Minutes of the
Ninth Annual Meeting of the Participants of the
INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)
Alfred Wegener Institut for Polar and Marine Research
Bremerhaven, Germany, 2 - 4 June, 1999

1.0 Opening of the Meeting

The ninth annual meeting of the Participants of the IABP opened at 9:00 on June 2, 1999 at the Alfred Wegener Institut for Polar and Marine Research (AWI), Bremerhaven, Germany. Prof. Augstein welcomed the attendees to AWI. The Chairman of the IABP, Tim Goos (TG), called the meeting to order. Hartmut Hellmer (HH) provided logistic information for the meeting, and offered a tour to the ice breaker, Polarstern. The list of attendees is given in Attachment 1.

2.0 Agenda Approval

The agenda was reviewed, amended and approved (Attachment 2).

3.0 Approval of Minutes of the IABP 8th Annual Meeting – 1998

Ignatius Rigor (IR) presented the minutes from the 8th Annual Meeting held in Seattle, Washington, U.S.A. Victor Savtchenko (VS) raised the following issues: 1.) the need to update the information for the attendees that may have changed since the last meeting. VS said that this problem would not be an issue if the minutes were approved in a shorter time period; 2.) the title of the meeting may be ambiguous; and 3.) the list of Participants should be amended to reflect their contributions.

It was decided that: 1.) the information on the Participants and attendees would not be changed in the past minutes, but a footnote would be added to the current minutes noting that the most current information on Participants would be available on the IABP web pages; 2.) the current minutes will be posted on the IABP web pages shortly after the meeting, these minutes will be edited by the attendees during the ensuing months, and finalized within two months after the meeting. This agenda item will thus not be necessary in subsequent meetings; 3.) the title of the meeting will now be “The Ninth Annual Meeting of the Participants of the IABP;” and 4.) the Participant list will be amended to include recent and future contributions. Recent meaning the contributions during the past intersessional year, and future meaning the next two years.

4.0 Review and Approval of the IABP Operating Principles

The IABP operating principles were reviewed. VS suggested that GCOS and GOOS be included as Programmes that the IABP should explicitly state that the IABP will support.

It was suggested that since the IABP is an action group of the DBCP, which also supports these Programmes, then the IABP implicitly also supports these Programmes.

The Terms of Reference for the Coordinator were also reviewed. It was decided that item 15 would be amended to state: To maintain a web page that promotes the IABP, provides access to the IABP datasets, and provides news and information relevant to the Participants and general community.

The IABP Operating Principles are given in Attachment 3.

5.0 Coordinator's Report

IR reported: 1.) on the developments in the buoy array during the past year, 2.) deployment plans, and 3.) on the progress of publications related to the IABP.

Since the last meeting when there were 33 buoys deployed in the Arctic, 25 buoys ceased transmitting, and 16 buoys were deployed, for a current array of 22 buoys. A map of the planned deployments was shown.

Two papers regarding the new IABP surface air temperatures (SAT) have been published. The first paper, Rigor, et al. documents the current analysis procedure and studies variations in SAT in the Arctic. The second paper, Jones, et al. discusses changes in SAT over the entire globe.

The full report of the Coordinator is given in Attachment 4.

6.0 Report from Data Buoy Co-operation Panel (DBCP)

Etienne Charpentier presented the DBCP and its activities in the last 12 months. He gave a short overview of present buoy programmes world-wide and listed quantity of buoy data available from the Global Telecommunication System (GTS) for specific variables (e.g. 286 buoys reporting air pressure, 757 buoys reporting SST). He reported on the last DBCP session which was held in Marathon, Florida, 12-16 October 1998. A workshop was organised in conjunction with the DBCP session where issues related to application of buoy data, buoy design, and using buoy data in conjunction with other observing techniques such as remote sensing were debated. David Benner attended the DBCP session and represented the IABP. Next DBCP session will be held in Wellington, New Zealand, 26-30 October 1999.

The DBCP adopted its implementation plan according to discussions among DBCP members, and comments from the DBCP Action Groups such as the IABP. The DBCP plan is being integrated in the GOSS and GCOS Implementation Plan.

New information regarding Argos message formats, buoy monitoring statistics, status graphics, data-flow monitoring tools, etc. has been added in the DBCP web site (http://dbcp.nos.noaa.gov/dbcp) . IABP is invited to provide the Technical Coordinator of the DBCP with its annual report for inclusion in the DBCP web site. An Internet Technical Forum (http://www-dbcp.cls.fr) has also been recently been established as a way to exchange technical information, answer technical questions, among buoy operators. The forum is for example being used in the context of the newly created SVPBW/Minimet drifter DBCP evaluation sub-group. A DBCP brochure has been produced and copies distributed to Action Group Chairmen and Coordinators for wider distribution. Extra copies can be obtained from the Technical Coordinator of the DBCP.

Regarding GTS distribution of buoy data, as discussed at its last session, and after consultation with key players, the DBCP decided to change the list of GTS bulletin headers used with buoy data distributed from the Argos Global Processing Centres. Pair of GTS bulletin headers used for Arctic data did not change, i.e. SSVX12 KARS, and SSVX07 LFPW for data distributed on GTS from Largo, USA, and Toulouse, France respectively. However, those two GTS bulletin headers will now include also Antarctic area data plus sea ice covered zones.

Mr. Charpentier also reported on improvements realised and planned with the Argos GTS sub-system (e.g. eliminating quasi duplicates, GTS distribution of sub-surface float data) and on outcome from the last Argos Joint Tariff Agreement (JTA) meeting in Marathon in October 1998.

The full report of the DBCP is given in Attachment 5.

7.0 Technical Session

7.1 Export of sediment laden sea ice from the Siberian Shelf areas - J. Kolatschek

Joseph Kolatschek presented work by J. Kolatschek, Martin Kreyscher, and Johnnes Freitag. on the mapping of “dirty” ice. Some of the dirty ice is a result of wind transport -5%. Another theory put forward for the sediment is that the sediment was that from river outflow. Outflow from the River Lena, for example, extends out 30 to 50 km. The sediment is however on fast ice and does not move out into the areas where the sediment ice had been noted. The

explanation for the bulk of the sediment lies in stays in the entrainment process. The 1995 Laptev Sea expedition recorded sediment and areas and their characteristics. Satellite imagery allows mapping of sediment areas via optical properties. AVHRR, SPOT, and Landsat imagery can be used . AVHRR can, for example, be used to differentiate medium (87.3 gm^{-2}) and high (616.9 gm^{-2}) sediment areas. Between July 1995 and November 1997, Siberian Shelf sediment was monitored. The monitoring was facilitated as a buoy was placed on the sediment laden ice. When and where sediment laden ice is being released is being modeled.

7.2 Modeling the Arctic ocean/sea ice system – R. Gerdes

A coupled ocean-sea ice model of the Atlantic is used to investigate Arctic sea ice variability. The sea ice model is almost identical to the SIMIP model with viscuous-plastic rheology while the ocean component is based on MOM. The coupled model is forced with heat and fresh water fluxes and daily wind stress distributions from the NCEP/NCAR reanalysis for the 1958-1997 period. The model simulates several ice export events through Fram Strait, including that preceeding the Great Salinity Anomaly and the directly observed event of the winter 1994/95. Most of the events are preceeded by ice accumulation in the East Siberian and Laptev Seas that takes several years to build up. A typical cycle of enhanced ice growth, reduced ice export during build-up, reduced thermodynamic growth immediately before an event, and ice export could be identified. The sea ice cycle, with a period close to 10 years, influences oceanic temperature, salinity and stability. Correlation and POP analysis indicate that changes in ice cover and thickness influence the atmospheric temperature and pressure distributions over the Arctic.

7.3 a Argos Downlink - C. Ortega

From late 2000, with the launch of satellite ADEOS-II, Argos users will be able to send short commands to their platforms. Typical applications will be switching a transmitter on or off, or modifying a sensor sampling rate. For additional details, see Argos newsletter, No. 54, April 1999, pages 17-20.

7.3 b Argos book and CD

Service Argos has produced a children's book titled "Argos, watching over planet earth" The book outlines the Argos satellite-based location and data system implemented in 1978 by the French space agency (CNES), the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA).JAMSTEC Research plan in the Arctic Ocean using new buoy (J-CAD) - K. Shimada

7.4 New Sellmann & Kruse (S&K) sea ice drift buoy – L. Sellmann

A new buoy developed by Sellmann & Kruse was presented.

7.5 Develops in the Russian Air Drop Buoy - S. Priamikov

7.6 ICEX and ICEXAIR deployments 1996 -1999 – T. Lothe.

The full text of this report is given in Attachment 6.

8.0 Status Report on Membership and Letters of Intent

IR reported that we currently have 25 Participants from 11 different countries, but informed the attendees that the Chairman has received a letter of withdrawal from the IABP from the United Kingdom Meteorological Office (UKMO). This will be its last year of participation. Edward Hudson (EH) read this letter to the attendees.

It was agreed that we will have a discussion at the next meeting concerning making provisions in the Operating Principles for withdrawal from the Programme.

It was noted that the withdrawal of the UKMO as a Participant of the IABP is a significant loss to the IABP, and that efforts should be made to revive the participation of the UKMO. The Chairman and Coordinator of the IABP will contact the UKMO and determine what can be done to reverse this decision.

For example, DB stated that the NIC would be willing to cover Argos costs if the UKMO would be able to contribute a buoy.

The list of IABP Participants is given in Attachment 7.

9.0 Status Reports from attending Participant

9.1 Environment Canada – E. Hudson

During the period from IABP-8, August 1998, to end of May 1999, two buoys were deployed and these just recently. In-house assembled buoys Argos id's 5313 and 5314 were deployed via Twin Otter landing on ice 30 March 1999. Two CALIB buoy deployments are slated for mid June and an ICEXAIR has been purchased for deployment during White Trident August 1999. The March 1999 deployment, supported by Polar Continental Shelf Project, made 'oceanography" a part of the deployment flight. A sounding to 600 meters was done at both of the deployment sites. For next year and future years, EC will seek "joint" efforts and cooperation with the oceanography community via shared flights and/or shared buoy "hulls".

EC continues to operate a local users terminal at Edmonton (about 53° 30'N). The Edmonton station "sees" buoys that lie on the Arctic Basin to the north and west of the Canadian Arctic archipelago. Data from these buoys is acquired, processed, and input to GTS. This data is a valuable addition to the surface weather maps done by the EC Arctic Weather Centre, Edmonton, and the Canadian Meteorological Centre, Montreal. At the time of this, the 9th Meeting of the IABP, 5 American and 2 Canadian buoys are being processed. EC Edmonton quality controls data from the buoys that it puts onto to GTS and makes "adjustments" accordingly. An ARGOS Summary Report for WMO is prepared monthly and distributed via email. Recipients include Etienne Charpentier, Technical Coordinator, Data Buoy Cooperation Panel.

EC now has access to a polar orbiting environmental satellite reception station in Resolute (approximately 75N). We will investigate acquisition, and processing of buoy data from this station.

EC continues to produce brochures, posters, and other promotional material for the IABP. See section 10.6.

The full report of the EC is given in Attachment 8.

9.2 U.S. Interagency Arctic Buoy Program / National Ice Center – D. Benner

In 1998-99, the U.S. Interagency Arctic Buoy Program (USIABP) received fiscal support, manpower resources, and other services from seven U.S. Government agencies. Presently, the USIABP has eleven buoys operating in the buoy network covering the central Arctic Basin and/or adjoining seas. This number includes seven Coastal Environmental System (CES) buoys, three Christian Michelsen Research (CMR) ICEXAIR buoys and one MetOcean buoy.

During the past year, the U.S. Navy provided aerial assets and funding for the annual White Trident deployment exercise. All ICEXAIR buoys deployed by White Trident were provided through the cooperative procurements of IABP Participants. Other USIABP activities and IABP contributions included:

- continued funding for the IABP Coordinator / Data Management function,
- data processing costs for a U.K. Meteorological Office ICEXAIR buoy, and

- management for the NICOP / U.S. Navy funded Russian buoy development program support for various 1998 Arctic Research activities.

These science activities included the U.S. Navy Submarine Science mission (SCICEX), the SHEBA ice camp, and the US/Canada North Open Water Project (NOW).

Anticipated 1999-2000 USIABP activities include:

- an increased emphasis on cooperative IABP deployment activities,
- procurement and deployment of 5-8 CES and/or ICEXAIR buoys and continued funding of the IABP Coordinator / Data Management function.

9.3 Arctic and Antarctic Research Institut (AARI) – I. Frolov

9.4 Alfred Wegener Institut (AWI) – H. Hellmer

In 1998, the AWI deployed 4 ICEXAIR buoys in the Arctic Ocean. Two of the buoys were air-dropped northwest of Svalbard. While one failed during set-up, the other left the Arctic Ocean soon via the East Greenland Current. The remaining 2 buoys were deployed by Polarstern close to the Russian economic zone on the eastern Siberian continental shelf. One buoy ceased operating after 3 months, but the other still collects standard variables witin the Transpolar Drift. At the moment buoy 14955 is at 160W 80N. See figure 2 of the Coordinator's report, attachment 4.

The Polarstern is available for use by the IABP for deployment of buoys, and the schedule will be given to the Coordinator.

9.5 U.S. Navoceano – E. Horton

The (US) Naval Oceanographic Office does buoy deployments across many of the world's oceans and seas. Deployments for the IABP are fitted into the overall deployment strategy.

During the intersessional period, the (US) Naval Oceanographic Office (NAVOCEANO) deployed 7 ICEXAIR buoys provided by IABP Participants as requested by the Chairman of the IABP in a letter to the Commander, Naval Meteorology and Oceanographic Command. NAVOCEANO worked with the (Russian Federation) Arctic and Antarctic Research Institute (AARI) to deploy 3 prototype ice drifters built by them. AARI arranged for the drifters to be deployed in the Laptev Sea by icebreaker. Although there was a technical problem with the transmitters, AARI identified the problem and, overall, NAVOCEANO was pleased with these prototypes and their deployment. At present, NAVOCEANO are working with AARI to get two more ice drifters deployed, along with four fixed weather stations during the next intersessional period.

9.6 Collecte Localisation Satellites – C. Ortega

Service Argos presented the status of Argos enhancements on both space and ground segments:

- Better time response: satellite passes every half hour in polar area and every one hour or so in most other regions will be achieved through a constellation of 5 satellites in orbit, starting by the end of year 2000 with the launch of ADEOS-II. Throughput time is also shortened by installing regional stations worldwide and setting connections with existing ones.

- Sending commands to the platforms : this capability will be provided by end Y2000 with ADEOS-II launch when Argos will become a two-way system.
- Managing platform's transmission and power budget thanks to satellite pass detection and prediction. This capability is provided by the Argos downlink.

- More messages, longer messages :

- Volume of data collected will be increased by 50-100% by reducing platform's repetition period. This could start with the launch of NOAA-M in January 2000 as there will then be two satellites equipped with Argos-2 unit (wider bandwidth and 3-4 times greater capacity).
- It will also be increased by about 2 fold by using the interactive transmission mode - i.e. satellite acknowledges the message reception, available with the Downlink capability (ADEOS-II),
- The Argos- 3 units will provide a 4.6 kps high data rate channel, starting in 2003 with METOP-1 launch.

• New data processing and management systems for the Argos processing centers are being phased in. These will provide a more open system that lets users access and modify platform processing, program characteristics and access to results, via an improved user interface. First phase including the new user interface will be completed in early 2000.

9.7 Christien Michelsen Research and Norsk Polarinstitut – T. Lothe

Mr. Torleif Lothe summarized the last year activity and outlined the plans for 1999/2000. Eight ICEXAIR buoys are scheduled for the White Trident mission 99. Mr. Torleif Lothe and Mr. Thor Kvinge will participate in the advanced preparations for WHITE TRIDENT '99. He further summarized the performance of the ICEXAIR buoys, emphasizing the comparatively long lifetime of the ICEXAIR. Christien Michelsen Research will work to improve the lifetime and reliability of the ICEXAIR even further, as the optimum lifetime for the buoys is 4 -5 years. This is related to the current deployment strategy of in the WHITE TRIDENT, causing most of the buoys to in the area of interest for 3-5 years.

9.8 World Climate Research Programme - V.Savtchenko

Dr V.Savtchenko reported progress in establishing a WCRP Climate and Cryosphere (CLIC) project.

The World Climate Research Programme (WCRP) has as its main goal to understand and predict, to the extent possible, climate variability and change including human influences. To achieve this goal requires not only understanding the components of the physical climate system – atmosphere, hydrosphere, land surface and cryosphere – but also their interactions. The cryosphere is an integral part of the global physical climate system, with important feedbacks generated through its influence on surface energy and moisture fluxes, clouds, precipitation, hydrology, and atmospheric and oceanic circulation.

WCRP has several activities which include some, but not all, of the cryospheric components and processes. ACSYS is currently the most prominent WCRP activity studying the cryosphere and climate. However, its regional focus means that it does not include all aspects of the global cryosphere.

No climate related scientific programme currently exists which encompasses all components of the global cryosphere (sea ice, snow cover, ice sheets and shelves, glaciers, lake and river ice, seasonally frozen ground and permafrost).Cryospheric issues are not just polar or high-latitude regional issues. They are science issues which must be understood, modelled and monitored if we are to study climate variability and change.

A conference on the WCRP:Achievements, benefits and challenges (Geneva, 26-28 August 1997) recommended that co-ordination of cryosphere and climate studies is required, and that WCRP should take the lead in this effort. The JSC-XIX (March 1998) established a WCRP (JSC/ACSYS) Task Group on CLIC to formulate a science plan for a WCRP Climate and Cryosphere project and recommend how to co-ordinate the appropriate WCRP activities with relevant on-going or planned projects/programmes/activities outside WCRP.

The first meeting of the CLIC Task Group was held from 8-11 July 1998 at the Institute for Marine and Atmospheric Research, Utrecht, the Netherlands. The CLIC Task Group were asked by the JSC-XIX to develop a Science and Co-ordination Plan for CLIC and set out the framework for its implementation in the WCRP. The CLIC Task Group and invited experts reviewed the status of related WCRP cryospheric research components within ACSYS, GEWEX and CLIVAR and those of other programmes (SCAR, SCOR, IASC) and organizations/activities (IPA, GCOS/TOPC). They discussed key science questions in plenary and working group sessions. The following framework for the science questions was adopted:

Cryosphere-Global atmosphere interactions
Cryosphere- Global ocean interactions
Atmosphere-Ice - Ocean interactions
Atmosphere - Snow - Land interactions
Atmosphere- Snow- Ice interactions.

In addition, the scope of cryospheric indicators of climate change was discussed.

A draft report on the meeting was submitted to the ACSYS SSG-VII (November 1998, Tokyo, Japan) for review and comments. The ACSYS SSG recommended that the draft be split up into the following two documents:

1) Report on the Utrecht session of the CLIC Task Group (issued as a WCRP white cover informal report No.4/1999), and
2) A draft CLIC Science and Co-ordination Plan (put on the ACSYS Home Pages by the IAPO) .

A second meeting of the CLIC Task Group will be arranged for 10-13 August 1999 in Grenoble, France, to revise the CLIC draft Science and Co-ordination Plan in response to community input. The revised draft CLIC Science and Co-ordination Plan will be submitted to the eighth session of the ACSYS SSG (14-18 February 2000) for their final review (Kiel, Germany). The final draft plan will be communicated to the JSC-XXI in March 2000 for the final review and a recommendation concerning the advisability of launching a CLIC programme as a separate WCRP component.

Some basic information on CLIC is available at the following ACSYS Web sites:
http://www.npolar.no/acsys/CLIC/statement.htm
http://www.npolar.no/acsys/CLIC/clic_initiative.htm
http://www.npolar.no/acsys/CLIC/clic_draft.htm
http://www.npolar.no/acsys/CLIC/clic_draft.pdf

The last two sites contain (in different formats) the draft CLIC Science and Co-ordination Plan.

9.9 Japan Marine Science and Technology Center – K. Shimada

The IOEB observation has been conducted in collaboration between JAMSTEC and WHOI since 1992. In 1998, two IOEBs were working in the western Arctic Ocean. One of them was IOEB-1 that originally deployed off the Alaska coast in 1992 and was refurbished off Queen Elizabeth Island in April 1997 and drifted along the rim of Canada Basin. The IOEB-1 entered the Chukchi Sea in early 1998 and ceased its operation in November 1998. The other one was SHEBA/IOEB-2 that was deployed southeast of the initial SHEBA site in September 30, 1997. The SHEBA/IOEB-2 drifted across the Northwind Ridge and Chukchi Plateau, and finally was recovered in the northern Canada Basin in October 1. Both IOEBs collected not only atmospheric data but also oceanic data such as temperature, salinity, and velocities.

JAMSTEC will be ready to deploy four new buoys (J-CAD: JAMSTEC Compact Arctic Drifter) including both oceanic and atmospheric sensors in 2000. Currently, their deployment plan in the Arctic Ocean is under consideration. The diagram of the J-CAD will be provided to the IABP Coordinator.

10.0 Other Business

10.1 White Trident Deployment (E. Horton)

10.2 DBCP Technical forum (E. Charpentier)

Etienne Charpentier presented the newly established DBCP Internet technical forum (http://www-dbcp.cls.fr) which is a useful tool for discussing technical issues within the buoy community. Four basic themes of discussion are presently proposed:

- Argos
- DBCP
- GTS (e.g. what is GTS? how to distribute data on GTS?)
- SVPBW/Minimet evaluation group (wind measuring Lagrangian drifter)

Also two "teams" with restricted access for "team" members have been created on the forum:

- DBCP
- EGOS (European Group on Ocean Stations)

IABP members are invited to register on the forum, and use it for exchanging information, asking or replying questions. IABP is also invited to consider whether it would be useful to create a dedicated IABP "team" on the forum. An IABP "team" could for example be administered by the IABP coordinator.

10.3 Report on IPAB (V. Savtchenko)

Dr V. Savtchenko informed the participants in the meeting that 19 organisations, representing 12 countries, had subscribed to IPAB by submitting letters of intent to participate in the programme (Attachment 9). Participant's contributions to the programme include not only data buoy activities, but can also take the form of data acquisition and processing, monetary contribution, logistic support for deployment, data communication services, data archiving, and scientific or technical advice. At present,only 3-4 of the participants in the programme are actively deploying buoys.

The second biennial session of the IPAB was held at the Istituto Universitario Navale in Naples, Italy, in May 1998. The Executive Committee of the programme, elected at the meeting, consists of a Chairman, Vice-Chairman, and two Committee members. The present Chairman is Dr C. Kottmeier, Germany. Dr I. Allison, Australia, is the present Co-ordinator of the programme, but the co-ordinator's role is being transferred to Dr P. Wadhams, U.K.

After a relatively large number of buoy deployments under IPAB in 1995, the number of platforms deployed dropped in 1996, 1997 and 1998. Almost all IPAB drifters have been deployed as part of individual institutional research programmes, and there has been very little activity from operational meteorological agencies. Data from the majority of IPAB buoys are however contributed to forecasting agencies via the Global Telecommunications System.

Between January 1995 and August 1998 there have been a total of 67 buoys deployments under IPAB auspices. The annual breakdown of deployments is:

Year	GTS buyos	Non-GTS	Total
1995	18	10	28
1996	4	9	13

1997	11	0	11
1998	9	6	15

The major foci of activity are the Weddell Sea and the East Antarctic sector between 20°E and 160°E. There have been few deployments under IPAB in the Bellingshausen, Amundsen or Ross Seas, until deployments in May 1998 by the Geophysical Institute, University of Alaska, USA. Even at a peak, the number of active drifters falls far short of the optimum requirement. Seasonally buoy numbers show a peak in late autumn when most are deployed from vessels. Buoy numbers drop steadily after the maximum due both to instrument failures, and to northward divergence, which takes many buoys out of the pack ice and out of the region of interest to IPAB. Although many drifters have sufficient battery power to operate for two or more years, only very few survive within the Antarctic pack to provide data for more than one ice season. Many of these longer lived buoys are in the Weddell Sea. Some buoys are designed specifically for ice deployment and do not survive in open water for a long time, and sometimes it has been difficult to directly determine whether the buoy is operating within the ice edge or not.

Detailed information on IPAB activities is available at:

http://www.antcrc.utas.edu.au/antcrc/buoys/buoys.html.

Buoy activity in 1999 is expected to continue at a somewhat increased level to the last few years. Planned routine deployments include 10-12 buoys to be placed in the Weddell Sea by the Alfred Wegener Institute for Polar and Marine Research, Germany, over two years. In addition, 4-5 meteorological buoys and a large number of drifters only are to be deployed around 145°E, as part of an Australian process study in the Mertz Glacier Polynya in July/August 1999.

Most IPAB data buoys report through System Argos. Data from the programme are archived in two streams. Three-hourly synoptic data from WMO-registered drifters in the programme are routed by Service Argos directly onto the GTS, from where they are taken for archiving and distribution by the MEDS (Canada). Participants in the programme also gave permission to Service Argos to send a copy of all original data, in the monthly CLS-Argos “Dispose" format, direct to the IPAB co-ordinating office at the Antarctic CRC, Hobart, Australia. These are used to assemble a research archive containing a uniform, quality controlled data set of ice motion and surface meteorology and oceanography, as required by the Antarctic research community. These time series for each platform include data from all available sensors, and for all valid transmissions from the platform. Data from a number of additional Antarctic drifters, not registered with IPAB at the time of their operation, are to be recovered and included in the IPAB research archive. A database, containing information on buoy characteristics and history (metadata) is also maintained for each platform. This research data set is currently being transferred to the National Snow and Ice Data Center/World Data Center A for Glaciology, Boulder, Colorado, USA for wider dissemination.

Taking into account the need for wider support of the IPAB, the ACSYS SSG-VII (Tokyo, Japan, November 1998) recommended that the WCRP JSC make a formal statement in support of the IPAB encouraging more active participation of the operational meteorological agencies in the programme. Attachment 10 contains the JSC-XX (March 1999) statement on the subject.

Responding to the request of the JSC-XX, the WMO Thirteenth Congress (Cg-XIII, May 1999) gave a strong encouragement to the IPAB. The following is an extract from the section 3.2.7.13 of the Cg-XIII/PINK 3.2.7 document (World Climate Research Programme):

" Congress …particulary appreciated the value of the data being collected in the WCRP International Programme for Antarctic Buoys (IPAB) , not only to support research in the region, but also in providing valuable operational meteorological data in real-time and establishing a basis for monitoring atmospheric and oceanic changes in the Antarctic sea-ice zone. Congress urged national Meteorological Services having interests in the Southern Ocean and Antarctic to participate actively in IPAB by providing ice-resistant drifting buoys or by other appropriate means".

10.4 Reports and Representation at the DBCP Annual Meeting (D. Benner)

DB represented the IABP at the meeting. His report is given Attachment 11.

10.5 IABP Brochures and Poster (E. Hudson)

Updated brochures were produced for the following:

- DBCP October 1998 Miami Meeting. Unfortunately these brochures did not get to the meeting.
- WMO May 1999 Geneva Meetings
- US/Canada Joint Ice Working Group May 1999 Monterey Meeting
- IABP-9 June 1999 Bremerhaven Meeting

The brochure for the DBCP Meeting featured, for the first time, a “centerfold” of the integrated buoy and SSMI ice map (22 Sep 1998 map).
The 3 subsequent editions featured the 02 April 1999 buoy/ice map.

EC will continue to produce updated brochures for such meetings, the next being the fall 1999 DBCP meeting. No poster is planned but EC remains open to producing posters albeit of the 11 x 17 inch size rather than full size posters. Ed Hudson reiterated the need for photos, and buoy deployment photos in particular for future editions of the brochure and/or poster.

Ed Hudson stated that the latest integrated buoy/ice map as posted on the IABP web site is a key element of the brochures. He stated that the map would be even more useful if the map showed a boundary between 1st year ice and multi-year ice and if the buoys were flagged by year via dot color.

In lieu of a poster for IABP 9, IABP hats were produced. The hats were presented to all attendees

10.6 Location of 10th meeting

VS and Koji Shimada (KJ) each offered to host the next two meetings. It was decided that IABP-10 (2000) will be held in Geneva, Switzerland and tentatively, IABP-11 (2001) will be held in Yokosuka, Japan.

HH noted that the European Geophysical Society meeting will be held in Nice, France on 25 – 29 April, 2000. The IABP meeting should be scheduled considering these dates.

11.0 Relationship to GCOS, and GOOS?

IR returned to the question of whether the IABP should more actively pursue ties with GCOS and GOOS. This topic was already discussed at length during agenda item 4.0, and it was decided that the IABP already implicitly supports these Programmes as an action group of the DBCP.

VS noted that we may need to reconsider explicit support of these Programmes in the future. It was agreed that representatives from GCOS and (Arctic) GOOS will be invited to the next meeting of the IABP in order to explore this relationship further.

12.0 New Directions

TG revisited the issue of pursuing projects to monitor ocean variables such as temperature and salinity. IR mentioned that in addition to the efforts of JAMSTEC, the Polar Science Center is also pursuing funding from NSF for long term monitoring of the ocean using buoys. IR recommended that the IABP be able to support these projects as necessary, and noted that these projects would be opportunities to deploy CES buoys.

HH brought up the issue of what data the IABP should include in its archives. For example, would ocean data from sub-surface floats (e.g. P-ALACE) be appropriate? TG noted that it is stated in the Operating Principles that in addition to the basic meteorological variables, other variables such as atmospheric pressure tendency, wind speed and direction, snow and sea-ice properties, as well as subsurface oceanographic characteristics are desirable.

It was noted that the IABP already collects as much data as it can from all Arctic buoys for which information is available, but because of the proprietary nature of some of the data, it is not allowed to re-distribute them. However, data which has been released to the community, will be re-distributed by the IABP through the internet.

13.0 Election of Officers

A nominations committee consisting of EH and IR determined that each member of the Executive Committee was willing to serve another year. They therefore nominated them to their current positions. Nominations were solicited from other attendees.

In accordance with the IABP Operating Principles, the following officers were elected:

Chairman: Timothy Goos, Canada
Vice Chairman: Thor Kvinge, Norway
Member: David Benner, USA
Member: Ivan Frolov, Russian Federation

Ignatius Rigor was re-appointed as the Coordinator of the IABP.

14.0 Review of Meeting and Recommendations

Participants agreed that certain sections (i.e. reports and technical) were completely the responsibility of the author/contributor and were not explicitly reviewed and approved.

Participants agreed that the complete version could be circulated PRIOR to the next meeting and receive FINAL approval prior to the next meeting

15.0 Draft and Approve Meeting Minutes

Prof. Thiede, the Director of AWI, welcomed the attendees and made a short presentation on some research at AWI using the IABP data.

TG thanked Prof. Thiede and AWI for hosting the meeting and for the continued support of the IABP.

Participants reviewed the summary report and approved pending final contributions.

Attachment 1

List of Attendees

David Benner
National Ice Center
FOB#4 Room 2301
4251 Suitland Road
Washington, DC 20395-5180
Phone: +1 301 457 5314 X 101
Fax: +1 301 457 5300
bennerd@natice.noaa.gov

Etienne Charpentier
Technical Coordinator, DBCP c/o CLS
Parc Technologique du Canal
8-10 Rue Hermés
F-31526 Ramonville St. Agne
France
Phone: +33 5 61 39 47 82
Fax: +33 5 61 75 10 14
charpentier@cls.fr

Ivan Frolov
Arctic and Antarctic Research Institute
38 Bering Str., St. Petersburg
199397, Russia
Phone: +7 (812)3520096
Fax: +7 (812) 3522688
aaricoop@aari.nw.ru

Timothy Goos
Environment Canada
Atmospheric Environment Branch
Twin Atria Building, Room 200
Edmonton, Alberta T6B 2X3
Canada
Phone: +1 780-951-8847
Fax: +1 780-951-8634
tim.goos@ec.gc.ca

Hartmut Hellmer
Alfred Wegener Institut für Polar und Meeresforschung
Postfach 12 01 61
D-27515 Bremerhaven
Germany
Tel: +49 471 4831 794
Fax: +49 471 4831 797
hhellmer@awi-bremerhaven.de

Commanding Officer
ATTN: Elizabeth Horton, N31
Naval Oceanographic Office
1002 Balch Boulevard
Stennis Space Center, MS 39522-5001
Phone: +1 228 688-5725
Fax: +1 228 688-5514
hortone@navo.navy.mil

Edward Hudson
Arctic Weather Centre
Environment Canada
Twin Atria Bldg. 2nd Floor
4999 98 Avenue
Edmonton, Alberta T6B 2X3
Canada
Phone: +1 780 951 8878
Fax: +1 780 951 8602
Edward.Hudson@ec.gc.ca

Thor Kvinge
Christian Michelsen Research Institute
Fantoftvn 38
P.O. Box 6031 Postterminalen
N-5892, Bergen, Norway
Tel: +47 55.12.16.88
Fax: +47 55.12.14.36
thkvinge@online.no

Torleif Lothe
Christian Michelsen Research Institute
Fantoftvn 38
P.O. Box 6031 Postterminalen
N-5892, Bergen, Norway
Phone: +47 55 574361
Fax: +47 55 574041
Torleif.Lothe@cmr.no

Christopher O'Connors
National Ice Center
FOB# 4 Rm 2301
4251 Suitland Rd.
Washington DC 20395
Phone: +1 301 457 5303 x304
Fax: +1 301 457 5305
oconnorsc@natice.noaa.gov

Christian Ortega
Collecte Localisation Satellites
8-10 rue Hermès
Parc Tecnologique du Canal
F-31526 Ramonville, St. Agne
France
Tel: +33 61 39 47 20
Fax: +33 61 75 47 97
christian.ortega@cls.fr

Sergey Priamikov
Arctic and Antarctic Research Institute
38 Bering Str., St. Petersburg
199397, Russia
Phone: +7 (812) 3520096
Fax: +7 (812) 3522688 or 3522685
Aaricoop@aari.nw.ru

Ignatius Rigor
Polar Science Center
Applied Physics Laboratory
University of Washington
Seattle, WA 98105-6698
Phone: +1 206 685 2751
Fax: +1 206 543 3521
igr@apl.washington.edu

Victor Savtchenko
JPS for WCRP
c/o World Meteorological Organization
7 bis, Avenue de la Paix
CH-1211 Geneva 2
Switzerland
Phone: +41 22 7308 486
Fax: +41 22 7308 036 or 038
Savtchenko_V@gateway.wmo.ch

Lutz Sellmann
Stresemann Strasse 46
D-27570 Bremerhaven
Germany
Tel: +49 471 140535
Fax: +49 471 14099
sellmann@awi-bremerhaven.de

Koji Shimada
Japan Marine Science and Technology Center
Ocean Research Department
2-15, Natsushima
Yokosuka 237-0061
Japan
Tel: +81 468 67 3891
Fax: +81 468 65 3202
shimadak@jamstec.go.jp

Attachment 2

Agenda

Ninth Annual Meeting of the Participants of the INTERNATIONAL ARCTIC BUOY PROGRAMME Alfred Wegener Institute Bremerhaven, Germany, 2 - 4 June, 1999

Wednesday, 2 June 1999

0900 - 1200 IABP Business Meeting

1. Meeting Opens -- Chairman, T. Goos
   - 1.1. Welcome (Prof. Augstein).
   - 1.2. Call to order
   - 1.3. Meeting Information (H. Hellmer)
2. Agenda Approval (T. Goos)
3. Approval of Minutes of the IABP 8th Annual Meeting - 1998 (I. Rigor)
4. Review and Approval of the IABP Operating Principles (I. Rigor)
5. Coordinator's Report (I. Rigor)
6. Report from Data Buoy Co-operation Panel (DBCP) (E. Charpentier)

1300 - 1700 IABP Technical Session

7. Talks
   - 7.1. Export of sediment laden sea ice from Shelf Seas - J. Kolatschek
   - 7.2. Modeling the Arctic ocean/sea ice system - M. Karcher
   - 7.3. Argos downlink – C. Ortega
   - 7.4. JAMSTEC Research plan in the Arctic Ocean using new buoy (J-CAD) - K. Shimada
   - 7.5. AWI sea ice drift buoy – L. Sellmann
   - 7.6. Develops in the Russian Air Drop buoy - S. Priamikov
   - 7.7. ICEX and ICEXAIR Deployments 1997-1999 – T. Lothe.

Thursday, 3 June 1999

0900 - 1200 IABP Business Meeting (Continued)

8. Status Report on Membership and Letters of Intent (I. Rigor)
9. Status Reports from each Participant (T. Goos)
10. New Business (T. Goos)
    - 10.1. White Trident Deployment
    - 10.2. DBCP Technical forum (E. Charpentier)
    - 10.3. Report on IPAB (V. Savtchenko)
    - 10.4. Reports and Representation at the DBCP Annual Meeting (D. Benner)
    - 10.5. IABP Poster (E. Hudson)
    - 10.6. Location of 10th meeting (T. Goos)

1300 - 1700 IABP Business Meeting (Continued)

11. Reports on related programmes such as GCOS, GOOS, etc. (I. Rigor)
12. New Directions (T. Goos)
13. Election of Officers (T. Goos)
14. Review of Meeting and Recommendations (T. Goos)

Friday, 4 June

0900 - 1200 Conclusion

15. Draft and Approve Meeting Minutes

Attachment 3

INTERNATIONAL ARCTIC BUOY PROGRAMME

Operating Principles

(Revised, July 1998)

1. Objective

   The objective of the International Arctic Buoy Programme (IABP) is to establish and maintain a network of data buoys in the Arctic Ocean to provide meteorological and oceanographic data for real-time operational requirements and research purposes, including support to the World Climate Research Programme (WCRP) and the World Weather Watch (WWW) Programme. The Programme will build upon cooperation among those agencies and institutions with arctic interests.

2. Programme Responsibilities

   The IABP will:

   2.1. Maintain an observational data network over the Arctic Ocean using data buoys;

   2.2. Distribute basic meteorological data (atmospheric pressure, air temperature) and buoy location from the network in real time over the Global Telecommunication System (GTS) and distribute relevant additional real-time data approved for public dissemination;

   2.3. Ensure data from the network are archived; and

   2.4. Cooperate with and provide results of the Programme to other related programmes.

3. Observation Programme

   3.1. Operational Area

   The operational area of the Programme will include the central Arctic ocean and its marginal seas, excluding economic zones except where agreements of the Coastal States have been obtained.

   3.2. Variables

   Basic meteorological variables will be measured. Additional variables such as atmospheric pressure tendency, wind speed and direction, snow, and sea-ice properties, as well as subsurface oceanographic characteristics are desirable.

   3.3. Basic Network Density

   The Programme will strive to establish and maintain a basic network with observational points no more than 500 kilometers apart. As far as practical, buoys will be deployed to achieve and maintain this density over the operational area.

4. Data Acquisition and Distribution

   4.1. Transmitters

   All buoys in the basic network will be equipped with transmitters to enable transmission of basic meteorological data in real time (synoptic and asynoptic modes). The preferred approach is to collect and locate data via Service Argos using the TIROS N series of satellites or their replacements.

   4.2. Coding

   All basic meteorological data and buoy location will be coded in the approved WMO code for data buoys.

   4.3. Global Telecommunication System

   Data will be inserted by Service Argos into the Global Telecommunication System (GTS). Data collected by Participants by other means may also be inserted into the GTS.

5. Data Archiving

   5.1. Operational Archiving

   All data transmitted on the GTS will be archived by the Marine Environmental Data Service (MEDS) as the Responsible National Oceanographic Data Centre (RNODC) for Data Buoys, on

behalf of both the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO).

5.2. Research Data Base

A uniform, quality-controlled data base for ice motion and surface meteorology has been established for use by the arctic research community. Periodically these data will be submitted to World Data Centre A (Glaciology), World Data Centre B (Sea-Ice), and to MEDS.

6. Management Structure

6.1. Participants

Participants in the IABP will be operational agencies; meteorological and oceanographic institutes; research agencies; and non-governmental organizations interested in the Arctic Ocean and contributing actively to the Programme. Participants will indicate their participation in the Programme by means of a Letter of Intent.

6.2. Election of Programme Executives

The Programme will be coordinated by the Participants. The Participants will arrange for the implementation of the Programme within the framework of the Programme objective.

On an annual basis, the Participants will elect a Chair and Vice Chair and appoint a Programme Coordinator. The Chair, Vice Chair, and two representatives elected from the Participants will form the Executive Committee. Elections will be held at annual meetings of the Participants and will be decided by a simple majority if a quorum of Participants is present. A quorum will consist of at least nine Participants. If a quorum is not present at the annual meeting of Participants, elections will be by unanimous vote.

A Participant who is unable to attend the annual meeting may register a proxy vote delivered by an attending Participant if such authority is signified in writing to the Chair.

6.3. Executive Committee

The Executive Committee will be responsible for the day-to-day management of the Programme within the guidelines set at the annual meeting of Participants. The Executive Committee will provide guidance and direction to the Coordinator.

6.4. Coordinator

The Coordinator will act as the focal point for the Programme and will carry out the directives of the Executive Committee during intercessional periods. Specific responsibilities and duties of the Coordinator are contained in Appendix 1.

6.5. Funding Provisions

The Programme will be self sustaining, supported by contributions of equipment, services (such as communications, deployment, archiving, and scientific or technical advice), coordination, and monetary contributions. As necessary, the articipants will establish a budget to implement the Programme. Other funding arrangements made between the Participants will be recognized as contributions to the IABP if they further the Objective of the Programme.

6.6. Programme Review

The management structure and operation of the Programme will be reviewed atthe annual meeting of Participants. The operating principles and procedures will be reviewed and updated as necessary at the annual meeting.

This edition of the operating principles and procedures of the IABP incorporates corrections made at the Fourth Annual Meeting of the IABP, Helsinki, Finland, June 1994. It includes an updated Letter of Intent to join the IABP. It also includes the Terms of Reference for the Coordinator of the IABP. (See Appendix 1)

7. Meetings

An annual meeting of the Participants will be held at a location to be determined by the Participants.

APPENDIX 1 to
The International Arctic Buoy Programme (IABP) Operating Principles

Terms of Reference for the Coordinator of the IABP

The Coordinator will facilitate the implementation of the IABP. The Coordinator will be appointed at the annual meeting of the Participants and will be directed by the Executive Committee. The Coordinator's appointed at the annual meeting of the Participants and will be directed by the Executive Committee. The Coordinator's specific responsibilities will be as follows:

1. To monitor and receive appropriate Argos and non-Argos data from the buoy network and to prepare a monthly status report of buoy positions;
2. To stay informed of the activities of non-Argos buoy programmes and other field operations and to make those data available, as possible;
3. To liaise with Principal Investigators and managers of individual buoy programmes in the Arctic Ocean;
4. To arrange for the maintenance of a research quality data base of ice motion and surface meteorological data, and to submit through the World Data Centre A (Glaciology) to World Data Centre B (Sea-Ice) and MEDS;
5. To develop a deployment strategy to maintain an optimum buoy network in the rctic;
6. To coordinate opportunities for buoy deployment;
7. To liaise on technical aspects of buoy deployment;
8. To prepare an annual summary of resources committed to the programme;
9. To liaise with the Technical Coordinator of the Data Buoy Cooperation Panel to ensure that; a) the proper quality control of arctic data is maintained and; b) the data are distributed over GTS;
10. To arrange for the purchase of buoys and ancillary equipment, as authorized;
11. To arrange for the payment of Argos data acquisition and Argos processing fees, as authorized;
12. To prepare and distribute an annual data report;
13. To maintain a distribution list for monthly status reports and annual data reports;
14. To respond to requests from WMO, WCRP, and the International Arctic Science Committee (IASC) for reports on arctic climatology, global change, and advice on experiment design;
15. To prepare and distribute a bimonthly newsletter of activities and plans;
16. To organize the annual meeting of Participants, present a report of the preceding year's activities, and prepare a plan for the following year; and
17. To promote the IABP so as to attract potential Participants.

NOTE: Additional contractual duties of the Coordinator that may be required in thefuture will be approved through the Executive Committee.

Attachment 4

Coordinator's Report

1. Status of the buoy array when we last met - July 1998 map, 33 buoys (Figure 1).
2. Lost 23 buoys, 6 of which were near SHEBA.
3. Deployed 15 buoys.

Expr	ID	GTS Header	Month	Year	WMO #	WD	P	T	Type
282	8356	SSVX06-KARS	Jul	98	25537	12	1	1	AARI
919	14954	SSVX01-LFPW	Jul	98	25573	21	1	1	ICEX-AIR
919	14955	SSVX01-LFPW	Jul	98	25574	21	1	1	ICEX-AIR
282	8357	SSVX06-KARS	Aug	98	25538	12	1	1	AARI
282	8358		Aug	98		12	1	1	AARI
29	1793	SSVX01-LFPW	Aug	98	48533	17	1	1	ICEX-AIR
314	3690	SSVX01-LFPW	Aug	98	25011	17	1	1	ICEX-AIR
484	1351	SSVX01-LFPW	Aug	98	48532	17	1	1	ICEX-AIR
557	1904	SSVX12-KARS	Aug	98	25524	21	1	1	ICEX-AIR
557	1905	SSVX12-KARS	Aug	98	25525	21	1	1	ICEX-AIR
557	1906	SSVX12-KARS	Aug	98	25526	21	1	1	ICEX-AIR
1053	3004	SSVX12-LFPW	Aug	98	25535	17	1	1	ICEX-AIR
1053	2388	SSVX12-KARS	Sep	98	25557	32	1	1	CES
627	5313	SSVX02-CWEG	Mar	99	47538	24	1	1	EC
627	5314	SSVX02-CWEG	Mar	99	48521	24	1	1	EC

4. Current status of the buoy array - May 1999 map, 25 buoys (Figure 2, and Table 1).
5. Current buoy deployment plans (Figure 3).
   - June, 1999: SCICEX Camp
   - July, 1999: JAMSTEC – 1 or 2 buoys in Beaufort Sea.
   - August, 1999: White Trident 8 buoys in Beaufort and Chukchi Seas, contributioned by the NIC, AWI, NPI, EC, UKMO.
   - Others?

6. Recent publications:
   - Rigor, I.G., R. Colony, S. Martin, Variations in Surface Air Temperature in the Arctic from 1979-1997, J. Climate, accepted, 1999.
   - Jones, P.D., M. New, D.E. Parker, S. Martin, and I.G. Rigor, Surface air temperature and its changes over the past 150 years, Rev. of Geophysics, V. 37, no. 2, p. 173, 1999.
   - 1997 Buoy report is now available and we should have the 1998 report available in the next month.

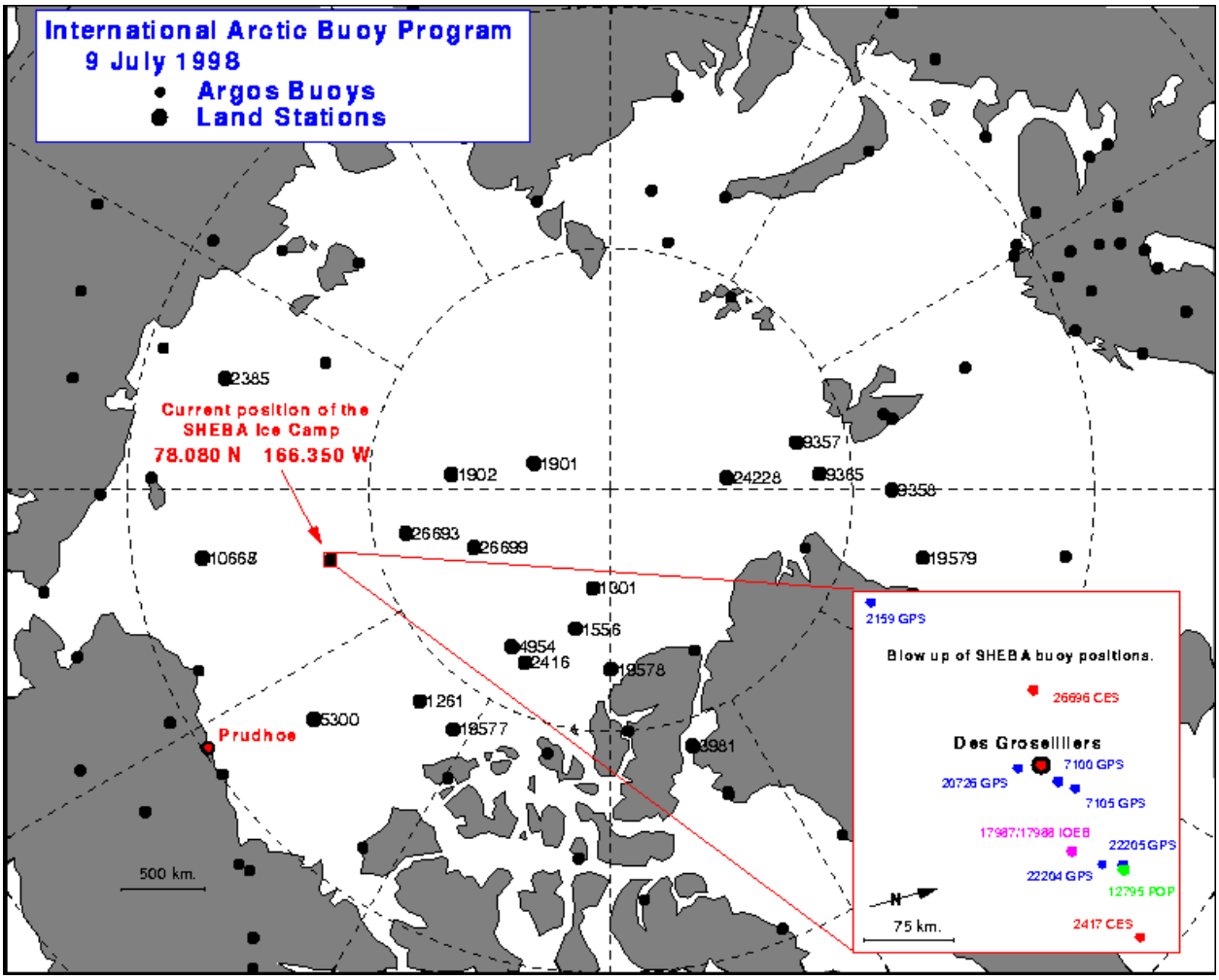


Figure 1: Buoy Array on 9 July 1999. The position of the buoys around the SHEBA ice camp are also shown in the inlay to the right of the map.

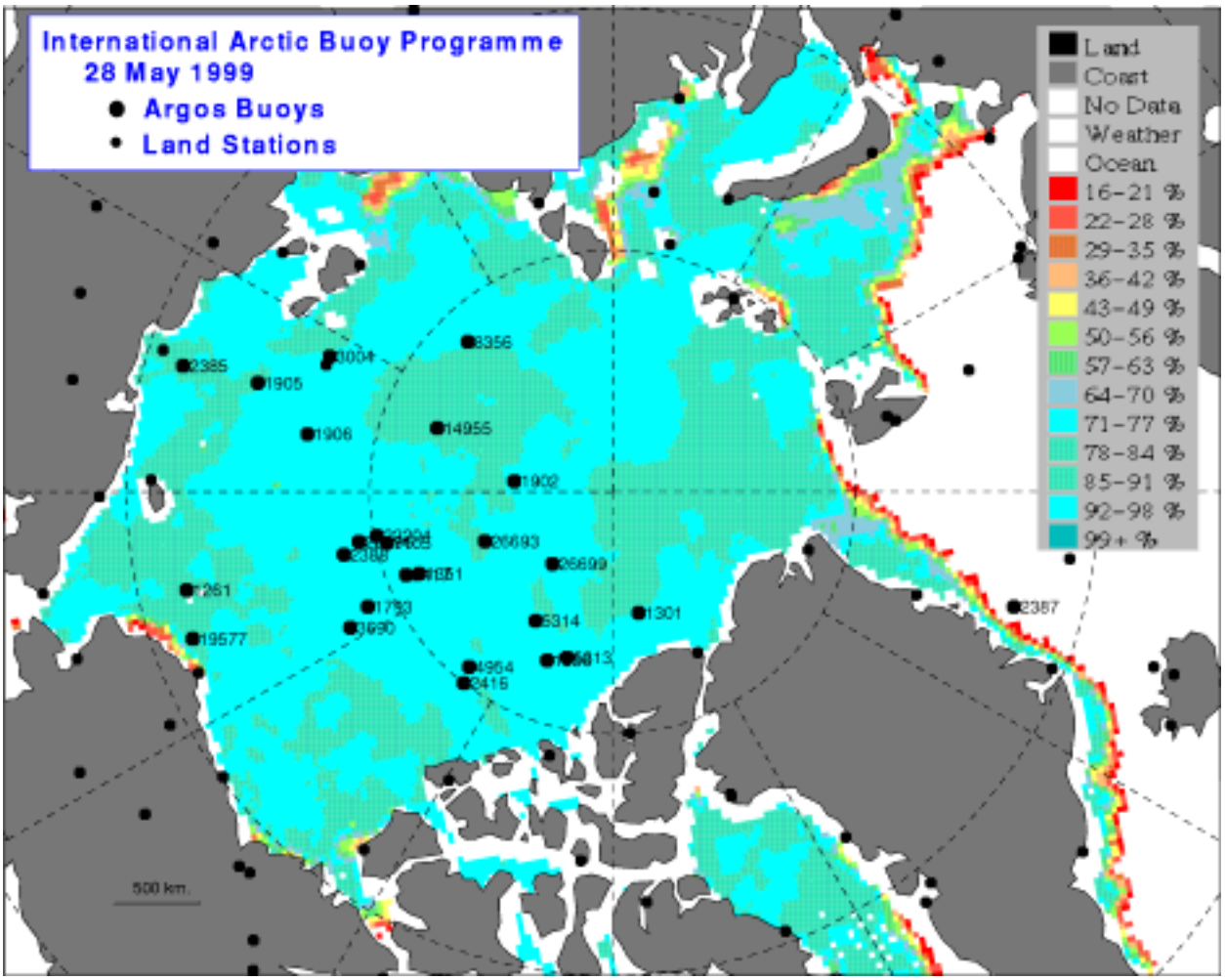


Figure 2. Buoy array on 28 May 1999. The ice concentration as analyzed by NCEP is also shown.

Table 1. Buoy Information

28 May 1999

DATE DEPLOYED	ARGOS ID	WMO ID	EXPR #	GTS HEADER	LAT	LON	DATA BYTES	P	T	BUOY DESCRIPTION
Aug 96	1261	48102	484	SSVX01-LFPW	71.808	-167.166	17			ICEX-AIR
Apr 98	1301	48581	1053	SSVX02-CWEG	84.866	-78.064	16	X	X	Metocean 'TOGA
Aug 98	1351	48532	484	SSVX01-LFPW	81.285	-156.415	17	X	X	ICEX-AIR
Aug 96	1556	48111	314	SSVX01-LFPW	82.481	-111.011	16			ICEX-AIR
Aug 98	1793	48533	29	SSVX01-LFPW	78.785	-154.398	17	X	X	ICEX-AIR
Aug 97	1902	25522	557	SSVX12-KARS	85.855	174.440	21	X	X	ICEX-AIR
Aug 98	1905	25525	557	SSVX12-KARS	74.708	163.060	21	X	X	ICEX-AIR
Aug 98	1906	25526	557	SSVX12-KARS	77.189	169.820	21	X	X	ICEX-AIR
Aug 97	2385	25549	1053	SSVX12-KARS	71.586	163.591	17	X		ICEX-AIR
Sep 98	2388	25557	1053	SSVX12-KARS	78.615	-166.349	32	X		CES / Zeno Ice Buoy
Apr 98	2416	47523	1053	SSVX02-CWEG	79.978	-127.920	32		X	ZENO-3200
Sep 97	2417	48572	1053	SSVX02-CWEG	80.782	-157.429	16	X		CES / Zeno Ice Buoy (SHEBA)
Aug 98	3004	25535	1053	SSVX12-KARS	77.057	154.932	17	X	X	ICEX-AIR
Aug 98	3690	25011	314	SSVX01-LFPW	77.729	-152.620	21	X	X	ICEX-AIR
Apr 98	4954	48580	1053	SSVX02-CWEG	80.625	-129.330	32	X	X	ZENO-3200
Mar 99	5313	47538	627	SSVX02-CWEG	83.000	-104.200	16	X	X	EC
Mar 99	5314	48521	627	SSVX02-CWEG	84.000	-120.100	16	X	X	EC GPS
Sep 97	7105		695		80.436	-166.590	32			PMEL GPS Buoy (SHEBA)
Jul 98	8356	25537	282	SSVX06-KARS	81.499	134.137	12	X	X	AARI Air Drop
Aug 98	14955	25574	919	SSVX01-LFPW	82.243	160.835	21	X	X	ICEX-AIR
Aug 96	19577	47601	1053	SSVX12-KARS	71.686	-161.094	16			ICEX-AIR
Sep 97	22204		695		80.110	-168.848	32			PMEL GPS Buoy (SHEBA)
Mar 96	26693	48578	1053	SSVX02-CWEG	84.296	-158.398	32	X		CES / Zeno Ice Buoy
Sep 97	26696	48576	1053	SSVX12-KARS	79.339	-168.362	32	X	X	CES / Zeno Ice Buoy (SHEBA)
Jul 96	26699	48573	1053	SSVX02-CWEG	86.079	-129.858	32			CES / Zeno Ice Buoy

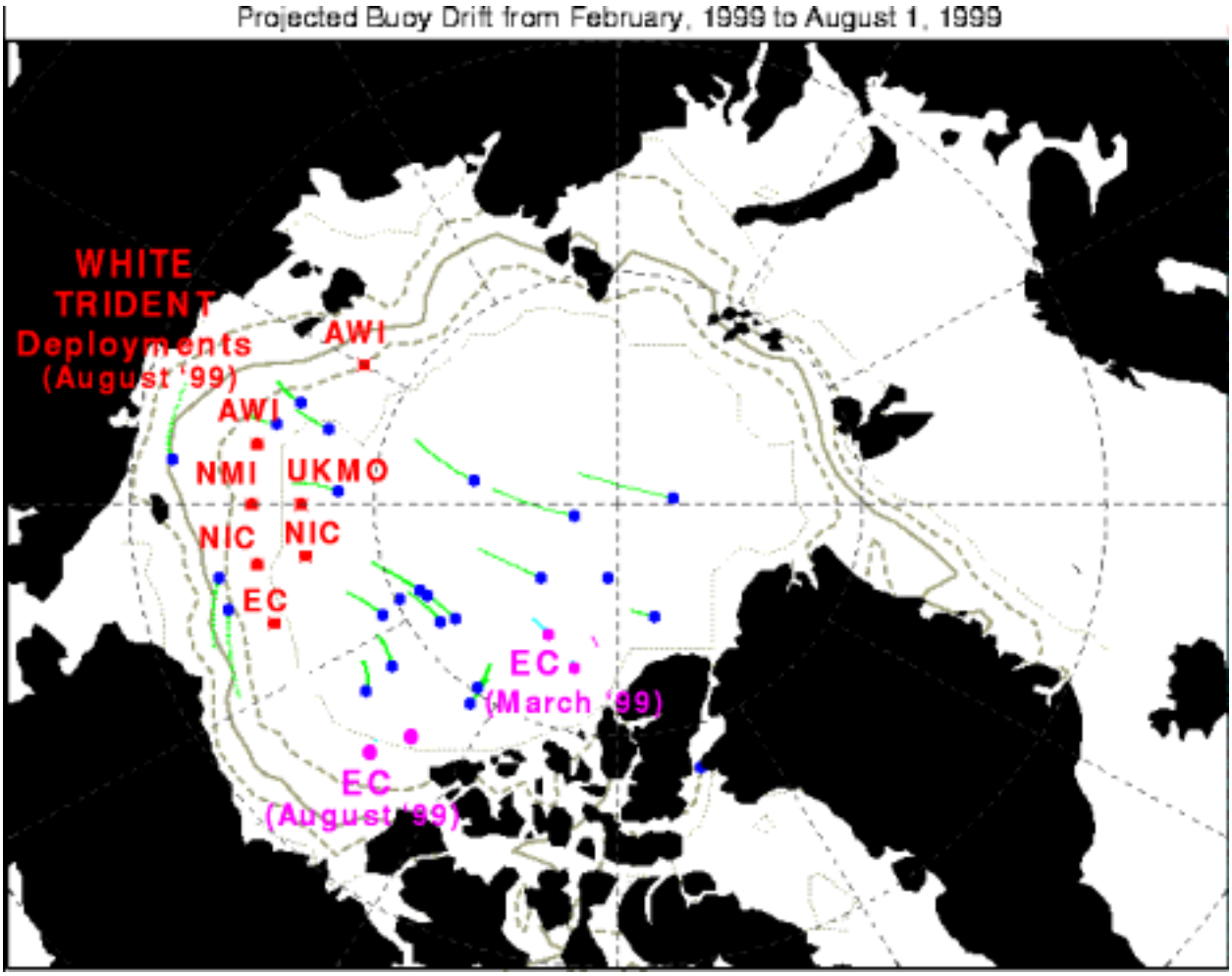


Figure 3. IABP deployment plans for 1999. The green streaks show the expected trajectory of the buoy array from February to August 1999. The blue ● show their expected positions on August 1, 1999.

- Last March, Environment Canada (EC) deployed 2 buoys north of the Canadian Archipelago. (magenta ● with cyan streaks).
- In August, EC plans to deploy 2 more CALIB buoys in the Beaufort Sea (magenta ● with no streaks).
- And also in August, the U. S. Navy WHITE TRIDENT operation will deploy 7 buoys in the East Siberian and Chukchi Seas (red ●). These buoys were contributed by:
    - Alfred Wegener Institute (2)
    - Environment Canada (1)
    - Norwegian Meteorological Institute (NMI) (1)
    - UK Meteorological Office UKMO (1)
        - US National Ice Center (NIC) (2).

Attachment 5

Report of the Data Buoy Co-operation Panel

1. Present status of buoy programmes

During the last two weeks of April 1999, a total of 1327 drifting buoys reported through the Argos system. 740 of the buoys reported their data onto the GTS (i.e. about 56%). The remaining buoys (44%) do not report on GTS for the following reasons:

- GTS distribution not effective yet: 15%
- Confidential: 8%
- Not relevant (tests, short duration, oil spill tracking, fishing buoy): 10%
- Unknown: 10%
- Other (technical obstacle, poor quality, ending programme): 1%

Those 1327 drifting buoys belong to operators from 20 countries, namely:

Country	Drifting buoys	GTS
Argentina	2	0
Australia	18	17
Brazil	17	9
Canada	13	3
China	4	0
France	54	34
Germany	65	10
Iceland	12	9
India	12	5
Italy	10	0
Japan	46	10
Korea	2	0
Netherlands	5	2
New Zealand	18	6
Norway	8	7
Portugal	4	0
South Africa	46	38
Taiwan	2	0
United Kingdom	89	15
USA	950	575

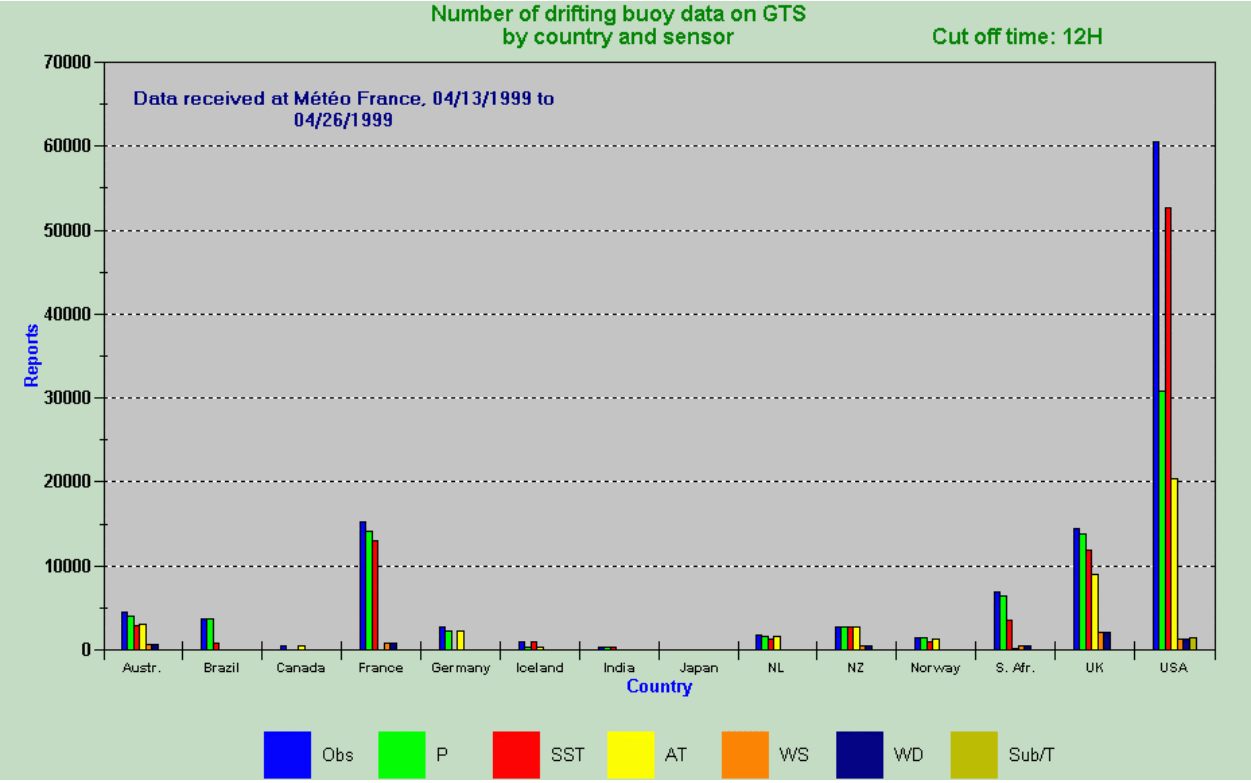
Moored buoy programmes for buoys deployed in the high seas are taken care of mainly by the following programmes (data are being distributed on GTS):

- The TAO array (http://www.pmel.noaa.gov/toga-tao/home.html)
- The PIRATA Programme (http://www.ifremer.fr/orstom/pirata/pirataus.html)
- The TRITON Programme (http://www.jamstec.go.jp/jamstec/OCEAN/TRITON/index.html)

Among the drifting and moored buoys which are reporting on GTS, the following variables are being measured (valid for buoy data received from GTS at Météo France during the period 13-26 April 1999):

Variable	Buoys	Reports /day	Remark
Air pressure	286	5137	
Sea Surface temperature	757	6012	
Air temperature	201	2612	
Wind	91	532	Mainly moored buoys
Air pressure tendency	225	2270	
Air relative humidity or dew point temperature	70	182	
Sub-surface temperatures	88	153	Mainly TAO array moored buoys; small number of drifting buoys with thermistor strings plus
Waves			Small number of buoys

Distribution by country is summarised in graphic below:



2. DBCP session and workshop

2.1. 14th DBCP session was held in Marathon, Florida, 12-16 October 1998. Scientific and Technical workshop was organised during the first 1 day and 1/2 of the DBCP Session. More than 50 people attended workshop and 20 presentations were made covering subjects such as (i) innovative concepts in moored and drifting buoy design and application, (ii) applications of and scientific results deriving from buoy data in research or operations, and (iii) buoy data as a

complement to remote sensing, modelling, and other disciplines. Workshop's proceedings will be published in 1999 within DBCP document series.

2.2. DBCP noted with appreciation application from TIP to become an Action Group of the DBCP. This was then formalised by the Chairman of the DBCP prior to the DBCP session.

2.3. David Benner attended the DBCP session and presented the IABP, its objectives, operating principles, and activities. He reported that in October 1998, the IABP operated 34 buoys, 95% of which were reporting on GTS. Dave also mentioned that 1998 represented the 20th anniversary of the Arctic Buoy Program and that in celebration of this anniversary, the IABP hosted a DBCP-sponsored conference entitled «The Arctic Buoy Programme - Scientific Achievements from the first 20 years» in Seattle, Washington on August 3-4, 1998. Conference presentations highlighted the use of IABP data in various scientific research areas including: the role of the Arctic Ocean on climate, decadal changes in large-scale atmospheric forcing and sea ice drift, transport of pollutants entrained in ice, global model verification and studies on structural changes to polar oceanographic phenomena such as the Arctic Cold Haline Layer and North Atlantic Deep Water formation.

2.4. 15th DBCP session will be held in Wellington, New Zealand, 26-30 October 1999.

3. Global Implementation

3.1. GOOS/GCOS Implementation plan

The DBCP was informed of the proposals within WMO and IOC to merge the existing WMO Commission for Marine Meteorology (CMM) and the IOC/WMO Integrated Global Ocean Services System (IGOSS) into a new joint Commission for Oceanography and Marine Meteorology (JCOMM). This Commission would be the reporting and coordinating mechanism for the DBCP and other existing bodies such as TIP, SOOPIP, etc. The proposal was adopted by the IOC EC in November 1998, and will be submitted to the WMO Congress (April 1999) and the IOC Assembly (June/July 1999) for final approval in mid-1999. The panel gave its full support to the concept of JCOMM, and agreed that it should eventually use JCOMM as the overall coordinating and management mechanism for its input to and support for GOOS and GCOS.

The Workshop on the Implementation of Global Observations for GOOS/GCOS (Sydney, March 1998) had for primary objective to enlist the coordinated support of existing operational ocean observing system implementation and data management mechanisms for the implementation of specified requirements for global ocean physical data for seasonal and inter-annual climate monitoring and prediction. The workshop had reviewed and analysed the status and capabilities of these mechanisms in the context of the stated requirements, assessed a number of cross-cutting issues for all existing systems, and developed a set of immediate implementation action items. To oversee the implementation of these actions, finalise a detailed Implementation Action Plan for GOOS/GCOS, and begin the specification of coordination strategies, the workshop established an interim Implementation Advisory Group, chaired by the chairman of I-GOOS and including representatives of all existing mechanisms (the technical Coordinator for the DBCP).

This IAG held its first meeting in Paris, on 30 November 1998, and was hosted by Météo France. The meeting reviewed the draft "Global Ocean Observations for GOOS/GCOS, an action plan for existing bodies and mechanisms" document. The participants reported on the existing bodies and operational implementation mechanisms. Data management and exchange mechanisms were reviewed. Issues relating to initial observing systems for physical observation for GOOS/GCOS, including system analysis, categories (surface, sub-surface, sea level), and unifying networks were discussed in detail. Cross-cutting of observing systems, responsibilities, implementation coordination, and management were also discussed in detail. A new draft document was produced by the Secretariats and discussed at the GOOS Steering Committee in April 1999. Final version should be available at the first transition planning meeting for JCOMM which will be held in Saint Petersburg, 19-23 July 1999.

3.2. DBCP Implementation plan

The panel recognised the importance of the Sydney workshop, of the actions taken there, and of the follow-up mechanisms put in place, to the development of a fully coordinated approach to the implementation of GOOS/GCOS and ultimately to the development of truly operational oceanography. In the context of the proposed GOOS/GCOS Implementation Action Plan, the panel recognised the value of its own Implementation Strategy. It therefore reviewed the most recent draft of the strategy, prepared by Mr David Meldrum on the basis of comments offered at DBCP-XIII and of the results of the Sydney workshop. It approved this draft. DBCP implementation plan is now finalised and will shortly be published within the DBCP document series, as well as made available on the DBCP web site.

4. Information exchange

4.1. DBCP Web server

The DBCP web server (http://dbcp.nos.noaa.gov/dbcp) has been substantially upgraded in the last 12 months. New information added includes description and access to the monthly buoy monitoring statistics, status graphics, information regarding the GTS and how to practically insert buoy data on GTS, data flow monitoring tools, DBCP publications in electronic form, and a document describing existing and planned data collection and/or location systems potentially available for buoy applications.

The map showing the DBCP Action Groups is now clickable with links to the AG web sites (e.g. IABP for the Arctic Ocean) depending upon where you click on the map. A menu item has been added to describe Argos message formats recommended by the DBCP (see paragraph 7). Those recommended formats presently include:

- Format proposed by Météo France
- SVPB so called 2-page format
- SVP standard drifter

Among possible improvements to the DBCP web site, MEDS, Canada, offered to provide access to archived QC messages produced by PMOCs in the context of the DBCP QC Guidelines.

IABP is invited to share its experience and submit information regarding the following issues in electronic form to the Technical Coordinator of the DBCP for publication via the DBCP web site:

- Buoy deployment methods
- Buoy recovery methods
- Buoy deployment opportunities or plan

IABP annual report to the DBCP should also be submitted in electronic form for publication via the DBCP web site.

4.2. DBCP Brochure

A brochure advertising the DBCP and its activities has now been published. Action groups are invited to express how many copies they desire for distribution by Chairmen, vice-Chairmen, Coordinators, and Participants.

4.3. DBCP Internet technical forum

In May 1999, the DBCP did open an Internet technical forum (http://www-dbcp.cls.fr) as a mean of debating on technical issues, answer technical questions, and exchange information among buoy operators or actors. The forum is a good complement to the DBCP web site and is directly linked to it. Documents, questions and answers can be exchanged over the forum while being accessible to anybody in the buoy community.

The forum presently includes the following themes:

- Argos (open to everyone)
- DBCP (open to everyone)
- GTS (open to everyone)
- SVPBW evaluation (reserved for DBCP evaluation group)
- Plus a DBCP team (reserved to DBCP members, including Action Groups).

If desired, new teams dedicated to DBCP Action Groups could be created on the forum with privileged access for AG Participants.

4.4. New DBCP publications:

The DBCP recently published the following documents within its Technical Document series:

- No. 11: DBCP annual report for 1997
- No. 12: October 1997 DBCP Workshop's report (La Réunion)
- No. 13: DBCP annual report for 1998
- No. 14: October 1998 DBCP Workshop's report (Marathon)

The following documents will soon be published:

- DBCP Document No. 4 (SVPB construction manual) is being updated. New version will be published as a DBCP publication and will be available via the web.
- DBCP implementation plan will be published as a DBCP publication

5. Buoy monitoring statistics

Algorithms for computing the buoy monitoring statistics produced by ECMWF, NCEP, UKMO, and Météo France have been substantially modified for greater consistency. A comprehensive report describing algorithms and remaining discrepancies is now available via the DBCP web site at http://dbcp.nos.noaa.gov/dbcp/monstats.html.

6. SVPBW evaluation group

A DBCP sub-group on SVPBW/Minimet has been created by the DBCP. Purpose of the sub-group is to deploy test drifters in all sorts of sea conditions, evaluate data, suggest hardware/software design changes, share experience, etc...

Sub-group will work through mail exchange and use the newly established DBCP technical forum (http://www-dbcp.cls.fr) for basic open discussion, record of those discussions and publication of intermediary or final results.

A "SVPB/SVPBW evaluation" sub-forum has been created in the DBCP technical forum where only sub-group participants can upload discussion topics and documents while all documents posted are available to everybody.

The sub-group will meet at DBCP workshops.

Sub-group presently includes the following people:

- Elizabeth Horton, Navoceano (chair)
- Pierre Blouch, Météo France
- Wynn Jones, UKMO
- Graeme Brough, BOM
- Peter Niiler, SIO
- Etienne Charpentier, DBCP
- Ray Mahr, Metocean
- Jeff Wingenroth, Technocean
- Gary Williams, Clearwater Instrumentation

The group is open to anybody who can provide something for the evaluation, namely:

- Drifters to deploy
- Deployment opportunities
- Archived data
- Expertise
- Software development (e.g. by buoy manufacturer)
- Design suggestions according to evaluation

Any other person interested in participating in the evaluation group should contact Elizabeth Horton.

7. GTS

7.1. BUFR

Report on DBCP views on BUFR was formally submitted to CBS by the chairman of the DBCP, and discussed at the CBS sub-group on data representation and codes, and CBS working group on data management. The proposal was formally adopted at the CBS extraordinary session in Karlsruhe, October 1998. Proposed changes are due for May 2000.

7.2. New GTS bulletin headers

The DBCP discussed a proposal from the NOAA GOOS center for a restructuring of the system of bulletin header assignment for buoy data distributed on the GTS. The present system essentially groups buoy reports into bulletins based on the geographical location of the buoys, which is advantageous particularly for small forecast centres concerned only with limited areas.

The proposal was for reports to be grouped into bulletins based on specific programmes and/or action groups, which would greatly facilitate programme monitoring and remedial action to correct any problems detected. It was recognised that the proposal was technically feasible, that global processing centres would not be affected one way or the other since they took all the data in any case, and that programmes and action groups were usually regionally based, except for the GDP, for which two bulletin headers could be assigned under the proposal, one for each of the hemispheres. The panel therefore considered that the concept had merit, and requested the Technical Coordinator and Mr W. Woodward to prepare a specific proposal for a new set of bulletin headers within this concept, making as much use as possible of the existing header assignments.

A proposal has been circulated among key players. A new list has been agreed upon and is proposed for implementation on the 13 October 1999 at 15UTC:

- Table 1: Data distributed from the US Argos Global Processing Centre, Largo, USA

Bulletin header	Deployment area	Remark
SSVX02 KARS	GDP	New
SSVX04 KARS	North Atlantic and EGOS	Same
SSVX06 KARS	Northern Hemisphere	Same
SSVX08 KARS	TAO, PIRATA	Was SSVX40 for TAO
SSVX10 KARS	Southern Hemisphere and ISABP	Same
SSVX12 KARS	Arctic, Antarctic, sea ice	Arctic, Antarctic merged
SSVX14 KARS	Indian Ocean and IBPIO	New
SSVX16 KARS	Navoceano	Same
SSVX18 KARS	Pacific Ocean	New
SSVX20 KARS	Navoceano	Same
SSVX22 KARS	Mediterranean sea	New
SSVX42 KARS	NOAA/NDBC, Southern Hemisphere	Was SSVX02
SSVX44 KARS	NE Pacific Ocean (USA, and Canada)	Was SSVX18
SSVX48 KARS	NOAA/NDBC, Northern Hemisphere	Was SSVX08
SSVX96 KARS	NDBC	Same

- Table 2: Data distributed from the French Argos Global Processing Centre, Toulouse, France

Bulletin header	Deployment area	Remark
SSVX01 LFPW	North Atlantic and EGOS	Same
SSVX03 LFPW	Southern Hemisphere and ISABP	Same
SSVX05 LFPW	Northern Hemisphere	Same
SSVX07 LFPW	Arctic, Antarctic, and sea ice	Arctic, Antarctic merged
SSVX09 LFPW	Indian Ocean and IBPIO	New
SSVX11 LFPW	TRITON	New
SSVX13 LFPW	GDP	New
SSVX15 LFPW	Pacific	New
SSVX21 LFPW	Mediterranean Sea	New
SSVX39 LFPW	French West Indies	Was SSVX19

Remark concerning GDP: since GDP drifters deployed world-wide may also participate in a DBCP regional action groups (e.g. ISABP if deployed in the South Atlantic), we have to agree on a policy on what GTS bulletin header to choose. Considering that GDP header was created basically for tracking Lagrangian drifters, it sounds reasonable to recommend to have all Lagrangian drifters participating in GDP report under GDP bulletin header and not under the other DBCP Action Group it is participating in. For example, a Lagrangian drifter participating in both

GDP and ISABP (South Atlantic) and which data are distributed from the French Argos Global Processing Center would report under SSVX13 LFPW (i.e. GDP) bulletin header, and not under SSVX03 LFPW (i.e. Southern Hemisphere).

Backup procedure: Backup procedure in case one of the two Argos global processing centres fails does not change. If one centre fails, the other centre processes all the data, i.e. the data it normally processed plus the data the other centre normally processes. Hence, when an Argos centre is in backup mode, it will generate bulletins with even and odd numbers (in normal mode, only even numbers are used by Largo, and odd numbers by Toulouse). In other words:

- In case the French Argos Global Processing Center in Toulouse fails, the US Argos Processing Center in Largo is switched to backup mode. In that case, GTS bulletins normally distributed from Toulouse under TTAAii LFPW bulletin headers are distributed from Largo under TTAAii KARS bulletin headers (e.g. SSVX01 LFPW becomes SSVX01 KARS and is sent out from Largo).

- In case the US Argos Global Processing Center in Largo fails, the French Argos Processing Center in Toulouse is switched to backup mode. In that case, GTS bulletins normally distributed from Largo under TTAAii KARS bulletin headers are distributed from Toulouse under TTAAii LFPW bulletin headers (e.g. SSVX04 KARS becomes SSVX04 LFPW and is sent out from Toulouse).

7.3. GTS Sub-system

Below is the list of recent improvements that have been realised with the Argos GTS sub-system:

- GTS Technical file read and write access via Email,
- Direct distribution of data from the GTS sub-system to Argos users,
- Data processing of BOM shipboard data and distribution in SHIP format,
- Computation of water salinity based upon water conductivity, temperature, and pressure,
- Implementation of new Qa field in BUOY reports,
- Implementation of an up to date geo-magnetic variation model for buoys measuring wind direction using compass,
- Data processing of relative humidity and daily SST for TAO buoys,
- New Quality Control automatic test for Argos XBTs, specific algorithm for computing air pressure tendency based upon P(H) and P(H-3),
- Data processing of JAMSTEC TRITON moored buoys.

Below is the list of improvements that are about to be realised within the Argos GTS sub-system:

- Rounding observation times to the nearest 5, 10, 15, 30 minutes or synoptic time. Previously rounding was only possible to the nearest second, minute, or hour. This should permit to avoid a number of duplicates for certain types of buoys.

- Specific algorithms for eliminating quasi duplicates (i.e. difference between observation times for the same platform less than a few minutes).

8. Argos message formats

Météo France presented a new Argos message format, initiated at the request of EGOS, which could be proposed as a standard for buoy operators designing or planning their buoy programme. Proposed format permits flexibility and transmission of historical as well as real time data. Age of observation is encoded in the message and one message contains only one observation. Historical data are split among consecutive Argos messages. Message length is optimised in order to limit its size as much as possible so that power budget permits extension of buoy operating life time.

Considering past experiences in this regard, the panel decided that it was not in a position to recommend a particular standard format but recognised the advantages of standard formats as developed by Météo France, EGOS, GDP, and other buoy operators. It therefore decided that it was worthwhile to publish a list of available formats via its web server, including those listed above, and encouraged new buoy operators looking for advice or expertise to use one of those. Advantages of listed formats should also be detailed. Although buoy operators are free to develop and use their own formats, usage of existing formats permits to substantially speed up insertion of buoy data onto the GTS through the Argos users' guidance offices.

Present list available on the DBCP web site includes format proposed by Météo France, SVPB so called 2-page format, and SVP standard drifter. This list can be extended in case IABP expresses the desire of adding IABP standard formats.

9. Argos Joint Tariff Agreement

18th session of the Argos Joint Tariff Agreement (JTA) was held in Marathon, Florida, USA, 19-21 October 1998. Following important decisions were taken:

- Bonus system is still accepted. About 16% of the 35% bonus had actually being used by countries in 1998. An additional 35% (compounded) bonus is granted for 1999 if applicable.

- Basic Tariff for standard location and data collection is maintained at 26000 FF.

- Maintain Argos revenues in 1999 at least at the level of 1998. Commitments to the 1999 JTA, as of 15 January 1999, should be at least equal to 1130 (1% inflation included based upon original JTA-17 bid). If below, difference will be made up through a pro rata assessment based upon percentage of bonus usage for those countries having taken advantage of this bonus.

- A fixed monthly fee per active platform is to be enacted in the 2000 JTA and onwards.

- Penalty charge introduced for 1999 contract for usage above 35% compounded bonus in case bonus applies and above contracted figure if no bonus applies.

Attachment 7

ICEX and ICEXAIR Deployments under the IABP 1996-1999

Torleif Lothe
Christian Michelsen Research A/S

A total of 19 ICEX and ICEXAIR buoys have been deployed in the Arctic under the International Arctic Buoy Programme (IABP) since 1996, and an additional 8 are scheduled for deployment in 1999. The overall majority of these buoys have a White Trident history (figure 1). As of June 1999, 12 of these were still operating in the Arctic Ocean.

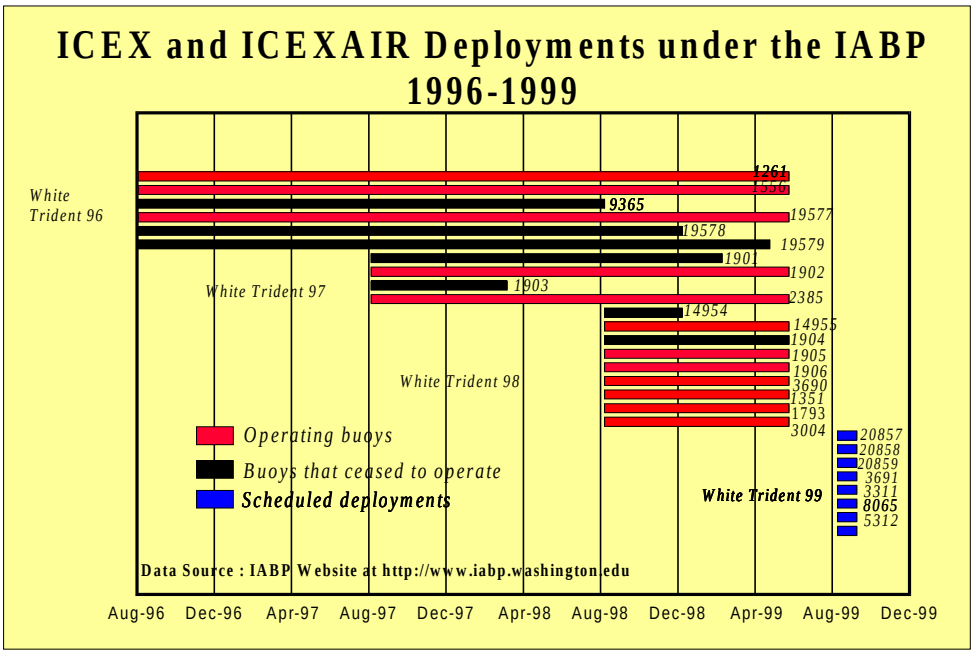


Figure 1 - Gantt- diagram showing the successive deployments and operational lifetime of all White Trident Deployments since 1996. By June 1999, 12 were still operating in the Arctic Ocean. (Data from IABP website at http://www.iabp.washington.edu)

During the same period a total of 14 ICEX and ICEXAIR ceased to operate. Their lifetime ranged from 127 to 1174 days, with an average of 652 days (figure 2).

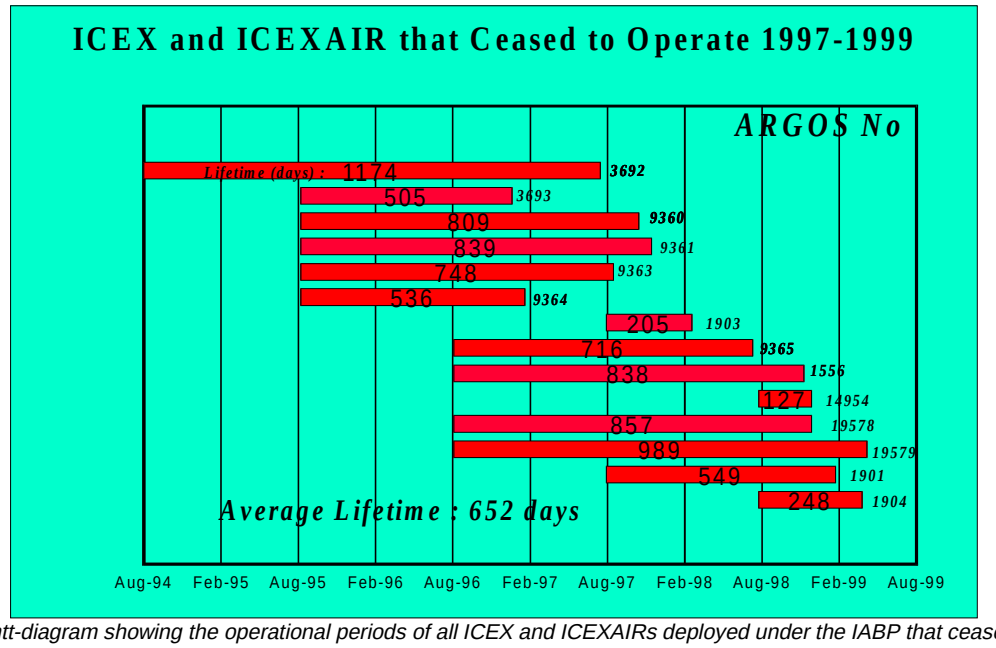


Figure 2. Gantt-diagram showing the operational periods of all ICEX and ICEXAIRs deployed under the IABP that ceased to operate 1997-1999. (Data from IABP website at http://www.iabp.washington.edu)

Based upon data from open ocean drifters in the North Atlantic, CMR has performed a study of the power consumption of the GPS. As the average power consumption of a GPS positioned system is heavily related to how much time the GPS needs to update, the GPS update time has been included in the new versions of ICEX. Investigation of open ocean drifters in the North Atlantic indicates that a GPS positioned system uses slightly less power than a standard system. This is due to the fact that a longer transmission interval may be used for GPS positioned buoys. Even if the message has to be longer to transmit GPS position, the overall budget is still slightly in favour of the GPS. Figure 3 shows an example of GPS computation time form an open ocean drifter in the North Atlantic. The average GPS computation time is about 3 minutes. Using this figure for the GPS computation time, the average power consumption of a GPS positioned buoy is 114 mW. The average power consumption of a standard system is 105 mW.

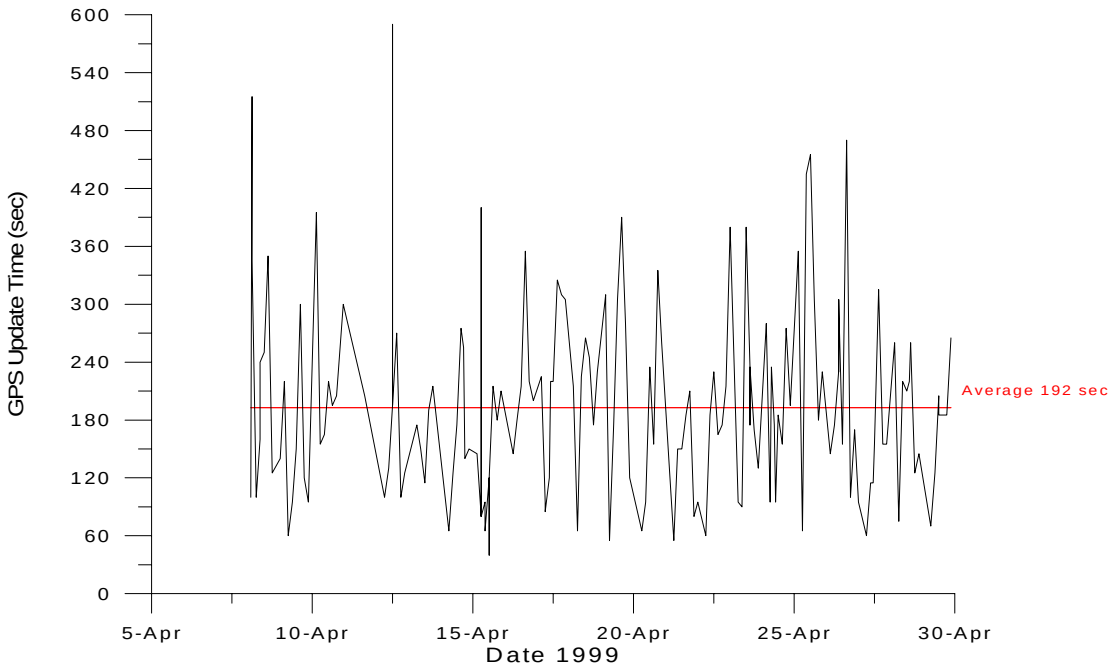


Figure 3. The time required in seconds for a GPS installed on an open ocean drifter to update the position. Data from the German Drifter 2295 WMO No 65594.

Attachtment 7

Membership and Letters of Intent

Participant	Contact
Environment Canada Twin Atria Bldg. 2nd Floor 4999 98 Avenue Edmonton, Alberta T6B 2X3 Canada	Ed Hudson Tel: 1 403 951 8629 Fax: 1 403 951 8762 Edward.Hudson@ec.gc.ca
Institute of Ocean Sciences P.O. Box 6000 Sidney, B.C. V8L 4B2 Canada	Humfrey Melling Tel: +1 604 363 652 Fax: +1 604 363 6746 mellingh@dfo-mpo.gc.ca
Marine Environment Data Service 200 Kent Street 1202 Ottawa, Ontario K1A OE6 Canada	Paul-André Bolduc Tel: +1 613 990 0231 Fax: +1 613 993 4658 bolduc@ottmed.meds.dfo.ca
Arctic Centre University of Lapland P.O. Box 122 SF-96101 Rovaniemi Finland	Manfred Lange Tel: +49 251 83 3591 Fax: +49 251 83 8397 manfred.a.lange@t-online.de
Collecte Localisation Satellites 18 Avenue Edouard-Belin FR-31055 Toulouse CEDEX France	Christian Ortega Tel: +33 61 39 47 20 Fax: +33 61 75 10 14 c.ortega@cls.cnes.fr
Alfred Wegener Institut für Polar und Meeresforschung Postfach 12 01 61 D-28359 Bremerhaven Germany	Hartmut Hellmer Tel: +49 471 4831 287 Fax: +49 471 4831 425 hhellmer@awo-bremerhaven.de
Japan Marine Science and Technology Center Ocean Research Department 2-14, Natsushima Yokosuka 237 Japan	Shinya Kakuta Tel: +81 468 67 3463 Fax: +81 468 65 3202 kakutas@jamstec.go.jp
Christian Michelsen Research Institute Fantoftvegen 38 N-5036 Fantoft Norway	Thor Kvinge Tel: +47 55.12.16.88 Fax: +47 55.12.14.36 thkvinge@online.no

Nansen Environmental and Remote Sensing Center Edvard Griegsvei 3A N-5037 Bergen – Solheimsviken Norway	Ola M Johannessen Tel: +47 55 29 72 88 Fax: +47 55 20 00 50 Ola.Johannessen@nrsc.no URL: http://www.nrsc.no/
Norwegian Meteorological Institute Postboks 320-Blindern N-0313 Oslo Norway	Knut Bjørheim Tel: +47 22 96 30 00 Fax: +47 22 96 30 50 knut.bjorheim@dnmi.no
Norsk Polarinstitutt Polarmiljøsenteret Hjalmar Johansensgt. 14 Postboks 399 N-9001 Tromsø Norway	Reinert Korsnes Tel: +47 77 75 05 00 Fax: +47 77 75 05 01 reinert.korsnes@tromso.npolar.no
Arctic and Antarctic Research Institute 38, Bering Street 199397 St. Petersburg Russian Federation	Ivan Frolov Tel: +7 812 351 0319/1520 Fax: +7 812 352 2688 aaricoop@aari.nw.ru
Russian Federal Service for Hydrometerology and Environmental Monitoring ROSGIDROMET 12 Novovagan'kovsjy Street 123242 Moscow Russian Federation	Sergey Hodkin Tel: +7 095 252 0728 Fax: +7 095 255 2400
World Climate Research Programme c/o World Meteorological Organization 7 bis, Avenue de la Paix CH-1211 Geneva 2 Switzerland	Victor Savtchenko Phone: +41 22 7308 486 Fax: +41 22 7308 036 or 038 savtchenko_v@gateway.wmo.ch
United Kingdom Meteorological Office Beaufort Park Easthampstead, Wokingham Berkshire, RG40 3DN United Kingdom	Wynn Jones Tel: +44 1 344 855 603 Fax: +44 1 344 855 897 dwjones@meto.gov.uk
Scott Polar Research Institute University of Cambridge Lensfield Road Cambridge CB2 1ER United Kingdom	Peter Wadhams Tel: +44 1223 336 542 Fax: +44 1223 336 549 pw11@cam.ac.uk
National Ice Center 4251 Suitland Road Washington DC 20397-5180 USA	Dave Benner Tel: +1 301 457 5314 ex 301 Fax: +1 301 457 5300 bennerd@natice.noaa.gov

Naval Meteorology and
Oceanography Command
1002 Balch Blvd.
Stennis Space Center, MS 39522-50029
USA

Elizabeth Horton
Tel: +1 228 688 5725
Fax: +1 228 688 5514
hortone@navo.navy.mil

Pacific Marine Environmental Laboratory
Bldg. 3
Bin C15700 CB 357940
7600 Sand Point Way NE
Seattle, WA 98115-0070
USA

James Overland
Tel: +1 206 526 6824
Fax: +1 206 526 6485
overland@pmel.noaa.gov

Polar Science Center
Applied Physics Laboratory
University of Washington
1012 NE 40th Street
Seattle, WA 98105-6698
USA

Ignatius Rigor
Tel: +1 206 685 2751
Fax: +1 206 543 3521
igr@apl.washington.edu

Service Argos
1801 McCormick Drive, Suite 10
Landover, MD 20785
USA

Archie Shaw III
Tel: +1 301 925 4411
Fax: +1 301 925 8995
shaw@argosinc.com

Woods Hole Oceanographic Institute
Woods Hole, MA 02543-1541
USA

Richard Krishfield
Tel: +1 508 289 2849
Fax: +1 508 457 2175
rkrishfield@whoi.edu

Institute of Oceanology
Chinese Academy of Sciences
7 Nanhai Road
Qindao 266071
Peoples Republic of China

Jinping Zhao
Tel: +86 532-2879062 extn 5804
Fax: +86 532-2870882
jpzhao@ms.qdio.ac.cn

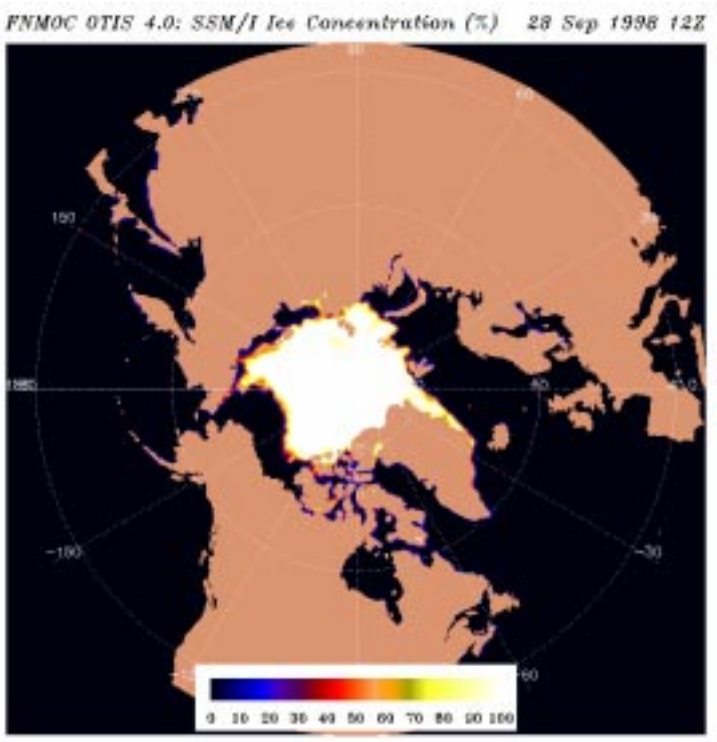
Russian Navy
Department of Navigation and
Oceanography
Ministry of Defense, Russian Federation
17, emb. Schmidt
St. Petersburg 199162
Russian Federation

Oleg Korneev
Tel: +7 812 213 9437
Fax: +7 812 213 7437
oleg@marin.spb.org

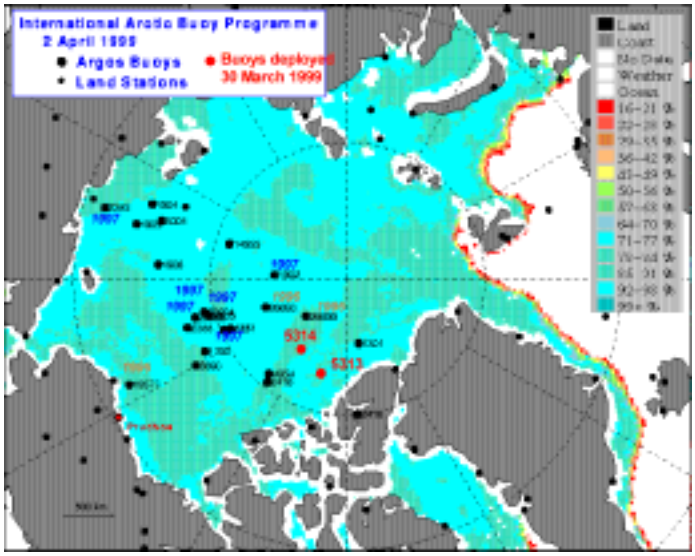
Environment Canada Participant Report for IABP-9

Edward Hudson, Arctic Weather Centre, for Summary Report of Ninth Meeting of the International Arctic Buoy Programme, Bremmerhaven. Germany, June 1999. (edward.hudson@ec.gc.ca 780 951-8878 fax 780 951-8602)

Deployments August 1998 to 31 May 1999 inclusive (from IABP-8 to present)



The expanse of open water across the Beaufort summer and fall of 1998 ruled out CALIB drops.



Buoys on Ice March 1999 - 30 March 1999, 2 Environment Canada in-house assembled buoys were deployed via Twin Otter landing on ice - ARGOS 5313 and 5314. Landing strip problems at Mould Bay precluded a fuel stop there and hence deployment of a third buoy for the US National Ice Center. This third buoy was slated to go west of Prince Patrick Island.

March 1999 on-ice deployments

5th year that EC technician Mark Pyper did the deployments
4th year that Polar Continental Shelf Project provided support in the form of Twin Otter flying time
3rd year that ?
2nd year that deployment flights originated out of Eureka
1st year that EC has "partnered" with Dr. Humfrey Melling, Institute of Ocean Science, whereby one of Dr. Melling's group, Darren Tuele, assisted with the buoy deployment and then Mark Pyper assisted with an oceanographic sounding to 600 metres.

The buoys deployed were designed and assembled in-house, Edmonton, by EC Monitoring and Systems staff Luke Lukawesky and Jeff Sowiak. One of buoys - 5314 - is GPS equipped. Both have gel batteries and solar panels.

Mark Pyper's Log - 30 March 1999

Departed Eureka 30/1534Z. Enroute had heavy head winds, dropped down to see if any lighter lower. At 83°55'N / 120°41'W, 1915Z winds at 1000 ft were 025° 70 knots and temperature was 0°C

BUOY 5314 (GPS equipped) - Landed at **84° 04.46'N / 124° 01.69'W** at 1950Z. Temperature -15°C, winds from the north at 30 knots, aircraft altimeter read 29.94 inches of mercury. Sky was -X with about 1 mile visibility in ice fog. Placed **5314** in pan of multiyear ice and powered it up at **2115Z**. Did water profile to 600 metres just to the side of the aircraft. At 2209Z altimeter was 29.91 inches of mercury. In the air for the second site at 2216Z.

BUOY 5313 - Landed at **83° 08.94'N / 106° 04.16'W** at 2320Z. Temperature -24°C, altimeter 29.68 inches of mercury, winds from the northwest at 20-25 knots. Sky was -X with thin broken AC, visibility dropped to about a ¼ mile after we landed but then improved to at least a couple of miles when we took off. 5313 was placed in the center of a large pan of multi-year ice and powered up at **310033Z**. Did another water profile to 600m. At 0116Z altimeter was 29.68 inches of mercury, temperature -25°C. In the air at 0124Z.

Back in Eureka 31/0311Z.

Per Mark Pyper's logs, water profiles were done to 600 metres at both of the deployment sites.

Dr, Humfrey Melling: "Influence from the Barents Sea is greatly enhanced since our last visit to this area more than a decade ago."

DEPLOYMENT PLANS JUNE 1998 TO JUNE 2000

CALIBS air-drops - 2 CALIBS are scheduled for deployment in the northern Canadian Beaufort mid June..

ICEX - Environment Canada has contributed 1 ICEX-Air for the 1999 White Trident deployment.

Landing on-ice - Twin Otter deployment flight(s) are anticipated out of Sachs Harbour or Eureka late March or early April 2000 to deploy buoys. The buoy array in place and ice conditions at that time will dictate where the deployment(s) is done from and the number of buoys deployed.

ACQUISITION, PROCESSING, TRANSMISSION AND STATUS OF BUOY DATA TO GTS

Environment Canada, Prairie and Northern Region, Edmonton, continues to acquire, process, and transmit onto GTS the 2 EC buoys - ARGOS 5313 and 5314 - and the meteorological data from five US National Ice Center CES Zeno buoys - ARGOS 1301, 2416, 2417, 4954, and 26693.

An ARGOS Summary Report for WMO is prepared monthly by Dennis Oracheski. and emailed out. Recipients include Etienne Charpentier, Technical Coordinator, Drifting Buoy Cooperation Panel. The summary outlines buoys / data being transmitted to GTS from the ARGOS Direct Readout Stations at CWEG ... Edmonton, Alberta, Canada and CYQX ... Gander, Newfoundland, Canada (data from Gander uses the CHWX identifier). Included is the latitude (deg N) and longitude (deg E) position and the list of sensors for each buoy. The report also includes the "status" of some of the data.

Extracts from the March /April 1999 summary follow:

Report Header ... SSVX02 CWEG
==========
... drifters on the Arctic IcePack:
ARGOS WMO Lat Long ------ Sensors -----
No. No. (N) (E) dd ff Ta P appp Tsea BV Tint Gust

```
 ====  =====   ====  =====   == == == = ==== ==== == ==== ====
 1301  48581   84.9  -76.5   - - x x  x   -  x  -   -
 2416  47523   80.2 -127.8   - - x F  -   -  x  x   -
 2417  48572   80.5 -157.7   - - F x  -   -  x  x   -
 4954  48580   80.9 -129.4   - - x x  x   -  x  -   -
 5313  47538   83.0 -104.2   - - x x  x   -  -  -   -
 5314  48521   84.0 -120.0   - - x x  x   -  -  -   -
26693  48578   84.2 -158.1   - - F x  x   -  x  -   -
```

Sensor Codes:
dd = wind direction
ff = wind speed
Ta = air temperature
P = msl pressure
appp = pressure tendency characteristic and amount
Tsea = sea surface water temperature
Pw = wave period
Hw = wave height
BV = battery voltage
Tint = internal buoy temperature
Gust = wind gust speed
- = buoy does not observe this parameter
x = buoy observes this parameter and data is ok
F = sensor failed
U = data is not usable

Buoys with bad sensors: ----------
(lines starting with "***" indicates new information)

2416/47523
==========
Arctic NIC ZENO-3200 pressure sensor is not breathing to the atmosphere. Pressure is "constant" at 1002mb with diurnal variations of 2 to 4 mb. Buoy was tested at Edmonton before deployment & pressure was found to be bad. The cause was found and fixed. But further problems still existed.

4954/48580
==========
980713: Arctic NIC ZENO pressure has been erratic since 980630 when compared with 2416. Data is being monitored.
980810: transmitting infrequently til 980720 & then ceased entirely 980721-980731. Revived completely on 980802. Pressure is ok.

5313/47538
==========
**** 990510: occasionally ceases transmitting or transmits intermittently for periods of 2 to 3 days

5314/48521
==========
**** 990431: on deployment, only transmitting once or sometimes twice per pass. Created special processing routine to use data checksum value to verify correctness of sensor data. Data stream contains GPS location so can create message based only on one transmission per pass. Enabled data to GTS 990408-08Z.
**** 990508: on deployment, air temperature was about 15deg C too cold; sensor disabled. Based on comparison with nearby 5313, adjusted temperature offset from -50 to -35 & enabled air temperature 990508-0330Z.

In Past TWO Months:
==========
Buoys deployed: 0 in Pacific, 2 in Arctic, 0 in Lake Winnipeg,
---------- 0 in Great Slave Lake, 0 in Atlantic
ARGOS 5313 wmo# 47538 was deployed via Twin Otter landing on Arctic ice pack on 99-03-31-00Z at 83.15N 106.07W. Data enabled to GTS 990331.
ARGOS 5314 wmo# 48521 (with GPS location) was deployed via Twin Otter landing on Arctic ice pack on 99-03-30-21Z at 84.07N 124.03W. Data enabled to GTS 990408-08Z.
The deployment of a third buoy (ARGOS 2418) had to be canceled.

Buoys lost: 0 in Pacific, 0 in Arctic, 0 in Atlantic
---------- 0 in Lake Winnipeg
Buoys revived: 0 in Pacific, 0 in Arctic

Contingency Backup Transmission: 0 in Pacific, 0 in Atlantic
---------- 0 in Arctic
South Nomad wmo# 46036 (ARGOS 7195) moored at 48.4N 133.9W: GOES transmitter failed 990404-12Z. NOMAD buoy was replaced 990508-22Z during annual servicing. ARGOS contingency backup was enabled from 990406-20Z to 990509-02Z.

Other Notes:
----
(1) Edmonton is now processing five National Ice Center ZENO buoys: ARGOS 1301, 2416, 2417, 4954, and 26693.

DORA/END

IABP BROCHURES AND POSTER

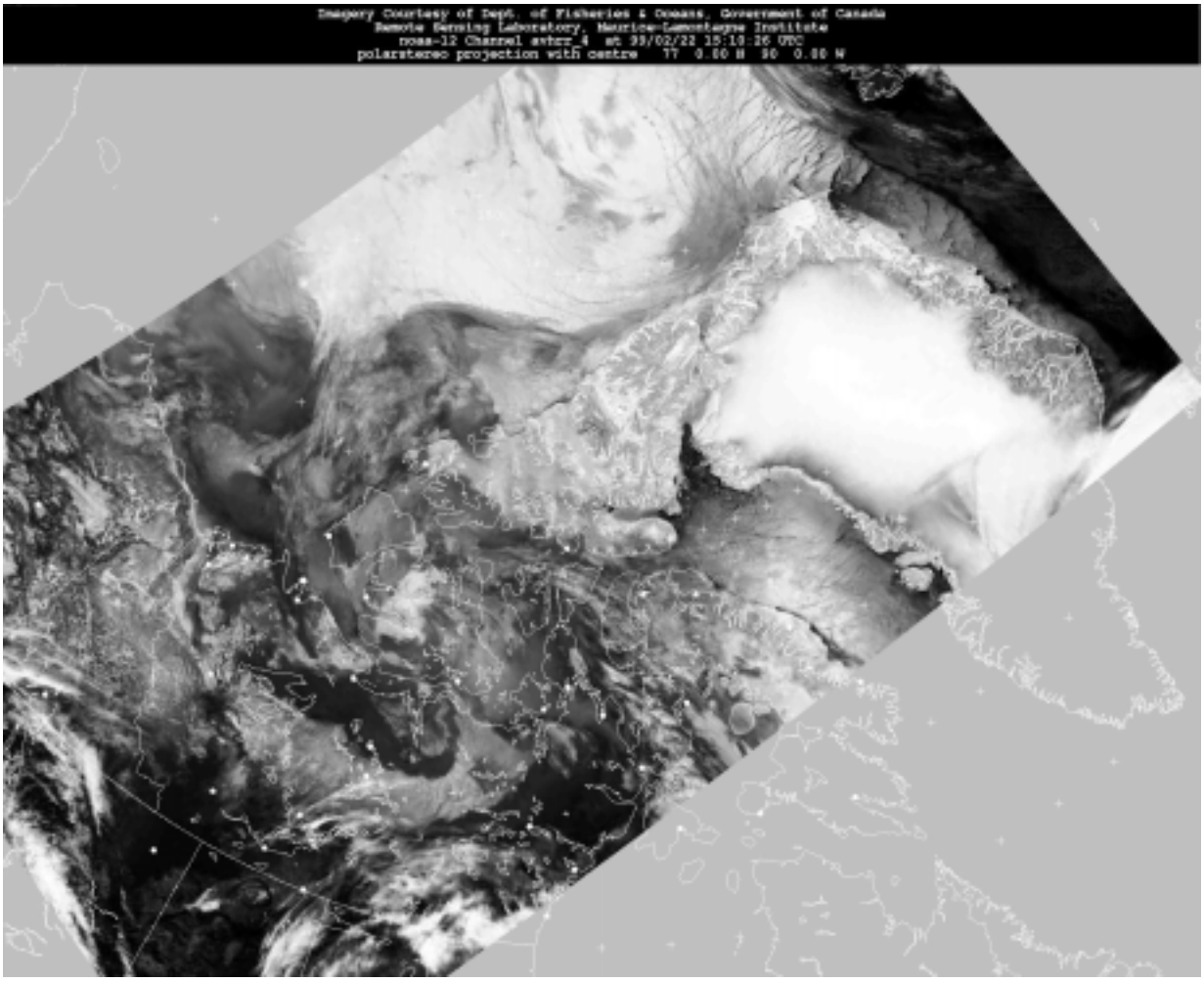
Brochures - The IABP brochure was updated October 1998 for distribution at the DBCP Miami meeting. The October 1998 brochure was the first to feature a “centerfold” - the buoys with the colored ice background. The brochure was updated again April 1999 for distribution at the May 1999 WMO meeting and at the May 1999 US/Canada Joint Ice Working Group meeting.

Poster 1999 - No poster was produced for the 1999 IABP meeting. The bear poster continues to be popular but only a handful remain. There are still lots of the 1998 posters available.

NOW HAVE ACCESS TO SATELLITE IMAGERY FROM STATION AT RESOLUTE

Early 1999, the Arctic Weather Centre got access to polar orbiting satellite data from a Department of Fisheries and Oceans station in Resolute. At present, we use phone lines to acquire jpeg images from the DFO system and then map the images to polar stereographic and add geography. We have purchased both software and hardware to do our own processing onsite Resolute and will use a raw data feed from the DFO system. In addition to the great view satellite image-wise that we get from the Resolute system versus our Edmonton system - 75N versus 5330N - we hope to be able to see, acquire data from, process, and get onto GTS buoy data that is not available to us from our Edmonton station We have not totally committed ourselves to Resolute and we continue to look at Eureka (80N but surrounding hills / mountains may block the horizon) as a site to install a dedicated EC satellite acquisition and processing station. Eureka gives us access to an existing satellite communication system south.

This sample image gives an idea of how much we can “see” from Resolute.

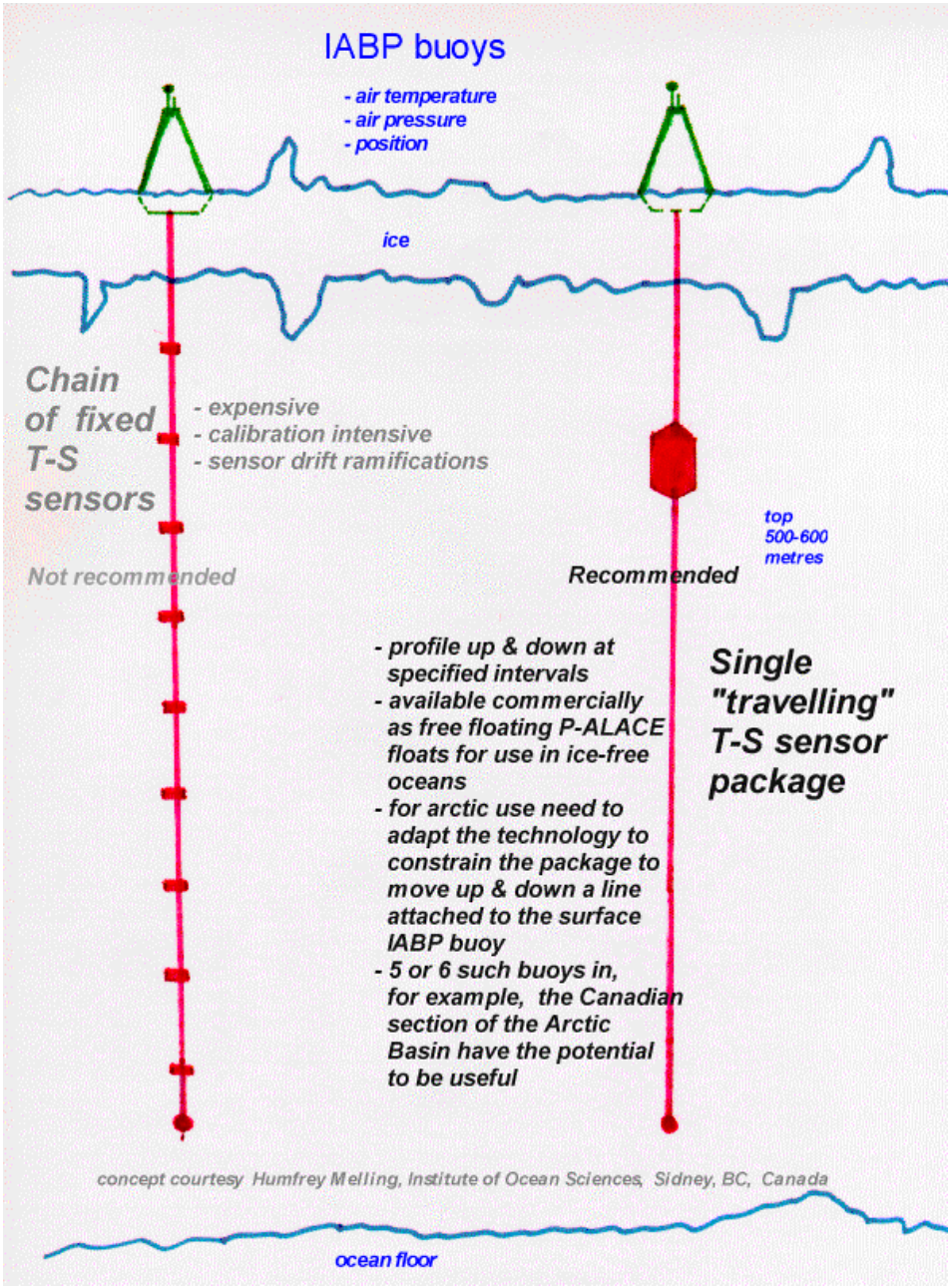


SEEK TO PARTNER WITH CANADIAN OCEANOGRAPHERS

In our on-ice deployments, EC seeks to work with Canadian oceanographers: :

- have oceanographers accompany deployments flights and do water profiles at the deployments sites.. as we did for the 1999 deployments
- share deployment flights where we land at sites for both our deployments and their oceanography
- share buoy hulls

Here is a concept from Dr. Humfrey Melling. The figure is not to scale and one would definitely not want to scrape the ocean floor so closely. Dr. Melliing et al talk of using this technology to monitor freshwater storage in the Arctic Ocean, with the focus on the top 200-300 m. However, per Dr. Melling, there is no problem in going to 500 m, and the temperature maximum in the Atlantic inflow is a good feature to monitor.



Attachment 9

IPAB Participants

Organization	Country	Contribution	Joining Date
Alfred Wegener Institute for Polar and Marine Research	Germany	4 buoys/year ship logistics	22/06/94
Antarctic CRC	Australia	Several buoys/year Co-ordinating Office Research Data Base	19/09/94
Australian Antarctic Division	Australia	4 buoys/year ship logistics	31/08/94
British Antarctic Survey	UK	Logistical support	14/05/95
Commonwealth Bureau of Meteorology	Australia	2 buoys/year	20/10/94
Geophysical Institute, University of Alaska Fairbanks	USA	9 buoys in the Ross Sea in 1998-99	10/02/98
INPE – National Institute for Space Research CNPQ funding)	Brazil	3 sea ice buoys in 1997/98 1-2 buoys/year after 1998	03/08/97
Institute for Marine Research & University of Helsinki	Finland	7 buoys in 1995/96	01/06/95
Institute für Meteorologie und Klimaforschung, Universität Karlsruhe	Germany	Sci. & tech. advice; support of IPAB publications; data transmission and analysis costs	08/05/98
Hydrographic Department, Maritime Safety Agency	Japan	2 or 3 buoys/year development of buoys	26/04/96
Jet Propulsion Laboratory, Polar Oceanography Group	USA	Sci. & tech. advice; development/archiving of a combined (satellite + buoy) istorical climatological ice drift dataset	22/04/98
National Ice Center	USA	Sci. & tech. Advice	04/08/95
National Institute of Polar Research	Japan	1 or 2 buoys/year	26/04/96
Programma Nazionale di Ricerche in Antardtide	Italy	2 buoys/year ship/aircraft logistics	21/07/94
Scott Polar Research Institute	UK	2 buoys/year	14/05/95
Service Argos	France	Support for meetings	06/08/96
South African Weather Bureau	South Africa	Buoys; ship logistics	03/08/95
United Kingdom Meteorological Office	UK	Argos costs for 2 PTT/year	14/05/95
World Data Center A, Glaciology	USA	Data archive and distribution	14/12/94

Attachment 10

Encouraging participation of National Meteorological Services (NMS)

in the WCRP International Programme for Antarctic Buoys
Statement by the twentieth session of the Joint Scientific Committee (JSC) for the WCRP

The WCRP International Programme for Antarctic Buoys (IPAB) was established in June 1994. IPAB builds upon co-operation among agencies and institutions with Antarctic and Southern Ocean interests to develop and maintain an optimum observational network for near-surface meteorological and oceanographic data within the Antarctic sea-ice zone, using drifter buoys and other appropriate data collection systems. The operational area of the Programme is south of 55°S, and includes that region of the Southern Ocean and Antarctic marginal seas within the maximum seasonal sea-ice extent. IPAB has a strong research component, and is endorsed as a self-sustaining project of the WMO/ICSU/IOC World Climate Research Programme. IPAB is also an Action Group of the WMO/IOC Data Buoy Co-operation Panel.

The objective of the IPAB is to establish and maintain a network of drifting buoys in the Antarctic sea-ice zone in order to:

i. support research in the region related to global climate processes and to global change, and, in particular, to meet research data requirements specified by the WCRP and relevant SCAR programmes;
ii. provide real-time operational meteorological data meeting the quality requirements of the WMO World Weather Watch (WWW) programme;
iii. establish a basis for on-going monitoring of atmospheric and oceanic climate in the Antarctic sea-ice zone, in particular contributing to the aims of GCOS.

The programme actually has 19 participating institutions. The IPAB is mainly supported by research agencies, although three National Meteorological Services (NMS) with regional and global interests contribute actively to the programme (Bureau of Meteorology, Australia; South African Weather Bureau; Meteorological Office, United Kingdom). IPAB presently maintains an array of 5-15 buoys in the region south of 55°S, all reporting on the GTS in real time. The number of IPAB buoys is obviously not sufficient to meet the requirements of the WWW and the need of the medium range weather forecasting using global models.

Recent research into the impact of surface buoy data on the analysis and forecasts by means of Numerical Weather Prediction Models (Turner et al.: The Antarctic First Regional Observing Study of the Troposphere (FROST) project, Bull. Am. Meteorol. Soc., 1996; Kottmeier et al.: Wind, temperature, and ice motion statistics in the Weddell Sea, WMO/TD-No. 797, 1997) has demonstrated strong potential impact of such drifting buoys on pressure and wind analyses.

WCRP IPAB therefore seeks more commitments from National Meteorological Services which would participate in the programme. This mainly concerns the provision of additional buoys and contribution to the Argos transmission costs, whereas the deployment of buoys would be done by research agencies during Antarctic research vessel activities.

The JSC-XX recalled Resolution 11 (WMO EC-XLVI, 1994) "Organization of an International Programme for Antarctic Buoys" and confirmed the value of the IPAB data for meeting the WMO World Weather Watch, WCRP and GCOS objectives. The Committee requested the WMO Congress-XIII (May 1999) to urge those National Meteorological Services which have Antarctic and Southern Ocean interests to participate actively in the implementation of the WCRP International Programme for Antarctic Buoys by providing ice-resistant drifting buoys, or by other appropriate means.

Attachment 11

INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP) CHAIRMAN'S AND COORDINATOR'S REPORT FOR THE FOURTEENTH SESSION OF THE DATA BUOY COOPERATION PANEL, MARATHON, FLORIDA (U.S.A.), 12 TO 16 OCTOBER 1998

prepared 30 August 1998

This report will focus on activities of the International Arctic Buoy Programme that have occurred since the report filed August 1997 for the 13th session of the Data Buoy Cooperation Panel. The report will also outline upcoming activities including directions that IABP Participants and the IABP executive would like the program to head. 1998 was not only the year of the eighth annual business meeting of the IABP, it also marked the 20th year of the Arctic buoy program. In celebration of this anniversary, the IABP business meeting was followed by an arctic buoy conference and an ice workshop. The 2-day mini conference "The Arctic Buoy Program - Scientific Achievements from the first 20 years" was sponsored by the IABP and the DBCP. The 2 ½ day workshop "Operational Sea Ice Charts of the Arctic - Scientific Achievements from the first 400 years" was sponsored by ACSYS (Arctic Climate System Study of the World Research Programme) and the US National Ice Center. The ACSYS international office in Oslo is collating proceedings from both the arctic buoy conference and the ice workshop.

For an up-to-date listing of IABP participants, monthly maps of the IABP buoys in place and their status, buoy diagrams, IABP images and plots to browse and borrow, IABP data animations, pointers to ice charts and more please access the IABP homepage maintained at the Polar Science Center, Applied Physics Laboratory, University of Washington: ***http://iabp.apl.washington.edu***

INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP) EIGHTH ANNUAL MEETING SEATTLE, U.S.A., JULY 1998

Members of the International Arctic Buoy Programme met 29-31 July in Seattle, Washington, USA for the eighth annual business meeting of the program. The meeting was hosted by the Polar Science Centre, Applied Physics Laboratory, University of Washington.

MEETING HIGHLIGHTS

New executive - The IABP executive changed chairman and coordinator-wise at the IABP 1998 annual meeting. Roger Colony, a founding member of both the Arctic buoy program and the International Arctic Buoy Programme, and the coordinator of the IABP since its formation 1991, is headed for a new job at the University of Alaska and Brian O'Donnell, Chairman of the IABP for all but one of the years of the IABP's existence, has moved to Environment Canada's Pacific and Yukon Region where the buoys are in water rather than on ice.
The present IABP executive is:

Chairman:	Tim Goos, Environment Canada, Canada
Vice Chairman:	Thor Kvinge, Christian Michelsen Research, Norway
Member:	Ivan Frolov, Arctic and Antarctic Research Institute, Russia
Member:	Dave Benner, U.S. National Ice Center, U.S.A.

and the appointed Coordinator is Ignatius Rigor, Polar Science Center, U.S.A

Common interests with the IPAB (International Programme for Antarctic Buoys) - Items of common interest to the Participants of the IABP and the IPAB will be explored by the coordinator of the IABP.

IABP data on CD-ROM - MEDS (Marine Environmental Data Service), Fisheries and Ocean, Canada, will work with the coordinator of the IABP and one of the Participants to develop a CD-ROM containing IABP data. It was noted that such data is available via the web from IABP homepage but a CD-ROM would facilitate access to, and use of, the data.

Real time processing of meteorological data - The timeliness of meteorological data getting onto GTS from local users terminals (LUTs) versus from the Service Argos facilities at Toulouse and Landover will be investigated. It was noted that data processed at Service Argos facilities have greater position accuracy than data processed at the LUTs such as Edmonton. Specifically, Environment Canada is interested in the merits of an HRPT station at Resolute or Eureka to put Arctic buoy data onto GTS. The question is how much of the buoy data presently not being received

from the satellite in real time would a station at Resolute or Eureka be able to acquire and process and get onto GTS in real time? Additionally what would be the time advantage of such an HRPT station for buoy data onto GTS versus the existing systems of real-time and stored data being received at stations such as Fairbanks and transmitted to Service Argos, Landover, for processing and input to GTS ?

IABP data is being used - Ignatius Rigor, Polar Science Centre, presented two examples of the use of IABP buoy data (A multitude of uses were outlined at the Arctic buoy mini-conference):

- predicting the drift of the SHEBA ice camp (Figure 2) and the position and deformation of the SCICEX survey area and
- inclusion of IABP surface air temperatures in global climatology such as that of Jones et al. (Jones, P.D. , M. New, D.E. Parker, S. Martin, and I.G. Rigor, Surface air temperature and its changes over the past 150 years, Rev. of Geophysics, submitted, July 1998).

IABP PARTICIPANTS

Participants of the IABP remain a mix of operational agencies, meteorological and oceanographic institutes, research agencies and non-government organizations that are interested in the Arctic Ocean and who contribute actively to the program. IABP Participants continue to seek partners within their respective countries and internationally who are willing to supply additional buoys or sensors for existing buoys so that the IABP can grow.

CURRENT BUOY ARRAY AND COOPERATION

Per Figure 1, the buoy array across the Arctic Basin as of 11 August 1998 was comprised of 20 buoys - the SHEBA buoys being counted as a single buoy due to their spacing - The array includes 3 buoys belonging to the U.S. National Ice Center deployed via landing on ice by Environment Canada using Twin Otter time provided in part by Polar Continental Shelf Project. The deployment flights were conducted from Eureka and a member of the U.S. National Ice Centre accompanied the first of the two deployment flights. There was also a June air drop of two CALIBs in the Canadian Beaufort but one of buoys never did transmit pressure information - became a position only buoy - and the other succumbed mid July to what is believed the breakup of the ice in the Beaufort. Indeed, the ice across the Beaufort by mid August was near the absolute minimum ever observed.

1998 DEPLOYMENTS TO COME

Ongoing Process - Deployments to replenish the buoy array across the Arctic Basin are ongoing. Buoys fail due to battery power coming to an end, other buoys exit the Arctic Basin for the North Atlantic and the ice that supports then melts away, and buoys fall through the ice while others get crushed as ice rafts and ridges. The number of operational buoys is usually at a peak late summer (September) and at a minimum during the early spring (March).

The following outlines planned 1998 deployments from 11 August onward. Many of the buoys are likely in place on ice as this report is being written 30 August. Figure 3 shows the planned deployments, projected positions of the existing array 01 September (dark dots), and 01 October (fainter dots), and the ice 11 August 1998.

- 2 ICEX buoys provided by Alfred Wegener Inst. and 1 AARI buoy provided by AARI / (US) Office of Naval Research Europe, Laptev Sea, from the Polarstern, August, (red) square
- 7 ICEX air buoys provided by UK Meteorological Office (2), Polar Science Centre / Japan Marine Science and Technology Center (3), Norwegian Meteorological Institute (1), and Norsk Polarinstitutt (1), Beaufort and East Siberian Seas, via U.S. Naval Oceanographic Office C-130 "*White Trident*" air drop, August, big solid (red) dots
- 2 AARI buoys provided by AARI / (US) Office of Naval Research Europe, North Barents and North Kara Sea, via the vessel Federov, August, (red) diamonds
- 1 CES Zeno buoy, provided by US National Ice Center, Beaufort Sea, via US Coast Guard icebreaker Polar Star, August or September, (red) triangle
- 2 CES Zeno buoys, provided by US National Ice Center, Beaufort Sea, via US submarine. August or September, (red) open circles

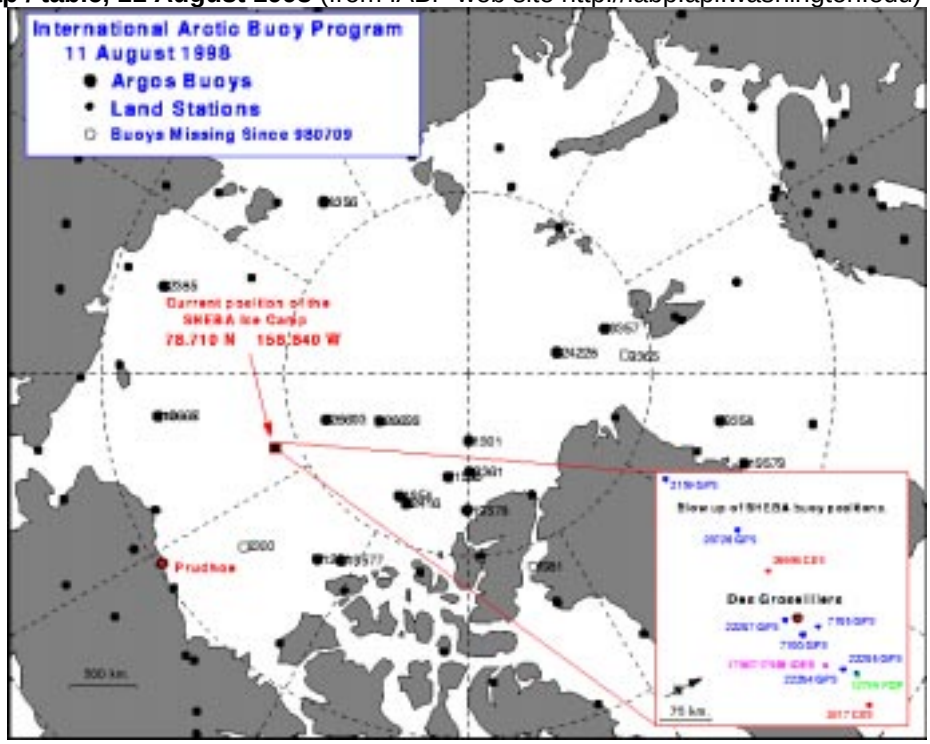
NEW DIRECTIONS

Under ice data - It was noted by Roger Colony that oceanographers have noticed a significant warming of the Arctic Ocean and the erosion of the layer of cold water extending from the surface to 200 metres. Is this a signal of climate change or a signature of natural climate variability? Buoys on ice to measure and feed to GTS the IABP principle parameters of surface air temperature and surface atmospheric pressure remain key to the IABP program. However, IABP participants look to the (expanded) use of POP (Polar Ocean Profiler) buoys to monitor upper ocean temperatures and salinity. The Participants will search for a dedicated person within the IABP to be a principal investigator in support of the deployment of POP buoys.

Tim Goos, Chairman IABP
Atmospheric Environment Branch
Environment Canada
Twin Atria Bldg - 2nd Floor
Edmonton, Alberta
T6B 2X3
Canada

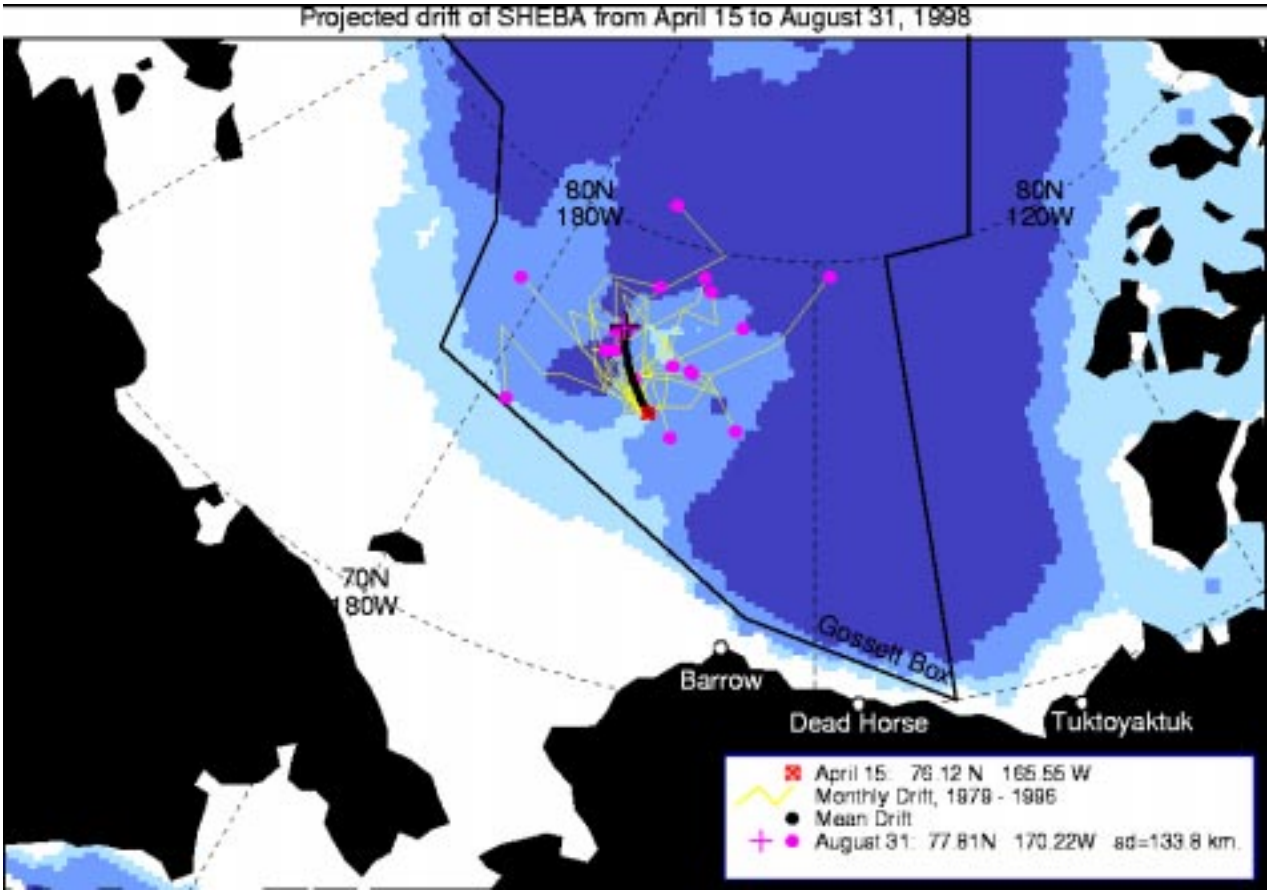
Ignatius Rigor, Coordinator, IABP
Polar Science Center
Applied Physics Laboratory
University of Washington
1013 NE 40th Street
Seattle, WA 98105
U.S.A.

Figure 1. Buoy map / table, 11 August 1998 (from IABP web site http://iabp.apl.washington.edu)



DATE DEPLOYED	ARGOS ID	WMO ID	YPR NUMBER	GTS HEADER	POSITION LAT	POSITION LONG	DATA BYTES	P	T	BUOY DESCRIPTION
IABP										
Aug 96	1261	48102	484	SSVX01-LFPW	76.942	-128.849	16	Y	Y	ICEX-AIR
Apr 98	1301	48581	1053	SSVX02-CWEG	86.308	-89.275		Y	Y	Metocean TOGA
Aug 96	1556	48111	314	SSVX01-LFPW	84.234	-100.727	16	Y	Y	ICEX-AIR
Aug 97	2385	25549	1053	SSVX12-KARS	72.753	163.829	17	Y		ICEX-AIR
Apr 98	2416	47523	1053	SSVX02-CWEG	82.102	-115.190		Y	Y	ZENO-3200
Apr 98	4954	48580	1053	SSVX02-CWEG	82.310	-119.140		Y	Y	ZENO-3200
Mar 93	8356	25538	282		77.729	129.844				
Aug 96	9357	63663	919	SSVX07-LFPW	82.143	18.297	22	Y	Y	Metocean
Aug 96	9358	63661	919	SSVX07-LFPW	76.028	-10.608	22	Y	Y	Metocean
Aug 95	9361	25571	919	SSVX07-LFPW	84.603	-88.828		Y	Y	ICEX-AIR
May 92	10667	48531	1016	SSVX02-CWEG	72.931	-172.153	32	Y	Y	IOEB
May 92	10668	48531	1016	SSVX02-CWEG	72.940	-172.133	32			IOEB
Aug 96	19577	47601	1053	SSVX12-KARS	77.642	-123.964	16	Y	Y	ICEX-AIR
Aug 96	19578	47602	1053	SSVX12-KARS	82.500	-90.386	16	Y	Y	ICEX-AIR
Aug 96	19579	48518	1053	SSVX12-KARS	74.163	-18.214	16	Y	Y	ICEX-AIR
Jul 96	24228		9053		85.025	13.583	32	Y	Y	Seimac
Mar 96	26693	48578	1053	SSVX02-CWEG	81.874	-161.904	32	Y	Y	CES X Zeno
Sep 97	26696	48576	1053	SSVX12-KARS	78.564	-162.619	32	Y	Y	CES X Zeno
Jul 96	26699	48573	1053	SSVX02-CWEG	84.531	-151.725	32			CES X Zeno
SHEBA										
May 98	2159		695		77.511	-169.835	32			PMEL GPS Buoy
Sep 97	2417	48572	1053	SSVX02-CWEG	79.068	-151.482	32	Y	Y	CES X Zeno
Sep 97	7100		695		78.698	-157.786	32			PMEL GPS Buoy
Sep 97	7105		695		78.904	-157.922	32			PMEL GPS Buoy
Sep 97	12795	48519	282	SSVX16-KARS	79.185	-154.096	32	Y	Y	POP
Sep 97	17987	48522	1016	SSVX02-CWEG	78.803	-155.203	32	Y	Y	IOEB
Sep 97	17988	48522	1016	SSVX02-CWEG	78.805	-155.228	32			IOEB
Sep 97	20726		695		78.331	-165.716	32			PMEL GPS Buoy
Sep 97	22204		695		78.998	-154.501	32			PMEL GPS Buoy
Sep 97	22205		695		79.194	-154.142	32			PMEL GPS Buoy
Sep 97	22207		695		78.555	-159.091	32			PMEL GPS Buoy
Sep 97	26696	48576	1053	SSVX12-KARS	78.564	-162.619	32	Y	Y	CES X Zeno

Figure 2. SHEBA position projections



The reported position of the SHEBA camp 30 August was 79 33'N 160 04'W which is about 160 nautical miles northeast of the 15 April projection for 31 August !

Figure 3. Deployments, the existing buoy array positions projected to 01 October 1998, and the ice 11 August 1998