SUMMARY REPORT OF THE THIRD ANNUAL MEETING OF THE INTERNATIONAL ARCTIC BUOY PROGRAM

Toulouse, France, 8-10 June 1993

1. Opening of the meeting

Brian O'Donnell, Chairman of the Program, opened the meeting. Thanks were expressed to CLS for hosting the meeting. The list of attendees is given in Attachment 1.

Michel Cazenave, Chairman of the Board of CLS, addressed the meeting to welcome the attendees in Toulouse. He also wished the participants the best for a successful meeting.

2. Approval of agenda

The agenda as approved is given in Attachment 2.

3. Approval of minutes of second annual meeting

The minutes of the second annual meeting were reviewed and approved.

4. Review of the Principles of the Program

The IABP Operating Principles (Attachment 3) were reviewed and the following changes were incorporated:

Pace 2, § .4: Observation Program, item 4.3, line 1 and 2.
Replace these two lines by: The program will strive to establish and maintain a basic network with observational points spaced no more than 500 km apart.

Page 3, § 6: Data Archiving, item 6.1: Operational Archiving.
Reword this item as follows: All basic meteorological data transmitted on the GTS will be archived by the Marine Environmental Data Service (MEDS) as the IOC Responsible National Oceanographic Data Centre for Drifting Buoys, on behalf of both IOC and WMO.

5. Coordinator's Report

Roger Colony, IABP Coordinator, reported on the activities of the Program since the fast IABP Annual Meeting in Oslo 1992. During June 1993, the IABP monitored 63 buoys. The majority, 46 buoys, are equipped with barometers and thermistors and 44 of the buoys presently report on the GTS. The attached (Attachment 4) table and maps were used to describe respectively the list of the Program buoys on the GTS; the location of buoys as of July 1993; and, the planned deployment of new buoys in 1993/94.

It was noted that two Germany buoys that are operating and whose data are on the GTS were not being included in the Coordinator's monthly status report. Roger Colony will work with Christoph Kottmeier to resolve this problem.

It was also noted that a highly successful joint U.S./Russian deployment called White Trident occurred in the spring 1993. Nine buoys were deployed during this program. The Chairman agreed to write letters of congratulations to the organizations participating in this deployment program.

It was agreed that the Coordinator produce a daily averaged surface air temperature analysis beginning in the 1993 Report.

The Coordinator also reported on his activities representing the IABP at various meetings (Hobart, Australia, on an Antarctic Buoy Program; the second session of the ACSYS Scientific Steering Group; NOAA Cryospheric Meeting; USAIABP; etc.).

6. Presentation of the Annual Report

The following proposal for the format of an Annual Report was made by the Coordinator and accepted by the Participants.

Two separate documents will be prepared to reflect the activities of the IABP:

(i) A brochure outlining the objectives, principles, participants, products, etc., of the IABP, and;

(ii) An annual newsletter reporting on the specific activities of a given year.

Participants are requested to submit ideas and subject matter reporting on 1992 activities to Roger Colony not later than September 15, 1993 for inclusion in the newsletter. This newsletter will be published by mid-October.

Ideas for the brochure are to be submitted to Tom Nichols as soon as possible.

7. Report from Data Buoy Cooperation Panel (DBCP)

The Technical Coordinator presented the activities of the Data Buoy Cooperation Panel since the last session of the IABP in Oslo, especially in the following fields:

1. Follow the development at the Global Drifter Centre (GDC, USA) of a low cost Lagrangian drifter equipped with a barometer port. More than ten prototypes purchased by GDC and several meteorological services (Australia, Canada, France, United Kingdom) were deployed and showed encouraging results;

2. Follow and participate in the development of a new Argos processing subsystem for GTS data. Phase 1 was implemented in February 1993 and Phase 2 is planned for October 1993. This new system permits more flexibility in data processing, quality control and encoding GTS data;

3. Follow the establishment of the pilot phase of the International Program for Antarctic Buoys;

4. Follow and coordinate the establishment of an international South-Atlantic drifting buoy program;

5. Coordination of Drifting Buoy data Quality Control Guidelines (GTS) via an Omnet bulletin board. A few minor problems were reported for Arctic buoys since the June 92 meeting.

As far as specific assistance that the DBCP provided to the IABP, we can mention the following topics:

* In early 1993, GTS bulletin header SSVX15 KWBC was changed to SSVX18 KWBC;

* Technical documentation was provided to AARI;

* List of GTS bulletin headers was provided to the program coordinator for inclusion in the monthly status report.

8. Status of Membership Roll

The attached (Attachment 5) list of organizations represents the Participants as of June 1993.

The Participants welcomed the Arctic Centre, University of Lapland as a new member of the IABP and Fairweather Forecasting Inc, as a member of the USIABP.

9. Status Reports from Participants

Alfred Wegener Institute for Polar and Marine Research

In Germany, two groups have contributed to the IABP during 1992/1993. These were the University of Hamburg and the Alfred Wegener Institute for Polar and Marine Research.

The buoy deployments were partly for regional scale programs and partly as a contribution to IABP.

1992: From previous deployments (in 1991), six buoys were still active. Two buoys were air-deployed in May 1992 by a Norwegian aircraft.

1993: During ARKTIS 93/REFLEX experiments in February/March 1993, 5 buoys (Univ. of Hamburg) were deployed in the Fram Strait region. Two of them were recovered after the experiment.

In August 1993, another two systems will be deployed from onboard POLARSTERN in the Laptev Sea.

Atmospheric Environment Service

In 1992, four Metocean buoys were deployed. One failed on deployment; one failed within weeks and two continue to operate as of June 1993. In 1993, 5 buoys were purchased. Four were successfully deployed on 5th June. The fifth buoy will be deployed at approximately 85° N, 90°W in the summer of 1993. The satellite receiving ground station has been upgraded with the addition of a new antenna and receiving system and a new processing system will be available by mid-summer 1993. A DSI TAD buoy was retrieved and will be refurbished and redeployed. The location of the deployment has not been decided.

MEDS

MEDS role as the RNODC for Drifting Buoys was illustrated by showing an increase in the number of buoys from which MEDS is receiving data and from the number of messages received daily on the GTS. The success of IABP for year 1992 was presented in terms of number of buoys (close to 140) and in terms of increase of number of messages (175,000). The increase of number of messages was shown with most of the increase in the East Siberian and Laptev Sea. The number of messages for 1992 from different GTS insertion Centre shows a heavy use of centre operated by Service Argos.

Météo France
Joèl Poitevin welcomed Participants to Toulouse on behalf of Météo France. He invites Participants to tour the weather forecasting centre of Météo-France. (Several of the Participants attended an excellent tour of centre and expressed their gratitude to Météo-France for their hospitality.)

Polar Science Center - University of Washington
Roger Colony reported that the University of Washington now has a contract with U.S. NAVY/NOAA Joint Ice Centre to perform program and data management functions for the IABP.

Russian Federal Service for Hydrometeorology and Environmental Monitoring (Rushydromet) and Arctic and Antarctic Research Institute
Ten buoys were deployed over 1991-1992 which did not provide real-time data on GTS. The data will be made available to the IABP coordinator.

In autumn 1993, four buoys will be deployed in Laptev Sea during the joint German-Russian expedition.

UK Meteorological Office
The UK Meteorological Office's main contribution to the IABP has been one ice drifting buoy per year.

Last year's buoy (number 1639), deployed in May 1992, is still working and is at present (9th of June 1993) at 77.3° N, 04.3° W. The buoy purchased in March 1993 (number 4065) was deployed by the Norwegian Air Force in May. It is now fully operational at 84.3° N, 112.3° E. It is expected that the UK Meteorological Office will supply the next buoy in Spring 1994.

U.S. NAVY/NOAA Joint Ice Center
Synopsis of 1992-1993 USIABP Activities:
- Presently nine separate U.S. agencies contribute to U.S. Interagency Arctic Buoy Program (USIABP). Contributions include fiscal resources and services. Potential participants for next year include the commercial firm Fairweather Forecasting, Inc. and a U.S. Naval Research Laboratory, Environmental Task Force initiative.

- The USIABP presently has 34 buoys operating in the Arctic Basin. This number includes 11 buoys with external thermistors deployed by the Joint Ice Center and 23 (TAD, POP, ANMET) buoys operated by the U.S. Naval Oceanographic Office. Significant accomplishments over past year include: (i) the spring, 1993 White Trident aerial deployment of 9 buoys achieved through the cooperative efforts of the Russian Federal Service for Hydrometeorology and Environmental Monitoring; (ii) the establishment and distribution of WMO bulletin (SSVX18-KWBC) with JIC, POP, and ANMET buoy data; and (iii) the funding of the Program Coordinator and Data management function for the International Arctic Buoy Program.

- Future USIABP activities for 1993 include: (i) the deployment of 5 additional JIC buoys during summer '93 cruises of the German icebreaker POLARSTERN, U.S. icebreaker POLAR STAR and the U.S. nuclear research submarine and (ii) the establishment and operation of a buoy

performance field test in Pt. Barrow, Alaska. Five separate buoy designs currently in use by the IABP participants will be tested.

WCRP

The WCRP ACSYS (Arctic Climate System Study) Scientific Steering Group (SSG) on its second session (Seattle, WA, USA, 2-6 November 1992) discussed the IABP activities and agreed that the preparation of comprehensive arctic wind stress and surface air temperature data sets (to be used to drive sea-ice models) was an important scientific task. While the measurements of atmospheric pressure were well in hand, obtaining reliable surface air temperature data from Arctic drifting buoys remained a research problem. The SSG was of the opinion that further participation of WCRP in the IABP was required to promote the development and testing of such observations, as required by the ACSYS Atmosphere Climatology Program.

The WCRP has also made a monetary contribution to the IABP to support the participation of an expert in the third session of the IABP.

10. Overview of CLS/Service Argos

An overview of CLS was given by Christian Ortega. The presentation included a description of CLS's activities, structure and growth.

CLS is a subsidiary of the French Space Agency created in 1986. Its purpose is to provide operational satellite-based services and products to study, monitor and protect environment.

CLS is represented in the USA by Service Argos Inc (SAI) which provides data processing and user services to Argos programs and to North American CLS (NACLS) which provides added value commercial services.

Argos activities were presented in terms of the number of platforms in the system and their applications and distribution mainly with regard to the GTS.
Finally, a status of the development of the Argos new GTS subsystem was provided. The development will be completed in October 1993. The first goal of the subsystem is to increase both quantity and quality of the data transferred onto the GTS.

11. New business

11.1. IABP Bank Account

The Chairman reported that he was in correspondence with WMO for the establishment of a "bank account" for the IABP. Mr. Treglos confirmed that this would be possible and described some of the characteristics of a "special trust fund". The Chairman agreed to follow-up and complete the establishment of the account as soon as possible.

11.2. Drifting Card Program

Tom Nichols, in consultation with the Coordinator, will further investigate the establishment of a program to deploy and monitor an array of plastic cards. These cards would be deployed for tracking ice motion. Christian Ortega will investigate the availability of low cost transmitters for this purpose.

11.3. International Program for Antarctic Buoys

Victor Savtchenko reported on the results of the first planning meeting on a WCRP International Antarctic Drifting Buoy Project (IAnDBP) that was held at Hobart, Australia, from 5 to 7 April, 1993. Participants in the meeting indicated the level of support to the WCRP IAnDBP that were either planned or could be obtained from institutional and national programs for the next several years. Plans for the launching of approximately 15 buoys per year for the next three years were announced. It was considered a promising start for the project. The participants agreed that the project should be renamed the International Program for Antarctic Buoy (IPAB) to avoid confusion with the International Arctic Buoy Program. The meeting agreed that the IPAB would commence with a pilot phase beginning at the end of the meeting. Dr I. Allison (Antarctic Co-operative Research Centre, Australia) was appointed by the participants as interim Chairman for the pilot phase of the Program. Subject to the confirmation of the availability of appropriate facilities at the Antarctic Co-operative Research Centre in Hobart, Dr Allison offered to coordinate the IPAB pilot program. The second planning meeting and inaugural meeting of the program are tentatively scheduled to be held at Venice, Italy in June 1994.

11.4. Data Distribution

Some GTS data are not being received at Roshydromet in Moscow. Roger Colony asked Etienne Charpentier to contact Roshydromet (Sergei Vassiliev) and AARI (Ivan Frolov) and assure all IABP data are routed to Moscow.

The 1992 data report will be available in October 1993.

11.5. Global Ocean Observing System (GOOS)

Yves Tréglos reported on the establishment of GOOS. A synthesis of the presentation is given in Attachment 6.

11.6. Global Climate Observing System (ISCOS)

GCOS originated in 1992 from a Memorandum of Understanding signed by: WMO, IOC, UNEP and ICSU. The objective of GCOS is to meet the observational needs for:

- climate system monitoring, climate change detection and response monitoring especially in terrestrial ecosystems;
- data for application to national economic development;
- research toward improved understanding, modelling and prediction of the climate system.

The first priority of GCOS is to evaluate the current observational systems and to define the initial operational observing system. A Joint Scientific and Technical Committee (JSTC), has the function to formulate the overall concept and scope of GCOS and to provide scientific and technical guidance.

Regarding sea-ice, the draft plan for GCOS proposed by the JSTC recommends:
- to maintain and optimize the Arctic Drifting Buoy network;

- to continue existing monitoring of global extent and concentration of ice using active and passive microwave sensors and Synthetic Aperture Radar (SAR).

11.7. Environmental Monitoring

A presentation was given on the water-borne and air-borne pollutants into the Arctic by Manfred Lange. He referred to the establishment of the Arctic Monitoring and Assessment Program (AMAP). He proposed an idea for a role for the IABP in the broader environmental field; ie, using IABP buoy platforms to collect environmental data.

12. Future Directions

The Participants agreed that the overall direction of the Program was consistent with the Principles of the IABP.

It was also agreed that additional effort be directed toward:

(i) improving the measurement accuracy of stated meteorological parameters with particular emphasis on the quality of ambient air temperature measurements;
(ii) standardizing buoy design;
(iii) expanding the collection effort to include other meteorological parameters as stated in IABP Operating Principles; and
(iv) broadening the objectives of the Program to include monitoring other environmental parameters (such as contaminants) beyond those stated in the Operating Principles.

Closer liaison with other international programs such as AMAP, GCOS, and GOOS was suggested as a means to work towards these new directions.

13. Election of Officers

In accordance with IABP Operating Principles, elections to the following offices took place on-9 June, 1993:

Executive Committee		Coordinator:	Roger Colony
Chairman:	Brian O'Donnell		
Vice Chairman:	Torgny Vinje		
Member:	David Benner		
Member:	Ivan Frolov		

It was agreed that the next meeting of the IABP be held at St. Petersburg, Russia in the first week of June 1994, subject to confirmation by the Executive Committee.

Two additional offers for hosting the 1994 meeting were received from: the British Meteorologial Service at Bracknell (England), Service Argos Inc. in Landover - Maryland (USA).

14. Scientific Session Summaries

Short summaries of some of the technical presentations are included as Attachment 7.

Attachment 1

LIST OF ATTENDEES
Third Annual IABP Meeting
8-10 June, 1993, Toulouse, France

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Attachment 2

Third Annual IABP Meeting

8-10 June, 1993, Toulouse, France

Agenda
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8 June 1993, Tuesday 0900-1300
Main Business Meeting

1. Opening of Meeting and Welcome by CLS Service Argos
2. Approval of Agenda
3. Approval of Minutes from Second Annual Meeting
4. Review of the Principles of the Program
5. Coordinator's Reports
6. Presentation of the 1992 Annual Report
7. Report from Data Buoy Cooperation Panel
8. Status of Membership Roll
9. Status of Reports from Participants

8 June 1993, Tuesday 1400-1800
Technical And Scientific Presentations

1. David, Benner, Impact of Arctic Data Buoy Data on Navy/NOAA, Joint Ice Center Operations
2. Terry Bryan, What's New in the Joint Tariff Agreement?
3. Roger Colony, Nansen Centennial Arctic Program Buoy Array
4. Roger Colony, Surface Wind and Geostrophic Wind in the Arctic Basin
5. Ivan Frolov, The History of the Russian Arctic Buoy Program

8 June 1993, Tuesday 1830-1930
Tour of Météo France

9 June 1993, Wednesday 0900-1300
Main Business Meeting

10. Overview of CLS Service Argos

Third Annual IABP Meeting

8-10 June, 1993, Toulouse, France

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11. New Business
    - .1 IABP Bank Account (O'Donnell)
    - .2 Drifting Card Program (Nichols)
    - .3 International Program for Antarctic Buoys (Savtchenko)
    - .4 Data Distribution (Colony)
    - .5 Global Ocean Observing System (Treglos)
    - .6 Global Climate Observing System (Merle)
    - .7 Utilizing the IABP for Environmental Monitoring (Manfred Lange)

12. Future Directions

13. Election of Officers

9 June 1993, Wednesday 1400-1800
Technical And Scientific Presentations

1. Victor Savtchenko, Arctic Climate System Study (ACSYS)
2. Sergei Vassiliev, State of the art and prospects of Russian Arctic Buoy Program
3. Christoph Kottmeier, Report on GPS test and temperature measure

10 June 1993, Thursday 0900-1300
Main Business Meeting

14. Review of Meeting and Recommendations

ATTACHMENT 3

INTERNATIONAL ARCTIC BUOY PROGRAM
OPERATING PRINCIPLES

1. This paper sets forth the principles and a set of operating procedures for the International Arctic Buoy Program (IABP).

2. **Objective**

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

3. **Program Principles**

The IABP will:

3.1 Maintain an observational data network over the Arctic Ocean using drifting buoys;

3.2 Distribute basic meteorological data from the network in real time over the Global Telecommunication System (GTS) plus relevant additional real-time data approved for public dissemination;

3.3 Ensure data from the network is archived; and

3.4 Cooperate with and provide results of the Program to other related programs.

4. **Observation Program**

4.1 **Operational Area**:

The operational area of the program includes the central Arctic Basin and its marginal seas excluding the economic zones except where agreements of the Coastal State have been obtained.

4.2 **Variables**:

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

4.3 **Basic Network Density**:

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

5. **Data Acquisition and Distribution**

5.1 **Transmitters**:

All buoys in the basic network will be equipped with transmitters to enable basic meteorological data to be transmitted in real time (synoptic and asynoptic mode). As a preferred approach, data will be collected and located via the Argos system using the TIROS N series of satellites or their replacement.

5.2 **Coding**:
All basic meteorological data will be coded in the approved WMO code for drifting buoys.

5.3 **Global Telecommunication System**:
Data will be inserted by Service Argos to the Global Telecommunication System. Data collected by participants by other means may also be inserted into the GTS.

6. Data Archiving

6.1 **Operational Archiving**:
All basic meteorological data transmitted on the GTS will be archived by the Marine Environmental Data Service (MEDS) as the responsible National Oceanographic Data Centre for Drifting Buoys, on behalf of both IOC and WMO.

6.2 **Research Data Base**:
A uniform quality controlled data base for ice motion and surface meteorology as required by the Arctic research community will be established. Periodically this data will be submitted to World Data Centre A (Glaciology) and B (Global Sea Ice Digital Data Bank) and to MEDS.

7. Management Structure

7.1 **Participants**:
Participants in the International Arctic Buoy Program will be operational agencies, meteorological and oceanographic institutes, research agencies and non-governmental organizations who are interested in the Arctic Ocean and who contribute actively to the Program. Participants will indicate their participation in the Program by means of a Letter of Intent (Appendix 1).

7.2 **Election of Program Executives**:
The program will be coordinated by the Participants. The Participants will arrange for the implementation of the program within the framework of the stated objectives. On an annual basis the Participants will elect a Chairman and Vice Chairman and appoint a Program Coordinator. The Chairman and Vice Chairman plus two other elected persons from the Participants shall form the Executive Committee.

Elections shall be held at annual meetings of the Participants. Election shall be decided by a simple majority provided that a quorum of Participants is present. A quorum shall consist of at least nine Participants. In case a quorum is not present at an annual meeting of Participants, elections shall be decided 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 Chairman.

7.3 **Executive Committee**:
The Executive Committee will be responsible for the management of the project on a day-by-day basis within the guidelines set at the annual meeting of Participants. The Executive Committee will provide guidance and direction to the Coordinator who will act as the focal point for the Program during intercessional periods on matters related to the

operation of the Program.

7.4 **Coordinator**:
Specific responsibilities and duties of the Coordinator are contained in Appendix 2, Terms of Reference for the Coordinator of the International Arctic Buoy Program.

7.5 **Funding Provisions**:
The Program will be self sustaining, supported by contributions in the form of equipment, services (such as communications, deployment, archiving, scientific or technical advise), coordination, or monetary contributions. As necessary, the Participants shall establish a budget in order to implement the Program. Other funding arrangements made between the Participants will be recognized as contributions to the IABP if they further the Objective of the Program.

7.6 **Program Review**:
The management structure and operation of the Program shall be reviewed at the annual meeting of Participants.

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

9. **Glossary**
Basic Meteorological Data - Atmospheric pressure, air temperature, and buoy location

Appendix 1

Letter of Intent to Join
International Arctic Buoy Program

Dear Colleague:

I propose that our agency will participate in the International Arctic Buoy Program to pursue the maintenance of a network of data platforms on the Arctic Ocean.

This participation is regulated by the terms of the Operating Principles of the IABP and other terms attached to this letter.

I expect that our agency will contribute_____to the IABP for the first year of our participation and_____in subsequent years.

The contribution is made with the understanding that it be applied to the objectives of the Program.

Yours faithfully,

_____

Appendix 2

Terms of Reference for the
Coordinator of the International Arctic Buoy Program

The Coordinator shall facilitate the implementation of the international Arctic Buoy Program. The Coordinator will be elected at the annual meeting of the Participants and will be directed by the Executive Committee. The Coordinator is charged specific responsibilities to:

1) monitor and receive appropriate Argos and non-Argos data from the buoy network and prepare a monthly status report of buoy positions;

2) coordinate with operators of non-Argos buoy programs and other field operations;

3) liaise with Principal Investigators and managers of individual buoy programs in the Arctic Ocean;

4) arrange for the maintenance of research quality data base of ice motion and surface meteorological data, and submit through the World Data Centre A (Glaciology) to World Data Centre B (Sea Ice) and MEDS.

5) develop a deployment strategy to maintain an optimum buoy network in the Arctic;

6) coordinate opportunities for buoy deployment

7) liaise on technical aspects of buoy deployment

8) prepare an annual summary of resources committed to the program

9) liaise with Technical Coordinator of the Data Buoy Cooperation Panel to ensure arctic data are properly quality controlled and distributed over GTS;

10) arrange for the purchase of buoys and ancillary equipment as authorized;

11) arrange for the payment of expenses for Argos data acquisition and Argos processing fees as authorized;

12) prepare and distribute an annual data report;

13) maintain a distribution list for monthly status report and annual data reports;

14) respond to requests from WMO, WCRP, and the International Arctic Science Committee (IASC) for reports on arctic climatology, global change, and advise on design of experiments;

15) prepare and distribute a bimonthly newsletter of activities and plans;

16) organize the annual meeting of Participants, present a report of the preceding year's activities, and prepare a plan for the following year;

17) promote the International Arctic Buoy Program to potential participants.

NOTE: Specific contractual duties of the Coordinator which may arise in the future will be approved through the Executive Committee.

ATTACHMENT 4

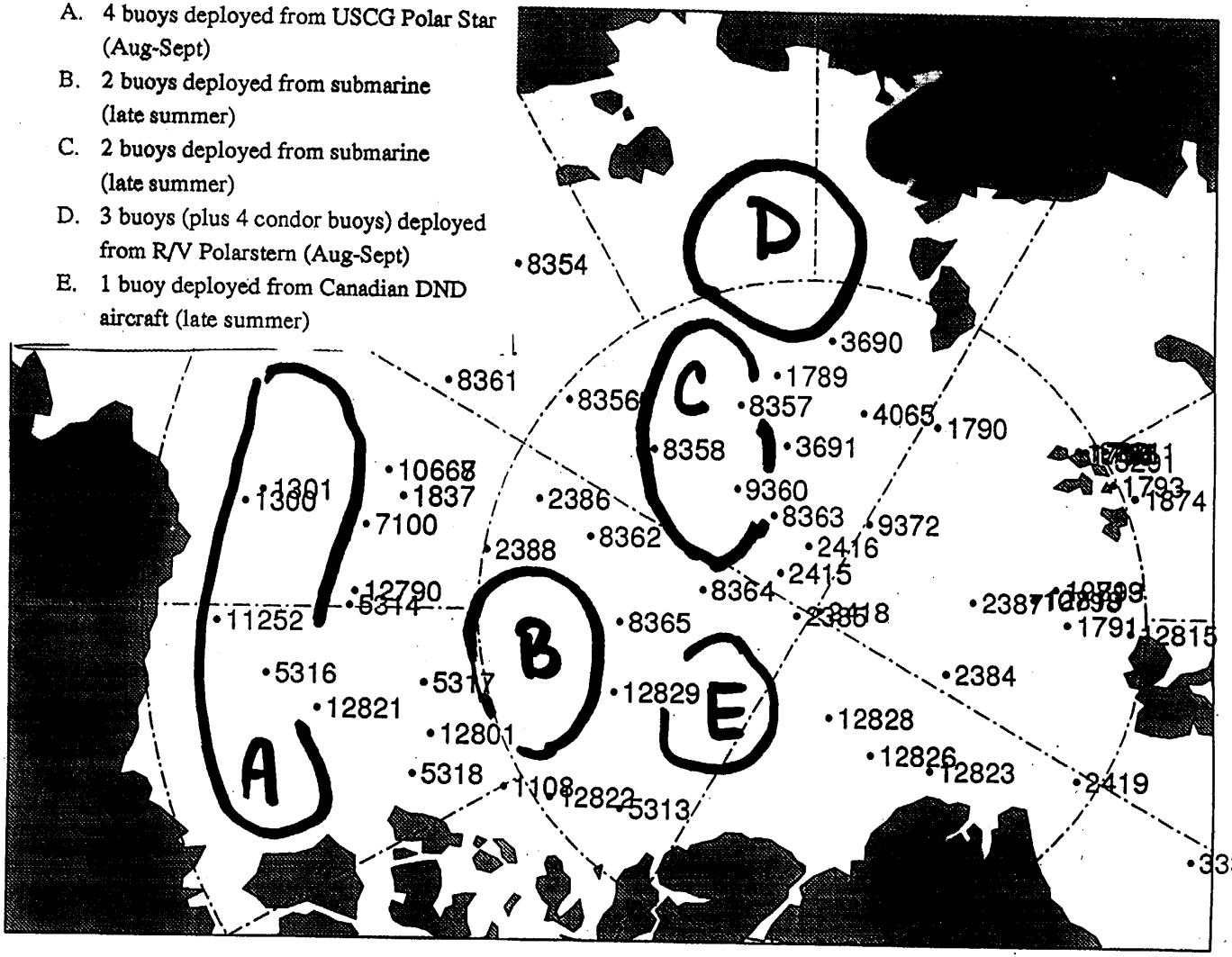
1 Jul 1993

DATE DEPLOYED	ARGOS ID	WMO ID	EXPR NUMBER	GTS HEADER	POSITION • LAT	POSITION • LONG	DATA BYTES	P	T
Oct 92	1105		633		71.393	-70.556			
Jun 93	1108	48521		SSVX02-LFPW	79.400	-120.000			
Apr 93	1300	63656	1053	SSVX12-KARS	72.765	-160.676	4	√	√
Apr 93	1301	63657	1053	SSVX12-KARS	73.213	-162.156	4	√	√
May 92	1639	25562	484	SSVX07-LFPW	74.405	-12.320	16	√	√
Dec 92	1788		29		80.571	62.396			
May 93	1789		29		82.759	128.617			
May 92	1790	26532	29	SSVX07-LFPW	83.185	86.695	16	√	√
May 92	1791	26531	29	SSVX07-LFPW	82.306	28.533	16	√	√
Dec 92	1793		29		80.123	54.233			
Dec 92	1795		29		80.384	61.582			
Dec 92	1796		29		80.531	61.777			
Mar 92	1837	48567	695	SSVX02-CWEG	77.312	-165.508	32	√	√
Dec 92	1872		29		76.600	26.049			
Dec 92	1874		29		79.675	50.689			
Sep 92	2384	25548	1053	SSVX18-KWBC	85.596	6.825	16	√	√
Apr 93	2385	25549	1053	SSVX18-KWBC	89.549	-145.794	16	√	√
Sep 92	2386	25550	1053	SSVX02-CWEG	81.176	-172.499	16		√
Sep 92	2387	25551	1053	SSVX18-KWBC	85.113	35.476	16	√	√
Sep 92	2388	25552	1053	SSVX02-CWEG	80.093	-160.675	16	√	
Apr 93	2415	25553	1053	SSVX18-KWBC	88.419	156.469	16	√	√
Apr 93	2416	25554	1053	SSVX18-KWBC	87.903	123.033	16	√	√
Apr 93	2418	25556	1053	SSVX18-KWBC	89.742	56.399	16	√	√
Sep 92	2419	25557	1053	SSVX18-KWBC	80.654	-1.599	16	√	√
Dec 92	3291		29		80.002	58.588			
Mar 93	3334		636		76.509	-2.719	16	√	√
Dec 92	3611		29		79.873	60.090			
Dec 92	3612		29		75.032	23.939			
Dec 92	3613		29		76.689	24.706			
May 93	3690	25011	314		81.770	115.947		√	√
May 93	3691	25012	314		84.869	128.494		√	√
May 93	4065	25013	484		83.735	105.827		√	√
Aug 92	5313	47532		SSVX02-CWEG	81.800	-103.800			
Aug 92	5314	48526		SSVX02-CWEG	76.200	-150.400			
Jun 93	5316	48522	627	SSVX02-LFPW	73.600	-143.000			
Jun 93	5317	48523		SSVX02-LFPW	78.200	-139.100			
Jun 93	5318	48524		SSVX02-LFPW	77.100	-127.400			
Mar 92	7100	48568	695	SSVX02-CWEG	76.439	-160.786	32	√	√
Mar 93	8354	25537	282	SSVX16-KARS	76.368	160.462	4	√	√
Mar 93	8356	25538	282	SSVX16-KARS	80.337	168.899	4	√	√
Mar 93	8357	25539	282	SSVX16-KARS	83.384	138.918	4	√	√
Mar 93	8358	25540	282	SSVX16-KARS	83.196	163.860	4	√	√
Mar 93	8361	48518	282	SSVX16-KARS	77.116	177.816	4	√	√
Mar 93	8362	48519	282	SSVX16-KARS	83.018	-168.962	4	√	√
Mar 93	8363	25541	282	SSVX16-KARS	86.795	141.082	4	√	√
Mar 93	8364	48557	282	SSVX16-KARS	86.688	-162.734	4	√	√
Mar 93	8365	48561	282	SSVX16-KARS	84.292	-146.889	4	√	√
May 92	9360	65663	919	SSVX07-LFPW	85.618	150.878			
May 92	9372	65662	919	SSVX07-LFPW	86.736	88.012			
May 92	10667		1016		76.661	-168.187			
May 92	10668		1016		76.661	-168.180	32	√	√
Apr 92	10798		111		83.290	34.820	32		
Apr 92	10799		111		82.594	36.814	32		
Sep 92	11252	48529	633	SSVX06-KARS	72.256	-148.641			
Apr 92	12790	47604	282	SSVX18-KWBC	76.345	-152.278	20	√	√
Mar 91	12801	48520	282	SSVX16-KARS	78.013	-131.722	4	√	√
Apr 92	12813	26509	282	SSVX18-KWBC	82.588	36.815	32	√	√
Apr 92	12815	26510	282	SSVX18-KWBC	80.437	27.385	32	√	√
Apr 92	12819	26511	282	SSVX18-KWBC	83.237	35.132	32	√	√
Apr 92	12821	48558	282	SSVX16-KARS	74.949	-138.409	4	√	√

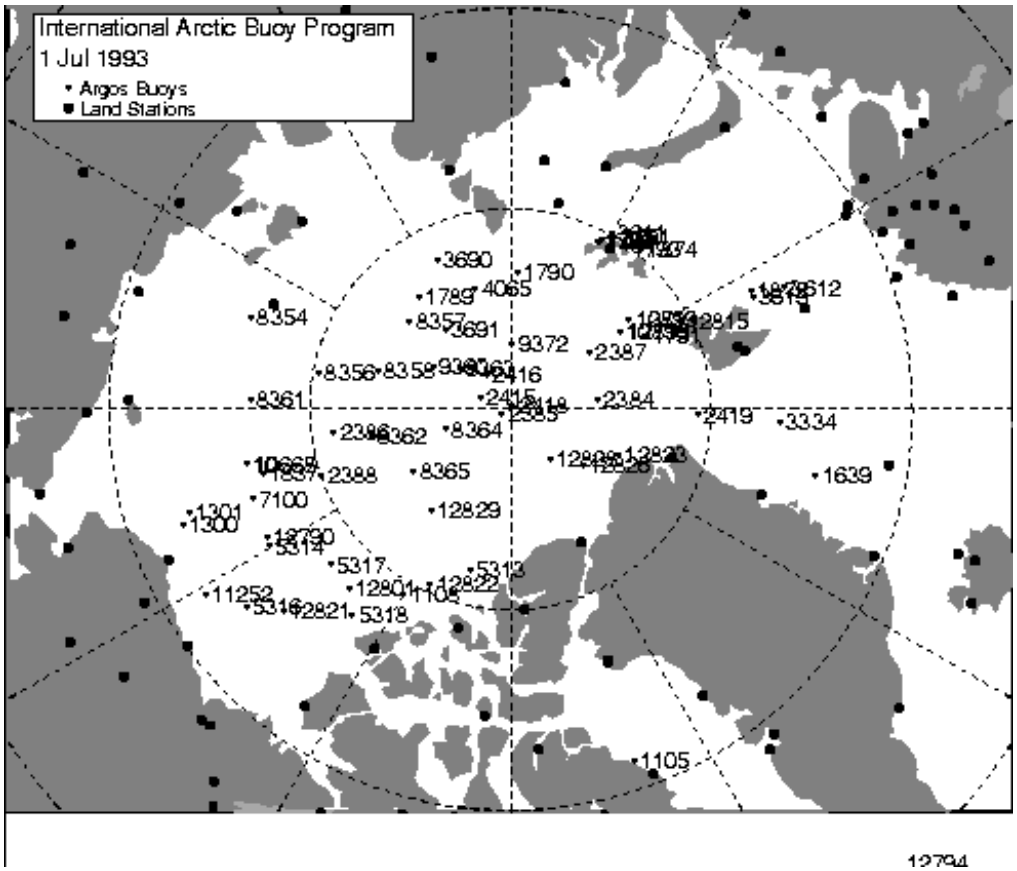
Apr 92	12822	48559	282	SSVX16-KARS	80.418	-114.357	4	√	√
Apr 92	12823	47601	282	SSVX16-KARS	84.138	-22.611	4	√	√
Apr 92	12826	48562	282	SSVX16-KARS	85.445	-37.067	4	√	√
Apr 92	12828	48564	282	SSVX16-KARS	86.854	-50.716	4	√	√
Apr 92	12829	48565	282	SSVX16-KARS	83.637	-127.530	4	√	√

IABP BUOY DEPLOYMENTS PLANNED FOR
SECOND HALF OF 1993

A. 4 buoys deployed from USCG Polar Star (Aug-Sept)
B. 2 buoys deployed from submarine (late summer)
C. 2 buoys deployed from submarine (late summer)
D. 3 buoys (plus 4 condor buoys) deployed from R/V Polarstern (Aug-Sept)
E. 1 buoy deployed from Canadian DND aircraft (late summer)



IABP BUOY POSITION AS OF 01 JULY 1993



Attachment 5

LIST OF PARTICIPANTS

in the International Arctic Buoy Program
June, 1993

The following organizations are Participants m the International Arctic Buoy Program:

1.	Alfred Wegener Institute for Polar and Marine Research	Germany
2.	Arctic and Antarctic Research Institute	Russia
3.	Arctic Centre, University of Lapland	Finland
4.	Atmospheric Environment Service	Canada
5.	Canadian Coast Guard	Canada
6.	Chr. Michelsen Research Institute	Norway
7.	Institute of Ocean Sciences	Canada
8.	Marine Environmental Data Service	Canada
9.	Nansen Environmental and Remote Sensing Centre	Norway
10.	Norske Polarinstitutt	Norway
11.	Norwegian Meteorological Institute	Norway
12.	Pacific Marine Environmental Laboratory	USA
13.	Polar Science Center, University of Washington	USA
14.	Russian Federal Service for Hydrometeorology and Environmental Monitoring	Russia
15.	Scott Polar Research Institute	U.K.
16.	Service Argos	France, USA
17.	U.K. Meteorological Office	U.K.
18.	U.S. Naval Oceanographic Office	USA
19.	U.S. Naval Oceanography Command	USA
20.	U.S. Navy/NOAA Joint Ice Center*	USA
21.	ICSU/IOC/WMO World Climate Research Program	

* Representing several U.S. agencies

ATTACHMENT 6

The Global Ocean Observing System

The Global Ocean Observing System (GOOS) has been initiated by the Intergovernmental Oceanographic Commission (IOC). The International Council of Scientific Unions (ICSU), the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP) have agreed to co-operate in this endeavor. GOOS will be developed on a sound scientific basis using the findings of existing, on-going research programmes including WOCE, TOGA and JGOFS, Operational programmes including IGOSS, IODE and GLOSS form a foundation. GOOS will utilize operational observing methods, both remote sensing and in-situ measurements obtained from ships, towed and anchored systems, drifting buoys, and sub-surface floats.

It is essential that we start developing GOOS now as a global framework for systematic ocean observations to meet needs for detecting and forecasting climate variability and change; for assessing the health or state of the marine environment and its resources, including the coastal zone; and for supporting an improved decision-making and management process --- one which takes into account potential natural and man-made changes in the environment and their effects on human health and resources. The planning presently encompasses five modules: (i) Climate Monitoring, Assessment and Prediction; this module is common with the ocean component of GCOS-the Global Climate Observing System; (ii) Monitoring and Assessment of Marine Living Resources; (iii) Monitoring of the Coastal Zone Environment and Its Changes; (iv) Assessment and Prediction of the Health of the Ocean; and (v) Marine Meteorological and Oceanographic Operational Services. The major elements of GOOS are operations oceanographic observations and analyses, timely distribution of data and products, data assimilation into numerical models leading to predictions, and capacity building within participating Member States, especially in developing countries, to develop analysis and application capability, GOOS will be developed in a phased approach: (i) a planning phase including conceptualization, design and technical definition; (ii) operational demonstrations for each of the five modules; (iii) implementation of permanent aspects of the Global Ocean Observing System; and (iv) continued assessment and improvement in the individual aspects of the entire system.

Today we are experiencing unprecedented pressures on our natural resources. Sustainable development of these resources is hindered by our inability to detect emerging environmental problems at an early stage when remedial measures are still possible. Nowhere is this inadequacy so pronounced as in the marine area. Global energy cycles and the biological processes upon which all life depends are critically influenced by the ocean. Governments collectively are only now beginning to recognize the complexity and interdependence of all aspects of the system. Systematic global observations of the world oceans are required to improve our knowledge and predictive capabilities which will be the basis for more effective and sustained use of the marine environment, with the associated economic benefits.

For further information please contact: IOC Secretariat, UNESCO GOOS Support Office 1, rue Miollis 75732 Paris Cedex 15 France Phone: (33)(1)45.68.40.42; Fax: (33)(1)40,56.93.16; Telemail: GOOS.PARIS/OMNET.

ATTACHMENT 7

Surface Wind and Geostrophic Wind in the Arctic Basin

By Roger Colony

The 10-m wind was monitored at the Soviet drifting ice stations (1950-1991) as part of routine meteorological observations. In 1979, the Arctic Buoy Program began monitoring the fields of surface pressure, surface temperature, and ice motion throughout the Arctic Basin. Data from these two programs are combined to produce a concurrent, collocated time series of 10-m wind and surface geostrophic wind (1979-1990). During this 12 year period there were usually two Soviet ice stations in operation, thus the time series contain about 600 daily observations for each calendar month. For this study the data is lumped together spatially in an effort to strengthen the, statistics of the seasonal cycle. The data is used to estimate the seasonal cycle for mean daily wind speed, variance of the vector wind, and covariance of the vector 10-m wind and the vector geostrophic wind. The analysis shows a pronounced seasonal cycle in the mean geostrophic wind speed, having a wintertime maximum of 8 ms-1 and a summer minimum of 6 ms-1. The monthly mean 10-m wind speeds are about 5 ms-1 and show no seasonal cycle. The overall study shows a seasonal cycle in both, the reduction of speed and the turning angle from the geostrophic wind to the surface wind. The wind data is also segregated by the vorticity of the geostrophic wind and the seasonal cycle of covariance is analyzed for cyclonic and anticyclonic events. The overall results are in qualitative agreement with observations from earlier expedition -- Fram, 1893-96, Maud, 1922-24; and AIDJEX, 1975-76. Our approach is considerably different from the usual studies of the atmospheric boundary layer, First, the data base spans 12 years, second, the measurement errors are large. The primary source of error comes from the analysis of the geostrophic wind, and we show how some of the statistics are biased by these errors. On the pragmatic side, any routine use of numerical weather prediction analyses must accommodate these same errors.

State of-the-art and Prospects of Russian Arctic Buoy Program

by Sergei V. Vassiliev

The Russian Federal Service for the Hydrometeorology and AARI are now developing and creating an automated ice-information system. The arctic buoys are an important part of the system. Unfortunately, the problems Russia faces have influenced the Russian arctic operations.

The active Russian system KONDOR includes:

- automated ice buoy KONDOR-1 with air temperature and atmospheric pressure sensors;
- device KONDOR-2 on board the satellite OKEAN;
- receiving ground stations KONDOR-3 located in Moscow and St. Petersburg.

The delay in receiving data from buoys range from 1 hour to 2 days due to the fact that there is only one satellite (OKEAN) in orbit with KONDOR on board. A buoy accumulated meteorological data for 5 synoptic periods and reports it at one contact.

Due to the disintegration of the Soviet Union, the space system OKEAN, developed and manufactured in the Ukraine, has ceased functioning. The last two OKEAN satellites should be launched in 1993 and 1994. There are 8 buoys ready to work with OKEAN.

The most appropriate national system for collecting data from Russia buoys for the future will be newly developed space system, COURSE, which will operate a minimum of two, satellites at optimum orbits of about 1000 km. Russia should begin operating new buoys under the COURSE system after tests are completed in 1995.

Russian experience of operating the drifting buoys in the Arctic

by Ivan Frolov

The first drifting radio buoy was developed in 1954. It did not have sensors and was used only for determining ice drift speed and direction mainly in die Arctic Seas. 10-15 buoys were deployed annually for 3 years.

In 1957 a drifting radiometeorological buoy, DARMS, with sensors was developed, this buoy provided information about air temperature, atmospheric pressure wind speed and direction. DARMS buoy were in use till 1972. In total 200 such buoys were deployed.

Over 20 years AARI deployed more than 350 radiobuoys in the Arctic Seas and the Arctic Basin with the average life duration about 6 months. The analysis of the drift data allowed one to find out important typical features of the ice dynamics and meteorological regime.

Arctic Climate System Study

by V. Savtchenvo

ICSU/IOC/WMO JPS for WCRP

Polar regions constitute the energy sink of the climate system. They also influence the global climate through them impact on the circulation of the ocean. In 1992, the ISCU/IOC/WMO Joint Scientific Committee (ISC) for World Climate Research Programme established a WCRP programme aimed at investigating, modelling and eventually predicting the circulation of the Arctic Ocean and the volume of sea ice, the fresh water budget of Arctic region, and the exchange of fresh water with the global ocean in the context of the overall objective of understanding the role of the Arctic as an interactive component of the global climate system. ACSYS is still at the planning stage. However, there are positive indications of the availability of required technical and logistic facilities.