SUMMARY REPORT OF THE FIFTH ANNUAL MEETING OF THE INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)

Landover, Maryland, USA
4-6 April 1995

The IABP was established in 1991 as an action group of the
World Meteorological Organization (WMO)/
Intergovernmental Oceanographic Commission (IOC)
Data Buoy Cooperation Panel (DBCP)

SUMMARY REPORT OF THE FIFTH ANNUAL MEETING OF THE INTERNATIONAL ARCTIC BUOY PROGRAMME (AIBP)
Landover, Maryland, USA
4-6 April 1995

1. Opening of the Meeting and Welcome

The fifth annual meeting of the International Arctic Buoy Programme, IABP-5, was opened at Service Argos, Inc. of Landover, MD, USA by Mike Balshaw, Chairman, at 0900 on 4 April 1995.

Mike Balshaw welcomed those in attendance and thanked Archie Shaw, President of Service Argos, Inc. for hosting this year's meeting.

A list of attendees is given in Attachment 1.

2. Approval of the Agenda

The draft agenda was updated and approved. (See Attachment 2)

3. Approval of Minutes of IABP-4, Helsinki, Finland, June 1994

The minutes of IABP4 were reviewed and approved with provisions for distribution in May 1995.

Changing the domain of the Arctic buoy map/table to include all operating IABP buoys was discussed. It was suggested that three buoy types be reflected on the monthly map: position-only, buoys equipped with ventilated and shielded air temperature sensors and other buoys. The Data Buoy Cooperation Panel (DBCP) Technical Coordinator recommended that DBCP position-only buoys should be distributed on the Global Telecommunication System (GTS).

It was noted that the IABP bank account has not been established and that the IABP has a need for a means to fund small projects. For example, editorial updates to IABP brochure were suggested and 500 additional copies are planned to be printed and distributed this year.

4. Review of Operating Principles of the Programme

It was suggested that the Operating Principles of the IABP (Attachment 3 of the Summary Report of the Fourth Annual Meeting of the International Arctic Buoy Programme) would be submitted to a professional editor for a style review. An edited version of the Operating Principles will be circulated for comments and presented at next the IABP meeting. It was suggested that original Operating Principles be used in the new printing of the IABP brochure.

It was suggested that changes to the Letter of Intent include: the closing to read "yours sincerely" vice "yours faithfully" and footnote 1 read "send to IABP Chairman in care of IABP Coordinator".

5. Coordinator's Report

Roger Colony, IABP Coordinator, delivered his annual report.

Roger Colony discussed current status of IABP buoy array and 1995 deployment plans of IABP Participants.(See Attachment 3) He expressed satisfaction in the status of the array but noted a scarcity of buoys in the Beaufort and Siberian Seas. Buoy deployment plans include: 2 USIABP buoys by submarine this spring, 9 buoys (3 Norwegian, 2 German, 1 UX, 2 USA and 1 Canadian) aerially deployed by the United States Navy this summer in the Beaufort Sea, 2 German buoys and 3 Russian/German buoys in the Laptev Sea and 4 Russian/USA beacons in the Kara Sea. It was noted that an additional deployment asset will be the Canadian icebreaker Louis St. Laurent- in the Beaufort Sea.

Roger Colony noted that the National Snow and Ice Data Center (NSIDC) and World Data Center-A, USA for Glaciology (WDC-G) serves as the permanent archive of IABP data while the Polar Science Center (PSC) serves as the primary distributor of data. PSC data distribution will now be done electronically by anonymous FTP and World Wide Web hypertext (http://iabp.apl.washington.edu) services of Internet.

Roger Colony discussed his acceptance of a new position as Director of the International Arctic Climate System Study (ACSYS) Project Office, but expressed that he could continue as IABP Coordinator. He advised the Participants that Ignatius Rigor and Polar Science Center staff would assist and provide in the data management and coordination duties.

Victor Savtchenko presented summaries of the science objectives of the Greenland Sea Project and International Arctic Polynya Programme which were presented at the Arctic Ocean Science Board (AOSB). It was suggested by the 14th session of the Board that the IABP foster coordination with these programmes. Questions concerning survivability of IABP buoys were discussed. It was suggested that the use of IABP buoys near the recurring polynyas of Baffin Bay and NE Greenland were not consistent with the objectives of the IABP. It was recommended that the IABP Coordinator formally respond to the AOSB.

Thor Kvinge presented statistical results from an Argos/GPS positioning comparison. Accuracy within one standard deviation was estimated to be 123 meters.

6. Report from Data Buoy Cooperation Panel

Etienne Charpentier reported on behalf of the Data Buoy Cooperation Panel (DBCP) on topics related to the IABP. (See Attachment 4)

7. Technical Presentations

.1 IABP Data in Support of Arctic Nuclear Waste Assessment Program, Roger Colony

Dirty ice has been observed throughout the Arctic Basin. The most likely source of this ice are the shallow water polynas of the marginal seas, where frazil ice is formed in turbid waters.
Using the IABP data, "backwards" trajectories can be analyzed to determine the origin of any piece of ice, given a sample's location and time of collection. This analysis has been applied to samples of Lead (Pb), smectite (a clay), etc., by Pfirman, Colony, et al. (submitted to Science, 1995). Samples of high lead concentration were shown to track back to the Kara Sea. Samples of

low lead tracked back to the Laptev and East Siberian Seas. Samples of smectite tracked back to the fast ice edge of the marginal seas were shown to generally match up with sea floor samples of the source areas. Ice production in the Laptev Sea has been estimated using ice motion derived from analysis of buoy motions and geostrophic winds. (Rigor, I. and Colony, R. not yet released.) A number of ice production areas were identified, but only ice produced in the shallow water during the fall freeze up, and ice produced in the shallow water polynyas during the early winter (Nov, Dec, and Jan) were considered candidates for long range transport of pollutants. He estimated that 250,000 square kilometers of dirty ice were produced, on average, each year from the marginal seas. This is roughly 25% of the net area flux through the Fram Strait, but because of deformation, possibly 20%.

.2 The IABP on the Information Highway, Ignatius Rigor

Traditionally the data from IABP has been distributed on tape by WDC-A at NSIDC. A couple years ago, PSC made the data available via anonymous ftp. Now the databases, the monthly map and table, other graphics and more information for the IABP have been made available on the World Wide Web using Hyper Text Transfer Protocol (http) and Mosaic, or Netscape software. Since the move to http service for the IABP databases was implemented, usage has steadily increased. Last month, over 250 different users have accessed the data and graphics via http. This amounts to potentially over 10 calls per working day that now do not need to be responded to, thus saving time and money, and makes access to IABP information significantly more convenient for users. To access the IABP home page, in Mosaic, or Netscape, open "http://iabp.apl.washington.edu".

.3 RADARSAT and the Use of Synthetic Aperture Radar Data at the National Ice Center, David Benner

The mission of the National Ice Center (NIC) is to provide global sea ice analysis and forecast products in support of USA government requirements. NIC sea ice products, used by both the operational and research communities, are produced by blending a variety of remotely sensed and ground-truth data sources. One of the most valuable is the all-weather high resolution capability provided by Synthetic Aperture Radar (SAR) data from the ERS-1 satellite. ERS-1 SAR data is from a C-band vertically polarized Radar, which is used to image ice at 240 meter resolution in 100x100 km scenes. ERS-1 SAR imagery are acquired from satellite receiving stations located in Alaska (Fairbanks), Canada (Gatineau) and Norway (Tromso). SAR data from these three station masks effectively cover the majority of ice-covered Arctic areas. NIC utilizes these data for the production of tactical-scale products to ensure the safety of navigation of vessels operating in the ice. Other uses of SAR data include: 1) the use of a classification algorithm (based on intensity backscatter) to identify different sea ice types (ages) and 2) the development of an ice motion product. IABP drifting buoys provide air temperature data, which are important to the ice classification products and ice drift data which can be used to ground-truth SAR derived ice motion products. RADARSAT, planned to be launched in late 1995, will provide the NIC with a global high resolution SAR capability. NIC will obtain RADARSAT data (ScanSAR) with 100 meter resolution in 500x500 km scenes. Ongoing SAR activities includes the development of an ice/no ice detection algorithm (in cooperation with the Ice Center, Environment Canada) and the development of an "expert system" for ice classification based on geophysical and geographical knowledge.

.4 Beaufort and Arctic Storms Experiment (Canadian), 01 Sept-13 Oct 1994, Ed Hudson

(See Attachment 5)

.5 Value of IABP Buoy Data to Operational Forecasters, Ed Hudson

(See Attachment 6)

.6 Argos II, Jeff Wingenroth

Mr. Jeffrey Wingenroth, Vice President of Service Argos, Inc., presented an update on plans for the Argos system. Included were discussion of the following:

1) System Use - The number of Argos PTTs in the field continues to grow; however, the number of PTTs transmitting each day is leveling off. This is indicative of the increased use of duty cycles (intermittent periods of transmission). Growth in PTT numbers is particularly strong in the Biology applications.

2) Multi-satellite service - The two operational satellites from which Argos is now processing data are NOAA 12 and NOAA 14, with NOAA 14 having replaced NOAA 11 this past winter. Additionally, Argos is now processing data from a third satellite, NOAA 9, on an as-available basis. Discussions are underway to include additional satellites in the future. The inclusion of NOAA 14 and NOAA 9 has profoundly reduced the gap in time between passes at lower latitudes and increased the number of locations and quantity of data available globally.

3) Argos-2 instrument - the next series of satellites (NOAA K, L, M) will carry the Argos-2 instrument. This instrument carries 8 Data Recovery Units (DRUs) (as opposed to 4 on earlier spacecraft). The receiver is more sensitive and operates with a wider bandwidth. This will facilitate the use of lower powered PTTs and nearly quadruples the capacity of the system.

4) Command Link - An agreement has been signed with NASDA (the Japanese space agency) to include an Argos-2 instrument on-board the meteorological satellite, ADEOS-II. Plans are to establish a two-way capability or Command Link to the PTTs. Modes of operation are under discussion. One stipulation is that existing modes of operation must be allowed to continue as before. ADEOS-II is scheduled for launch in early 1999.

8. Status of Membership Roll

The list of Participants was reviewed. (See Attachment 7) A motion was set forth to ensure all Participants included on the roll have a signed Letter of Intent on file with the IABP Coordinator. Action concerning this item and confirmation of a Participant's interest in the IABP will be reaffirmed every five years by the Executive Committee.

9. Reports from Participants

Status reports were given by, or on behalf of, the following Participants: (See Attachment 8)

CANADA	Environment Canada Canadian Coast Guard Institute of Ocean Sciences
GERMANY	Alfred Wegener Institute for Polar and Marine Research

NORWAY	Christian Michelsen Research Institute Norwegian Polar Institute Norwegian Meteorological Institute
RUSSIA	Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet) Arctic and Antarctic Research Institute (AARI)
UNITED KINGDOM	U.K. Meteorological Office
UNITED STATES OF AMERICA	Polar Science Center, University of Washington National Ice Center (representing several U.S. agencies)
INTERNATIONAL ORGANIZATION	World Climate Research Programme (WCRP)

10. New Sensors for Buoys

Dave Benner opened the discussion by noting that the United States Interagency Arctic Buoy Program (USIABP) sponsors have expressed interest in incorporating additional sensors on-drifting buoys. Of particular interest are thermistor chain extending from ice surface to underlying ocean. Roger Colony confirmed that this technology is well-proven and should not add a prohibitive cost to the surface deployed buoys.

Etienne Charpentier suggested that all previous work done by IABP Participants on the measurement of air temperature by drifting buoys be shared with other action groups of the DBCP. The IABP chairman suggested that the IABP consider presenting these findings at the meeting of the 11th session of the DBCP on 17-20 October, 1995 at Pretoria (South Africa).

Roger Colony noted that the IABP has been very successful with the current sensor array on IABP buoys. He noted that RADARSAT data may preempt the importance of the ice motion products currently being produced by the IABP. This trend, coupled with an IABP future focus on surface deployed buoys, reinforces the interest in integrating additional environmental sensors. Roger Colony suggested that internal stress sensors could provide valuable information to the scientific community. It was noted that the cost of incorporating anemometers may not be justified by the collection of data which can be explained by geostrophic wind calculations.

Victor Savtcheriko discussed the importance of snow thickness measurements to the WCRP ACSYS study of the hydrological cycle. Mike Balshaw stated that the future of data collection will be a complete ecosystem approach and that the IABP should engage other programs as potential partners.

11. New Business

The IABP Chairman opened the discussion on the ability of the IABP to handle incidental expenses. Two proposals were considered: 1) opening an account with WMO and 2) estimating

expenses at each annual meeting and identifying Participants who are willing to contribute to cover the costs. It was agree that the 2nd method was preferable.

The NOAA office of Global Programs graciously offered to cover the miscellaneous travel costs associated with the 1996 IABP meeting. Environment Canada offered to cover costs associated with re-printing the IABP brochure.

An offer to host the next IABP meeting was received from the U.K. Meteorological Office to be held in the Bracknell area of U.K. in June, 1996. It was noted that the IABP meeting would benefit by coordinating the meeting date with the bi-annual meeting of the International Programme of Antarctic Buoys. The IABP Executive Committee will confirm the exact dates for the Sixth Annual Meeting of the IABP.

The benefits of joint meetings and technical seminars with the European Group on Ocean Stations (EGOS) and the MRP International Programme for Antarctic Buoys (IABP) were discussed. A working group was established to investigate the possibility of joint meetings in the U.K.

12. Information on Related Observational and Data Programs

.1 RADARSAT Geophysical Processing System (RGPS), Roger Colony

The RGPS, which will be located in Alaska (Fairbanks), will process RADARSAT imagery to produce gridded geophysical products. These data will be used to study the impact of sea ice on climate, pollution monitoring, navigation, weather forecasting and climate prediction. Proposed RGPS data products include a 5 km Lagrangian weekly ice motion product; 100 km gridded field of pressure, wind and air temperature; and a 100 km gridded field of ice motion and ice age/thickness distribution. It is believed that the RGPS implementation team will request the IABP to provide a daily averaged air temperature field product. (See Attachment 9)

.2 International Programme for Antarctic Buoys, Victor Savtchenko

(See Attachment 10)

.3 Global Ocean Observation System (GOOS), Muriel Cole

GOOS is an operational system designed to observe the ocean for the benefit of society. GOOS is both international and intergovernmental and consists of five modules: climate prediction/climate change, living marine resources, health of the ocean, marine weather/operational oceanographic services and coastal zone management. GOOS provides ocean observations for the Global Climate Observing System (GCOS). (See Attachment 11)

.4 Quality Control at the Ocean Products Center, Christine Caruso

The Ocean Products Center (OPC) of the National Ocean Service presently uses the Quality improvement Performance System (QUIPS) to quality control ship and buoy observations prior to input to the weather models at the National Meteorological Center (NMC). Observations taken from the Global Telecommunication System (GTS) and Automated Weather Network (AWN) are compared to first-guess model fields, past histories and neighboring reports to aide in any decision to correct or remove an observation from the system. Monthly statistical summaries are distributed via Internet (buoy-qc@vedur.is) and can be subscribed to by sending a message to buoy-qc-request@vedur.is.

.5 Surface Heat Budget of the Arctic Ocean (SHEBA), Roger Colony

SHEBA is a field experiment planned to operate from Spring 1997 through the Fall of 1998 throughout the Arctic Basin. This program offers a great opportunity to all Participants to deploy surface buoys using the aircraft assets of this program. The point of contact for this experiment is Dick Moritz at the Polar Science Center. The best opportunity for buoy deployment will be in March and April of each year.

.6 Update on Joint Tariff Agreement, Terry Bryan

A summary of services and tariffs currently covered under the Joint Tariff Agreement was presented with an explanation of the new inactive status for buoys which are of no further use to the user or community. As an incentive for commercial organizations to become contributing members in the IABP and other international programmes, Terry Bryan offered that the JTA will undertake negotiations with CLS/Service ARGOS to amend the Agreement to allow such organizations a preferential tariff for Argos processing. (See Attachment 12)

13. Future Directions

The Participants agreed that the overall direction of the Programme was consistent with the Operating Principles of the IABP. It was clear from the Participant reports and the invited information presentation (as detailed in the attachments) that there were many emerging initiatives related to operational and research issues in the Arctic Region for the coming years 1995-2000. These initiatives were viewed as opportunities for IABP to offer support and to seek increased participation in both the Programme's scope and its technical developments. The challenge will be to establish effective linkages with each of these initiatives to ensure continued efficiencies are achieved through cooperation, sharing of equipment, logistics support, and data interchange across these many and varied programs and between the various researchers.

Participants also confirmed the need to pursue the expansion of daily temperature data sets from IABP platforms and to encourage the development of new sensors suitable for Arctic buoy deployment to measure additional meteorological, ice, ocean and environmental variables. Particular mention was made of the need for an operationally effective snow measurement technology for Arctic conditions and for in ice thermistor chains to facilitate heat flux calculations and to infer thickness in real time. Recent progress in maximizing timely availability and operational use of IABP data in real time from the GTS and by operational agencies was also noted.

It was agreed further that Participants would take every opportunity to promote greater awareness of IABP activities, interests and accomplishments within their respective operational research and public communities in order to ensure continued support for the long term benefits which accrue to all Participants from international cooperation in Arctic environmental monitoring within the IABP.

14. Election of Officers

In accordance with IABP Operating Principles, elections to the following offices took place:

Elected: <u>Executive Committee</u>

Chairman:	Mike Balshaw, Canada
Vice Chairman:	Thor Kvinge, Norway
Member:	Ivan Frolov, Russia

Member: Dave Benner, U.S.A.

Following the election of the Executive Committee, a vote of confidence and appreciation was expressed for Roger Colony to continue the appointment as the Coordinator of the IABP.

15. Review of Minutes of the Meeting

Draft minutes for the meeting up to and including items to 14 were reviewed and corrected. Dave Benner and LT Stephen Martin will distribute corrected draft minutes including Participants reports by the end of May 1995.

16. Tour of National Ice Center

A tour was made of the National Ice Center in Suitland, Maryland.

Attendees - International Arctic Buoy Programme Meeting
Landover, Maryland, U.S.A. 04-06 April 1995

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Agenda

Fifth Annual Meeting of International Arctic Buoy Programme, IABP-5
Landover, Maryland, USA
04-06 April 1995

Host: Service Argos Inc.
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Landover, Maryland

Archie Shaw, President
tel: (301) 925 4411
fax: (301) 925 8995

Tuesday 04 April, 1995 (0900)

1. Opening of the Meeting and Welcome

2. Approval of the Agenda

3. Approval of Minutes of IABP-4, Helsinki, Finland, June 1994

4. Review of Operating Principles of the Programme

5. Coordinator's Report

6. Report from Data Buoy Cooperation Panel
   Break for Lunch (1230-1400)

7. Technical Presentations (1400-1800)
   .1 IABP Data in Support of the Arctic Nuclear Waste Assessment Program, Roger Colony
   .2 The IABP on the Information Highway, Ignatious Rigor.
   .3 RADARSAT and the Use of Synthetic Aperture Radar Data at the National Ice Center, David Benner
   .4 Beaufort and Arctic Storms Experiment (Canadian), 01 Sept - 13 Oct 1994, Ed Hudson
   .5 Value of IABP Buoy Data to Operational Forecasters, Ed Hudson
   .6 Argos II, Jeff Wingenroth

Wednesday, 5 April 1995 (0900)

8. Status of Membership Roll

9. Reports from Participants

10. New Sensors for Buoys

Break for Lunch (1230-1400)

11. New Business

12. Information on Related Observational and Data Programs
    .1 RADARSAT Geophysical Processing System (RGPS), Roger Colony
    .2 International Programme for Antarctic Buoys, Victor Savtchenko
    .3 Global Ocean Observation System (GOOS), Muriel Cole
    .4 Quality Control at the Ocean Products Center, Christine Caruso
    .5 Surface Heat Budget of the Arctic Ocean (SHEBA), Roger Colony
    .6 Update on Joint Tariff Agreement, Terry Bryan

13. Future Directions

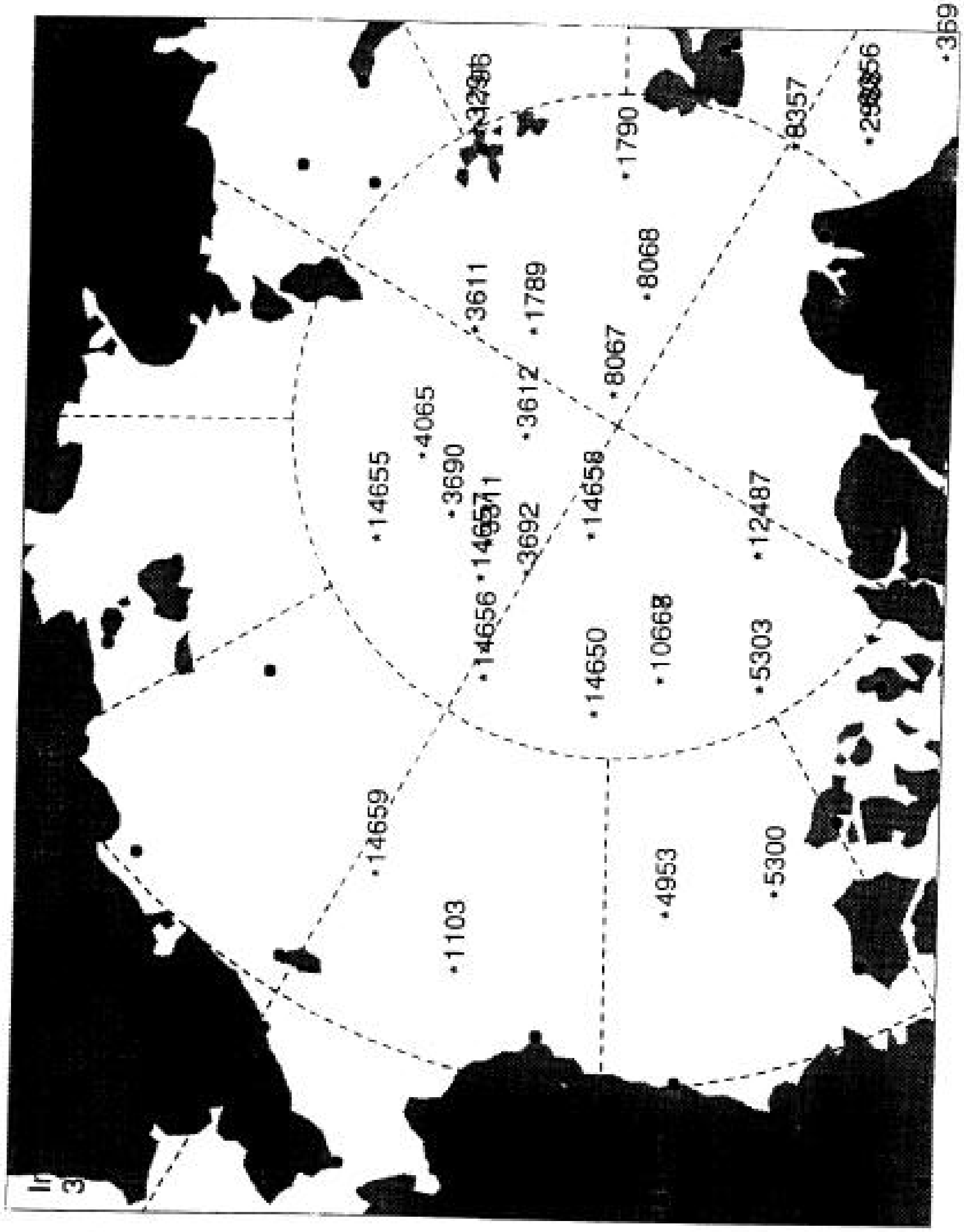
14. Election of Officers

Thursday, 6 April 1995 (0900)

15. Review of Minutes of the Meeting and Recommendations

Break for Lunch (1200-1300)

16. Tour of National Ice Center (1300-1500)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10668
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5300

31 Mar 1995

DATE DEPLOYED	ARGOS ID	WMO ID	EXPR NUMBER	GTS HEADER	POSITION ° LAT	POSITION ° LONG	DATA BYTES	P	T
Sep 94	1103		633		72.844	-165.503	4		
May 93	1789		29		86.138	73.778			
May 92	1790	26532	29	SSVX07-LFPW	82.452	29.832	16	√	√
Dec 92	1796		29		79.919	56.705			
Sep 92	2388	25552	1053	SSVX02-CWEG	78.618	-10.149	16	√	
	2960				71.969	19.373			
Dec 92	3291	25012	29		80.018	57.733			
Sep 93	3311	63662	919	SSVX07-LFPW	84.737	162.938	16	√	√
May 94	3611		29		84.713	87.967	16		
May 94	3612		29		87.173	127.602	16		
May 93	3690	25011	314	SSVX01-LFPW	84.279	148.728		√	√
May 93	3691	25012	314	SSVX01-LFPW	75.265	-10.490		√	√
May 94	3692		314	SSVX01-LFPW	84.781	179.313		√	√
May 93	4065	25013	484	SSVX07-LFPW	83.929	129.782		√	√
Oct 93	4953	48573	9053	SSVX02-CWEG	75.152	-142.958	32	√	√
Aug 92	5300	48525		SSVX02-CWEG	75.060	-130.050			
Aug 92	5303	48526		SSVX02-CWEG	80.950	-120.030			
	6288				72.062	18.643			
May 94	8067	63665	919	SSVX07-LFPW	89.043	39.743	24	√	√
May 94	8068	63661	919	SSVX07-LFPW	86.038	18.844	24	√	√
Mar 93	8356	25538	282	SSVX16-KARS	78.025	-7.405	4	√	√
Mar 93	8357	25539	282	SSVX16-KARS	80.075	-1.117	4	√	√
May 92	10667		1016		82.230	-138.989			
May 92	10668		1016		82.230	-138.958	32	√	√
Sep 92	11252	48529	633	SSVX06-KARS	70.986	-67.955			
Sep 93	12487	48577	9053	SSVX02-CWEG	84.195	-101.281	32	√	√
May 94	14650	48520	282	SSVX16-KARS	81.327	-153.179	4	√	√
May 94	14655	25546	282	SSVX16-KARS	81.882	145.706	4	√	√
May 94	14656	25547	282	SSVX16-KARS	81.418	-177.083	4	√	√
May 94	14657	25563	282	SSVX16-KARS	83.807	168.726	4	√	√
May 94	14658	25564	282	SSVX16-KARS	86.595	-162.038	4	√	√
May 94	14659	25537	282	SSVX16-KARS	74.625	-177.345	4	√	√

Data Buoy Cooperation Panel (DBCP) Report

Etienne Charpentier reported on behalf of the Data Buoy Cooperation Panel (DBCP) on topics related to the IABP. At its tenth session, La Jolla, November 1994, the DBCP agreed on Terms of Reference for its Action Groups stressing (i) provision of good quality and timely data to users, (ii) insertion of real time (and near real time) data onto the Global Telecommunication System (GTS), and (iii) exchange of information on data buoy activities and development and transfer of appropriate technology.

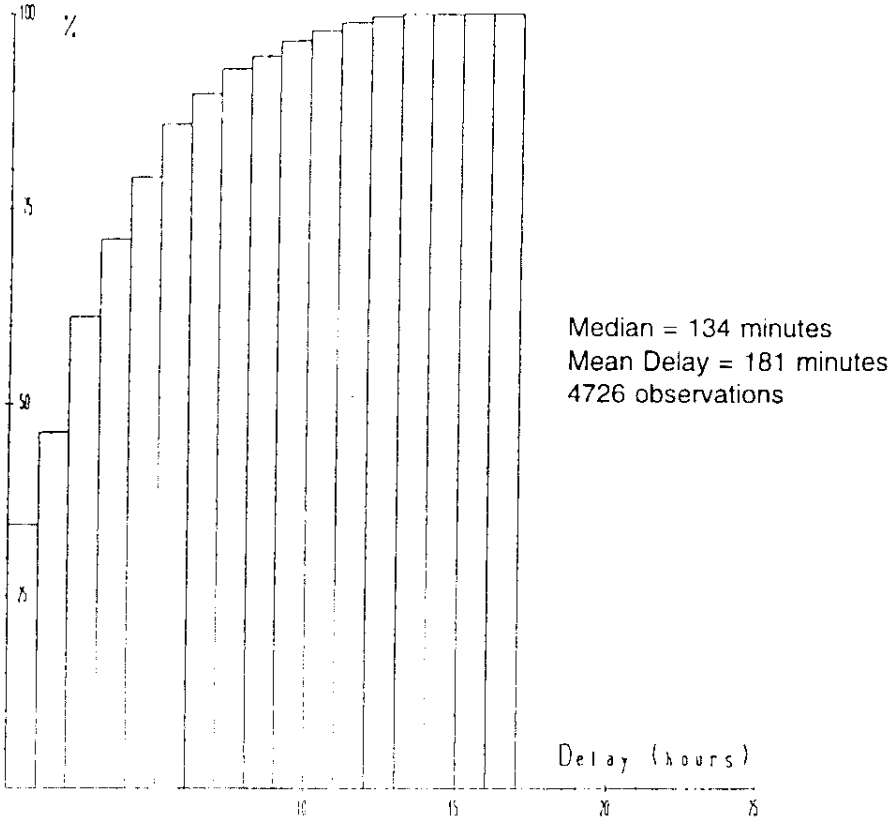
In that regard, as far as the IABP is concerned, the DBCP recognized that these objectives are being achieved. The issue of transmitting ice beacons (i.e. position only) on GTS was also discussed. It was finally recommended that this should be done.

A DBCP Internet World Wide Web server (accessible via address HTTP://DBCP.NOS.NOAA.GOV) was established in February 1995. The IABP server is directly accessible from it. The DBCP server includes general information regarding the Panel activities plus other relevant information such as Buoy Technology Development, Data Collection and Location Systems, and Quality Control Issues. For example, the list of WMO/Argos numbers and buoy operators is available on the server.

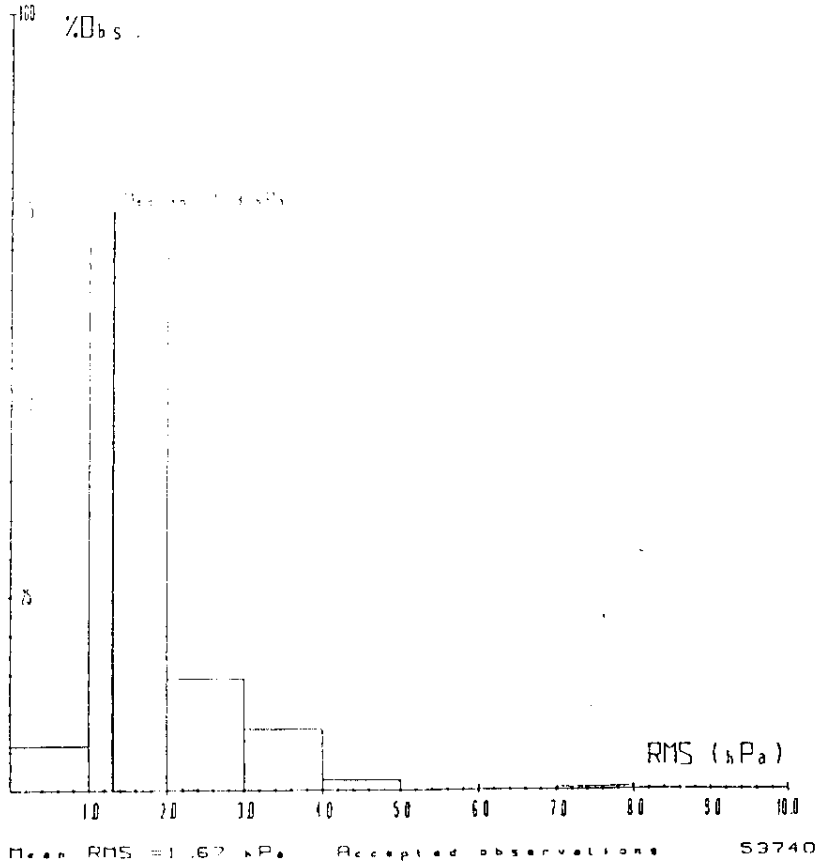
Various DBCP products were presented to the Programme, including data availability index maps (useful in adjusting deployment strategies), monitoring statistics (i.e. comparisons of the observed data with the first guess field of numerical weather prediction models which give a fair idea of the quality of the data), GTS delivery delays (as estimated at various GTS Hubs based on data collected during a dedicated period), etc... Examples of such products are given in Annex 1 of this Attachment.

It was suggested that the DBCP Technical Coordinator assemble statistics that are dedicated to IABP buoys to accompany future IABP reports. Etienne Charpentier stated that an IABP activities report was necessary for inclusion in the 1994 DBCP annual report. It was decided that the IABP Coordinator will provide the necessary report.

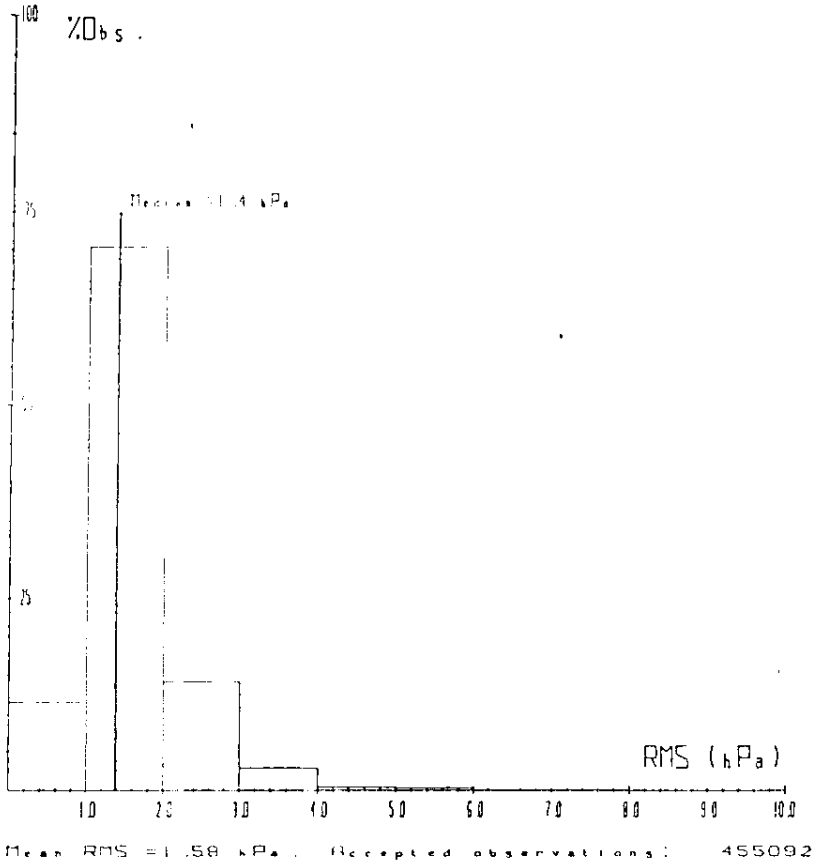
Percent of buoy messages with Reception Time minus Observation Time less than Delay for the period 08 to 15 January 1995. Based on buoy messages received from GTS at Meteo-France



Distribution of Root Mean Square (observation - first guess) for accepted IABP buoy air pressure data using ECMWF statistics from September 1994 to February 1995



Distribution of Root Mean Square (observation - first guess) for accepted buoy air pressure data using ECMWF statistics from September 1994 to February 1995 - global buoys.



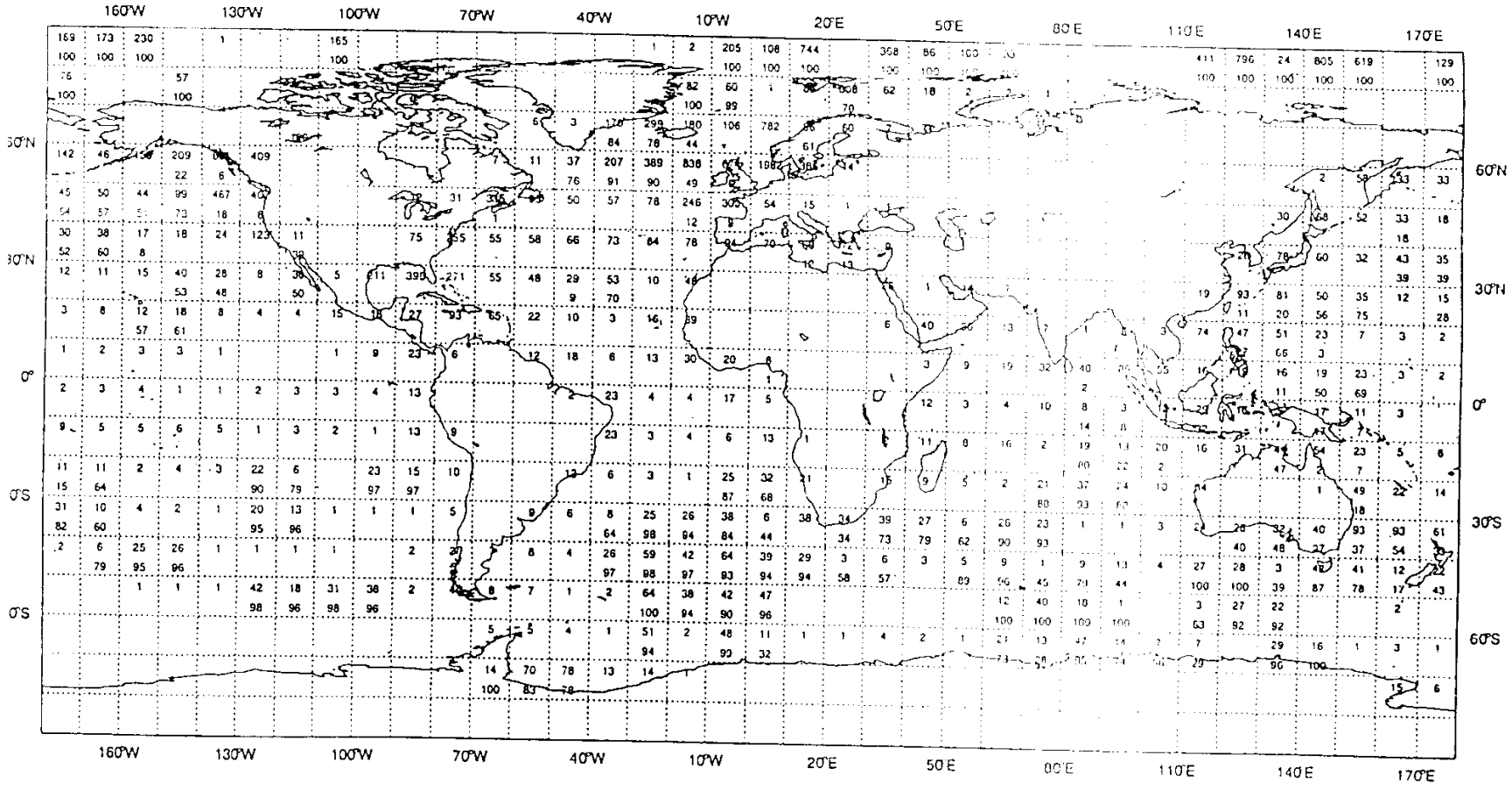
METEO - FRANCE

PRESSURE

FEBRUARY 1995

IABP-5

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



Attachment 4

Beaufort and Arctic Storms Experiment (Canadian), 01 Sept - 13 Oct 1994

(Hudson)

The data gathering stage of the Beaufort and Arctic Storms Experiment took place 01 September to 13 October 1994 and operated from facilities in Inuvik and Tuktoyaktuk. The data analysis phase is now in progress. Results will be published in scientific journals as they become available.

The project involved scientists, researchers and meteorologists from Canada, Japan, Russia, and the United States. During the experiment, in addition to ground based sensors which included two Doppler radars, several research flights were flown to gather data from storm systems over the Beaufort. Figure 1 shows, for example, the flight track of BASE research flight B412.

Through most of the experiment period, September in particular, there was an upper low(s) pressure system over the sector of the Arctic Ocean to the north of Alaska / west and north of Canada. See Figure 2. The upper low supported surface features that favored cyclonic flow at the surface across the Beaufort. The resultant ice drift across the Canadian Beaufort through the BASE period was eastward rather than the 'expected' westward. The drift of buoy Argos ID 4953 confirms this eastward drift. See Figure 3. Per Figure 4, there was also an intrusion of ice into Amundsen Gulf.

Figure 1. **BASE research flight B412, 1819 to 2302 UTC 01 October 1994.**

This flight was flown to determine the circulation near the centre of the mesoscale low whose warm front was flown the day before. Dropsondes were deployed at upper-levels and several low level legs were made in the vicinity of the low centre.

Figure 2. **History of 500 hPA low centres through September 1994**

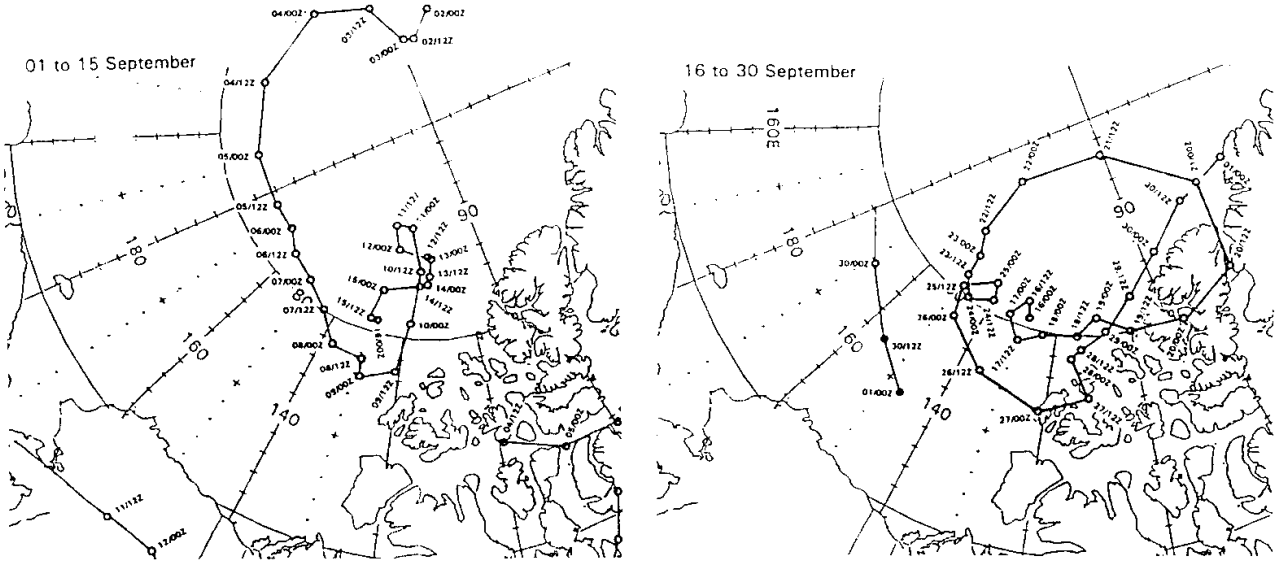
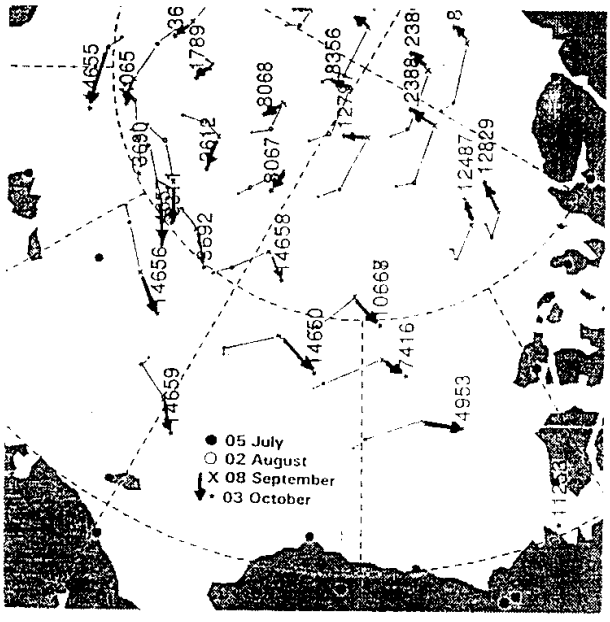


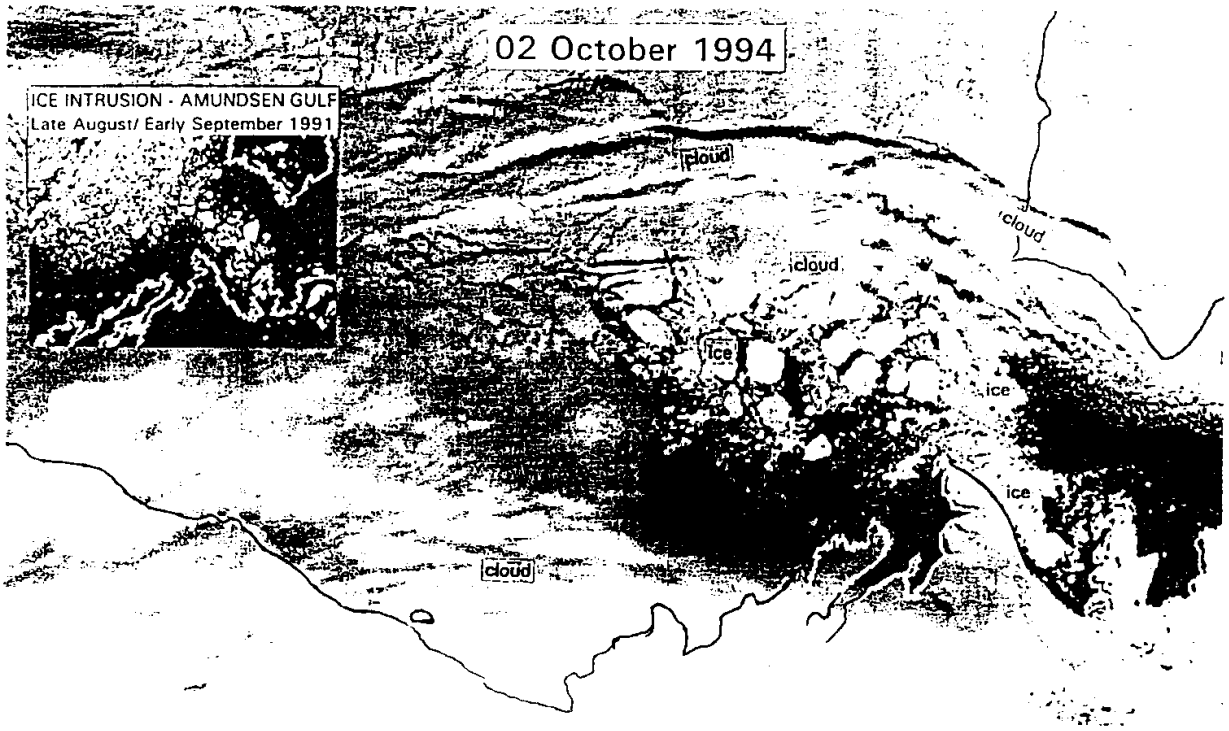
Figure 3. **Buoy (Ice) displacement 05 July to 03 October 1994 and Annual mean of ice motion in the Arctic Basin based on 1979 through 1990 buoy data.**

Buoy displacement
from IABP monthly buoy position charts



Annual mean of ice motion
(solid lines indicate number of years ice resides in the Basin before existing Fram Strait)

Figure 4. **Ice intrusion Amundsen Gulf and southeastern Canadian Beaufort late September / early October 1994**



Value of IABP Buoy Data to Operational Forecasters (Hudson)

Buoy data is used operationally at the Arctic Weather Centre to resolve the pressure pattern across the Arctic Ocean. The surface weather map of 15 February 1995 1800 UTC showed buoy W.M.O. ID 48573 (Argos ID 4953) to have a pressure of 1020.2 millibar and a 994 millibar low pressure center 'miles away' vicinity the pole. Figure 1. The weather map of 16 February 1995 0000 UTC showed the pressure at buoy 48573 to have fallen 12.1 millibar since the last map to 1008.1 millibar. Figure 2. The 3 hour pressure fall was 7.0 millibar and this was plotted on the weather map. Such pressure fails are not routine and thus catch the attention of the forecasters.

The low which had been analyzed near the pole on the 15 February 1800 UTC weather map was moving southward. Subsequent maps showed the pressure at 48573 failing to a low of 991.3 millibar and the development of a very tight gradient across the Beaufort as the low centre made its way to Amundsen Gulf by 16 February 1800 UTC. Figure 3.

The dramatic change in pressure from 15/1800 UTC to 16/0000 UTC and the subsequent gradient that developed across the Beaufort lead to questions as to what buoy data was available to the forecasters at the Arctic Weather Centre through the event and in particular what data was available from buoy 48573 to help the forecasters analyze and monitor the event.

The check on buoy 48573 and the availability of data from it revealed:

- There was a gap of about 17 hours (from 1700 to 0100 UTC) when no buoy data was available to the forecasters. A review of the specifications for buoy 48573 showed it was programmed to transmit only through the period 1700 to 01 00 UTC to take advantage of the reduced rates through service Argos if data is sent only for 8 hours per day. It was noted that even if there was data through the period 1700 to 0100 UTC, there would have been a few hours overnight when there was no satellite passes overhead to capture data.
- data from buoy 48573 that was available at synoptic hours was plotted on the Arctic Weather Centre maps but there were decode problems in the "SHP" program that the forecasters use to access and display buoy data on screen. When the forecasters tried accessing the buoy data using "SHP", they got nothing. A review of the raw buoy messages showed that there were several reports from buoy 48573 if the forecasters had gone beyond the "SHP" program to the raw messages.

In summary, buoy data remains critical to analysing pressure systems over the Arctic Ocean on the weather maps done at the Arctic Weather Centre. Buoy 48573 was the only buoy 'operational' in the Beaufort through the event of 15/16 February and the event emphasized that, for operation purposes, buoy data should be transmitted around the clock. It is noted that the orbit of satellite NOAA 14, recently launched, has reduced the time period overnight when buoy data is not available to the forecasters at the Arctic Weather Centre to just a few hours. The software problem with the "SHP" program is being fixed so that the forecasters will be able to access buoy data on screen. Access to buoy data is also being added to an onscreen display program. Furthermore, a booklet is being prepared for the forecasters at the Arctic Weather Centre to show what buoy data is available (headers etc), how to access the data, and how to decode it.

Figure 1

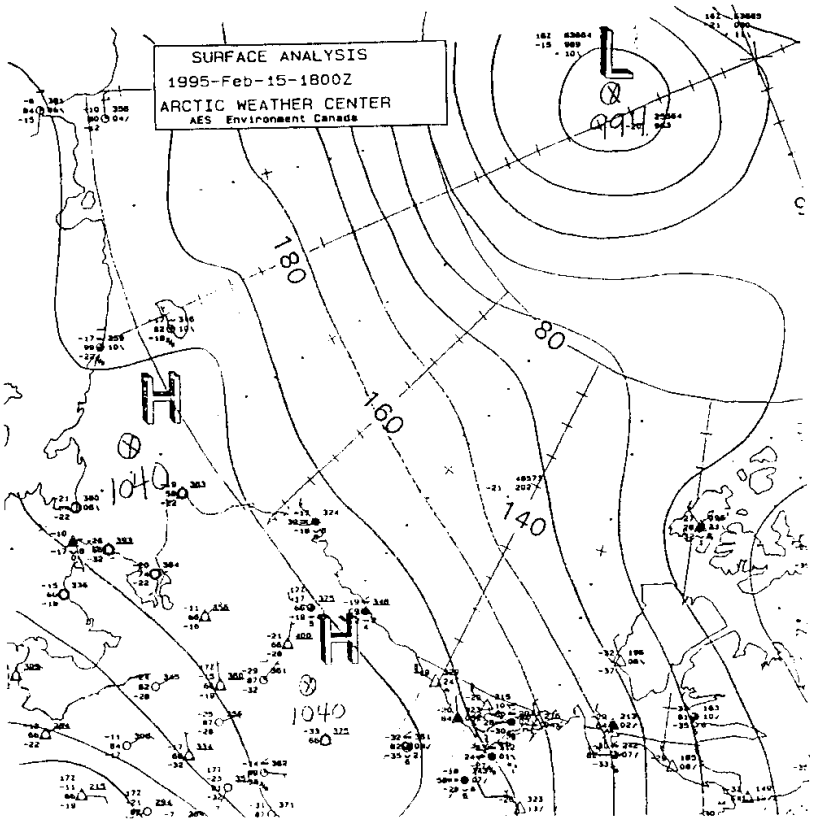

SURFACE ANALYSIS
1995-Feb-15-1800Z
ARCTIC WEATHER CENTER
AES Environment Canada
180
160
140
80
1040
1040
994

Figure 2

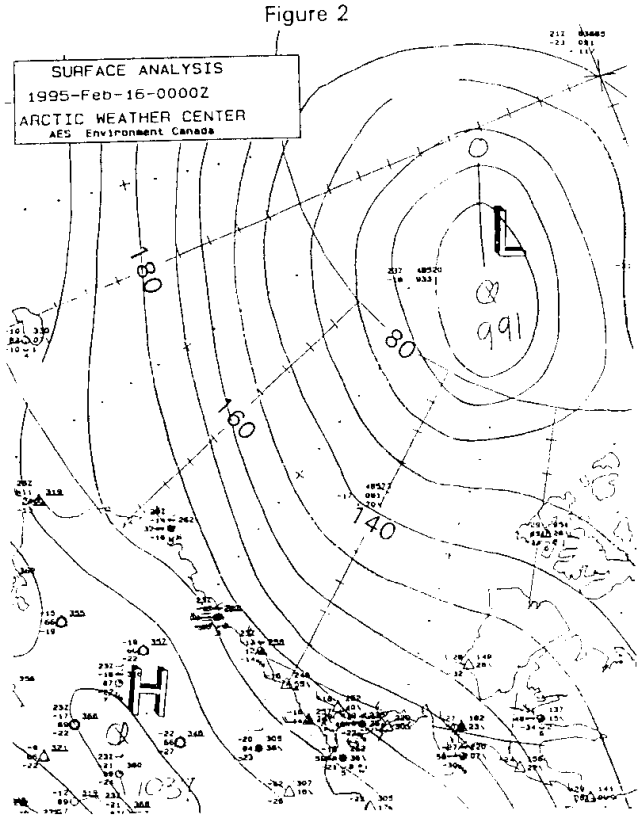
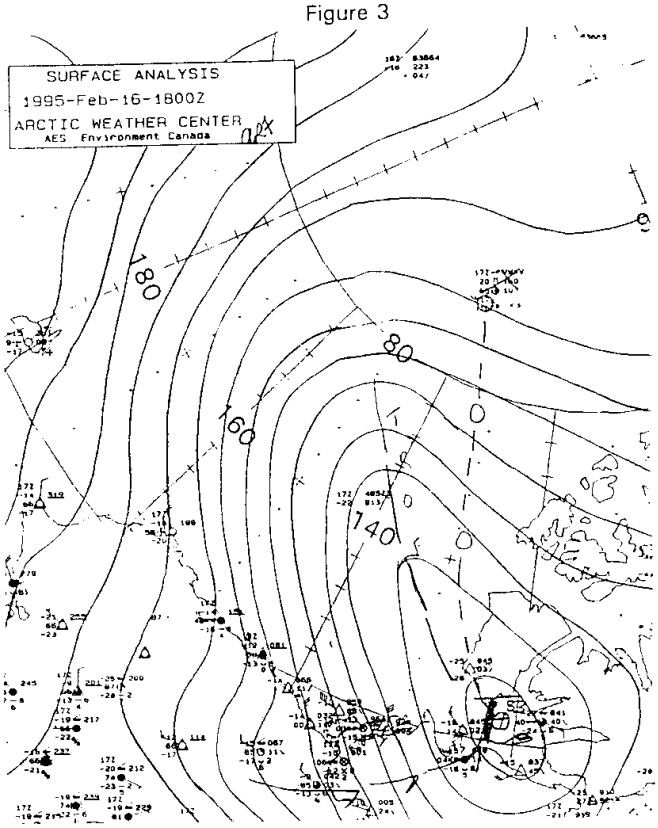


Figure 3



MEMBERSHIP ROLL
INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)
April 1995

CANADA
Canadian Coast Guard
Environment Canada
Institute of Ocean Sciences
Marine Environmental Data Service

FINLAND
Arctic Centre, University of Lapland

FRANCE / USA
Service Argos

GERMANY
Alfred Wegener Institute for Polar and Marine Research

JAPAN
Japan Marine Science and Technology Center

NORWAY
Christian Michelsen Research Institute
Nansen Environmental and Remote Sensing Centre
Norske Polarinstitutt
Norwegian Meteorological Institute

RUSSIA
Arctic and Antarctic Research Institute
Russian Federal Service for Hydrometeorology and Environmental Monitoring

UNITED KINGDOM
Scott Polar Research Institute Meteorological Office

UNITED STATES OF AMERICA
Pacific Marine Environmental Laboratory
Polar Science Centre, University of Washington Naval Oceanographic Center
Commander Naval Meteorology Oceanography Command National Ice Centre (representing several agencies)

INTERNATIONAL ORGANIZATION
World Climate Research Program MCRP) of the World Meteorological Organization (WMO) / Intergovernmental Oceanographic Commission (IOC International Council of Scientific Unions (ICSU)

Participants' Reports and Other Reports
Fifth Annual Meeting of the International Arctic Buoy Programme
April 1995

CANADA

INTRODUCTION

This paper outlines Environment Canada's activity for the period June 1994 to April 1995 with respect to:
- International Arctic Buoy Programme (IABP);
- buoy acquisition; and
- buoy deployments and opportunities.

The paper concludes with our plans for the future.

Environment Canada meteorologists continue to use buoy data 'operationally' both at the Arctic Weather Centre in Edmonton and the Canadian Meteorological Centre in Montreal for their analyses of the pressure across the Arctic Ocean.

ENVIRONMENT CANADA ACTIVITY WITH RESPECT TO THE INTERNATIONAL ARCTIC BUOY PROGRAMME (IABP)

- Brochure produced for the International Arctic Buoy Programme. 850 copies were printed and mailed out to primarily IABP Participants for distribution. The first draft of the brochure was presented at the annual IABP meeting in Helsinki and participants provided helpful editing. Subsequent drafts were edited by primarily Victor Savtcheriko and Roger Colony. All but one of the figures in the brochure are compliments of the Polar Science Center, University of Washington. The World Climate Research Programme contributed towards the printing costs.

- Continued to operate a local users terminal (LUT) from the Edmonton Environment Canada facility. A monthly summary report which outlines which buoys are being transmitted to GTS from the Edmonton Argos direct readout station is copied to, among others, Etienne Charpentier, Technical Coordinator, Data Buoy Cooperation Panel.

- Chairman of the IABP from Environment Canada - Currently Mike Balshaw, was Brian O'Donnell

ENVIRONMENT CANADA ACTIVITY RE BUOY ACQUISITION and BUOY STATUS

- Three CALIB buoys were purchased. The buoys arrived too late for deployment for the Beaufort and Arctic Storms Experiment. Two of the buoys were successfully deployed 23 March, 1995 courtesy of a Canadian Forces aircraft. The third buoy is being held in reserve.

- CALIB buoys are designed to be deployed via the sonobuoy "A" size tube on the Canadian Force's Orions and parachute to their resting place on the ice. Environment Canada's ice reconnaissance Dash-7 also has an "A" size tube. They use it to deploy CALIB buoys that have no additional sensors but rather are tracked to provide ice motion. One such buoy, buoy Argos ID 1103 / WMO# 48552, was deployed 30 September 1994 on a piece of multi year ice at 7203N

14907W. The 27 March position for the buoy is 72.50N 164.47W. The CALIB buoys are not an off-the-shelf item. Thus, there can be a few months between order and delivery. Size and weight restrictions preclude large size sensors and having a multitude of sensors. It also precludes a large battery. The final result is a buoy that will deploy through a sonar buoy or identical size tube, a buoy that provides pressure and temperature but not with the pressure sensor of choice, and a buoy with a life of 3 to 4 months if the buoy survives its initial parachute landing - at a cost of about $6000 Canadian.

- One CALIB buoy remains with Dave Benner, U.S. National Ice Center. When returned, this buoy will be given new batteries and shipped to a Canadian Forces Base to join the 'third' buoy.

- A new battery pack was purchased for the TAD buoy that presently resides in Edmonton. A parachute assembly for the buoy was acquired from the Polar Science Center. The complete assembly will be shipped to the U.S.A. for deployment.

- A weather station for surface deployment has been assembled inhouse. The station as assembled will provide wind speed and direction, air pressure, and air temperature. Surface deployment adds the potential to add, for example, a sensor such as a thermistor chain through the ice into the water. It is planned to have the station deployed on one of the Arctic Islands bordering the eastern Arctic Ocean for a test-year. If the test proves successful, subsequent deployment will be on ice and more buoys may be assembled inhouse.

- Components similar to those purchased by Roger Colony, Polar Science Center, for an ice beacon being assembled by the Arctic and Antarctic Research Institute for deployment in the Kara Sea were purchased from Seimac, Dartmouth, Nova Scotia. The components include a GPS module. The buoy being assembled in Edmonton has a pressure sensor.

- Polar Continental Shelf Project has two buoys in Resolute. One of these buoys has wind sensors in addition to temperature. The other, provides the pressure and temperature. We may have this buoy set up on Ward Hunt Island.

BUOY DEPLOYMENT SUMMARY and OPPORTUNITIES

- Two CALIB buoys were deployed 23 March 1995 by the Canadian Forces for Environment Canada - one at approximately 81°N 120°W and the other at approximately 75°N 130°W.

- Third CALIB buoy and one presently on loan to Dave Benner at Point Barrow could be deployed later in the year. Flights are planned for the area similar to that flown 23 March late August and again mid September.

- One position only ice beacon was deployed off the north coast of Alaska at 7203N 14907W by the Canadian Ice Patrol 28 September 1994.

- Polar Continental Shelf Project is likely willing to deploy one of their buoys, at some cost to Environment Canada, on the ice to the north of Ward Hunt Island. This buoy had been scheduled for deployment on a piece of ice of the Ward Hunt ice shelf summer of 1994.

- If a suitable buoy is "available", Environment Canada, will deploy the buoy west of Mould Bay.

Environment Canada will be active at Isachsen for the next 2 or 3 years providing additional buoy deployment opportunities.

- An opportunity exists annually, early April, to have a buoy deployed north of Tuktoyaktuk by Institute of Ocean Sciences' scientists. The scientists work to about 72°N between about 130 and 135°W and are willing to extend to about 72°30'N to ensure that the buoy they deploy is further back in the pack.

- An additional opportunity for buoy deployment may exist through the Institute of Ocean Sciences and the Canadian Coast Guard. The icebreaker Louis St Laurent is scheduled to depart Dartmouth, Nova Scotia, in July for the Arctic. Late August into September, the vessel will be working in the Beaufort. Specifically, the vessel will be going to approximately 73N 140 W to recover a mooring. If a buoy were loaded on the vessel in Dartmouth, it could be deployed in the Beaufort late August or early September.

THE FUTURE OF ENVIRONMENT CANADA'S BUOY DEPLOYMENTS

Environment Canada will endeavor to optimize use of funds and deployment opportunities to sustain buoys across the Canadian sector of the Arctic Ocean - thereby supporting Canadian and International Arctic Buoy Programme interests. We will work toward:

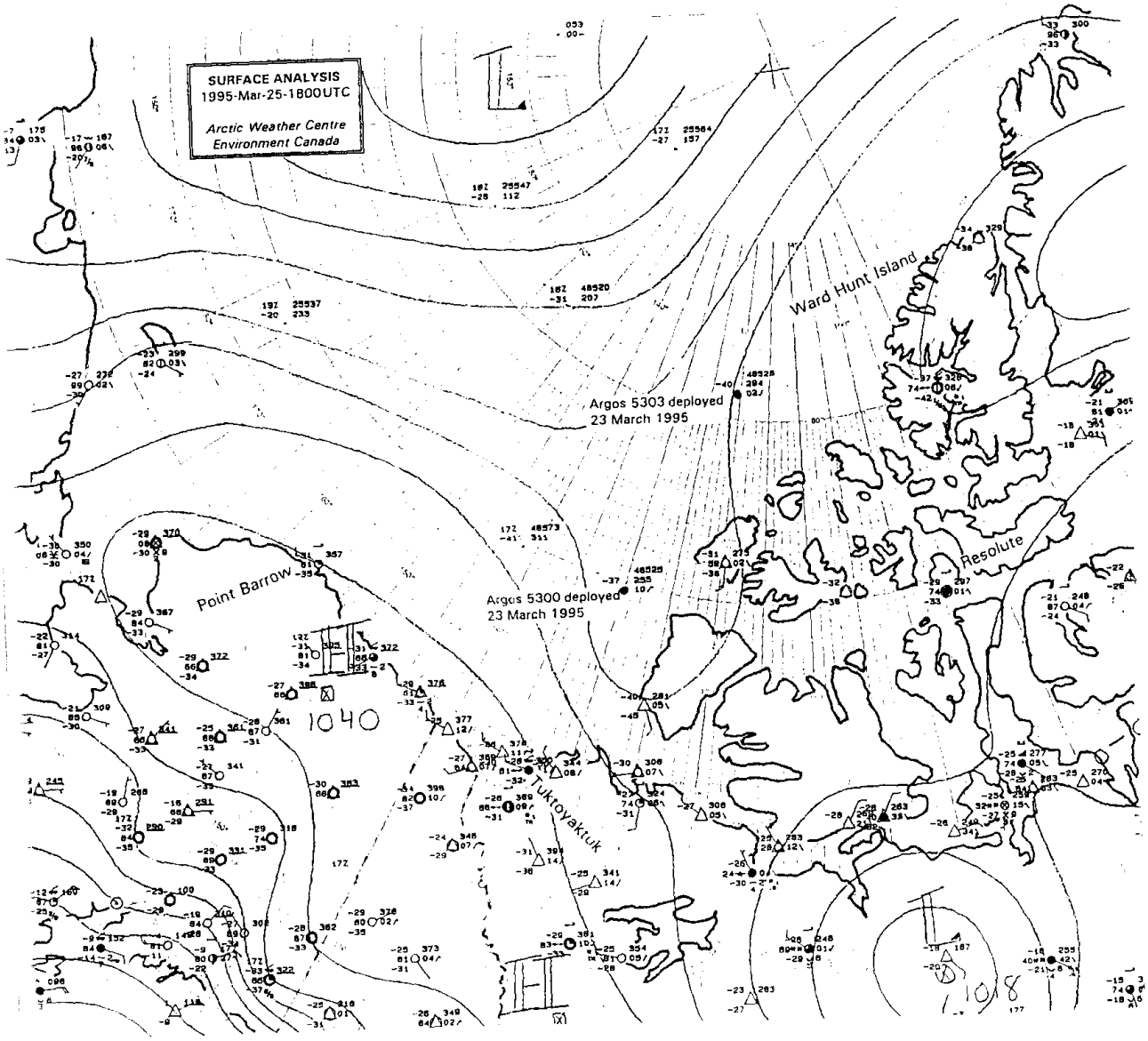
- having the "basic to IABP" sensors (air pressure and air temperature) on all buoys that are deployed by Environment Canada including any buoys deployed by Ice Services in the Beaufort;

- using surface deplorable buoys as this type is deemed to offer the best opportunity for reliable temperature readings and for other sensors and equipment such as oceanographic thermistor chains. Additionally, this type of buoy/deployment allows for 'affordable' battery systems lasting 2 to 3 years; and

- annually purchasing and/or assembling and deploying at least 2 buoys.

IABP-5

Attachment 8



GERMANY and NORWAY

Thor Kvinge gave a report on behalf of:

Christian Michelsen Research Institute
Norske Polarinstitutt
Norwegian Meteorological Institute
Alfred Wegener Institute for Polar and Marine Research
ICEX buoys developed by the Christian Michelsen Institute are provided to the Norwegian Programme and deployed in the Arctic Ocean by aircraft from the Norwegian Air Force.

PREVIOUS YEARS BUOY DEPLOYMENT (All ICEX-AIR type buoys)

1992: 6 Total Buoys Deployed
3 Norwegian (NPI and DNMI)
2 from Alfred Wegener Institute
1 UK Meteorological Office
Progress
Buoy 1556 drifted through Fram Strait and Denmark Strait, operated in the Atlantic, stopped after 2 yrs.
Buoy 1639 drifted through Fram Strait, crushed in the East Greenland drift ice about 69°N.
Buoy 9360 drifted through Fram Strait into the Norwegian Sea, ashore at Soroya, Finmark, Norway in Dec 1994, recovered in good shape, operated 2 and a half years. A test showed that the air pressure readings were within 0.1 hPa of the control barometer.
Buoy 9372 drifted north of Spitzbergen into Fram Strait, stopped transmitting in Mar 1995, operated 2 and a half years

1993: 4 Total Buoys Deployed
3 Norwegian (NPI and DNMI) {Buovs:1789, 3690,3691}
1 from UK Metereological Office. {Buoy:4065}
Progress
Buoy 1789 data deleted due to errors, deleted from GTS in May 1995

1994: 6 Total Buoys Deployed
3 Norwegian (NPI and DNMI) {Buoys:3611, 3612, 3692}
2 from Alfred Wegener Institute {Buoys:8067, 8068}
1 from UK Metereological Office. {Buoy:1639)
Progress
All buoys operating in April 1994.

The two Alfred Wegener Institute buoys deployed in 1994 were both equipped with GPS position receivers and the position data inched in the Argos message. It was clearly shown that the two position systems coincided very closely and provided data for accurate and meaningful drift speed calculations. See figures 1 through 5 for a comparison of these two buoys and their respective measured readings.

In August 1995, the same array of buoys as those in 1992 and 1994, 3 Norwegian, 2 German, and 1 United Kingdom, will be deployed in the Beaufort Sea by a United States aircraft. The two buoys from Alfred Wegener Institute to be deployed will be equipped with GPS positioning.

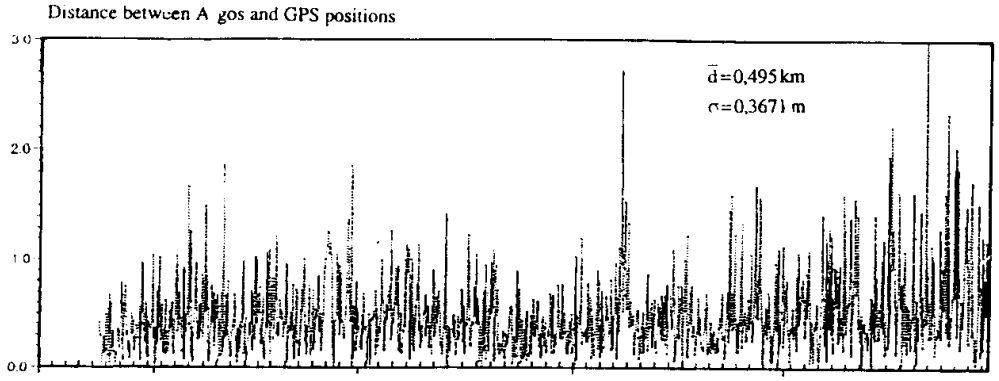

Distance between A gos and GPS positions
3.0
2.0
1.0
0.0
d=0,495 km
σ=0,3671 m

Fig 1.

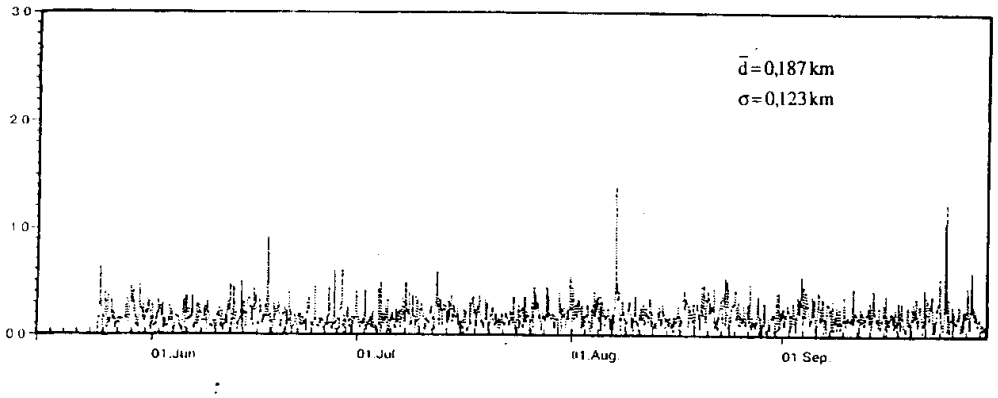

3.0
2.0
1.0
0.0
d=0,187 km
σ=0,123 km
01.Jun
01.Jul
01.Aug
01.Sep

Fig 2.

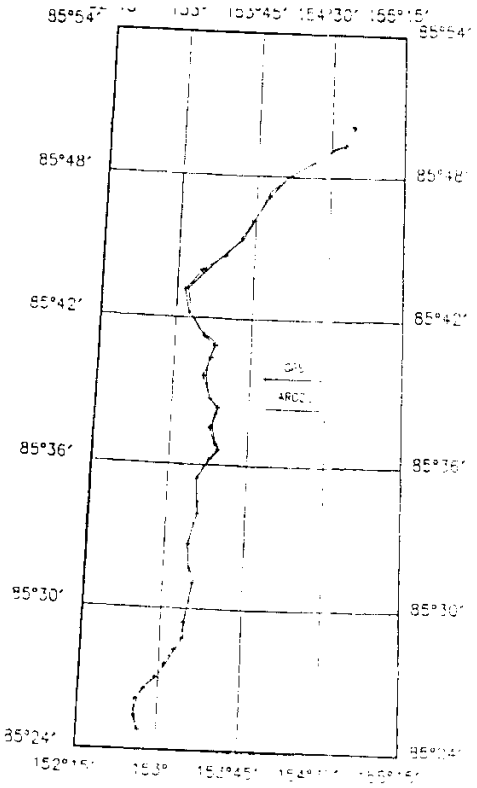


Fig 3.

Numbers of Argos Positions

Argos-Position Qualityflags

	0	1	2	3	all
buoy 8067:					
May	30	59	197	37	323
June	178	266	350	37	831
July	161	435	205	70	871
August	161	462	206	48	877
September	180	488	131	52	851

buoy 8068:					
May	21	46	94	157	318
June	49	84	187	529	849
July	35	27	239	573	874
August	33	29	204	613	879
September	87	24	193	543	847

0 = no position during satellite pass
1 = better than 1000 m.
2 = better than 350 m.
3 = better than 150 m.

Fig 4.

Numbers of GPS positions (every 3 hours one position)

buoy 8067	yes	no	max. avail
May	61	3	64
June	228	12	240
July	238	10	248
August	245	3	248
September	235	5	240

buoy 8068			
May	58	6	64
June	225	15	240
July	238	10	248
August	242	6	248
September	235	24	240

Fig 5.

RUSSIA

Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet) and Arctic and Antarctic Research Institute (AARI)

COOPERATIVE BUOY DEVELOPMENT and 1995 DEPLOYMENTS

Russia will continue be an active Participant in the IABP during 1995. During the 1995 summer season, Russia plans to deploy 7 buoys on the Arctic Ocean. Three of the buoys will be built in cooperation with Alfred Wegener Institute. These buoys will have air temperature and atmospheric pressure sensors, Expected lifetime is 3 years. The buoys may additionally be equipped with wind speed and direction sensor and ice surface temperature sensor. See Figure 1 for buoy design. It is planned to deploy these buoys in the Northern Laptev Sea in October during a joint Russian-German expedition aboard the icebreaker "Kapitan Dranitzyri". The deployment positions were chosen through analysis of the tracks of the 10 buoys deployed last summer in cooperation with NAVOCEANO and consideration of the summer limit of pack ice.

The four other buoys will not have pressure sensors. They will, however, have a GPS module and an air temperature sensor. These buoys, or rather ice beacons, are being produced in cooperation with Polar Science Centre, University of Washington. Russia plans to deploy these buoys in an array in the northeastern Kara Sea in the vicinity of Vise Island on a large multiyear ice floe in October 1995 during the "Kapitan Dranitzyn" cruise. Expected lifetime is 1 year. See figures 2 for buoy design.

LUT FOR ARCTIC AND ANTARCTIC RESEARCH INSTITUTE

With the support of the IABP Executive Council, NAVOCEANO will install an LUT-unit, with software, at AARI. This will allow AARI to get direct access to information reported from buoys supported by ARGOS. AARI greatly appreciates all the effort that went into making this happen.

PROPOSED ACTIVITY 1998

An ambitious and extensive oceanographic survey of the Arctic Basin is proposed for 1998. Figure 3 illustrates this activity.

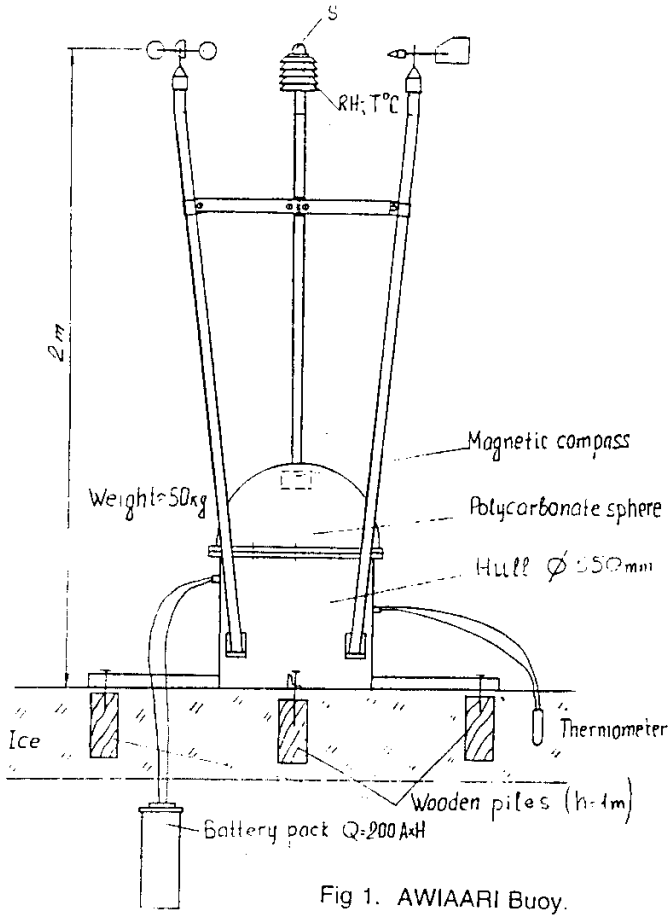


Fig 1. AWIAARI Buoy.

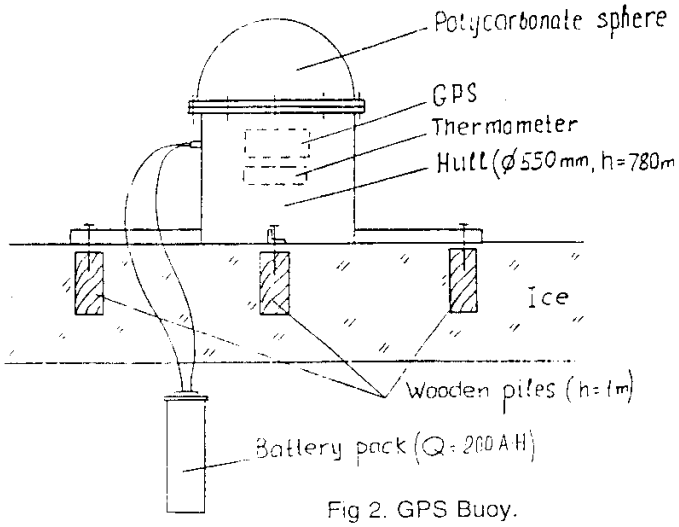


Fig 2. GPS Buoy.

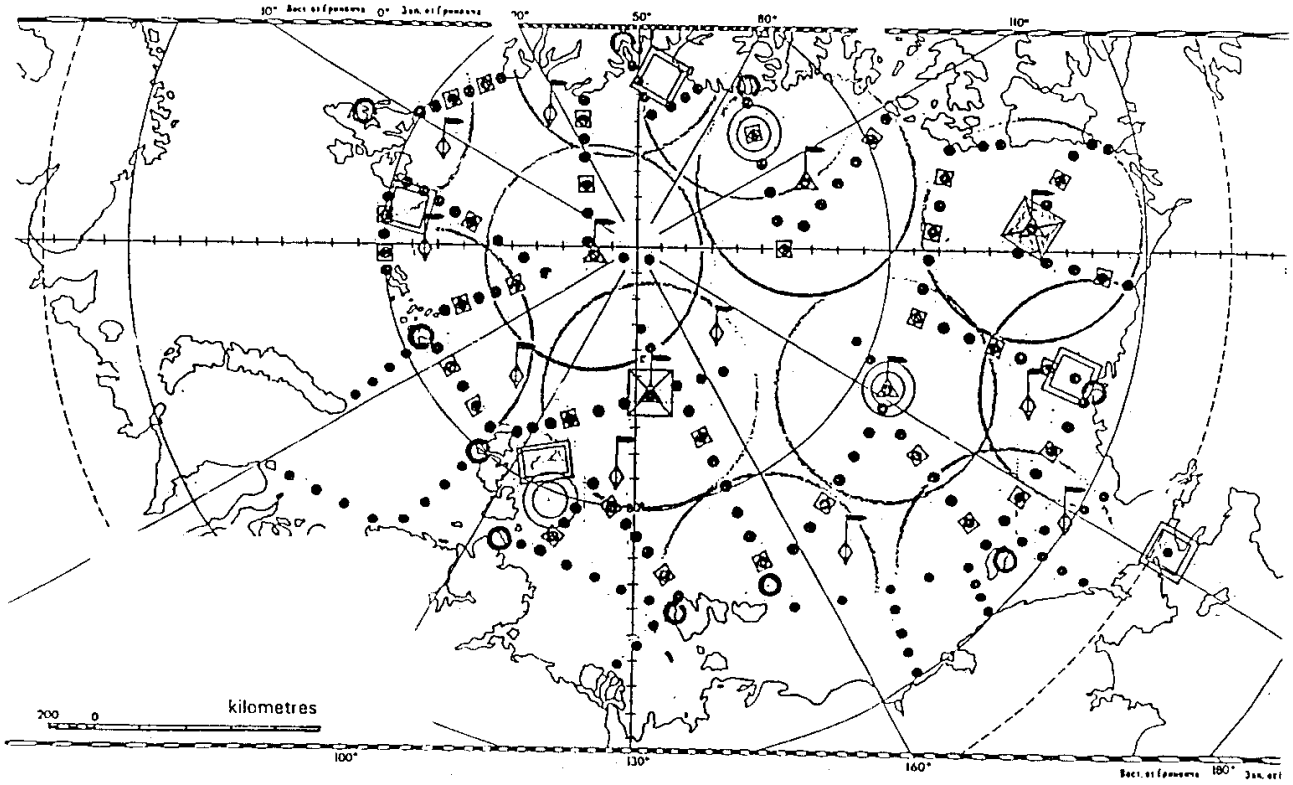


Figure 3. Proposed oceanographic survey of the Arctic Basin

Legend:

- Oceanographic CTD stations
- Polygon for the study of interaction of shelf waters with Arctic Basin waters
- Polygon for the study of the mesoscale thermohaline and dynamic structure
- Polygon of the observations of jet currents at the continental slope
- Drifting automated oceanographic stations
- Temporal drifting research bases and drifting automatic oceaographic stations
- Oceanographic stations with water sampling
- Permanent bases

UNITED KINGDOM

UK Meteorological Office

Tony Bentley reported that the U.K. Meteorological Office's main contribution to the IABP for 1995 will be an ICEX buoy. The buoy was tested at the Christian Michelsen Institute, Bergen, Norway, during January 1995. The buoy will be available to be deployed with other IABP buoys in August.

The UK Meteorological Office buoys deployed in May 1993 (number 4065) and May 1994 (number 1639) are still operational. On Tuesday, the 4th of April, 19959 4065 was at 84° 06' N, 28° 54' E, and 1639 was in the vicinity of 62° 10'N, 35° 38'W.

The UK Meteorological Office expects to make a buoy available as its contribution to the IABP in the Spring of 1996 but has asked that another member of the IABP agree to finance the Argos PTT operating costs for the buoy to be deployed in August 1995.

UNITED STATES OF AMERICA

National Ice Center

Presently eight separate U.S. government agencies contribute fiscal resources and services to the U.S. Interagency Arctic Buoy Program (USIABP). As of 31 March 1995, the USIABP had 11 buoys operating in the Arctic basin and adjoining marginal seas. This number includes 3 Coastal Environmental System (CES) buoys operated by the National Ice Center as, well as 8 TIROS Arctic Drifters (TAD) operated by the U.S. Naval Oceanographic Office. All 11 buoys are presently distributing meteorological data via the Global Telecommunications System.

SIGNIFICANT ACCOMPLISHMENTS OVER THE PAST YEAR

(a) The continued operation of a field site at Pt. Barrow, Alaska to performance test five buoy designs presently in use by participants of the International Arctic Buoy Programme (IABP). Buoys included in the test were the CES buoy, TAD buoy, METOCEAN CALIB buoy, METOCEAN Drifter buoy with Gill radiation screen, and ICEX buoy manufactured by the Christian Michelsen Institute of Norway. Surface atmospheric pressure and temperature measurements reported by each buoy were compared to a 2.5 meter standard observed at the manned station. Results demonstrate a similar performance in surface atmospheric pressure but an improvement in the accuracy of air temperature measurements reported by buoys with external thermistors. Air-deployable buoys which lay on the ice surface exhibited a dampened and time-delayed diurnal temperature cycle during the darkness of the Arctic winter. These temperature errors can be attributed to the use of an internal temperature sensor (in the TAD), clogging of the ventilation ports with snow and ice (in the ICEX) and the overall insulating effect of overlying snowcover. Both air deployed buoys also demonstrated higher than normal air temperature during periods of high solar radiation.

(b) Based on the performance test results, the USIABP standardized design specifications for a surface deplorable Arctic meteorological buoy.

(c) The USIABP continued the funding for the Programme Coordinator and Data Management function for the International Arctic Buoy Programme (IABP).

FUTURE USIABP ACTIVITIES FOR 1995-96

(a) The USIABP will procure and deploy five CES meteorological buoys.

(b) The USIABP will provide funding for the Argos processing costs of the Siberian Marginal Seas Drifting Buoy Program. The Arctic and Antarctic Research Institute (AARI) will deploy these buoys in the Kara/Laptev Seas.

(c) The U.S Naval Oceanographic Office will install a VFH Local User Terminal (LUT) at AARI, provide LUT training and provide two reference Platform Transmitter Terminals.

(d) The U.S Naval Oceanographic Office will provide aerial assets to deploy nine TAD and ICEX buoys in the Beaufort Sea during the summer of 1995.

(e) The USIASP will maintain the buoy performance field test site at Pt. Barrow, Alaska.

(f) The USIABP will fund the Programme Coordinator and Data Management position of the IABP.

INTERNATIONAL ORGANIZATION

World Climate Research Program

Dr. Victor Savtchenko reported on Arctic climate System Study (ACSYS) developments since IABP-5 underlined that the physical climate system was constituted by a "fast component" and a "slow component". The fast component is controlled by the atmospheric and upper-ocean heat engine. The slow component is controlled by the global ocean. ACSYS is one of the "slow climate processes" studies of the WCRP and is the only regional WCRP programme. A Scientific Concept of the ACSYS was issued as WCRP-72 in 1992. An Initial Implementation Plan of the study was published in 1994 as WCRP-85. The primary goal of the programme is to ascertain the role of the Arctic in global climate. The main observational phase of the ACSYS began on 1 January 1994 and will continue for a ten-year period. The main focus of ACSYS is on the interactions between the Arctic Ocean circulation, sea-ice processes and the hydrological cycle.

The ultimate objectives of ACSYS are to:

- provide a valid scientific basis for the representation of the Arctic region in coupled global atmosphere-ocean models;

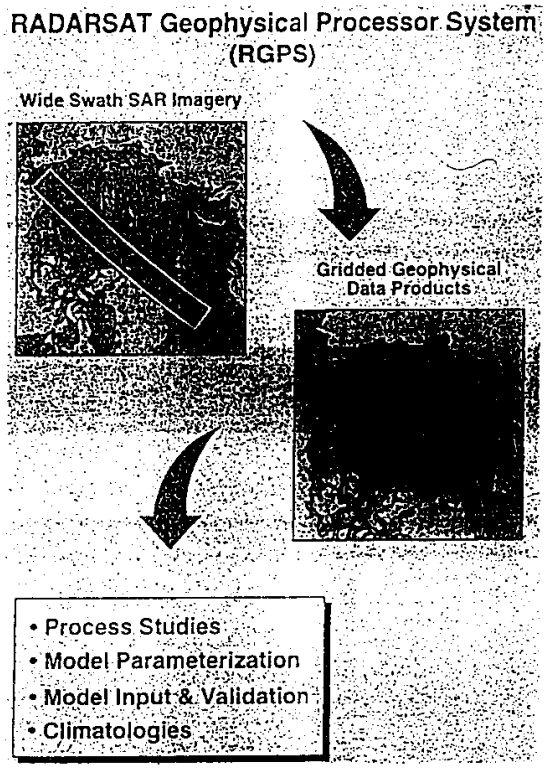
- develop an effective climate monitoring scheme in the Arctic;

- perform climate sensitivity studies with various model formulations; and

- carry out scenario computations for specified large-scale atmospheric conditions, in order to evaluate possible impacts of climate change on the Arctic region.

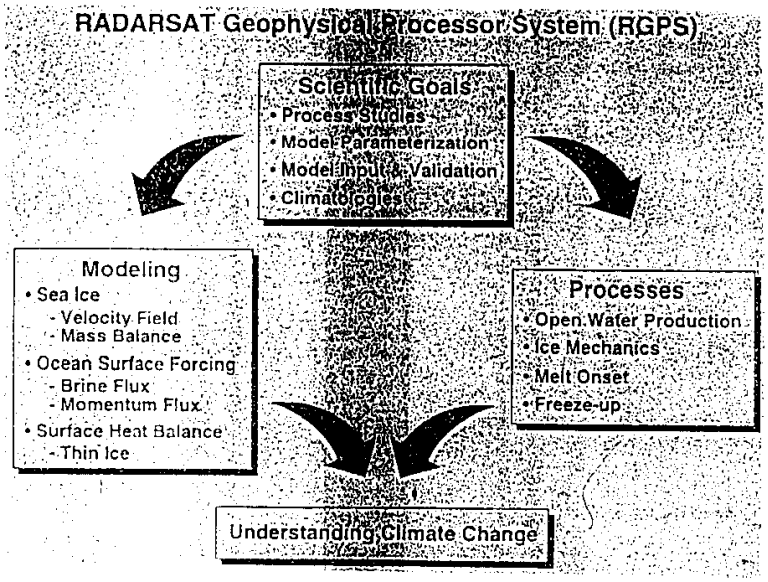
Therefore, ACSYS includes studies of Arctic Ocean circulation and its variability, sea-ice cover, and Arctic atmosphere, as well as hydrological and oceanographic long-time climate research and monitoring.

The ACSYS modelling strategy includes optimization of the different models for the Arctic region using as many observations as possible, and response experiments to investigate the influence of the Arctic river run-off on the oceanic circulation, the dependence of the fresh water export to the North Atlantic upon processes occurring in the Arctic Ocean, and its influence on the global "conveyor belt' circulation through modification of the deep water formation. A special emphasis is placed upon the question to what degree is the high sensitivity of polar regions to CO2 increases due to inadequate model components or to real positive feedbacks.

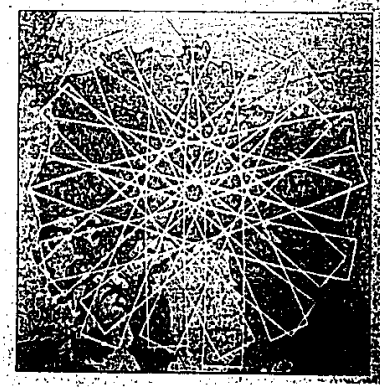


Overall Goals—Science and Applications

- Impact of sea ice on climate
- Pollution monitoring
- Ice navigability and oil resources
- Weather forecasting
- Climate prediction



RADARSAT Mission



Duration: August 1995–2000

ScanSAR (W) Mode

100 x 100 m	resolution
4–8	looks
510 km	swath width
20°–40°	angle of incidence
24 day	orbit repeat
3 and 7 day	near repeats

Proposed Data Products From RGPS

Product	Source
Lagrangian grid, 5 km, weekly	
• Ice motion • Ice age distribution • Ice thickness distribution	• Repeat SAR imagery • Temperature fields
Gridded fields, 100 km, daily	
• Pressure • Geostrophic wind • Surface air temperature	• NMC, ECMWF, and buoys
Gridded fields, 100 km, weekly	
• Ice motion • Ice age distribution • Ice thickness distribution	• Interpolated from Lagrangian products

International Programme for Antarctic Buoys (IPAB)

Dr. Victor Savtchenko reported that as of 21 February 1995, Letters of Intent to participate in the programme had been received from the following institutions:

Antarctic Cooperative Research Centre, Hobart, Australia - several buoys per year
- coordinating office
- research data base

Australian Antarctic Division
- 4 buoys per year
- ship logistics

ENEA, Italia (National Antarctic Research Programme)
- 2 buoys per year
- ship and aircraft logitics

World Data Center-A for Glaciology, Boulder, CO, U.S.A.
- data archive and distribution activities

Alfred Wegener Institute for Polar and Marine Research, Germany
- 4 buoys per year
- ship logistics

Meteorological Office, U.K.
- Argos transmission costs for 2 PTT per year

Letters of Intent have also been announced by:

Scott Polar Research Institute, U.K.
- 2 buoys per year

British Antarctic Survey
- logistcal support

Australin Bureau of Meteorology
- 2 buoys per year.

Since March 1995, the programme has been a registered user with CLS Argos. All original data from platforms, nominated by the registered owners, are copied direct to the coordinating office, and form the basis of the Research Data Base. Original data from the period before the programme was registered with Argos have been received at the Coordinating office from the Participants.

The following buoys, all south of 60°S are contributing to the programme. The date of the report varies from buoy to buoy since the first direct data from CLS is just starting to arrive.

PTT	GTS	Owner	Lat	Long	Report date
14954	71547	AWI	-72°	346°	17 Jan 1995
14954	71548	AWI	-72°	346°	17 Jan 1995
14956	71549	AWI	-72°	346°	17 Jan 1995
14957	71550	AWI	-72°	346°	17 Jan 1995
14958	71553	AWI	-72°	346°	17 Jan 1995
14959	71555	AWI	-72°	346°	17 Jan 1995
23008	no	SPRI	-73°	205°	31 Jan 1995
23380	74531	AntCRC	-63°	90°	28 Feb 1995
2932	73504	BoM	-61°	143°	28 Feb 1995
4475	from 4/4	AAD	-66°	68°	31 Mar 1995
6983	from 4/4	AAD	-66°	145°	31 Mar 1995
6984	from 4/4	AAD	-66°	62°	31 Mar 1995

PTT	GTS	Owner	Proposed		Proposed launch date 1995
			Lat	Long	
6550	yes	AntCRC	-56°	75°	early April
4472	yes	AAD	-66°	110°	early May
4473	yes	AAD	-66°	120°	early May
4474	yes	AAD	-66°	130°	early May
24663	yes	AAD	-66°	140°	early August
24664	yes	AAD	-65°	145°	early August
24665	yes	AAD	-66°	150°	early August

The latest available report of MEDS indicates that 3 buoys were on the GTS in November 1994.

U.S. GOOS

- NOAA, NASA, NSF, NAVY, EPA, DOE, STATE et al
- 1990 origin; 1993 Interagency *ad hoc* Working Group
- 1993 U.S. National Report to Intergovernmental Committee
- Current U.S. GOOS effort approximately $300M/yr plus satellites (all dual-labeled activities)
- Focus: data for El Niño predictions
  detection of changes (ecosystems, coastal)
  improved marine services

ECONOMIC BENEFITS OF EL NINO PREDICTION

ASSUMPTIONS:

U.S. Agricultural Sector Only
Value reduced 9% by a severe El Nino event
Value reduced 4.5% by a moderate El Nino event

With 60% skill: assume 15% of sector loss avoidable
With 77% skill: assume 20% of sector loss avoidable

Two moderate and one severe event in 12 years

CONCLUSIONS:

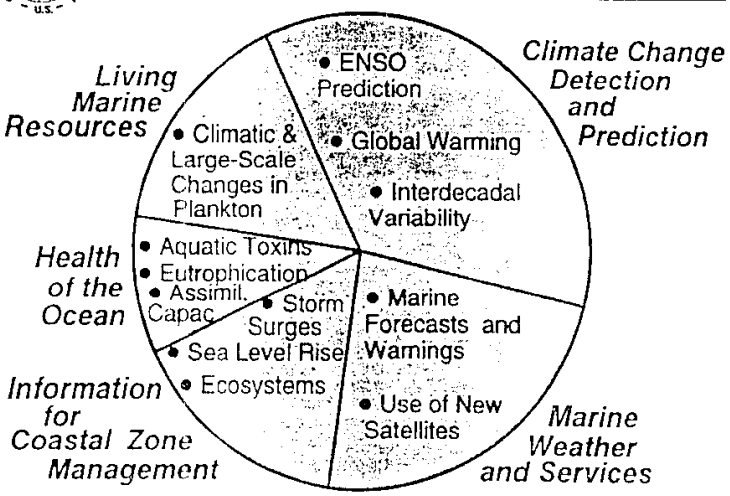
$200M+ per year benefit; increases to $300M+ per year with increased skill

Across several sectors, value of predictions --->> $1B

CURRENT EFFORTS

- TOGA Observing System transitioning from Research to Operations (TAO, then drifters, sea level, XBTs)
- Operational Predictions of ENSO, in parallel with research efforts to improve the preciptation and temperature forecasts
- Cost-Benefit studies of ENSO Predictions, Moored Buoy Arrays
- International arrangements for cooperation, shared funding, scientist/engineer exchanges, data-sharing
- U.S. Interagency Working Group formulated

SUGGESTED FOCI IN GOOS



WMO

ARGOS

IOC

Joint Tariff Agreement

Inactive Status

- Platforms are of no further use to the user or the community
- Platforms in Standard Service only apply
- Platforms must have operated in Standard Service for a minimum of two months
- Information cannot be retrieved nor can the platform revert to any category of service
- Location and/or data may not be computed using a Local Users Terminal (LUT) or other direct readout facility

WMO

Summary of Services and Tariffs Under the Joint Tariff Agreement

IOC

Processing by CLS or SAI	Category	Repetition Period	Location Computed	Data Collection and Sensor Processing	On-Line Data Access	Data Archiving	Tariff
Standard	1	≤ 120 sec	Yes	Yes	Yes	Yes	x
	2	≥ 200 sec	No	Yes	Yes	Yes	x/2
Limited Use	1a	≤ 120 sec	Yes	Yes	Yes	Yes	*
Backup	3	≤ 120 sec	Yes	Yes	No	Yes	2x/5
	4	> 200 sec	No	Yes	No	Yes	x/5
Inactive Status	5		No	No	No	No	x/6

* Users will be charged the standard data collection and location rate for actual PTT days used up to a maximum of ten per month.