Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-WMO-UNEP-ICSU Scientific Steering Committee of the Global Ocean Observing System (GOOS)

Twelfth Session
25-27 February 2009
Perth, Australia

GOOS Report No. 175
UNESCO

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ABSTRACT

The 12th session of the IOC-WMO-UNEP-ICSU Scientific Steering Committee of the Global Ocean Observing System (GSSC), was held in Perth Australia, on 25-27 February, 2009. The Second session of the Panel for Integrated Coastal Observations, PICO II, met 24-26 February and in joint session with GSSC-II on February 26. The GSSC-II reviewed open ocean implementation progress and data management programmes. A GSSC working group evaluated the implications of GODAE Ocean VIEW involvement with GSSC and concluded that close cooperation with the JCOMM ETOOFS was necessary. The relationship of GSSC with GEO/GEOSS was discussed in plenary and working groups, with a recommendation that I-GOOS be requested to directly support higher level representation of GOOS. A recommendation was made to support the submission of a resolution to IOC-XXV for the adoption of the new Equation of State for seawater, TEOS-10. Joint session with PICO II approved the progress toward drafting a comprehensive coastal implementation plan.

(SC-2009/……)

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1 OPENING AND WELCOME

The chairman of the GSSC, Ralph Rayner, opened the GSSC XII by welcoming the committee, invited experts and other participants. The themes to this year's GSSC meeting are cooperation, coordination and collaboration with other programmes. Reports have been requested from many programmes, OOPC, SCOR, UNEP Regional Seas, SCAR, JCOMM, POGO, IOCCP, GODAE, OceanVIEW, GEOSS, WIGOS, IOOS, IODE, NOAA, GCOS, GEO and others. Where a representative of the programmes was unable to come to Perth for the meeting, presentations and reports will be made on their behalf. The challenge of evaluating the interaction of GOOS with these many programmes is great and requires continuous engagement and communication. Engagement and communication are the goals of the GSSC XII.

1.4 REVIEW OF PREVIOUS GSSC ACTION ITEMS, THOMAS GROSS, IOC SECRETARIAT

The action item and recommendation list from the GSSC-XI, were reviewed in session. Progress on most items met with satisfaction by the committee. Progress has been made on the Coastal Hazard Mitigation Report and a draft will be circulated soon. Outreach material continues to be refined and will be presented on the http://oceanunited.net website as it is composed, including the consolidated outreach message of GOOS and the GOOS Use Case Scenario. GEO/GEOSS interactions remain an on-going issue, and will be addressed by presentations and working groups in this meeting. Continuing tasks will be brought over to the GSSC XII task list.

2 REVIEW OF PROGRESS AGAINST IMPLEMENTATION PLANS

2.1 OCEAN DOMAIN IMPLEMENTATION STATUS & ISSUES, ED HARRISON

D. E. Harrison, NOAA/PMEL, chair of OOPC, summarized the GOOS open ocean module and Global Climate Observing System, GCOS, implementation status and issues for 2008-09. The GCOS Implementation Plan has seen substantial progress in every action, most notably the completion of the Argo and Surface Drifters deployment goals. Important new developments in technology have increased the feasibility of implementing observations of many more Essential Climate Variables, although metadata and standards issues are limiting some progress. Ocean reanalysis and near real time analysis systems, as reviewed by the GODAE symposium, have become a reliable and routine part of the GCOS, although evaluation and modeling coupling methods could be improved. Data exchange needs and distribution systems are still in need of coordination and standardization. Sustaining the implementation of the observation systems remains an elusive goal of GCOS and GOOS programmes. National institutional arrangements to sustain activities should organize at the I-GOOS and IOC levels of intergovernmental commitment. Coastal systems and Arctic systems require an integrated framework and support.

Observation systems have now achieved good coverage for SST and upper ocean T and S for the ice free ocean. An emphasis should now be passed over to achieving high resolution local / regional data sets which will satisfy many critical societal needs. Global sea level rise, while attracting great attention as an index of global climate change, is quite different from local relative sea level rise, which can be an order of magnitude greater and of much more immediate interest to many users around the world. Local measurements providing interannual and decadal variability, are essential for this issue.

Analysis/Reanalysis of ocean data has been advanced greatly by the GODAE and Argo programmes. With GODAE, as a pilot project, completed, future strategies for GODAE/

OceanVIEW and the JCOMM Ocean Forecast Systems, CLIVAR, WCRP and the Global Synthesis and Observations Panel will work together to continue analysis/reanalysis research and operational development. Coupled analysis/reanalysis are a fundamental part of the climate change dialogue and scenario development. Other research issues include surface current syntheses, sea ice, carbon and air-sea surface flux, and carbon inventory designs.

GOOS and GSSC should examine new technologies which may enable new ocean observation systems to be brought on-line. GSSC should actively advocate for the advancement of appropriate technologies. In particular, nutrient observation methods have moved far forward with the adoption of standards for intercalibration. Abyssal temperature observations could be added to many deep sea deployments relatively inexpensively. Animal oceanography has proven to be an extremely useful adjunct to the Argo system for under ice measurements. The Alliance for Coastal Technologies is doing great work in moving technology forward, establishing standards and encouraging private enterprise investment.

Institutional issues which impede sustained funding and therefore development of operational systems are the biggest GOOS problem. No framework has been found within which to have meaningful high-level, multi-lateral discussions about sustaining ocean or coastal in situ observations. WCRP and IGBP research programmes continue to provide our in situ observation base. The development of CEOS constellations has proven very useful to demonstrate the interrelated structure of the observation systems. The role of climate and ecosystem regulations/treaties has not been fully exploited by GOOS developers. JCOMM is a key part of GOOS, yet it is already treated as a mature entity. It needs support to grow into its design. To convince institutions of the value of GOOS, nothing works better than concise Ocean Indicators. An indicator for subsurface heat is still under development. The data itself must be indicated, and information represented by an “honest broker”. Recommendations for GCOS:

- Continue to press all Actions in v1 GCOS-IP
- Agree how best to incorporate new knowledge, new technologies, new sampling results
- Support CEOS Constellations process?
- Bring more biogeochemical and ecosystem observations into system plan and organizations.
- GSSC should participate in OceanObs09 in Venice, September 2009
- Build close connections with next-generation WCRP (and IGBP and CoML) programs, such as the GODAE OceanVIEW.
- Participate in COP-15 with GCOS-IP v.2 to SBSTA/UNFCCC Dec 2009

The committee continued discussion following the coffee break.

The above list of recommendations concerns the relationship of the GSSC with other institutions. GCOS is the appropriate arm of GOOS to communicate global and climate issues with GEO and the UN Framework Convention on Climate Change. However a weakness is perceived in that GCOS may not have the GOOS mandate for this role. Other institutional opportunities are not being exploited. The Argo system is largely created by 10 countries. A convening of this group would be a useful tool to further sustainable goals for Argo. The GODAE OceanVIEW is another important institutional collaboration which GSSC must face. The GSSC should endeavor to monitor communications and assure that important institutional communications are not falling to the wayside. The JCOMM requires more proactive support from GSSC and GOOS to further goals of the sustained observing system.

JCOMM can do part of this, but it also requires GSSC involvement.

The world of ocean observations does not have persuasive products which make the connection between societal benefit, everyday interest and the need for operational ocean observations. Can the GSSC build toward this type of message? An ocean index, an user case, ocean observation constellation concept, fisheries index; any of these ideas might work to create an ocean story which society would be interested in and which would reveal to people that the governments are not supporting Ocean Observations, as the people most likely assume they are. The GCOS implementation plan was built around this type of premise and achievable goals which demonstrate the progress of the system. The CEOS constellation concept should be more directly supported by ocean science. We already take the satellite systems for granted. POGO should be encouraged to engage more with WMO and Coordination Group for Meteorological Satellites (CGMS) to advocate for satellites.

The chair of I-GOOS, François Gérard, explained that a summary for policy makers is being prepared for the IOC assembly, to convince governments to engage in long term support of observation systems. This will be a political process, which can be best driven by each nation's commitment to legal agreements specifying observation systems, such as the meteorology services found in most nations. IOC cannot act like the WMO as an implementation body, but it is trying to create sustainable implementation of the ocean observing system. The IOC assembly should be carefully instructed as to what GOOS can be and what it cannot do.

Action 1 OOPC, GSOP to formulate and cosponsor a workshop to examine the technology for development of an observing system of the sub Argo Ocean. (March 2010)

Action 2 GSSC Chair to request recommendation on national support of JCOMM. Recognizing the importance of JCOMM to GOOS implementation, request I-GOOS to urge member states to enhance resource contributions (human and financial) to JCOMM programme activities. (I-GOOS IX)

2.2 REVIEW OF STATUS OF GOOS PILOT PROGRAMMES, THOMAS GROSS, IOC SECRETARIAT

Pilot Programmes hold an important role in the implementation plans for GOOS. They are intended to be proving grounds and demonstrations of the importance of marine observations systems before the systems become committed to be a permanent aspect of GOOS. GOOS Pilot Projects begin as proposals to the GOOS Scientific Steering Committee (GSSC) to demonstrate a component of the observing system. Upon approval a Pilot Project is expected to run for 3-5 years after which it should continue on as an operational system. All Pilot Projects demonstrate operational techniques and user demand for products. During the demonstration phase the Pilot Projects are supported as research programmes from host institutions and other IOC member state sources. GOOS programmes are not operationally funded from IOC/GOOS sources. Therefore a significant aspect of a Pilot Project is the demonstration of sustained funding sources for continuation based on tangible user demand and needs. Current pilot projects include: ChloroGIN, ChloroGIN Africa, Ferry Box, Ocean Tracking Network, Meta-T, PP-WET. The GSSC will become more active in the monitoring of on-going pilot projects and the approval of pending pilot projects.

3 COORDINATION AND COLLABORATION WITH OTHER PROGRAMMES

3.1 SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH, SCOR, SESSION

3.1.1 Equation of State of Seawater, Working Group 127 Report: Trevor McDougall, CSIRO and chair of SCOR/IAPSO WG127

The GSSC has been requested to make a recommendation to the IOC about the new Equation of State of Seawater as presented by the SCOR/IAPSO Working Group 127 Report. Trevor McDougall presented the case in favor of updating the existing 1980 International Equation of State (EOS-80) to include necessary expressions for thermodynamic properties of seawater, entropy, internal energy and enthalpy. A single Gibbs function may be used to derive these properties, as well as the potential temperature in a consistent manner. The WG127 was convened to examine the feasibility and necessity of this improvement. A definition of Reference Composition of seawater was developed based on the ionic composition of Standard Seawater from earlier analytical measurements. The Absolute Salinity, based on the Reference Composition, replaces the Practical Salinity, which reflects the conductivity of seawater, in calculations of the Gibbs function. The Absolute Salinity Anomaly, delta SA, which corrects the Practical Salinity to Absolute Salinity has been measured for over 800 samples and can now be related to the silicate concentration to give a useful and accurate correction factor. Why bother? The freshwater content of seawater is (1 – 0.001SA) not (1 – 0.001SP), and SA and SP are known to differ by about 0.47%. There seems no good reason for continuing to ignore this known difference in ocean models. Practical Salinity expressed in the PSS-78 scale is outside the system of SI units. PSS-78 is limited to the salinity range 2 to 42. Density of seawater is a function of SA not of SP. Hence we need to use Absolute Salinity in order to accurately determine the horizontal density gradients (for use in the "thermal wind" equation). Once adopted the Absolute Salinity allows calculation of the Gibbs function from which all of the thermodynamic properties of seawater can be determined by simple differentiation and algebraic manipulation. As an example of the importance of this difference the calculation of "thermal wind" from density gradients is examined. For more than 60% of data from the world ocean below 10 Mpa ~ 1000m, the improvement in accuracy is greater than 2%. A further example shows how the potential temperature differs from heat content and thus is not conservative under pressure changes. Therefore potential temperature is not as accurate a water mass tracer as heat content. The MOM4 ocean model uses the enthalpy as a tracer and obtains 0.5 degree Centigrade improvements.

Recommended changes to oceanographic practice:

- *Adopt the TEOS-10 definition of the Gibbs function for seawater, requiring the use of its new algorithms for density, sound speed, enthalpy, etc, (these algorithms are available on the TEOS-10 web site)*

- *Adopt Absolute Salinity SA; requiring the use of the new algorithm to go from the present conductivity-based measure of salinity, SP, #to SA (McDougall, Jackett & Millero, Ocean Science, 2009).*

- *Continue to report Practical Salinity SP to national data bases because# (i) SP is a measured parameter and # (ii) we need to maintain continuity in these data bases.*

- *Note that this treatment of salinity is similar to what we presently do for temperature; we store in situ temperature, but we publish potential temperature.*

The committee expressed respect for the work and concept. The need to insert this rigorously correct method into oceanography classrooms is evident and new textbooks will be rewritten. The community must be reassured that the PSU data will be retained in all databanks and instrumentation output. Databanks should continue to record and store the actual measurement of conductivity or its algebraic equivalent PSU. A concern was expressed that the calculation of Absolute Salinity Anomaly is dependent upon the composition calculation which is empirical and based on "only" 850 samples. Trevor McDougall reiterated that it is the Gibbs function which is being proposed, which does not have any empirical component. The calculation of Absolute Salinity is enabled by the Gibbs function formulation, allowing the usage of composition information thereby only improving the calculation of sea water properties. The EOS-80 method implicitly assumes a single form of composition and thus could be seen to be dependent upon only one data point. The committee noted the ongoing expert review requested by the GOOS Programme Office on the TEOS-10 and looked forward to being informed of the results.

Action 3 *GSSC to recommend I-GOOS and IOC to accept the TEOS subject to the outcome of the expert review requested by the GPO (I-GOOS IX)*

3.1.2 SCOR/IAPSO OceanScope Working Group, Missy Feeley.

October 2008 the SCOR executive committee approved the OceanScope with the vision statement: "In partnership with the merchant marine shipping industry we will develop an integrated approach to the observation of the global ocean on a regular and sustainable basis. This effort, entitled 'OceanScope' will equip commercial ships with fully automated unattended instrumentation to accurately measure and report upon both the currents and the physical, chemical and biological characteristics of the water column throughout the world ocean. These data will in time become a fundamental resource for studies of the climate and health of our planet" Tom Rossby's creation is bearing fruit and the programme will begin by identifying data needs, ships, routes and data paths. The current economic downturn has adversely affected shipping and slowed up deployment plans. The JCOMM Ship of Opportunity Programme and OceanScope chairs are invited to cooperate more closely. There is already appreciable overlap of the members of the two groups. The OceanScope group should focus on technologies and standards. Plans are being developed to specify requirements for a wet lab to be built into future ships for operations and calibrations of the observing equipment, including Ferry boxes. The ship building industry and ship certification societies are engaged in this effort.

3.1.3 Report of Workshop on Ocean Biology Observations in the Oceans, John Gunn, Australian IMOS Board

Ed Urban from the SCOR office, and a Panel on New Technologies for Observing Marine Life, have been active in planning for a workshop to be held in association with Ocean Obs '09. The workshop will bring together biologists, observing community, and technological community to develop ocean biology observatories that could address the grand challenges of observing ocean life and its response to global change. Attached are a brief outline of the draft agenda, and a statement of intent from SCOR (GSSCXII-3.1.3_Ocean Biology Workshop-v2.doc). The Panel has a white paper accepted for the Ocean Obs meeting to report on the outcomes of the workshop. This is a very useful initiative by the SCOR community who hope that GOOS SSC would endorse and actively support the workshop. Updates on the workshop will be posted at http://www.scor-int.org/OBO_Workshop.htm

3.2 UNEP REGIONAL SEAS PROGRAMME, RALPH RAYNER, CHAIR GSSC

The 10th Global Meeting of the Regional Seas, Conventions and Action Plans was held in Guayaquil, Ecuador, 25th - 27th November, 2008. The outcome was the document "Global Regional Seas Strategic Directions 2008-2012", UNEP (DEPI)/RS.10/INF.3.RS, (GSSC-

XII/3.2). The UNEP Regional Seas Programme promotes the sustainable use and conservation of coastal and marine ecosystems and the services they provide. In this time of declining biodiversity the charge has become more important than ever. The example of the Regional Seas Conventions is a model the GOOS should attempt to emulate. Through the UNEP member states the conventions give the Regional Seas programme visibility and resources that enable it to participate in UN programmes such as the Millennium Development Goals, One UN Delivery, UNEP-UNDP Poverty Facility, and UN Development Assistance Frameworks, UNDAF. The IOC is tasked with cooperating with the Regional Seas Programmes, which it should strive to engage with at as many levels as possible.

Action 4 *GSSC Chair to meet with UNEP head of Regional Seas to discuss GOOS contribution (June 2009)*

3.3 THE SOUTHERN OCEAN OBSERVING SYSTEM, COLIN SUMMERHAYES, SCAR EXECUTIVE DIRECTOR (PRESENTED ON HIS BEHALF BY THOMAS GROSS, IOC SECRETARIAT

The Southern Ocean Observing System, SOOS, is a major contribution of Scientific Committee on Antarctic Research, SCAR, to the International Polar Year, IPY and will constitute a major legacy of the IPY. SOOS is being developed by the joint SCAR/SCOR Expert Group on Oceanography (EG-Ocean). SCAR's involvement in the Southern Ocean includes: (i) SOOS and the EG-Ocean; (ii) co-sponsorship of Southern Ocean GLOBEC; (iii) co-sponsorship of ICED (Integrating Climate and Ecosystem Dynamics, (which will be a successor to JGOFS and GLOBEC and is part of IMBER); (iv) the Continuous Plankton Recorder Expert Group (compiling international Sothern Ocean CPR data); (v) co-sponsorship of the International Panel for Antarctic Buoys (IPAB); (vi) the Antarctic Sea Ice Processes and Climate project (ASPeCt) and its sea ice database. (vii) a new group looking at the biology and geology of hydrothermal seeps; (viii) the Census of Antarctic Marine Life project (CAML); (ix) the Marine Biodiversity Information Network MarBIN. SOOS development will depend on progress with research developments in the two large marine IPY programmes from the Southern Ocean, CASO (Climate of Antarctica and the Southern Ocean) and SASSI. (Synoptic Antarctic Shelf-Slope Interactions). The SOOS implementation has been supported by many international programmes, (SCAR, SCOR, GOOS, CAML, POGO, WCRP, JCOMM, GCOS...), leading environmental agencies and other key players. Links between SOOS, research programmes and international organizations will be affected by the SOOS coordination group. The SOOS coordination group will also oversee coordination of field activities; development of a funding strategy; etc. A draft SOOS planning document was made available in January 2009 to the community for comment. GSSC and GOOS are involved in the process.

3.4 OCEAN OBSERVATORIES INITIATIVE, RALPH RAYNER, CHAIR GSSC

The Ocean Observatories Initiative (OOI) will construct a networked infrastructure of science-driven sensor systems to measure the physical, chemical, geological and biological variables in the ocean and seafloor. OOI is the National Science Foundation's contribution to the U.S. Integrated Ocean Observing System (IOOS). While the science-driven OOI will focus on discoveries enabled by new technologies, IOOS will concentrate on direct applications to everyday societal needs. The GSSC will stay informed of the OOI, as it integrates into the IOOS, a part of the US-GOOS contributions to GOOS. More information is available at http://www.joiscience.org/ocean-observing/initiative.

3.5 JCOMM EXPERT TEAM ON OPERATIONAL OCEAN FORECAST SYSTEMS, GARY BRASSINGTON, CHAIR JCOMM ETOOFS

Gary Brassington, chair of the JCOMM Expert Team on Operational Ocean Forecast Systems, described the initiation and purpose of the JCOMM ETOOFS. The final meeting of the GODAE in December 2008 emphasized the necessity of planning for the transition of numerical ocean models into the operational stream. JCOMM formed a team of experts experienced with existing forecast systems and anticipates evolving with additional system experts. Operational systems are not tools for research of numerical methods. They must adhere to standards and protocols which emphasize operational reliability and verification. This is a change in development methods for most modeling teams and will require early engagement with the ETOOFS. New systems will rely upon nesting technologies, which require a higher level of interoperability than presently exists in most systems. The standardization will require open access to data and model results. The JCOMM ETOOFS and the GODAE OceanVIEW complement each other for development of ocean modeling and forecast capabilities. The objectives of JCOMM ETOOFS focus on support and coordination for agencies and systems delivering operational ocean forecasting and related services. The objectives of GODAE OceanVIEW focus on the scientific challenges associated with development of operational oceanography and coordination with the research community. A draft record of understanding is being agreed upon between the two groups. The ETOOFS ToRs specify the advice giving role of the ETOOFS. Through a Guide to Operational Oceanographic Forecasting Systems, they will advise upon standards, nomenclature, an inter-comparison framework and observation requirements.

Today's GOOS forecast systems are ocean basin scale, and do not include tides and surface gravity waves. Future GOOS systems will embrace coastal processes, and provide coupling to biogeochemical processes. The goal will be to span decadal climate forecasts to hourly scale coastal needs for wave and inundation modeling. The GODAE models do not take advantage of optimal data assimilation methods and therefore require more observations and cost than might be necessary. Forecast and model system design interact with the observing system, setting requirements and cost. GOOS/GODAE partnership is critical to get right balance between observation needs and a viable end-user product. Forecast system needs will be quite demanding of real-time data access, including real-time automatic Quality Control methods. Free and open data must be used in order that derived forecast products be fully available to the widest group of end-users.

ETOOFS is a new group in the formative stage. It is critical that GOOS be engaged and use ETOOFS as strong national advocates of global forecasting capabilities. The technical challenges are very large and will require community wide agreement to build a solid base for future forecast systems.

COMMITTEE DISCUSSION:

The committee observed that the GOOS should be embracing forecast products and ocean modeling as part of the full chain from instrumentation to observation to information. Data processing and data management have been a GOOS priority alongside observation systems. Previously GOOS may not have appropriately emphasized forecast and assimilation.

It is not clear whether the GODAE products are mature enough to become operational products. There are research issues to be resolved, which seem to be the responsibility of GODAE OceanVIEW. Some components of GODAE may be operationally ready. The line between research and operations in this field appears particularly blurry. What is the separate role of ETOOFS and GODAE OceanVIEW? The JCOMM WMO mandate is to deliver services, GODAE OceanVIEW has identified many research issues which require resolution. The need to define operational priorities for forecast systems seems clear. However it may not be useful to separate this function from the research goals of GODAE OceanVIEW. GODAE

could accept standards prescribed by JCOMM, but it would be much more efficient and science based if GODAE OceanVIEW was involved with the development of operational methods. JCOMM cannot be asked to accept models and information products from GODAE, it would be much more efficient for JCOMM to match user needs and data requirements to modeling needs.

Existing forecast systems require formats and standardization, it will be key to global operations and interoperability. Standardization issues may be best resolved within the intergovernmental process. The ETOOFS seems well poised to provide advice on these issues to the I-GOOS, WMO and IOC intergovernmental processes. The ETOOFS can be a centralized conduit for advice to member states. Guidance materials, as ETOOFS has emphasized, are required before standards should be pushed on the research community. The GSSC can help in this process by setting observational requirements which match forecasting needs. The data stream must be coordinated with forecast systems, a job clearly within the JCOMM mandate. However making the models accept these input standards is almost a research issue, as the models are only owned by researchers. Again this is an unavoidable overlap of the ETOOFs and GODAE OceanVIEW missions.

The GSSC decided to continue the discussion of the relationship of JCOMM ETOOF and GODAE OceanVIEW in a working group. The report and advice of that working group is Section 6.4.

4 EMERGING ISSUES

4.1 DEEP OCEAN MONITORING, D. E. HARRISON NOAA/PMEL, CHAIR OOPC

At present the Argo floats are able to sample to about 2 km depth throughout most of the ice-free ocean. However, most of deep oceans are drastically under sampled. There is an unfulfilled need for a Deep Ocean Monitoring system. Many fundamental questions about climate change require better information about the deep ocean. The total heat content of the ocean, an essential element of the rate of temperature increase due to climate change, cannot be accurately monitored. Conspicuous discrepancies are evident in trends of sea level change and upper ocean heat content. Deep ocean circulation, meridional overturning circulation and formation of intermediate and deep waters are more variable and episodic than previously believed, requiring longer, continuous records of essential climate variables in the sub-Argo ocean.

Engineering a deep ocean monitoring system will not require new technological advances. Nothing impedes the development of deep ocean Argo floats or gliders. Moorings and existing DART moorings can be easily fitted with additional deep sensors. A dedicated hydrographic ship could substantially increase the amount of deep ocean sampling.

The scientific need for deep ocean monitoring has driven several groups to advocate for a system, including the UNFCCC/WCC3 (World Climate Conference 3). This should become a priority for the next generation WCRP program focus. GOOS risks allowing another major observation system to be designed by experimental researchers. A white paper will be delivered to the Ocean Obs 09 meeting, (Silvia Garzoli, NOAA/AOML, “Moving towards the future of a global array of deep ocean observations”). The GSSC should follow these developments and begin to integrate deep ocean monitoring into the open-ocean module of GOOS.

4.2 WAVE MEASUREMENT EVALUATION AND TEST FROM MOORED BUOYS, THOMAS GROSS, IOC SECRETARIAT

The DBCP – ETWS Pilot Project for Wave measurement Evaluation and Test from moored buoys, (PP-WET http://www.jcom.info/wet), was recommended by the JCOMM Technical Workshop on Wave Measurements from Buoys (October 2008, New York, USA. http://www.jcomm.info/wavebuoys). This pilot project will investigate emerging technologies for measuring waves from GPS drifters, formulate wave instrument intercomparison projects, and identify best practices and standards for wave observations and analysis. The programme serves the important need of technological evaluation of wave observation techniques and prepares the ground for the inclusion of wave observations into the operational data streams of the JCOMM. The GSSC recognizes the need for this programme and will monitor its progress toward incorporation of more wave measurements into GOOS. The coastal components of GOOS and the GRAs have a great need to include real-time wave observations into the network.

4.3 INTERNATIONAL OCEAN CARBON COORDINATION PROJECT, MARIA HOOD, IOC/IOCCP COORDINATOR.

The International Ocean Carbon Coordination Project, IOCCP (http://ioccp.org), was approved in 2005 by IOC and SCOR to coordinate an international effort to quantify global ocean uptake of atmospheric CO2 and understand its drivers, variability, and vulnerability. The IOCCP is the central information source for observation programmes and research activities. The IOCCP is a community and an international forum to address issues to ensure that individual efforts can become part of global data and information. Ship based repeat hydrography, surface underway pCO2 measurements, and Time Series Carbon moorings in collaboration with OceanSITES, form the core observation system of IOCCP. These are all international programmes, almost always research activities, which can be brought together to form a global observation network. IOCCP guides the field by encouraging standards and methods for the GCOS Essential Climate Variables involving carbon (Carbon dioxide partial pressure, dissolved inorganic carbon, dissolved organic carbon, alkalinity, pH). Further development of the system will require continuous development of new technologies for on-board systems to improve intercomparison and cost effectiveness. Sensors for moorings and subsurface profiling floats are underdevelopment, but it may be another 5-10 years before these are mature enough to blend into the global data stream. Data interpolation methods are under research to determine if the sampling methods and historical coverage is adequate to determine decadal trends.

IOCCP major activities for 2009 include the Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP), a 2 year advisory panel which is revising the WOCE manual and developing a strategy for the global survey. GO-SHIP will be represented at the OceanObs09, where it will present progress to date on the manual revision. The Surface Ocean CO2 Atlas Project (SOCAT) is a long term project to develop a global common format surface ocean CO2 data set with well documented quality control and no interpolation. SOCAT data set now includes over 7 million measurements from more than 2100 cruises from 1968-2007 and will be published in 2009 and made available via Live-Access Server. Plans are being developed to sustain this activity. The Changing Times Inventory is a multiplatform inventory of carbon and biogeochemistry “time series” measurements that is more inclusive than OceanSITES (but still restricted to observation programs that are meant to be long-term and would not include process studies or one-off experiments).

The IOCCP reflects the active engagement of its participants and many partnerships. The necessity of coordination for global carbon measurements is recognized and supported by a wide range of organizations including: UNESCO, IOC, US NSF, NIES, JAMSTEC, CDIAC, Univ. Bergen, NOAA PMEL, US OCB, EU CARBOOCEAN, EUCOCOS, EU EPOCA,

SOLAS, IMBER, CLIVAR, OceanSITES, Argo, OOPC / GCOS. The GSSC should encourage GOOS to embrace the IOCCP as a fundamental part of the global ocean observation system.

4.4 OCEAN ACIDIFICATION, CAROL TURLEY, PLYMOUTH MARINE LABORATORY.

The issue of ocean acidification due to increased CO2 in the atmosphere has only recently received widespread interest by the climate change community. But the effects of a high CO2 world on ocean acidification are anthropogenic planetary-scale perturbations that could significantly modify oceanic biogeochemical fluxes and severely damage marine biota before other climate change problems manifest themselves. The ocean is a highly buffered system and has been absorbing the majority of anthropogenic carbon releases. But the increased partial pressure of atmospheric CO2, to levels already reached, will most certainly decrease the pH by 0.1 units in surface waters by 2050, a 30% increase in acidity. The ramifications of such pH changes on foraminifera and other life forms dependent upon calcareous shells will be extraordinary. Laboratory studies show substantial increases in mortality of larval forms, decreases in growth rates of shell fish and decreased calcification of coral reefs in the tropics. Time series data of pH are sparse and very scattered away from the tropics. Existing evidence shows great variability in rate of change pH throughout the oceans. Local conditions are important to predicting exposure to corrosive waters, which may episodically upwell, inundating sensitive ecosystems. Monitoring of pH should be increased throughout the oceans to substantiate these trends. In summary the acidification of the ocean seems unavoidable. Oceans will become more acidic – a very high certainty. The impact on ocean food webs, ecosystems and biogeochemical cycles could be very serious. The only way of reducing the impact of global ocean acidification is a substantial and urgent reduction in CO2 emissions – very high certainty and very unlikely. Mitigation will make a difference – ocean acidification argues for stabilizing atmospheric CO2 to levels lower than 450 ppm.

The European Project on Ocean Acidification, EPOCA, was launched in June 2008 for four years. The overall goal is to advance understanding of the biological, ecological, biogeochemical, and societal implications of ocean acidification. The report from the Second International Symposium on The Ocean in a High-CO2 World, Monaco Oct. 6-9, 2008, received widespread circulation and high level attention through the Monaco Declaration released on 30 January, 2009. Links to these reports are on The Ocean Acidification Network website, http://www.ocean-acidification.net .

4.5 GOOS AS THE OCEAN COMPONENT OF GCOS, JOHN W. ZILLMAN, CHAIR GCOS STEERING COMMITTEE

The GOOS has been the ocean component of the Global Climate Observing System from their inception. The interests of both GOOS and GCOS reinforce one another and drive one another. The need for climate observations are well known and are now recognized to be an integral part of the requirements of the IPCC, the UNFCCC and other international conventions and agreements. The call for a GCOS which integrates atmospheric and ocean systems was made in 1991 and led to the establishment by the sponsors, WMO, UNEP, UNESCO, IOC, FAO, ICSU. The goal of the Global Climate Observing System (GCOS) is to provide comprehensive information on the total climate system, involving a multidisciplinary range of physical, chemical and biological properties and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes (Annex A to 1992 and 1998 WMO-IOC-UNEP-ICSU MOU). GCOS's primary role is to be the system of systems to help systems perform their climate monitoring role. Four schematic organization charts were presented describing: i) The GEOSS observation system to user needs; ii) GCOS sponsors and observing systems (GOOS, GOS, GAW, GTOS which make up GCOS); iii) GCOS planning and advisory mechanisms; iv) GOOS, WIGOS and GTOS serving the UNFCCC through GCOS. The OOPC plays an important linking role between GCOS and GOOS. GCOS is available to sponsor and provide

moral support for the bodies of GOOS which do climate work, like OOPC, GSSC and JCOMM and with WIGOS. WMO's engagement with GEOSS has been beneficial but is, like GOOS, confused about how to manage these interfaces without competing or duplicating efforts.

GCOS is engaged with the UNFCCC meetings. A side event in Bonn will feature observing systems and the needs of the convention. GEO, if it is to meet climate needs, must accept GCOS, GOOS etc. as observing systems for GEOSS.

The committee discussed the ambit of the GCOS. GCOS is objective oriented, and would leave product delivery to the JCOMM. Climate conventions relate not to services, but to support of observations and research. New conventions might be more oriented to services and applications, an integrated climate services system. GCOS and GOOS need to do better on mediation applications. The climate agenda will be replaced by climate knowledge initiative, decadal predictions, user driven tools, strengthened role for monitoring and observation. The observation systems should solve their internal incompatibility and deficiencies within the systems, and deliver integrated information products to meet climate change needs. This is a GEO proposition, and it is necessary to have a successful unifying system, i.e. GEOSS, in the world. The framework is right, and we all should ensure that the facilities and resources are used well to satisfy user needs. GOOS and GCOS will work with GEO if they give visibility and promote the observation networks. GEOSS has been emphasizing data flow, access and data products. It needs more attention to the capacity to use the data and the value to high level political supporters.

Action 5 GSSC Chair to request GCOS Chair to: Coordinate GCOS steering committee and secretariat of GOOS input to UNFCCC and SBSTA-30 and COP-15. (May 1, 2009)

4.6 GOOS AND GEO GEOSS ENGAGEMENT, FRANÇOIS GÉRARD, CHAIR I-GOOS

GOOS has been accepted as the “ocean component of GEOSS” and engages with the GEO GEOSS process at many levels. The intersection of GEOSS societal benefits and GOOS societal benefits is very close and there is no conflict in the mission of GOOS as the ocean component of GEOSS and the mission of GOOS to plan and facilitate the implementation of a global observing network for climate monitoring, coastal management and environmental sustainability. The GOOS is engaged in the GEOSS architecture task where the basic infrastructure of GEOSS is being built. GOOS Africa is leading the GEOSS task for building capacity for operational oceanography, by emphasizing the role of the GOOS Africa GRA and developing the GEONETCast applications for developing countries. The GOOS has other roles in GEO and other expectations from GEO. The GEO is an overarching infrastructure, but lacks long term commitments from member states. The GOOS has the same issues and must work with GEO to coordinate the many people in the many fora who represent GOOS in GEO. IOC, I-GOOS are not implementation bodies, and they should not be expected to implement GEOSS. A GOOS project as a part of IOC means the member states agree to participate. A GOOS project must immediately implement IOC data policy. A framework is provided for multilateral projects and agreements, with GSSC acting as an advisory body. It is clear that GSSC does have the advisory mandate to interface GOOS with GEO, by participating in the planning of GOOS/GEO programmes. But the most important form of GOOS participation in GEO projects will be through mobilizing the IGOOS member states. A benefit received by local institute as and governments working within IOC and GOOS is the goodwill and legitimacy given by working globally within IOC and GEO. A more involved GOOS contact point would be useful when working with GEO. The GOOS should use contacts with the GEO member states to promote support of the GOOS.

4.7 PROPOSAL FOR THE POSITION OF GODAE OCEANVIEW IN THE GOOS STRUCTURE, ANDREAS SCHILLER, CO-CHAIR GODAE OCEANVIEW

The Global Ocean Data Assimilation Experiment, GODAE, was a GOOS pilot project launched in 2000 and terminated with a final GODAE meeting, December 2008. Its objectives were to: to provide a practical demonstration of real-time operational global oceanography; regular comprehensive description of the ocean circulation at high temporal and spatial resolution; consistent with a suite of remote and in-situ measurements and appropriate dynamical and physical constraints. The resultant suite of products included 10 km resolution global models and re-analysis products. The value of the Argo, GHRSST-PP, altimetry and in-situ observation systems was well demonstrated. Utility and feasibility were demonstrated through products for nowcasting, forecasting, ocean climate, marine pollution and safety, marine resources, etc. Now most GODAE groups are transitioning toward operational or pre-operational status. Continuous improvements, evolution, acceptance of new requirements and new societal demands continue to drive the GODAE research process. The GODAE OceanVIEW science team was created to accelerate the improvement and exploitation of real-time operational ocean forecasts, hindcasts and reanalysis through exchange of information and expertise and the coordination of joint assessments. ToRs for the GODAE OceanVIEW Science Team emphasize the improvement of analysis and forecasting capabilities, and to liaise with other international programmes. The GODAE OceanVIEW will be mainly a research programme. Toward this end it is suggested that GOV be an advisory body to GSSC, to stand alongside OOPC and PICO. This would help GSSC with its mandate to advise on analysis and forecast product development and operational uses of data sources. It helps GOV by lending it legitimacy and authority through GSSC, I-GOOS and IOC. The advisory role of the GOV toward GSSC will allow GOV to maintain its autonomy, while participating in GOOS. The overlap of the advisory roles of OOPC and GOV must be delineated. Support for the secretariat functions of GOV will be sought from stakeholder agencies/groups.

Initial task teams are proposed: Intercomparison and Validation in cooperation with JCOMM ET-OOFS and CLIVAR GSOP; Observing System Evaluation in cooperation with OOPC; Coastal Ocean and Shelf Seas will develop systems coupling open ocean/coastal zone; Marine Ecosystem Monitoring and Prediction in cooperation with IMBER.

Discussion of the relationship of GODAE OceanVIEW, JCOMM Expert Team on Operational Ocean Forecast Systems and the GSSC was deferred to a working group. The main issue will be to devise the most effective structure to capitalize on the invaluable expertise of the GOV and ET-OOFS for the development of GOOS.

Action 6 GSSC Chair to: Request report to GSSC XIII of activities of GODAE OceanVIEW during 200. (December 2009)

5 PROGRAMMES REPORTS

5.1 REPORT ON GRA PRIORITIES AND REGIONAL UPDATES, JOSÉ H. MUELBERT, PICO CO-CHAIR.

PICO-I recommended that the GRAs and PICO review the Implementation Strategy for the Coastal Module of GOOS Report 148 and that the PICO should assemble information on the GRA projects and programmes. A questionnaire was circulated and partial responses received. Recommendations and advice are given on seven topics. i) Governance: A GRA users forum

and GRA Steering Committee should be established to facilitate improved communications. The Fourth GRA Forum appears to have initialized these actions. ii) Implementing Measurement Subsystem: Highest priority is review of common variables and standards, and database of national and regional observation systems. iii) Implementing the Data Management Subsystem: Working with IODE and Data Management clusters to determine metadata content and develop web services. Need to adopt top down international standards, which are already available. iv) Modelling and Analysis Subsystem: developing community modeling networks and regional modelling capability. v) Developing and improving capacity: no systematic coastal programme has been established. Identified a need to implement operate and improve coastal networks. vi) Pilot Projects: pilot projects are preferred route for progress in some regions. They can be used to usefully build operational and forecasting capacity in less developed regions. vii) Performance Evaluation: Need for procedures for periodically assessing and updating common variables, intercalibration activities and standards and protocols. The GSSC has a role to move forward the establishment of interregional programmes for progress on many of these themes. The diversity of GRAs in nature and activities makes these inter-regional and top-down actions difficult to assess and manage. Expectancy regarding implementation is not the same within GRAs and between GRAs and advisory bodies. The lack of the "GOOS framework" is evident and limiting implementation. An assumption of successful implementation is the existence and effectiveness of the GOOS Regional Council. It was pointed out that JCOMM cannot help with design of such implementation strategies, as it can only receive and implement mature observation systems. Pilot Projects are identified as a preferred mechanism to spur cooperation and development.

5.2 REPORT FROM PICO II, PAUL DIGIACOMO, PICO CO-CHAIR.

Paul Digiacomo, co-chair of PICO, briefed the GSSC on the proceedings of the PICO II meeting held the previous two days and alongside the GSSC-XII meeting in Perth. The primary role of the PICO II meeting is to develop the next coastal implementation plan. An implementation plan will build around the ideas of the COOP phenomena of interest, to build an end to end system. The PICO II has created a draft outline of the plan. Six phenomena of interest have been identified, around which the plan will be based: coastal flooding, pathogens, acidification, habitat loss, hypoxia, marine resources. The plan will map the phenomena verses the user communities, available observation systems and models, capacity building efforts and maturity of systems. The cross cutting nature of the phenomena reveal several overlaps which use the same variables, systems etc. In this way several pilot projects may be indentified which will show the feasibility of implementation and design of end to end systems. The Ocean Obs 09 meeting will move forward the process planning process, with an intermediate report to be presented. An internal draft Implementation Plan should be ready by January 2010, with a finished report before the GSSC XIII in 2010. PICO continues to develop linkages with other programmes: GEO, GODAE OceanVIEW, GEF, LME and the GOOS Regional Alliances and the GRA Council. The coastal programmes have a large number of institutions and people working on coastal oceanography, it is difficult to maintain connections to all. The GRAs provide a very important service to GOOS and to PICO by providing local and regional connectivity to the community. PICO has had fair success interfacing with the GEO through the Coastal Zone Community of Practice.

Action 7 GSSC chair and PICO co-chairs to establish a dialogue between GOOS and LME programmes (August, 2009)

Action 8 GSSC chair and PICO co-chairs to dialogue with GEF and seek funding in support of implementation of GOOS (August 2009)

5.3 REPORT FROM GSSC-XII WORKSHOP: "GLOBAL AND REGIONAL OPERATIONAL OCEANOGRAPHIC SYSTEMS: A WORKSHOP TO EXPLORE COLLABORATIVE BENEFITS IN THE INDIAN, ASIAN, SOUTHERN PACIFIC AND AUSTRALIAN OCEANIC REGIONS", NICK D'ADAMO, IOC-WAGOOS COORDINATOR.

A GSSC XII workshop was held in Perth, February 23-24, 2009. The purpose of the workshop was to bring together those involved in implementing and operating oceanographic systems for the Indian Ocean, Asian, South West Pacific and Australian regions. Key individuals responsible for technical, organizational and advocacy aspects of ocean observing systems in these regions discussed the successes and problems on the path to implementation. Success of each of the systems will require clear commitment to providing societal benefits which will in turn make it possible to seek sustained support from institutions and governments. The Australian BlueLINK system was highlighted and discussed as a core service for the other regional systems. A working group was convened to discuss a pilot programme demonstration of integration of the BlueLINK ocean analysis and forecast models with IOGOOS and SEAGOOS regional forecast needs. Harmonizing the data systems between regions and transfer of capacity to the regional forecast centers will be key components of the demonstration. Another working group discussed the need for action on developing a cost benefit analysis of ocean observation systems and their products designed for industry and government users.

6 WORKING GROUPS

6.1 WORKING GROUP ON RESPONSE TO GEO 2009-2011 WORK PLAN TASK LIST MATRIX

The GEO Secretariat has requested from IOC and GOOS confirmation of participation in the GEO 2009-2011 Work Plan and to provide particular contact information for relevant Tasks. The workgroup met to review these commitments and recommend contacts for the GOOS related GEO tasks. The working group instructed the GSSC chair, Ralph Rayner, to submit to the GEO Secretariat the revised GEO Task List Matrix with nominations for Task leads and contributors. The GSSC will express its willingness to contribute a leadership role to several tasks and will participate in clarifying the task descriptions. Recommendations for Task Team leads are:

AR-09-03c: Global Ocean Observation System, Ralph Rayner, GSSC, Keith Alverson, IOC

CB-09-03d: Building Capacity for Operational Oceanography, Justin Ahanhanzo, IOC

CB-09-04c: User Oriented Workshops for GEOSS Outreach and Feedback, Justin Ahanhanzo, IOC

DI-09-03a: Tsunami Early Warning System of Systems, Peter Koltermann, IOC

CL-09-03a: Integrated Global Carbon Observation (IGCO), Kathy Tedesco, IOC

6.2 WORKING GROUP ON RESPONSE TO QUESTIONNAIRE FOR REPORT ON PLANNING AND IMPLEMENTATION FOR GOOS

The breakout group considered the questionnaire launched by James Baker to gather information about programmes which are part or participants of the IOC or GOOS. He has

been contracted by the IOC to report on the "Planning and Implementation for GOOS and Associated Ocean Observations Services, and Data Management". The report will be delivered to the I-GOOS IX in June 2009.

IMPLEMENTATION

1. Global module of GOOS is being implemented per the recommendations of the GCOS-IP and as called for by GEO Work Plan and UNFCCC Decision COP10.5. This is taking place largely via national research agency funding, driven by individual PI activities in response to national priorities or as participation in international ocean and climate research programs. Ocean reanalysis and high-resolution ocean forecast systems have been developed and are generating products. All of the observations reported via the GTS, and the reanalysis and ocean forecast products are available via web-based systems and at no cost.

2. Additional support is needed to complete the initial global system and additional efforts are required to extract societal benefits beyond those now available.

3. It is not clear whether the initial system can be sustained under its present arrangements; few, if any, national institutional arrangements have been made to sustain any of these activities.

4. JCOMM coordination of many of the in-situ observing activities, data management activities and some of the service activities is essential.

5. IOC and WMO support of the GOOS, GCOS and WCRP secretariats, is critical for the development of international plans and to international coordination of the range of global activities being carried out under these plans.

6. An implementation plan for the coastal module is still under development, so the wide range of coastal activities being undertaken is not at present taking place as part of a coordinated international plan. Thus there is no framework in place against which to evaluate implementation progress.

7. The GRAs are envisioned to be primary implementation groups, but the state of their development and of national support for their priorities varies widely at present. The establishment of the GRC is intended to simplify communication of common GRA priorities to IOC member states, advisory bodies and JCOMM. The GRC should be actively involved in the development of the implementation plan for the coastal module.

ADDITIONAL NATIONAL ACTIVITIES.

1. Restrictions on availability of in-situ observations from national waters (and sometimes from national efforts in international waters) are limiting the ability of many nations to carry out useful ocean forecasts. Improved program-level and national data exchange is essential. GRAs should identify particular data needs.

2. Access to air-sea interface fields from NWP centers is essential for national and regional ocean forecast systems, but these fields are not always available. Provision of these fields by national weather services is critical.

3. Increasing capacity for nations to take advantage of the global ocean reanalysis and ocean forecast products is needed.

4. Nation by nation evaluation of the utility of the products of the global system is needed. GRAs should identify specific capacity building projects and regional pilot projects that would make use of global system observations and products.

GOOS PROGRAMME EVALUATION

1. Making the connection between existing implementation activities and intermediate and end-users of the system needs to be developed. There is no evaluation framework, beyond research and forecast community activities, for GOOS data and products. Task I-GOOS members to identify national needs / priorities; task them to steward their program activities against those identified needs and priorities

2. IOC based progress reporting process is needed through GOOS office. An annual report on progress should include both open ocean and coastal and include end users whenever possible.

3. Results based management framework with independent evaluation of progress is needed. The GSSC could be part of the evaluation process.

4. Integration of the global and coastal module analysis and forecast activities should be progressed to the greatest extent feasible.

I-GOOS ACTIVITIES

1. Member state needs for ocean information must be clearly articulated in order for the GSSC to provide technical advice about the activities needed to meet these needs.

2. It would assist the development of national enthusiasm for GOOS if the member states would provide case study examples of successful national development and use of ocean information, and the key actions that led to it.

3. Improved member state leadership awareness of national ocean observing, analysis and forecast activities (which are undertaken via GRAs and global programs) and plans is needed so that coordination between national efforts can be improved.

4. Data release/availability for GOOS activities needs to be addressed at each IOC Assembly. Progress has to be tracked by the GOOS Secretariat via reports from the GRAs and end-users.

Action 9 GSSC Chair to pass deliberations of working group on Response to Questionnaire for Report on Planning and Implementation for GOOS to James Baker (ASAP).

6.3 WORKING GROUP ON GSSC RELATIONSHIP TO THE GEO GEOSS PROCESS.

John Zillman led a discussion with Missy Feeley, Thomas Gross, Dong Young Lee and Shao Hua Lin on the role of GSSC and GOOS in the GEO planning and implementation process. GOOS and GCOS are embedded in the GEO planning process as individual GEO Tasks, and participants in several related GEO Tasks. It is up to GOOS to develop the task within the GEO framework, by becoming involved in the GEO planning process. While many uncertainties exist about the future of the GEOSS, the process is, of itself, a worthwhile pursuit in which the GOOS and the GSSC should be active participants. The complexity and ambitious scope of the GEOSS makes this difficult and will require greater organization and

commitment from the GOOS, GSSC, GPO and the IOC itself. Paramount in the recommendations is the request that the IOC and I-GOOS obtain funding from their member states to sponsor this participation. This seems somewhat difficult, as the GEO secretariat is having similar funding problems of its own, and member states may be reluctant to fund GEO activities twice.

Action 10 The GSSC recommends I-GOOS to promote via the GOOS sponsors and member states that GOOS be fully recognized as the ocean component of GEOSS (I-GOOS IX).

Action 11 The GSSC recommends I-GOOS to encourage members' GOOS experts participating in GEO task teams, etc. to take all available opportunities to draw attention to the role of GOOS as the ocean component of GEOSS and to provide prompt feedback from the GEO process to the GPO on all matters related to GOOS (I-GOOS IX).

Action 12 The GSSC recommends I-GOOS to agree that GOOS should be represented at GEO Plenary by the GSSC chair (I-GOOS IX).

Action 13 The GSSC recommends I-GOOS to encourage GOOS contribution to the GEO planning process via a clearly identified contact in the GOOS programme office (I-GOOS IX).

Action 14 The GSSC recommends I-GOOS to encourage its member state representatives to communicate with their GEO national delegations to promote GOOS to GEO Plenary (I-GOOS IX).

Action 15 The GSSC recommends I-GOOS to invite member states to explore opportunity to provide funding support for active engagement of the GOOS programme office in GEO process (I-GOOS IX).

6.4 WORKING GROUP ON GODAE OCEANVIEW AND GOOS

Paul DiGiacomo, José H. Muelbert, John Parslow, Ed Harrison, Detlef Stammer, François Gérard, Thorkild Aarup, Andreas Schiller, Peter Dexter and Philippe Dandin considered in detail the proposals put forward to the GSSC for the organization of GODAE OceanVIEW and its relationship to GSSC, GOOS, JCOMM and the recently organized JCOMM Expert Team on Operational Ocean Forecasting Systems. Key points agreed upon:

The legacy of GODAE can be continued as a tool for GOOS.

We see the need for the on going R&D work to be closely linked to all GOOS activities, including PICO and future activities.

We can’t afford separate (or duplicate) efforts. The ET OOFS has a clear job to do which cannot be separated from the science and development

Advantage to the linkage to IOC/WMO JCOMM: A clear institutional home that links to existing operational ocean programs and agencies through the parent organizations.

The linkage recognizes the success of GODAE as a GOOS pilot project, and enters it into the next phase as a mature “programme”.

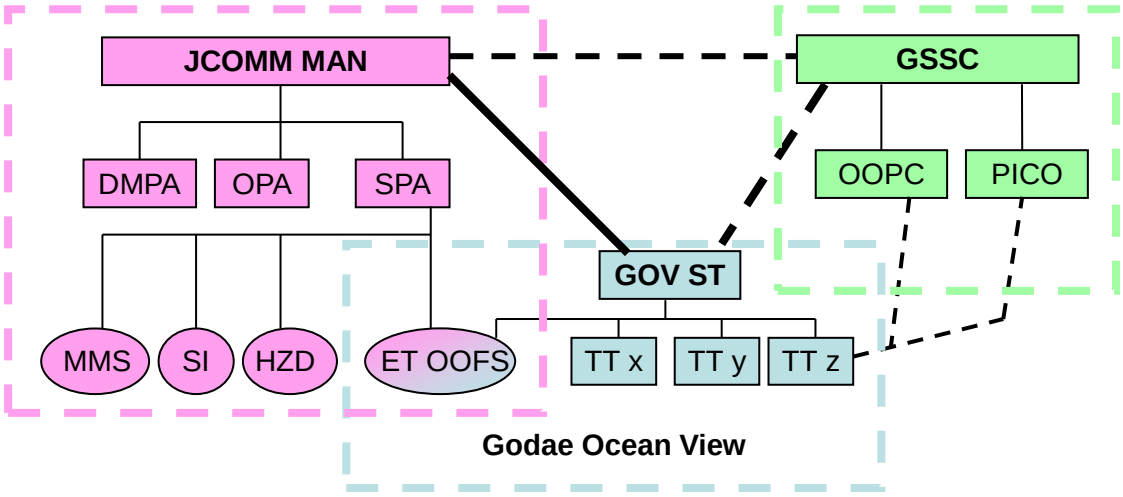
The linkage also facilitate the way to interaction with atmospheric & climate modeling.

Under JCOMM/Services PA, OV would be like Argo (free but connected) and would have the possibility to interact with the Member States/Members.

GOV brings its own fundings.

GOV keeps the autonomy to conduct its R&D as determined by its members, but understanding that reaching maturity in the intergovernmental system requires a "group discipline".

***Figure 1**: Flow Chart of GOV within GOOS, GSSC, JCOMM structure.*



Action 16 GOV co-chairs to circulate information on GODAE OV to GSSC attendees (Andreas Schiller)

Action 17 GOV co-chairs to propose a single proposal to go to both GODAE OV steering team and I-GOOS IX, June 2009 (Andreas Schiller took notes & recommendations)

Action 18 JCOMM Co-President to discuss issue with JCOMM MAN (Peter Dexter)

Action 19 JCOMM Co-President to consider inclusion of the GOV in the new structure to be proposed for JCOMM III, Nov. 2009 (Peter Dexter)

Action 20 JCOMM co-President to report on conclusion of discussion on incorporating GODAE OceanVIEW into JCOMM to GSSC XIII. (GSSC XIII)

6.5 WORKING GROUP ON OCEAN FORECAST DEMONSTRATION PROJECTS IN IOGOOS AND SEAGOOS

The working group continued discussions which began during the Monday-Tuesday Workshop on Regional Observation Systems. A proposal was discussed for a demonstration project to integrate the Australian BlueLink oceanic assimilation and forecast system with regional ocean forecast systems in the IOGOOS and SEAGOOS.

MOTIVATION:

There are ocean forecasting systems “ready to go”. They can be applied right now to willing members of the IOGOOS and SEAGOOS alliances. This can be done in principal without existing available data. However quality and amount of data input dictates quality of outputs. There is interest by at least some countries to work closely with initially Australia’s BlueLINK to get the ball rolling. The workgroup believes that by showing this project works for at least one or two sub-regions (eg Malaysia) it will foster engagement by others (hopefully to cross-GRA level) and facilitate the provision of existing data sets.

AIM:

To demonstrate and realize the potential benefits of the current global and regional ocean forecasting capacity to the IOGOOS/SEAGOOS communities.

VIA:

Giving access to broad scale ocean model data and products to selected partner countries in the GOOS Regional Alliances, to be used as boundary conditions for their regional and local high resolution models. This could be done initially through experiments in a small number of countries, using their existing regional/local data and high resolution modeling capabilities. If this project is successful it will constitute a test case and will work to encourage other countries to participate. The initial global ocean model for the project will be BlueLINK, with others to be entrained at a later stage. There is potential for the later involvement of global modeling groups in France, UK, Japan and the USA.

This project will demonstrate the advantages of data sharing for each region. There also remains an overall requirement to improve the ocean modeling and forecasting science and demonstrate the value of the derived information to the community. The science requires a common validation strategy and better regional/local observational data, as the products coming out of the forecasting system are highly dependent on the quality and quantity of the observational data being assimilated. More observations will be assimilated under the project and thus enhance the quality of the analysis and forecast.

The project will have two overall components:

- Development of an IOGOOS ocean forecast application pilot project,
- Development of a SEAGOOS ocean forecast application pilot project,
- Focusing on specific sub-regional projects.
- There should be two parallel but linked outcome streams:
- Demonstrate societal value through demonstration projects under IOGOOS/SEAGOOS.
- Advance the science through GODAE OceanVIEW and a possible regional GODAE

There will be a requirement to define the level of users. Each user’s needs are different, so the projects must specify and focus on what is the most important oceanographic information that is required by these users.

WHAT:

Components of the current BlueLINK system that are of interest: i) Access to current BlueLINK forecast and re-analysis data products, ii) Education and training in current BlueLINK products, iii) Possible creation of new user defined BlueLINK products.

WHY:

IOGOOS/SEAGOOS would like ocean forecast and re-analysis system information for:

- Characterizing regional and coastal water circulation, using global model output as boundary conditions in enhancing downscaling through existing high resolution models, such as POM/ROMS
- Biological studies
- SST forecasts (understand stress on primary producers)
- Seasonal predictions for the monsoons, which can result in strong drought or flooding; if BlueLINK can cover the monsoon regions in the IO and SEA it can create a good connection for the coupled ocean atmosphere seasonal prediction model.
- Assist in the creation of a cohesive SEAGOOS ocean observing system
- Create an ocean 'weather' service, create a good global connection and then leave space for downscaling.

WHO:

Identify groups in Indonesia, Thailand and Malaysia, all looking at these issues, to entrain as project partners. There is an opportunity and a need to take advantage of existing ocean forecasting knowledge/outputs to address questions from regional users who have access to high resolution regional models, which would benefit from boundary condition information.

STEPS:

As an initial focus group:

- IOC - Nick D'Adamo
- IOGOOS - Balakrishnan Nair
- SEAGOOS - Somkiat Khokiattiwong / Fredolin Tangang / Weidong Yu
- INDONESIA – Edvin Aldrian (?)
- JAPAN and IOP –Yukio Masumoto

This group will draft a more detailed project document, for review, agreement, resource identification and implementation plan development at a focused meeting around August 2009. The project implementation would then commence in late 2009.

Action 21 Nick D'Adamo, WA IOC Secretariat, to report on discussion of Ocean Forecast Demonstration Project to initial focus group (June, 2009)

7 COORDINATION OF DATA MANAGEMENT PROGRAMMES

The GSSC seeks to provide advice to the I-GOOS and GRAs about different data management programmes in use across the GOOS with the purpose of discerning what redundancies and best practices might be identified.

7.1 GODAE OCEANVIEW UNDERPINNING TECHNOLOGIES FOR OCEANOGRAPHIC DATA SHARING, VISUALIZATION AND ANALYSIS, JON BLOWER, READING UNIVERSITY

The GODAE has identified and worked with many data sources, instrumentation, archives, modeling centers and information users. The community has organically settled upon middle

ware which satisfies the needs of the researcher environment of GODAE. This consists of a combination of: NetCDF, an array based, binary, platform-independent data format; CF Metadata Conventions, providing a controlled vocabulary of scientific data types and units and spatial and temporal referencing; OpeNDAP, an internet protocol providing remote access to data files with subsetting and data discovery tools. Standardization on these tools has driven forward the GODAE and allowed researchers to get the most out of their data. The selection of these middleware standards has allowed the development of toolboxes, such as the Matlab OpeNDAP toolbox and the Java NetCDF API. The NOAA/PMEL has developed the LAS, a web based viewer of data with sophisticated on-line graphics interfaces and discovery tools. GODAE model intercomparisons have been greatly aided by these developments.

Marine Environment and Security for the European Area, MERSEA, a European infrastructure project, part of the GMES programmes, has developed data discovery, viewing and downloading services. The system goes across sources and programmes and interfaces with derived products downstream. These tools are in use and demonstrate that GODAE is good at sharing gridded data within the scientific committee and delivering basic information via the web. However work is needed on sharing in-situ or remotely sensed data, sharing data outside the research community and integrating efforts.

Open Geospatial Web Services supported by the Open Geospatial Consortium, OGC, brings the GODAE efforts to the worlds of Geographic Information Services, GIS. Godiva2 is an example of GIS web services combining 4D gridded data and GIS raster and feature data (http://www.reading.ac.uk/godiva2). GIS technologies can help reach a wide audience, interface with KML (Google Earth protocol which is widely used for sharing geographic information) and is widely supported and aggressively developed in the commercial sector. A GODAE goal is development of model-data intercomparison tools on the web, ECOOP, OceanDIVA.

In conclusion, there may be many technical solutions, but agreement and communication between developers, scientists and other users, who may not know about the technical capabilities, will drive this forward successfully. Within the GODAE arena the questions of data access security has not been a strong issue, but probably will be in a more inclusive system. A key issue remains database catalogues and data discovery tools.

7.2 GEO DATA ARCHITECTURE, NOTES FROM JAY PEARLMAN, FIEEE CHAIR, IEEE COMMITTEE ON EARTH OBSERVATION

GEO has implemented an initial operating capability for an information system that provides user access, registry of services, registry of standards and community best practices and a clearinghouse to access data from archives worldwide. The GEOSS Common Infrastructure, GCI, was open for experimentation and comment on 2nd June, 2008. The system is still evolving in real time to make it easier to use and to provide reliability and interoperability. In addition, GEO has a Standards and Interoperability Forum (SIF) that facilitates the use and understanding of standards and GEOSS interoperability. The entire system is planned to transition to be fully operational by summer or early fall. There are currently three portals offered by Compusult, ESA and ESRI. It is likely that the three will continue for some time as we do not plan a "down select". If you go to the GEO web site, www.earthobservations.org, you can access all three of the portals. The SIF is a global forum with regional teams. These teams review standards offered to GEO when systems are registered. These are de-conflicted with other offers if necessary. They also look at special arrangements. The regional teams currently operating or expected near term are Europe/Africa, North America, South and Central America, Japan and China. There would be significant interest in the registration of more ocean observing services and data services. GSSC should encourage GOOS and JCOMM data systems to register. Members of the GSSC are encouraged to exercise the

system. While there are still some rough spots, the user feedback is valuable. Active participation in the standards work would also be useful. There is a GOOS task in the new GEO work plan. Within this task, there is the creation of a data infrastructure for the subsurface ocean with IEEE as point of contact. Last year GPO discussed this and encouraged IEEE to take the lead. While the satellite data and the related archives address the surface environment and some of the data archives such as NDBC address surface in situ, there is a perceived need for a comprehensive information system for subsurface data (surface to the bottom) and information. Since the goal is not to duplicate existing capabilities, the task and its outcomes must be carefully defined. I suggest that GOOS, through GSSC, play a proactive role in the definition and framework of the information system. I anticipate it will evolve into a system of systems approach. Finally, planning for the 2010 ministerial meeting is commencing. One feature of the plans is to have 5-10 outcomes highlighted which can be directly traced to GEOSS. These can be in any of the societal benefit areas and must clearly demonstrate impacts on living conditions or societies in some direct way. We are open to suggestions and recommendations for such activities. The GSSC may want to consider if there is an ocean or coastal related outcomes that could be highlighted. If something is identified now, there would be another 12 to 15 months to mature and expand the activities and their related outcomes - so an in-hand result is not required.

7.3 WIGOS PILOT PROJECT FOR JCOMM, PETER DEXTER, AUSTRALIAN BOMET

WMO Integrated Global Observing Systems, WIGOS, Pilot Project for JCOMM were presented by Peter Dexter on behalf of Greg Reed, co-chair, Joint Steering Group for the IODE Ocean Data Portal and the WIGOS Pilot Project for JCOMM, who was unable to attend the meeting. The WIGOS will provide a single focus for the operational and management functions of all WMO observing systems and WMO co-sponsored observing systems. It will create an organizational, programmatic, procedural and governance structure that will significantly improve the availability of observational data and products. Initial WMO pilot projects for WIGOS include one to integrate marine meteorological and other appropriate ocean observations into the WMO global observing systems. The pilot project will coordinate with IODE, NODC network and use the Ocean Data Portal, ODP. Coordination within JCOMM will entrain the Observations Programme Area, Data Management Programme Area and Services Programme Area. The intention is to build marine data systems that are interoperable with the WMO Information System, WIS, to provide real-data to modelers and to integrate marine data which had not previously been part of the WIS. The WIS will be at the heart of the Pilot Project and the development of interoperability between ocean data management systems and the WIS will be one of the key Pilot Project deliverables. To achieve integration of instrument best practices, the Pilot Project will be promoting the establishment of instrument centres dedicated to marine and other appropriate oceanographic instruments. The IODE Ocean Data Portal operates on a standards-based infrastructure that provides for the integration of marine data and information from a network of distributed NODCs. The key principle behind the ODP is its interoperability with existing systems and resources. The ODP requires IODE data centres to generate discovery metadata about their datasets for data search and retrieval. The WIS integrates data from traditional WMO sources, GTS, National Meteorological Centres, DCPCs etc., to make them available through registered and searchable web services. The pilot project will also promote quality management and standards via the production of a JCOMM catalogue of best practices and standards. Capacity building will be promoted by focusing on developing countries, national level products and training courses on all aspects of WIGOS and ODP. The pilot project web page: http://www.wmo.int/pages/prog/www/wigos/marine_pp.html .

Action 22 JCOMM co-President, GSSC Chair to encourage that dialogue between GEO data architecture task team and WIGOS proceeds to a coordinated implementation plan. Invite GEO data architecture task team and WIGOS to

present the coordinated plans to the GSSC-XIII (December 2009)

Action 23 GSSC Chair to invite JCOMM data management programme area coordinator to brief GSSC on plans with specific action to progress development of ocean data systems in support of GOOS objectives (December 2009).

7.4 IOOS DIF REPORT, THOMAS GROSS, IOC SECRETARIAT

The IOOS will help modernize the way NOAA collects, shares and uses ocean information, increase data interoperability and efficiency of operations across NOAA and the eleven IOOS regions and expedite access to data for improved decision making. The IOOS Data Integration Framework, DIF, is a set of protocols and data access methods which will demonstrate these goals by conducting a limited scope implementation of the IOOS structures. DIF is intended as a proof of concept pilot programme to inform the larger IOOS effort. The initial implementation begins with a subset of core variables, (ocean currents, temperature, salinity, water level, waves, chlorophyll, surface winds), a subset of well defined web services and encoding conventions. The methods are targeted at four NOAA data and product providers and their user groups, (Harmful Algal Bloom Forecast System, Integrated Ecosystem Assessments, Coastal Inundation, Hurricane Intensification). Recommended web services and data encodings are provided for three data types, in-situ data, gridded data and image data. An emphasis is put on Geographic Information Services, NetCDF and tools and protocols developed for the Open Geospatial Consortium, OGC. Implementation of the DIF is proceeding. The DIF offers a simple approach to data access for a small subset of the GOOS data sources. Data discovery methods are barely a part of DIF, it relies on well known data streams, and will implement GEOSS registry services. The GRAs have expressed an interest in the DIF recommended web services and data encodings, as they are practical, easily demonstrated and integrate well into many commercial GIS software tools in use by the coastal management community.

7.5 DISCUSSION OF DATA MANAGEMENT PROGRAMMES

Data management and GOOS observations to products end to end systems are intertwined at all levels and inseparable. Jay Pearlman summarized the issues. What do we mean by data? What are the issues in moving toward a global construct? Finally, who is the end user of all this magic? I propose that the end user is the societal decision maker or the corporate manager. I suggest what they need is decisionable information, not strictly data. To make information decisionable, it must have certain characteristics. These include timeliness, reliability, quality and sustainability, among others. In moving this direction, we have issues of data/metadata, interoperability and collection continuity. We have more requirements because we are interested in actionable information. Thus we must address models, model interoperability, sustainability, uncertainty assessments, etc. The role of the GSSC must be to analyze the promises of the data management programmes, but with a clear understanding of the need to produce actionable information. The GOOS cannot simply be an observation programme, it must take responsibility for the integrity of the full end to end system.

8 OUTREACH AND ADVOCACY

8.1 REPORT FROM RALPH RAYNER, CHAIR GSSC

Communication and outreach are tools which the GOOS must use in order to further the goals of creating a sustained and viable ocean observation system. Communication of the GOOS message does not occur spontaneously, so the advocacy group has been charged with organizing and pushing forward on development of a communication plan. The GSSC

Outreach and Advocacy group has created several subgroups to pursue issues of advocacy for the GOOS. A coherent GOOS message, verbally, in writing and graphically, is an important aspect of creating recognition and unity of purpose. Messaging material is being gathered, including "Elevator speeches", "one-pagers", photo and graphics library, presentation material and case studies. This material will be made available to interested parties through the web site http://oceanunited.net . The site also contains communication tools, a forum, blogs and mailing lists which will be further developed. Next steps are to further populate the Ocean United website with additional photographs, case studies, presentations and news items. A generic version of the POGO DVD will be produced, put on line and made available to the public. Participating in conferences and events is an important form of outreach. A graphical display and handout materials have been created which may be setup at events. Advice and participation by the GSSC in recommending and targeting particular events would be useful. ImarEST has held several workshops on behalf of GOOS goals, targeting industrial users of the ocean observing systems. The next on March 24, 2009 will engage with the shipping industry to discuss ships of opportunity observing systems. Other events are planned for London, Washington DC and other USA sites. The period between now and COP15, Copenhagen Oct. 2009, will involve intensive discussions in many fora relevant to environmental monitoring. The European Environment Agency (EEA) believes that these should be complemented by a focused senior-level discussion, within the GEOSS framework, to explore the vital question of how to ensure that global environmental monitoring systems are equal to the expectations of user communities, and how to ensure their sustainability. A wider outreach to foundations for fund raising has been successful in raising funds for individual events. The group is investigating more substantial funding opportunities, including building an industry leadership group, which will be subscription funded. The Global Alliance for Industry, Climate & the Oceans offers its members exchange of best practice between sectors and offers to the observation systems access to impartial advice and an advocacy group who are motivated to see the system succeed. A foray into issue advocacy was more successful than perhaps we had planned. A petition to advocate governments to support the continued missions of the Jason 3 satellite was answered by over 400 ocean experts. The petition was useful in helping the satellite program continue. The method should be expanded, not only for the issues, but for the activism for GOOS goals it creates in individuals. An important outreach message is the Economic Case for GOOS. A European study of the economic value of ocean observations has been undertaken, which the GOOS should engage with. A synthesis report will be produces for the OceanObs09.

Action 24 GPO to circulate POGO DVD to GSSC-XII attendees and to post video to Ocean United web site and YouTube (April 2009)

Action 25 D.Y. Lee to report on Korea Ocean Expo preparations to GSSC (GSSC-XIII)

Action 26 GSSC Chair to request I-GOOS members to identify national needs and priorities (I-GOOS IX)

9 FORMAL ISSUES

9.1 DISCUSSION AND ACCEPTANCE OF THE GSSC-XII ACTION ITEMS

The accumulated action items discussed throughout the committee meeting were revisited. There were items from the previous GSSC XI action items list which must be carried over to the GSSC XII list. They are included in the GSSC XII Action Item list document, (GSSC XII/9.1) but not in this Report of the GSSC XII.

9.2 GSSC MEMBERSHIP

Following the GSSC-XI the membership of the GSSC was reviewed by the GOOS Programme Office and nominations for continuing the membership and adding Ralph Rayner as chair were prepared. The GPO, having received no response to the July 25, 2008 email soliciting advice from the GSSC, moved forward with submission of nominees to the ICSU process. The 2009 GSSC will consist of these members:

Philippe Dandin, Météo-France (France, standing 2009)

Mary Feeley, ExxonMobil (USA, renew for 2009-2011)

Colin Grant, BP (UK, renew for 2009-2011)

John Gunn, CSIRO (Australia, renew for 2009-2011)

Dong-Young Lee, Korea Ocean Research & Development Inst. (S. Korea, renew for 2009-2011)

Ralph Rayner, IMAREST (UK, renew for 2009-2011)

Detlef Stammer, Universität Hamburg (Germany, renew for 2009-2011)

The GSSC discussed the makeup of its membership. Not all scientific fields are, or can be, covered by the relatively small number of members. This meeting's discussion of data management programmes showed that data management is an expertise which may need strengthening on the GSSC. Modelling and forecast products are also not well represented on the committee. While the relationship of GODAE OceanVIEW to the GSSC could affect this recommendation, a person involved with the GODAE data systems could be a valuable addition to the membership. Satellite observation programmes are not represented on the GSSC. These programmes are more under the guidance of the OOPC and GCOS and might not need immediate representation on the GSSC. The GSSC should more proactively seek expertise for the committee which will add to the effectiveness of the advisory role of the GSSC within GOOS.

9.3 DATE AND LOCATION OF GSSC-XIII AND PICO III

The GSSC and PICO traditionally meet once a year, alternating the location between the UNESCO in Paris and another country to give regional focus. The next meetings will therefore be in Paris in 2010. A discussion of this week's meetings revealed a discontent with the overlapping of the PICO and GSSC. However, subsequent meetings would create a five day meeting for participants who wish to attend both. No resolution is forthcoming. There was a suggestion that a meeting of the GRA Steering Committee, GRC, could be held with the GSSC and PICO meetings. This would have to be subject to funding, and probably could not be acted upon until 2011. The question of funding for this type of activity was discussed. The GPO budget for meetings precludes discretion to fund other activities. The meetings should be supported by a different source from the IOC general fund. The first week of March, 2010, was proposed as the provisional date for the GSSC-XIII and PICO III to be held at UNESCO in Paris, France.

9.4 CLOSURE OF THE SESSION

The chairperson thanked the committee and the invited experts on behalf of the GSSC and GOOS. The chairperson emphasized that this work is voluntary, and that the effort put forward on behalf of the GOOS process is greatly appreciated. The chairperson also thanked the local hosts of Perth, including the IOC Perth Regional Programme Office, the Australian Bureau of Meteorology, CSIRO and WAGOOS. GSSC Chairperson Ralph Rayner formally closed the session at 17:00 pm, on Friday, February 27, 2009.

Action 27 GPO, GSSC Chair to acknowledge and thank sponsors of GSSC-XII and PICO II (March 2009)

10 LIST OF ACTIONS

ANNEX I
AGENDA

DAY 1: 25 February 2009
Plenary Session

1. OPENING AND WELCOME
1.1 Local host UNESCO IOC Perth Office, Dr Nick D'Adamo
1.2 GSSC Chair, Ralph Rayner
1.3 Adoption of Agenda, Working Arrangements, Ralph Rayner, Chair GSSC
1.4 Review of the Previous Sessions, Thomas Gross, GPO

2. REVIEW OF PROGRESS AGAINST IMPLEMENTATION PLANS
2.1 Review status of Open Ocean Module against Implementation Plan, Ed Harrison Chair OOPC
2.2 Review status of GOOS Pilot Programmes, Thomas Gross, GPO

3. COORDINATION AND COLLABORATION WITH OTHER PROGRAMMES
3.1.1 SCOR Session
3.1.1 Equation of State of Seawater, Working Group 127 Report, Trevor McDougall
3.1.2 OceanScope Working Group, Missy Feeley
3.1.3 Report of Workshop on Ocean Biology Observatories from the SCOR Panel on New Technologies for Observing Marine Life by John Gunn, presented by Thomas Gross
3.1.4 Discussion of GSSC – SCOR recommendations for development of GOOS
3.2 UNEP Regional Seas Programme
3.3 SCAR Update on IPY and Polar observing systems
3.4 Ocean Observatories Initiative Consortium for Ocean Leadership
3.5 JCOMM Operational Ocean Forecast Systems, Gary Brassington Australian BoMet
3.6 POGO Ralph Rayner, chair GSSC
3.7 DISCUSSION SPECIFIC RECOMMENDATIONS FOR INTERACTION WITH PROGRAMMES, Ralph Rayner, GSSC Chair

4. EMERGING ISSUES
4.1 Deep Ocean Monitoring, Ed Harrison, Chair OOPC
4.2 Wave measurement Evaluation and Test from moored buoys, DBCP-ETWS PP-WET
4.3 International Ocean Carbon Coordination Project, Maria Hood, IOC. (by phone Paris)
4.4 Ocean acidification, Carol Turley, Plymouth Marine Laboratory, (by phone, UK)
4.5 GOS as the Ocean Component of GCOS, John Zillman
4.6 GOOS and GEO GEOSS Engagement, François Gérard
4.7 GODAE OceanView, Andreas Schiller
4.8 Large Marine Ecosystem

DAY 2: 26 February 2009
Plenary Session

5. JOINT SESSION WITH PICO
5.1 Report from PICO
5.2 Report of the Workshop

6. WORKING GROUPS ORGANIZATION
6.1 Interaction with climate convention. How will GOOS respond to COP-15?
6.2 Report on planning and implementation for GOOS

6.3 Interaction of GOOS, GSSC, I-GOOS with the GOE GEOSS
6.4 GODAE Ocean Vioew with the GOOS structure. Discussion of proposal and ToRs.
6.5 Develop theme of the Workshop into a GSSC and / or PICO perspective. Outline and assign the writing assignments for the Workshop report, paying attention to needs of SSC and PICO.

7. WORKING GROUPS CONTINUE

DAY 3: 27 February 2009
Plenary Session

7. COORDINATION OF DATA MANAGEMENT PROGRAMMES
7.1 GODAE Data Architecture, Jon Blower (by phone, UK, Wednesday 17:30)
7.2 GEO-GEOSS Data Architecture, Jay Pearlman
7.3 WIGOS JCOMM Pilot Project, Peter Dexter, Australian BoMet,
7.4 IOOS DMAC, Data Integration Framework, NOAA IOOS Office
7.5 Discussion

8. OUTREACH AND ADVOCACY
8.1 Report from Outreach Working Group
8.2 Outreach Discussions

9. FORMAL ISSUES
9.1 Review and Acceptance of GSSC-XII Actions and Recommendations
9.2 Membership Review
9.3 Date and Place of Next GSSC and PICO Sessions
9.4 Closure of the Session

ANNEX II

LIST OF PARTICIPANTS

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ANNEX III
LIST OF DOCUMENTS

(All documents and presentations are available on line at http://www.ioc-goos.org/GSSC-XII)

Document Code	Title	Responsible	Agenda item	By when
WORKING DOCUMENTS				
GSSC-XII/1.1	Provisional Agenda	Secretariat	All	(web)
GSSC-XII/1.2	Overview	Secretariat	All	(web)
GSSC-XII/1.3	Provisional List of Participants	Secretariat	All	(web)
GSSC-XII/1.4	Provisional list of Documents (this document)	Secretariat	All	(web)
GSSC-XII/1.5	Report on Progress toward completion of GSSC-XI Action Items	Secretariat	1.4	(web)
GSSC-XII/2.1P	OOPC Global Domain Status and Issues 2009	D. H. Harrison	2.1	(web)
GSSC-XII/2.2	GSSC-XII Pilot Projects Review	Secretariat	2.2	(web)
GSSC-XII/3.1.1P	The New Thermodynamic Definition of Seawater	T. McDougall	3.1.1	(web)
GSSC-XII/3.1.1a	Draft Resolution: Thermodynamics and Equation of State of Seawater TEOS-10	Secretariat	3.1.1	(web)
GSSC-XII/3.1.1b	Request for Evaluation of TEOS-10	Secretariat	3.1.1	(web)
GSSC-XII/3.1.2P	OceanScope Working Group Report to GSSC	M. Feeley	3.1.2	(web)
GSSC-XII/3.1.3	Ocean Biology Observatories Workshop 2009 Agenda	Secretariat	3.1.3	(web)
GSSC-XII/3.2	Global Regional Seas Strategic Directions 2008-2012	UNEP	3.2	(web)
GSSC-XII/3.3P	Southern Ocean Observing System	H. Dahlin	3.3	(web)
GSSC-XII/3.5P	JCOMM ETOOFS Obs Requirements	G. Brassington	3.5	(web)
GSSC-XII/4.1P	Deep Ocean Monitoring – Some issues	D. H. Harrison	4.1	(web)
GSSC-XII/4.2	DBCP-ETWS Pilot Project on Wave Measurement Evaluation and Test from more buoys (DBCP-ETWS PP – WET)	Secretariat	4.2	(web)
GSSC-XII/4.3P	International Ocean Carbon Coordination Project	M. Hood	4.3	(web)
GSSC-XII/4.4P	Ocean Acidification	C. Turley	4.4	(web)
GSSC-XII/4.5	GOOS-GCOS Collaboration 2009	J. Zillman	4.5	(web)
GSSC-XII/4.6	GOOS Contributions to the GEO 2009-2011 Work Plan	Secretariat	4.6, 6.1	(web)
GSSC-XII/4.7P	Proposal for the position of GODAE OceanView in the GOOS structure	A. Schiller	4.7	(web)
GSSC-XII/4.7.1	GODAE Ocean View One Pager	A. Schiller	4.7	(web)

Document Code	Title	Responsible	Agend a item	By when
GSSC-XII/4.7.2	Letter: Proposal for the Position of GODAE OceanView in the GOOS structure	A. Schiller / E. Dombrowsky	4.7	(web)
GSSC-XII/4.7.3	Proposal for the position of GODAE OceanView in the GOOS structure	A. Schiller	4.7	(web)
GSSC-XII/4.9.1	OTN Metadata Goes Public	B. Branton OTN	4.9	(web)
GSSC-XII/4.9.2	Start-up phase (an Assessment of Assessments)	WG	4.9	(web)
GSSC-XII/5.1P	Report on GRA Priorities and Regional Updates	J. Muelbert	5.1	(web)
GSSC-XII/6.1.1	GEO 2009 Task List Matrix	WG	6.1	(web)
GSSC-XII/6.1.2P	GOOS Contributions to the GEO 2009-2011 Work Plan	Secretariat	6.1	(web)
GSSC-XII/6.2	Breakout 6.2 Report on Planning and Implementation for GOOS	WG	6.2	(web)
GSSC-XII/6.2.1	Questionnaire - Planning and Implementation for GOOS	J. Baker	6.2	(web)
GSSC-XII/6.3P	GSSC Response to GEO	WG	6.3	(web)
GSSC-XII/6.4P	GODAE OceanView and GOOS	WG	6.4	(web)
GSSC-XII/6.5	Ocean Forecast Demonstration Projects in IOGOOS and SEAGOOS	WG	6.5	(web)
GSSC-XII/7.1P	GODAE Data Architecture: review and future outlook	J. Baker	7.1	(web)
GSSC-XII/7.2P	Report of the GEO Architecture and Data Committee (ADC)	J. Pearlman	7.2	(web)
GSSC-XII/7.3P	WMO Integrated Observing Systems (WIGOS) Pilot Project for JCOMM	G. Reed	7.3	(web)
GSSC-XII/7.4P	Review of IOOS DMAC and Data Integration Framework	F. Gérard / F. Adragna	7.4	(web)
GSSC-XII/7.6	MyOcean Relation to GOOS	F. Gérard / F. Adragna	7.5	(web)
GSSC-XII/7.7	GOSIC Report to GSSC XII	C. Lief	7.5	(web)
GSSC-XII/8.1P	GSSC Outreach and Advocacy	R. Rayner	8.1	(web)
GSSC-XII/9.1	GSSC-XII Action Items	Secretariat	9.1	(web)
GSSC-XII/9.2	Report GSSC Membership February 2009	Secretariat	9.2	(web)
BACKGROUND DOCUMENTS				
GOOS-170	GSSC-XI	Secretariat		(web)
OTHER DOCUMENTS				
GSSC-XII/1.0.01	GSSC-XII Draft Agenda	Secretariat		(web)
GSSC	Terms of Reference for the GOOS Scientific Steering Committee (GSSC)	Secretariat		(web)

ANNEX IV
TABLE OF ACRONYMS

AOML	Atlantic Oceanographic and Meteorological Laboratory
API	Application Programming Interface
ASPeCt	Antarctic Sea Ice Processes & Climate
CAML	Census of Antarctic Marine Life
CASO	Climate of Antarctica and the Southern Ocean
CDIAC	Carbon Dioxide Information Analysis Center
CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
ChloroGIN	Chlorophyll Globally Integrated Network
CLIVAR	Climate Variability and Predictability
CoML	Census of Marine Life
COP-15	Conference of the Parties conference, UNFCCC
CPR	Continuous Plankton Recorder
CZCP	Coastal Zone Community of Practice
DART	Deep-ocean Assessment and Reporting of Tsunamis
DBCP	Data Buoy Cooperation Panel
DCPC	Data Collection and Production Centres
DIF	Data Integration Framework
ECOOP	European Coastal-shelf sea Operational monitoring and forecasting system
EEA	European Environment Agency
EG-Ocean	SCAR/SCOR Expert Group on Oceanography
ESA	European Space Agency
ETOOFS	Expert Team on Operational Ocean Forecasting Systems
EUCOCUS	EU Carbon Observing System Coordination
EUEPOCA	EU European Project of Ocean Acidification
FAO	Food and Agriculture Organization of the United Nations
FIEEE	Fellow of the Institute of Electrical and Electronics Engineers
GAW	Global Atmosphere Watch
GCOS	Global Climate Observing System
GCOS IP	Global Climate Observing System Implementation Plan
GEF	Global Environment Facility
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GHRSST	Global High-Resolution Sea Surface Temperature
GIS	Geographic Information System
GLOBEC	Global Ocean Ecosystem Dynamics
GMES	Global Monitoring for Environment and Security
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GOS	Global Ocean Sampling expedition
GO-SHIP	Global Ocean Ship-based Hydrographic Investigations Panel
GOSIC	Global Observing Systems Information Center
GOV	GODAE OceanVIEW
GPS	Global Positioning System
GPO	GOOS Project Office
GRAs	GOOS Regional Alliances
GRC	GOOS Regional Council
GRF	GOOS Regional Alliance Forum
GSOP	Global Synthesis and Observations Panel

GSSC	GOOS Scientific Steering Committee
GTOS	Global Terrestrial Observing System
GTS	Groupe de Travail Scientifique
GTS	WMO Global Telecommunications System
IAPSO	International Association for the Physical Sciences of the Oceans
ICSU	International Council for Science
IEEE	Institute of Electrical and Electronic Engineers
IGBP	International Geosphere-Biosphere Programme
I-GOOS	Intergovernmental Committee for GOOS
IGOS	Integrated Global Observing Strategy
IMarEST	Institute of Marine Engineering, Marine and Technology
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCCP	International Ocean Carbon Coordination Project
IODE	International Oceanographic Data and Information Exchange
IO-GOOS	Indian Ocean GOOS Regional Alliance
IOOS	Integrated Ocean Observing System (NOAA)
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMM-MAN	JCOMM Management Committee
JGOFS	Joint Global Ocean Flux Study
KML	Data encoding standard for Google Earth
LAS	Live Access Server
LME	Large Marine Ecosystem
MarBIN	SCAR Marine Biodiversity Information Network
MERSEA	Marine Environment and Security for the European Area
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration (USA)
NCDC	National Climatic Data Center
NetCDF	Data file format
NIES	National Institute for Environmental Studies
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Center (USA)
NSF	National Science Foundation (USA)
NWP	Numerical Weather Prediction centers
OceanDIVA	Ocean Data Inter-comparison and Visualization Application
OCB	Ocean Carbon and Biogeochemistry
ODP	Ocean Data Portal
OGC	Open Geospatial Consortium
OOPC	Ocean Observations Panel for Climate
PICO	Panel for Integrated Coastal Observations
PI-GOOS	Pacific Islands GOOS Regional Alliance
PMEL	Pacific Marine Environmental Laboratory
POGO	Partnership for Observation of the Global Ocean
POM	Princeton Ocean Model
PP	Pilot Project
PP-WET	Pilot Project for Wave measurement Evaluation and Test from moored buoys
PSU	Practical Salinity Unit
R&D	Research and Development
ROMS	Regional Ocean Modelling System

SAON	Sustaining Arctic Observing Networks
SASSI	Synoptic Antarctic Shelf-Slope Interactions
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCAR	Scientific Committee on Antarctic Research
SCOR	Scientific Committee on Oceanic Research
SEA-GOOS	Southeast Asian GOOS Regional Alliance
SGGOOS	Steering Group for GOOS
SIF	Standards and Interoperability Forum
SOLAS	Surface Ocean-Lower Atmosphere Study
SO	Southern Ocean
SOCAT	Surface Ocean CO2 Atlas
SOOP	Ship-of-Opportunity Programme
SOOS	Southern Ocean Observing System
SPINCAM	Southeast Pacific data and Information Network in support to Integrated Coastal Area Management
SST	Sea Surface Temperature
TEOS-10	Thermodynamic Equation Of Seawater 2010
ToR	Terms of Reference
UN	United Nations
UNDAF	United Nations Development Assistance Framework
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNFCCC	United National Framework Convention on Climate Change
WCC3	World Climate Conference-3
WCRP	World Climate Research Programme
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization