POGO-15 Draft Minutes
21-24 January 2014
Hobart, Tasmania
Australia

Wednesday 22 January

Inauguration (Chair: John Field)

John Field welcomed the delegates to the POGO-15 Meeting, then introduced His Excellency The Honourable Peter Underwood AC, Governor of Tasmania, who was invited as a guest of honour to open the meeting. The Governer had invited the delegates to a Welcome Reception at Government House the same evening.

Theresa Sainty, a member of the aboriginal community working for the education department welcomed the delegates, in a local aboriginal language, to her country and to Hobart. She spoke about the long and illustrious aboriginal heritage, which is dynamic and continually evolving. After the welcome, she shared a DVD with the delegates.

His Excellency then gave his Opening Address. With a population of half a million, Tasmania prides itself in its commitment to ocean science and to Antarctic research. Hobart is home to a critical mass of scientists dedicated to climate change, including the Convention on the Conservation of Antarctic Marine Resources (CCAMLR) Secretariat, which holds a 2-week Commission Meeting every year; the Australian Antarctic Division (AAD); CSIRO; IMAS whose new premises were to be formally opened on 24th January; and the University of Tasmania (UTAS) Cooperative Research Centre. His Excellency was very honoured to welcome so many distinguished scientists to Hobart. He highlighted the importance of oceans in shaping the Earth's climate and the interconnectedness of the oceans. He noted that POGO has achieved a great deal in its short life of 15 years, such as its contribution to the completion of the Argo network, the advancement of OceanSITES, and more generally to the establishment of a global ocean observing system through international cooperation. He also noted that POGO had succeeded in reducing the imbalance in observations between the northern and southern hemisphere. He lauded POGO's goal of communicating the importance of ocean observations to policy makers and the general public. He suggested that the work of scientists was of no import if it could not be communicated to policy makers in non-technical terms, and that effective communication was at least as important as the data themselves. "A word from the wise is of no use unless it can be understood". He said that communication was a skill that could be learnt, and that although public outreach was listed as the last bullet point in POGO's list of priorities, it should never be seen as the least important.

Bruce Mapstone then provided the welcome from the host's perspective, on behalf of CSIRO. He thanked the Governor and Theresa Sainty. He said that is was a very important time for POGO to be meeting. Scientists were facing many challenges with new developments in modern technology for ocean observations implying the production of vast amounts of data. At the same time, Australia and many other countries were facing funding constraints with respect to maintaining the scientific community necessary to analyse and understand the data and to deliver the results to the broader community. This meeting provided an opportunity to discuss separate and collective responses to these challenges. It would also be desirable to attract new members to the POGO community.

Mike Coffin welcomed the participants on behalf of IMAS, and thanked the excellent support teams of both CSIRO and IMAS staff. He stated that POGO's greatest challenge was to harness the expertise of its members and to strategise and advance ocean observations. There would be ample opportunities for interaction between members, both formally and informally.

Overview of POGO activities in 2013 (Chair: Bruce Mapstone)

Highlights: John Field

John Field gave an overview of POGO and its achievements in 2013, for the benefit of the new delegates and His Excellency. He underlined that POGO was a non-governmental organisation, hence able to respond quickly to new situations and needs.

He mentioned POGO's contribution to Capacity Building: the IOC Panikkar Medal awarded to Shubha Sathyendranath in recognition of POGO's contribution to capacity building; the successful start of the NF-POGO Centre of Excellence (CofE) in Germany, after the first phase was completed in Bermuda; results from the NANO regional projects; enthusiastic feedback on the POGO-SCOR fellowships; and cooperation with SCOR and leverage of additional funds for the POGO professorships.

POGO was represented at the high-level Science and Technology for Society (STS) Forum in Kyoto, Japan. The Ocean session was chaired by Jane Lubchenco (former NOAA Administrator), and reported on by the Editor-in-Chief of *Nature*.

Oceans United's first major initiative was the launch of the Blue Planet Task within GEO. This Task now provides an opportunity for POGO members to access funding for collaborative work on an Atlantic Observing System.

He also underlined that a new format had been adopted for this Meeting (Finance Committee, workshops, Partners' Meeting) and that he was looking forward to seeing how it worked out. There would also be opportunities to learn from the meeting hosts given their successes in scientific collaboration (IMOS and Blue Link models).

Report on the new NF-POGO Centre of Excellence at AWI: Karen Wiltshire

The new CofE runs at two locations, the islands of Helgoland and Sylt in the North Sea. One approach is "Question-based learning", whereby students are presented with the "backdrop" of ideas and problems on a number of issues facing oceans such as oil and gas industry, offshore wind parks, marine noise, marine genetic resources, sea cables, marine reserves, offshore aquaculture, marine extraction. Human resources and communication are key to addressing such issues. The goals of the CofE are to: expand the world-wide capacity to observe the oceans; develop human resources in emerging countries, and enhance international networking in ocean sciences, with an emphasis on training young scientists from emerging countries. Thus, the Centre provides world-class education, using the infrastructure and expertise of the AWI and building on existing POGO expertise, and networked with international experts.

Each year 10 students from 10 countries will be selected. The selection criteria are: trainees have to have at least a first degree in science; they should have a position in a research or academic institution in a developing country and anticipate returning to their home country after the training; they should demonstrate the relevance of the training to planned ocean observations in home country, and a history of working in team. Thanks to the NANO programme, the activities of the trainees will be monitored for many years to come. The selection procedure is extremely complicated. An initial evaluation of applications reduces the pool of applicants to 25-40 very high-scoring ones. Inputs are solicited from a POGO Advisory Committee and from POGO members from specific regions. After the meeting of the POGO Advisory Committee, a list of finalists and alternates is submitted to NF. The level of English language ability is established through a more personal evaluation, conducted via a telephone interview.

The current group of scholars has four females and six males. There are scholars from Cuba, Trinidad & Tobago, Brazil, Togo, Tanzania, Indonesia, Thailand, Bangladesh, India and Tibet. Karen presented the individual profiles of the 10 students, their academic backgrounds, countries and

personal traits/key skills. She showed how the students share their knowledge and expertise, depending on their specialisms (e.g. some scholars help with the teaching of their specialist topic). So far the students have undertaken 2-week modules on statistics, writing and presentation skills, general oceanography, biogeochemistry, and biological oceanography. In the next few weeks they will be taught remote sensing, chemical/physical oceanography, then they will move to Sylt for the last 5 months of the programme. They will each undertake a research project, which will be mentored by a supervisor.

Global Alliance of CPR Surveys: Nick Owens/Graham Hosie

This talk highlighted the importance of sustained long-term observation conducted in a consistent manner. Sir Alister Hardy recognized the importance of plankton observations for fisheries studies. In the 1920s, he devised a simple mechanical device for sampling plankton that is towed behind a ship over hundreds of miles: the Continuous Plankton Recorder (CPR). Its key advantage is that it does not require a research ship, because it can be deployed from commercial vessels, and the samples are returned to the lab for analysis. The core area of sampling is the North Atlantic for SAHFOS, which conducts 10,000 nautical miles of sampling per month.

Sustained biological time series are rare (examples include CalCOFI, BATS, HOTS). However, this type of observation is the only way to obtain data showing community changes over time. Over the last hundred years open-ocean biological records and time-series observations have increased, and the CPR survey was one of the earliest to start. The CPR survey now has a "commonwealth" of observations around the globe: the Global Alliance of CPR Surveys. CPR sampling in the period 1931 – 2013 has produced over a million samples. Based on the data, GACS produces a Global Marine Ecological Status Report every year or so. Findings include changes in phenology (i.e. the spring phytoplankton bloom has become more spread out). New developments imply that scientists are moving from microscopes to molecular techniques to analyse the CPR samples, and so discovering previously unknown phytoplankton species.

Progress in and future plans for the "Oceans and Society: Blue Planet" Task: Trevor Platt

Blue Planet is a Task within the Group on Earth Observations (GEO). GEO has 88 member states and European Commission and 67 participating organisations (including several UN Agencies) and POGO. GEO produced a 10-year plan to develop the Global Earth Observing System of Systems (GEOSS), initially from 2005-2015. The continuation and structure of the programme were confirmed in Jan 2014 at the 10th GEO Plenary and Ministerial Summit (GEO-X) in Geneva. GEO is structured around nine Societal Benefit Areas, and the ocean impacts on all of these. POGO has lobbied strenuously over the years to increase the prominence of oceans. These are now explicitly represented by the Blue Planet Task.

Mission: The Oceans and Society: Blue Planet Task of GEO seeks, through the mobilisation of expert knowledge,

- to raise public awareness of the role of the oceans in the Earth system, of their impacts (good and bad) on humankind, and of the societal benefits of ocean observations;
- to coordinate the various marine initiatives within GEO and develop synergies between them; and
- to advocate and advance the establishment and maintenance of a global observing network for the oceans.

The Blue Planet task has six components: sustained ocean observations, sustained ecosystems and food security, ocean forecasting and services, services for the coastal zone, ocean climate and carbon, developing capacity and social awareness. Partners include a diverse and highly influential

community. The four members playing central roles are: POGO, representing in situ capacity, CEOS representing satellites, GODAE for modelling and GOOS for coordination at the UN level.

A Kick-off Symposium was held in Ilhabela, Brazil, in November 2012, with the aim of finding synergies between the Task elements. Actions included the production of a White Paper and a book. The book has been submitted to the publisher and the White Paper has been finalised, and distributed at GEO-X and POGO Meeting. Following the Symposium, many requests were received from other programmes willing to participate (e.g. Ocean Acidification Network, Coastal Zone Community of Practice). The Task now has significant clients, such as the UN World Ocean Assessment. A second Symposium is planned to take place in Australia in late 2014.

Blue Planet received multiple endorsements by national delegations and Participating Organisations at GE-X. It benefits from a strong engagement with the EC, in relation to ocean observations. The statement from the Galway Meeting to explore intergovernmental collaboration with Canada and USA (the Atlantic – A shared resource) mentions Blue Planet. As a further example, the EC requested that its side event in Geneva be hosted jointly with Blue Planet (this was called "Towards an Integrated Atlantic Ocean Observation System aided by GEO's Blue Planet Initiative"). The EC has recently launched a new research funding programme for the next 7 years (Horizon 2020). Among the first set of calls, issued in December 2013, is a call for an Atlantic Ocean Research Cooperation Alliance, which could provide opportunities for POGO and Blue Planet. In this context, Atlantic Observing infrastructure could be developed, with the global ocean in mind.

POGO business (Chair: John Field)

Some meeting logistics were presented by Bruce Mapstone and Mike Coffin, before the self-introduction of participants.

The delegates approved the Minutes of the 14th meeting of POGO, with no amendments.

The meeting agenda was adopted with no further amendments, although it was noted that some changes had been made since it had been distributed electronically, and that the new version was available as a hard copy.

John Field then introduced the concept of the Interim Finance Committee. Following the model used by SCOR, this was being tried for the first time for POGO, as a mechanism to engage members outside of the POGO Executive Committee in the detailed scrutiny of the budget. The members of the FC, an ad hoc body, were appointed by the Chair in advance of the meeting, so that they would have the opportunity to meet prior to the meeting (this took place on Tuesday 21 January) to go over the budget in some detail. The FC for POGO-15 was chaired by Nick Owens (UK) and the members were Sun Song (China), Gilles Lericolais (France) and Graham Shimmield (USA).

Some discussion followed about the mechanism for appointing the Chair and members of the FC. It was noted that this mechanism, if found useful, needed to be formalised in writing, with Terms of Reference and a mechanism for appointing the FC (Avery, Hill).

New members:

A new member in 2013 is the Geochemical and Environmental Research Group/ Department of Oceanography (GERG/OCNG) of Texas A&M University, represented by Tony Knap. Some delegates (Avery, Taylor) raised concerns about GERG being a very small component of a much larger ocean science effort at TAMU. *[Further discussion of this took place during the Partners' Meeting]*.

As of January 2014, the Australian Institute of Marine Science (represented by John Gunn) is joining POGO. AIMS is a Federal Institution, established in 1972, with its headquarters in Townsville, and

laboratories in Darwin and Perth, plus an office in Canberra. It is ranked globally in the top 1% for Environment and Ecology, and Plant and Animal Science (Thomson ISI). SCIMAGO ratings are consistently world class. AIMS receives $40m/yr in appropriation funding and approximately $20m/yr in co-funding (industry and Foundations), and counts 200 staff + 20 Postdoctoral Fellows and 80 PhD students. It has a number of research vessels, a National Sea Simulator, advanced analytical labs and instrument workshops. AIMS is an organisation with strong national and international collaborations and a focus on research training.

Reports on POGO activities in 2013 (Chair: Mike Coffin)

Overview of Action Items: Sophie Seeyave

See presentation and background documents.

Report from Communications Workshop: Sophie Seeyave

The Workshop was attended by 13 people, plus one attending via Skype. The attendees were members of the POGO News and Information Group (2), POGO members (2), communicators from Hobart-based international/national organisations (6), and members of the Secretariat (3 + 1 via Skype). Presentations were given on the following topics:

- Australia's Integrated Marine Observing System (Jess Tyler)
- Communicating the RV Investigator (Sarah Schofield)
- Communicating an international observing program (Louise Newman).

Achievements in 2013 included:

- Increased input from members to the POGO newsletter; e.g. last issue had articles from: VLIZ, SAMS, KAUST, NOC/BAS, AWI, IMR/NOAA, GERG, PML, JAMSTEC, SIO, NIOZ (13pp).
- Facebook page created for all POGO alumni; joined by 40+ alumni in the first month; alumni post opportunities and links to NANO website.
- Plans for 500th anniversary celebration of Magellan Expedition underway, focussing on past, present and future of ocean observations.
- Craig Macaulay has arranged for a film student (Nick Roden) to film interviews of POGO Member Directors during the POGO Meeting. The resulting video could be used to attract media interest in the Magellan celebrations, and in ocean observations more generally.

Outcomes from the Communications Workshop:

- Hobart-based organisations interested in joining POGO NIG (as agreed during POGO-14): SOOS, IMOS.
- Interaction between POGO and other organisations has generated some new thoughts and ideas.
- Other organisations see the value in engaging with POGO.
- Feedback on Communications Strategy (further discussion required).
- New contacts in media; Possible collaboration with BBC (*New Frontiers from North to South*) –contact through Jess Tyler.
- Radio/press interviews set up by Craig.

Actions/issues:

- Possible need to formalise the role of NIG members so that they feel their participation has appropriate support at their institute.
- Also need to demonstrate the value of being a member of NIG.
- Inter-sessional on-line meetings, with physical meeting perhaps every 3 years.

- POGO promotional materials to be made more readily available to NIG members, e.g. banners, brochures, presentations…

Possible funding sources:

- Horizon 2020 call on ocean literacy: discussions with MBA/VLIZ/Gothenburg Univ. They are very interested for POGO to join their consortium, as they see the value in having networks such as POGO to increase the global coverage without having too many partners/work packages and dilution of funds.
- Need to discuss mechanism through which this could be done (practical issues).

Reports from Member Directors on specific Action Items

International Training Centre for Operational Oceanography (ITCOOcean): Satheesh Shenoi

The Centre organised a short course on "Ensemble Kalman Filtering - Methods and Algorithms for Data Assimilation" during July 15-26, 2013

- Faculty - Prof. Lakshmi Varahan, The University of Oklahama, USA
- 40 Participants from around India

A Summer School on "Fundamentals of Ocean Climate Modeling at Global and Regional Scales" was held during August 5-14, 2013, in collaboration with the International Centre for Theoretical Physics (ICTP) and CLIVAR.

- Faculty from USA, Australia, Italy and India
- 30 Participants from Australia, Belgium, Nigeria, Kenya and India.

Planned courses during 2014:

- One-week course on Remote Sensing of Potential Fishing Zones (PFZ) and Ocean State Forecasts on March 24-29, specially designed for Indian Ocean RIM Countries.
- Tsunami SOP familiarization -1 day intensive training course in April-May for state and national disaster management officials.
- Tsunami Warning –customized one week course for the officials of Oman Tsunami Warning Centre.
- Two day workshop on Ocean Information and Ocean Data Products for the cyclone forecasters of IMD in March/April.
- Training workshop on the Use of Satellite Wind and Wave observations in Marine Forecasting for the Indian Ocean region planned jointly with NOAA – a two week training course in September 2014.
- Operational Oceanography - two months Certificate course being planned jointly with Ocean Teacher Academy of IODE/IOC in Oct –Dec 2014.

Courses in collaboration with POGO are envisaged in the future.

Plans to form an inter-operability working group: Bob Weller

In response to this task, it is proposed that POGO adopt a strategy to promote interoperability among ocean observatories by taking an initial focus on a pilot project on ocean observatory interoperability followed by subsequent plans to foster this interoperability on a global basis. The initial focus, during the pilot project, would be on coordinating and guiding interoperability of ocean observing in the North Atlantic. The intent with this focus is to use current and planned observing efforts in that basin together with the current momentum to build a foundation of cooperation on observing and interoperability. Given this foundation, POGO would then work to adopt the North Atlantic as a model for expanding and sustaining ocean observing on a global basis. The context for the initial focus on the North Atlantic includes the following: the Galway Declaration on North Atlantic

cooperation; the planned deployment of the US and UK OSNAP arrays; the planned deployment of the US NSF Irminger Sea Array; German, Dutch observing efforts; FixO3 time series sites; Canadian/German efforts in the Labrador Sea; the Atlantic Meridional Overturning Circulation (AMOC) observing efforts; the Argo float deployments; repeat hydrographic/biogeochemical sections; remote sensing; collaboration on interoperability under efforts such as COOPEUS; IPCC class modelling of change and variability in the Atlantic; and ecosystem change observed in the North Atlantic. This would be done in coordination with the COOPEUS effort, an EU-US program to promote interoperability of geophysical observatories, including a pairing of the US Ocean Observatory Initiative (OOI) with the European Multidisciplinary Seafloor and Water Column Observatories (EMSO). It would also be done using the OceanSITES data sharing success as a foundation and in dialogue with other ocean data interoperability programmes such as ODIP.

POGO and its partner organisations (Chair: Nick Owens)

Oceans and Society: Blue Planet (cont'd): Trevor Platt

Trevor Platt gave additional information in the afternoon on the 6 components of Blue Planet and elements within each Component.

Ed Hill asked what the expectations were (from GEO), what resources exist and whether POGO was equipped to deliver the Blue Planet agenda. Trevor answered that many elements within BP had their own funding but there had been no funding for coordination since the end of the Canadian Space Agency funding. GEO activities are typically conducted on a "volunteer best effort" basis. Nonetheless, Australia has offered to sponsor a Symposium in 2014.

Outcomes of the 2014 GEO Ministerial Summit: Douglas Cripe

GEO is an international voluntary partnership for coordination of Earth Observation and to raise the visibility of issues that need to be addressed. The increased visibility could enhance the raising of resources where needed. The GEO Plenary approved the GEO Report on Progress for 2011-2013, which featured ChloroGIN. It also approved the Assessment of Task Progress, where Blue Planet was given a yellow rating, because ChloroGIN and SAFARI need funding. This also highlighted the need for inter-operability between ocean data portals such as OceanSITES and the GEOSS portal. The European Commission has been putting a lot of money into GEO-related activities. EC is certainly very interested in Blue Planet and has earmarked 20 Million Euros for Atlantic observations, which it hopes will be addressed under the Blue Planet umbrella.

The Ministerial Summit was well attended by ministers of Member States. The Mandate for GEO was renewed through to 2025. The Vision for GEO 2025 was approved. A Working Group is to be nominated to prepare the next GEOSS Implementation Plan (2016-2025). POGO members could nominate experts to speak on oceans to their individual governments.

Several global programmes have been initiated through GEO (GEOGLAM, GFOI) and Blue Planet is prominent there even though it is very recent, and POGO is to thank for taking the lead in preparing the WP, organising the Symposium and organising the Task and pushing it through the various GEO channels.

There is the possibility of a meeting on Southern Ocean observations in South Africa under the Blue Planet umbrella.

Intergovernmental Oceanographic Commission: Nick D'Adamo

The IOC's Perth Programme Office (PPO) was renewed for a further 5 years, aligned with the 4 year renewal of the co-located Secretariat for the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning System, both significantly underpinned by Australian resourcing. The PPO focusses on the Indian, SW Pacific and Southern SEA oceanic regions, with added relevancies to Australia. It helps to maintain and facilitate the GOOS Regional Alliances in the Indian and SW Pacific oceans, and works in an integrative manner with neighboring regional IOC nodal offices (eg IOC Sub-Commissions) and Australian ocean observing systems, such as the national Integrated Marine Observing System (IMOS).

The IOC assigned significant resources, through both its central Secretariat and PPO, in moving forward the development of plans for the IIOE-2 (International Indian Ocean Expedition 50th Anniversary Initiative). This involves bringing together a community of practice through reference group meetings co-chaired by Nick D'Adamo (PPO) and Prof. Raleigh Hood (UMCES, USA; SIBER) - so far in India and China during 2013, the IIOE-2 agenda item at the 2013 27th IOC Assembly meeting, and imminently a likely third Reference Group meeting for the western Indian Ocean in Mauritius, all leading to papers and a related draft resolution at the forthcoming 47th IOC Executive Council in mid-2014, with a view to having IOC adopt the IIOE-2 as a formal programme for 2015-2020. IIOE-2 is gathering momentum and engaging an ever increasing complement of high level scientists, institutions, global science alliances and countries. The PPO's website is a good source of information on IIOE-2 (http://iocperth.org).

As an exemplary highlight of overall progress of the Global Ocean Observing System, the Argo profiling float network surpassed one million profiles for vertical temperature and salinity, being twice the number collected by all research vessels in the 20th century. Over 100,000 new profiles are collected every year, about one new profile every four minutes, giving the world a 3D picture of key aspects of the globe's upper ocean structure on average approximately every 10 days, harmonized with the data returns from the many other GOOS components.

IOC continued to provide scientific and technical support to the Regular Process, now called the World Ocean Assessment (WOA). The IOC made a voluntary Commitment at the Rio+20 Conference (Brazil, 20-22 June 2012) on 'Building Global Capacity for Marine Sciences, Observation and Transfer of Marine Technology'.

The Commission has initiated a process to develop a Capacity Development Strategic Plan – to motivate implementation via partnerships. A high level Inter-sessional Working Group now meets to take this forward.

Another UN / Rio+20 related initiative is the concept of developing a Global Ocean Science Report, also having an inter-sessional working group which meets ahead of the next IOC Assembly meeting. The report will provide an overview of national investments, resources and productivity in ocean sciences, motivated by a need to assess and react to related needs of developing nations and small island developing states.

In his closing remarks, Nick D'Adamo mentioned that partnerships are ever more critical for all of us, and expressed, on behalf of Wendy Watson Wright, the IOC's appreciation and acknowledgement of POGO's role in supporting our collective aims in the global oceans, noting POGO's strong connections and linkages to the IOCs own mission. The IOC looks forward to working closely with POGO into the future.

GOOS and Framework for Ocean Observing: John Gunn

The GOOS Steering Committee met in Qingdao in March 2013. A GOOS Regional Forum will be held in May to bring all GOOS regions together. GOOS made a presentation to the IOC General

Assembly in June 2013. It was stated that biogeochemical/ecosystem observations would have to be dropped unless additional funding was made available –this was not well received by the Assembly.

New Co-Chairs and a Secretariat for the Ocean Observations Panel for Climate (OOPC) have been established. GOOS is working on the alignment of key initiatives (DOOS, TPOS, AtlantOS) with FOO. A Workshop of Technical Experts was held in Townsville, Australia, in November, to identify Biogeochemical and Ecosystem EOVs.

GOOS funding decreased from ~450K to ~350K in 2012, dipping into its emergency fund (200K USD) in 2013.

GOOS held its first Biological/Biogeochemical Observations workshop, including 40 international experts, many of them from the POGO community. The Workshop consisted of intense discussions, and the development of candidate EOVs for Biology/BGC. The formation of Working Groups to continue the work, and prospective pilot projects were discussed. The Terms of Reference for the Panel were determined. The Chair and membership of both panels are to be determined if funding comes through.

In terms of collaboration between GOOS and POGO it was noted that we (1) Share a common goal, (2) Want to avoid duplication or any sense of competition, and (3) See merit in promoting each other's mission. Also, building the Biological and Biogeochemical Panels and extending GOOS would benefit hugely from POGO input. GOOS also sees the value of collaborating with Blue Planet (remote sensing and in situ observations critical for Biology/BGC), and particularly with GACS and Ocean Tracking Network.

Ed Hill commented on the need for POGO members to maximise the use of POGO as a forum to discuss directly the collective effort of POGO members towards advancing the global observing system.

Report on OceanSITES and proposal for deep MicroCAT network: Uwe Send/Bob Weller

POGO could play a role in advocating for the continued operation of time-series stations (e.g. New Zealand to be discontinued). There has been some regional buy-in: for example Korea (KIOST, Seoul National University and KOPRI) has become a major contributor to OceanSITES, with sites established in the Pacific.

The 2013 OceanSITES meeting was held in Seoul at the Seoul National University. Both Steering Committee and Data Management Teams met. Both Taiwan and China participated for the first time. The participants worked on updating network information and maps, defining requirements, metrics, and improving data flow.

OceanObs09 identified a gap in the Global Ocean Observing System below 2000m. In response, the OceanObs09 follow-up process – The GOOS Framework for Ocean Observing (FOO) is developing a deep ocean observing system (DOOS) as a GOOS pilot project. OceanSITES can make a quick contribution to this. They have put forward the following proposal for consideration by POGO and FOO.

The rationale is that OceanSITES can make use of existing platforms for deep observations to reduce cost, speed up implementation, increase time/event resolution, provide higher data quality compared to other autonomous systems, and allow autonomous sensor improvement in general.

Early implementation would focus initially on temperature and salinity (T/S); 50 locations already have deep T/S sensors, but uneven coverage and data QC. The challenge is to add ~50 more to get a more even distribution, which requires 100 new sensors. PIs who add one deep sensor to a mooring contributing to increased coverage would earn an additional sensor from a matching pool.

Donations have been received from several POGO members, both financial (SIO, WHOI, GEOMAR) and instrument donations [AWI (3), SNU/KIOST (3), NOC (20)]. Possible donations are currently under discussion with Brazil and JAMSTEC. OceanSITES has negotiated with SeaBird Electronics for them to match these donations. A total of ~50 instruments have been received, which is what was wished for. In addition, all instruments purchased since Oct 2012 are eligible for free factory calibrations.

One-off financial contributions to running the project office were received from POGO, WHOI, SIO and NOC (5K USD each). Annual contributions are made by Ifremer (5K) and NOAA (30K). The office has been without a data management leader for 2 years. They have identified a possible new leader at SIO, but funds (at least for travel) would need to be sought.

A report on OceanSITES and a proposal for deep MicroCAT network have been produced. OceanSITES is well positioned to address many issues that have been raised by the Deep Sea community. Many of the time-series stations in OceanSITES are multi-disciplinary sites.

Discussion of collaboration with other organisations, particularly through the Blue Planet Task

Gilles Lericolais commented that Oceans Compact was not consultative and POGO could play a role in writing a position paper for this document.

Ed Hill stated the need to articulate, collectively or individually, the need for sustained ocean observations and their value for money. There are examples such as CPR where the applications of the data, for example in fisheries, are being demonstrated.

Brian Taylor commented that POGO could work on identifying and filling in the gaps in the observing system, particularly in the Southern Hemisphere. John Gunn raised the question of whether the members are working as a community or as individual institutions justifying their funding at the national level. If they are working together, the aim should be to identify the gaps and pool resources to fill in those gaps. Stein Kaartvedt mentioned that KAUST is looking to fill gaps in the Red Sea through collaboration with international partners.

Bob Weller noted the issue of ship time for access to the Southern Ocean and other remote areas.

Ed Hill stated that ship capacity is decreasing in Europe and N. America. Alternate technology such as gliders can fill some gaps, but some critical measurements cannot be undertaken without ships.

POGO Capacity Building (Chair: Karen Wiltshire)

Update on NF-POGO Alumni Network for Oceans (NANO): Sophie Seeyave

See presentation and background material.

Report on other POGO capacity building activities: Shubha Sathyendranath

See presentation

Fellowships should be seen as beneficial to both parent and host institutes. Out of all POGO-SCOR fellowships 70 hosts and 38 parent institutes have been POGO institutes.

Jesse Ausubel asked how much should be spent on CB, and if there is a good balance between CB and other activities. Shubha replied that it was important to have a portfolio of activities that complement each other, and that it would be detrimental to drop any particular element of that portfolio. She also stated that it was valuable to keep track of the alumni and monitor their progress, as is being done through NANO.

Linking POGO with OceanTeacher Global Academy: Greg Reed

IODE aims to assist IOC Member States to acquire the necessary capacity to manage their marine data and information. Ocean Teacher is a web-based training resource for marine data and information management, aimed at data/information managers, researchers and University students. It consists of a Course Management System, using the Moodle software (>35 courses available), and a digital library (wiki). Ocean Teacher Academy (OTA) aims to establish an annual teaching programme; >700 students have been trained between 2009 and 2013.

The next phase, Global Academy, aims to establish regional training centres, and to plan, organise and implement training courses that serve needs of regions and use local experts. It will promote collaboration/networking between Regional Training Centres. These are to be established in IOC-Africa, IOCaribe, IOC-INDIO and IOC-WESTPAC, and topics will relate to all IOC programmes (IODE/OBIS, IODE/ICAN, HAB, GOOS, JCOMM, Tsunami Warning). The aim is to use cloud teaching to enhance participation and lower cost. Focus will be on local issues while keeping a global perspective. The programme has been funded for 2014-2018.

IODE has been cooperating with POGO for a number of years, in particular providing data management training at the CofE in Bermuda (total 29 students trained during 2-week courses over 3 years). Future plans include continued cooperation with CofE, accreditation of courses, providing training to POGO members through OTA Global Academy; sharing training programmes through OTGA (on-line, through Moodle, materials can be uploaded).

Discussion of POGO Capacity Building

Jesse Ausubel raised the issue that POGO is a very small organisation and therefore cannot do everything. Training the future leaders is a niche that POGO could occupy and make a difference in.

Trevor Platt responded that identifying the future leaders is facilitated by a very rigorous selection process, and that there are many excellent applicants for the training programmes.

Ed Hill stated that "What is POGO?" is an excellent document that describes the original objectives (mandate) of POGO, and questioned whether POGO is carrying out all the types of activities that are listed. He suggested that POGO needs to find a relative balance between activities, and that the core observing activities are perhaps not getting enough attention. This issue cannot be resolved overnight; perhaps a group of interested individuals should prepare a short list of items that are mandatory bearing in mind POGO's limited budget, and assess if POGO is reaching its goal in these areas.

John Field highlighted that the three legs on which POGO stands are capacity building, ocean observations and policy/outreach. The parallel workshops during POGO-15 aim to address the observing part, and give some of the responsibility to the members. He agreed that organisations need to reassess their priorities periodically, but that the current POGO Strategy is relatively recent (2011). Ed Hill suggested establishing a process for determining the POGO strategy.

Trevor Platt underlined that not only the scholars but the host institutions are beneficiaries of the fellowship programme. If institutes want to benefit more from this, they could propose a brief summary of work that could be undertaken as part of the fellowship, which would be made available to prospective applicants. They could also offer cruise training, which would involve giving up one berth and some travel/subsistence funds.

Thursday 23 January

Parallel workshops

1. Autonomous devices for deep-sea observations (Chair: Bob Weller)

The objectives of this workshop were: (1) To discuss the need for deep ocean observations by autonomous devices, identifying what variables should be observed and with what sampling design; (2) To identify the challenges to be faced (e.g., calibration, stability, power consumption); (3) To summarize the present state of the art (what exists, what is needed); (4) To call out the need for further development.

Presentations were given by:

- Steve Rintoul: Climate Change 2013: The Physical Science Basis (Working Group I contribution to the IPCC 5th assessment report
- Bernadette Sloyan: Deep Ocean Observing Strategy
- Susan Wijffels: A deep mission for Argo? Requirements and status
- Bob Weller/Uwe Send: OceanSITES

Discussions addressed to what extent existing initiatives (e.g. OceanSites, GO-SHIP) could be used to populate a deep-ocean observation system. The idea of a Minimalist OceanSITES Interdiciplinary Network (MOIN) was mentioned, with the goal of enhancing a subset of existing platforms with a minimal set of identical physical, biogeochemical, ecosystem observations (air-sea flux, mixed-layer, 15 m currents, pCO_2 and O_2). Discussions then focussed on possible collaborations with industry (e.g. oil and gas, deep-sea mining, fisheries). It was agreed that multiple platforms are needed to have a complete deep ocean observing system (e.g. Argo, gliders, ROVs, fixed-point time-series, repeat hydrography). The importance of data integration, synthesis and access, as well as modelling of deep-sea processes, was highlighted.

2. What can POGO do for SOOS? (Co-chairs: Dosoo Jang and Louise Newman)

The objective of this workshop was to address the question "How can SOOS and POGO work together and use our collective international might to address some of the big gaps in our understanding of the Southern Ocean and our ability to observe it?".

Presentations were given on the following topics:

The Science and Vision of SOOS – *Bronte Tilbrook (CSIRO, SOOS SSC)*
The Data Vision for SOOS – *Kim Finney (AAD, SOOS SSC)*
Current and Future Priorities – *Louise Newman (SOOS IPO)*
An International Contribution to SOCOM – *Steve Rintoul (CSIRO, SOOS SSC)*
An International Contribution to a Mammal-Tagging Initiative – *Mark Hindell (IMAS)*

The discussion addressed the possibility of POGO (members) to be involved in putting together an international bid for a project relating to Southern Ocean observing. Although such a project was not considered to be a role for POGO as an organisation, individual members were encouraged to contribute to SOOS, in particular through in-kind contributions (e.g. ship time). POGO could also play a role in facilitating the data contribution from POGO member institutes to SOOS, and from SOOS to GEOSS. Coordination of ships operating in the Southern Ocean could also be a topic for POGO and SOOS to work together, in collaboration with ODIP (Ocean Data Interoperability Portal), COMNAP (Council of Managers of National Antarctic Programs) and CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources).

Emerging initiatives in ocean observations (Chair: Margaret Leinen)

Need for a global, long-term programme of ecological monitoring: Tony Koslow

In his talk, Tony Koslow pointed to a way forward based on more closely allying physical, biogeochemical and ecological observations with fishery observations, leading to a truly sustainable global end-to-end ocean observing system.

GOOS, established in 1990, and Argo have been remarkable achievements. However, the promise of GOOS is still unfulfilled. Ecological measurements have been referred to as "an embarrassing gap" (K. Alverson). Coastal GOOS remains fragmented and unsystematic. Zooplankton time series with species resolution include CalCOFI, CPR, Station Papa and a Japanese programme that have run for longer than 20 years, and some other more recent programmes. Regarding micronekton, the only time series is CalCOFI, which has run from 1951 to present. The dominant pattern in ichthyoplankton relates to oxygen in the water. Oxygen has been declining across the northern N Pacific and in tropical waters, confirming predictions by GCM. This is a potentially profound impact of global climate change with implications for global ocean food webs, ecology and biogeochemistry, but these are presently unknown.

A solution could be to use the CalCOFI model and apply it globally. CalCOFI is a partnership between a federal agency (NOAA), state fishery/ management agencies and an academic institute (SIO). Government agencies undertake stock assessments for key regional fisheries (sardine, anchovy, hake) based on egg production and/or acoustic/trawl surveys, whereas the academic partner focusses on physical/biological ocean environment. Quarterly fishery and oceanographic sampling at each station builds fishery/oceanographic scientific infrastructure and produces interdisciplinary science. This lays the foundation for ecosystem-based management. In addition, linking ocean observations to fisheries management enhances program sustainability. As a result, today there are time series for >400 fish taxa, both commercial and non-commercial. The presentation ended by highlighting that the cost of applying the CalCOFI model to the 56 Longhurst biogeochemical provinces would be approximately 280 million USD. Compared with the cost of the US Ocean Observatories Initiative (386 million USD) and the US space programme (18 billion USD), this suggests that the cost is not the real issue, it is rather about setting priorities.

The Ocean observing system 2014: Jesse Ausubel

The software is now as much the global ocean observing system as the hardware (e.g. biogeographical observations). Every vessel, every platform, every research project can now be part of "The System" (e.g. Ocean exploration vessels). We need to persuade the offshore oil and gas industry to become a big financial supporter. The distribution of taxonomically reliable biological observations is uneven, with large gaps in the (South) Pacific and Arctic. Interoperability is improving (e.g. Encyclopedia of Life). "TraitBank" allows users to search on many biological and environmental traits associated with organisms.

The proportion of ocean industry represented by oil and gas pumping and mining has increased over the last 40 years, from 11 to 42 %, while tourism has decreased. Offshore oil & gas fields are distributed throughout the world but three regions - the North Sea, the Gulf of Mexico and the South China Sea - attract over 50% of spending. Relative shares are changing, with steady growth forecast everywhere except Western Europe, and with the Atlantic margin off West Africa and Brazil plus the Persian Gulf now attracting much greater spending levels. Another major new expanding area is Sakhalin Island off Russia's east coast.

New programmes for Indian Ocean observations as part of IIOE-2: Satish Shenoi

The International Indian Ocean Expedition (IIOE) was the first initiative of SCOR when the organization began in 1957, to address the paucity of oceanographic data in the Indian Ocean. Many

US scientists were inspired by the idea and became involved. The management of IIOE was transferred to IOC in 1962. The scientists involved in planning IIOE also felt need for the establishment of laboratories in this area in addition to sampling the Indian Ocean.

Prof. R.B. Montgomery was the first to express his desire that "…this program can be so designed as to aid directly the development of one or more oceanographic centers in the countries bordering the Indian Ocean".

The planners of IIOE also recognized the importance of standardization and intercalibration. An Indian Ocean Standard Net was adopted for plankton hauls and the Indian Ocean Biological Centre was established at Cochin to process the samples. 13 countries participated in the programme between 1959 and 1965. Some 350 months of ship time was brought to bear in the Indian Ocean in cruises under IIOE. IIOE ended in India with a Post Graduate level training programme (25 trainees) held in Mumbai (sponsored by UNESCO and CSIR) and the birth of NIO on 1 January 1966.

The middle of this decade marks the 50th Anniversary of IIOE. A combined meeting of IOGOOS, IOP, SIBER and IRF in Cape Town, South Africa, in 2012, decided to champion IIOE-2 on behalf of Indian Ocean countries. India appointed a National Organising Committee in March 2013 to coordinate the activities. A meeting of interested scientists was initiated by IOC Perth Programme Office, hosted by INCOIS at Hyderabad, India in May 2013, with additional co-sponsorship from IMBER and held under the auspices of IOC, IOC PPO and IOGOOS, under the banner of the IIOE-2 Reference Group. That meeting, as with all subsequent planning meetings for IIOE-2, received participation from hosts and members under a voluntary engagement spirit, almost without exception.

IOC, SCOR and IOGOOS have committed to 'championing' IIOE-2 at respective Governmental, scientific and societal levels and decided to consider the formalisation of IOC's involvement in IIOE-2 (planned during 2015-2020) at the IOC Executive Council in 2014. Topics of interest include data management; bathymetry; ocean carbon; planetary waves (Kelvin and Rossby waves); biodiversity; paleoclimatology; and basin wide currents; and others. The connection of the science to user applications through knowledge transfer and capacity building themes will form a fundamental element of the IIOE-2.

An International Symposium on the 50th Anniversary of IIOE will be organised jointly by India, SCOR and IOC in Goa, in Nov/Dec 2015. There will be an opportunity for discussion of piracy issues among Indian Ocean researchers, and with the involvement of the navy.

General discussion

The Large Marine Ecosystem (LME) programmes funded by the Global Environment Fund (GEF) undertook the type of integrated ecosystem observations that Tony Koslow addressed in his presentation, but for a finite period, before the science was dropped from these programme agendas. John Field suggested that a solution could be to use the LME model with funding from the oil and gas industry.

Shubha Sathyendranath asked whether there were plans to digitise and archive the data from the original IIOE, Satheesh Shenoi replied that INCOIS was responsible for undertaking this in the next two years.

Susan Avery suggested that POGO members should share lessons learnt in engaging the private sector, as many members are doing this independently. Jesse agreed, stating that public sector support was unlikely to increase significantly in the near future. In addition to the financial benefits, society could benefit from the private sector exploiting ocean resources more responsibly by linking with science. Tony Koslow mentioned a *Nature* Comment on Deep-Sea Marine Protected Areas approaching the oil and gas industry to apply a tax on deep-sea mining and other activities that impact on the deep sea. Karen Wiltshire said that scientists need to be careful with partnerships

between research and industry, regarding the apparent conflict of interest, and the impact this could have on research or on perceptions pertaining to impartiality of research findings. In Norway they have found a solution whereby funds obtained through partnership with industry are held by the government, and then redistributed through the normal funding channels. In the US, a special organisation was set up to manage the funding (and peer-review the proposals) from BP after the Gulf of Mexico oil spill. Jesse Ausubel mentioned that the Nippon Foundation is working with the shipping industry. Henk Brinkhuis said that the Marine Board has produced a position paper on this topic.

Parallel workshops

1. Data from observing systems (Chair: Karen Wiltshire)

The context for this workshop was the discussions and the Action Item from POGO-13 that led to a side-meeting during POGO-14 on long-term datasets being organised. It was agreed that it would be almost impossible to place and manage data sets in one format and with one definition or with mutual priority on a POGO platform. Thus it was agreed that it should be left up to each POGO partner institution to define its own Long Term Data sets and to provide a link (URL). These links could then be provided to the general user via the POGO website. At POGO-14 it was agreed that national and regional working group discussions would be useful in order to define areas where future LTER action was needed. The way forward should be to consolidate and harmonize metadata/data and to foster data visibility and synthesize information to facilitate data and metadata discovery. There is a confusing diversity of measured parameters, archival mechanisms, technical specifications and projects (e.g. OceanSITES, GACS, GOOS, LTER, GEOSS, Argo, PANGAEA, ChloroGIN, IMOS, IODE, EMODNet, MaNIDA, PLANKTON*NET, NOAA, COOPEUS, as well as individual institutes' programmes).

What is needed is to get away from the details of timeseries technical/ organisational problems and provide a global overview of activities. The product should not introduce more complexity but make things simpler. Alex Kraberg talked to several experts about this idea including several at AWI to check whether something similar is already being done, but they said they would find this extremely useful and would expected considerable traffic. POGO's role could be:

- To create a resource that provides a global overview of activities; or
- To create a webGIS resource with technical, measurement methods and other sublayers for timeseries stations/repositories.

The discussion that followed emphasised the issue that data are currently not seen until they are published, and that data should become more easily discoverable, so that anyone can search for (1) data of all types (e.g. including biodiversity and socio-economic data), by location, or (2) to search for one type of data everywhere (i.e. coastal, open ocean, inland water). Data standards do not exist for all types of data. This would be a huge task for POGO, and would require significant funds. The discussion addressed the idea of approaching large multinational IT companies such as Google, IBM and Apple. Google already has the project Google Ocean; Gilles Lericolais mentioned that Google has already created an institute and a research vessel. Roger Proctor said that AODN/IMOS has already created open-source software that could be used for this; it would just be a question of finding resources for staff (3-4 full-time to set up and maintain it).

2. Tropical moorings (Chair: Yoshihisa Shirayama)

The motivation for holding this workshop was that the tropical moored arrays are facing a number of crises: they are currently implemented at ~50% of requirement; continued funding to sustain and

enhance the arrays remains problematic; there are persistent threats to existing arrays from vandalism in all oceans; and piracy is a major hindrance to implementation and maintenance in certain areas. So it is important for POGO members to articulate the scientific need for tropical moorings; to collaborate to overcome engineering challenges for sustainable observation; and to collaborate to overcome challenges against sustainable operation.

Objectives are (1) To share information on the challenges that the existing observing systems are facing to sustain the air-sea interaction data; (2) To identify the scientific needs and technological challenges, which foster development of tropical observation research; (3) To edit messages regarding societal benefits obtained through tropical oceanographic observation; and (4) To explore possible partnerships for fostering comprehensive ocean observation.

It was anticipated that the outcome would be a set of recommendations to POGO on strategies to facilitate international partnership contributing to a new direction for future tropical observations.
Compared with other observing systems, mooring arrays are expensive, and vulnerable to vandalism, but have many other advantages, e.g., with respect to data frequency, access to deep-sea data, capability to measure biological and meteorological data and maturity of experience.

Presentations were made on the following topics:

1. The Global tropical moored buoy array (Kentaro Ando, JAMSTEC)
2. Deep ocean tropical moorings in the Indian Ocean (RAMA): status and challenges (Nick D'Adamo, IOC)
3. National Data Buoy programme of India (Satheesh Shenoi, INCOIS)
4. How can KIOST contribute to Pacific Tropical Moored Arrays? (Dongchull Jeon, KIOST)
5. Features of JAMSTEC moorings (Shoichiro Baba, JAMSTEC).

Kentaro Ando highlighted that oceanic systems are subject to interacting variations in a variety of scales. The PIRATA array in the Atlantic is currently the healthiest of the moored tropical arrays. It is maintained by Brazil, France and the USA. RAMA buoys in the Indian Ocean are at 67% occupation, maintained by USA, India, Indonesia, China, Australia and South Africa. Piracy problems currently limit full implementation, although piracy is on the decline. But other types of vandalism remain a problem especially for moorings closer to land. The TAO/TRITON array in the Pacific is maintained by USA (TAO) and Japan (TRITON). The number of buoys reporting data, and total data return rate has decreased drastically since 2012, related to the decline in ship time. For this reason, JAMSTEC extended the one-year moorings to 1.5 years. Currently, 20 out of 55 TAO moorings are not transmitting. Data return from TAO is presently at less than 40% for any given day. NOAA Ship Ka'imimoana (KA) has been deactivitated without replacement in 2012. For JAMSTEC, TRITON cruises are assured until 2016, but not thereafter. There will be a loss of climate data and a decrease in capability for climate forecasting. A Tropical Pacific Observing System (TPOS) 2020 workshop is to be held at SIO on 27-30 January. 14 White Papers are now being developed, covering reviews, requirements, and implementations for TPOS2020, from a variety of perspectives ranging from research and assimilation to operational forecast. Not only moored buoys but also autonomous observing platforms (e.g. underwater gliders, surface gliders, Argo for tropics) will be key elements for a new Pacific observing system.

Capacity building is an important element supporting tropical moored buoys, whereby system operators or developers give lectures to and/or accept engineers/scientists from new contributors, and new contributors usually provide ship-time for operators and developers. This type of capacity building is very costly, and has to be through careful development of partnerships.

Nick D'Adamo highlighted that IOP, SIBER, IRF – IOGOOS, IMBER, CLIVAR/WCRP are all engaged in the Indian Ocean Observing System (IndOOS). A major challenge is that Indonesia can no longer support 2014 RAMA cruises, which they had previously committed to. Ship time support

is urgently needed. Although piracy incidents have declined significantly, the Lloyds of London exclusion zone has not changed. IIOE-2 can significantly enhance GOOS in the IO (IndOOS) in terms of physical, biological and biogeochemical observations. POGO can play a key role in Capacity Building in collaboration with IOGOOS/IOP/SIBER/IRF with reference to IndOOS, and also by participating in IIOE-2.

Satheesh Shenoi talked about a real-time ocean observation system for identifying cyclone and tsunami events that was developed initially for surface meteorological observations, but is being extended to measure sub-surface variables. Some 21 buoys are functional and returning data at 85%. Variables measured include meteorological, temperature, conductivity, currents, and waves. The buoys are being redesigned to minimize vandalism.

Dongchull Jeon talked about the situation in the Pacific. Data recovery rate in 2013 was less than 50%. NOAA and JAMSTEC want to reform the Tropical Pacific Ocean Moored Array System.

NDBC (NOAA) needs more ship-time to operate the TAO array. JAMSTEC is about to give up 3 vulnerable stations, and replace them with wave/underwater gliders. Both feel the difficulty to gather data from the buoys, and the need to change the method of data gathering.

Regarding the possibility of KIOST taking over 2 TAO lines, a proposal with scientific justification would need to be approved by MOFA. KIOST is involved in the Pacific moored array, in TIPNet (Indonesian Seas) and is interested in joining RAMA network (Indian Ocean).

Shoichiro Baba showed that a variety of moorings have been developed at JAMSTEC since 1998 (e.g. for strong currents, icy/rough conditions). The new mooring m-Triton is cheaper to run, easy to assemble and easy to operate. JAMSTEC operates about 18 TRITON or m-TRITON moorings in the Pacific Ocean. They successfully moored a prototype buoy in the Southern Ocean for a year in 2012. They have also been modifying the design of the buoys to mitigate the effects of vandalism. TRITON has 2 means of gathering the data: real-time (transmitted via Service Argos) and delayed mode (acquired from recovered sensors). From 2014, JAMSTEC is taking away 5 moorings from the TAO-TRITON array, and Indonesia will be taking over one of the sites from JAMSTEC, exchanging it from TRITON to m-TRITON (JAMSTEC started to transfer the operation of m-Triton to Indonesia in 2009).

Brian Taylor said that the eastern arrays are most affected in the Pacific and western arrays in the Indian Ocean. Has the impact of losing those buoys been assessed? JAMSTEC has been doing assimilation experiments to assess the impact of observation data and lack of data. Argo can replace mooring data for ocean variables, but it is more difficult to replace atmospheric observations in the surface ocean. Bob Weller mentioned that the purpose of the moorings should include validation of models (not only data assimilation).

Susan Wijffels said the crisis is related to ship time. There needs to be a coalition of the willing to fill the gaps in ship time. There is also a need to transition to new technology. Social/operational needs also exist and should be addressed in addition to the scientific needs.

In summary, there are two types of crisis and associated types of solution:

(1) An urgent crisis to do with the lack of ship support. Solutions: Cruise information data on POGO website is very helpful. It is proposed to appeal to POGO members to contribute more regularly and in advance to cruise information database, even if information is somewhat vague and general. Also, the POGO newsletter could be used to exchange information on cruise requirements and cruise availability; funding system to exploit ships going nearby; system to support ship time for maintaining arrays in critical places.

(2) A longer-term crisis to do with the scientific needs. Long-term solutions include new technologies, new systems with low-cost operations and maintenance. It was necessary to prioritise

places where buoys are essential. The Indian Ocean Resource Forum appears to be a good system for addressing resource issues in the Indian Ocean. It would help to have similar fora for other regions. POGO should issue a Statement of Support, based on a consensus on what is needed and where.

Friday 24 January

Reports back on workshops and discussion

Deep-sea observations

Bob Weller reported on the deep-sea observations workshop. There was some discussion about engagement with industry. Douglas Cripe highlighted the possibility of linking with GEO efforts. Gilles Lericolais said he could provide some information regarding the American Association of Petroleum Geologists (AAPG) meeting in Houston (Annual Convention and Exhibition) in April 2014. Susan Avery also has contacts at the high level.

A possible Action Item is for POGO to work with DOOS community to translate their "vision" into a position paper.

Brian Taylor specified that there were two different sides two cooperation with industry (licence to operate and development of instrumentation) and that POGO should target a specific area.

It was decided that a Working Group would be needed to carry out these Actions.

SOOS

Louise Newman reported on the Southern Ocean workshop. Bob Weller suggested that POGO could help to articulate the value of scientific investment in the Southern Ocean.

The Cloud Physics and Air-Sea Flux communities are very active and should be engaged.

Regarding funding mechanisms, Douglas Cripe said that GEO has links with the Belmont Forum and could help make the appropriate links. There is also the ESF COST mechanism (funding for meetings).

Data from observing systems

Karen Wiltshire reported that POGO can only make recommendations at this stage, and needs to link with other groups attempting data integration, and revisit this every 5-6 years.
An exercise to see how useful portals are for data discovery could be done during the year and reported on at next meeting.

Gilles Lericolais disagreed about data not being accessible, and said that a lot of EU efforts and progress have been made in sharing of data and metadata. Karen Wiltshire responded that they are not just looking at European level, but at the global picture. SeaDataNet does not function as well as it should. She agreed that we have progressed in the last 15 years but thinks we can still go further. The current speed of progress does not reflect the need for better access to the data "deluge" and the cost of producing this system is not proportional to the cost of producing the data.

Tropical moorings

Aska Vanroosebeke reported on the tropical moorings workshop. KIOST has been discussing how to support tropical moored arrays since NOAA decreased its servicing of the TAO buoys. NOAA-KIOST has an annual panel meeting. A new vessel is under construction by KIOST, due for completion by the end of 2015. KIOST hopes to use her for servicing the TAO array.

Bob Weller suggested that the mooring community could expand the suite of measurements to include other disciplines and thus enhance the scientific value of the moorings. POGO should consider making a request to mooring community to consider these additions. Yoshihisa Shirayama highlighted that the more sensors are added and the more expensive moorings are, the more careful we need to be to safeguard them against loss and vandalism.

General feedback on workshops:
Bob Weller thought they were a good addition. Margaret Leinen agreed but suggested soliciting in advance feedback on who would want to attend which workshop. Susan Avery also thought the discussions were very good and all focussed on key priorities for POGO (observing systems). She also suggested that members need to commit to actions at the end of each session. Ed Hill said the workshops were generally well prepared, and that a set of questions was needed to get an appropriate set of outcomes. There is a danger of generating an unmanageable amount of activity, therefore POGO needs to sift through the suggested outcomes and prioritise. The role of POGO needed to be better defined so that it does not take on activities that are outside of its remit or ability, or overlap with what other organisations are doing. Bruce Mapstone highlighted the need for workshops to be well organised in advance, and that this was the case even though the leaders were given relatively short notice; he thanked all the workshop leaders.

Australia's Integrated Marine Observing System (IMOS) and Australian Ocean Data Network (AODN) Showcase (Chairs: Mike Coffin, Bruce Mapstone)
(See http://www.imos.org.au/ and http://portal.aodn.org.au/aodn/)

Tim Moltmann gave an overview of Integrated Marine Observing System. IMOS is a national, collaborative, research infrastructure, funded by the Australian Government. It provides the means for multiple institutions to undertake sustained observing of the marine environment, and for making all of the data openly available for research and other purposes. IMOS is integrated from the open ocean, onto the shelf and into the coast, and across physics, chemistry, and biology. IMOS has been designed to address big science questions posed through a series of Nodes, which bring together the research community and the stakeholders.

IMOS has been implemented through a portfolio of technologies and platforms, called Facilities, which are operated by multiple Institutions. All of the Data are open access, made available through a single national marine information infrastructure called the Australian Ocean Data Network (AODN, http://portal.aodn.org.au). Facilities include Argo floats; ships of opportunity; deep water moorings; ocean glider fleet; Autonomous Underwater Vehicles; national mooring network; ocean radar network; animal tagging and monitoring network; wireless sensor network; and satellite remote sensing.

The Data Facility works with other components of IMOS, making all data discoverable, accessible and usable via the IMOS Ocean Portal http://imos.aodn.org.au/webportal/. It is an integrated infrastructure encompassing data, middleware, standards, access, and discovery. It provides daily maps of surface currents, temperature and ocean colour.

IMOS core funding provides about half the funding required. Remaining funds are raised through members and external sources. IMOS 2025 is the new Strategy, which includes updated Node Science Plans.

Links between POGO and IMOS can be facilitated through POGO's awareness of IMOS and AODN, and the creation of opportunities for collaboration using IMOS (e.g. platforms, data). There are specific programmes discussed by POGO that IMOS supports (e.g. GACS, OceanSITES). General issues of interest to POGO and to IMOS include observations of the deep ocean, the Southern and Indian Oceans, ecological monitoring, and marine data.

Susan Wijffels gave a presentation on Argo Australia, which contributes to the global Argo programme by maintaining about 50% coverage in the oceans around Australia. They contribute to Argo's system design, data management and Steering Committee. Australia currently has 379 active

floats. About 30 of them carry oxygen sensors. They are moving to high-data transmission Iridium systems. Planning recognizes the need for higher density coverage in equatorial regions, marginal seas and seasonal sea ice zones. Iridium ice floats are storing and transmitting under-ice data in winter. Bio-Argo is under development, with over 200 floats carrying oxygen sensors. QC and sensor stability is still a work in progress. Nitrate, pH, and bio-optical sensors are being developed and proposed on a subset of Argo floats (regional pilot). Challenges include ongoing improvement in sensor stability; resourcing and development of data management protocols, especially for delayed-mode quality control; and EEZ sensitivities with many nations. For Bio-Argo in Australia, sensor accuracy has been a major stumbling block and CSIRO has been working on it for 6 years. They will continue deployments at the Southern Ocean Times Series Site through to the end of 2015 (high frequency and shallow profiles, converting to regular Argo mission when the float leaves the site). In 2014 there are plans for joint India-Australia deployments in the Indian Ocean - their first use in tropical and subtropical regimes. A major future evolution of Argo will be its extension into the deep ocean, profiling beyond 2000m. Deep Argo floats are being developed, and successful deployments have been carried out using 4000 and 6000m designs. A CTD with improved sensor stability needed for abyssal measurement is under parallel development. Objectives of Deep Argo, in combination with satellite missions including altimetry and gravity, will include closure of the sea level, ocean mass, and energy budgets on regional and global scales. Deep Argo will also provide new information on ocean circulation and water mass formation and properties, as well as many other new applications. For ocean data assimilation modeling, Deep Argo will mitigate the lack of observations below 2000m.

Tom Trull provided a report on the Australian Bluewater Observation System (IMOS ABOS). There are four sites from the tropics to the ice: Southern Ocean Time Series (climate and carbon fluxes), Ice-edge Mertz Polynya (polynya monitors); Indonesian Through-Flow and East Australian Current (boundary current arrays). IMOS ITF mooring arrays are a component of the international monitoring of the ITF inflow and outflow passages. Other countries monitoring this area include USA, China, France and Japan. IMOS EAC is also part of an international collaboration for monitoring western boundary currents. It is a component of SPICE (a French, US, Australian, New Zealand study on the Western Pacific boundary). They are also building a collaboration with US colleagues that will utilise glider and mooring to monitor western boundary currents. All moorings are components of OceanSITES and provide vital time series data for climate research. The system is proceeding reasonably well despite some funding and equipment hiccups. They need to sustain this broad set of observations; increase data transmission to minimize losses; increase mooring durability to minimize ship needs; augment moorings with floats, gliders, and ship missions; seek and support international collaborations and continue to participate strongly in OceanSITES, SOOS, IOOS, and other observing programmes.

Roger Proctor gave a presentation on the IMOS “e-infrastructure” and AODN. The preferred data format is NetCDF because it is self-describing (metadata+data), offers efficient binary storage, V4 includes compression, adheres to OGC standards, and provides many tools available to users. One can search for data using the map facility or the search facility. Using the map view, one can click on a feature to get more information such as description, link to metadata, links to data, summary of data, plots and a related image. Using the search facility, one can add layers to the map as well as download the data. The IMOS Matlab Toolbox aims to provide an automated interface for converting raw instrument data into IMOS compatible QC NetCDF files. The system also includes an AUV image viewer and a passive acoustic data viewer. The Marine Virtual Laboratory (MARVL) brings IMOS observations and models together. AODN is an interoperable, on-line network of

marine and coastal data resources; it is Australia's interface to large amounts of otherwise undiscoverable marine data. It provides infrastructure and visualisation tools to establish free access to data and metadata. It is neither generating, nor storing data. AODN uses the information infrastructure of the IMOS Ocean Portal for publication of Australia-wide marine data. There are barriers to this re-use due to the various formats, vocabularies, co-ordinate systems, policies and best practices that are in use at the regional, national and even organisational scale within a country. A number of regional initiatives have made significant progress in addressing these barriers by developing marine data management infrastructures (e.g. e.g. SeaDataNet, Geo-Seas in Europe; R2R, IOOS in the USA; AODN, IMOS in Australia). Development of these infrastructures is being promoted and supported by international organizations such as IOC.

The Ocean Data Interoperability Platform (ODIP) is establishing an EU/USA/Australia/IOC-IODE co-ordination platform to facilitate the development of interoperability between these regional ocean and marine data management infrastructures. It aims to demonstrate this co-ordination through the development of several joint EU-USA-Australia prototypes that would ensure persistent availability and effective sharing of data across scientific domains, organisations and national boundaries. There are 19 partners including institutes in UK, France, Belgium, Netherlands, Italy and USA, IMOS and IODE. Prototype activities are:

- ODIP 1: Establishing interoperability among EU, USA and Australia in Data Discovery and Access services, making use of a brokerage service, towards interacting with the IODE-ODP and GEOSS portals (led by EU);
- ODIP 2: Establishing deployment and interoperability between Cruise Summary Reporting (CSR) systems in EU, US and Australia, making use of GeoNetWork, towards interacting with the POGO portal (led by US); and
- ODIP 3: Establishing a prototype for a Sensor Observation Service (SOS) for selected sensors (SWE), installed on vessels and in real-time monitoring systems [includes 52N and OGC] (led by Australia).

Erlend Moksness enquired about data accessibility. Roger Proctor replied that AODN was adopting the IMOS philosophy to make all data freely available. Ed Hill asked for an estimate of the resources required for core data management. Roger replied that IMOS has 20FTE for data management (software/data managers) in addition to a CSIRO contribution (which outweighs IMOS contribution). Generally, 10% of research funds are used for data management.
Douglas Cripe mentioned that although IMOS is discoverable through the GEOSS portal, AODN is not. Roger replied that a prototype activity was addressing this.

POGO Business (Chair: John Field)

Election of next Chair: John Field announced the result of the election that had been conducted electronically. The Chair-elect, Karen Wiltshire, thanked the membership for their vote of confidence, and promised to take comments from the members on-board, and hoped that changes would be made to enable the organisation to move forward.

Brief report from Partners' Meeting on POGO priorities: John Field stated that most of the participants had been in the Meeting so there was no need for a report.

Adoption of Action Items: the Action Items needed to be edited by the Secretariat following the discussions during the Partners' Meeting and would be circulated to the members electronically.

Venue and date for POGO-16: Eduardo Balguerias gave a brief presentation on the IEO facilities on Tenerife. It was agreed that the next POGO Meeting (POGO-16) would be held on Tenerife.

Eduardo had no preference for dates so the penultimate week of January was proposed, with the exact dates to be confirmed by the Executive.

There was also an offer from JAMSTEC to host POGO-17 in 2016. Yoshihisa Shirayama said their new ship should be ready and with 2 years to prepare they would arrange for the research fleet to be shown to the participants. The President of JAMSTEC is very keen to invite POGO to JAMSTEC. The offer was approved by the membership.

Final comments and closure: John Field
The Executive will meet in the northern summer of 2014 to address the various issues that had been raised, particularly during the Partners' Meeting. Finally, John thanked the meeting hosts and Secretariat for their hard work in organising the meeting and making it a success.