done between each measurement, but it is not felt that this is a repetition level is necessary. Typically a calibration is done every 10 measurements.

### **Paul Holthus on Ocean Sustainability**

Paul Holthus of the World Ocean Council gave the next presentation. Paul is founding President and Chief Executive Officer of the World Ocean Council. He works with the private sector and market forces to develop practical solutions for achieving sustainable development and addressing environmental concerns, especially for marine areas and resources. His experience ranges from working with the global industry associations or directors of UN agencies to working with fishers in small island villages. He has been involved in coastal and marine resource sustainable development and conservation work in over 30 countries in Europe, Asia, the Pacific, Central America and Africa.

Paul discussed the question of ocean sustainability. This is a global issue involving all segments of ocean participation. The discussion was provided in the context of an upcoming conference by WOC on Ocean Sustainability. The Sustainable Ocean Summit (SOS) is a global, multi-sectorial platform for leadership of companies and organizations to

advance the development and implementation of industry-driven solutions to ocean sustainability challenges. The WOC is looking at a 15-50 year vision of the oceans with a look at different segments of the ocean industry including areas such as aquaculture, renewable energy, mining and fishing. The objective of the meeting is to address alignment across sectors, which can create long-term capabilities to more broadly address sustainability. This work of WOC should be of interest to the science community. Paul suggested that there are opportunities for joint collaboration and mutual benefit. For example, industry has platforms and vessels that can be used for ocean observations. Paul will report on the results of the conference at the RCN December 13 2015 meeting.

### **In situ Sensor advances by Eric Delory**

Dr. Eric Delory has worked in ocean science and biomedical engineering in positions ranging from applied research to management, in Europe and Asia. Before specialising in ocean observing systems and infrastructures, he developed hardware solutions, signal processing and machine learning techniques, applied to bioengineering and ocean sciences. Oceanic Platform of the Canary Islands, a now long-term funded infrastructure for ocean science and technology, where he became head of the observatory (PLOCAN) in 2010. Among other activities, Eric is coordinator of the NeXOS project that is part of the European Commission Oceans of Tomorrow program.

Dr. Delory addressed two areas in his presentation – passive acoustics and transversal innovations. Transversal innovations are those areas that can support multiple sensors such as biofouling innovations or new data management capabilities. Working from sensor to user, application of recent technologies such as Pluggable Underwater Connector with Knowledge (PUCK) enable increased interoperability platform across sensor type. Adding to this web-enabled sensor operating system (SOS) sensor to user web enabled software addresses insertion of up to date technology into observation systems. For acoustic systems, the incorporation of embedded processing enables improved acoustic measurements in bandwidth limited systems and platforms. NeXOS is a European Oceans of Tomorrow 2013 project that is addressing these issues. Through the development of a Smart Electronic Interface for Sensor Interoperability (SEISI) incorporating PUCK, SOS and other capabilities consistent with open standards and a focus on miniaturization and low power consumption, there are new opportunities for multi-sensor functionality for mobile platforms.

Eric gave an example of AUVs and an acoustic sensor interfacing with the platform through an RS232 link. While the RS232 was identified, multiple options were mentioned including many of the existing solutions for both on-board processing and communications (e.g. Ethernet connectivity). Looking at the RESON 4032 hydrophones, Eric showed data at three frequencies (63 Hz, 125 Hz and an integrated band from 10Hz to 10KHz). In NeXOS, acoustic sensors with much higher dynamic range and sensitivity will be available for testing during the next year. Eric summarized these developments planned for NeXOS including the platform that are planned for test and validation. The project is about halfway into its four-year life and testing will be started in 2016.

### **Community Activities**

Bio Task Team status - Sam Simmons/Bob Houtman updated the status of the Bio Task Team report. The report is the results of surveys to government agencies and a panel of science experts as to priorities for ocean biology measurements. The report has grouped observations into priority categories that complement the current IOOS EOVs. The report is undergoing review in the government with release expected this year. Upon release, Sam will provide a presentation to the RCN.

Bio Sensors - Francisco Chavez is leading a working group on sensors for ocean biology. This is a follow-on to the Bio Task Team. The question of matching requirements with measurement capability – present and planned – is a part of prioritizing the biology essential ocean variables. The working group is creating a matrix of possible sensors and their attributes. The outcomes will be provided to the ocean community to stimulate further discussion.

Blue Planet Initiative – Hans Peter Plag noted that the Blue Planet Initiative of the Group on Earth Observation concluded its second workshop earlier this year in Australia. Outcomes will be available in proceeding that will be published shortly. The third meeting will be held in 2017 in the US.

Meeting in San Francisco December 13 – Jay Pearlman noted that the next meeting of the RCN will be an in person meeting to be held in San Francisco the day before the AGU. An agenda is being confirmed and will be available in mid November.

There were no questions about the community reports.

Jay Pearlman thanked all the speakers and participants for their participation. The meeting was adjourned.