

Minutes
Partnership for Observation of the Global Oceans
POGO-6 Meeting
Brest 29 November – 1 December, 2004
Hosted by Ifremer

29 November Afternoon: Tour of Ifremer

The meeting began with an introduction to the activities of Ifremer, followed by a tour of the Ifremer facilities at Brest. Gérard Riou welcomed the participants and presented a brief outline of the activities of Ifremer. Howard Roe thanked Ifremer for hosting the meeting. These introductory remarks were followed by a presentation by Sylvie Pouliquen on the CORIOLIS project and its relevance for Argo, and by Yves Desaubies on the MERSEA project. Philippe Marchand then talked about technological development activities and Chantal Cahu informed the participants of fish-farming related activities in Ifremer. These informative presentations were followed by a visit of Ifremer facilities in Brest, in particular those related to aquaculture, deep-sea biology and geosciences. The participants dispersed after a reception hosted by Ifremer.

Session 1: Inauguration
Chair: Howard Roe

The first session was chaired by Howard Roe. Jean-Louis Fellous welcomed the participants. The event was part of Ifremer's 20th Anniversary celebrations. Jean-Francois Minster was at the board meeting of Ifremer, but was expected to join POGO at least on the next day. The new French research vessel *Pourquoi Pas* was to be delivered in March 2005. He then provided some logistical information. All the participants introduced themselves.

Howard Roe invited comments on the agenda, which was adopted with minor additions. He then invited comments on the minutes of POGO-5, which were adopted without change. Howard Roe drew the attention of participants to the planned message to be sent to GEO: it had to be finalised by 12 noon, so that it could be sent to the GEO Plenary in Ottawa, which was taking place on the same day.

Howard then thanked everyone for their contributions to POGO. He noted that it had been a privilege to chair POGO for two years. He believed the years had been productive. POGO had come of age, achieving what we set out to do at the beginning. POGO had been established as a collection of representative marine institutions, able to influence ocean observations, to carry out education and capacity building, as well as contribute to awareness building on matters related to oceans. In that year POGO had become a significant presence in the international scene. He thanked everyone, and hand over the chairmanship of POGO to Jan de Leeuw.

Jan de Leeuw noted that it was a pleasant task to thank Howard Roe for all his work. POGO has entered a new phase, and picked up momentum. It was involved in activities not foreseen a couple of years earlier. Two years ago, GEO had not yet emerged on the scene; nor could one anticipate the impact it would have on POGO, or of its potential impact on GEO. Another step in capacity building had been achieved through the NF-POGO Visiting Professorship. He reminded Howard Roe that he was to serve on Exec committee of POGO for two more years, and was counting on continued help from him. According to by-laws incoming chair was to be elected the next day. POGO was run by a team. The participants were to discuss the future of POGO next day. He drew the attention of the participants to Charlie Kennel, Founder and first Chairman of POGO, who was leaving the Exec that year. He had been very active, and his leadership was important. POGO would always count on him for help with POGO matters.

Session 2: GEO Status, Way forward
Chair: Jan de Leeuw

Howard Roe talked in this session of POGO involvement in GEO. He briefly recalled the recent history of the GEO process, with a series of international events (EO Summits, GEO meetings) starting in Washington in July 2003, continuing in Baveno, Cape Town, Tokyo, now in Ottawa, and culminating in February 2005 in Brussels. He stated that the importance of ocean and *in situ* observations was rather underestimated in the early stages, then better recognized thanks to the efforts of a number of individuals, notably in Cape Town. A draft Implementation Plan was at that time being reviewed, and POGO, jointly with IOC, submitted a number of comments on this document. Further comments had been submitted by POGO to the last version of the document, which is not a true Implementation Plan from some perspectives. The actual work would start after it was adopted in Brussels, and it was hoped that a fast course of action would develop immediately, to show that GEO really made a difference. All in all, POGO had been active and represented at all times in this process.

Shubha Sathyendranath reported on the activities of the Capacity Building Sub Group (CBSG) of GEO. She, together with Howard Roe (SOC) and Ehrlich Desa (IOC), constituted a total of three ocean representatives out of 60 participants in the WG. She outlined the report from the CBWG, and stressed the importance of ocean for most, if not all, of the nine societal benefit areas (disasters, health, energy, climate, water cycle, weather, ecosystems, agriculture, biodiversity) identified in the GEO Implementation Plan. She mentioned the recommended GEO trust fund of \$ 3.5M, of which POGO had requested that a large fraction be devoted to concrete actions, including capacity building, training, data management, infrastructure development and establishment of observing capacities where it is missing, rather than in meetings and reports.

Jesse Ausubel (Sloan Foundation, CoML) inquired about GEO management structure so far. The absence of oceanographers at all level was noted. Charlie Kennel expressed his concern on the "laconic" way in which the role of science and research is described in the GEO process. Howard Roe (SOC) concurred and noted the continuing uncertainty on the future governance of GEO. Most current ocean observing systems were operated by research institutions on short-term research funds. This message had been repeatedly expressed through all possible channels, and there were some signs that it starts being heard, e.g., in the UK, where the government had started considering long-term funding for observations.

Jan de Leeuw and John Gould informed the participants of the Architecture Subgroup of GEO. In the proposed architecture, GEO was designed as a comprehensive, co-ordinated and sustained "system of systems", with observations and predictions providing decision support, leading to policy and management decisions. The 10-year implementation plan was user-driven. Action items included formal commitments regarding interoperability and standard protocols. POGO contributions could include standardisation of observing systems, interoperability of data and data bases, contribution of existing data and data bases, identification of observation gaps. The marine voice for *in situ* marine observations had to be heard. Gould had contributed many pages of material to the long GEO document, which had been distilled into 2 pages in the short reference document of the GEO Implementation Plan. Main contribution was the role of research in GEO. Oceanographers were at the cutting edge of designing the system needed which had then to be implemented. There was risk of the implemented system being fossilised. It was felt that the voice of the ocean was grudgingly heard in some quarters.

These presentations were followed by discussions on the Brest Communiqué to be sent to the GEO meeting in Ottawa. Jan de Leeuw introduced the discussion: POGO should emphasize the role of oceans; participate in GEOSS governance; identify observation gaps; stimulate standardization and data archiving; help obtain sustained funding; and promote the recognition of the scientific and technological community as stakeholders. Tony Knap and Ed Harrison expressed concerns with respect to proper representation of coastal and deep ocean observations. Yves Desaubies was of the opinion that POGO should also defend

satellite observations, and should not restrict to *in situ*. Ed Harrison and Howard Roe supported this view, that the societal benefit is the most important criterion. K. Suyehiro (JAMSTEC) thought that the document should emphasize the role of *in situ* ocean data, as being POGO's own contribution. Jan de Leeuw and Tony Knap agreed that it was possible to support both satellite observations, and *in situ* observations, and Jean-Louis Fellous (Ifremer) observed that the situation was evolving, with some oceanographic institutions operating or becoming more and more involved in satellite systems.

Jim Luyten remarked that one needed compelling reasons for why research should be involved in GEO. A telling reason was the extreme difficulty of making observations. Whereas the importance of satellite observations was well-recognised in GEO documents, *in situ* observations had received less attention. Many participants stressed that the importance of *in situ* observations could not be over-emphasised. Ed Harrison noted that information rather than observations would drive the action. Therefore, information development and dissemination were important. Mike Sinclair suggested that an annual report on state of the ocean be prepared, including, e.g., progress in observation status, impacts of global change.

Charlie Kennel stated that "something has to happen in GEOSS AND in POGO", but the expected increase in work load highlighted the need for full-time commitment. Howard Roe also insisted that that the demands required additional resources. John Field suggested strengthening the liaison with GOOS and with SCOR. Jean-Louis Fellous thought that it would certainly be nice to have additional staff to go to meetings, but he felt that there was mostly a need for concrete contributions from POGO to GEOSS. In the same way Charlie Kennel offered the example of the pilot projects of IGOS. Jan de Leeuw pointed out that even concrete action would require experienced staff, and mentioned the Sloan Foundation offer to help with additional funding, and picked up the suggestion made to share the burden with GOOS and SCOR. Jesse Ausubel thought it necessary to have a full-time, highly competent person for the next one-two years. He suggested that one look for some in-kind contribution by one institution through part-time detachment, additional cost being supported by other interested institutions, and incremental costs (travel, etc.) by the Sloan Foundation. Howard Roe inquired about a possible increase of membership fees. He noted that hiring of additional person would require an accurate job description, and an evaluation of costs.

Stan Wilson put emphasis on POGO contribution being mostly through advocacy, and he insisted on the need to measure progress: identify near-term, specific actions, prioritize, advocate them, monitor advances. K. Radhakrishnan also put priorities on advocacy and capacity building. Jean-Louis Fellous summarized the discussion, and said that if POGO was to pursue the idea of hiring an additional person, the job description should include the suggestions made with regard to near-term actions.

After the coffee break, the session continued with Jean-Louis Fellous as Chair. The Brest Communiqué was discussed in detail, and its wording was amended and improved. It was then transmitted for distribution at the GEO meeting simultaneously held in Ottawa.

November 30, Afternoon

Session 3: Data Management & Assimilation, Co-ordination & Use of Research Vessels.

Chair: Sang-Kyung Byun

The meeting continued after lunch under the chairmanship of S.K. Byun.

Issues in Data Assimilation: Peter Oke (CSIRO, Blue Link Project) presented the principles of ensemble and variational methods, both being used in data assimilation techniques, and the issues related to those methods, e.g., timely access to data for near-real time applications (Jason rated as best choice for altimetry), or data access for reanalyzes (of particular interest as highlighted at GODAE Symposium). Future challenges include design and assessment of optimal observing systems, illustrated by the example of a projected Indian Ocean tropical mooring array, assimilation of unconventional observations, understanding user requirements

and providing credible estimates of error and uncertainty. There was some discussion on the issue of error and uncertainty, and ways to assess the accuracy.

Cruise coordination: Marieke Rietveld introduced different existing coordination mechanisms (ISOM, UNOLS, OFEG – Ocean Facilities Exchange Group) related to optimizing the use of research vessel time. The ESF Marine Board had established an Ocean Research Working Group, expected to report in early 2005. The MarinERA, a so-called ERA-NET Project, funded by the European Commission (3M€) and led by Ifremer, also pursues the objective of improved fleet coordination. Inventories of research fleets could be found in various sites, but the definition of a research vessel differs from one place to another. European fleet is estimated to include 42 R/V, while UNOLS show only 28 academic R/V. Such discrepancies create difficulties in Europe, where the governments tend to think the European fleet was too big. POGO could help get more accurate evaluation of the fleet available. Another issue was the optimal use of ship time, as exemplified by the OFEG exchange practice. A first OFEG AO was released for 2006. Future perspectives include adding new members, sharing instrumentation, etc. The OFEG model could help improve the situation in other regions of the world. POGO could again help progressing along these avenues.

John Field echoed a need for a data base of planned cruises identified as priority by SCOR. To be effective coordination, should take place at cruise pre-planning stage. Requests to embark on planned cruises would come too late in most cases, though some opportunities might exist.

Contributions of Research Vessels to the GOSUD Project: Yves Gouriou (IRD) presented (on behalf of Thierry Delcroix, unable to come) some information on the Global Ocean Surface Underway Data pilot Project. The variable of interest was the Sea Surface Salinity. A GOSUD GDAC was now operational at Ifremer in Brest. Oceanographic institutions were invited to populate that data center with the measurements gathered, in particular by their research vessels. Australia, the USA, Japan, have already decided to join in, and were sending their data to the GOSUD GDAC. POGO might help encourage its members to increase the number of ships (and particularly research vessels) transmitting their data to the GOSUD Data Center.

The question was raised of a formal approach to invite oceanographic institutions to join in. Yves Desaubies expressed the opinion that such initiatives could raise large benefits for little effort.

Contribution of POGO members to Argo Calibration: In his presentation, John Gould (Argo) argued in favour of improving the way we are making use of R/V fleet, as an essential complement to *in situ* or satellite-based global observation. Argo is now the most abundant source of ocean profile data. Hydrography in support of Argo was largely insufficient. Argo data were delivered in near-real time (90% within 24 hours), and in delayed mode (within one year) after detailed scrutiny by comparison with regional climatologies, and were regularly and speedily updated with research-ship based data. POGO might like to consider bringing this issue to the attention of scientists, encouraging the rapid submission (within one month) of CTD data to National or Regional ocean data centers. The MERSEA project already encouraged real-time submission of CTD profiles via TESAC messages. POGO could also encourage ship operators to give information on their actual past and planned cruises. These ideas could be expanded to other uses, *e.g.*, float/drifter deployment opportunities, etc.

Charlie Kennel inquired on the cost involved, which appeared to be minimal. What was required was rather a change of culture, to convince every scientist or ship operator that their data might be of interest to someone else. Yves Desaubies said that there could be some cost associated (for manpower to perform and monitor those tasks); but it was negligible in view of the expected benefit.

Progress report on BEAGLE 2003 Cruise: Kiyoshi Suyehiro reported that the *Mirai* BEAGLE 2003 was successfully completed. JAMSTEC planned to release all data by April 2005. One of the main observations was that Antarctic Intermediate Water had become cooler by 0.05 deg. C.

POGO News and Information Group: Cindy Clark reported that the N&I Group was established at the onset of the creation of POGO itself. The main goal of the group was to communicate the activities in the ocean realm to a broad audience. News items considered by the Group should be news of interest to the whole community; not just POGO. She made a plea to participants to make good use of the POGO web site. The N&I group had helped make the POGO brochure, and the Argo brochure. The Group shared resources and helped transfer news among communication people. POGO had provided opportunity to create a network of communication people. An example was the Argo news letter. Agence France Press had its communiqué out regarding the POGO-6 event, thanks to the Group. As an example of the activities of the group, she examined the case of advocacy for the relevance of ocean observations. A collection of illustrative examples of the benefits of ocean observations could be placed on POGO web site, and eventually form the basis of another brochure. She enquired whether there was a need for a communiqué related to GEO summit in Brussels. The group could also share information on journalists and science writers with each other, thereby facilitating the day-to-day activities of the members in their home institutions.

Session 4: Data and co-ordination (continued)

Chair: Yves Desaubies

The presentations in this session were followed by discussion and planning of actions regarding contributions of POGO to address co-ordination issues. The discussion was led by Yves Desaubies. He started the discussion by reviewing the arguments in favour of increased involvement in data management and coordination activities: cost-effectiveness of the proposed actions; value of well-equipped (with CTD and TSG), well-manned (with competent and experienced technical staff) R/V data; etc. In the lively discussions, several actions were proposed. These included the following: to bring the issue to the attention of scientists and technical groups collecting CTD data; encourage rapid (1 month) submission of CTD data to regional NODCs. Some funding agencies already required this sort of reporting; encourage real-time submission of CTD profiles as TESAC messages. MERSEA project is an example where it was already done. It would be useful if ship operators could provide advance information about where the RVs would be. Other uses of improved coordination include float/drifter deployment opportunities, thermosalinograph data, high-quality meteorology (Autoflux packages) and ADCP. POGO members should make better use of the research fleet for global observations. Argo had a specific and urgent need for action (POGO and ship operators). There were other possibilities highlighted by CLIVAR for surface temperature, salinity and meteorological observations. There was a need to regard the research community (and research ships in particular) as an integral and essential part of the ocean observing system. These points were very important, in view of POGO's remit to "... promote global oceanography, particularly the implementation of an international and integrated global ocean observing system."

POGO budget: Shubha Sathyendranath presented the provisional situation of expenditures and income in 2004, with a present imbalance of US\$ 56,000, due to delays in some membership dues, and other anticipated income. The rolling capital carried over from 2003 was about US\$ 140,000. Projected expenditures for 2005 amounted to US\$ 228,000, with the assumption of no support from IOC. The projected income amounted to US\$ 208,000, so that there was an imbalance of US\$ 20,000, which could be reduced if additional members joined POGO. Should there be an IOC contribution, it would increase the projected effort in capacity building. The budget of the Nippon Foundation Project was presented separately. Most of it however was still at the planning stage. One serious issue was the depreciation in the value of the US dollar.

There was concern on the planned imbalance, and the question was raised of increasing membership dues, at least to correct for inflation, but this option had not been retained so far by the Executive Committee. Jan de Leeuw referred to the discussion in the morning about the possibility of hiring an experienced person to assist with GEOSS, and mentioned the need to develop a plan for leveraging additional funds for POGO in the near future. A formal proposal to revise membership dues for 2006 would be tabled in due course.

The meeting adjourned at 6.00 PM. The day concluded with a dinner hosted by Ifremer.

December 1 Morning

Session 5: Chair: Howard Roe Issues in Operational Oceanography

Operational Oceanography, a European perspective: Jean-Francois Minster made the first presentation in this session. From a European perspective, operational oceanography consisted not only of climate-related activities but also policy related to general needs associated with the ocean, such as pollution detection, impact studies and prediction systems (hindcast, nowcast, forecast). Studies into these aspects had to be transformed into services. Complementary approaches have to be tried, bearing in mind the intrinsic limits of the potential to monitor oceans.

It is understood that development was undertaken through research. Long-term operational services had to be linked to R & D (which performed innovation, offered solutions, provided validation, and was also a customer). Feedback from operation to research and development was also vital. Connection to research and development was essential to sustainability of an operational system. Research had to be incorporated into operations. Operations had to have teams to address issues. Such ideas existed in Europe, and were crucial for the future.

Specific regional dimensions were also important, and were illustrated using the Mediterranean Sea. Usage was more critical than resource exploitation in this area. High population density, tourism-related activities and proximity of large cities were important factors. It was a small-scale, but complex system. Political diversity of regional players had to be accounted for, in dealing with issues such as pollution.

Efforts often had to be international, and might not yet always be successful. Continuity and guarantee of satellite observations were still difficult. There was a need to work with space agencies. To maintain their interest, they had to be involved in development. Space agencies developed new generation satellites, which might in turn facilitate funding of recurrent satellites.

When operational oceanography was discussed, it was important to recognise that it was a combination of routine measurements and evolving techniques. In the development phase, it would be easy to evolve, since incremental change was small. When a big system was implemented, say in meteorology, evolution became a major issue. Oceanography was getting to the stage where evolution from one generation to the next of operational system was getting to be very difficult. Even with the MERCATOR project, the next stage of evolution would be difficult.

Validation and quality control had to be integral parts of an operational system. Inter-comparisons were also important. These could be made routine and in-house, but it was still a major task. Various operational systems had to work together, which introduced the need for interoperability. Hence European and multi-national approaches were being followed.

Demonstration of usefulness of operational oceanography required provision of services. Here one had to think of needs of users, and adaptation of products to needs. The magnitude of this task was often underestimated. For each of the various applications identified, services had to be implemented, and adaptation of services to the needs was essential.

Working together yielded better results. High-resolution global ocean model was beyond the capabilities of individual institutes. Thus GMES (Global Monitoring for Environment and Security), which was a joint initiative of the EC and ESA, had been established to provide a sound basis to European policies related to environment and security. Its goal was to provide Europe with independent access to global information useful for, e.g., international conventions such as the Kyoto protocol. An extended partnership among national space agencies, industries and science was envisaged.

In oceanography, organisation was fragmented. It was therefore essential to work with a system of systems where one had some things in common, but at the same time it was possible to implement regional variants for regional needs. This needed involvement of institutions, and not just programmes.

Status of ECOMF (European Centre for Ocean Monitoring and Forecasting): number of countries realised that they should come together to launch the ECOMF. Concepts existed, but it was not a reality yet.

Minster also gave some possible examples of early and valuable examples of usefulness of operational data. Since research was customer, operational oceanography could provide *ad hoc* outputs to research organisations for fisheries cruises and climate studies. A major application in the military domain in France was for acoustic prediction for acoustic detection of submarines. Fisheries application for fisheries of large pelagic fish was another promising area. Another application was for prediction of oil-spill movement. He also used a Norwegian example showing the connection between ocean currents and bloom prediction. Off Mexico, prediction of high wave events at drilling platforms was important.

Links between Operation and Research: In his presentation, Dean Roemmich focused on links between research community and operational oceanography. One of the biggest challenges for putting together a global observing system was the link between research and operations. The questions were: why was research/operations partnership a major issue? What was the role of research and research institutions in operational oceanography? He used examples from Argo to illustrate the points.

Research and operations both required observations that were sustained over long periods of time. The requirements of climate-quality observations were more demanding than for other applications. Extended participation by the research community was needed to ensure the needed spatial and temporal coverage; to maintain sensor calibration and eliminate systematic errors; to evolve system design while preserving core measurements; to introduce new instruments and observational methodologies.

Sustaining the ocean observing system would also require the continuity of existing and predominantly research-based *in situ* and satellite activities (GCOS). The agencies tasked with implementation of climate observations had not largely recognised the magnitude of the task. There was no precedent for successful transition from research to operations in the climate context.

He provided some Argo examples. Argo was truly international. Argo had adopted a broad spectrum of approaches to the research/operations interface, ranging from full research responsibility to full operational control (e.g., under meteorological services). More successful examples were from research-mode operations. The profiling float was not an “operational instrument”. It was an instrument capable of producing an operational data set. The research programs carried out technical diagnoses. They identified and corrected systematic problems in design and production, and introduced design innovations to extend float capabilities. Argo’s most significant technical achievement had been a dramatic increase in float reliability. In contrast to profiling floats, XBTs were the least technically-sophisticated instrument used in the observing system. In spite of this, researchers continued to sustain and advance the climate-relevant XBT networks.

He identified one of the essential steps as the development of a common language in the oceanographic community so that we had a common message to agencies. There was a

need to articulate the role of the research community in sustained ocean observations. The default assumption was that the role of researchers ended when observing systems were sustained. There was a need to advocate effective research/operations partnerships through dialogue involving the institutions and the agencies. He asked for a demonstration of the institutional interest and commitment to a sustained observing system. Models had to be created for sustaining observations independently of individual PIs. The terms of the partnership had to be defined. The future of the ocean observing system was at stake. A new paradigm with a proper articulation between research and operation is needed.

Minster noted that technological difficulty was not per se the problem. Met services typically included research. The important point was that research should be an integral part of the operational system.

GCOS Implementation Plan and OOPC: Talking about GCOS, Ed Harrison noted that OOPC had developed recommendations for a sustained global ocean observing system. The international research and sustained oceanography programs (WCRP, GOOS, GCOS) have worked together for more than 10 years to evaluate what actions are feasible and cost-effective for an initial global observing system for climate that will serve the needs of ocean climate assessment, forecasting and research. These were described in the ocean domain sections of the GCOS "Second Adequacy Report", which was accepted by the UNFCCC in Nov 2004. The UNFCCC has requested development of a GCOS Implementation Plan to address the recommendations of the Second Adequacy Report and these will be the primary recommendations of the plan which is to be completed and reviewed in 2005. These recommendations are congruent with the POGO Yokohama Declaration. Ocean research scientists have been instrumental in their preparation.

The recommended system is integrated (it depends on many subsystems, satellite and in situ) and interdependent (e.g. SOOP ships not only drop XBTs but also deploy surface drifting buoys and some make high accuracy air-sea observations and underway observations (e.g. pCO₂, Salinity)). Improved awareness of upcoming cruise times and areas would facilitate our ability to sustain the system and ensure optimal use of ocean ship assets.

Real time transmission of observations is key to monitoring the state of the observing system and to maintaining it at design coverage. Operational oceanography depends upon having as much information available as quickly as possible, and high quality research observations are essential for (near) real time data QC.

The extent to which the ocean is under sampled is not appreciated in many circles. Some recent work on estimating 50 year trends in upper ocean temperature was presented; in many areas of the world ocean even minimal data coverage in space and time is lacking, and it is difficult to identify statistically significant trends.

POGO is requested to continue its advocacy for the recommended global observing system, to assist in the preparation of a cruise database and to discuss the advocacy of real time data transmission of preliminary research observations for purposes of monitoring the status of the global system and QC of other real time observations.

Global Sea Level Observing System: Stan Wilson noted that Argo and Jason were progressing reasonably well. GLOSS required active participation of a large number of nations. Half of the 300 existing tide gauges did not report their data at all. Some only reported monthly averages. Maps showed that only 78 tide gauges reported within a day, and that 46 reported within one month. Of the 78 that reported daily, only half met the needs of Tsunami prediction.

There were multiple needs for coastal sea level data: some applications could accept delayed mode data; others required real-time data. What were the lessons learned? Two recent experiences (USA and Norway) with installing equipment in the Caribbean and Indonesia had been failures. Additional lessons learned recently: Brazil, India, China, Indonesia, Philippines, etc. were being brought into the stream. Essential ingredients for success required governmental agencies with mission; motivated and capable individuals to maintain the

gauges; training for those individuals; on-call technical support; political recognition of the importance of the gauges; willingness to share data; and capacity building.

Next steps were to generalise GLOSS to serve multiple purposes, providing real-time data, measurement of vertical motion, and data access without restriction. Establishing a coastal sea-level network could be near-term action for GEOSS. New source of some sort of funding was required. Capacity building was an essential ingredient. NOAA was funding half of the global *in situ* observing system; but it did not have a capacity building mandate. USAID was country-specific in its approach. Feasibility of funding from GEF for GLOSS had to be explored.

International Polar Year: IPY: 2007-2008. Gerard Jugie was invited at very short notice, and very kindly made the presentation on IPY. He noted that the first polar year was in 1882-83; second in 1932-33 and third one in 1957-58. Several organisations in different countries were involved in IPY 2007-08. Why did we need a polar year? The polar regions played a key role in the global system of the Earth. They were the locations of significant changes today. Why did it have to be international? Polar processes were not limited to national boundaries. There was a need for a reference site and observations of a seasonal cycle. Several organisations were involved in the organisation of IPY, including SCAR, and the International Arctic Science Committee. The main themes included: Take the pulse of the region; understand changes; establish global links; study the unknown; gain from the unique position of the polar region to study various phenomena; and human science.

GOOS: John Field provided a personal perspective on GOOS. The GODAE initiative was in demonstration phase, and the Implementation Plan of Coastal GOOS was under review. The challenges of Coastal GOOS were that coastal observations were politically sensitive; the stages of development and technological capabilities were very diverse from one region to another; regional needs were different; and the user bodies that drove regional GOOS initiatives were diverse. The Coastal GOOS implementation plan was ambitious but realistic. It was scientifically difficult to downscale from global to fine scales needed for coastal applications. The plan dealt with chemical and biological observations, in addition to physical ones. Standards, frequency of observations and density of observations had to be established for each variable to be measured. He mentioned a few lessons learned from the Benguela Forecasting Meeting, held in Cape Town in Nov. 2004: it was important that users get organised in each GOOS Regional Alliance. Research was needed to identify indicators, which were products for users, for example, for pollution, the state of the ecosystem or state of fish stocks. Usually, multiple indicators would be needed. Realistic plans had to be developed taking into account the state of development and needs of each region. Indicators would dictate which variables to measure and how frequently. GOOS Regional Alliances were crucial for development of Coastal GOOS, for implementation of Coastal GOOS and for pilot studies. Each GRA had to determine its own needs and priorities. GRAs needed scientific guidelines and supporting network. GRAs would need POGO support in these. He noted that there was a need for GOOS to simplify its structure, which included IGOOS (for political buy-in), JCOMM (for implementation), and GRFs (buy in) which in turn included GRAs, and the GSC (for scientific and technical advice).

COOP Implementation Plan: This was followed by a presentation by Tony Knap on the COOP Implementation Plan. Successful management and mitigation of the effects of human activities, extreme weather and climate required rapid and repeated detection of changes over a broad spectrum of time and space scales, as well as timely prediction of such changes with known uncertainty. We do not have this capability today. The hurdles to be overcome included inefficient and ineffective data management; under sampling in time, space and ecological complexity; and lack of capacity for rapid data acquisition and analysis. GOOS was designed as a system with 6 goals: to improve safety and efficiency of marine operations; to mitigate effects of natural hazards more effectively; to improve predictions of climate change and their effects; to minimise public health risks; to protect and restore healthy coastal marine ecosystems and to restore and sustain living marine resources. With respect to coastal ecosystems, Knap noted that nations and regions had some common requirements for data, data management and analyses. Regional approaches were needed to link global and coastal scales of variability. On the other hand, some other requirements were unique to regions and

nations, and these needs also had to be recognised. National and regional programmes provided the most effective venue for engaging user groups and for product development. Many elements of GOOS were already in place, and operational capabilities were most advanced for marine operations, natural hazards and climate. Capacity to contribute to, and benefit from, GOOS varied enormously among nations and regions.

GOOS envisaged a hierarchy of observations partitioned into modules with a range of resolution in observations. Implementation was through a series of GOOS Regional Alliances and National GOOS Programmes. Large Marine Ecosystem Programmes were an important mechanism for implementing the coastal module of GOOS. The backbone of the Coastal GOOS was a set of common variables (physical, chemical and biological). GOOS was envisaged as a sustained system that routinely and continuously provided data and information specified by groups that used, depended on, managed or studied oceans and coasts. Measurements (*in situ* and remote sensing), data (communications and management) and analysis/modelling formed the three subsystems of GOOS. A suite of models was needed to predict changes in various elements of the system at different time and space scales. He discussed the present structure of GOOS and the proposed structure, and the links between GOOS and JCOMM. He requested POGO to support the Implementation Plan within institutions by: setting up a common, global skeleton of key observations; developing new methods and standards and by carrying out related research; setting common standards and protocols for core measurements; sharing methods for data archiving and data management; comparing “typologies” of ecosystems which transcended regional boundaries; providing boundary conditions for open-ocean models; by sharing techniques of analyses and modelling; and by capacity building.

Session 6: Way forward in Operational Oceanography

Chair: Jan de Leeuw

After the coffee break a discussion was held on the issues pertaining to operational oceanography highlighted in the first part of the morning session. Jan de Leeuw chaired the session.

Shubha Sathyendranath presented an overview of past and present activities of POGO. She reviewed the efforts devoted to capacity building, to supporting international programmes, to resolving data issues, to increasing awareness on global ocean issues, to filling gaps in, *e.g.*, Southern Hemisphere observations, to organizing regional or thematic workshops, to developing new partnerships, to expressing the needs for ocean observation in GEO. Regarding organization and finance, POGO had stable resources, based on a truly international membership.

Jan de Leeuw presented his views on the way forward for POGO. With respect to relationship to GEOSS he suggested that one identify a few highly skilled, influential members of the community to attend future GEOSS meetings to lobby for marine observations, and help with the implementation plan. POGO would seek additional funding for the travel expenses incurred. Concerning capacity building he proposed to submit a proposal to Nippon Foundation to continue the Visiting Professorship Program, and to seek additional funding to extend activities in that respect. Concerning research vessels he summarized the recommendations agreed upon the day before to optimize their use and improve access to CTD and underway SSS data. He also mentioned the action items adopted with respect to communication and outreach.

Jean-François Minster (Ifremer) said that POGO had achieved a lot of good results, but to become more visible, it had to find ways to deliver some concrete products. Tony Knap asked about the follow-up on the time-series working group recommendations (web site, brochure, white paper). Shubha Sathyendranath said that those action items were in the pipeline. Charlie Kennel picked up on Jean-François Minster's comment, and drew attention to the upcoming Brussels EO Summit, as a great opportunity to increase visibility. John Gould restated the opportunity to improve the support to Argo through adding new data into the climatological data base. Kiyoshi Suyehiro stressed the importance of the effort devoted to

organize and perform the *Mirai's* BEAGLE cruise, and there were expectations from POGO to build upon it. Howard Roe and Carina Lange emphasized the outstanding contribution provided by JAMSTEC through this cruise, its tremendous impact and vital scientific results. The international links established would have lasting impact. Tony Haymet concurred in highlighting the particular importance for modellers of the results gained through the cruise in the Southern Hemisphere. POGO had to follow-up on the *Mirai* cruise and capitalize on it. It had been used by Australia to argue for more observations in the Southern Hemisphere.

Tony Haymet suggested that POGO request IOC, WMO, etc. to simplify the structure of international committees. Such requests should be accompanied by specific examples. No group should be made with an open-ended mandate. They should be of finite-duration, with a well-defined mandate. During discussions, Radhakrishnan noted that there was a need for a cultural change where credit went for delivery of service, rather than for publication of papers. Jean-Francois Minster responded that recognition of services was needed; but organisational structure that facilitated close interaction between research and operation was essential. Sharing of experience between institutions was also important. In oceanography, major mandate was research, and operational aspects were built on top of this. In Ifremer, operations was about 20% (contrast Met offices, where operations were 80%). It was therefore difficult to build on the Met experience. Hence sharing between institutions was important. Tony Haymet requested that the Exec be empowered to respond to the needs of the moment, in response to the GEO opportunity.

December 1, Afternoon

Session 7: Capacity building

Chair: Kiyoshi Suyehiro

Capacity Building Activities in Chile: Carina Lange reported that POGO had supported 34 students so far at training programmes organised by the University of Concepción, such as the Austral Summer Institute series and the International Courses. Such help from POGO was very much appreciated. She then reported briefly on the activities of COPAS, which was recognised as the Centre of excellence in oceanography for all of Chile. It maintained time series observations in the South East Pacific. Oceanography in the Eastern South Pacific was the topic of a special issue in *Deep-Sea Research*. A second volume was planned. The *Mirai* cruise represented a big effort for Chile, both on oceanographic, and paleo-oceanographic points of view. Chilean scientists had participated in it as scientific partners, which was an extremely valuable experience and opportunity. She spoke of their plans and efforts to obtain a ship.

Fellowship Program, SEREAD, Antares Network

Shubha Sathyendranath (POGO) presented a brief progress report on the fellowship program initiated in 2001. 12 fellowships were awarded in 2004. Support from SCOR was expected to continue, whereas contribution from IOC was uncertain. The maximum stipend was proposed to be raised up to US\$ 1,300. The SEREAD program was still very active, with teacher training workshops being organised. The South American Antares network planned to have its first meeting in January 2005, with support from POGO and IOCCG.

Nippon Foundation – POGO Visiting Professorship Program

Shino Takahashi (POGO) reported on the progress of the program, which was initiated in 2004 with help from JAMSTEC. The programme provided for two visiting professorships every year. The programme allowed for 3-6 months stay of the visiting professor in a host institution in a developing country. The programme was based on the concept of teacher and students "eating out the same bowl". Prof. Trevor Platt (Canada) and Motoyasu Miyata (Japan) will be the first two Visiting Professors. An application to extend the program over five years was being prepared. JAMSTEC was extremely helpful in establishing the relationship between POGO and the Nippon Foundation, as well as in the execution of the programme.

New Vision and Initiatives in Capacity Building at IOC

Ehrlich Desa (IOC) presented the orientations of IOC, which was poised at the interface between science and policy, and put emphasis on coastal regions rather than the open ocean. He stressed the importance of capacity building in view of sustainable use, particularly in the context of an evolving system. He discussed a number of principles for capacity building. Long-term commitment, treating inputs as investments, focusing on regional issues, self determination of needs, twinning initiatives, were amongst those principles. The role of institutions and leadership was crucial. Helping the Directors of Institutes in developing countries could really make a difference. GEO had certainly triggered, through its dynamics, the renewed interest given to capacity building, which was everybody's interest.

Jan de Leeuw thanked Ehrlich Desa for his presentation and proposed that a face-to-face meeting take place in the near future to discuss the continuing collaboration of POGO and IOC.

GODAE and Capacity Building: Mike Bell (UK Met Office) described the extremely successful GODAE Summer School, which took place in late September in La Londe Les Maures, south of France, with support from CNES, MERSEA, GODAE, NASA and NSF. 65 students (24 nations) and 28 lecturers attended the School, devoted to the prospects for operational oceanography in the 21st century. Jean-Louis Fellous mentioned a follow-up to this School, to take place in Morocco, in September 2005.

Session 8: POGO Business, Next Meeting

Chair: Charlie Kennel

Operational Oceanography in India, Next POGO Meeting (POGO-7): K. Radhakrishnan (INCOIS) introduced operational oceanography in India. He recalled the successive steps of ocean development in this country, until the recent adoption of a national agenda for the next ten to fifteen years, and described the structure and objectives set out in this plan. He highlighted the importance of remote sensing of ocean, from a series of satellites, including international collaborative missions, and described the Indian contribution to *in situ* networks, its research fleet, moorings, floats, etc. Various applications were developed: utilization of satellite data for fisheries management, wave propagation model, ocean-atmosphere modeling. Then K. Radhakrishnan presented an official invitation from INCOIS to host POGO-7 in Hyderabad in January 2006. The audience gave a round of applause to the invitation, which was accepted with warm thanks.

POGO gladly accepted the invitation of IOCAS to hold POGO-8 in China. Invitations from COPAS and BBRS to host future meetings of POGO were gratefully noted.

Election of Incoming POGO Chair (Successor to Jan de Leeuw)

Charlie Kennel recalled the by-laws of POGO. Being Chair of the Search Committee he had investigated and found a nominee for the next incoming Chair of POGO, Tony Haymet, who received immediate and unanimous approval from the audience.

Discussion, Action Items, Conclusion

Shubha Sathyendranath proposed to hold a meeting of the N&I group in 2005, asking participating institutions to support the participation of their representatives.

Jan de Leeuw closed the meeting with words of thanks to Ifremer for a seamless organization and memorable welcome, to all participants for their active contribution, and to Shubha Sathyendranath for her tireless work for POGO. **Jean-Louis Fellous** added his own thanks to Shubha and all participants. With no more business the meeting closed at 4.00 PM.

All Action Items agreed upon at the meeting are reproduced in the next section.

Action Items from POGO-6

POGO-6 Meeting was held from 29 November till 1 December, 2004 in Brest, France hosted by Ifremer. The following action items were proposed during the meeting.

Session 1 & 2: GEO-related Actions

Objective: To Continue POGO participation in GEO to ensure appropriate ocean representation in the GEO Governance structure (Steering Group and/or Science & Technology Panels)

1. Prepare Brest Communiqué to GEO-5
2. Communicate the Communiqué to GEO-5, and have it tabled.
3. Identify experienced, skilful and influential scientists and technologists to participate in future GEO working groups

The first two Actions have been completed.

Session 3 & 4: Data and Co-ordination Issues

Objective: Further the quality and quantity of global observations and observational data

4. All POGO members to request their scientists who make high-quality CTD data to relay the data in real time (if possible) or at least within one month, to an appropriate regional or international data base for operational oceanography. The same applies to other physical data (XBT, TSG) collected during research cruises.
5. All members to encourage agencies, ship operators, institutes to take the necessary steps to activate instruments that are on board research vessels and can record data automatically (typically thermo-salinographs). To ensure that the data are collected during all research cruises and transits, and transmitted to operational centres. This requires that the instruments be monitored and calibrated regularly.
6. Dean Roemmich / John Gould / Yves Desaubies to prepare and distribute a document summarizing the issues involved, and indicating the steps that should be taken to implement the actions above, referring to the existing international programmes (CLIVAR, GOSUD) and data infrastructures that are set up to accommodate underway or real-time data. This document to indicate contact points where specific information can be obtained for practical implementation.
7. The above actions to be recognised as a matter of high priority, and the matter to be taken up by POGO members at the national levels to get this approach enshrined in national policies.
8. Directors to report on Actions 4 – 7 at the POGO-7 meeting.

Objective: To improve on efficiency of RV use worldwide

9. The members recognised the need to improve on co-ordination of pre-planned, planned and actual cruises and data bases to enhance awareness of opportunities, to improve cost-effectiveness and to improve data mining. Marieke Rietveld (POGO, Royal NIOZ, Netherlands), Douglas White (U. Delaware), SCOR nominee (Ed Urban), EurOceans (Laurent D'Ozouville) and IOC nominee (VOS system) to meet (in person or by e-mail) to:
 - A) Identify features needed in an ideal database of research cruises
 - B) Determine how well existing databases fit the ideal, and how they would need to be changed to meet the needs of scientists
 - C) Estimate the cost of modifying an existing database or create a new one
 - D) Request support from appropriate agencies to augment an existing database.
 - E) Time frame for the operations of this group is 1 year.

F) To report at POGO-7 on progress and conclusions

Objective: To (re)vitalize POGO's outreach

10. POGO members to nominate an appropriate outreach/media person from their institute to the News & Information Group of POGO. All nominations to be sent to Cindy Clark (cclark@ucsd.edu), the present chair of the group.
11. POGO members to authorise the Executive Committee to work with the News & Information Group to develop press release material as appropriate, with the help of Shubha Sathyendranath
12. POGO members to contribute to a database of ocean science writers and journalists (Lead: Cindy Clark and members of News & Information Group)
13. POGO members to contribute to the development of a web site that illustrates through various examples the value of ocean observations (Lead: Cindy Clark and members of News & Information Group) (Several good examples are already on the web)

Sessions 5 & 6: Issues in Operational Oceanography; Re-focussing of POGO Activities

Objective: Streamlining and innovating in-situ observations

14. All POGO members to raise the issue at national and institutional levels of the importance of maintaining close links between research and operations in oceanography.
15. POGO to request IOC and other sister organisations to reduce the number of sitting committees by combining committees with overlapping functions, and to terminate committees that have become obsolete or inactive.
16. POGO members to facilitate this transition by contributing representation only to committees that are active and productive
17. POGO itself should not generate standing committees: only committees with a finite task and a limited life span.
18. POGO to request the Time Series Working Group to report on progress in recent years; in particular on the status of the various time-series sites maintained by POGO member institutions; on the web site; on the white paper; and the brochure.
19. POGO members recorded their appreciation of the tremendous long-lasting impact and vital scientific results generated by the JAMSTEC *Mirai* BEAGLE 2003 cruise. This was a ground-breaking initiative, from various points of view: the excellence of the scientific results that have already emerged; the generation and maintenance of new international collaborations; and the capacity building activities that were carried out; all make this an outstanding expedition. POGO members to capitalise on this JAMSTEC initiative, and to use it as a stepping stone to further improved observations in the southern hemisphere.
20. POGO to produce a brochure highlighting the importance of the BEAGLE 2003 cruise, from the POGO perspective (Lead: Cindy Clark and the News & Information Group)
21. POGO has made important achievements in its lifetime, but visibility is poor. Generate ideas to increase visibility of POGO achievements. (Action: all members, Secretariat and the News & Information Group).
22. POGO members to consider the ways in which POGO can contribute uniquely and concretely to the ocean issues of the day.
23. POGO to respond to the opportunity provided by the International Polar Year to augment observations in the Southern Hemisphere.
24. POGO Executive Committee to be empowered to respond as appropriate to the GEO/GEOSS movement and activities, where essential to complement the national and the IOC contributions.

Session 7 & 8: Capacity Building and POGO Business

Objective: Improve and extend capacity building and POGO Business

25. POGO members acknowledged the tremendous potential impact of the Nippon Foundation POGO Visiting Professorship Programme, and resolved to pursue the implementation of the programme as a priority.
26. Impact of the falling dollar on the POGO budget was discussed. POGO to try to offset this deficit by bringing in new members, and to explore a well-planned and strategic mechanism for implementing small increases to the membership dues to offset inflation. A proposal on this matter to be distributed to POGO members well in advance of the next POGO meeting. (Action: Secretariat, with Exec.)
27. POGO members accepted the invitation from Dr. Radhakrishnan, and resolved to hold the next meeting of POGO (POGO-7) in Hyderabad, India, hosted by INCOIS, on Jan 18-20, 2006.
28. POGO members accepted the invitation from IOCAS and resolved to hold the POGO meeting in 2007 (POGO-8) in China, in the second half of Jan 2007.
29. POGO noted the invitations from COPAS and BBSR to host subsequent POGO meetings.
30. POGO and IOC to discuss further possible actions to further common goals in capacity building.
31. POGO will further explore capacity building possibilities through USAID.