INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

WORLD METEOROLOGICAL ORGANIZATION

DATA BUOY COOPERATION PANEL

GLOBAL DATA BUOY OBSERVATIONS
A DBCP Implementation Strategy

Seventh Edition
2007

Website only: ***http://www.wmo.ch/web/aom/marprog/Publications/publications.htm***

DBCP Technical Document No. 15

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NOTES

FOREWORD

The Drifting Buoy Co-operation Panel (DBCP) was established in 1985, jointly by the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, as a means of enhancing cooperation, coordination and information exchange among the operators and users of drifting buoys, meteorological and oceanographic, research and operational, with a view to improving both the quantity and quality of buoy data available on the Global Telecommunications System of WMO in support of major programme requirements of the two Organizations. The panel appointed a full-time technical coordinator in 1987, using funds provided voluntarily by panel member countries, and in 1992 its terms of reference were widened and its name changed to Data Buoy Co-operation Panel to reflect its work in co-coordinating all forms of ocean buoy deployments.

During the 15 years of its existence, the panel has achieved great success in achieving its initial objectives. At the same time, this period has also seen remarkable advances in buoy and communications technology, as well greatly enhanced and expanded requirements for buoy data, in particular in support of global climate studies. Major global experiments such as TOGA and WOCE have clearly demonstrated the value of buoy data for this purpose, and at the same time established and refined the buoy networks needed to fulfill the scientific requirements. One of the major challenges now facing the panel and buoy operators is to convert the buoy networks established for these experiments into long-term operational programmes.

In recognition of these new developments and expanded requirements, and in the context also of the implementation plans and requirements of the Global Ocean Observing System (GOOS) and the Global Climate Observing System (GCOS), the panel agreed in 1997 on the need for a DBCP Implementation Strategy, which would provide an overall framework for the panel's work, and at the same time enable it and its members to react appropriately to future developments. A draft strategy document was prepared for the panel by Mr David Meldrum, reviewed and revised at the panel session in 1998, and is now published in this DBCP Technical Document. The strategy document will also be made available through the DBCP web server.

PREFACE TO 7th EDITION, October 2007

It was always intended that the Implementation Plan should be a dynamic document that reflected the evolution of the DBCP's aims and aspirations within the rapidly changing environment of oceanography and marine meteorology. This edition takes particular note of recent reflections within the DBCP community as to its future mission and purpose, given that many of the original problems affecting data buoy observations had been tackled by the Panel and overcome. Accordingly, new initiatives for the Panel such as pilot projects, task teams, user workshops, training courses and other outreach activities now feature in the Panel's strategy, alongside other major updates, more accurately reflect our current position and aspirations.

CONTENTS

RECORD OF CHANGES

Version No	Date	Change
A	Oct 1997	First draft
1.0	Oct 1998	First release
2.0	Oct 2000	Revised and updated to take account of JCOMM and developments in satellite communications
2.1	Oct 2001	New references, graphics and textual changes
3.0	Oct 2002	New section 3.4, updated Annexes E and F
4.0	Oct 2003	Add para 8.13, update Annex F
5.0	Oct 2004	Updated paras 2.1, 3.5, 3.8, 4.1, 4.2 and 7
6.0	Oct 2005	Updated Intro, paras 3.5, 3.8, 6.1, 6.2, 8.13
7.0	Oct 2007	Substantial changes

GLOBAL DRIFTING BUOY OBSERVATIONS - A DBCP IMPLEMENTATION STRATEGY

1. INTRODUCTION

Oceanographers and meteorologists have used satellite-tracked drifting buoys for two decades in support of both research and operational programmes. With the exception of the Global Weather Experiment FGGE, early deployments were largely uncoordinated at an international or even national level. Co-operation between the meteorologists and the oceanographers was also practically non-existent, not only because of a lack of motivation stemming from different perceptions of the aims of drifter deployments, but also because no forum for dialogue existed. Some changes came about through the establishment of the Argos Joint Tariff Agreement (JTA), and its requirement for basic coordination of national plans, and through Argos User Conferences. However, it was not until the creation of the DBCP in response to WWW requirements for routine high quality observations from the world's oceans that positive steps were taken towards large-scale international cooperation in drifter deployment and data management.

Some time before the establishment of the DBCP, a European initiative (COST-43) was established involving the collaborative deployment of meteorological drifters in the north Atlantic and this became in due course the first regional action group - the European Group on Ocean Station (EGOS) - of the DBCP. The group retains complete autonomy in all its operational and administrative matters, but draws on the support of the DBCP through its Technical Coordinator, the WMO and IOC Secretariats, and its meetings. The freedom to determine its own affairs, yet benefit from association with an established and internationally recognized parent body, has been a keynote in the success and stability of EGOS, and it has become the model for subsequent drifter action groups such as IABP, IPAB, IBPIO, ISABP, TIP GDP, and OceanSITES. EGOS has gone from strength to strength, and has now re-emerged as E-SURFMAR – the Surface Marine programme of the Network of European Meteorological Services, EUMETNET.

All this has happened against a background of the fundamental global climate change that seems likely to result from increasing concentrations of greenhouse gases. Such is the universal appreciation of the consequences of climate change that climate issues have moved to the forefront of the international political agenda. GCOS and GOOS both owe their origins to this concern, and are responding directly to the needs, expressed in Agenda 21, by the IPCC, and in support of the FCCC, for ocean data to underpin the understanding and prediction of global climate and environmental change.

Much practical progress has been made in bringing together all sides of the oceanographic, meteorological and climate communities to define these observational requirements and the organizational structure that will assume responsibility for them, notably at the OceanObs 99[1] and JCOMM[2] planning meetings. This plan takes note of these requirements and defines the DBCP role in the new structure.

The Terms of Reference of the DBCP and its Technical Coordinator are given in Annex F.

2. RATIONALE

GCOS, GOOS, WWW, and nor the DBCP action groups, currently operate as funding bodies for observational networks. Therefore, any DBCP implementation strategy must attempt to reconcile the needs and aspirations of the global programmes with those of the drifter programme operators and funders. Ultimately, it is an objective of the implementation strategy to assist in the unlocking of sustained national funding in support of the wider regional and global needs, at the same time recognizing that the aims of the programme operator remain paramount. In practice, with the advent of low-cost multi-function buoys, (e.g. the WOCE/TOGA SVP-B barometer drifter, see Annex D), is no longer the insurmountable problem that it once was.

2.1 The definition of requirements

The observational networks requirements proposed by the DBCP Data Users and Technology Workshop[3], Reading, UK, 27-28 March 2006, based on specific requirements for Numerical Weather Prediction (NWP), climate variability and predictability, ocean/climate modeling, and climate forecasts are detailed in Annex B. Taking SST as an example, the WMO's World Weather Watch (WWW) seeks observations at least every 3 hours over a 50km to 250 km horizontal grid with accuracy better than 0.5C and timeliness better than 3 hours for Global NWP.; Ocean/climate application requirements expressed by the Ocean Observing Panel for Climate (OOPC) are an order of magnitude coarser in space and time, but at a level of accuracy an order of magnitude higher. In essence, this means that the density of any network deployed and maintained in support of weather forecasting will be more than adequate for the perceived needs of climate monitoring, provided that the accuracy and stability of the sensors can be improved. It should also be noted that OOPC calls for new sensors (e.g. for conductivity) that are not yet operational. In this context, the OOPC suggest that any practical, achievable implementation plan be broken down into a number of elements running over differing time scales, viz:

- the identification of elements that are part of existing operational systems;
- the identification of elements to be added now to constitute the initial observing system (either enhancements to existing operational systems or parts of existing research observing systems ready for conversion to operational status);
- the identification and specification of observations not now readily obtainable that are urgently required and should be added as enhancements to the initial system at the earliest feasible time;
- the identification of future research and development likely to be needed for further expansion of the system.

This analysis is used as a basis for the plan that follows. Although this strategy is restricted to drifting buoy applications, the Panel recognizes that moored buoys, sub-surface floats and profilers will also play a part in any future ocean observation network.

These basic requirements have been endorsed and further developed by other agencies, notably by GCOS and the UNFCCC[4], and fall within the remit of the Group on Earth Observation (GEO), established by the Earth Observation Summit in 2003. Climate aspects are detailed in the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (GCOS-92, Oct. 2004)[5]. While the exact composition of the desired network has yet to be defined, a figure of 1250 drifters is achieving wide acceptance, and has been set as a target within the JCOMM Observations Programme Area strategic plan.

3. ANALYSIS OF EXISTING DRIFTING BUOY NETWORKS

3.1 Existing networks - current status

In general, most current operational drifter networks fall within the scope of one or other of the existing DBCP action groups. Figure 1 indicates the areas of responsibility of each action group. Two of them are global: the Global Drifter Programme, and OceanSITES. The deployments are increasingly of SVP-B drifters, which combine quantifiable current-following characteristics with reliable measurements of atmospheric pressure and SST. At present, in excess of 1250 drifters report their data via the GTS (Figure 2 and 3); about 450 of these report atmospheric pressure. Regular re-seeding is needed to maintain observational density in dynamic areas such as the south Atlantic. The action groups are the key to implementing and maintaining deployments in all ocean basins. Annex C gives an example of the operating principles for an action group.

3.2 Existing networks - enhancements needed in support of the GOOS, GCOS, and the WWW

Although the statistics for data availability collected by the various operational and archiving centres do not always fully agree, and despite the completion of the global drifter array in September 2005 with the deployment of drifter "1250" offshore from Halifax, it is clear that the existing networks do not approach the required observational density in a number of areas, viz:

- the global oceans (waves)
- the tropical oceans (P, waves)
- the tropical Indian Ocean (wind, waves)
- the Arctic (P)
- the North Pacific Ocean (SST, P)
- the NorthEast Tropical Pacific Ocean (SST, P)
- the Arabian Sea (SST, P)
- the Gulf of Guinea (SST, P)
- the Southern Ocean south of 40 S (SST, P, waves)

Figures 4 to 7 illustrate the problem through data availability indices for specific variables as a function of expressed WWW requirements.

The JCOMM Observations Coordination Group (OCG) has made recommendations to achieve better global coverage. Deployment and re-seeding strategies will be developed which optimize the expenditure of available resources, and which allow accurate and credible prediction of future resource requirements, and their relation to declared objectives. A method has already been developed by NOAA/AOML for this purpose using a simple model to forecast the probability of having buoys in specific regions 90 days in advance.

3.3 New observations urgently required

Equatorial areas, where the atmospheric pressure signal is typically weak, would benefit from a greatly increased density of wind observations but requirements for accurate in situ pressure measurements from these regions have also been expressed by NWP at a resolution similar to the global drifter array (i.e. 500km x 500 km). Plans are therefore underway to install barometers on all drifters by 2010. Whereas the equatorial Pacific is adequately sampled by the moored TAO and TRITON arrays, and the PIRATA programme is addressing the sparsity of observations in the tropical Atlantic, the Indian Ocean is currently almost devoid of accurate *in situ* wind measurements, although plans are being drawn up for the establishment of a moored buoy array in the area.

High temporal resolution SST: OOPC has also expressed the requirement for collecting and transmitting high temporal resolution (i.e. at least hourly) SST measurements from all drifters in order to resolve the diurnal cycle of SST.

Wave observations: The vast majority of existing wave measurements are made in the coastal margins of North America and Western Europe, with a huge data void in most of the rest of the global ocean, particularly in the southern ocean and the tropics, while other existing observational systems have often considerable coverage in these areas. The JCOMM Expert Team on Wind Waves and Storm Surges has called for additional wave measurements comprising, at a minimum, significant wave height, peak period and 1-D spectra, hourly in real-time, for assimilation into coupled atmosphere-ocean wave models for real-time forecasting activities, and subsequent verification. These are required for Maritime Safety Services, calibration/validation of satellite wave sensors, the description of the ocean wave climate and its variability on seasonal to decadal time scales, and the role of waves in the coupled ocean-atmosphere system, and their inclusion in weather and climate models. Considering the lack of wave data, the DBCP is inviting buoy operators and Panel Members to increase wave measurements, particularly from open ocean areas, in the Southern Ocean, and the tropics. Wave measurement technology issues will also be considered by the Panel.

3.4 The observational challenge posed by 4D assimilation schemes

Recent studies using models that allow assimilation of non-synoptic-hour data have demonstrated the positive impact of such data. In particular, the inclusion of hourly extra-tropical buoy data was found to significantly, improve forecast quality, particularly in the southern hemisphere. Non-synoptic-hour data is not routinely reported by all buoys, nor is its insertion on the GTS by CLS/Service Argos currently supported. In both cases, little change would be needed to current practice to allow these additional data to be made available to forecasters.

3.5 Future research and development

In addition to the development and proving of an accurate and reliable wind sensor, OOPC have stated a requirement for ocean surface salinity and rainfall measurements. Very few drifters currently possess this capability, and it will become an area for further research and development. *In situ* salinity measurements will be of great value in developing the sensors and algorithms for salinity determination by satellite.

The Panel will also support other technology developments, e.g. the use of adaptive sampling ('smart buoys') to increase the impact and cost effectiveness of data buoy observations.

The Panel also recognizes the need for research to quantify the impact of buoy observations, and to use existing current climatologies and the like to develop deployment and reseeding strategies that optimize these impacts within defined logistical and financial constraints.

3.6 Regional and national issues

It should not be forgotten that drifter deployments continue to be made in support of both operational and research programmes, which do not fall within the sphere of influence of any of the DBCP action groups. Efforts by the DBCP and the action groups will continue, to involve these buoy operators, in the work of the Panel, and to ensure where appropriate, that their buoy data are made available to the wider community, in near real time if possible.

3.7 Deployment opportunities

The deployment and re-seeding of a large network of data buoys poses a huge logistical problem. To date, deployments have largely been accomplished opportunistically using volunteer ships and aircraft. This system is showing increasing signs of strain, and the DBCP will actively pursue additional strategies, recognizing that the issue of funding and associated logistical effort will have to be tackled.

3.8 Coordination issues

Within the above context, the regional action groups are best placed to identify the precise needs in their particular areas of responsibility and to obtain the resources required. The Panel recognizes the autonomy of these groups and does not seek to impose any additional level of management or control. The Panel will also actively pursue the creation of new action groups to take care of issues associated with particular platform types, or other non-regional issues such as tsunami detection and warning.

There are areas, however, where the Panel is best placed to advise on overall methodology and policy; such areas include:

a) Co-ordination of deployments in areas not covered by the Action Groups or which involve several Action Groups.

Such areas presently include:

- The Southern Ocean
- The Mediterranean Sea
- The Black Sea

Unless there is a need to specifically establish DBCP Action Groups for those areas, it is proposed to include one or more of such buoy programmes directly within the DBCP implementation strategy and to discuss important co-ordination and implementation issues at Panel sessions where all DBCP Action Groups are normally represented. During intersessional periods, co-ordination can take place through direct exchange between buoy operators (e.g. email, DBCP internet forum), and through the Technical Coordinator as focal point. Specific mailing lists can be established for this purpose. In the event that such programmes eventually reach a sufficiently high level of co-ordination, and if the buoy operators express the need, it could be eventually proposed to establish new DBCP Action Groups. Initially, the following buoy programmes are now part of the DBCP implementation strategy:

- The Southern Ocean Buoy Programme (SOBP), which would maintain a network of about 300 barometer drifters South of 40S, excluding the Antarctic sea-ice zone.
- The Black Sea Buoy programme (BSBP).

b) Real-time data quality control,

c) Data management,

d) Provision of instrumental metadata for climate studies

e) Other co-ordination issues such as the negotiation of bulk purchase rates for drifter hardware and communications costs.

The role of the Panel and its Technical Coordinator within the proposed new JCOMM structure is discussed in section 7.

4. DATA COLLECTION AND EXCHANGE

4.1 The status quo

With few exceptions, drifting buoys use the Argos satellite system for location and data collection. Argos centres in France and the USA process telemetry datasets stored on board the NOAA satellites that carry Argos. Data are quality controlled and inserted on to the GTS for use by weather forecasters and climate modellers, and for archival by the responsible data centres, if authorised by the buoy operator. Data timeliness, vital for weather forecasting, can be improved by using LUTs to access buoy data rebroadcast by the satellites in real time. The operators of the Argos system have been attentive to the need for faster data turn round times, and have taken steps to increase the amount of LUT data that are processed by the two main centres.

An agreed share of the operating costs of the two centres (approx € 6 million in 2005 out of a total of € 11.7 million) is recovered under the terms of the Argos JTA, under which all non-commercial usage of the system (of which drifting buoy operators account for roughly 50%) is charged out to designated national representatives (ROCs) at an agreed and supposedly equitable rate. ROCs then pass on costs to individual operators as they see fit. The Argos costs associated with a drifter programme are nowadays generally comparable or lower (for large programmes) with the actual buoy procurement costs, following the development of inexpensive buoy hardware. The DBCP will negotiate actively to achieve the best possible terms for data buoy users.

The charges associated with real-time data distribution via the GTS are currently borne by national weather services; individual buoy operators in general have to pay additional costs, over and above the processing costs described above, for access to their own data held at the Argos centres.

4.2 Future developments

Many new mobile satellite services are at the planning or pre-operational stage (see http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS.woa/wa/menu?abbrev=J_SAT_COMM), and these are attractive to buoy operators, both from the cost perspective and from the increased operational flexibility (e.g. two-way communication) that they potentially offer. Systems, which feature a continuous global coverage (e.g. those intended to supplement the existing terrestrial cellphone networks), would in addition allow a return to truly synoptic reporting of observations.

However, most of these new systems will never reach full operational capability, nor will buoy operators ever achieve more than minority status. Systems such as Iridium and Orbcomm, which have in fact launched services, encountered severe financial difficulties before emerging into commercial viability. Potential users of any new systems therefore need to exercise considerable caution in selecting a replacement for Argos. Argos for their own part has responded with a development programme, which should greatly increase the usefulness of their system for data buoy operations. In particular, they have established a protocol for the assimilation of data from third party communications providers into their own GTS processing chain.

The Panel will, in this context, act as a focus for the exchange of practical information on the performance of the various systems, and will be active in sponsoring evaluation trials of new equipment and systems as they become available. As with Argos, the Panel will seek to negotiate the best possible terms for data buoy users of these systems.

Accordingly, the Panel has established a DBCP Drifter Iridium Pilot Project, for an initial period of two years starting in November 2006, and planning for the global deployment in various conditions of more than 50 drifters using the Iridium satellite data telecommunication system for the data collection.

5. DATA MANAGEMENT

5.1 Quality control

Quality control procedures, jointly developed and implemented by the DBCP and the operators of the Argos system, currently ensure that surface observations are validated in real time before insertion on to the GTS (see DBCP Technical Document No. 2). Sub-surface (e.g. from the TAO array) data are further controlled by NOAA/NDBC. Several other bodies (ECMWF, national weather and oceanographic agencies, GDC, ISDM, ...) contribute to an active off-line assessment of data quality. A well-defined feedback mechanism ensures that any interventions arising from this off-line quality control (e.g. modifications to individual sensor transfer functions) are implemented into the real-time data processing chain in a coordinated and auditable fashion. The Panel will encourage the users of other satellite communications channels and observing systems to benefit from its experience in this regard, with a view to avoiding the many quality pitfalls that beset the acceptance of early drifting buoy data by the operational community.

5.2 Data archiving

Drifter data inserted on the GTS are routinely archived by ISDM, the IODE Responsible National Oceanographic Data Centres (RNODC) for Drifting Buoys. The DAC archives all data from the GDP, and any other drifter data that are made available to it. The Panel and its action groups will actively encourage all buoy operators to forward their data to one or other of these responsible global archives.

5.3 Instrumental Metadata

There has been an increasing demand for instrumental metadata in recent years to server a number of applications, and climate studies in particular. The DBCP has established its own metadata collection system at JCOMMOPS and is participating in the water temperature metadata Pilot Project (META-T).

5.4 Data access policy

At present, all of the archiving agencies and many of the operational and research bodies make provision for the release of drifter data to scientific and other customers. In particular, many data are available via the World-Wide Web (see Annex E), either in the form of trackplots or as datasets. In many cases, the policies relating to the release and use of these data are not immediately clear. The Panel is seeking clarification from these agencies, and from its action groups, with a view to developing a coordinated data access policy for drifter data within the letter and the spirit of the WMO data exchange policy defined in WMO Congress Resolution 40 (Cg-XII).

5.5 DBCP publicity

Many suggestions have been made over the years regarding ways of publicizing the DBCP and its activities. The DBCP server on the World-Wide Web has in practice, superseded most of these, and this web site is now the *de facto* entry point for current information about the DBCP and its action groups.

The Panel is taking steps to ensure that resources and information are available to allow this web site to be developed and updated as required.

6. SUPPORTING ACTIVITIES

6.1 User workshops

The Panel recognizes the enormous importance of engaging with the many communities that impinge upon its activities, from the research organizations developing new sensors to the manufacturers that provide the products on which buoy operators depend and the user groups, both operational and research that depend on data buoy observations. To this end, it will from time to time organize workshops to draws together these communities in addressing key common issues.

6.2 Capacity Building

In recognition of the vast experience that exists amongst its members, the wish for developing nations to become engaged in data buoy activities, and the benefits that would accrue to the Panel from developing collaborative deployment arrangements with these countries, the Panel will actively create and deliver training courses targeted at these regions. Materials developed for these courses will be added to the repositories of educational resources on websites such as Ocean Teacher (http://ioc.unesco.org/oceanteacher).

6.3 Task Teams and Pilot Projects

Experience has shown that specific technical or organizational issues facing the Panel are often best attacked by a small team of experts, working during intersessional periods, and that their deliberations may lead logically to coordinated evaluation activities. The Panel will continue to foster the creation of such Task Teams and Pilot Projects as an efficient way of meeting its objectives within resource constraints.

6.4 *Other outreach activities*

The Panel is increasingly cited as a model of a practical coordination group, capable of managing the transition of an observing system from the research laboratory to the operational arena. Other bodies frequently come to the Panel for advice and assistance, and the Panel will continue to offer every possible support to such groups, in recognition that its activities are but a component of a much wider effort.

7. RESOURCE REQUIREMENTS

7.1 Manpower

Most of the success of the Panel to date in implementing its objectives is entirely due to the efforts made on its behalf by its Technical Coordinator, and by the support afforded to him by the buoy operators and other agencies. The Panel will build on this success by actively seeking adequate and secure resources to ensure the continued employment of its Technical Coordinator. In this context, the Panel will make every effort to act as a responsible employer and will make every effort to ensure that sufficient and stable funding is in place to meet its obligations in this regard

7.2 Hardware and telecommunications

The JCOMM strategic implementation workplan is calling for maintaining a network of about 1250 drifters in the global oceans, all equipped with barometers (representing a global 5*5° coverage, achieved in 2005).. This presently represents a hardware investment of USD 4 million.

The maintenance of the network itself presents formidable reseeding and enhancement challenges if its value is to be fully realised. Reseeding of networks to cover buoy mortality and dispersion will require a further annual hardware commitment of 650 SVP-B (USD 2 million at current cost levels), if present drifter lifetimes and trajectories are maintained.

The initial goal of the reseeding strategy is to tentatively maintain a homogeneous network of buoys with a 500*500 km resolution. Considering that all operational drifters are transmitting every day via the Argos System, about 1250 PTT-years are needed to ensure data collection. At present data telecommunication costs for small and larger buoy programmes, this would represent about USD 2 million. With increased pressure from potential competing data collection systems (e.g. Iridium) there is still a potential to substantially decrease telecommunication costs.

In recognition of the economies of scale that will flow from global annual procurements of this size, the Panel and its action groups will seek negotiations with the drifter manufacturers and the communications service providers to establish economical prices that will then be available to individual buoy operators.

8. THE DBCP ROLE WITHIN JCOMM

In deciding an organizational structure for JCOMM, the JCOMM planning meetings have noted the Panel's success in resolving many operational and co-ordination issues regarding buoy data quality, data flow, deployment scheduling and so on, and have adopted a similar 'Observations

Co-ordination Group' for the management of the JCOMM observational programme (See Annex G). Membership of this group includes the Chair and Technical Coordinator of the DBCP. In practical terms, the DBCP Technical Coordinator works alongside the coordinators of other observing systems to implement a common approach to deployment strategy, data management and quality control, and to ensure the most efficient use of deployment opportunities. In this regard, the Panel will actively encourage the operators of other observing and satellite data collection systems to make full use of the Panel's experience and expertise in these areas.

9. SUMMARY OF AIMS AND OBJECTIVES

9.1 *Deployment and re-seeding strategies, and associated funding mechanisms, will be developed which optimize the expenditure of available resources, and which allow accurate and credible prediction of future resource requirements, and their relation to declared objectives.*

9.2 *The Panel will seek to implement accurate pressure measurements using SVPBs throughout the global oceans, including tropical regions.*

9.3 *The Panel will seek increased measurements of significant wave height, peak period and 1-D spectra, hourly in real-time, especially in the Southern and Tropical Oceans.*

9.4 *The Panel will actively encourage the collection and distribution of high temporal resolution SST data to meet the OOPC requirement for resolution of the diurnal SST cycle.*

9.5 *Further research and development will be undertaken on new sensors to observe variables such as salinity, rainfall, wind, heat flux, ocean colour and* CO_2*.*

9.6 *Efforts will continue by the DBCP and the action groups to involve other buoy operators in the work of the Panel, and to ensure, where appropriate, that their buoy data are made available to the wider community, in near real time if possible.*

9.7 *The Panel recognizes the autonomy of its action groups and does not seek to impose any additional level of management or control.*

9.8 *The Panel will seek to implement the collection of instrumental metadata for climate studies, initially within the context of the META-T pilot project, for submission to the JCOMM ODAS metadata centre (China).*

9.9 *The Panel will act as a focus for the exchange of practical information on the performance of the various satellite communication systems, and will be active in sponsoring evaluation trials of new equipment and systems as they become available.*

9.10 *The Panel will from time to time establish dedicated Task Teams and Pilot Projects to address particular areas of interest or concern for its activities, within agreed timescales*

9.11 *The Panel will engage in appropriate outreach activities, such as the organization of user workshops, the development and delivery of training courses, and the assistance of other observing system groups in the achievement of their aims.*

9.12 *The Panel and its action groups will actively encourage all buoy operators to forward their data to one or other of the responsible global archives.*

9.13 *The Panel will seek clarification of their data release policy from all agencies that distribute drifter data, and from its action groups, with a view to suggesting coordinated* *data access guidelines for drifter data, compatible with the WMO policy defined in Resolution 40 (Cg-XII).*

9.14 *In recognition of the economies of scale that will flow from global annual procurements of the size indicated by the WWW and the OOPC requirements, the Panel and its action groups will develop negotiations with the drifter manufacturers and the communications service providers to establish prices that will then be available to individual buoy operators.*

9.15 *The Panel will seek adequate and secure resources to ensure the continued employment of its Technical Coordinator.*

9.16 *Within the context of the proposed JCOMM operational structure, the Panel will encourage the users of other satellite communications channels and observing systems to benefit from its experience in data management and co-ordination, with a view to their avoiding the many pitfalls that beset the acceptance of early drifting buoy data by the operational community.*

9.17 *The Panel will note the deliberations of the UN Convention on the Law of the Sea (UNCLOS) and the provisions of the Antarctic Treaty, as amended by the Madrid Protocol (1991), with regard to data buoy operations.*

9.18 *The Panel will regularly review its mission in the light of changing research, organizational and operational imperatives, and will update this document and its terms of reference as appropriate.*

10. REFERENCES

1. Smith, N (ed), 2000. OceanObs 99 Conference Statement, 28 pp. WMO, Geneva.

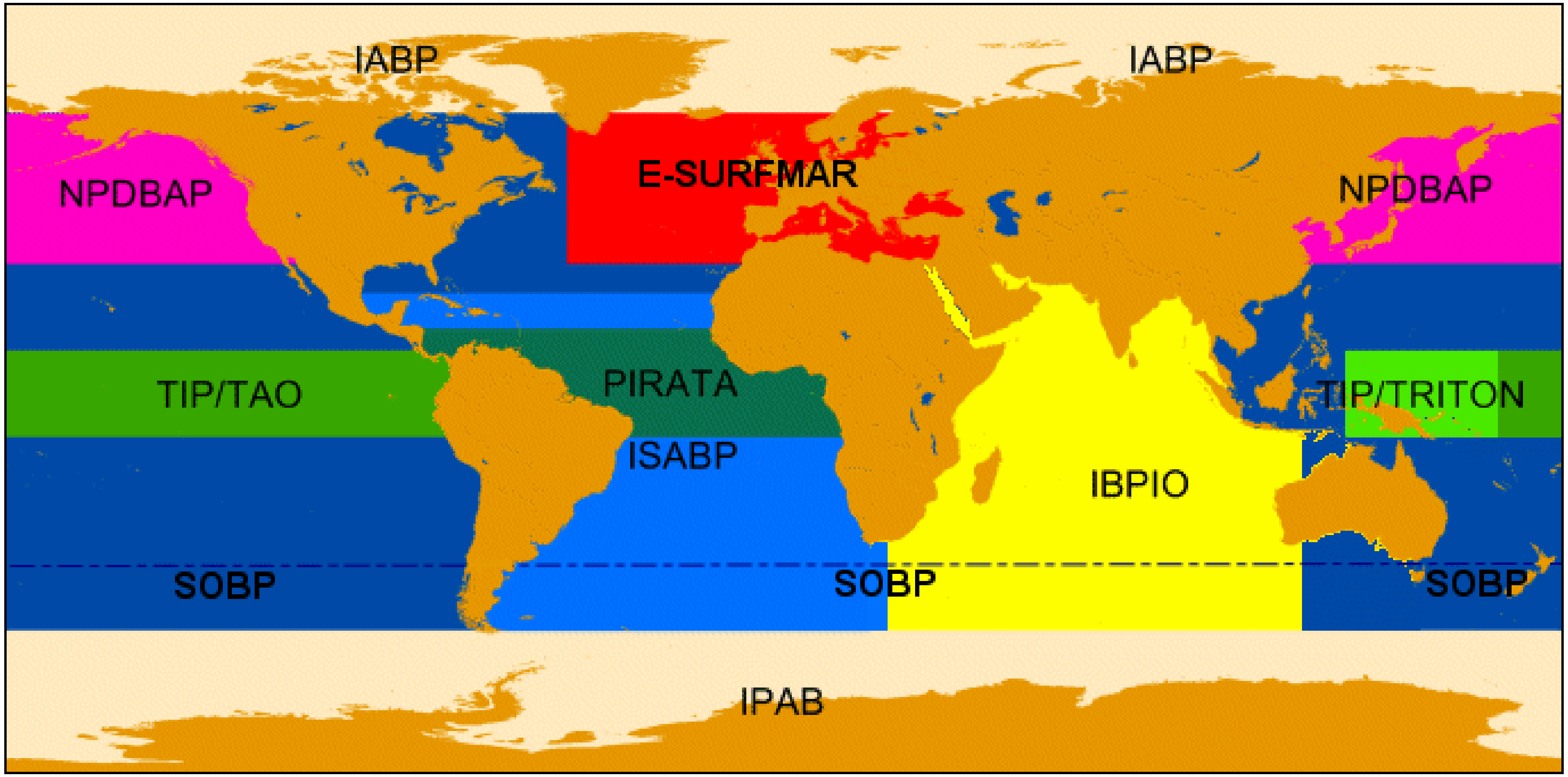
2. Guddal, J and Kohnke, D, 2001. Report by the Interim Co-presidents of the Commission, JCOMM-I, Doc 3, 14pp. WMO, Geneva.

3. JCOMM MR No. 40, DBCP Data Users and Technology Workshop, Reading, UK, 27-28 March 2006.

4. The Second Report of the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC, 2003. GCOS-82, WMO/TD No 1143, WMO, Geneva.

5. GCOS-92, October 2004, Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC

FIGURES



Regional Action Groups:
E-SURFMAR: EUCOS Surface Marine Programme
IABP: International Arctic Buoy Programme
IBPIO: International Buoy Programme for the Indian Ocean
Global Action Groups (not shown on the map):
GDP: Global Drifter Programme
OceanSITES: Global deep ocean time-series reference stations

IPAB: WCRP-SCAR International Programme for Antarctic Buoys
ISABP: International South Atlantic Buoy Programme
NPDBAP: DBCP-PICES North Pacific Data Buoy Advisory Panel (North 30°N)
TIP: Tropical Moored Buoy Implementation Panel (includes PIRATA and TAO/TRITON Arrays)

Figure 1: DBCP Action Groups in 2007.

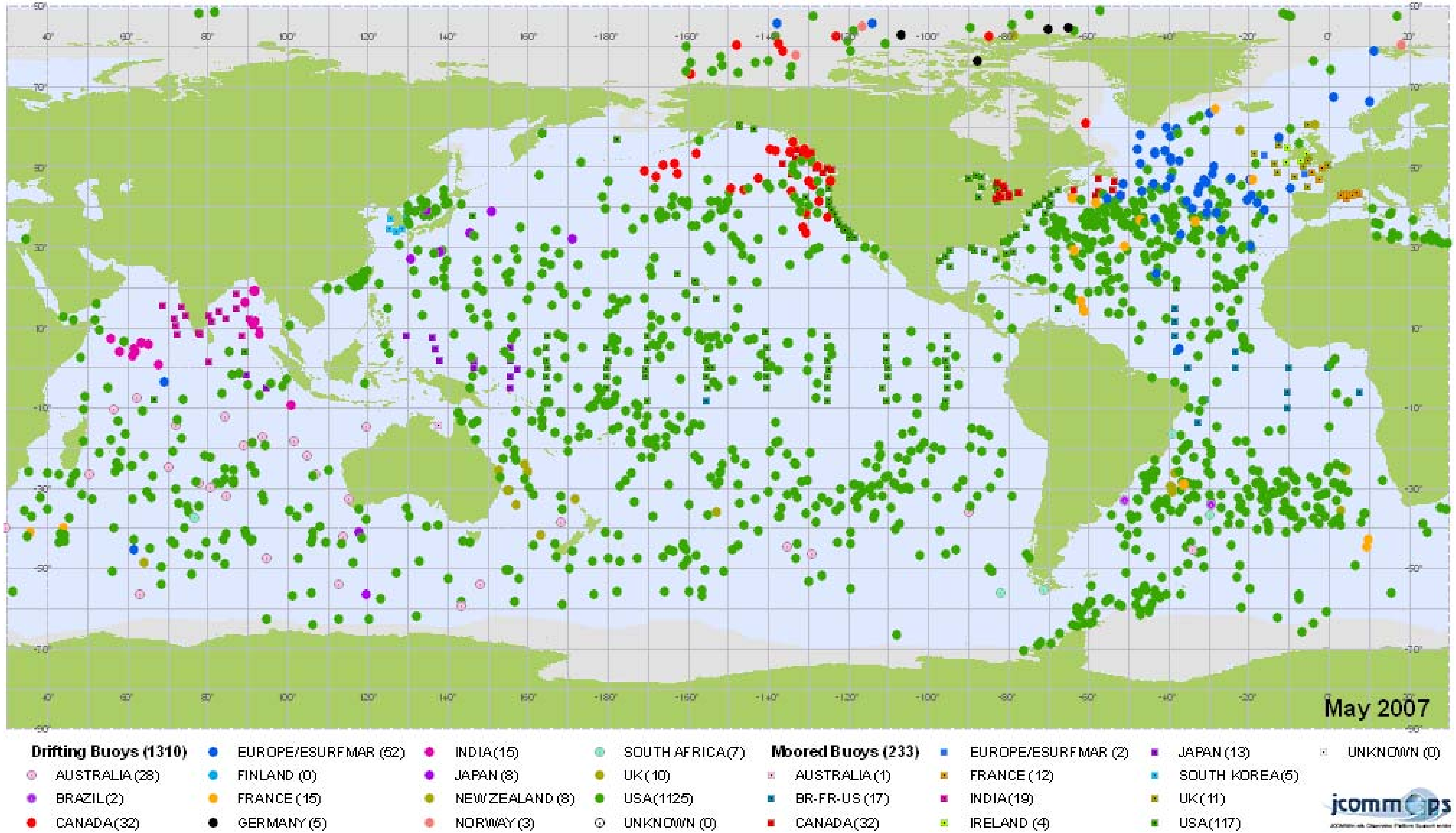


Figure 2. DBCP Status by country, May 2007

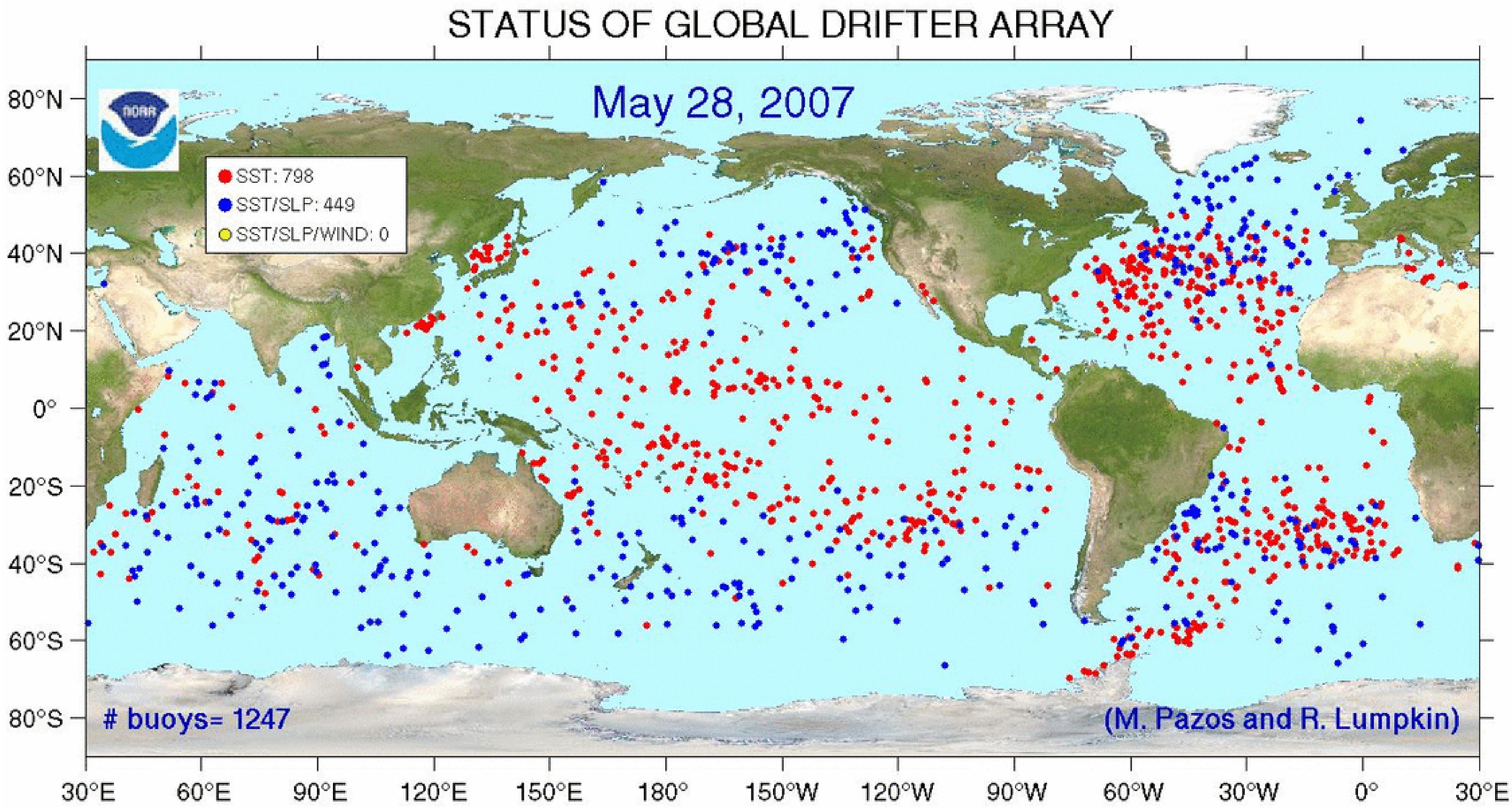


Figure 3. The Global GTS drifter array in May 2007, by courtesy of the Global Drifter Center, NOAA-AOML.

METEO–FRANCE PRESSURE MAY 2007

Marsden square distribution chart of mean monthly data availability index (top)
(Index 100 = 8 obs. per day per 500kM * 500kM area of SHIP and BUOY reports)
and
Percentage of BUOY reports compared to SHIP+BUOY reports (bottom)

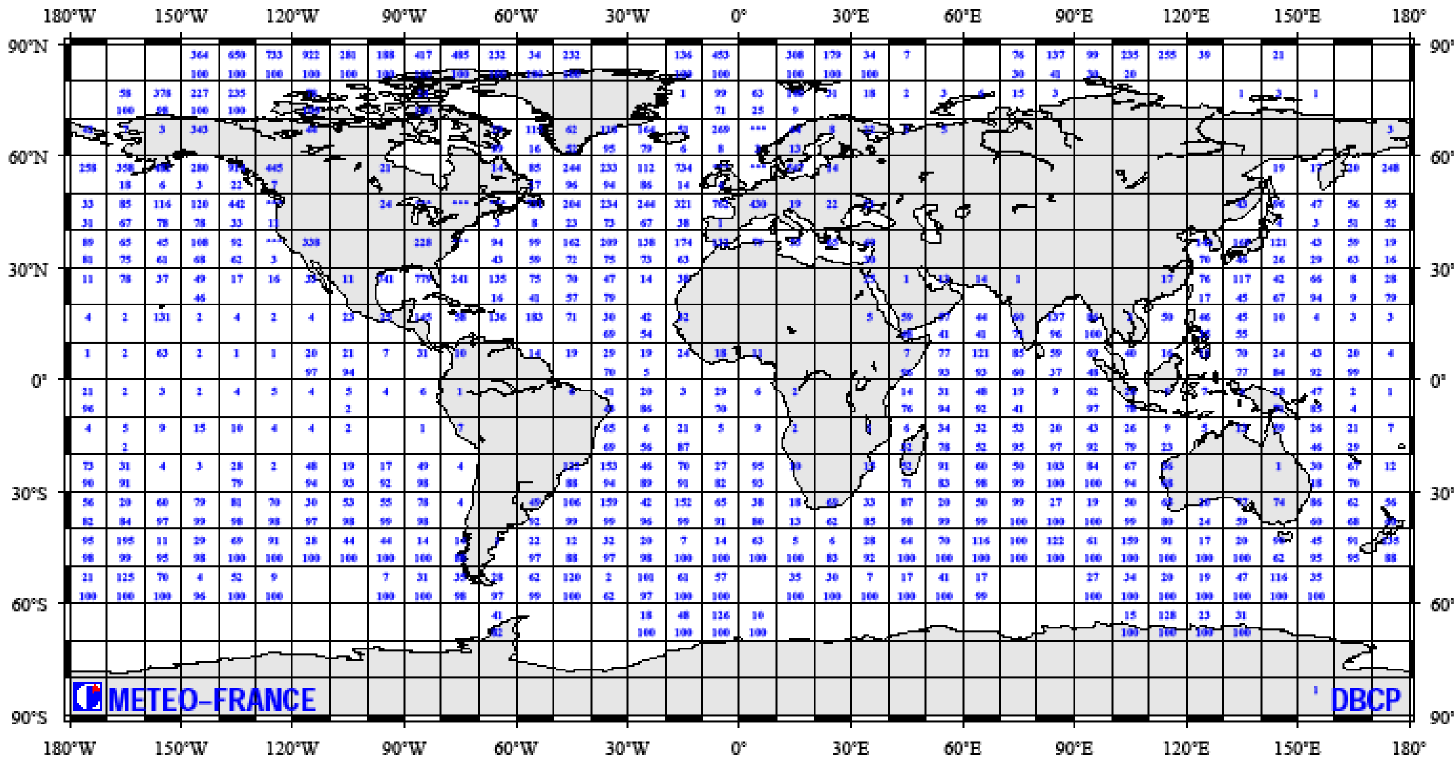


Figure 4. GTS data availability, May 2007 – Surface atmospheric pressure (by courtesy of Météo France).

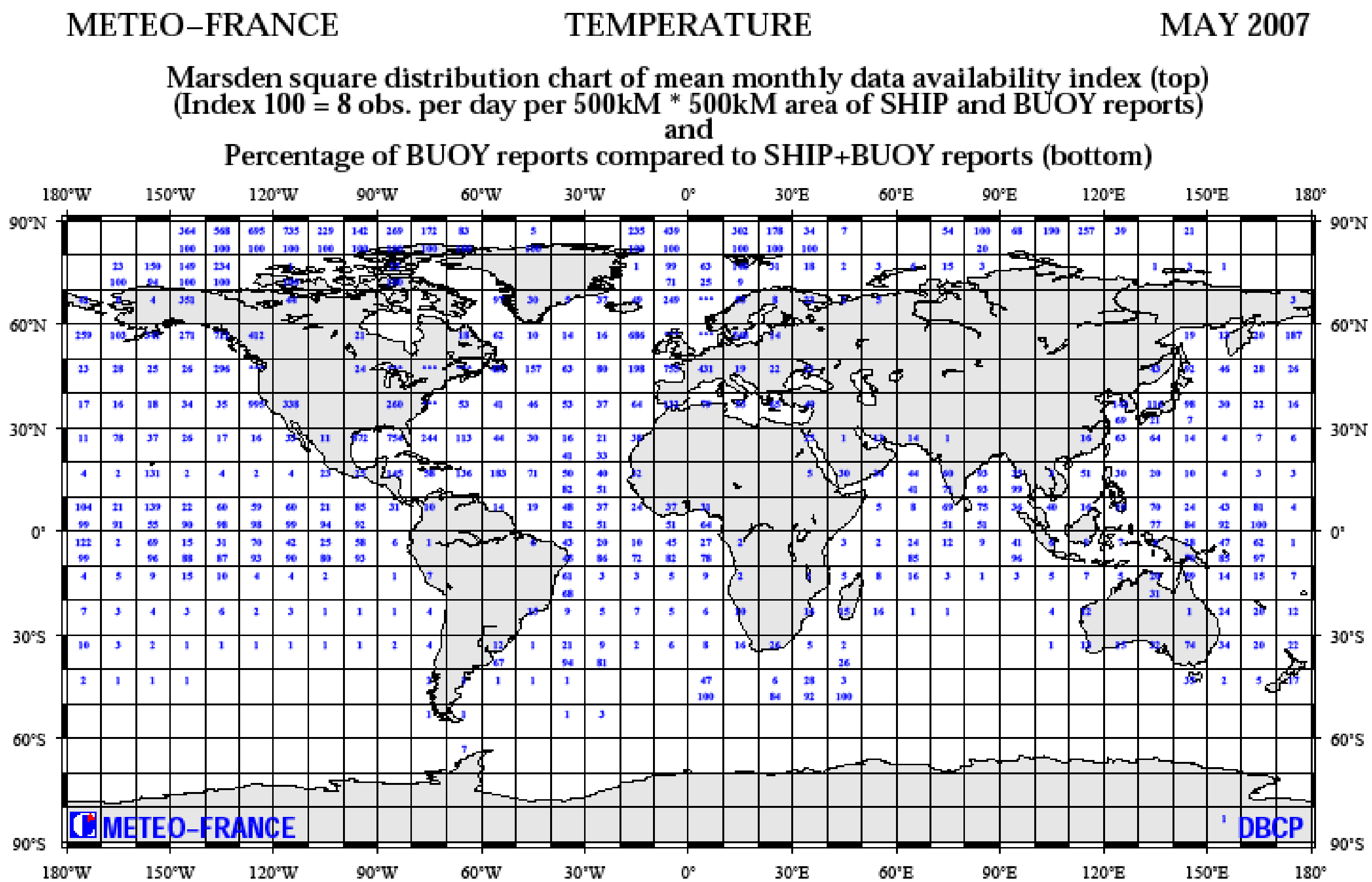


Figure 5. GTS data availability, May 2007 – Air temperature (by courtesy of Météo France).

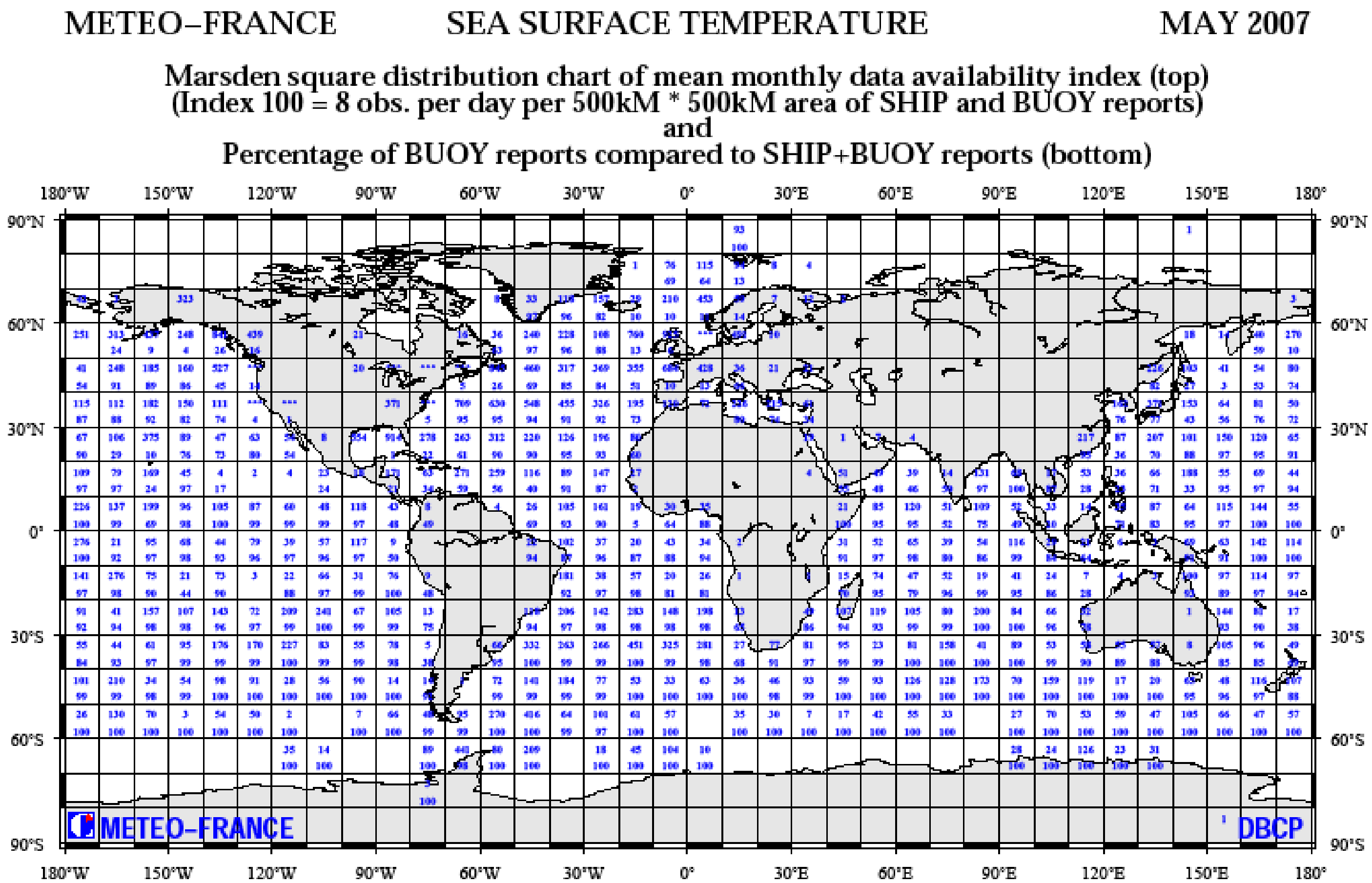


Figure 6. GTS data availability, May 2007 – Sea surface temperature (by courtesy of Météo France).

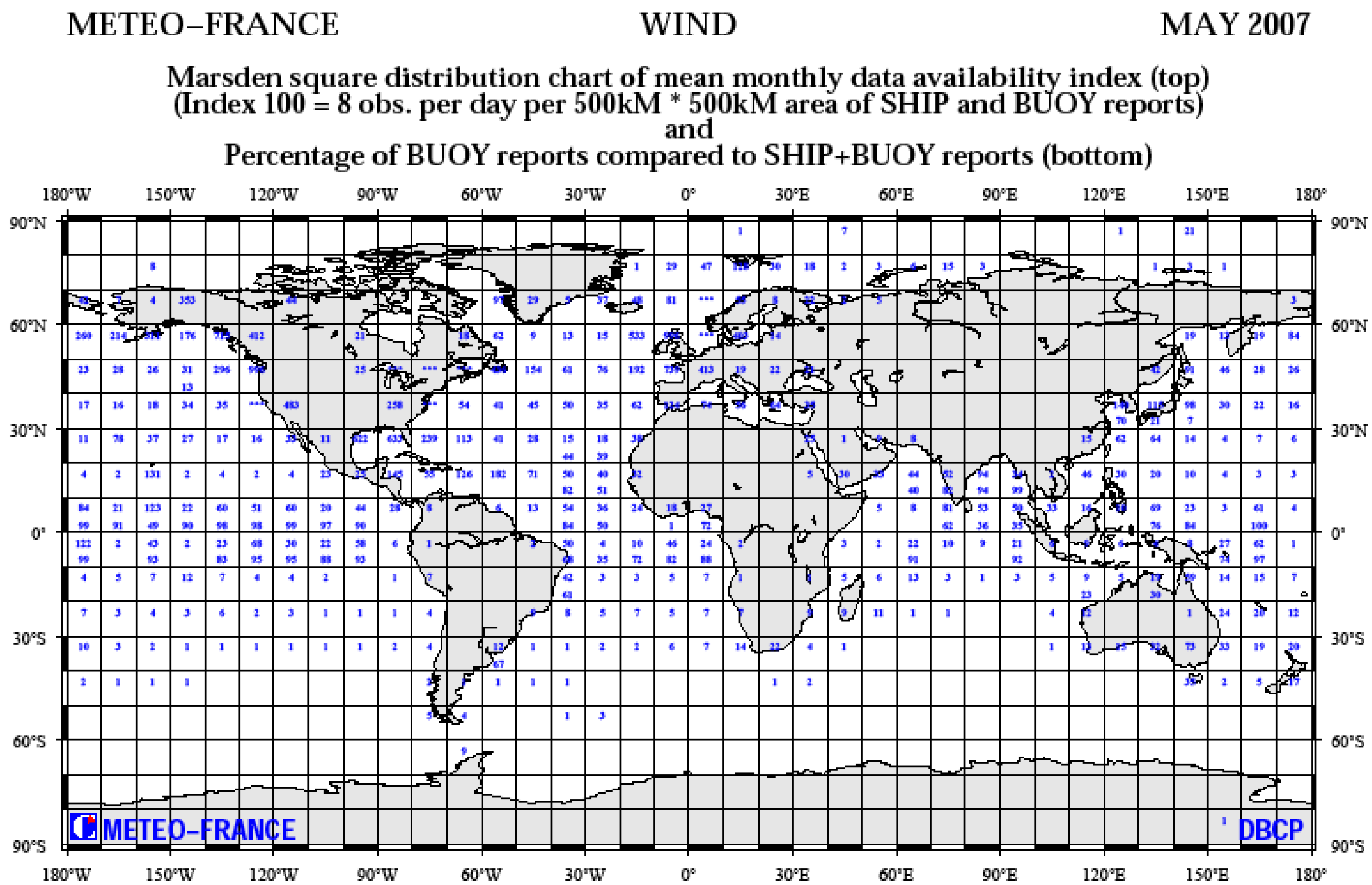


Figure 7. GTS data availability, May 2007 – surface wind (by courtesy of Météo France).

ANNEX A ACRONYMS

CLIVAR	Climate Variability and Predictability (WCRP)
CMM	Centre de Météorologie Marine (Météo France)
DAC	Data Assembly Center (of the WOCE Surface Velocity Programme)
DBCP	Data Buoy Co-operation Panel
ECMWF	European Centre for Medium-range Weather Forecasts
EGOS	European Group on Ocean Stations
FGGE	First Global GARP Experiment
FCCC	Framework Convention on Climate Change
GARP	Global Atmospheric Research Programme
GCOS	Global Climate Observing System
GDC	Global Drifter Center
GDP	Global Drifter Programme
GOOS	Global Ocean Observing System
GTS	Global Telecommunication System
IABP	International Arctic Buoy Programme
IBPIO	International Buoy Programme in the Indian Ocean
IOC	Intergovernmental Oceanographic Commission
IPAB	International Programme for Antarctic Buoys
IPCC	Intergovernmental Panel on Climate Change
ISABP	International South Atlantic Buoy Programme
ISDM	Integrated Science Data Management (Canada, formerly MEDS)
JCOMM	Joint Commission for Oceanography and Marine Meteorology (WMO/IOC)
JCOMMOPS	JCOMM *in situ* Observing Platform Support centre
JTA	Joint Tariff Agreement
LUT	Local User Terminal
MEDS	Marine Environmental Data Service (Canada, now ISDM)
NOAA	National Oceanographic and Atmospheric Administration
NOS	National Ocean Service
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment Observation System
OCO	Office of Climate Observation (US)
OOPC	Ocean Observation Panel for Climate
OOPC	Ocean Observing Panel for Climate
OOSDP	Ocean Observing System Development Panel
RNODC	Responsible National Oceanographic Data Center
ROC	Representative Organization of Country
SST	Sea Surface Temperature
SVP	Surface Velocity Programme
TAO	Tropical Atmosphere Ocean Array
TC	Technical Coordinator (of the DBCP)
TIP	Tropical moored buoy Implementation Panel
TOGA	Tropical Ocean Global Atmosphere
UNCLOS	United Nations Convention on the Law of the Sea
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch

ANNEX B OBSERVATIONAL REQUIREMENTS

These requirements are based on realistic implementation targets for important variables measured with in situ ocean networks, and follow recommendations from the DBCP Data Users and Technology Workshop, Reading, UK, 27-28 March 2006. The table has been compiled taking into account requirements for Numerical Weather Prediction, climate variability and predictability, ocean/climate modeling, and climate forecast.

Variable	Horizontal resolution	Time resolution	Timeliness	Accuracy
SST	5 °	1 H	3 H	0.2 C
SSS	200 km	10 days	3 H	0.1 psu
Wind	2°	1 – 2 days	3 H	0.1 to 1 m/s
T profiles (Argo)	3°	10 days	3 H	0.001 C
Velocity (derived from drifters)	600 km	1 month	6 H	2 cm/s
Ice velocity	200 km	1 day	3 H	1 cm/s

Specific requirements for the WWW, GOOS, and GCOS can be found in the WMO CEOS database, which is available on-line from the WMO web site (http://www.wmo.int/pages/prog/sat/Databases.html).

ANNEX C EXAMPLE OPERATING PRINCIPLES OF A DBCP ACTION GROUP

OPERATING PRINCIPLES OF THE ISABP

The ISABP strives to:

- Maintain a data network over the South Atlantic Ocean using *in situ* ocean platforms such as island weather stations, moored buoys and in particular drifting buoys;
- Establish and maintain data collection and data communication facilities, and ensure that the necessary quality control is undertaken according to DBCP guidelines;
- Distribute basic meteorological and oceanographic data from the network at operationally useful time-scales over the Global Telecommunication System;
- Arrange for the archival of data from the network and for the provision of archived data sets to programme participants;
- Liaise on technical aspects of buoy development and operational matters;
- Continually review the effectiveness of the programme in satisfying data requirements of the users.

Operational area:

The operational area is the Tropical and South Atlantic Ocean.

Variables:

Atmospheric pressure, sea-surface temperature and buoy location are reported. Additional variables such as air temperature, atmospheric pressure tendency, wind speed and direction, and surface and sub-surface oceanographic variables, especially waves, are viewed as highly desirable.

Data archiving:

All basic meteorological and oceanographic data from drifting buoys in the programme are archived by the Marine Environmental Data Service (Canada), as the Intergovernmental Oceanographic Commission (IOC) responsible national oceanographic data centre for drifting buoys.

Other buoy data quality control and archival activities are relevant to the programme, in particular those of the Global Drifter Centre in Miami.

Basic network density:

To be consistent with the requirements stated by the World Weather Watch, we attempt to provide a network of the basic variables with data points spaced at approximately 250 km intervals over the operational area. As far, as is practicable, sufficient platforms are deployed to achieve and maintain this density, taking into account other observing system components.

Buoy recovery and refurbishment:

Participants retain ownership of their buoys. While no specific plans for buoy recovery are made, agencies are encouraged to make arrangements, as appropriate, for the recovery, refurbishment and re-deployment of buoys, which drift ashore, or which, in other ways, no longer contribute to the goals of the programme.

Data acquisition and distribution:

All buoys in the basic network are equipped with transmitters to enable basic meteorological and oceanographic data to be transmitted in real-time (synoptic or asynoptic mode). As a preferred approach:

- Data are collected and located via the Argos systems;
- All basic meteorological and oceanographic data are coded in the approved WMO code form for buoys;
- Data collected through the Argos system are inserted by CLS/Service Argos into the Global Telecommunication System.
- Data collected by the participants through other means may also be inserted on the Global Telecommunications System;
- The programme seeks to establish and maintain, as necessary, Argos Local User Terminals (LUTs) covering the area.

Duration:

The programme will operate for an initial five-year period with formal review by the participants after three years leading to a decision on its continuation.

Funding arrangements:

The programme will be self-sustaining, supported by contributions in the form of equipment, services (such as communications, development, archiving or co-ordination) or monetary contribution. The participants will make suitable arrangements for administration of monetary contribution.

Meetings:

An annual meeting of the participants will be held at a location to be determined by them. All the participants are eligible to attend at their own expense.

ANNEX D SPECIFICATIONS OF THE SVPB "BAROMETER" DRIFTER

1) Introduction

The SVPB drifter is basically a standard SVP drifter to which an air pressure port has been added (figure 1). Both standard SVP and SVPB drifters are proven and reliable designs and have been deployed at sea in large quantities for oceanographic research and operational meteorological programmes (e.g. WOCE, TOGA, WWW). SVPB is capable of accurately measuring sea surface currents (+/- 1 cm/s) in 10 M/S winds, sea surface temperature (+/- 0.1 C), and atmospheric pressure (+/- 1 hPa). Nominal lifetime is 18 month.

Design of the SVPB is regularly being upgraded to take advantage of new technologies and therefore to improve its overall reliability and lifetime. In latest design, the following changes have been proposed:

- Reduced Size hull (32cm)
- 490 cm long drogue, 61cm in diameter

A construction manual, which does not mention above modifications has been produced and published by the DBCP (DBCP Technical document No. 4). Manual has been revised in 2005 to reflect recent changes. Free copies can be obtained from the Technical Coordinator of the DBCP. A revised version of the manual is on the DBCP website.

2) Surface current measurement

For measuring surface velocity, standard SVP buoys have been designed to be good Lagrangian drifters (buoys which follow the water motion well) and very specific requirements of drogue and surface float design have been developed (large holey sock drogue, spherical floats and thin wire tethers...). Laboratory and at sea tests have been conducted to guarantee the reliability of SVP drifter measurements.

The slip (i.e. the motion of the centre of the drogue relative to the moving water parcel) has been minimized. Many phenomena can induce slip; the main ones are wind stress, surface gravity wave effects and vertical shear of currents. Therefore tests have been conducted on various shapes of floats and drogues (NOAA data report 1990). These tests show that the most efficient shapes are small, spherically-symmetric surface and subsurface floats, thin-wire tethers and a large semi-rigid drogue. The drogues which have high drag coefficient and stable water following characteristics are the TRISTAR (Niiler, *et al*., 1987) and the Holey Sock (Nath, *et al*., 1979). The drag area ratio is the drag coefficient of the drogue times the frontal area divided by the sum of the products of the drag coefficient and the largest projected frontal areas of floats and tethers. A drag area ratio for the drifter greater than 40 will give the instrument the capability to make current measurements accurate to within 2 cm/s. Using a correction formula, a wind correction will then improve this accuracy to 1 cm/s if the wind is known within 4 m/s.

3) Drogue detector (Submersion switch)

A drogue detector is necessary for ascertaining if the drogue is still attached. A drifter without a drogue is of little value for surface velocity measurements. Since the surface float goes under the water more often when the drogue is attached, one principle is to install a submersion detector (switch) on the surface float and to analyze the time series in order to deduce if the drogue is still attached. Another principle is to use strain sensor where the drogue is attached to the drifter.

4) Sea Surface Temperature measurement

The SVPB drifter is also equipped with a sea surface temperature sensor that is designed to make measurements accurate to 0.1 Celsius. Experience gained with the standard SVP drifter has been used. To obtain this accuracy, tests show that one must install the temperature sensor outside the hull of the drifter float. Also, calibrations of a number of thermistors while connected to the electronics circuitry in a test tank in various ranges of temperatures must be done. Only these kind of tests and calibrations can provide accurate coefficients to be used to convert raw data (resistance) into physical values (Celsius) within +/- 0.1 Celsius. The lifetime of the sensor will exceed that of the transmitter.

5) Atmospheric Pressure Measurement

The air pressure port has been designed to withstand frequent immersion with no loss of accuracy. The port is elevated to some height above the float itself to avoid Venturi effects caused by airflow over the curved float surface. The total surface of the mast is lower than 10% of the total frontal area so that wind stress does not induce a substantial slip effect compared to the one induced through the hull itself. The design is based on a port used on moored buoys by the United Kingdom Meteorological Office, which has had extensive field tests in the wind tunnel. Internal baffling is provided against submergence surges and sufficient back up volume of air assures that water does not enter the barometer duct.

The barometer port design is based on the following rationale:

(i) Field observations indicate that the surface float of the SVP Lagrangian drifter is pulled under the water to a depth of 1-2 m at the crests of wind waves, therefore an overpressure of 200 hPa can be expected on the barometer. Data from the submergence switch on drifters in WOCE Heavy Weather Drifter Test (Sybrandy and Niiler, 1991) indicate that they spend about 20-30% of the time under the water in winds in excess of 15 m/s. Upon resurfacing, the port has to clear from sea-water quickly and completely. Flaps and valves to close a port will fail or become encrusted. An inverted port, with sufficient backup volume of air which can be compressed upon submergence so the water is kept out of the barometer air duct was incorporated in the design.

(ii) A long air pressure duct to the barometer can collect condensation in the extreme changes of moisture and temperature which occur in synoptic weather systems. This problem was solved by placing the barometer very close to and above the air intake. Specially configured barometers were made for this application for GDC by several manufacturers.

(iii) In a wind stream, the surface float produces a lowering of air pressure due to the Bernouilli effect. In 10 m/s wind, this effect produces less than 0.1 hPa pressure lowering at a distance of one radius of a sphere. The barometer port air intake is placed on a mast 24 cm above the top of the sphere. A second Bernouilli effect is produced by the airflow around the mast. This problem has been studied extensively, and a tabular windshield, with air intake holes inside an inserted, second sleeve is adopted (Osmund and Painting, 1984).

(iv) The sampling and averaging scheme for the air pressure has to be sensitive to when the port is under the water. Tests have run at sea under 15 m/s wind conditions off San Diego, Ca. (WOCE/TOGA Lagrangian Drifter with barometer port, May 91, Sybrandy and Niiler) where pressure was sampled at 2Hz inside the surface float. A laboratory standard barometer of identical construction was used to obtain data at identical rates about 3 meters above sea level in a semi-enclosed laboratory on a ship. No significant wind effects, or delay times, were observed on the barometer port response on the surface float in the water.

The sensor itself is an AIR SB-1A model. It is a ceramic diaphragm capacitance sensor equipped with a built-in temperature compensating circuit. AIR sensors have been carefully tested for WOCE and finally proved reliable (Payne *et al,* IMET). Accuracy is +/- 1 hPa with a stability of +/- 1 hPa over a one-year period. Sensor output is digital in tenths of hPa.

Data are sampled at 1 Hz, and averaged over a 160 seconds period. A dedicated despiking algorithm was designed to remove from the average these air pressure measurements made while the barometer port is submerged.

The latest average of every hour is stored on-board. The last 12 hourly measurements are memorized on-board and transmitted through Argos using multiplexing techniques. It is expected that the full series of 24 hourly measurements will be recovered every day. Hence the latest available air pressure and tendency measurements (real time) as well as the synoptic air pressure measurements can be distributed on GTS (deferred-time).

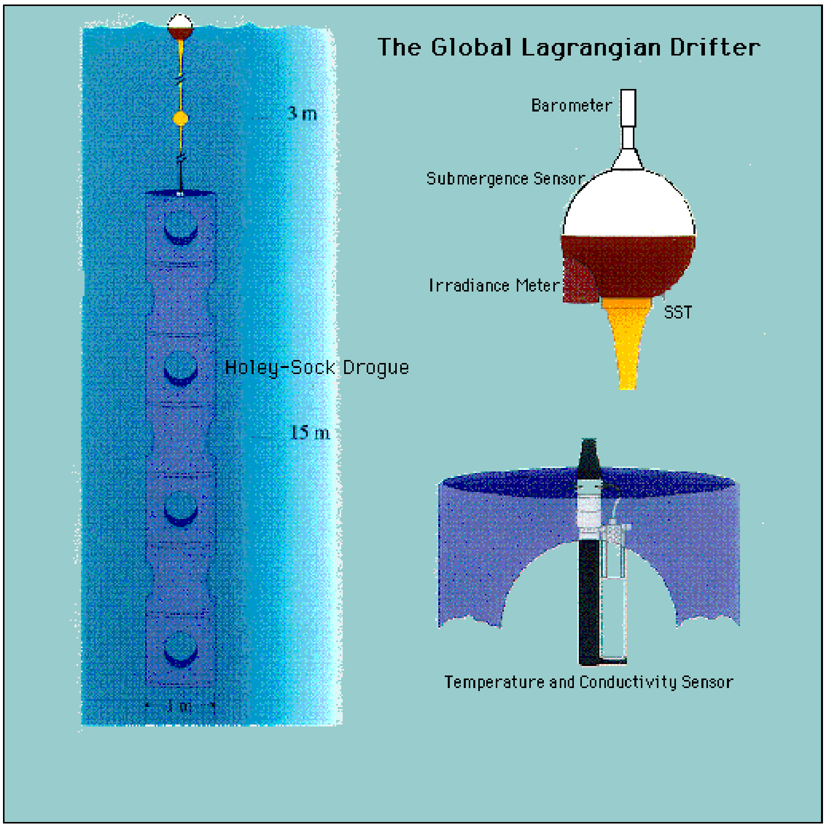


Diagram displaying the low-cost Global Lagrangian Drifter on the left hand side, and schematics of the sensor attachments (barometer, submergence, SST, irradiance and SEACAT), on the right hand side. Most drifters are also equipped with drogue sensors that indicate drogue loss. Buoys without drogues do not depict ocean currents accurately, because the drifter becomes susceptible to wave and wind action. Drifters transmit sensor data to satellites that determine the buoy's position and relay the data to Argos ground stations. Service Argos provides raw drifter data to the DAC where the data is processed and distributed.

Figure 1: The Minimet drifter. The SVPB drifter does not have the irradiance meter nor sub-surface temperature and conductivity sensor. The standard SVP drifter does not have the barometer as well. Latest designs omit the subsurface float.

ANNEX E CONTACT INFORMATION AND WORLD-WIDE WEB ADDRESSES

The Data Buoy Co-operation Panel
Ocean Affairs Division
World Meteorological Organization
CP 2300
CH-1211 Geneva 2
Switzerland

tel: (+41) 22 730 8237 fax: (+41) 22 730 8021 e-mail: ecabrera@wmo.int

DBCP Technical Coordinator
JCOMMOPS
8-10 rue Hermès
Parc Technologique du Canal
31526 Ramonville St-Agne
France

tel: (+33) 561 39 47 82 fax: (+33) 561 75 10 14 e-mail: viola@jcommops.org

DBCP home page	http://www.jcommops.org/dbcp/
WMO home page	http://www.wmo.int/
GCOS home page	http://www.wmo.int/pages/prog/gcos/
GOOS home page	http://ioc.unesco.org/goos/
OOSDP Final Report	http://ocean.tamu.edu/oosdp/FinalRept/
E-SURFMAT home page	http://surfmar.meteo.fr/wikisurf/index.php/Main_Page
IABP home page	http://iabp.apl.washington.edu/
IPAB home page	http://www.ipab.aq
ISABP home page	http://www.dbcp.noaa.gov/dbcp/isabp/index.html
IBPIO home page	http://www.meteo.shom.fr/ibpio/
GDC home page	http://www.aoml.noaa.gov/phod/dac/gdc.html
ISDM home page	http://www.meds-sdmm.dfo-mpo.gc.ca/
NPDBAP home page	http://npdbap.noaa.gov/
TIP home page	http://www.pmel.noaa.gov/tao/proj_over/tip/newpanel.html

ANNEX F TERMS OF REFERENCE OF THE DBCP AND ITS TECHNICAL COORDINATOR

Terms of Reference of the Data Buoy Cooperation Panel (Resolution 4 (EC LII))

The Data Buoy Cooperation Panel shall:

Consider the expressed needs of the international meteorological and oceanographic communities for real-time or archival data from ocean-data buoys on the high seas and request action from its members, the Technical Co-ordinator or action groups to meet these needs;

1. Co-ordinate activity on existing programmes so as to optimize the provision and timely receipt of good quality data from them;

2. Propose, organize and implement, through the co-ordination of national contributions, the expansion of existing programmes or the creation of new ones to supply such data;

3. Support and organize as appropriate such action groups as may be necessary to implement the deployment of data gathering buoys to meet the expressed needs of oceanographic and meteorological programmes such as WWW, WCRP, GOOS and GCOS;

4. Encourage the initiation of national contributions to data buoy programmes from countries which do not make them;

5. Promote the insertion of all available and appropriate buoy data into the Global Telecommunication System;

6. Promote the exchange of information on data buoy activities and encourage the development and transfer of appropriate technology;

7. Ensure that other bodies actively involved in buoy use are informed of the workings of the panel and encourage, as appropriate, their participation in the panel deliberations;

8. Make and regularly review arrangements to secure the services of a Technical Co-ordinator with the terms of reference given in Part B;

9. Report formally to the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), and participate in and contribute to an integrated global operational ocean observing system, implemented and co-ordinated through JCOMM;

10. Submit annually to the Executive Councils of the WMO and the IOC, to JCOMM and to other appropriate bodies of WMO and IOC, a report which shall include summaries of the existing and planned buoy deployments and data flow.

Terms of Reference for the Technical Coordinator of the DBCP

The Technical Coordinator of the Data Buoy Cooperation Panel shall:

1. Under the direction of the Data Buoy Cooperation Panel take all possible steps within the competence of the Panel to assist in the successful achievement of its aims;

2. Assist in the development, implementation, and management of quality control procedures for data buoy systems;

3. Assist in setting up suitable arrangements for notifying the appropriate user communities of changes in the functional status of operational buoys;

4. Assist in the standardization of buoy data formats, sensor accuracy, etc.;

5. Assist when requested with the development of cooperative arrangements for buoy deployment;

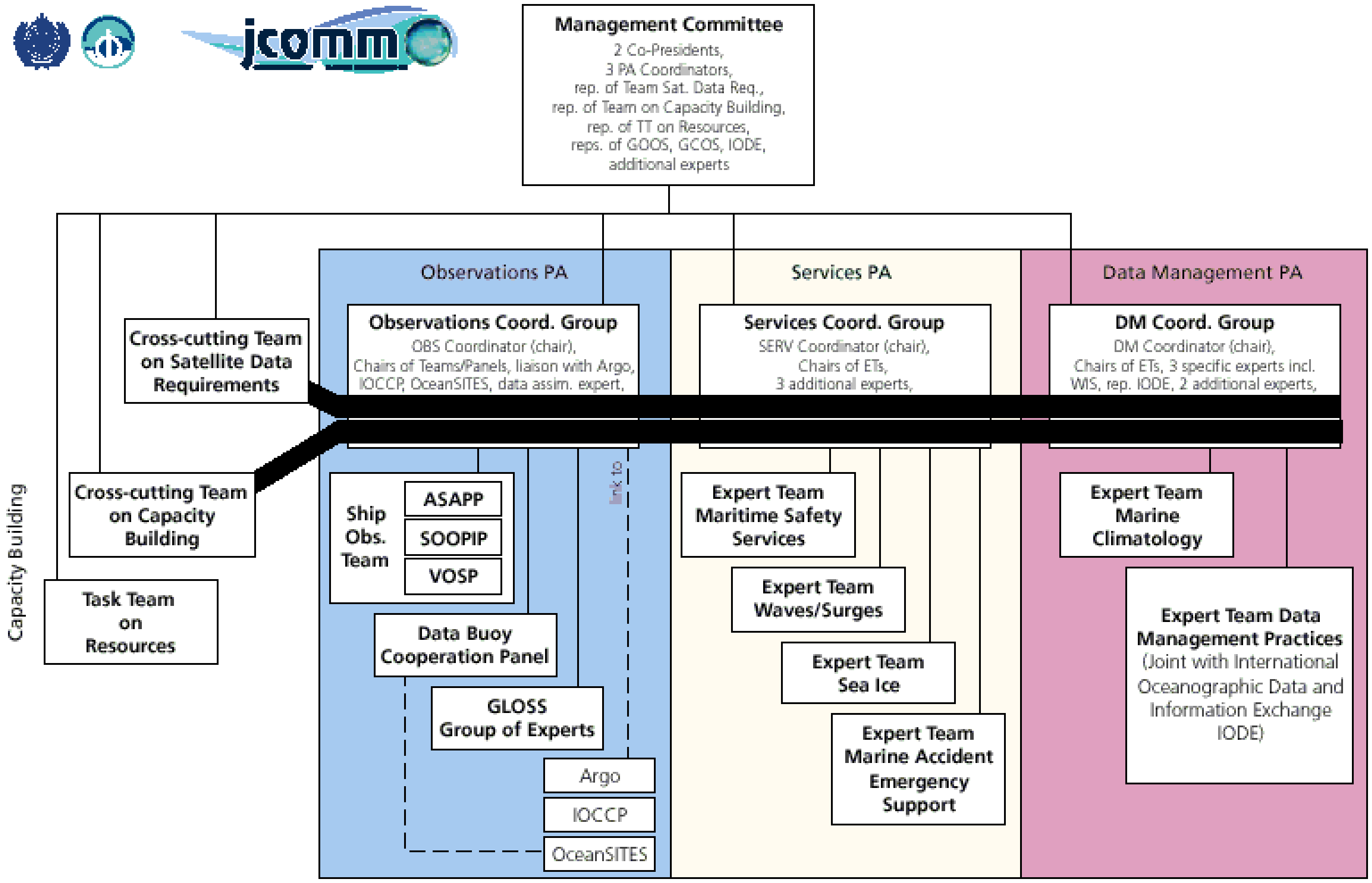
6. Assist in the clarification and resolution of issues between Service Argos and buoy operators;

7. Assist in promoting the insertion of all available and appropriate buoy data into the Global Telecommunications System;

8. Supply information about buoy developments and applications to the WMO and IOC Secretariats and assist the Data Buoy Cooperation Panel to promote an international dialogue between oceanographers and meteorologists;

9. Coordinate and monitor the flow of buoy data into appropriate permanent archives.

ANNEX G JCOMM STRUCTURE



TERMS OF REFERENCE AND GENERAL MEMBERSHIP OF THE OBSERVATIONS COORDINATION GROUP AND SHIP, DATA BUOY AND SEA LEVEL OBSERVATIONS TEAMS

1. Observations Coordination Group

Terms of Reference

1. Keep under review and advise on the effectiveness, coordination and operation of the observations work program, including performance measured against scientific requirements, delivery of raw data, measurement standards, logistics and resources.
2. Provide advice to JCOMM and to Observation Teams on possible solutions for newly identified requirements, consulting as appropriate with relevant scientific groups and CBS.
3. Taking into account the continuing development of satellite observations and their capabilities, review **in situ** data requirements and recommend changes as appropriate.
4. Coordinate the development of standardized, high quality observing practices and instrumentation and prepare recommendations for JCOMM.
5. Examine trade-offs and use of new and improved techniques/developments against requirements and available resources.
6. Liaise with and input to CBS activities regarding the consolidated requirements database and operational satellites.

General Membership

PA/Observations Coordinator (chair)
Chairman Ship Observations Team
Chairman DBCP
Chairman GLOSS Group of Experts
Chairman Argo Science Team
Chairman TAO Implementation Panel
Technical Coordinator DBCP/SOOP
Rapporteurs as required
Satellite expert
One other expert

2. Ship Observations Team

Terms of Reference

Generic

1. Review and analyse requirements for ship-based observational data expressed by the WWW, WCP, WCRP, GOOS, GCOS and in support of marine services, and coordinate actions to implement and maintain the networks to satisfy these requirements;
2. Review marine telecommunications facilities and procedures for observational data collection, as well as technology and techniques for data processing and transmission, and propose actions as necessary for improvements and enhanced application;
3. Coordinate PMO/ship greeting operations globally, propose actions to enhance PMO standards and operations, and contribute as required to PMO training;
4. Review, maintain and update as necessary technical guidance material relating to ship observations and PMOs;
5. Liaise and coordinate as necessary with other JCOMM Programme Areas and expert teams, in particular those relating to maritime safety services, marine climatology and ocean data management; in addition, liaise and coordinate with CBS, WCRP, GOOS

and GCOS regarding the contribution of ship based observations to their respective programmes;
6. Establish, as necessary, *ad hoc* task teams to address specific issues such as: accuracy of hardware and software used on board ship; data quality control procedures for shipboard instrumentation; specifications for modifications to data transmission codes and general data formats;
7. Participate in planning activities of appropriate observing system experiments and major international research programmes as the specialist group on ship based observations;

SOOP Implementation Panel

1. Review, recommend on and, as necessary, coordinate the implementation of specialized shipboard instrumentation and observing practices;
2. Coordinate the exchange of technical information on equipment and expendable development, functionality, reliability and accuracy;
3. Ensure the distribution of available programme resources to ships to meet the agreed sampling strategy in the most efficient way;
4. Ensure the transmission of low resolution data in real time from participating ships; ensure that delayed more high resolution data are checked and distributed in a timely manner to data processing centres;
5. Maintain, through the SOOP Coordinator, appropriate inventories, monitoring reports and analyses, and information exchange facilities;
6. Provide general guidance to the Coordinator in his support for the SOOP;

ASAP Panel

1. Coordinate the overall implementation of the ASAP, including recommending routes and monitoring the overall performance of the programme, both operationally and in respect of the quality of the ASAP system data processing;
2. As may be required by some members, arrange for and use funds and contributions in kind needed for the procurement, implementation and operation of ASAP systems and for the promotion and expansion of the programme;
3. Carry out other activities as agreed upon by participating members to implement and operate ASAP and to promote and expand the programme internationally;
4. Prepare annually a report on the status of ASAP operations, data availability and data quality;

VOS panel

1. Review, recommend on and coordinate the implementation of new and improved specialized shipboard instrumentation, siting and observing practices;
2. Support the development and maintenance of the VOSClim Project;
3. Develop and implement activities to enhance ship recruitment, including promotional brochures, training videos, etc.

General Membership

Chairperson selected by JCOMM
Operators of VOS, SOOP and ASAP
Representatives of monitoring centres, data management centres and bodies
Representatives of Inmarsat and other communications satellite systems
Representatives of manufacturers as appropriate
Representatives of science advisory bodies and users as appropriate

3. Data Buoy Observations Team

Terms of Reference

Existing Terms of Reference for DBCP, TIP and Action Groups

General Membership

Open, existing DBCP members, Action Groups, TIP

4. Sea Level Observations Team

GLOSS Group of Experts

Terms of Reference

Existing terms of reference as determined by the IOC Executive Council

General Membership

Existing GLOSS GE and GLOSS Scientific Subgroup

ANNEX H TECHNICAL DOCUMENTS ISSUED WITHIN THE DATA BUOY COOPERATION PANEL SERIES

No.	Title	Year of first issue	Last revision and year
1	DBCP Annual Report for 1994	1995	
2	Reference Guide to the GTS Sub-system of the Argos Processing System	1995	Rev. 1.6, 2005
3	Guide to Data collection and Location Services Using Service Argos	1995	
4	WOCE Surface Velocity Programme Barometer Drifter Construction Manual	1995	Rev. 2, 2005
5	Surface Velocity Programme Joint Workshop on SVPB drifter evaluation	1995	
6	DBCP Annual Report for 1995	1996	
7	Developments in buoy technology and enabling methods (DBCP workshop, Pretoria, Oct. 1996)	1996	
8	Guide to moored buoys and other ocean data acquisition systems	1997	
9	DBCP Annual report for 1996	1997	
10	Development in buoy and communications technologies (DBCP workshop, Henley on Thames, Oct. 1996)	1997	
11	DBCP Annual report for 1997	1998	
12	Developments in buoy technology and data applications (DBCP workshop, La Réunion, Oct. 97)	1998	
13	DBCP Annual report for 1998	1999	
14	Variety in buoy technology and data applications (DBCP workshop, Marathon, Florida, Oct. 98)	1999	
15	Global drifting buoy observations, A DBCP Implementation Strategy	1999	Rev. 7, 2007
16	DBCP Annual Report for 1999	2000	
17	Developments in Moored and Drifting Buoy Design, Programmes, Sensors, and Communications (DBCP Workshop, Wellington, Oct. 1999	2000	
18	DBCP Annual report for 2000	2001	
19	Developments in buoy technology, communications, and data applications (DBCP Workshop, Victoria, Oct. 2000	2001	
20	DBCP Annual report for 2001	2002	
21	Dev. in buoy technology, communications, science and data applications(DBCP Workshop, Perth, Oct. 2001)	2002	
22	Research, applications and developments involving data buoys(DBCP Workshop, Martinique, Oct. 2002)	2003	
23	DBCP Annual report for 2002	2003	
24	Research, Applications and Developments involving data buoys (DBCP Workshop, Angra Dos Reis, Brazil, October 2003)	2004	
25	DBCP Annual report for 2003	2004	
26	DBCP Annual report for 2004	2005	
27	DBCP Annual report for 2005	2006	
28	JCOMM TR No. 35. Application of collected data, Presentations at the DBCP Technical Workshop, Chennai, India, 18-19 October 2004 - **Web only** (web)	2006	
29	JCOMM TR No. 37. Application of collected data, Presentations at the DBCP Technical Workshop, Buenos Aires, Argentina, 17-18 October 2005 - **Web only** (web)	2006	

These publications can be ordered from: Hester Viola, Technical Coordinator of the DBCP, JCOMMOPS, 8-10 rue Hermès, Parc Technologique du Canal, F-31526 Ramonville Saint-Agne, France – Internet mail: viola@jcommops.org – Telefax: +33 5 61 75 10 14
