## 7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

## 7.1 International Council for Science (ICSU) Sicre

ICSU plans to allow SCOR to check the draft report of the SCOR-SCAR review committee for factual errors before finalizing it.

### 7.1.1 World Climate Research Programme (WCRP)

***The World Climate Research Programme (WCRP): a Short Update to SCOR-2017***

***General background***

The Mission of the World Climate Research Programme (WCRP) is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society. The two overarching objectives of the WCRP are (1) to determine the predictability of climate; and (2) to determine the effect of human activities on climate.

WCRP is organized as a network of core and co-sponsored projects, working groups, modelling activities and cross-cutting initiatives (see www.wcrp-climate.org). Those activities of most relevance to the work of SCOR are highlighted below.

WCRP is sponsored by the World Meteorological Organization (WMO), the International Council for Science (ICSU) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

**The WCRP Grand Challenges**

The overarching WCRP Grand Science Challenges (GCs) http://wcrp-climate.org/grand-challenges represent major foci of scientific research, modelling, analysis and observations over the next decade or so. The WCRP intends to promote these GCs through community-organized workshops, conferences and strategic planning meetings to identify high-priority and exciting research that requires international partnership and coordination, and that yields "actionable information" for decision makers. Currently, WCRP has seven GCs, including two approved in April 2016 focussed on decadal climate prediction and climate and carbon:

1. Clouds, Circulation & Climate Sensitivity
2. Melting Ice & Global Consequences
3. Weather and Climate Extremes
4. Regional Sea-level Change & Coastal Impacts
5. Water for the Food Baskets of the World
6. Near-term (decadal) Climate Prediction
7. Carbon Feedbacks in the Climate System

Of these the GC on *Regional Sea-Level Change and Coastal Impacts* is of most relevant to SCOR, though many others (e.g., decadal climate, carbon feedbacks) have a significant ocean component. This Grand Challenge represents an integrated interdisciplinary program on sea level research reaching from the global to the regional and local scales to

- Establish a quantitative understanding of the natural and anthropogenic mechanisms of regional to local sea level variability;
- Promote advances in observing systems required for an integrated sea level monitoring; and
- Foster the development of sea level predictions and projections that are of increasing benefit for coastal zone management.

The effort will focus on all components of global to local sea level changes and will consider the necessary analyses on global and regional climate change data and simulations, extreme events and potential impacts, including the evaluation of sea level rise impacts for coastal zones. The program also aims to have close interaction with coastal communities to assure that results of the proposed scientific research are incorporated into practices of coastal zone management, and impacts and adaptation efforts. A WCRP-IOC Joint Sea Level Conference is being planned in commemoration of the ten years' anniversary of the WCRP Sea Level workshop held at IOC in Paris in 2006. The conference is scheduled for July 10-14 2017 at Columbia University in New York City (http://www.sealevel2017.org).

**The WCRP Core Projects**

WCRP carries out a major part of its activities through its four core projects, CLIVAR http://www.clivar.org), CliC (cryosphere and climate - www.climate-cryosphere.org), GEWEX (water and climate www.gewex.org) and SPARC (atmosphere and climate - http://www.sparc-climate.org). Both CLIVAR and CliC are official endorsers of the SCAR/SCOR Southern Ocean Observing System (SOOS). Discussions are also being held on the formation of a possible Northern Oceans panel. Of these core projects the work of CLIVAR is of particular relevance to SCOR.

**The CLIVAR Project**

2016 marked the celebration of 20 years of CLIVAR, and culminated with the CLIVAR Open Science Conference (OSC) in Qingdao, China, and the launch of the draft of the new Science and Implementation Plan, which will be finalized during the 23rd CLIVAR SSG to be held in Pune, India, during November. The overarching goals of the project continue: to improve understanding and prediction of the ocean-atmosphere system and its influence on climate variability and change, to the benefit of society and the environment.

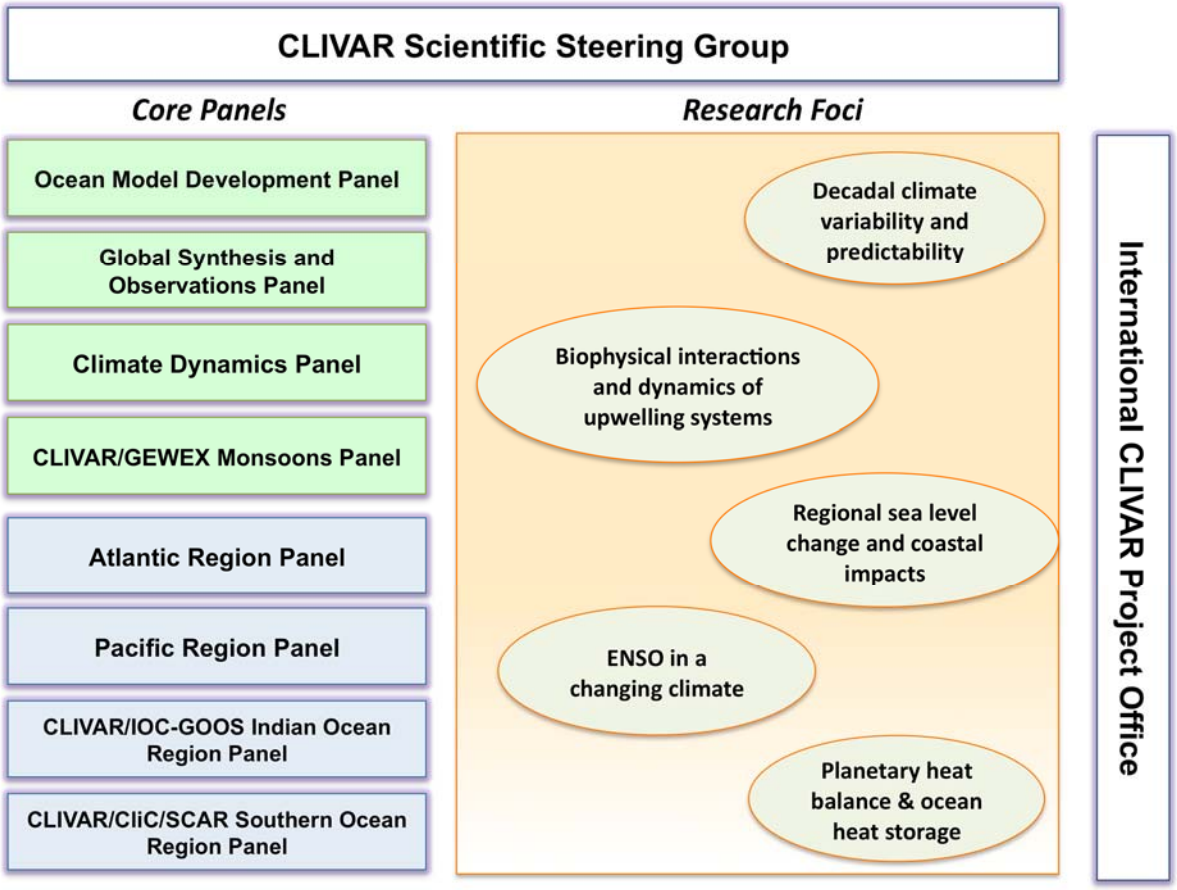
The Open Science Conference "Charting the course for future climate and ocean research" (www.clivar2016.org), was held in Qingdao, China on 19-23 September 2016. An exciting programme was prepared, based on the review of 936 abstracts submitted by 750 authors from 66 countries. Daily plenary sessions and 12 parallel sessions with community leaders and promising young scientists speaking covered diverse aspects of CLIVAR science. To contribute to the formation of the new generation of scientists, more than one-third of participants were students or within 5 years of their PhD. They presented their work through 234 posters and oral presentations, including plenary talks, served as daily chairs, poster judges and rapporteurs. The associated Early Career Scientist Symposium (ECSS), on 24-25 September also had a programme focusing on discussions of science frontiers and fostering the engagement of young researchers in CLIVAR science topics. CLIVAR is grateful to SCOR for providing travel

support that enabled a couple of young scientists from developing countries to attend the ECSS and OSC.

The CLIVAR organisational structure is comprised of four global panels (Ocean Model Development Panel, the Global Synthesis and Observations Panel, the Climate Dynamics Panel, and the joint CLIVAR-GEWEX Monsoons Panel), and currently four regional ocean basin Panels (Atlantic, Pacific, Indian and Southern Ocean). All Panels report to the CLIVAR Scientific Steering Group.

The regional ocean basin panels have developed through the years strong partnerships with groups that also work on the implementation of the ocean observing system, like the CLIVAR/IOC-GOOS Indian Ocean Region Panel, links with IIOE-2 activities and the CLIVAR/CliC/SCAR Southern Ocean Region Panel's links with SOOS. More recently, the Atlantic Region Panel and the Pacific Region Panel are involved with AtlantOS and TPOS2020, respectively.

Recognizing the need for the CLIVAR project to be flexible and responsive to new ideas and challenges, the CLIVAR SSG has initiated the concept of *Research Foci* (RF, http://www.clivar.org/about/research-foci). These are focused research topics identified by members of the CLIVAR community as being ripe for progress in the next 5-10 years and that would significantly benefit from enhanced international coordination. The RF are an effective means for CLIVAR to initiate activities and invigorate progress in areas that go beyond the traditional areas addressed by the Panels, fostering cross-panel, cross-community collaboration, and an opportunity to bring young scientists into CLIVAR. Five RF (ENSO in a Changing Climate, Decadal Climate Variability and Predictability - DCVP, Sea Level Rise and Regional Impacts (also a WCRP Grand Challenge), Planetary Heat Balance and Ocean Heat Storage - CONCEPT-HEAT, and Eastern Boundary Upwelling Systems - EBUS) have presented their science and implementation plans to the SSG and been endorsed. All of them have organised kick-off meetings and held further meetings around the CLIVAR OSC.




Panels and RF activities:

*The CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP)* works closely with the Southern Ocean Observing System (SOOS) program, providing scientific and technical input to the observation system design and implementation, particularly on air-sea fluxes in the Southern Ocean, which is also an important topic identified in the contribution from SORP to the Year of Polar Prediction (YOPP[1]) plans. SORP intends to strengthen the link with YOPP by inviting the Polar Prediction Project (PPP) Steering group member and also the leader of YOPP Southern Hemisphere (YOPP-SH), Dr. David Bromwich, to be a new panel member from 2017. The 12th SORP session at Boulder, 29-30 June 2017 will have a joint session with YOPP-SH to define the Southern Ocean oceanographic observations needed during the YOPP-SH special observing period, 16 November 2018–15 February 2019. SORP members have also had critical involvement in the proposal that led the Southern Ocean Carbon and Climate Observations and Modelling (SOCCOM) project to be funded. SOCCOM will contribute further to the scientific and public understanding of the role of the vast Southern Ocean in climate change and biogeochemistry.

[1] http://www.polarprediction.net/yopp/

*The Atlantic Region Panel (ARP)* actively interacted with the regional observing efforts in the Atlantic Ocean, including OSNAP and OVIDE in the north Atlantic, SAMOC in the south Atlantic, PIRATA in the tropical Atlantic, and AtlantOS building on an integration of ocean observing activities across all disciplines for the Atlantic. The panel has provided OOPC with scientific input to strengthen the observation at boundaries and the air-sea exchanges, and further development of the tropical and south Atlantic observing system particularly including regions off Africa that are not well covered by observations so far. ARP also agreed on strengthening the interaction with AtlantOS, through its panel members, who are already part of the AtlantOS consortium, to provide scientific advice for further development of the Atlantic Ocean Observing System. Meanwhile, the significant advancement in Atlantic observation has contributed to the progress in validation of climate simulation models, in particular for the AMOC. In collaborating with the US CLIVAR Eastern Tropical Oceans Synthesis (ETOS) Working Group, significant progress has been made in understanding the causes of the warm SST bias in IPCC climate models in the South Tropical Atlantic. The 'CLIVAR-PIRATA-PREFACE Tropical Atlantic Variability Conference' was organised at the end of 2016 in reflecting to the recently experienced pronounced shifts of great socio-economic importance. The ARP also set a priority to understand ocean eddies and their interaction with the atmosphere, and started preparing a meso-scale eddy workshop to be held during the 2018 Ocean Science Meeting.

*The Pacific Region Panel (PRP)* has been discussing recently, among other things, how to better observe the Indonesian Throughflow (ITF) ocean current, which is of great importance to countries in that region. The panel, together with the IOC Sub-Commission for the Western Pacific (WESTPAC), will continue to engage regional partners with strong interests in monitoring the ITF. The panel has also contributed in the planning of the Tropical Pacific Observing System (TPOS 2020) project that is being led in collaboration with the Ocean Observations Panel for Climate (OOPC), including having panel member in the groups of TPOS 2020 and in reviewing its white papers. Observation activities in the upwelling regions of the Pacific off Peru and Chile are currently being planned by the panel. Significant interactions between the Panel and the CLIVAR ENSO Research Focus have taken place. Both groups planned their group meeting at the ENSO Complexity workshop hosted by Pusan National University at Busan Korea in October 2017.

*The CLIVAR/IOC-GOOS Indian Ocean Region Panel (IORP)* has coordinated on behalf of the international community and started the IndOOS review by jointly organising the IndOOS Review workshop in Perth with SIBER and IOGOOS. A writing team consisting of 24 lead authors has been organised to prepare the chapters for the IndOOS Review White Paper, which is expected to be drafted by September 2017. The close cooperation between SIBER and IORP to provide inputs to IndOOS and other scientific researches in the Indian Ocean, from their respective biogeochemical and physical perspectives, has demonstrated the usefulness of the IORP. The Year of Maritime Continent (YMC) has been endorsed by CLIVAR with positive feedback from IORP. The panel will seek further engagement and collaboration with YMC, EIOURI, and initiatives in the ITF region. Moreover, IORP has taken the lead in preparing the scientific programme for the IIOE-2 Summer School on "Indian Ocean Physical and Biological Oceanography: From Observations to Modeling", which is expected to be organised in INCOIS in 2018. The review paper on 'Indo-Pacific interactions' and 'monsoon-Indian Ocean

interactions' is also under preparation by IORP.

*The Global Synthesis and Observations Panel (GSOP),* the production of ocean reanalyses, or ocean state estimates, is now an established activity in several research and operational centres. A new generation of products has recently been produced and a coordinated community effort on the intercomparison of those ocean reanalyses has been undertaken addressing a variety of aspects. GSOP, in collaboration with the EOS ("Evaluation of Ocean Syntheses") COST action ES1402, is organising the COST/CLIVAR Workshop on ocean reanalyses and inter-comparisons, which will take place on 29-30 June 2017 in Toulouse, France. GSOP members continue to support activities of projects like TPOS2020, and liaise with the Ocean Observations Panel for Climate (OOPC).

*The Ocean Model Development Panel (OMDP)* fosters the development of ocean models for research in climate and related fields through the development of models and improved representation of ocean processes (parameterizations, resolution, numerics, addressing model biases) and the design and implementation of coordinated ocean-ice modelling studies and their analysis. The 2nd Session of the CLIVAR OMDP was held on 14-16 January 2016 at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) in Yokohama, Japan. The focus of the meeting was primarily on a detailed evaluation of the new Japanese Reanalysis (JRA-55) atmospheric product for forcing ocean – sea-ice climate models produced by the Japan Meteorological Agency (JMA). Presentations and discussions included technical aspects of the JRA-55 reanalysis, the JRA-55/OMDP collaborative evaluation that has been on-going since early 2015, reviews of applied and/or additional corrections; creation of a repeat-annual-cycle forcing data set; and preliminary simulations forced with the JRA-55 data sets. An important goal of the meeting was to receive input from the wider ocean and climate modelling communities participating in the CORE-II and OMIP efforts. OMDP, jointly with two other CLIVAR panels (Pacific Region Panel and Climate Dynamics Panel) and the WESTPAC project on Air-Sea Interaction in the Kuroshio Extension and its Climate Impact (AIKEC), organised the "CLIVAR/JAMSTEC Workshop on the Kuroshio Current and Extension System: Theory, Observations, and Ocean Climate Modelling", held in Yokohama, Japan, January 12-13, 2016 (http://www.clivar.org/omdp/kuroshio). The workshop was hosted by JAMSTEC. The main objective of the workshop was to assess the state-of-science of the theory, observations, and ocean climate modelling of the Kuroshio Current and Extension systems in the North Pacific Ocean. A special issue of *CLIVAR Exchanges* issue 69: "The Kuroshio Current and Extension System" was made available online in July 2016. OMDP will join the Pan-WCRP modelling meeting to be held by Met Office in Exeter, UK in October 9-13, 2017 to interact with other modelling groups within WCRP on common issues and future planning.

*Sea Level rise and Regional Impacts:* This RF is also a WCRP Grand Challenge (GC). The WCRP GC Regional Sea Level Change and Coastal Impacts: Science and Implementation Plan has been formed via two steering team meetings in March 2015 at Utrecht of the Netherlands and February 2016 at New York of US, respectively, and made public on CLIVAR's website in February 2017. The GC Sea Level has also planned and been organizing the international IOC/WCRP conference on Regional Sea-Level Changes and Coastal Impacts to be held at Columbia University, New York, US from 10 to 14 July 2017. The conference follows 11 years

after the first WCRP sea level conference (Paris, 2006), and three years after the last Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). It will provide a comprehensive summary of the state of worldwide climate-related large-scale sea level research. Over 300 abstracts have been received for the conference and its estimated that over 400 participants are expected to attend this conference.

*Climate Dynamics Panel (CDP)* This newly established panel is in the process of finalising a science and implementation plan of its activities for the coming years. The panel will foster and coordinate international research efforts to increase understanding of the dynamical processes that control circulation variability and change in the atmosphere and ocean on synoptic to centennial time scales. The focus is on large-scale phenomena, processes, and mechanisms of coupled climate variability/modes, teleconnnections and change on seasonal to centennial time-scales, in particular i) storm tracks, jet streams and weather systems, ii) tropical-extratropical interactions, and iii) long-term coupled atmosphere-ocean circulation.

*ENSO in a Changing climate:* The 4th CLIVAR workshop on the evaluation of El Niño-Southern Oscillation (ENSO) processes in climate models was held at Sorbonne-Universités in Paris in July 2015, in conjunction with the UNESCO "Our Common Future Under Climate Change" conference. The workshop, hosted by IPSL and attended by 50 experts including 12 early-career scientists, was organized by the CLIVAR Research Focus on "ENSO in a changing climate." It also entrained members of the US CLIVAR working group on ENSO diversity, which has focused attention on understanding the substantial inter-event differences in ENSO mechanisms and impacts. Presentations highlighted ENSO mechanisms, the role of intraseasonal variability, climate change and decadal variability, modeling and prediction, and historical and paleo observations. Discussion sessions focused on model evaluation and metrics, and on envisioning future observations as part of the Tropical Pacific Observing System 2020 (TPOS 2020) initiative. This RF is planning to have a meeting before the ENSO Complexity Workshop, to be held in Busan, South Korea on 16-20 Oct.

*The Eastern Boundary Upwelling Systems (EBUS)* Research Focus was established as a joint effort with IMBeR and SOLAS in 2015. The EBUS Prospectus has been approved by the CLIVAR SSG at the beginning of 2016. EBUS organised its 1st session in Qingdao during the CLIVAR Open Science Conference, and formulated the work plan for 2017-2018. EBUS will work in collaboration with the CLIVAR Ocean Model Development Panel (OMDP) to carry out analysis of the JRA-55 forcing dataset in EBUS, and develop an EBUS specific diagnostics and metrics for model analysis, which includes comparisons to existing observational datasets. Meanwhile, co-chairs in EBUS took the lead to submit a working group proposal to SCOR on 'Eastern boundary upwelling systems (EBUS): diversity, coupled dynamics and sensitivity to Climate Change'. Moreover, an ICTP Summer School on upwelling system is planned in 2018.

*The Decadal Climate Variability and Predictability (DCVP)* RF organised the CLIVAR-ICTP International Workshop on Decadal Climate Variability and Predictability: Challenge and Opportunity, in Trieste, Italy, on 16-20 November 2015. In association with the workshop, DCVP hosted its kick-off meeting in order to address the "obstacles to progress", and identify cross-CLIVAR linkages and implementation, and relationship and interaction with the WCRP

GC on Near Term Prediction, relevant CMIP 6 MIPS, and partner projects e.g. CliC, SPARC, GEWEX, and PAGES. The RF Science and Implementation plan has been approved by the CLIVAR SSG.

Planetary Heat Balance and Ocean Heat Storage (CONCEPT-HEAT) RF: The overall goal of the "Consistency between planetary energy balance and ocean heat storage" Research Focus is to bring together several climate research communities all concerned with the energy flows in the Earth's System to advance on the understanding of the uncertainties through budget constraints.

WCRP and CLIVAR look forward to exploring possible collaborations in ocean related activities in the future. Please contact Mike Sparrow (WCRP - msparrow@wmo.int) or Jose Santos (CLIVAR - jose.santos@clivar.org) to discuss this further.

**7.1.2 Scientific Committee on Antarctic Research (SCAR)** **Brussaard**

Scientific Committee on Antarctic Research

# 2017 Report to the Scientific Committee on Oceanic Research (SCOR)

11 May 2017

**Report Prepared by:**
Eoghan Griffin and Jenny Baeseman
SCAR Secretariat

## *SCAR activities of relevance to SCOR*

SCAR and SCOR have a strong overlap of interest in the Southern Ocean region. In many cases, the two organisations work together (e.g., with the SOOS) and in other cases there are SCAR activities, which may be of interest to SCOR (as well as vice versa). Below are a few of those activities. Please see www.scar.org for further details.

**1. The Southern Ocean Observing System**
Louise Newman <newman@soos.aq>

SCOR and SCAR jointly sponsor the Southern Ocean Observing System and provide funds for the meeting of the Steering Committee (see separate SOOS report to SCOR for details).

In order to address growing disparities in Polar remote sensing, and in particular to articulate the satellite needs specific to the Southern Ocean, in 2015 SOOS and CliC (Climate and the Cryosphere Project) coordinated a community survey to canvas uses of remote sensing and define limitations and recommendations for improvement of Southern Ocean remote sensing. These survey responses have been brought together into a summary report, which was around the entire Southern Ocean community (both operational and research). Sections of the report include sea ice variables, atmospheric parameters, SST, SSH, SSS, terrestrial cryospheric connections, marine microbes/ocean colour, marine biology, surface winds, and more. The aim of the report is to represent the Southern Ocean community's satellite data needs for the coming decade. It is designed to stand as an important strategy paper that provides the rationale and information

required for future strategic planning and investment.

The report was published as an open-access article in *Antarctic Science* online in October 2016: https://www.cambridge.org/core/journals/antarctic-science/article/community-review-of-southern-ocean-satellite-data-needs/78B68BDE8535CAF03D0BA00B1F3F07F4

More information on SOOS will be provided in their report.

**2. Southern Ocean Acidification Report**
Richard Bellerby <richard.bellerby@niva.no>

SCAR appointed an international ocean acidification Action Group to document the scientific understanding of ocean acidification. The Action Group consists of an international cross-disciplinary team of ocean acidification experts representing the fields of marine carbonate chemistry, global and regional modelling, marine ecology, ecotoxicology/physiology and paleoceanography. The Ocean Acidification Action Group is finalizing a report to:

- define our present understanding of the contemporary rates and future scenarios of Southern Ocean acidification;
- document ecosystem and organism responses from experimental perturbations and geological records;
- identify present and planned observational and experimental strategies;
- identify gaps in our understanding of the rates and regionality of ocean acidification; and
- define strategies for future Southern ocean acidification research.

The report has been delayed for a few years, but is now in the final stages of review.

**3. The International Bathymetric Chart of the Southern Ocean**
Jan Erik Arndt <Jan.Erik.Arndt@awi.de>

In April 2013, IBCSO Version 1.0 was released by the Alfred-Wegener-Institute (AWI), in Germany. The map and data are now available: http://www.ibcso.org. A new version is in the works that would include data south of 50°S latitude; however, funding needs to be secured for this to progress to a full new version.

A new Antarctic map, “Bathymetry and Geological Setting of the Drake Passage”, has just been released. This SCAR product represents an international collaborative effort coordinated by the Spanish Geological Survey (IGME) and the British Antarctic Survey (BAS), working together with the Korea Polar Research Institute (KOPRI), the Alfred Wegener Institute (AWI) and the United States Antarctic Program (USAP).

The map covers an area of 1470000 km$^2$ between parallels 52ºS and 63ºS and between meridians 70ºW and 50ºW. The data were collected over the last 25 years on more than one hundred oceanographic cruises onboard six different Antarctic research vessels. This initiative is part of SCAR's IBCSO (International Bathymetric Chart of the Southern Ocean) Expert Group, which

recognises the importance of regional data compilations in Antarctic areas of particular scientific interest. The map has been published by the BAS and the IGME, with support from SCAR through the Geosciences Group.

For more details on this SCAR product, see the Drake Passage Bathymetry Map page: http://www.scar.org/ibcso/drake-map

**4. Antarctic Biodiversity Informatics**

Bruno Danis <bdanis@ulb.ac.be>

Biodiversity Informatics is the application of informatics techniques to biodiversity information for improved management, presentation, discovery, exploration and analysis. The purpose of the Antarctic Biodiversity Informatics (ABI) group is to foster the application and development of biodiversity informatics in the SCAR community, and it does this by coordinating and participating in a range of projects across the SCAR biodiversity science portfolio.

Current projects include:

Retrospective Analysis of Antarctic Tracking Data (see the Birds and Marine Mammals section below)

Southern Ocean Diet and Energetics Database

> Information related to diet and energy flow is fundamental to a diverse range of Antarctic and Southern Ocean biological and ecosystem studies. ABI is collating a centralised database of such information to assist the scientific community in this work. It will include data related to diet and energy flow from conventional (e.g., gut content) and modern (e.g., molecular) studies, stable isotopes, fatty acids, and energetic content. It will be a product of the SCAR community and open for all to participate in and use.

The Microbial Antarctic Resource System (mARS)

> mARS is an open information system dedicated to facilitate the discovery, access and analysis of geo-referenced, molecular microbial diversity (meta)data generated by Antarctic researchers. It encompasses all free-living and host-associated viruses, bacteria, archaea, and singled-celled eukaryotes. mARS is composed of interoperable modules, iteratively building the microbial component of the biodiversity.aq infrastructure.

**5. Continuous Plankton Recorder**

Kunio Takahashi <mailto:Takahashi.kunio@nipr.ac.jp>

The SCAR Southern Ocean Continuous Plankton Recorder (SO-CPR) Survey was established in 1991 by the Australian Antarctic Division to map the spatial-temporal patterns of plankton biodiversity and use the sensitivity of plankton to environmental change as early warning indicators of the health of the Southern Ocean.

The Australian Antarctic Division hosts the SO-CPR database. From their website linked below

it is possible to

- View the metadata record describing the Southern Ocean Continuous Zooplankton Records [AADC-00099] database.
- Search Tow Records by date, coverage
- Access the full tow list sorted by season and voyage. There are links to view the sample locations for a tow within the Australian Antarctic sector.
- Access a list of observed species with links to a distribution map within the Australian Antarctic sector.

For access to the data see the SO-CPR website at http://data.aad.gov.au/aadc/cpr/index.cfm.

**6. Birds and Marine Mammals**
Mark Hindell <Mark.Hindell@utas.edu.au>

The second Retrospective Analysis of Antarctic Tracking Data (RAATD) meeting took place in Delmenhorst, Germany in April 2016. The RAATD team has brought together tracking data from 38 biologists from 11 different countries to accumulate the largest animal tracking database in the world, containing information from 15 species, containing over 3,400 individual animals and almost 2.5 million at-sea locations. The report from the meeting is available at:

http://www.scar.org/scar_media/documents/science/egbamm/RAATDworkshopreport2016_v3.pdf.

In terms of RAATD outputs as a result of the workshop, it was decided that there would be two initial papers, one detailing the Areas of Ecological Significance in the Southern Ocean and relating these to the intensity of human activity in those areas and also the hotspots of Southern Ocean climate change in terms of changes in ice and sea surface temperature (SST). This would be submitted to a high-impact journal and at the same time a companion data paper would be submitted.

A workshop session was held prior to the SCAR Open Science Meeting and established the aim of producing circumpolar habitat maps and identifying areas of ecological significance.

RAATD's future workshops are already supported as the group has secured a French-based grant to fund two workshops a year for the next 2 years as well as a full time post-doc to work on the project.
The fourth RAATD workshop, in March 2017, was hosted at the CESAB (Center for Synthesis and Analysis of Biodiversity), in Aix-en-Provence. 10 participants from 7 countries attended the meeting.

As a result of the RAATD meetings, a synopsis of multi-predator tracking data is being developed to expose potential gaps of data coverage in regions or seasons that are important but under-represented, either as a result of a low regional research presence or a low ecological significance. This will provide an important input for directing future studies.

**7. Antarctic Climate in the 21st Century**
Thomas Bracegirdle <mailto:tjbra@bas.ac.uk>

AntClim21 now has strong links with a major NSF-sponsored project called SOCCOM (Southern Ocean Carbon and Climate Observations and Modeling) through one of the Steering Committee members Joellen Russell. This has helped solidify plans for providing an AntClim21 contribution to community climate model evaluation diagnostics (www.esmvaltool.org) for the next major climate model inter-comparison dataset (CMIP6). This model dataset will feed into the next round of IPCC reports, therefore this is potentially a high-impact contribution to the global climate modelling community.

Two notable research papers with significant AntClim21 contributions have been published. In the first by Mayewski et al. (doi:10.1016/j.quascirev.2016.11.017) the emphasis is on changes in atmospheric circulation because the atmosphere rapidly transports heat, moisture, momentum, and pollutants, throughout the middle to high latitudes. The resulting climate analog examples include a continuation of the current trend in Antarctic and Southern Ocean climate characterized by some regions of warming and some cooling at the surface of the Southern Ocean, Antarctic ozone healing, a generally warming climate, increases in meridional versus zonal winds, and natural variability.

The second paper, by Turner et al. (doi:10.1038/nature18645), shows that the absence of 21st Century warming on the Antarctic Peninsula is consistent with natural variability and attributes the change from the rapid warming seen from the 1950s to the late 1990s to a combination of stabilization of the ozone hole along with natural climate variability.

#GreatAntarcticClimateHack will be held October 9-12 2017, at the Scripps Institute of Oceanography Forum, La Jolla, CA. This workshop is intended to train non-modeling experts to use observational datasets to interrogate CMIP model results, thereby creating new model metrics and validation tools. The event will focus on bringing Antarctic and Southern Ocean observations to bear on evaluating the latest generation of climate and earth system models, producing new climate model metrics for the 21st Century.

**8. State of the Antarctic Ecosystem**
Jan Strugnell <J.Strugnell@latrobe.edu.au> and Huw Griffiths <hjg@bas.ac.uk>

The British Antarctic Survey funded a research cruise (JR15005) to the South Orkney Islands (February 2016) with a team of self-funded AntEco scientists (SO-AntEco). This work was part of the research and monitoring required by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to inform and support the management of Marine Protected Areas (CM 91-04). The team conducted a benthic study of the South Orkney Islands Southern Shelf (SOISS) MPA and adjacent shelf and shelf-slope areas in order to better understand the distribution and composition of the seafloor communities around islands. They explored the different seafloor habitats to investigate if different environments support different communities of animals.

The team included 22 participants from nine different countries and 16 institutes. The expedition took place on board the RRS *James Clark Ross* in February-March 2016. Results from a total of 124 trawled gear and 34 video/camera deployments include over 700 seafloor habitat photographs, 3,900 live specimen photos and over 38,000 individual invertebrates and fish (158 kg) collected and preserved for future analyses. Eighteen phyla of animals were found from depths between ~500 m and ~2000 m.

Highlights included new species found in most groups of animals examined on the cruise including corals, anemones, echinoderms and polychaete worms, with many other probable new species awaiting further identification. There was also an evident correlation between abundance of animals from Vulnerable Marine Ecosystem groups and the overall diversity of seafloor life, both inside and outside of the SOISS MPA.

One of the objectives of the SO-AntECO cruise is to contribute information and scientific advice to the CCAMLR South Orkney Islands MPA review in 2019.

In January 2017 a further research cruise involving AntEco members departed Hobart for the Sabrina Coast, East Antarctica. The cruise aboard the Australian research vessel *Investigator* is a multidisciplinary programme comprised of geologists, geochemists, geophysicists and biologists with 22 scientists aboard from universities and research institutes in Australia, Italy, USA and Spain. The aim is to explore the continental slope of this little-known region and understanding the surface and seafloor communities, and their resilience to past changes, will help to better manage and protect these organisms into the future.

**9. Antarctic Thresholds - Ecosystem Resilience and Adaptation**
Julian Gutt <Julian.Gutt@awi.de>

A special issue of the journal *Biodiversity* was recently published as a main product of AnT-ERA, covering aspects of variation and function at all levels of biological organisation. Other publications highlighted by the group include an up-to-date synthesis of the current knowledge about Antarctic krill and an important paper showing how icebergs destroy an enormous amount of biomass in polar shallow waters, releasing carbon that would otherwise be sequestered in the sediment. See the Ant-ERA website (http://www.scar.org/srp/ant-era) for more details.

Major contributions were also provided (Gutt and Isla) to working papers on a Marine Protected Area initiative in the Weddell Sea which is being considered in the CCAMLR system.

A major publication linked to the outcomes of the SCAR Horizon Scan was published in 2016 entitled “Future challenges in Southern Ocean ecology research”. The paper (doi:10.3389/fmars.2016.00094) assesses high-interest research areas related specifically to Southern Ocean life and ecology. The study concluded that basic biological information on the taxonomy of numerous organisms is still lacking in areas, such as the deep-ocean floor or the under-ice environments. Furthermore, there is a need for knowledge about the response and resilience of Antarctic marine ecosystems to change.

**10. Antarctic Nearshore Terrestrial Observing System (ANTOS)**
Craig Cary <mailto:caryc@waikato.ac.nz>

The ANTOS Expert Group has published its report from their 2016 meeting in Kuala Lumpur. At this workshop, ANTOS committee members reported on progress and deliverables from previous workshops that will direct the design and implementation of ANTOS, and attendees at the workshop discussed program "next steps".

Progress to date includes (1) a preliminary version of a database management schema and user interface (UI) that will be the backbone of an ANTOS website. This has been developed by Soon Gyu Hong from the Korean Polar Research Institute (KOPRI). The website and database will provide a portal for data management and sharing among the international research community; (2) Action group committee members, led by Byron Adams (Brigham Young University, United States) and Emmanuelle Sultan (Muséum National d'Histoire Naturelle, France) have designed an online survey to poll the international community to designate suitable, high-priority sites that should be included in the ANTOS network; (3) Action group members have reviewed technical aspects of site instrumentation (e.g., sensor networks, telemetry, remote data transfer) and have drafted technical guidelines for standards for a 3-tier system to guide investment in ANTOS site infrastructure by national programs; (4) Peter Convey (British Antarctic Survey, BAS) presented results from a BAS-supported workshop to create an Atlas of Ice-Free Areas of Antarctica to identify prospective terrestrial ice-free sites that should be prioritized to be included in the ANTOS network.

The ANTOS action group has successfully identified a need for international collaboration to measure and understand continent-wide, long-term trends in Antarctic biology and environmental parameters, and has begun to design a framework for a coordinated international effort to address these issues. As such, the ANTOS action group applied to gain designation as a SCAR expert group by early 2017, which was granted. As ANTOS shifts to an expert group, next steps include a cost-benefit analysis of SCAR investment in ANTOS, conducting the survey to identify candidate ANTOS sites, implementing the database design and user interface to create an ANTOS data portal website, developing a working relationship with COMNAP to communicate why it is necessary national programs invest in such an effort, and providing technical details of the three measurement tiers to guide national funding agencies and research programmes.

The full report on the workshop is available at:
http://www.scar.org/scar_media/documents/science/antos/2016-ANTOS-Workshop-Report-KL.pdf.

**11. The Monaco Assessment - Progress**
Steven Chown <Steven.Chown@monash.edu>

In June 2015, SCAR, in partnership with the government of the Principality of Monaco, and Monash University, held a meeting of biodiversity, legal and policy experts to assess Antarctic

and Southern Ocean biodiversity and its conservation status in the context of the Strategic Plan for Biodiversity 2011 to 2020.

To date, Antarctica and the Southern Ocean have not been adequately represented in global biodiversity assessments undertaken as part of Strategic Plan Activities. The meeting considered the current status of biodiversity conservation in Antarctica and the Southern Ocean, available evidence for this status, and both their trajectory and evidence for this trajectory, in the context of each of the 20 Aichi Targets of the Strategic Plan for Biodiversity 2011 to 2020.

The full assessment has now been completed and appeared in the journal *PLoS Biology* in the 28 March 2017 issue, along with comprehensive evidence underpinning the assessment.

While in some areas, such as invasive species management, the Antarctic region is doing relatively well, in others, such as protected area management and regulation of bioprospecting, it is lagging global trends. Overall, the biodiversity and conservation management outlook for Antarctica and the Southern Ocean is no different to that for the rest of the planet.

Promisingly, however, the agreements under the Antarctic Treaty System lend themselves to effective action, and nations, industries operating in the region, and the general public have recently reinforced their desire to protect the region's biodiversity. An Antarctic biodiversity strategy and action plan would help deliver such effective action. SCAR and partners are undertaking work to provide the basis for such an Antarctic biodiversity strategy and action plan.

For more information on the assessment visit: http://www.scar.org/monaco-assessment.

**12. CLIVAR/CliC/SCAR Southern Ocean Region Panel**

Inga Smith <mailto:inga.smith@otago.ac.nz> and John Fyfe <mailto:john.fyfe@canada.ca>

The 11th session of CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP) was held on 17-18 September 2016 in Qingdao, China. The full meeting report is available here: http://www.clivar.org/clivar-panels/southern.

The meeting included discussions on strategic mapping of panel activities which reflected a need for SORP representation and input to SOOS, SCAR and other relevant groups meetings and initiatives.

Three cross-panel meetings were held between:

(1) Atlantic Region Panel, SORP and Eastern Boundary Upwelling System Research Foci (ARP-SORP-EBUS). At the meeting four possible common themes of interest were identified:

- "Climate" teleconnections between the SO and EBUs regions a) Global thermocline and water mass properties in coastal and open-ocean upwelling, including source of upwelled

waters b) Changes in wind forcing and consequences on upwelling under changes in large-scale circulation (climate change and/or interannual variability)
- Mesoscale (and sub-mesoscale) "mixing" and restratification processes responsible for the surface effects of wind-driven upwelling.
- Importance of spatio-temporal variability of wind forcing field and its consequences for the spatio-temporal distribution of upwelling.
- Related to all of the above, model systematic biases and underlying process representation in open ocean and in coastal upwelling systems, in particular dependence on resolution, representation of mixing processes (e.g., near-inertial waves or Langmuir turbulence) and coupling frequency.

(2) Ocean Model Development Panel and SORP (OMDP-SORP)

The meeting discussed issues identified with the representation of various processes within the modelling efforts of both groups, for instance the land-ice runoff. The Southern Ocean Modelling Intercomparison Project (SOMIP) was introduced and it was noted that if it is approved for CMIP6, SOMIP will be the first approved regional MIP.

(3) Atlantic Region Panel, SORP, Indian Ocean Region Panel and Pacific Region Panel (ARP-SORP-IORP-PRP)

- Discussions were held on the ocean carbon cycle under the following topics:
  - Paths for carbon into deep ocean.
  - Locations of carbon uptake and storage.
  - Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM).
  - Southern Ocean anthropogenic acidification.
  - Suggestions on best measures for carbon.
  - Including carbon expertise into CLIVAR panels.
  - Ocean Reanalysis data and modeling.

**13. Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED)**
Rachel Cavanagh < mailto:iced@bas.ac.uk>

At the 2016 SCAR Delegates Meeting in Kuala Lumpur the ICED Group outlined its future plans and expected outcomes:

Future Plans
- A series of ICED community papers are planned for 2016-2017 that present clear messages on change in the Southern Ocean. These include scenarios of change, historical data rescue and synthesis, stakeholder engagement, polar food web diversity and functioning, and an ICED mid-term programme review.
- ICED is providing input to a range of meetings in 2016 including the Joint Workshop of SC-CAMLR and the CEP, Punta Arenas, Chile, May 2016; the High-$CO_2$ Symposium,

Hobart, May 2016; SC-CAMLR WG-EMM, July 2016; and the SCAR Open Science Conference, Kuala Lumpur, August 2016.

- ICED workshops and meetings planned for 2016-18 will synthesise research to date, forming a comprehensive view of status and changes in Southern Ocean ecosystems. These will include an ICED workshop on projections of change (2017) and an ICED International Conference on Assessing Status and Trends of Habitats, Key Species and Ecosystems in the Southern Ocean, Hobart, Australia, 2018 (www.measo2018.aq).

Expected Outcomes

Through the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project, SCAR and associated programmes, ICED will continue to raise the profile of Southern Ocean science and ensure that our activities reflect international as well as regional priorities. ICED will also continue to engage with stakeholders to facilitate the provision and uptake of policy-relevant science on Southern Ocean climate and ecosystem dynamics. ICED will publish the upcoming ICED community papers on scenarios, historical data, stakeholder engagement, and Antarctic-Arctic food web diversity and functioning; and further develop key science areas as outlined in the soon to be published ICED review.

**14. Antarctic Sea Ice Underway Observation Platform v2**
http://aspect.antarctica.gov.au/ or contact Petra Heil <mailto:petra.heil@utas.edu.au>

The Antarctic Sea Ice Process and Climate (ASPeCt) digital underway ice observation method, v.2, has been launched. Voyages from October 2015 - March 2016 have uploaded near-real time data, pending networking from vessel to central server, and automatic cameras were implemented on some research cruises to take images that currently supplement ASPeCt visual observations. Ships going to the Antarctic are encouraged to participate in data collection.

The Group is also likely to seek to work with the recently created SCOR Working Group 152 on Measuring Essential Climate variables in Sea Ice (ECV-Ice).

The ASPeCt (Antarctic Sea Ice Processes) Group supported a novel capacity-building activity in South Africa. Despite the availability of a state-of–the-art icebreaker, the RV *SA Agulhas II*, which is used for research as well as to serve the Antarctic base, there is almost no expertise in South Africa on sea ice observations and sampling. An expert sea ice observer, Trond Robertsen of the Norwegian Meteorological Office, participated in a cruise in July 2016 and trained participants on the ASPeCt (Antarctic Sea Ice Processes) protocols with a series of daily morning meetings on the way to the MIZ, during which information and lectures were given. This first voyage was very limited in scope, but it has afforded South Africa the opportunity of linking with the ASPeCt community and building an initial expertise in Antarctic sea ice.

**15. Biogeochemical Exchange Processes at the Sea-Ice Interfaces**
A SCOR working group since 2012, Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII) was approved in 2016 at the SCAR Delegates Meeting in Kuala Lumpur as an Action Group within the Life Sciences Group. The group is also supported by CliC and

Surface Ocean - Lower Atmosphere Study (SOLAS).

BEPSII intends to

- Develop dedicated consistent methodologies for sea-ice biogeochemical research;
- Establish effective sea-ice biogeochemical data archiving approaches and databases;
- Summarize existing knowledge in order to prioritize processes and model parameterizations;
- Foster ecological process studies to determine their impact on biogeochemical cycles;
- Foster technological developments towards large-scale, autonomous and high-frequency sampling of sea-ice biogeochemical parameters;
- Improve the representation and evaluation of sea-ice biogeochemistry in regional and Earth System numerical models;
- Synthesize and integrate observational and modeling efforts; and
- Continually revise and renew scientific foci, teams, and objectives.

As BEPSII serves as a unique forum linking modellers and field scientists studying sea-ice biogeochemistry the group is expected to complement the sea-ice process focus of the Antarctic Sea-ice Processes and Climate (ASPeCt) Action Group.

**16. Tropical Antarctic Teleconnections Action Group**

A new Action Group on Tropical Antarctic Teleconnections (TATE) was approved at the 2016 SCAR Delegates Meeting in Kuala Lumpur. There are very distinct connections between tropical and Antarctic climates, particularly over the South Pacific and South Atlantic with the West Antarctic/Antarctic Peninsula regions, but these are not fully explored.

All these variations have important roles on the tropical-Antarctic relationships including, for example, the one between climate and sea ice extent. Coupling of tropical forcing with the SAM also impacts the weather and climate throughout the Southern Hemisphere. For example, extreme weather events in subtropical South America result from interactions between tropical and Antarctic regions.

Goals of the TATE Group

- The Group intends to increase discussion and collaboration to explore tropical and polar weather and climate interactions, carrying out at least one interdisciplinary workshop;
- To investigate the tropical forcing of the atmospheric circulation in the present and in the recent past (the last 200 years based on proxy records such shallow ice core studies);
- To explore the air-sea ice coupled systems and their relation to weather and climate of the tropics and subtropics, including interactions with the monsoons systems;
- To conduct case studies on the relation between complex weather and climate patterns in the South Atlantic, Indian and Pacific regions and the Southern Ocean sea ice cover, and how they are connected to natural modes of climatic variability (e.g., ENSO, SAM, PSA, PDO) or anthropogenic-induced changes;

- To organize a session at the XXXV SCAR (Davos, 2018) exploring the tropical polar teleconnections (to be carried out together with IASC);
- To produce at least one special volume of articles on the tropical polar teleconnections.

**17. Celebrating Women in Antarctic Research Wikibomb**
Jan Strugnell <J.Strugnell@jcu.edu.au>

One of the highlights of the 2016 SCAR Open Science Conference was the Women in Antarctic Research Wikibomb event. A team of volunteers, led by Dr. Jan Strugnell and Wikipedian Dr. Thomas Shafee, created and updated more than 110 biographies of high-achieving women in Antarctic science. The team of volunteers, primarily female early-career researchers, had been developing Wikipedia pages in preparation for the event from 170 nominations received from 30 countries.

The event underlined how important it was that senior women scientists were visible to younger female scientists as role models. Some 60% of early career Antarctic researchers are women, with strong reputations in the scientific community, but only about 10% of awards and prizes are presented to women.

Correspondence about the event was included in *Nature*:
http://www.nature.com/nature/journal/v536/n7615/full/536148b.html

For more information see:
http://www.scar.org/outreach/women

**18. SCAR products**

SCAR products of relevance to SCOR include:

- *ADD - Antarctic Digital Database*
  The SCAR ADD consists of geographic information layers including coastline, ice-shelf grounding line, rock outcrop, contours, elevation point data such as survey points and spot heights, and human-presence features such as Research Station locations. It also includes other relevant information sources such as the Landsat Image Mosaic of Antarctica (LIMA), bedrock and surface Digital Elevation Models from BEDMAP, and glacier and ice-shelf change information for some regions.
- *Antarctic Map Catalogue*
  The SCAR Map Catalogue allows users to search for maps and charts of Antarctica, the Southern Ocean and subantarctic islands from over 26 countries.
- *Antarctic Master Directory (AMD)*
  The Antarctic Master Directory is the largest collection of Antarctic data set description in the world, holding over 7,700 dataset descriptions from 25 countries. It is hosted by the Global Change Master Directory (GCMD) of the CEOS-IDN network to minimise duplication of resources and metadata.
- *Biodivesity.aq (formerly SCAR Marine Biodiversity Information Network (SCAR-MarBIN))*

Biodiversity.aq establishes and supports a distributed system of interoperable databases, giving easy access through a single internet portal to a set of resources relevant to research, conservation and management pertaining to Antarctic biodiversity.

- *Composite Gazetteer of Antarctica (CGA)*
  The CGA is a collection of all those names of features that have been submitted by representatives of national gazetteers. It includes the names of features south of 60° S, both terrestrial and undersea or under-ice. The CGA is a compilation of recognized features, with a numerical Unique Identifier code (UID) assigned to each of them, jointly with a list of applicable place names. The CGA is compiled purely for the convenience of the scientific community and has no legal authority or standing.
- *CPR - Continuous Plankton Recorder Database*
  The CPR was established to map the spatial-temporal patterns of plankton biodiversity and use the sensitivity of plankton to environmental change as early warning indicators of the health of the Southern Ocean. It also contributes to or can serve as a reference for other observational/monitoring programmes such as the Southern Ocean Observing System (SOOS), Southern Ocean Sentinel (SOS), CCAMLR Ecosystem Monitoring Program (C-EMP), and the Integrating Climate and Ecosystem Dynamics (ICED) program.
- *READER - REference Antarctic Data for Environmental Research*
  There are three components of READER:

  MET-READER providing surface and upper air mean climate data
  ICE-READER providing links to ice core data
  OCEAN-READER which holds oceanographic data

- *Biogeographic Atlas of the Southern Ocean*
  The Atlas provides the most thorough audit of marine life in the Southern Ocean. Leading marine biologists and oceanographers from all over the world spent four years compiling everything they know about the distribution of Antarctic marine species from microplankton to whales.
- *Quantarctica*
  Quantarctica is a collection of Antarctic geographical datasets which works with the free, open-source software QGIS. It currently includes geography, glaciology and geophysics data, and will expand with contributions from the research community.
- *Antanym R Package*
  Recently, the SCAR ABI Group and Standing Committee on Antarctic Geographic Information have produced an R package around the CGA. This R package (called "antanym") is intended to provide R users with easy access to CGA data, as well as functionality for filtering, searching, and using place names in the R software environment.
- *SOOS Field Projects Database*
  SOOS is coordinating the development of a multi-disciplinary, international field projects database.

For the full list of SCAR products visit http://www.scar.org/data-products

**19. Upcoming Conferences**

- ***SOOS Scientific Steering Committee Meeting 2017***, 11-13 June, Alfred Wegener Institute, Bremerhaven, Germany.
- ***SOOS Data Management Sub-Committee Meeting 2017***, 13-15 June, Alfred Wegener Institute, Bremerhaven, Germany.
- ***12th Workshop on Antarctic Meteorology and Climate,*** 26-28 June, 2017, Boulder USA.
- ***Year of Polar Prediction in the Southern Hemisphere (YOPP-SH) Meeting***. 28-29 June 2017, Boulder, USA.
- ***Southern Ocean Regional Panel (SORP) Meeting***, 29-30 June, 2017, Boulder, USA.
- ***2017 SCAR Biology Symposium***. 10-14 July 2017, Leuven, Belgium.
- ***Past Antarctic Ice Sheet Dynamics (PAIS) Conference 2017***. 10-15 September 2017, Trieste, Italy.
- ***International conference on Marine Ecosystem Assessment for the Southern Ocean.*** 1 April 2018, Hobart, Australia***.***
- ***POLAR2018, including the XXXV SCAR Delegates Meetings.*** 15-27 June 2018, Davos, Switzerland. The conference will cover both Polar Regions, being organized jointly by SCAR and the International Arctic Science Committee (IASC). http://www.polar2018.org/

**20. SCAR Fellowships and Prizes**

In order to expand capacity within all its Members, SCAR runs several Fellowship and Prize Schemes (*http://www.scar.org/awards*):

- ***SCAR Fellowships*** focus on early-career researchers and aim to build new connections and further strengthen international capacity and cooperation in Antarctic research. The fellowships are advertised in tandem with the CCAMLR Scholarships. In 2016, four SCAR Fellowships, including the second Prince Albert II of Monaco Biodiversity Fellowship, were awarded. The 2016 SCAR Fellows are from Australia, Italy and South Africa and will visit France, Australia and Canada to advance their research. Their research proposals included: "Effects of natural iron fertilisation by baleen whales on the microbial community in the Southern Ocean"; "Trophic dynamics and nutritional condition of *Pleuragramma antarctica* in the Weddell Sea, as related to population genetic structure" and "Marine Top Predator Habitat Use around the Sub-Antarctic Prince Edward Islands". A mini-symposium to highlight the SCAR/COMNAP fellowships was held during the 2016 SCAR Open Science Conference. *http://www.scar.org/awards/fellowships*

- ***SCAR Visiting Professor Scheme*** provides mid- to late-career scientists the opportunity to undertake short-term visits to a facility in, or operated by, SCAR member countries, to provide training and mentoring. Two Visiting Professorships were awarded in 2016 to visit Argentina and Iran, *http://www.scar.org/awards/visitingprofs*

- ***Tinker-Muse Prize for Science and Policy in Antarctica***, facilitated by SCAR, is a USD $100,000 unrestricted award presented to an individual in the fields of Antarctic science or policy. Prof. Rob DeConto was awarded the 2016 Tinker-Muse Prize for his outstanding work on past and future Antarctic climate. *www.museprize.org*

For 2017, SCAR has secured additional funding from India, Switzerland and Norway to support additional Fellowships and Visiting Professorships.

SCAR would welcome SCOR's interest in a joint Fellowship or Visiting Professorship to support Southern Ocean activities.

**21. 2016 ICSU Review of SCAR**

Through 2015 and 2016 an external review was carried out by the International Council for Science (ICSU). Their report included 15 recommendations which were presented to the SCAR Delegates meeting in August 2016. In their concluding remarks, they commended the Officers and Secretariat of SCAR for the excellent work they do for the Antarctic community. They added that the recommendations were meant in the spirit of helping advance the work of SCAR and should not be taken in a negative way.

**22. Future SCAR/SCOR Collaborations**

There are several existing and upcoming opportunities for further collaboration between SCAR and SCOR.

The Antarctic Environments Portal provides science-based information on the vulnerability of Southern Ocean biota for stakeholders. The Portal will continue to provide an important link between Antarctic science and Antarctic policy and welcomes relevant input from SCOR scientists.

The Year of Polar Prediction (YOPP) will be officially launched in May 2017. During the core phase of YOPP from mid-2017 to mid-2019, a Special Observing Period in the Southern Hemisphere will take place from mid-November 2018 to mid-February 2019. This will have intensified research activities, including enhanced routine synoptic observations and radiosonde launches. SCAR would like to encourage SCOR members to participate in this special observing period.

To make further progress in the coordination of the various activities planned in the Southern Hemisphere during YOPP, the second YOPP-SH planning meeting will be held immediately following the SCAR sponsored Workshop on Antarctic Meteorology and Climate in Boulder, USA, June 2017.

SCAR looks forward to continuing our mutual activities and welcomes suggestions from SCOR on new joint ventures.

### 7.1.3 Future Earth Initiative Sicre

## Update of Future Earth Ocean issues, June 2017

Oceans have been a highlighted focus for Future Earth during the first half of 2017, partially due to the UN SDG14 conference and the increased focus on this topic in the UN process. Some key activities for Future Earth has been:

**SDG 14 conference** – The Future Earth Secretariat Swedish Hub was in contact with the Swedish government and the delegation that was chairing the UN conference. At the conference we spoke in plenary about the need of integrated science for the SDG on Oceans and had a number of side events, including one on science communication and one to launch the Oceans KAN.

**Ocean KAN** – The first scoping for the Ocean Knowledge-Action Network was performed in Kiel in late 2016. The focus of the KAN has since been to gather a development team. A call for applications was open during the spring of 2017 and a team has recently been selected from those applications, but there is a need to complement the team to get better representation, mainly for the geographical balance. Once a few more candidates are identified, the development team will be formed and become active.

**Belmont Forum Ocean CRA** – Future Earth has been actively engaged in the scoping of the upcoming Belmont Forum CRA on Oceans. The themes of the call will be focused on what Future Earth has proposed: over-harvest, pollution, and global [climate] change. On Future Earth's recommendation, Carol Robinson from IMBER has been selected to the expert group leading the continued scoping process for the Belmont Forum, with a couple of workshops that will yield a draft call text for presentation at Belmont Forum's annual meeting on 7-9 Nov. 2017 in São Paulo, Brazil.

## 7.2 Affiliated Organizations

### 7.2.1 International Association for Biological Oceanography (IABO) Miloslavich

# IABO report to SCOR 2017

**IABO Executive Committee**

Mark Costello, *President* – University of Auckland (New Zealand)
Annelies Pierrot-Bults, *Past President* – University of Amsterdam (The Netherlands)

**Members:**
Philippe Archambault – *Chair of the 4th WCMB* - Université Laval (Canada)
Suchana Chavanich - Chulalongkorn University (Thailand)
Adrian Glover – Natural History Museum (UK)
Patricia Miloslavich, *SCOR representative* – University of Tasmania (Australia) and Universidad Simón Bolívar (Venezuela)
Tina Molodtsova – Shirshov Institute of Oceanology (Russia)
David Paterson – University of St. Andrews (UK)
Siew Moi Phang – University of Malaya (Malaysia)
Eulogio Soto – Universidad de Valparaíso (Chile)
Isabel Sousa-Pinto – CIIMAR, University of Porto (Portugal)
Sun Song – Institute of Oceanology, Chinese Academy of Science (China)
Mike Thorndyke – University of Gothenburg (Sweden)

## 2016-2017 Activities

**Organization: the 4th World Conference on Marine Biodiversity (May 13-16, 2018)**
The *World Conference on Marine Biodiversity* has become the major focal assembly for sharing research outcomes, management and policy issues, and for discussions of the role of biodiversity and biodiversity conservation in sustaining ocean ecosystems. In this context, the 4th World Conference on Marine Biodiversity (http://www.wcmb2018.org), and its main partners (Convention on Biological Diversity secretariat, Fisheries and Oceans Canada, and Canadian Healthy Ocean Network) are inviting all marine biodiversity stakeholders to Montreal (Canada) in 2018. The theme, *Connecting with the living ocean*, will underline the need to replace our current exploitation relationship with the ocean's living resources, with a sustainable connection based on scientific knowledge.

The 4th WCMB will be the perfect forum to exchange and try to make a difference at all levels, from the discovery to the management of our ocean. Presentations by leading scientists and practitioners from around the world will bring to light the very latest developments, innovations and discoveries in marine biodiversity.

The WCMB is open to partners, exhibitors, and scientists to share scientific results and discuss the importance of marine biodiversity for our planet. Registration and abstract submission are now open. The next IABO General Assembly will be held in Montreal in May 2018 during the WCMB.

**Establishment of the International Award in Marine Biodiversity**
IABO has established an international award, similar to what IAPSO has had for several years: http://www.wcmb2018.org/carlo-heip-award.html. Inaugurated in recognition of Carlo Heip's leadership in marine biodiversity research and founding of the World Conference on Marine Biodiversity, the Carlo Heip International Award for outstanding accomplishments in marine biodiversity science will congratulate an individual who has demonstrated exemplary leadership in marine biodiversity science. IABO invites SCOR members to encourage their scientists to nominate people for this new award.

**Communications**
The IABO email list, MARINE-B, has been expanded to over 1,100 scientists. A Facebook page is also in progress. MARINE-B provides news and relevant information related to biological oceanography, marine biology and biodiversity, including funding, job and studies opportunities, relevant papers and reports, conferences, etc.

**Associations**
IABO encourages international networking and cooperation in marine biological science. To that end, it endorses the following global-scale marine initiatives and encourages its members and members of SCOR to support them:

- Ocean Biogeographic Information System OBIS (www.iobis.org)
- Marine Biodiversity Observation Network MBON (http://geobon.org/networks/thematic-bons/marine-bon/)
- World Register of Marine Species WoRMS (www.marinespecies.org)
- Global Ocean Observing System – GOOS Biology and Ecosystem Panel (www.goosocean.org)

IABO also endorses the collaboration agreement signed by GOOS, the Ocean Biogeographic Information System (OBIS), and the Marine Biodiversity Observation Network (MBON) of the Group on Earth Observations Biodiversity Observation Network (GEOBON) (http://www.iobis.org/documents/GOOS-BioEco-OBIS-GEOBON-MBON_collaboration_SIGNED.pdf). Aims of the agreement are to

- build a unified and globally consistent observing system
- encourage open access and data sharing
- enhance existing observation capacity
- use the best available resources
- implement best practices and international standards
- enhance global capacity
- ensure continuity and sustainability of global marine biological and ecosystem observations

### 7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS) — Turner

# The International Association of Meteorology and Atmospheric Sciences 2017 Report to SCOR
## (www.IAMAS.org)

IAMAS is one of the eight associations dealing with the Earth system and its environs that make up the International Union of Geodesy and Geophysics (IUGG). The scope of IAMAS includes the atmospheres of the Earth and other planets. IAMAS is made up of ten international commissions and one committee that play a major role in implementing IAMAS's activities. The ten commissions cover *Atmospheric Chemistry and Global Pollution* (ICACGP), *Atmospheric Electricity* (ICAE), *Climate* (ICCL), *Clouds and Precipitation* (ICCP), *Dynamical Meteorology* (ICDM), the *Middle Atmosphere* (ICMA), stratospheric *Ozone* (IOC), *Planetary Atmospheres and their Evolution* (ICPAE), *Polar Meteorology* (ICPM), and atmospheric *Radiation* (IRC). The *Committee on Nucleation and Atmospheric Aerosols* (CNAA) brings together scientists covering the areas of Nucleation Theory and Experiment, Tropospheric and stratospheric aerosols, Cloud Drop and Ice Nucleation and Aerosol-Climate Interactions.

Many of these commissions play international leadership roles in their specialist areas [see http://www.iamas.org/commissions-within-iamas/]. The commissions provide an important supplement and extension to the leadership and research role of the *World Meteorological Organization* (WMO), which is the governmental body with a comparable scientific scope to IAMAS.

The current Bureau of IAMAS elected in Prague consists of:

- President - John Turner (UK)
- Secretary General – Teruyuki Nakajima (Japan)
- Vice President – Joyce Penner (USA)
- Vice President – Laura Gallardo Klenner (Chile)
- Deputy Secretary General – Peter Pilewskie (USA)
- Assistant Secretary General – Yoshi Sasaki (Japan)
- Assistant Secretary General - Nozomi Tomizawa (Japan)

The organization also has five Members at Large who promote IAMAS activities:

- Prof. Daren Lu (China) 2015-2019
- Prof. Colin Price (Israel) 2015-2019
- Dr. Lisa Alexander (Australia) 2015-2023

- Dr. Keith Alverson (USA/Japan) 2015-2023
- Dr. Iracema Cavalcanti (Brazil) 2015-2023

a) The IAMAS Bureau, commissions and Executive have been heavily involved in the planning of the joint IAPSO-IAMAS-IAGA assembly, which will be held in Cape Town, South Africa over 27 August – 1 September 2017. The conference web site can be found at http://www.iapso-iamas-iaga2017.com, where there are details of the scientific programme.

b) The IAMAS-associated journal is *Advances in Atmospheric Sciences* (AAS) is published by Springer. AAS regularly publishes meeting reports on IAMAS activities, such as the 3rd ANtarctic Gravity Wave Instrument Network (ANGWIN) science workshop and the 10th Antarctic meteorological observation, modeling, and forecasting workshop. It also published selected papers by members of IAMAS.

c) The IAMAS web site (www.iamas.org), which is hosted in Japan, continues to be developed and provides details of the 10 IAMAS commissions, upcoming meetings and news items.

d) The 2017 IAMAS Early Career Scientist Medal was awarded to Prof. Corinna Hoose of Karlsruhe Institute of Technology for her work on modelling of aerosol-cloud interactions. Corinna will be presented with her medal at the IAPSO-IAMAS-IAGA assembly in Cape Town in August 2017.

e) The IAMAS Information E-mail continues to be published several times a year and provides news on IAMAS activities, meeting reports, information from the commissions and details of forthcoming meetings. The current and past issues can be found at http://www.iamas.org/NewsLetters/.

f) Each year the IAMAS commissions hold a number of high-profile conferences either alone or in conjunction with other organizations. Some recent and planned meetings are given below. Details of all IAMAS meetings can be found at http://www.iamas.org/meetings/.

- The 14th International Global Atmospheric Chemistry Science Conference, Breckenridge, Colorado, 26-30 September 2016.
- The 33rd International Conference on Lightning Protection, Estoril, Portugal, 25-30 September 2016.
- International Ozone Commission Quadrennial Ozone Symposium 2016, 4-9 September 2016, Edinburgh, United Kingdom
- The 17th ICCP Conference on Clouds and Precipitation, Manchester, UK, 25-29 July 2016.
- The 20th International Conference on Nucleation and Atmospheric Aerosols, Helsinki, Finland, 25-30 June 2017.
- The 1st IUGG Symposium on Planetary Science, Berlin, Germany, 3-5 July 2017

For more information on IAMAS please contact :

John Turner, President (jtu@bas.ac.uk)
Teruyuki Nakajima, Secretary General (terry-nkj@nifty.com)

*Submitted by John Turner, IUGG/IAMAS representative to SCOR, 20 June 2017.*

### 7.2.3 International Association for the Physical Sciences of the Ocean (IAPSO) — Smythe-Wright

IUGG | IAPSO
International Association for the Physical Sciences of the Oceans

*http://iapso.iugg.org*

INTRODUCTION

IAPSO has the prime goal of 'promoting the study of scientific problems relating to the oceans and the interactions taking places at the sea floor, coastal, and atmospheric boundaries insofar as such research is conducted by the use of mathematics, physics, and chemistry.' IAPSO works mainly through 1) biennial scientific assemblies; 2) working groups; 3) commissions; 4) services and 5) website information. Of special importance to IAPSO is the involvement of scientists and students from developing countries in oceanographic activities.

IAPSO maintains formal liaison with other scientific commissions and committees. These include the ICSU's Scientific Committee on Oceanic Research (SCOR), and UNESCO's Intergovernmental Oceanographic Commission (IOC). For more information see http://iapso.iugg.org/.

ADMINISTRATION

The 2015-2019 Bureau of IAPSO comprises:

President: Denise Smythe-Wright, (UK)
Past President: Eugene Morozov, (Russia)
Secretary General: Stefania Sparnocchia (Italy)
Treasurer: Ken Ridgway (Australia)

The Executive Committee comprises the Bureau members and Vice-Presidents:

Dr Isabelle Ansorge (South Africa)

Trevor McDougall (Australia)

Members:

Dr Agatha de Boer (Sweden)
Dr Hans van Haren (The Netherlands)
Prof Toshiyuki Hibiya (Japan)
Dr Christa von Hildebrandt-Andrade (USA and Puerto Rico)
Dr Chris Meinen (USA)
Dr Satheesh Chandra Shenoi (India)

The IAPSO office is located at the Institute of Marine Science of the National Research Council of Italy, Trieste and day-to-day business is managed by Secretary General (SG), Stefania Sparnocchia. The SG is responsible for the IAPSO website and in July, 2015 a new IAPSO page was created in the Facebook social network, with the aim of facilitating the spreading of information in the community (see https://www.facebook.com/iapso.iugg.org). Together with the President, the SG also prepares and distributes a bi-annual Newsletter to IAPSO delegates and interested parties.

Financial management is presently split between Australia and Sweden. The previous Secretary General, Johan Rodhe, was co-opted by the IAPSO executive to assist the Treasurer, Ken Ridgway, with day-to-day banking and facilitate a smooth transfer of funds from the IAPSO bank account in Sweden to a new account in Australia. The majority of IAPSO finances have now been consolidated there.

ACTIVITIES

**2017 Assembly**

The main IAPSO activity during 2016 has been the organisation of the IAPSO-IAMAS-IAGA Joint Assembly "Good Hope for Earth Sciences", Cape Town, South Africa, from 27 August to 1 September. With the help of 45 IAPSO-related scientists 15 symposia have been organised, covering a wide range of IAPSO topics; 8 of them jointly with IAMAS and IAGA. IAPSO EC meetings are planned for 28 and 29 August and 1 September. The IAPSO General Business Meeting will be held on 31 August. During the third EC meeting, the Eugene LaFond Medal Committee will report on the selection of the ocean scientist from a developing country who will be given the 2017 award. On 31 August, Distinguished Professor Lynne Talley, from the Scripps Institution of Oceanography, University of California San Diego, La Jolla, California, USA, will be awarded the Prince Albert I Medal 2017, and will deliver her Albert I Memorial Lecture. The Joint Assembly program details and other relevant information can be found on the website: http://www.iapso-iamas-iaga2017.com/.

**Task force on the IUGG 100th anniversary**

President Denise Smythe-Wright is serving on the Task Force for the IUGG 100$^{th}$ Anniversary (TF100) to be celebrated in 2019. The TF100 was appointed by the IUGG President Michael Sideris and will prepare a program for celebration of the event, including activities related to

publications, science and education, science policy and outreach, and the legacy of the centennial.

**SCOR Administration**
IAPSO has maintained its formal relations with SCOR during the year. It is presently involved in the evaluation of the 2017 Working Group proposal to be funded by SCOR in the next years. President, Denise Smythe-Wright participated in the SCOR Annual Meeting in Sopot, Poland, 5-7 September 2016, and will participate in the next meeting in Cape Town, South Africa from 4 - 6 September 2017.

**Co-funding SCOR proposals**
Following the evaluation of the SCOR proposals in 2016, IAPSO decided not to offer co-funding for this round, as those proposals aligned to IAPSO objectives were not of sufficient quality. The IAPSO Executive Committee will closely review the 5 proposals now on the table for the 2017 round.

Sadly, the expectation of IAPSO that members of any co-funded WG would arrange a session at one of the IUGG assemblies is still to be resolved, Since SCOR policy prevents any offer of funding being bound by conditions, the IAPSO Executive Committee have up to now relied on the good will of the working group Chairs, but recently they have not always honoured the IAPSO request. IAPSO will again discuss the way forward at their Executive Committee meetings in Cape Town.

**IUGG/IAPSO support to scientific meetings**
With IUGG, IAPSO is sponsoring three scientific meetings in 2017:

- IndOOS Review Workshop, Perth, Australia, 30 January-1 February 2017.
- Past Antarctic Ice Sheet (PAIS) conference, Trieste, Italy, 10-16 September 2017.
- THEMES 2017, Venice, Italy, 29 November-1 December 2017.

**IAPSO-sponsored activities**

- Commission on Mean Sea Level and Tides (CMSLT), President: Gary T. Mitchum. Vice-President: Simon Holgate. Website: www.psmsl.org/
- Permanent Service for Mean Sea Level, hosted by Proudman Oceanographic Laboratory, UK. Director: Dr. Lesley Rickards. IAPSO Liaison: Philip L. Woodworth. Website: www.psmsl.org/
- IAPSO Standard Seawater Service, hosted by OSIL, Havant, Hampshire, UK. Director: Richard Williams; Website: www.osil.co.uk
- Joint Committee on the Properties of Seawater, JCS (with SCOR and IAPWS). Chair: Rich Pawlowicz. Vice-Chairs: Trevor McDougall, Rainer Feistel. Website: http://www.teos-10.org/
- IAPSO/IASPEI/IAVCEI Joint Tsunami Commission. Chair: Dr. Vasily V. Titov. IAPSO Representative: Efim Pelinovsky. Website: www.iaspei.org/commissions/JCT.html

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The working groups, commissions and services report to IAPSO. These reports are published on the IAPSO website: http://iapso.iugg.org/working-groups.

**IAPSO Liaison Officers and IUGG Commission Correspondents**
The Liaison Officers and Correspondents to Commissions and Committees for 2015-2019 are as follows:

- UNESCO Intergovernmental Oceanographic Commission (IOC): Stefania Sparnocchia (Italy) and Eugene Morozov (Russia)
- ICSU Scientific Committee on Oceanic Research (SCOR): Denise Smythe-Wright (UK)
- ICSU Regional Office for Africa (ROA): Isabelle Ansorge (South Africa)
- Climatic and Environmental Changes (CCEC): Harry Bryden (UK)
- Mathematical Geophysics (CMG): Adam Monaham (Canada)
- Geophysical Risk and Sustainability (GRC): Christa von Hillebrandt-Andrade (USA)
- Data and Information (UCDI): Sateesh Shenoi, Chair (India) and Robert M. Key, Member (USA)
- Working Group on History (WGH): John Gould (UK)

Submitted by
Denise Smythe-Wright, IAPSO
President Stefania Sparnocchia,
IAPSO Secretary General

16 May 2017

## 7.3 Affiliated Programs

SCOR-Affiliated Projects and Programs

SCOR sponsors many, but not all, of the major international ocean research projects and programs. Some projects not co-sponsored by SCOR can gain benefits from association with SCOR, such as (1) increased visibility; (2) participation in SCOR activities, such as project coordination meetings and annual SCOR meetings; (3) opportunities to provide comments on working group proposals and membership; (4) access to national SCOR contacts; and (5) opportunities to apply for SCOR funding for travel of scientists from developing countries and countries with economies in transition to their workshops and symposia. In 1995, SCOR developed the option of formal affiliation of relevant projects/programs with SCOR. Unlike projects sponsored by SCOR, affiliated projects and programs receive funding from organizations besides SCOR and do not need staff support from SCOR.

SCOR's role in relation to affiliated projects and programs is one of advice and regular review. SCOR gives advice about appropriate balances on the projects' steering committees and adequate rotations of these committees to renew the committees' memberships regularly. SCOR's national contacts can be used to find new members in regions where there is a need, or to entrain new countries into projects. SCOR can also provide an independent mechanism for the review of planning documents such as science or implementation plans.

Application for SCOR Affiliation

Application to SCOR for program affiliation should be initiated with a proposal of 2 to 5 pages, sent to SCOR at least three months before an annual SCOR meeting. The proposal should include an outline of the program's science plan, the terms of reference, current membership of the steering committee, and rotation procedures and schedule. The proposal for SCOR affiliation should also address the following criteria, accepted at the 1995 SCOR Executive Committee meeting (see *1995 SCOR Proceedings*). The Executive Committee agreed that in order to become a SCOR-affiliated project/program, an activity must

- be truly international, with a committee membership that rotates on a regular basis;
- show evidence of existing financial and/or organizational support;
- demonstrate a benefit from SCOR affiliation;
- have a scientifically well-integrated theme;
- show that it is in SCOR's interests to establish this affiliation;
- be of broad scale and global importance;
- show, as appropriate, that any scheme of membership dues includes some nominal level so as to encourage the widest possible international participation by all countries; and
- be willing to adhere to the SCOR Publication Policy.

After a program is affiliated with SCOR, annual reports are required, and scientific presentations may be requested at any annual SCOR meeting, as a basis for the decision on continuing the relationship between SCOR and each project/program. The Chair of each affiliated

project/program serves as an ex-officio member of SCOR as a Scientific Rapporteur (see SCOR Constitution, paragraph 4). Continued affiliation with SCOR depends on the project meeting the guidelines specified above, and maintaining high scientific quality and adequate rotations of committee members and chairs.

Reports to SCOR

Annual reports to SCOR should answer the following questions and present any additional information that the project/program would like to transmit to SCOR:

- What scientific accomplishments have been achieved by the project/program in the past year?
- How has the project's steering committee membership changed in the past year?
- What is the financial status of the project?
- What is the status of the project's secretariat?
- What are the plans for the scientific development and implementation of the project over the next two to three years?
- How is the project interacting with and contributing to other SCOR activities?

In addition, projects/programs should communicate regularly with their SCOR Executive Committee Reporter regarding their activities and progress.

### 7.3.1 InterRidge - International Ridge Studies (affiliated in 1996) — Devey

# 2017 InterRidge Update for SCOR

**InterRidge – International Cooperation in Ridge-Crest Studies**
Since its creation 25 years ago, InterRidge has been an international forum for mid-ocean ridge (MOR) scientists, expended to other oceanic spreading centers and related processes. InterRidge promotes interdisciplinary studies by creating a global research community, planning and coordinating new science programs that no single nation can achieve alone, exchanging scientific information, and sharing new technologies and facilities. InterRidge plays a dual role. Its primary aim is to favor the emergence of new concepts and makes possible ambitious experiments at international level. InterRidge also supports community-wide initiatives such as the definition and dissemination of a code of conduct for scientific studies in relation to chemosynthetic hot-spot ecosystems and their vulnerable environments. More recently, with the growing interest of countries and industries for deep-sea mineral resources, including sea-floor massive sulfide (SMS) deposits at MOR, InterRidge has become the voice of expert scientists in different fora. Through its observer status at the International Seabed Authority (since 2012), particularly, InterRidge developed formal interactions with this organization under the United Nations Convention on the Law of the Sea (UNCLOS).

InterRidge scientific activities are currently led under the frame of the 3rd Decadal Plan 2014-2023 'From Ridge Crest to Deep-Ocean Trench: Formation and Evolution of the Oceanic Crust and Its Interaction with the Ocean, Biosphere, Climate and Human Society' launched in 2012. Beside its affiliation with SCOR, the InterRidge program has links with international research programs such as the International Ocean Discovery Program and the International Lithosphere Project. InterRidge activity includes meetings and workshops where the advancement of scientific knowledge, new issues, methodological improvements and standardized protocols are discussed. InterRidge also dedicates itself to interact with the public, scientists and governments, and to provide a unified voice for ocean ridge researchers worldwide. While remaining at the level of fundamental science, an increasing role for InterRidge is our involvement in compiling information and advice for policy makers. The multidisciplinary coverage of InterRidge working groups give the organization a key role in future discussions concerning the exploration and exploitation of mineral resources associated with ridges, volcanic arcs and back-arcs and associated hydrothermal systems.

InterRidge has a Steering Committee comprising representatives of the member countries and of working group chairs that are scientists nominated for their expertise in a particular field. The Steering Committee meets at least once a year (the last meeting was held in Hangzhou, China, on September 25-27, 2015, the next one is planned on July 20-21, 2017 in Paris). The Steering Committee considers updates to its Science Plan, endorses InterRidge memberships, approves the InterRidge budget, decides on membership fees, oversees the operation of the InterRidge Office, reviews bids for the InterRidge Office and nominates the Program's chair. It also

evaluates working group progress, assesses and admits/rejects working group proposals, and nominates the working group chairs.

The InterRidge contribution is 25 000 US$ for a Principal Member country and 5 000 US$ for a Regular Member country. Considering the present membership (China, France, Norway, UK and USA as Principal members and Japan, Canada, India, South Korea, Germany and Portugal as Regular members) and the double contribution for the host country, the resulting annual budget is c.a. 150 000 US$.

**Achievements and changes during the last year**

**Office rotation**
The rotation of the office after the completion of the 4-year office coordination by China was discussed during the last Steering Committee in Hangzhou (China) on September 28, 2015. The proposal submitted by France, for the coordination of Jérôme Dyment (jdy@ipgp.fr; IPGP - CNRS, marine geophysics, co-chair) and Nadine Le Bris (lebris@obs-banyuls.fr; Université Pierre et Marie Curie, Sorbonne Universités - CNRS, Marine ecology and marine environmental sciences, co-chair) was accepted unanimously by the Steering Committee members. The IR Office was in transit to France and had limited activity during 2016. Because of administrative issues, the final establishment of an operational office was delayed until 2017. The new InterRidge Coordinator (Kamil Szafrański – interridge@ipgp.fr) was recruited in February 2017 and took the position on April 1, 2017. The French National Center for Scientific Research (CNRS) is the French institution affiliated to InterRidge, and the InterRidge Office is hosted at the Institut de Physique du Globe de Paris (IPGP), which is responsible for the budget management and administration of the program. The InterRidge website and vent database, (http://vents-data.interridge.org/) operated by Peking University until June 30, 2016, have been running at IPGP since September 2016 and are updated regularly since April 2017.

**Scientific activities**
Due to administrative limitations in 2016, the main scientific networking activities of InterRidge have been organized around the two active Working Groups (WGs) – Circum-Antarctic Ridges WG and Ecological Connectivity and Resilience WG. Other activities in liaison with InterRidge included the continuous update of the IR Hydrothermal Vent Database (Beaulieu et al., 2015) by Stace Beaulieu (WHOI).

***Report on activities of the InterRidge Circum-Antarctic Ridges Working Group***
The co-chairs of the InterRidge Circum-Antarctic Ridges Working Group are Anne Briais (OMP Toulouse, France), Jian Lin (WHOI, USA) and Sung-Hyun Park (KOPRI, Korea). This Working Group is dedicated to the mid-ocean ridges encircling the Antarctic Plate (CAR). CARs constitute one-third of the global mid-ocean ridge system, and include the Pacific-Antarctic Ridge, Chile Ridge, Australian-Antarctic Ridge, Southeast Indian Ridge, Southwest Indian Ridge, and American-Antarctic Ridge. CARs are unique in that they exhibit shallow water depths, ultra-slow or intermediate spreading rates, and complex series of transform offsets compared to low-latitude ridges. Furthermore, since these ridges cover all major oceans with no continental barriers, we may be able to trace mantle flow between different oceanic domains, as

well as the migration routes of hydrothermal vent animals between major oceans.
The activities of the Circum-Antarctic Ridges WG in the last two years included coordinating science with one workshop, gathering new data, with cruises performed all around the Antarctic, and sharing the results, with a proposal for one special session at the 2017 AGU Fall meeting. The CAR WG organized a workshop in Incheon, South Korea, on October 12-15, 2015. The meeting gathered about 50 scientists from all over the world, and included 30 oral presentations and 12 posters. It was the opportunity to have an update on research in multiple topics from mantle sources and processes to hydrothermal activity and biological communities, from the Southwest, Southeast, Pacific-Antarctic ridges and the Scotia Sea. The discussions following the presentations permitted to initiate new collaborations for research around the Antarctic plate. Several cruises have occurred in the past two years, including UK cruises in the East and West Scotia seas, French and Korean cruises on the Southeast Indian Ridge south of Tasmania (Australia-Antarctic Ridge), and cruises on the Southwest Indian Ridge. To have a new update on the results and projects regarding the southern ridges, a special session at the 2017 Fall AGU meeting, entitled "Circum-Antarctic Mid-Ocean Ridges: Structure, Evolution, Mantle Dynamics, Hydrothermal Activity and Ecological Communities" has been proposed. We hope to organize a meeting around the Working Group activities and collaborations within the framework of the AGU meeting, for example on the evening after the special session.

***Report on activities of the InterRidge Ecological Connectivity and Resilience Working Group***
Working group chairs Anna Metaxas (Dalhousie University, Canada) and Lauren Mullineaux (Woods Hole Oceanographic Institution, USA) presented the WG at a dedicated meeting during the Deep-Sea Biology Symposium (Aveiro, Portugal in September 2015). The objectives of the open meeting were to refine the goals and the content of the papers to be produced, to identify task leaders, interested participants, their roles, and a time-line.

The ecological connectivity of vent communities, and their resilience in the face of disturbance, has been a hot topic of research ever since their discovery. This topic has become particularly timely and societally relevant as plans for deep-sea mining progress toward implementation. It is also directly relevant to management decisions under consideration for recently designated deep Marine Protected Areas (MPAs), such as those on the Endeavour Segment, in the Marianas region, on the mid-Atlantic Ridge off the Azores, and in the Guaymas Basin and Eastern Pacific Rise. These topics were also identified in InterRidge's Third Decadal Plan (2014-2023). The objectives of the WG were to generate a synthesis of scientific data on vent community connectivity. The intent was to assemble a group of objective scientists with broad expertise in this field (including physical oceanography, larval biology, environmental geochemistry, microbial ecology, population genetics, metacommunity dynamics and biogeography) to assemble existing data, interpret it in the context of human disturbance, and disseminate it to the scientific community, the public, and policy makers. Part of this effort was also to identify and evaluate potential ecosystem services from vent communities. The data synthesis will be used to identify gaps in our knowledge and to facilitate international cooperation in future research in fields relevant to this topic.

Since September 2015, the WG has been working on an article. As planned, the co-Chairs circulated an outline of the potential structure of the article to the Steering Committee in October

2015, which, after many edits and input from the Steering Committee, was finalized by mid-January 2016. In late January 2016, the outline was circulated to the InterRidge community, and particularly all members that had expressed interest in participating, requesting short proposals on their potential contribution. Based on the proposals, we refined the structure of the paper and requested input from the authors in June 2016. This was a long process, particularly given the number of co-authors and everyone's busy schedules. We had received most input by November 2016, which we then combined, edited, integrated and sent out to the authors again in March 2017 for the next stage of their input. We have now received most input from all co-authors and are editing the manuscript for what we hope is the final stage before submission. We hope to submit the article for review by July 2017. It will be submitted to an open-access journal and we hope that we can use the IR funding to our working group to cover the cost.

***Update of the IR Hydrothermal Vent Database***

The InterRidge Vents Database (http://vents-data.interridge.org/) has been transferred to a new server in Paris, upgraded to Version 3.4 and revised by Stace Beaulieu (stace@whoi.edu), supported by the NSF Grant "Metacommunity Dynamics at Hydrothermal Vents" and in relation with the InterRidge Office. That is why the database was off-line between June and September 2016. Version 3.4 was launched on October 13, 2016 and has the same vent field listings as Version 3.3. There is now a total of 689 records – confirmed or inferred active vent fields in the database and the corresponding kml file for visualization in Google Earth.

***Update of former WG Hydrothermal energy transfer and the ocean carbon cycle Working Group***

Though this joint SCOR-IR WG has been disbanded at InterRidge since 2015, after 5 years of activity, including two group meetings, a session at an international conference (EGU, Vienna, Austria) and one published article (German et al. EPSL 2015), the activity of the group is still on-going. A subgroup supported by young scientists that attended the EGU session has been working on a synthesis paper, which is close to a final editing stage by the whole group before being submitted. Furthermore, a synthesis of WG outcomes (including cruises, projects, papers) that have at least partly arise from the collaborations among group members is being assembled for SCOR.

**Plans for future development of IR approved by the Steering committee**

**Build on experience to maintain and reinforce InterRidge as an efficient scientific forum**

- ***InterRidge Working Groups*** (or WGs) build small task forces, meet, brainstorm, and develop reports and plans. WGs usually interact with the interested community by organizing an ***InterRidge Workshop***. The IR WGs should complete their task on a two- or three-year basis. The WGs are dynamic structures, with inactive WGs being stopped and new ones created. In 2017, the InterRidge Office has announced a call for proposals of new InterRidge Working Groups. Proposals should describe the WG objectives, importance and timeliness to ridge-related science, available and required means, and expected achievements. The new WGs should substantially differ in objective from the existing or former WGs. Each proposal should have at least four proponents from at least three InterRidge member countries. Cross-disciplinary proposals will be given special

attention. Successful proposals will receive support from the InterRidge Office and funding for one workshop. Proposals should be sent by June 2, 2017. The InterRidge Office will discuss and nominate the new WGs at the next Steering Committee in July 2017.

- Development and advertisement of the ***InterRidge Vent Database***, include portals toward other external databases of interest for ridge scientists (including, for instance, regional oceanography).
- ***Cruise Information*** to promote the exchange of information, technologies and facilities among international research groups. A virtual platform (IR Info, website and IR News) is offered by the InterRidge Office to share information with the InterRidge community.
- Disseminate ridge-related information through ***InterRidge Info*** (biweekly e-mail), the annual ***InterRidge News***, workshop and Working Group reports within the InterRidge community and beyond its own field (e.g., physical and biogeochemical oceanography, paleooceanography, geobiology, deep-sea ecology).
- Update the ***Code of Conduct*** for responsible research at hydrothermal vents. The current text was finalized under the German IR presidency and is cited as a model of self-organization of the scientific community on different high-level international instances. The text certainly needs to be updated as regards new knowledge, technological developments and societal issues related to ridge-research. Only the whole ridge community can provide an outline of the critical needs and organize the discussions/fora with the community in the next months (gathering information internationally and across disciplines).

**Support young scientists in international ridge-crest studies**

- ***InterRidge Fellowships*** (including the IR-ISA fellowships funded by the International Seabed Authority (ISA) Endowment Fund) promote the involvement of young scientists in international, collaborative, and interdisciplinary studies of oceanic spreading centers. The InterRidge Office has announced the launch of the 2017 Student and Postdoctoral Fellowship Program. We invite proposals for InterRidge Student and Postdoctoral Fellowships of up to 5 000 US$ each. These Fellowships are designed to encourage international collaboration on any aspect of ridge-crest science by graduate students or postdoctoral researchers, fostering long-standing partnerships for their future careers. The Fellowships can be used for any field of ridge-crest research. These awards may be used, for instance, for cruise participation or laboratory work by adding an international dimension to the Fellow's research. In 2017, we may offer up to 6 IR Fellowships including 3 joint IR-ISA Fellowships. Fellowships funded by the ISA Endowment Fund are open either to graduate students or postdocs from developing countries, or to young scientists from any other country if the application demonstrates that it will benefit ridge-related science in developing countries. Applications are to be submitted by June 6, 2017. For InterRidge-funded Fellowships, the final selection will be made by the InterRidge Steering Committee. For the three Fellowships to be funded by the ISA Endowment Fund, the InterRidge Steering Committee will provide the highest-ranked of these applications to the ISA Endowment Fund Advisory Panel for final selection. All successful Fellows will be announced at the end of July 2017.

- ***InterRidge Travel Awards*** offered to young scientists to attend conferences and InterRidge Workshops. In 2017, InterRidge provides funding for ten 500 US$ Student and Postdoc Travel Awards to increase the participation of students and postdocs at the 6th International Symposium on Chemosynthesis-Based Ecosystems (CBE6 in Woods Hole, Massachusetts, USA on August 27 – September 1, 2017). The Travel Awards will be distributed on a need basis to students and postdocs who are presenting research falling under the scope of InterRidge, broadly defined as 'From ridge crest to deep-ocean trench: Formation and Evolution of the Oceanic Crust and Its Interaction with the Ocean, Biosphere, Climate and Human Society' (https://www.interridge.org/thirddecade). Awardees will be selected from the applicant pool by the local scientific committee.
- ***InterRidge Cruise Bursaries*** up to 2 000 US$ will be awarded for travel and subsistence costs to encourage new collaborations across the InterRidge member nations, to enable early-career, ridge-crest scientists to participate in mid-ocean ridge research cruises and to develop new research directions. Awardees will have to participate in the planned science program onboard, to carry out collaborative research and produce a final report for the IR community. The call for IR Cruise Bursaries is planned to be launched soon.

**Develop bridges between the scientific community and the society**

***A scientific voice to international/national agencies, policy makers, etc.***
InterRidge has built a privileged relationship with the International Seabed Authority (ISA). It is affiliated to the Scientific Committee on Oceanic Research (SCOR) and has developed specific interactions through joint working groups and conferences. Through these specific relationships and new partnerships to be developed, InterRidge should be recognized as the voice of the scientific community, providing authoritative advices on societal topics such as environmental impacts of Sea-floor Massive Sulfides (SMS) exploration or exploitation.

The peculiar ecosystems found at MOR hydrothermal systems are important with respect to biodiversity, and several of such systems have been recognized as EBSA (Ecologically and Biologically Significant Areas) and are or may be later proposed as Marine Protected Areas (MPAs). InterRidge may provide decision-makers with the most accurate and recent knowledge and identify knowledge gaps to help consider the need for conservation and/or management with the necessary scientific exploration and provide relevant scientific information in the design and regulations of such MPAs.

***Outreach***
Although InterRidge does not have the resources to produce its own outreach material – a task that would be hampered by the diversity of languages in which this material should be produced – the office can play a role in facilitating attempts by Working Groups, member countries or any third party to produce media material related to MOR and ABA (e.g., papers for the general press, movies, websites…). For instance, in 2016 InterRidge has interacted with and provided contacts and photographic material to colleagues from the University of Victoria, Canada, to design and print a thematic calendar 'Discover the Ocean. Understand the Planet.' for year 2017.

### 7.3.2 International Ocean Colour Coordinating Group (IOCCG) (Affiliated in 1997)

Bernard, Sun Song

IOCCG Annual Report to SCOR
Venetia Stuart (IOCCG Project Coordinator)
**Reporting Period: June 2016 – May 2017**

The International Ocean-Colour Co-ordinating Group (IOCCG) was established in 1996 to promote communication and co-operation between the space agencies and the ocean-colour user community. IOCCG is an Affiliated Program of SCOR, and an Associate member of CEOS (Committee on Earth Observation Satellites). The IOCCG has a wide-ranging mandate addressing technological and scientific issues through its scientific working groups and task forces, conducting advanced training courses, and helping to ensure continuity and quality of the ocean-colour data stream though the CEOS Ocean Colour Radiometry-Virtual Constellation (OCR-VC). SCOR has been instrumental in helping the IOCCG secure funding from NASA for general IOCCG activities, as well as funding to host the biennial International Ocean Colour Science meetings. The group is currently chaired by Cara Wilson (NOAA, USA), and the IOCCG Project Office is located at the Bedford Institute of Oceanography, Canada, staffed by Project Coordinator, Venetia Stuart.

**1. IOCCG Scientific Working Groups**

IOCCG scientific working groups are relatively short-lived (2-4 years) and investigate various aspects of ocean-colour radiometry and its applications, and generally publish an IOCCG report upon completion. There are currently five active IOCCG working groups in various stages of deliberation, as well as a new working group on vicarious adjustment of ocean colour sensors (see below).

1) Joint GEOHAB/IOCCG WG on Harmful Algal Blooms (Chair: Stewart Bernard, CSIR, South Africa).

   This joint working group between the IOCCG and the GEOHAB program of IOC-SCOR was established several years ago, but the Chair of the group (Stewart Bernard) had many other commitments at the time, so the group is still finalizing their report on the topic. The main goal of the report is to provide a resource to improve communication between the satellite ocean colour community and the HAB scientific community. Various case studies are presented in the report, split according to their impact. Chapters are devoted to *Pseudo Nitschia* (toxic diatoms), cyanobacteria (mostly inland), fish killers, red tides (high biomass mixed blooms) and ecologically disruptive algal blooms (e.g., *Aureococcus*). There is also a chapter on emerging approaches (e.g., hyperspectral remote sensing). A slightly surprising output from the report is that the main constraint of remote sensing of HABs is atmospheric correction. Ocean colour is useful for detecting high-biomass blooms, but for many lower concentration harmful blooms, ocean colour remote sensing cannot be used. Blooms may have major ecological impacts, but if they occur deep in the water column, or at low cell numbers, they cannot be detected using ocean colour radiometry, especially in Case 2

waters. Sophisticated regional algorithms can only be used in high biomass, Case-1 systems.

The SCOR GlobalHAB project funded a small writing meeting of the working group in November 2016 to help bring the report to conclusion. The HAB report on the topic is nearing completion and the final report should be available by the end of this year.

2) Uncertainties in Ocean Colour Remote Sensing (Chair: Frédéric Mélin, JRC, Italy).

This working group is reviewing the methods for quantifying uncertainties for remote sensing reflectance and derived products, and is developing a set of recommendations for the various sources of uncertainty in ocean-colour applications. Various approaches of uncertainty propagation will be discussed in the report as well as representation and distribution of uncertainty fields. The group will also outline procedures on how best to determine the uncertainties, and develop methods to routinely distribute the information. The final chapter will include recommendations.

3) Intercomparison of Atmospheric Correction Algorithms Over Optically-Complex Waters (Cédric Jamet, LOG, Wimereux, France).

This working group aims to inter-compare and evaluate existing atmospheric correction algorithms over turbid waters to understand retrieval differences. The challenge is to understand the advantages and limitations of each algorithm and their performance under certain atmospheric and oceanic conditions. The group is examining 12 algorithms in 5 different categories to understand advantages and limitations of each, using three different databases (classic match-up, simulated dataset for sensitivity studies, and satellite images). They will provide recommendations for improving and selecting the optimal atmospheric correction scheme for various water types, along with the range of validity and limitations of each algorithm.

The group is currently focusing on match-up analyses using AERONET-OC and the LOG *in sit*u dataset, but they are having issues with the simulated datasets. The Committee discussed whether it was possible and realistic to complete the remaining tasks and prepare a WG report, or whether the group should just publish their results as a scientific paper, rather than an IOCCG report. The Committee agreed to a 1-year extension with a mid-year review, after which the Committee will make a decision about whether the working group should be terminated.

4) Earth Observations in Support of Global Water Quality Monitoring (Chairs: Steven Greb, Wisconsin Depart. Natural Resources, USA; Arnold Dekker, CSIRO, Australia; Paul DiGiacomo, NOAA/NESDIS).

This working group was established to help develop a strategic plan for incorporation of Earth observation information into coastal and inland water quality monitoring efforts. To

date, management agencies have been slow to embrace satellite-derived measurements, even though important parameters such as chlorophyll, suspended solids, light attenuation, and coloured dissolved organic matter have been quantified with required accuracies. The group has produced a draft report, with most chapters nearly complete and it is anticipated that it will be ready for printing at end of this calendar year.

The AquaWatch Water Quality Community of Practise, under the auspices of GEO, has also been building off this IOCCG working group activity. The group is starting to develop operational water quality monitoring capabilities, and the reports from Work Packages 3 and 4 will highlight the value of ocean colour data for water quality services.

**5)** Role of Ocean Colour in Biogeochemical, Ecosystem and Climate Modelling (Chaired by Stephanie Dutkiewicz, MIT, USA).

This working group was formed to create a closer connection between the biogeochemical ocean colour community and the modelling community, and to facilitate the integration of ocean colour observations with modelling. The report will address regional (coastal) sub-mesoscale models as well as global (climate change) models, and will also address data assimilation. The group plans to hold several meetings of opportunity this year, and a draft of all chapters is expected by January 2018, with the final report ready by April 2018.

**6)** Long-Term Vicarious Adjustment of Ocean Colour Sensors (Chaired by Christophe Lerebourg, ACRI-ST, France and Craig Donlon, ESA, Netherlands).

One of the major challenges in ocean colour radiometry is to ensure that the data obtained from different satellite sensors meets the accuracy requirements for satellite climate-quality data. A new IOCCG working group was formed to address this issue. It has been demonstrated that the accuracy required cannot be achieved through instrument calibration and characterisation alone, so we must rely on complementary calibration using ground-truth measurements, i.e., system vicarious calibration (SVC). The new working group will foster a wide-ranging debate with the objective of providing guidelines for the best practices for SVC to reach a high standard of precision and accuracy for *in situ* OCR measurements necessary to fulfil the system vicarious calibration requirements.

The working group will build on the ESA FRM4SOC project, which recently organised a workshop on vicarious infrastructure to bring together the international community to open discussions on the issue of vicarious adjustment. The output from the workshop will serve as a baseline for the proposed IOCCG report on the topic. Working group membership includes 15 institutions from the EU, USA, Korea, Japan and China. The final report is expected to be delivered in June 2018.

## 2.0 Capacity Building

A very successful third IOCCG Summer Lecture Series took place at the Laboratoire d'Océanographie de Villefranche (LOV, France) from 18 – 30 July 2016. This training course is dedicated to high-level training in bio-optics and ocean colour, and focusses specifically on current critical issues in ocean colour science. A total of 145 excellent applications were received, of which 22 students from 15 different countries were nominated by the selections committee, a very difficult task because of the high standard of all applications. The majority of the trainees were PhD students and post-doctoral students, and came from a broad range of backgrounds. SCOR sponsored two students to attend the training course (from Brazil and Kenya), which is gratefully acknowledged. Sixteen prominent scientists delivered a comprehensive program including lectures, discussions and hands-on tutorials. Because of the high demand for the course, all the lectures were video recorded and are available for download from the IOCCG website, together with the PowerPoint presentations (see http://ioccg.org/what-we-do/training-and-education/lectures/), providing a valuable teaching resource. Material from previous training courses has proven to be an extremely useful resource, and the files have been downloaded thousands of times by researchers from around the world. The 2016 IOCCG Summer Lecture Series was an outstanding success, and many students noted that it was a life-changing experience that allowed students to create bonds that will last throughout their entire careers. A full report of the training course is available at http://www.ioccg.org/training/Report-SLS-2016-final.pdf.

## 3.0 2017 International Ocean Colour Science (IOCS) Meeting

The IOCCG will host the third International Ocean Colour Science (IOCS) meeting from15-18 May 2017, in Lisbon, Portugal (see http://iocs.ioccg.org/), following two very successful IOCS meetings in 2013 and 2015. The goal of these biennial IOCS meeting is to nurture a strong global user community for ocean colour science and applications, and to foster exchange between the ocean colour research community and international space agencies. The meeting will be convened by IOCCG, in partnership with, and thanks to sponsorship from, EUMETSAT, ESA, the European Commission and NASA, and with local support from the Instituto Português do Mar e da Atmosfera (IPMA), and local sponsors Thales Alenia and Airbus.

The primary focus of the IOCS meetings is to serve as a venue for the ocean colour community to communicate their views, ideas, concerns and issues to the satellite agencies. This year the meeting will be extended by one extra day and will include 7 invited keynote lectures, 11 agency talks, 9 breakout workshops, community discussions, NASA, Copernicus and NOAA town halls, as well as three poster sessions. The breakout workshops will provide a forum for discussion of new concepts and techniques and to collectively provide feedback to the space agencies. More than 420 people have already registered for the meeting, which promises to be another successful event.

## 4.0 Ocean-Colour Radiometry-Virtual Constellation

All IOCCG agencies contribute to the CEOS Ocean-Colour Radiometry-Virtual Constellation (OCR-VC), a set of space and ground segment capabilities operating together in a coordinated manner, to meet a combined and common set of Earth Observation requirements. The individual satellites and ground segments belong to single agencies, but the Constellations effort provides a

unique forum to increase mutual benefit among space and other environmental agencies in support of common interests. The OCR-VC helps to provide long time series of calibrated ocean colour radiances at key wavelength bands from measurements obtained from multiple satellites.

At the last IOCCG Committee meeting there was consensus that a multi-agency "Ocean Colour Radiometry-Implementation Team (OCR-IT)" should be formed to prepare a rolling implementation plan to ensure high accuracy and consistency among products from present and future ocean colour missions. Various activities/projects (e.g., ESA FRM4SOC Project, the IOCCG protocols activity, IOCCG sensor calibration task force) will contribute directly to the implementation. The power of this arrangement lies in the fact that this is a dedicated IOCCG activity that is closely linked to the CEOS OCR-VC. Agencies can contribute in any way they wish, but there will also be overarching synergistic activities which might require additional resources. The critical aspect is to ensure that there is a link between the requirements as specified in the INSITU-OCR White Paper, and the Agency-funded activities. All IOCCG agencies have agreed to support some aspect of the OCR-IT, and are taking a leadership role in the activities.

## 5.0 Project Management and Coordination

The IOCCG Committee meets once a year to coordinate the activities of the group as a whole, discuss plans for the year ahead and review the progress of the various working groups. The Executive Committee also approves the budget for the coming year. The annual IOCCG-22 Committee meeting was hosted by CSIRO, and took place in Perth, Australia (7-9 February 2017). The full minutes of the meeting are available on the IOCCG website at: http://ioccg.org/what-we-do/committee-meetings/. The 23rd IOCCG Committee meeting is scheduled to take place the last week in February 2018 in Rome, Italy, hosted by CNR and ESA.

## 6.0 IOCCG Membership (2017)

The IOCCG Committee consists of members drawn from space agencies as well as the scientific ocean-colour community. Rotation of members is being implemented according to a roster: three members marked with an asterisk (*) are new members for 2016. The IOCCG Executive Committee consists of all representatives from the sponsoring agencies, plus the IOCCG Chair and past-Chair.

| | | |
|---|---|---|
| Agyekum, Kwame | - | University of Ghana, Ghana |
| Bélanger, Simon | - | Université du Québec à Rimouski, Canada |
| Bergeron, Martin | - | Canadian Space Agency, Canada |
| Bernard, Stewart (past Chair) | - | University of Cape Town, South Africa |
| Bontempi, Paula | - | NASA HQ, USA |
| Boss, Emmanuel | - | University of Maine, USA |
| Chauhan, Prakash | - | ISRO, India |
| DiGiacomo, Paul | - | NOAA/NESDIS, USA |
| Donlon, Craig | - | ESA/ESTEC, The Netherlands |
| Dowell, Mark | - | EU JRC, Italy |
| Dutkiewicz, Stephanie | - | Massachusetts Institute of Technology, USA |

| | | |
|---|---|---|
| Escudier, Philippe | - | CNES, France |
| Franz, Bryan | - | NASA GSFC, USA |
| Hardman-Mountford, Nick | - | CSIRO, Perth, Australia |
| He, Xianqiang | - | Second Institute of Oceanography, China |
| Hu, Chuanmin* | - | University of South Florida, USA |
| Kampel, Milton | - | INPE, Brazil |
| Kim, Wonkook* | - | KIOST, South Korea |
| Kwiatkowska, Ewa | - | EUMETSAT, EU, Germany |
| Loisel, Hubert | - | Université du Littoral, France |
| Mélin, Frédéric* | - | EU Joint Research Center, Italy |
| Murakami, Hiroshi | - | JAXA EORC, Japan |
| Park, Youngje | - | KIOST, South Korea |
| Santoleri, Rosalia | - | ISAC-CNR, Italy |
| Wilson, Cara (Chair) | - | NOAA/NMFS, USA |

## 7.0 IOCCG Sponsors

The IOCCG is sponsored and supported by contributions from various national space agencies and other organisations listed below:

- Canadian Space Agency (CSA)
- Centre National d'Etudes Spatiales (CNES, France)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia)
- Department of Fisheries and Oceans (Bedford Institute of Oceanography, Canada)
- European Space Agency (ESA)
- European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- National Institute for Space Research (INPE, Brazil)
- Indian Space Research Organisation (ISRO)
- Japan Aerospace Exploration Agency (JAXA), Joint Research Centre (JRC, EC)
- Korea Institute of Ocean Science and Technology (KIOST)
- National Aeronautics and Space Administration (NASA, USA)
- National Oceanic and Atmospheric Administration (NOAA, USA)
- Scientific Committee on Oceanic Research (SCOR)

The Bedford Institute of Oceanography (Canada) provides in-kind support, providing office space and informatics support, while SCOR provides infrastructure support and manages the NASA funds. SCOR has also sponsored students from developing countries to attend IOCCG training courses or the IOCS meetings.

**7.3.3 Global Alliance of CPR Surveys (GACS) Burkill**

# Global Alliance of CPR Surveys (GACS) – report of activities

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The most recent GACS meeting was held in September 2016 at the offices of the Sir Alister Hardy Foundation for Ocean Science. In addition to the main business meeting there were also meetings of the Standards & Methodologies Advisory Group (which discussed the analysis of microplastics in CPR samples and automating the determination of the CPR Phytoplankton Colour Index) and the Database Technical Team. While GACS partners are all very active, GACS itself remains unfunded despite several proposals being submitted in the last year and this limits the rate of progress.

Engagement with other organisations remains high, however; the POGO Executive Director, Dr Sophie Seeyave attended the GACS meeting and POGO often sponsors an attendee at SAHFOS training workshops. Dr Sanae Chiba is promoting the use of GACS indicators through the Biodiversity Indicators Partnership. GACS is included as an operating network for the GOOS Biology and Ecosystems Panel, and two GACS members are on the Panel.

**Highlights**
Recent CPR surveys that have begun since the inception of GACS continue to make progress:

- In October 2016 the MedCPR completed two years of successful monthly tows in the Eastern Mediterranean Sea. Up till now only one route has been sampled (Cyprus-Israel) while discussions have taken place to consider a second route (Cyprus- Greece). Although in its infancy, the survey has demonstrated great potential for capturing the spatial variation in plankton distribution.
- Since 2013, France has towed CPRs annually once per year during the Austral in the Indian part of the Southern Ocean between the French Southern Antarctic Territories (TAAF of Crozet, Kerguelen, Saint Paul and New Amsterdam). On December 12, 2016, the French government declared an extension of the Marine Reserve in the Crozet, Kerguelen and New Amsterdam EEZ. The extension covers 672,000 km² including large oceanic areas. CPR surveys will help to monitor this new Marine Reserve and the consequences of global change.
- In 2017, the Brazilian CPR survey towed two more transects, one across Drakes Passage and the second across Bransfield and Gerlache straits in Antarctica as part of the . INTERBIOTA (*Biological Interactions in the Marine Ecosystem around the Antarctic Peninsula under Different Impacts of Climate Changes*) project.
- Since 2011, when South African scientists from the Department of Environmental Affairs (DEA) completed their first CPR tow from Cape Town into the Southern Ocean from the German RV *Polarstern*, they have been towing CPRs from their polar research and

supply vessel, MV *SA Agulhas II*, on each of three annual relief voyages to the South African research bases on Antarctica (austral summer) and the sub-Antarctic islands Gough (spring) and Marion (autumn), as well as on research and training cruises-of-opportunity (winter). To date, a total distance of >28,000 n. miles has thus been covered by CPRs in the SE Atlantic and SW Indian oceans. Proposals have been submitted to the South African government to fund the analysis of this large backlog of CPR samples by outside laboratories within the next 2-3 years, while a dedicated CPR laboratory is being established at DEA, facilitating in-house analysis of future CPR samples. Once analysed, the data will enable to examine seasonal variations in the abundance, distribution and diversity of phyto- and zooplankton assemblages in the Atlantic and Indian sectors of the Southern Ocean. As such, they will make invaluable contributions to the SO-CPR Survey database managed by the AAD and SCAR, as well as the global CPR database managed by GACS.

- Northwest Pacific samples are being used to test a new technique recently developed by JAMSTEC, using micro X-ray computed tomography (CT) to quantitatively measure acidification impact on planktonic organisms. The Japanese CPR team started a feasibility study to apply this technique to measure variation in shell density of foraminifera collected by the CPR. Once the feasibility is established within the GACS framework, it could be a global standard method to monitor ocean acidification impacts on marine ecosystems.

**Training**

Workshops continue to be held by SAHFOS on a regular basis; on larval fish identification (Nov 2016) and there is an upcoming phytoplankton taxonomy workshop (July 2017).

In December 2016, a one-week workshop was held at the Australian Antarctic Division in Hobart, Australia involving members of the Scientific Committee on Antarctic Research (SCAR) Southern Ocean-CPR Expert Group. Karen Robinson (NIWA, NZ), John Kitchener (AAD), Kunio Takahashi, (NIPR, Japan), along with Graham Hosie (past GACS Chair) discussed a range of topics covering laboratory methods (preservation and storage, with emphasis on maintaining pH), future training of new analysts, updating of species identifications (in particular foraminifera and euphausiid larvae identification/staging) and future workshops/conferences, including comprehensive training workshops for emerging SO-CPR survey partners (India). An updated version of the 2010 Standards Workshop held in Tokyo, Japan will be produced as a result of this meeting.

## 7.4 Other Organizations

### 7.4.1 Partnership for Observation of the Global Oceans (POGO) Shapovalov

**Partnership for Observation of the Global Oceans (POGO)**
**Report to SCOR Annual General Meeting**
**2017**

**Introduction**
POGO was established in 1999 by a group of directors of marine research institutions who met to discuss ways in which they could work together more effectively in support of global oceanography. As stated at the founding of POGO, the objective of POGO is to make a major contribution to the attainment of sustained in situ observations of the global ocean that meet the requirements of international research and operational programmes.

In the last seventeen years, POGO has established itself as a respected, politically neutral and credible voice for the marine science community at a global level. Members value POGO as a forum in which they can meet their peer directors at least annually, in well-attended meetings, to discuss matters of common interest.

**POGO Vision and Mission**
POGO's vision is to have by 2030, world-wide cooperation for a sustainable, state-of-the-art global ocean observing system that serves the needs of science and society.

POGO's Mission is to:

1. Lead innovation and development of the crucial components of the ocean observing system.
2. Identify and contribute to the development of the key skills, capabilities and capacities needed to achieve the vision.
3. Work with governments, foundations and industry, to articulate the benefits to society and required funding to build and sustain the system.

The structure of POGO's agenda can be summarised as the following 3 pillars:


**Highlights**

***1. Ocean observations***

- One of the first priorities of POGO was to throw the collective weight of its members behind the concept and the world expansion of Argo. Because the members of POGO are directors with the power to commit resources and influence decision makers, a resolution to accord full support to Argo had immediate effect, and the distribution of floats around the world ocean improved rapidly.
- POGO member institutions have been driving the establishment of OceanSites (coordinated, deep-ocean, multi-disciplinary time-series reference sites), which has made significant progress in recent years. In particular, deep temperature and salinity sensors have been added through a concerted effort by POGO members, as a contribution to the Deep Ocean Observing System.
- POGO contributed significantly to OceanObs'09 in Venice in 2009, and was able to lobby successfully to open up sustained ocean observations to a broader community, including chemical, biological and biogeochemical observations.
- POGO has lobbied successfully for a greater prominence of oceans within the intergovernmental Group on Earth Observations (GEO), since its inception in 2005. Since 2011, POGO has taken a leadership role in the formulation of a new, collaborative GEO initiative, "Oceans and Society: Blue Planet". There have been 2 Symposia, with a third taking place in May/June 2017, and the initiative has successfully reached out to, and become inclusive of, many intergovernmental, non-governmental and private-sector organisations, programmes and projects with an interest in ocean observations and their societal benefits.
- POGO and SCOR co-sponsor a new international research initiative, the International Quiet Ocean Experiment (IQOE). This is a researcher-driven, interdisciplinary, international program to increase scientific opportunities and to respond to societal drivers

regarding the effects of global changes in ocean noise. POGO in particular sponsors a Working Group on the acoustical observation aspects of IQOE.

- Since 2015, POGO has been funding Working Groups on specific topics of interest to its membership, related to ocean observations. The aim is to identify specific areas where there is a lack of coordination and where POGO can make a direct, significant and rapid contribution to advancing ocean observations by facilitating discussions, enhancing collaboration, and building capacity.

***2. Professional training***

- For the last 16 years POGO has been providing advanced training in ocean observations to over 800 early-career scientists from almost 80, mostly developing, countries. A recent evaluation of the long-term impacts of the training (conducted in collaboration with SCOR) have shown that it has been achieving its objectives by (1) enabling the trainees to participate in new research projects, (2) enabling them to implement new research methods, and (3) facilitating networking and collaboration with scientists in other countries. The programmes were also successful in "training the trainers" via seminars or lectures based on the training and student and colleague supervision/mentoring. Additional evidence of "sustained capacity building" was also provided by the outcome that the institutions that received the training were able to implement new areas of research and provide the infrastructure and staff to support these in the long term. The results also showed that the training enabled the institutes to set up new monitoring or observation programmes (e.g., time-series station, repeat cruise, tide gauges, moored buoys, etc.).
- POGO's capacity building programme receives substantial support from the Nippon Foundation. The NF-POGO programme has been running as a partnership since 2005, with the NF-POGO Centre of Excellence as its flagship. The NF-POGO CofE is an intensive, multi-disciplinary, international 10-month post-graduate training programme in observational oceanography hosted by high-calibre oceanographic research institutions.
- The NF-POGO partnership has recently added to its portfolio a ship-board training programme that includes dedicated "floating summer schools" as well as ship-board training fellowships, using spare berths on oceanographic research cruises organized by POGO member institutions.
- The pool of former scholars trained under Nippon Foundation-POGO initiatives have been integrated into a global network (NANO), which has over 200 members, produces a biannual newsletter, has conducted five regional, collaborative research projects and one outreach project (2012-2017) and is currently launching a new global research/observation programme.
- POGO members are invited to submit to POGO proposals for funding of training initiatives as collaborations between several member institutions. There have been 3 of these funded since 2015.

***3. Outreach***

- POGO has participated in a number of international events to promote the importance of oceans and ocean observations, notably the World Expo in Korea in 2012, GEO Ministerial Summits (2007, 2010, 2014, 2015) and Oceanology International (2010, 2016).

- POGO has created an informal grouping, Oceans United, to allow many organisations to speak with a common voice on issues of relevance to oceans and society. Under this umbrella, it established "Ocean Communicators United", which brings together over 60 communications experts and representatives of international/regional organisations to exchange ideas, best practices and expertise in the field of marine science communication.
- POGO has been invited to contribute to the development of a new UN "World Oceans Day" portal, which is being led by the Intergovernmental Oceanographic Commission (IOC) and to advise the EU project on ocean literacy "Sea Change".

**Current priorities**

***POGO Workshops:***
During its Annual Meetings, POGO holds short, targeted workshops on specific topics of interest to its members, related to ocean observations. In 2017, these included:

- Engaging with industry (see below)
- Arctic observations
- Innovative biological sampling.

***Current Working Groups:***
- **Implementation of IQOE Science Recommendations on Marine Noise Exposure and Broad-Scale Acoustic Monitoring:** This focusses in particular on the development of an Acoustic Essential Ocean Variable (EOV), in collaboration with the Biology and Ecosystems Panel of GOOS, and on the creation of a portal to summarise the acoustic observation systems currently deployed (and links to their data).
- **POGO Industry Liaison Council (POGO ILC):** Aims to (1) form a bridge between academic and government POGO member institutions and a range of industry sectors, through which contacts can be made, ideas discussed and joint projects established; and (2) produce recommendations to the POGO Executive, POGO members, the wider scientific community, and various industry partners to promote and optimize collaborative interactions, including issues such as intellectual property, intellectual dividend, perspectives, cultures, training, business decision-making, and conflicts of interest.
- **Our Global Estuary (OGE):** POGO members (or prospective members) in developing countries will engage estuarine scientists, educators and managers at an OGE workshop. Through a targeted questionnaire, OGE will create an inventory of interests, observing assets, and scientific expertise of POGO members relevant to estuaries. Through a working group, OGE will advance the linkages between estuarine and global ocean observing.
- **Observing and understanding the ocean below the Antarctic sea ice and ice shelves (OASIIS):** The goal is to develop a detailed implementation plan for an under-ice observing system, including definition of quantitative sampling requirements and identification of leaders (teams) to take implementation of key elements of the observing system forward. Support from POGO makes a clear, global statement on the importance

of an under-ice observing system, and will deliver the international clout required to drive the uptake of the recommendations resulting from this WG effort.

- **Biological Observation:** A task force has been established to further develop POGO's understanding of the state of biological observing technology for moorings, AUVs and other persistent observing systems and as assessment of the ways in which POGO could promote biological observing technologies and strategies.

***Collaboration with SCOR***

SCOR is the leading international organisation in the marine science arena, and it is essential that POGO maintain good relations with it. We enjoy the highest level of cooperation with SCOR, especially with its Executive Director, Dr Ed Urban. For example:

- POGO funds jointly with SCOR a fellowship programme that enables young scientists from developing countries to study for up to three months in a major oceanographic institution chosen by the candidate. The programme is managed by POGO. Candidates are selected by a committee in which both POGO and SCOR are represented.
- SCOR also runs a Visiting Professorship modelled on the POGO one, and on several occasions the two programmes have complemented one another (for example, in Southern Africa).
- POGO and SCOR also collaborate in assessing capacity building at the world level in marine science and coordinate their respective capacity-building programmes. Together with partner organisations IOC/IODE, SCOR and POGO have created a website advertising summer schools and other training opportunities in ocean sciences (www.oceansummerschools.org).
- In 2015 and 2016, SCOR and POGO Secretariats worked on an impact evaluation questionnaire to send all past trainees of their respective and joint training programmes and have analysed the data obtained to draft a joint publication on the POGO-SCOR fellowship and other POGO programmes.
- SCOR has established jointly with POGO a new research initiative, the International Quiet Ocean Experiment (IQOE). This is a programme aimed at the acoustic background in the ocean, including its anthropogenic and natural components. The IQOE Science Plan was published in 2015. The Sloan Foundation was instrumental in starting up this initiative, and in providing seed funding for coordination.
- POGO contributed to the establishment, and continues to support the development, of the SCOR-SCAR Southern Ocean Observing System (SOOS).
- Both POGO and SCOR support the Global Alliance of Continuous Plankton Recorder Surveys (GACS).
- POGO has an interest in contributing to the activities planned under the second International Indian Ocean Expedition (IIOE-2), an initiative of SCOR and IOC.
- POGO has been in correspondence with SCOR regarding feedback on the first World Ocean Assessment and possible input to the second round of WOA.