Intergovernmental Oceanographic Commission
Workshop report no. 17

Report of the Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS)

Moscow, 9-11 April 1979

Workshop report No. 17

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No.	Title	Publishing Body	Languages
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asis /Report of the IDOE Workshop on/; Bangkok, Thailand, 24-29 September 1973 UNDP (CCOP), 138 p.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2	CICAR Ichthyplankton Workshop, Mexico City, 16-27 July 1974. (Unesco Technical Paper in Marine Science, No. 20)	Division of Marine Sciences, Unesco Place de Fontenoy, 75700 Paris, France	English Spanish
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
4	Report of the Workshop on the Phenomenon known as "El Nino", Guyaquil, Ecuador 4-12 December 1974	FAO Via delle Terme di Caracalla, 00100 Rome, Italy	English Spanish
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
7	Report of the Scientific Workshop to initiate planning for a co-operative investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/UNESCO/EAC, Nairobi, Kenya, 25 March - 2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	Full text (English only) Extract and Recommendations: French Spanish Russian

No.	Title	Publishing body	Languages
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
11 Suppl.	Collected contributions of invited lecturers and authors to the IOC, FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
12	Report of the IOCARIBE Interdisciplinary Workshop on scientific programmes in support of fisheries projects, Fort-de-France, Martinique, 28 November - 2 December 1977	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, 16-18 January 1978	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and adjacent areas, Abidjan, Ivory Coast, 2-9 May 1978	UNEP Palais des Nations 1211 Geneva 20 Switzerland	English French
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the Southeast Pacific Santiago de Chile 6-10 November 1978	IOC, Unesco Place de Fontenoy 75700 Paris, France CPPS Dir. de Soberania Maritima Ministerio de Relaciones Exteriores Lima Peru	English Spanish

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No.	Title	Publishing Body	Languages
16	Workshop on the Western Pacific	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Russian

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Workshop report No. 17

SUMMARY REPORT OF THE JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

1. Opening of the Workshop

1.1 The Workshop on Oceanographic Products and IGOSS Data Processing and Services System (IDPSS) was held in Hotel Russia in Moscow from 9 to 11 April 1979.

1.2 The Workshop was opened by Captain R.E. Nawratil (Argentina), Chairman of the Workshop, who extended a hearty welcome to all participants. He described the main tasks of the Workshop as being:

(i) To identify types of guides and supporting documentation for IDPSS and to prepare guidelines for manuals and guides related to IDPSS;

(ii) To consider and propose actions aimed at the further development of IDPSS;

(iii) To comment on the draft of a Glossary of Terms used in connection with IGOSS.

He then drew the attention of the participants to the fact that a Workshop is a meeting of individual experts and therefore any statements by participants do not necessarily represent the opinions of their country.

1.3 The agenda as adopted, the list of participants and the list of documents for the meeting are given in Annexes I, II and III respectively.

2. Manuals and Guides on the IGOSS Data Processing and Services System (IDPSS) and Other Supporting Documentation

2.1 The Workshop agreed that there was an increasing need for publishing guidance material which would describe practices, procedures and specifications which Member States could follow in the implementation of the IDPSS. It was also agreed that such guidance material should not be regarded as a detailed instruction manual but rather as the basis for the preparation of such manuals by Member States to meet their own individual requirements. The Workshop felt that such an action should lead to the desired degree

of standardization of data processing and services throughout the world.

2.2 The Workshop reviewed the draft outline of a Guide to IDPSS submitted by the Secretariats. In the course of these discussions, reference was made to the draft guidelines for establishing an IGOSS programme in a selected ocean area and it was felt appropriate to include these guidelines in the proposed Guide to IDPSS. The draft outline of a Guide is given in Annex IV.

2.3 Taking advantage of the presence of a number of experts who had participated in the Seminar held during the preceding week, the Workshop invited experts to contribute short articles on subjects to be dealt with in the Guide in their specialized fields. It was considered that these articles would constitute a valuable basis for further development of various sections of the Guide. These are attached to the present report as Annex V.

2.4 The Workshop then proceeded with the identification of the names of experts who might be invited to contribute to the preparation of the Guide. It agreed that the task of writing should be allocated to countries rather than to individual experts. It was, however, understood that the countries listed were lead countries and that other countries would be consulted, as necessary, as the work progresses. The allocation of individual chapters and sections is given in Annex VI.

2.5 The meeting also considered the time schedule according to which the Guide should be prepared and published. It was agreed that the Secretariats should, within the next few months, invite the lead countries listed in Annex V, to draft material for the Guide. The time schedule for the various compilation and editing procedures would be decided upon by the Secretariats. It was recommended that the Secretariats endeavour to submit the draft of a part or the whole of the Guide to the second session of the Joint IOC/WMO Working Committee for IGOSS (September/October 1980) for approval.

3. Further Development of IDPSS

3.1 The Secretariats introduced this item by noting that the development of IDPSS could not occur without the development of associated environmental monitoring and exchange programmes to support specific IGOSS products and services which would be required. Therefore, in the context of this report, the Workshop agreed that an "IDPSS Programme" would emphasize IGOSS products and services, but would include consideration of other IGOSS elements, such as data acquisition and exchange. Referring to document IOC-WMO/IDPSS-SW/7

"Development of IDPSS for Selected Ocean Areas", the Secretariats recalled that although global initiatives have indeed had some success, several previous IGOSS meetings, in particular that of the first session of the Joint IOC/WMO Working Committee for IGOSS (Paris, September 1978) and the Joint IOC/WMO Meeting of Governmental Experts on IDPSS (Hamburg, March 1978), had stressed the desirability of implementing the global IGOSS programme on national and regional bases as outlined in the General Plan and Implementation Programme 1977-1982 (IOC Technical Series No. 16, WMO Pub. No. 466). In particular, these meetings gave emphasis to the implementation of the IGOSS programme in selected ocean areas. For IDPSS development, the Workshop stressed the importance of a Specialized Oceanographic Centre (SOC) for each regional programme.

3.2 Guidelines for implementing an IDPSS programme in a selected ocean area

The Workshop reviewed the draft guidelines for establishing and implementing an IDPSS programme in a selected ocean area (see Annex II of document IOC-WMO/IDPSS-SW/7) and noted that these guidelines were based on the concepts for IGOSS programmes, as outlined in the General Plan and Implementation Programme 1977-1982. The guidelines were generally accepted but were modified as presented in Annex VII **hereto**.

3.3 The Workshop recognized that the establishment and implementation of such IGOSS programmes in selected ocean areas represented a significant increase in the level of sophistication of the IGOSS programme, and each selected programme would require considerable effort both by Member States participating in it and by the Secretariats themselves. However, it was pointed out that unless the IGOSS programme realistically dealt with specific programmes, no further significant advance could be made. In particular, a general call for data and oceanographic products and services had not produced sufficient results. Thus, Member States must organize themselves so that:

- data are collected and exchanged efficiently within a selected ocean area;

- requirements of IGOSS products and services within that ocean area can be met.

3.4 It was recognized that IGOSS programmes are based on national efforts. However, the Workshop emphasized that it is the organization and co-ordination of these efforts that will ensure that IGOSS is recognized as a programme which benefits Member States beyond their own national programmes. Thus, Member States were encouraged to co-ordinate their programmes.

3.5 Identification of possible IDPSS programmes in selected ocean areas

The Workshop noted that many initiatives by Member States are under way and would result in IGOSS programmes in a selected ocean region. These

initiatives were discussed as follows:

3.6 Eastern Tropical Atlantic

A French proposal for an intensification of IGOSS Activities in the Eastern Tropical Atlantic Ocean was presented by Mr. H.A.H. Noel (ORSTOM, France). The project would utilize ships-of-opportunity in the Atlantic Ocean for the collection of surface and sub-surface temperature observations. Mr. Noel stated that the proposal, if successfully implemented, would benefit both the fishing and scientific communities. The Workshop wished to emphasize Mr. Noel's comments to the effect that this project would need the participation of other Member States in order to achieve success. In this context it was noted that perhaps it would be appropriate to have an international meeting in about one year, organized within IGOSS, at which interested Member States could discuss their participation in the project. The Workshop commended ORSTOM for highlighting this initiative and hoped that other Member States would follow suit in the future.

3.7 Western Pacific

The Secretariats brought to the attention of the Workshop two decisions from the first session of the IOC Working Group for the Western Pacific (WESTPAC) (WESTPAC-I.14 and 15), in which an IGOSS monitoring programme was given high priority. Dr. S. Pazan (USA) explained how this WESTPAC initiative would be coupled with that of NORPAX and stated that several IGOSS products were being contemplated for the programme. He also said that a real-time observation component for sea-level was being considered.

3.8 COST-43

Prof. H. Walden presented the status of COST-43 to the Workshop. COST-43 is being organized by a group of European countries, and will be involved with real-time collection of oceanographic and meteorological data from various oceanic platforms including drifting and moored buoys. In addition, products were being considered which could in future form a contribution to IDPSS.

3.8 "El Niño"

The Workshop was informed that consideration is being given to an oceanographic and atmospheric monitoring programme, including elements of IGOSS, in the area of the phenomenon known as "El Niño" off the western coasts of South America. This programme will most likely be implemented under the recently-formed Joint IOC/WMO/CPPS Working Group on the Investigations of "El Niño".

3.10 Central Western Indian Ocean

Although the countries of the region have organized themselves within the framework of a programme known as the Co-operative Investigations in the North and Central Western Indian Ocean (CINCWIO), to this date they have not identified a specific need for an IGOSS programme in the region, even though many documents are available on the importance of fisheries research and products for the region. The meeting felt that one possible reason for this is that Member States lack information on IGOSS. The meeting stressed that the Secretariats should send more public relations type material on IGOSS to these countries. In addition, as part of the IGOSS/TEMA effort, consideration should be given to a representative of IGOSS touring the region to inform the countries directly of the IGOSS programme and its benefits.

3.11 Flemish Cap

The session was pleased to note that the ICNAF Flemish Cap Experiment incorporates real-time transmission of IGOSS BATHY/TESAC data. It was also mentioned that consideration is being given to the preparation of IGOSS products for use in this experiment.

3.12 Climate

In addition to the above ocean areas, the meeting recognized the importance of recent developments in the future World Climate Programme (WCP) to the IGOSS programme. Ocean monitoring programmes have already been mentioned within the context of the WCP and, in fact, a meeting to define the first Pilot Ocean Monitoring Study (POMS) will be held in conjunction with the Joint SCOR/IOC Committee on Climatic Changes and the Ocean, in September 1979. The first POMS will most likely be in a selected ocean area, notably the tropical Pacific or the tropical Atlantic Ocean and will emphasize time series of oceanographic sections. The Secretariats announced that it is planned that an IGOSS representative attend this and future sessions, so that IGOSS principles of data observation, data transmission and exchange, and oceanographic products and services can be incorporated into the ocean monitoring systems for climate at an early stage.

Although the Climate programme is still in the infant stage, the meeting emphasized that IGOSS participants must now begin to identify the types of products and data that will be needed by the Climate programme. In this way, IGOSS will be able to meet the inevitable demands that will be placed on it by the Climate community.

4. Formulation of recommendations on IDPSS

The recommendations of the Workshop can be found as underlined phrases throughout this report. The recommendations of the Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, held in Moscow the previous week, 2-6 April 1979, can be found in Section 5.2 herein.

5. Other business

5.1 IGOSS Glossary

Under this item the Workshop considered the draft Glossary of Terms used in connection with the IGOSS programme (doc. IOC-WMO/IDPSS-SW/8) upon the request of the first session of the Joint IOC/WMO Working Committee for IGOSS. The participants were presented with the draft prepared by the Secretariats with the help of a few IGOSS experts and a consultant. It was noted that basically the terms included in this document are taken from existing WMO and IOC publications. It was stressed that the Secretariats ensure that the definitions of terms included should comply, where available, with those already used in relevant IOC and WMO publications. The meeting reviewed all the terms and made the following conclusions:

- The intent of the Glossary, as described in the document, is to define operational terms as they are used within the IGOSS programme but not to redefine basic oceanographic or meteorological parameters or common terms used in ocean programmes.

- The Glossary should include a list of the reference documents used for its preparation.

- Additional terms related to IGOSS were proposed by the participants for inclusion in the Glossary.

- The Workshop agreed that the revised draft should be prepared by the Secretariats, initially in English only, on the basis of discussions during the meeting. It should then be distributed to the National Representatives for IGOSS for review and comments. The final draft, in English only, thus prepared will be submitted for approval to the second session of the Joint IOC/WMO Working Committee for IGOSS (September/October 1980). After approval, the Glossary will be translated into the working languages of the Secretariats.

5.2 Review of the IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System

5.2.1 The Workshop also reviewed the results of the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS) held in Moscow prior to the Workshop, from 2 to 6 April 1979. This Seminar was organized by the USSR State Committee for Hydrometeorology and the Control of the Natural Environment, under the co-sponsorship of IOC and WMO. The major objective of the Seminar was to identify the application of oceanographic products by marine user groups and the exchange of knowledge and experience among specialists on oceanographic product formulation and methods used for their preparation. Upon the joint invitation of IOC and WMO, 57 participants from 15 countries and international organizations attended the Seminar. 32 papers were presented thereat.

5.2.2 The participants of the Workshop wished to express their appreciation to the State Committee for Hydrometeorology and the Control of the Natural Environment, and particularly to Dr. K.P. Vasiliev, the Conference Co-ordinator, for the excellent arrangements made for the Seminar.

5.2.3 In view of discussions held at the end of the Seminar, the participants of the Workshop wished to stress the following:

- the great usefulness of such type of discussion for the development of IGOSS on sound scientific and practical bases;

- that the meeting noted with great satisfaction the participation for the first time in the IGOSS-related Seminar of experts from Bulgaria, German Democratic Republic, Ireland, Democratic People's Republic of Korea, and Poland;

- that the Joint IOC/WMO Working Committee for IGOSS considers the possibility of including in future similar scientific/technical Seminars more specific subjects related to the IGOSS programme;

- that the preparation of IGOSS products and services go hand in hand with oceanographic data observation collection and exchange. More emphasis should be given to the recognition of the coupling of these programme elements, and in particular:

  i) systematic co-ordinated IGOSS programmes should be explored in various selected ocean areas. This concept should include a Specialized Oceanographic Centre (SOC) for product preparation and dissemination;

  ii) information on the optimization of each of these elements should be identified and distributed so that Member States participating in IGOSS programmes for the first time might know where best to place their resources. In particular, a study should be carried out on the "best mix" of Ocean Data Acquisition Systems,Aids and Devices (ODAS). This study should emphasize consideration of new observation techniques including drifting buoys and satellites;

- that IDPSS must be well organized and co-ordinated. Such material as IDPSS guides, general programme information, etc. should be distributed. In so far as co-ordination and information are concerned, the IGOSS brochure and the guide to the IDPSS were given special recognition;

- that more attention should be given to building up a user community for IGOSS products and services. This can be done through national as well as international fora. Furthermore, evidence was given at the Seminar by several speakers, that the initiation of an IGOSS-type, real-time project with resulting products can produce its own users. In several cases, once the products were provided, the user community began to demand these products on a regular basis;

- that more requirements need to be specified for oceanographic products, so that appropriate data collection requirements can be implemented;

- that IGOSS must continue to be actively supported by both oceanographers and meteorologists. Most IGOSS initiatives have benefits for both communities. In addition, the operational meteorology community is well established, and IGOSS organizers must look to it for guidance on operational procedures for product preparation, distribution, etc.;

- that as a certain minimum density of data with time and space is necessary for the preparation of products, and that since knowledge of this question is relatively poor, there should be an investigation into the problem especially with regard to sub-surface products. The Workshop recommended that this problem should be referred to the IGOSS Sub-group of Experts on Operations and Technical Applications;

- that the Secretariats should ask Member States to keep records of requests for data, both by public and private sectors, in order to determine what types of data are in most demand;

- that IGOSS should sponsor an investigation of applications of drifting buoy products from, and resultant oceanographic requirements for, drifting buoys (for example, inclusion of sub-surface temperature measurements, wave measurements, current measurements using drogues): the use of drifting buoys in regional studies (data requirements and spacing); and

- that IGOSS should encourage those agencies producing global and regional products at frequent intervals (i.e. every few days) to produce documentation such as pamphlets, slides or time-sequence films, complete with dialogue, for educational and training purposes.

5.3 Value of Temperature-Salinity Relationships to IGOSS

The Workshop considered the proposal made by a few participants on the development of a standardized set of temperature - salinity relationships by which sub-surface temperature data available to IGOSS might be converted in a consistent manner to infer temperature-salinity pairs for calculation of density structure, geostrophic flow, etc. (cf. W.J. Emery "Use of historical data to compute density and dynamic height from temperature profiles", in Proceedings of the IGOSS Seminar on Oceanographic Products and IDPSS). The Workshop recommended that this subject be referred to the Joint IOC/WMO Sub-group of Experts on Scientific Matters related to IGOSS for study. It was suggested that the Sub-group might consider the preparation of a catalogue of water masses for this purpose.

5.4 Drifting Buoys

5.4.1 Dr. K.P. Vasiliev raised the subject of drifting buoys. In particular, he referred to those drifting buoys remaining operational after the termination of FGGE. As of the end of the FGGE Operational Year, 1 December 1979, the satellite data collection and processing centre, Service ARGOS, which is located in France, will charge for the processing of data from such buoys. The Workshop recommended that Member States be encouraged to provide funds to cover these charges. In addition, the Workshop suggested that the IGOSS Sub-group on Operations and Technical Applications should keep close watch on the development and usage made of FGGE drifting buoy data in order to see if further development can be suggested to improve the data collecting capability of these buoys. The Workshop encouraged Member States to carry out studies on the feasibility of using drifting buoys to measure ocean currents, in particular the effects thereon of wind, waves and currents. The FGGE Southern Hemisphere Drifting Buoy System and the NORPAX drifting buoy arrays could offer a data base for such studies. The Workshop noted that some work on this problem is already under way, particularly in Canada and the USA.

5.4.2 In a more general context, the Workshop noted that many countries such as Australia, Canada, France, Japan, Norway and the USA are planning drifting buoy programmes in the future. The Workshop was informed that various plans are being considered to use drifting buoys for measuring ocean currents, waves and sub-surface temperature. In view of the importance of these observations to IGOSS products, the Workshop recommended that countries be encouraged to continue drifting buoy programmes in the future and to ensure that the data from these buoys are inserted into the GTS. Further, recognizing the decrease in the cost of data processing for groups of buoys, the Workshop recommended that block funding arrangements be explored within the IGOSS programme.

5.4.3 The Workshop noted that the importance of drifting buoys had been reflected in resolution EC-XI.12 of the eleventh session of the Executive Council. With this resolution, the IOC Executive Council decided that a joint IOC/WMO co-ordinating mechanism for drifting buoy initiatives should be established within IGOSS at an early date. The Workshop recommended that the Joint IOC/WMO Working Committee for IGOSS undertake this task as a high priority action.

5.5 Ocean Weather Station "PAPA"

The Workshop noted with regret the decision of the Canadian Government to discontinue the operation of OWS "PAPA" located in the North Pacific. Recognizing the great value of observations from this station for IGOSS, the meeting wished to express its concern and requested the Secretariats to bring this opinion to the attention of the Canadian Government. It was also recommended that the Joint IOC/WMO Working Committee for IGOSS consider possible ways and means, through international co-operation, to continue to take the valuable time series data at the location of OWS "PAPA".

6. Closure of the Workshop

6.1 The Chairman expressed his gratitude, on behalf of the participants, to the staff of the USSR State Committee for Hydrometeorology and the Control of the Natural Environment, particularly Dr. K.P. Vasiliev, for their hard work in hosting this Workshop. He also thanked the IOC and WMO Secretariats for their support. Appreciation was also expressed to the Chairman for his leadership through the three-day Workshop. The Workshop was closed by the Chairman at 1400 on Wednesday 11 April 1979.

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Annex I

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

A G E N D A

1. Opening of the Workshop

2. Manuals and Guides on the IGOSS Data Processing and Services System (IDPSS) and other supporting documentation

3. Further development of IDPSS

4. Formulation of the recommendations on IDPSS

5. Other business

6. Closure of the Workshop

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Annex II

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

LIST OF PARTICIPANTS

I. MEMBER STATES

ARGENTINA

R.E. NAWRATIL
Armada Argentina
Servicio de Hidrografia Naval
Avenida Montes de Oca 2124
Buenos Aires

CANADA

S. TABATA
Department of Fisheries and Oceans
Institute of Ocean Sciences
Patricia Bay
P.O. Box 6000
9860 West Saanich Road
Sidney, B.C. V8L 4B2

FRANCE

C. FONS
Direction Metéorologie Nationale
Service metéorologique métropolitain
2, Avenue Rapp
75007 Paris

J.A.H. NOEL
ORSTOM
24, rue Bayard
75008 Paris

Y. TREGLOS
Chairman IGOSS
Centre National pour l'Exploitation des Océans (CNEXO)
66, Avenue d'Iéna
75016 Paris

GERMAN DEMOCRATIC REPUBLIC	E. FRANCKE Institute of Marine Research Academy of Sciences of the German Democratic Republic 15, Seestrasse DDR-2530 Warnemünde
	J.-O. HOLZ Meteorological Service of the German Democratic Republic Marine Weather Office 15, Seestrasse DDR-2530 Warnemünde
	H. VEIT Meteorological Service of the German Democratic Republic Albert-Einstein-Strasse 42-44-46 DDR-15 Potsdam
GERMANY (Federal Republic)	K. HUBER Deutsches Hydrographisches Institut Bernhard-Nocht-Strasse 78 2000 Hamburg 4
	H. WALDEN Tinsdaler Kirchenweg 233a 2000 Hamburg 56
IRELAND	P. LYNCH National Board for Science and Technology Shelbourne House Shelbourne Road, Ballsbridge Dublin 4
	O. SWEENEY National Board for Science and Technology Shelbourne House Shelbourne Road, Ballsbridge Dublin 4
JAPAN	K. NAGASAKA Marine Department Japan Meteorological Agency 1-3-4 Ote-machi Chiyoda-ku Tokyo 100

THAILAND

M. HUNGSPREUGS
Department of Marine Science
Chulalongkorn University
Bangkok 5

UNION OF SOVIET SOCIALIST REPUBLICS

Yu. G. IONOV
Head Office of Navigation and Oceanography of the USSR
11 Linia 11
Vasilevsky Ostrov
Leningrad

K.P. RYZHKOV
USSR State Committee for Hydrometeorology and the Control of the Natural Environment
12, Pavlik Morozov Street
123376 Moscow

K.P. VASILIEV
Hydrometeorological Centre of the USSR
9-13 Bolshevistskaya Street
123376 Moscow

UNITED STATES OF AMERICA

A. BAKUN
Pacific Environmental Group
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
c/o F.N.W.C., Monterey
California 93940

W. GEMMILL
National Meteorological Center
National Weather Service/NOAA
Washington D.C. 20233

R.E. HUNT, Jr.
Pacific Marine Environmental Laboratory
3711 15th Avenue N.E.
Seattle, Washington 98105

R.C. JUNGHANS
Office of Research and Development (RDI)
National Oceanic and Atmospheric Administration
6010 Executive Boulevard
Rockville, Maryland 20852

J.E. OVERLAND
Pacific Marine Environmental Laboratory
3711 15th Avenue N.E.
Seattle, Washington 98105

UNITED STATES OF AMERICA/cont'd

S.E. PAZAN
Scripps Institution of Oceanography
A-030
La Jolla, California 92093

S.A. PIACSEK
NORDA, Code 322
NSTL Station
Bay St. Louis
Mississippi 39529

B.J. THOMPSON
Ocean Services Branch
U.S. National Weather Service
Gramax Building, Room 1213
Silver Spring
Maryland 20910

II. INTERNATIONAL ORGANIZATIONS

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (ICES)

J. SMED
International Council for the Exploration of the Sea (ICES)
Charlottenlund Slot
2920 Charlottenlund, Denmark

III. SECRETARIATS

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

A. TOLKACHEV
Assistant Secretary
Intergovernmental Oceanographic Commission
Unesco
7, place de Fontenoy
75700 Paris, France

G.W. WITHEE
Assistant Secretary
Intergovernmental Oceanographic Commission
Unesco
7, place de Fontenoy
75700 Paris, France

WORLD METEOROLOGICAL ORGANIZATION (WMO)

S. MIZUNO
Chief, Ocean Affairs Division
World Weather Watch Department
World Meteorological Organization
Case Postale No. 5
1211 Geneva 20, Switzerland

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Annex III

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

LIST OF DOCUMENTS

A. Working Documents

IOC-WMO/IDPSS-SW/1	Provisional Agenda
IOC-WMO/IDPSS-SW/2	Annotated Provisional Agenda
IOC-WMO/IDPSS-SW/3	Summary Report
IOC-WMO/IDPSS-SW/4	Provisional List of Documents
IOC-WMO/IDPSS-SW/5	Provisional List of Participants
IOC-WMO/IDPSS-SW/6	Proposed Outline of the Guide on IGOSS Data Processing and Services System (IDPSS)
IOC-WMO/IDPSS-SW/7	Development of IDPSS for selected ocean areas
IOC-WMO/IDPSS-SW/8	A Glossary of Terms used in connection with the IGOSS Programme

B. Reference and Information Documents

IOC Technical Series No. 16, WMO Pub. No. 466 (January 1977)	IGOSS General Plan and Implementation Programme, 1977-1982
IGOSS Programme Information Circular No. 013 (December 1977)	IDPSS Development
IOC Technical Series No. 12	Oceanographic Products and Methods of Analysis and Prediction

B. Reference and Information Documents/cont'd

Joint IOC/WMO Circular Letter No. 77-31 dated 27 June 1977	Information on Oceanographic Products Issued by National Centres
Joint IOC/WMO Circular Letter No. 77-47 dated 15 November 1977	First Issue of a Regular Information Service Bulletin on Oceanographic Products Issued by National Centres
WMO Pub. No. 471	Guide to Marine Meteorological Services
IOC-WMO/IGOSS-I/3	Provisional Summary Report of the First Session of the Joint IOC/WMO Working Committee for IGOSS (Paris, 18-27 September 1978)
IOC-WMO/IDPSS-I/3	Summary Report of the Joint IOC/WMO Meeting of Governmental Experts on IGOSS Data Processing and Services System (IDPSS) (March 1978)
IOC-WMO/IGOSS-I/19	Consideration of the Present IGOSS and a Proposed Special Investigation (May 1978)
IOC-WMO/IDPSS-I/5	A Discussion on the Development of IDPSS (February 1978)
IOC-X/25	A proposal regarding IOC's concept of the Integrated Global Ocean Station System (IGOSS) (1977)
IOC-WMO/IGOSS-I/20	Proposals for the implementation of the IGOSS Programme on a regional basis (July 1978)
IOC/WESTPAC-I/3	First session of the IOC Working Group for the Western Pacific (WESTPAC-I) (February 1979)
IOC-WMO/IGOSS-SGF-II/3	Second session of the Joint IOC/WMO Sub-group of Experts on IGOSS Products of Interest to Fisheries (March 1978)
IGOSS Information Brochure (first draft, English only, 15 March 1979)	
IGOSS/POLYMODE Experiment Reports 1-4	

Workshop report No. 17

Annex IV

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

DRAFT OUTLINE OF A GUIDE TO THE IGOSS DATA PROCESSING AND SERVICES SYSTEM

Preface

Introduction	Purpose, principles and scope (reference material IGOSS General Plan and Implementation Programme 1977-1982 (IOC Technical Series No. 16, WMO Pub. No. 466) and paragraph 96 of the World Weather Watch Plan and Implementation 1976-1979, WMO-418)
Chapter 1	Requirements for products and services
1.1	Applications and benefits
1.2	Shipping
1.3	Fisheries operations, management, and research
1.4	Coastal activities and ocean engineering
1.5	Marine pollution - abatement and control
1.6	Search and rescue
1.7	Aquaculture and mariculture
1.8	Permanent ocean monitoring
1.9	Recreation
1.10	Short-, medium- and long-range weather forecasting
1.11	Support of oceanographic, meteorological and climatic research
1.12	Ground truth for satellite observations
1.13	Sea ice and iceberg prediction services

Chapter 5 — Presentation of products

5.1 — Preparation of charts and diagrams

5.1.1 — Specifications of base charts

5.1.1.1 Standard projections

5.1.1.2 Standard scales

5.1.1.3 Colours

5.1.1.4 Standardization of charts for facsimile transmissions

5.1.2 — Plotting of observations

5.2 — Representation of analyses and prognoses

5.2.1 — Depths or pressure levels for analyses and prognoses

5.2.2 — Isopleths

5.2.3 — Symbols

5.2.4 — Frequency of issue of charts for individual parameters

Chapter 6 — Organization and procedures for data collection and dissemination

6.1 — Observational data requirements

6.2 — Data collection and dissemination including the BATHY/TESAC Operational Programme

6.3 — Quality control

Chapter 7 — Data archiving and exchange

7.1 — General description of IGOSS Data Archiving and Exchange (reference: IOC Manuals and Guides No. 1)

7.1.1 — BATHY/TESAC data

7.1.2 — Marine pollution data

7.2 — General description of IODE (reference: IOC Manuals and Guides No. 9)

7.3 — Functions of RNODCs

Chapter 8 Training, Education and Mutual Assistance Programmes

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Annex V

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

SUPPORTING MATERIAL TO THE OUTLINE OF THE IDPSS GUIDE

During the Workshop, many participants felt that the outline of the Guide to the IDPSS (see Annex IV) should be expanded somewhat in text form using the available expertise of the participants themselves. The following paragraphs, based on contributions from the participants, refer to the numbered sections of the outline as presented in Annex IV. This material does not represent the final text of the Guide to the IDPSS, but was thought to be of potential use when the Member State nominees, as listed in Annex VI, prepare the various sections of the Guide.

1.2 Shipping (J. Overland)

Support to shipping is dependent upon 2-3 day forecasts of surface winds and wave fields. Shorter than this time, the ship cannot alter course, but in a two-day frame a ship can change course to avoid opposing waves which can slow it to two-thirds of its speed. Charting strong currents, particularly boundary currents, can add or subtract from ship speed. Opposing waves and currents form steep waves which are extremely dangerous such as the Agulhas current off South Africa.

1.3 Fisheries operations, management, and research (A. Bakun)

(i) Brief expansion of chapter title

Environmental inputs are required for both operation and management of fisheries, but on generally different time scales. Operations are concerned with factors affecting ability to operate, effectiveness of gear, and distribution (i.e. availability) of the fish stock being harvested; real-time inputs are required. Management is concerned with abundance (implying reproductive capability) and requires that environmental effects on fish populations be integrated over longer time scales.

(ii) Introduction

During recent years there has been a phenomenal growth in world fisheries (e.g. world marine and freshwater fish catch in 1954 was 27.6 million metric tons; in 1971 it was 70.2 million metric tons). Recently there have been an increasing number of disastrous collapses of fishery stocks attributed to a combination of overfishing and adverse environmental conditions. The methodology for inclusion of environmental effects in fishery management models is at present not well developed, partly due to lack of environmental information on pertinent time and space scales. In addition there is a need for environmental products supporting fishing operations, in order to increase efficiency, conserve scarce energy resources, etc.

(iii) Products supporting fishing operations

A. Weather advisories

B. Wave and swell forecasts

The scales of these forecasts should be the usual synoptic weather forecast time and space scales. Transmission of these products should be by radio or radio facsimile to the fishing fleet in real-time.

C. Sea temperature analyses

D. Ocean frontal analyses

Frontal analyses in particular should incorporate the finer space scales observable in satellite I.R. observations. Products should clearly indicate where analysis is based on real data, as opposed to interpolations or climatology, so that the fisherman can properly weigh his options (e.g. perhaps to search a nearby area which lacks data as against steaming a long distance to a region of definable favourable conditions). Sea surface temperature and frontal analysis should be produced on areal maps on finest available resolution scale. Sub-surface temperature information could, perhaps, be indicated by representative temperature-depth traces where observations are available. Transmission should be by facsimile, in real-time.

E. Mixed layer depth, etc.

This allows selection of areas where particular gear will be successful in harvesting available fish. Scale should be as fine as resolvable from available data. Transmission should be by radio facsimile,in real-time.

F. Ocean current analyses

This would have potential use on longer time-scales for indicating probable areas of fish concentration etc. (e.g. a fisherman might choose to base his operation on a different port of call, etc. under certain seasonal current conditions). Time-scale : weeks to months.

(iv) Products supporting fishery management

As noted in the introduction, the need for incorporation of information on environmental fluctuations in the fishery management process is urgent. Lack of environmental data on proper time and space scales has hindered the establishment of useful fishery-environmental relationships. Thus the development of data sources and the development of management techniques must proceed together. Previous relationships established between properties such as temperature and salinity, and fish reproductive success, for example, have tended to hold for a while and then to break down. The likely explanation is that both the property and the fish were responding to a common process rather than a direct linkage between the two. When the conditions relating the property to the process had eventually modified, the apparent relationship to fisheries disappeared. Recently, progress has been made in the problem by attempting to use indicators of varying processes such as upwelling, drift, etc.

At present we are far from deterministically modelling the complicated linkages of a fish population to its environment. Thus the approach is generally statistical. A major problem in such an approach is that there are generally available only very small time series samples with which to work. Fishery data characteristically yield one data point per year and the period over which the time series can be considered homogeneous does not normally exceed ten to twenty years. To sort out a multitude of possible environmental effects from a series with ten to twenty data points is a statistically impossible task. It is necessary therefore either to find the means to reduce the multitude of environmental factors to one, or at most several, indices of integrated environmental state, or to hope that one or perhaps two environmental factors will have such a dominant effect as to be discernible through the "noise level" generated by the other environmental effects not accounted for. The Pacific Environmental Group in the USA has had recent success in generating indicators of critical process fluctuations from surface wind analyses.

Thus, the class of data products suited to fishery management applications are those which can be updated through the IGOSS system, but are based on the type of data sources that are available in time series. Ideally, there should be a historical backlog of data so that the time series can be lengthened by hindcasting. Most likely candidates for use in fishery management include:

A. Sea level observations

Sea level is an "integrating" measurement, i.e. a point of measurement gives information applicable to a larger scale than, for example, a temperature measurement. It represents a point on the pressure topography of the ocean. Longer time-scale variations may represent fluctuations of geostrophic flow and be related to coastal upwelling, etc. Short scale variations are signatures of environmental disturbances (coastal trapped waves, etc.). If IGOSS could provide timely updates of coastal sea level series, this would be very valuable to development of fishery-environmental models (most important fisheries are near the coasts). Also, sea level provides a boundary observation for ocean current analyses.

B. Products derived from surface wind analyses

a) Upwelling indices : The sea surface stress is estimated and the offshore Ekman flux is computed. Offshore Ekman flux is the primary driving force of coastal upwelling;

b) Surface convergence - Divergence indices : The Ekman layer divergence is computed from the wind stress curl, with a smaller term proportional to the zonal stress;

c) Wind mixing index : Proportional to the cube of the surface wind speed.

C. Sea temperature analysis

Temperate affects all biological rates. Long-time scale variations can affect viability of fish stocks.

D. Ocean structure analysis

The formation of critical food concentrations necessary for survival of pelagic fish larvae appears to be dependent on stability of the water column.

E. Ocean current analysis

Fluctuations of ocean currents affect the loss of fish reproductive products, exchanges of populations, etc. Time series of such fluctuations would be an important management tool. It is important that the need for observations in such an analysis be recognized. Ocean models without observations are in some ways comparable to atmospheric models without observational input - interesting but not much use in predicting the weather. Dynamics should, of course, be used to merge observations, but cannot create observational data. Coastal sea levels on the boundary may help. The possibility of ship drifts from satellite-navigation equipped vessels should be evaluated. Large quantities of data can in some ways compensate for low precision. Wind effects could, perhaps, be handled as error variance about a statistically determined average bias. Observations in strong winds could be rejected, etc.

1.3 Fisheries operations, management, and research (J.A.H. Noel)

Use of IGOSS for support to fishing in the Atlantic

A. Area of concern

The fishing activity concerned is that carried on all the year round off the coast of Africa and off the coasts of Europe. It is concentrated primarily on the exploitation of the stocks of large pelagic fish (tuna) and sardine.

Harvesting is carried out by well organized industrial fishing fleets, but the economic importance of small-scale inshore fisheries, which are particularly affected by environmental conditions, must not be underestimated.

B. Interaction between fishing strategy and environment

A substantial body of research has confirmed the interaction between fish concentration and hydroclimatic conditions. Recent studies have highlighted the importance of surface temperature changes at a given position for defining probable areas of fish concentration.

C. Contribution of a knowledge of the environment to fishery management

The ever-increasing costs of moving from one fishing ground to another, and the greater distances to be covered (extension of the economic area to 200 miles) make it necessary to possess a real-time knowledge of the hydroclimatic seasons in order to direct fleets to fishing areas at the right moment.

In addition, regular observation of climatic and hydroclimatic fluctuations should make it possible to modify the fishing effort in a given area.

1.4 Coastal activities and ocean engineering (J. Overland)

There are three activities concerned with nearshore operations - design of structures, assessment and operations. Design is based upon historical data, particularly wave data. This climatology is usually developed by hindcasting waves from historical wind fields. Operations must stop if wind and sea conditions become too severe. Forecasting these conditions is based upon accurate short-range weather forecasts - 12-24 hours. Assessment activities are the same as under section 1.5.

1.5 Marine pollution abatement and control (Y. Treglos)

Meteorology as a means of assisting different users

For the protection of off-shore oil exploration and the working of productive marine deposits, user needs concern:

- waves;
- currents.

For the protection of fishing:

- surface temperatures;
- temperature profiles in the first 100 metres.

1.11 Support of oceanographic, meteorological and climatic research (J. Overland)

The emphasis of air-sea interaction studies and climate studies is on process oriented research to determine rates of transfer of heat and momentum, and to indicate the relevant dynamics of the processes. To carry out these objectives, case studies are performed. IGOSS can make a large contribution to these experiments by real-time processing of data from a fleet of research ships, such as done in POLYMODE, to allow modification of the experiment while under way.

1.11 Support of oceanographic, meteorological and climatic research (S. Pazan)

Climate studies including climate modelling

NORPAX embraces several regional programmes directly and indirectly concerned with climate. Herein data requirements for North Pacific ocean-atmosphere interaction studies and climate prediction studies are presented; future data requirements are estimated.

A. Ocean-atmosphere interaction studies

a) The Anomaly Dynamics Study of the NORPAX experiment is designed to test an hypothesis that ocean thermal anomalies are a response to wind forcing. This experiment uses XBT profiles in an area from 30 to 50 N, 170 E to 130 W. Real-time data acquisition is not necessary, although a timely (i.e. monthly) acquisition would be. Drifting buoy data are also being acquired on a timely basis.

b) Future studies having somewhat similar needs for timely data are now being planned in the Western Pacific and the Equatorial Pacific. These studies will be able to use IGOSS XBT data, current data, and drifting buoy data in their respective areas of interest.

B. Statistical climate forecasting

The effect of the ocean on continental climate has been hypothesized for at least a century. "If the ocean can initiate climate change, then some of the ocean variables, such as water temperature anomalies, should be effective predictors of atmospheric properties".[1] That a

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1) Barnett, Tim, "Ocean Temperatures: Precursors of Climate Change", OCEANUS, 21 : 4, Autumn 1978, pp. 27-32

relationship between variations in ocean properties, such as sea surface temperature, exists, has been demonstrated (ibid. 1978). Although it has not been proven that ocean parameters are precursors of climatic change, dissemination of ocean property values would be of great importance to climate research. For research purposes, the data should be acquired in a timely way, and calculation of anomalies should be left to the end user, since climatologies are not as yet standardized.

1.12 Ground truth for satellite observations (C. Fons)

Use of IGOSS for satellite ground truth observations

A. Area of concern

The effective use of satellite data (such as METEOSAT, LANDSAT, NOAA) entails the collection of such data at the right moment and constant comparisons between ground observations and the results of imagery processing.

As satellites provide virtually synoptic observation, a vast network is needed,capable of taking and transmitting ground measurements simultaneously.

The use of future (increasingly specialized) satellites will make it necessary to expand the measurement network and speed up data transmission time.

B. Use of real-time data

In view of the extremely high cost of acquiring and processing satellite data, a prior knowledge is required of the climatic conditions prevailing in the area concerned (clouds, atmosphere).

Because of the small storage capacity of some satellites (LANDSAT, SPOT), there must be very careful acquisitions programming which takes environmental conditions into account.

C. Use of simultaneous data

The measurement network enables satellite sensors to be calibrated for the utilization of data.

Furthermore, satellites must be monitored to ensure that they are functioning correctly and continuous ground truth measurements can provide the assurance that everything is working properly.

4. Methods and techniques used for the preparation of oceanographic products (S. Piacsek)

Numerical modelling

Research and development in numerical modelling of the ocean

A. Numerical models for ocean forecasting and analysis in real-time

Develop and test numerical computer models for real-time ocean analysis and prediction. The models being developed should include a detailed treatment of the turbulent mixed layer, MODE-size eddies, and western boundary and equatorial currents, and plan to use both XBT and satellite data for initialization and updating.

B. Numerical models as tools for theoretical studies of ocean dynamics

Develop numerical models with the theoretical part of the research efforts performed in large-scale field experiments such as NORPAX (North Pacific), INDEX (Indian Ocean) and POLYMODE (North Atlantic). Carry out basic research using non-real-time data, with access to recently updated climatology.

Test real-time ocean analysis and prediction schemes, with access to real-time ocean observations. No operational forecasts are made at present on a daily basis. Use National Oceanographic Data Centres (NODCs) as one of the depositories of IGOSS data, but if any data from some nations do not arrive at NODC (surface or satellite), then use IGOSS in negotiating with individual centres for additional data.

If any analyses, statistics or climatological operations are performed at any ocean centre on global data, they should be available to numerical model centres. For example, transmission of digitized and enhanced satellite pictures.

Numerical Products for IGOSS Use

A. Objective schemes that:

a) perform mixed layer depth analysis

b) perform eddy analysis

c) combine satellite data with XBT/Buoy/Ship data

d) perform current analysis

B. Predictive schemes that:

a) forecast structure of ocean mixed layer

b) forecast currents

c) forecast sea-surface temperature

4. Methods and techniques used for the preparation of oceanographic products (W. Gemmill)

Regional thermal structure products

Regional thermal structure products can be developed in several ways depending on the products desired and the data available. Thermal structure can be presented by the following means:

A. Sea surface temperature - Objective analysis

The analysis technique should be kept simple for ease of implementation as well as control of data being used in the analysis. The quantity and quality of most ocean real-time data do not warrant advanced analysis methods at the present time. The main data problem is to identify "maverick" and "gross error" data. However, optimum interpolation methods appear to be suitable for ocean analysis.

B. Feature (fronts, eddies, etc.) analyses - manual analyses

These analyses are based on satellite imagery supported with conventional surface and sub-surface data. New analysis methods (i.e. pattern recognition) of satellite data should be employed to locate objectively and track important ocean features. The feasibility of using XBT data with the "Emery" T-S scheme for producing operational current measurements should be investigated.

C. Sub-surface analysis

The analysis will be based on a combination of

a) observations from XBT/STDs, and

b) diagnostic model derived values (derived from physical models using atmospheric input), and

c) inferred sub-surface parameters from satellite imagery.

Needs for regional thermal structure products

A. Navigation

a) to identify ocean current systems (i.e. Gulf Stream, Kuroshio, etc.) and related eddies

B. Fisheries

a) to identify temperature and water mass boundaries

C. Meteorologists

a) coastal weather - fog, winds, etc.

b) cyclogenesis

c) local air-sea interactions

D. Oceanographers

a) to assist research studies in location of features

b) to monitor short-term and long-term ocean conditions for assessment

E. Recreational

a) beach SST, winds

b) pleasure boating

c) sail boat racing

Regional products

A. Sea surface temperature

- accuracy $\pm$ 1.0°C
- gradients $\pm$ 1.0°C/100 km
- wavelength resolution 200 km
- 3-day composite
- 2 times weekly
- data source
  - . fixed and drifting buoy temperature
  - . ship (temperature)
  - . XBT/STD (temperature)
  - . satellite retrievals (temperature)
  - . satellite retrievals (gradient).

B. Feature analysis

- accuracy $\pm$10 km
- gradient detection 7°C/10 km
- feature resolution (50 km eddies)
- wavelength 100 km
- 1 day composite
- 3 times weekly
- data source
  - . satellite imagery
  - . satellite infrared $\xrightarrow{\text{(automation)}}$ pattern recognition (of features)

C. Sub-surface level (200 m)

- accuracy $\pm$ 2.0°C
- gradients $\pm$ 2.0°C/100 km
- wavelength resolution 500 km
- 10-day composite
- weekly produced
- data source
  - . XBT/STD
  - . satellite surface features
  - . diagnostic models

4. Utilization of IGOSS data

Methods and techniques used for the preparation of oceanographic products (Y. Treglos)

A. Meteorology for exploitation purposes

For some fifteen years, many countries have been developing numerical prediction models (dynamic meteorology). Although there is still room for improvement, these models are now operational. The 72-hour forecasting period is a hurdle that is difficult to overcome at present in view of the disparity between numerical forecasts and actual fluctuations. One of the reasons for this disparity is inadequate knowledge of ocean-atmosphere thermal exchange. This influence can be understood more thoroughly through the real-time use of BT data in conjunction with radiosonde observations, thus providing a better gauge of the quantities of heat yielded by the ocean into the atmosphere.

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

RESPONSIBILITIES FOR PREPARATION OF THE MANUAL AND GUIDES ON THE IDPSS (TO BE CONFIRMED BY THE SECRETARIATS

Chapter	1	Rapporteur	Chairman, Joint IOC/WMO Working Committee for IGOSS
	1.2	U.S.S.R.	
	1.3	France	
	1.4	Netherlands (coastal activities)	
		Norway (ocean engineering)	
	1.5	Japan	
	1.6	U.S.A.	
	1.7	Ireland	
	1.8	U.S.S.R.	
	1.9	U.S.S.R.	
	1.10	France	
	1.11	U.S.A.	
	1.12	Canada	
	1.13	Canada	
Chapter	2	Responsible	Secretariats
Chapter	3	Responsible	Secretariats
Chapter	4	Lead country	U.S.A.
Chapter	5	Lead country	U.S.S.R.
Chapter	6	Lead country	Federal Republic of Germany
Chapter	7	Responsible	Secretariats

JOINT IOC/WMO WORKSHOP ON OCEANOGRAPHIC PRODUCTS AND THE IGOSS DATA PROCESSING AND SERVICES SYSTEM (IDPSS)

Moscow, U.S.S.R., 9-11 April 1979

DRAFT GUIDELINES FOR ESTABLISHING AND IMPLEMENTING AN IDPSS PROGRAMME IN A SELECTED OCEAN AREA

These guidelines are offered to provide a framework for Member States, once sufficient interest has been shown in developing an IDPSS project in a selected ocean area. The guidelines have been formulated recognizing that an IDPSS programme in a selected ocean area will depend on environmental monitoring and data transmission and exchange, as well as oceanographic processing, products and services. Thus, for example, the requirements for ocean products will impinge upon the requirements for data acquisition, etc. The following guidelines are a comprehensive list of planning activities which Member States may wish to consider when carrying out such a programme in a selected ocean area. In particular, a Member State may choose to contribute to only a part of these activities.

i) The Joint IOC/WMO working Committee for IGOSS should be consulted for endorsement of a selected ocean area designated by Member States for which an IDPSS programme could be implemented. If the area involves waters under national jurisdiction, the nations concerned must be willing and active participants in such an IDPSS programme;

ii) The critical planning activities for such a programme should include:

- defining the scope and objective of the programme
- compiling background information on the ocean area of interest including user categories and identification of required expertise
- identification of contact points in the region
- examining user categories, the extent of user needs and benefits from an IDPSS project
- identifying the contribution of this programme to the global objectives of IGOSS

- examining observation potential

- examining telecommunication potential

- examining product potential

- preparing a proposal containing the results of the above activities for an IDPSS programme in the selected ocean area.

In the event that the above planning cannot be accomplished by the Member States themselves, appropriate assistance from IOC and WMO should be arranged to conduct a feasibility study including the above detailed planning considerations.

iii) An example of the process which may be followed in the planning and implementation of a programme is given below:

a) Member States and regional bodies should be invited to indicate their willingness to participate and to support these projects based on the proposal (containing feasibility study results) and to participate in a task team to formulate, implement and co-ordinate the IDPSS programme in the selected ocean area;

b) The task team (consisting of representatives of Member States who have expressed interest in the project) should formulate a Project Plan for desired projects including detailed planning for:

. products and services (requirements for capabilities of processing centres);

. observations (requirements for observation platforms);

. telecommunications (requirements for coastal radio stations, satellites, etc.);

c) The draft Project Plan should be distributed by the Secretariats;

d) Member States to review the plan and to declare their intention of participation and support;

e) Task team to prepare the implementation programme and to outline a specific time-table for implementation;

f) A programme operation co-ordinator within the Secretariats should be appointed to follow the project from the planning stages through its implementation and operational stages;

g) If required, the task team should seek resources needed for the implementation of the plan (including UNDP, TEMA, IOC- and WMO-VAP, Trust Fund, etc.);

h) Implementation of project (Secretariats to act as implementation co-ordination centres).