



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

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Agenda Item 4.7.2

A STRATEGY FOR REMOTE SENSING

In response (i) to the evident need of developing countries to make best use of the data from the satellites that overfly their waters day after day, (ii) to the wishes of Member States as expressed in various Resolutions and most recently at the 35th Executive Council following the Revelle Lecture, and (iii) to the calls of the WSSD Implementation Plan for widespread use of remote sensing from space as a tool for sustainable development, the IOC is in the process of developing a coherent strategy on remote sensing.

The strategy outlined here calls (i) for the new professional P5 in charge of developing the IOC Capacity Building Programme to have as a high priority the development of Member States' capacity in remote sensing; (ii) for the IOC to develop a series of regional conferences/workshops to bring together specialists in ocean science and remote sensing to establish regional requirements in terms of data access, product development, and training, and (iii) for the IOC to make widespread use of appropriate training tools in remote sensing, including among others the UNESCO Bilko learning project on remote sensing.

The Assembly is asked to endorse the strategy, the proposed priority for the Capacity Building Programme, and the use of appropriate training materials, including the UNESCO Bilko Project, and to ask the Executive Secretary to present a comprehensive plan to the 37th session of the Executive Council for increasing training in remote sensing, and access to remotely sensed data. Given the financial implications in that endorsement, **the Assembly is asked further** to endorse Draft Resolution XXII-(4.7.2).

Introduction

1 The increasing population of the world, and especially of the world's coastal zones, imposes new challenges on society to manage the finite marine resources of the planet in a sustainable and environmentally responsible manner. For the oceans in particular, the challenge to humankind of observing the oceans, understanding them, and transferring knowledge and information about them into management processes is very demanding. Many of the countries of the world do not yet have the resources to enable them to routinely and systematically collect from their coastal seas and Exclusive Economic Zones the observations at high resolution that are required on the one hand for fully effective ocean management in the pursuit of sustainable development, and on the other hand for the improvement of weather and climate forecasting.

2 In this context, the ability of satellites to provide climatic and synoptic coastal and oceanic information at high resolution can be of critical importance, but its use has not yet been developed to its full potential by many developing countries. Only a fraction of remotely sensed ocean data has been put to actual use.

3 The importance of remote sensing for human development has been stressed many times, most recently through high-level international documents including the 1999 Vienna Declaration of UNISPACE-III (see Table 1) and the 2002 WSSD Implementation Plan (paragraphs 3c, 38g, 110b, 132 a, and b, and 133 a, b, and c). Earlier in 1998, the IOC organized in cooperation with the space agencies of the world the International Conference on "Satellite, Oceanography and Society" (Lisbon).

IOC's Commitment

4 The IOC has a potentially very important role to play in encouraging and facilitating the building of capacity in developing countries so that they also can capitalize on the untapped wealth of ocean data that remote sensing from satellites can supply. Chief requirements are ease of access to these data at high resolution and in real time, personnel trained to use them for practical purposes, and a ready supply at no or low cost of developed products from exterior centres of excellence. Member States have long made their requirements known, for example in Africa through the PACSICOM Declaration of July 1998 (see Table 1), which identified the following need common to all developing countries:

"To encourage the formation of a network of specialists trained in the use of remotely-sensed data from space satellites, and to ensure the increased access to regional satellite receiving stations in Africa, so as to ensure that coastal managers have ready access to the rapidly increasing wealth of spatial data on the coastal environment."

5 In the African context remote sensing is one of the key components of the proposal developed with the help of the IOC as part of the African Process, for a "Regional Ocean Observing and Forecasting System for Africa" (ROOFS-AFRICA), which is a component of GOOS-AFRICA and was developed by 22 sub-Saharan countries. In addition, remote sensing is the main component of the successful UNESCO Cross Cutting project on "Application of Remote Sensing for Integrated Management of Ecosystems and Water resources in Africa", which is about to be renewed for a second biennium, and which involves the development and application of strategies for improving access to and training in the use of remote sensing for 9 sub-Saharan African countries.

6 The needs of Member States for improved access to and training in the use of satellite data have been most recently re-emphasized in responses to the Revelle Lecture of the 35th IOC

Executive Council in June 2002. As noted in Table 1, item 17, the Executive Council agreed (para.24) “...that there was a need for IOC to facilitate access by developing countries to remotely sensed data, and to facilitate training in the use of such data for the development of products useful for decision and policy makers”. The Council further agreed (para. 27) “...that the IOC should encourage more widespread use of remotely sensed data for alerts and warnings of severe events, like hurricanes, storm surges, floods and droughts.”

7 As is evident from Table 1, the IOC has long recognised that it has responsibilities in the area of remote sensing. Since the early 1990s IOC has been working increasingly closely with the satellite operating community, for example through the Committee on Earth Observation Satellites (CEOS), the Partnership for an Integrated Global Observing System (IGOS), and more recently the Coordinating Group for Meteorological Satellites (which also handles operational oceanographic satellites), to develop approaches to capacity building that would meet the needs of Member States. Several training courses have taken place in a number of regions since November 1997, as listed in Table 1. The IOC is now part of the CEOS Working Group on Education and Training, which is developing a strategy for education and training for all CEOS Members and Affiliates (including IOC).

8 Despite these various efforts, the IOC’s actual achievements in providing access, providing training, and providing products fall far short of the growing expectations. The shortfall is a direct consequence of the following facts: (i) the IOC’s Secretariat is very small and its staff is already over-committed to ongoing programmes; and (ii) there are insufficient financial resources available to start up new work. Either the governing bodies must change the priorities, or they must find additional human and financial resources to meet the stated need. One option is to make capacity building in remote sensing a high priority for the about to be appointed P5 Professional post for capacity building.

A Proposed Strategy

9 To meet the demands of the 35th Executive Council, IOC should rapidly develop a comprehensive and coordinated IOC programme in training in remote sensing for developing countries. Key tasks for building capacity in remote sensing are as follows:

- (i) As a start, hold focused regional workshops or conferences in Africa, the Caribbean, Latin America, South East Asia, and the Pacific Islands (one per region), to bring together representatives of the marine science community, remote sensing specialists, creators of information products based on remotely sensed data (merged with *in situ* data), and users of such products. The object of such meetings should be (i) to demonstrate what is available actually or potentially, (ii) to show how such information is currently being used in the region, (iii) to explore what the regional requirements are in terms of technical specifications for remotely sensed data, (iv) to explore what the requirements are for *in situ* measurements necessary for calibrating and validating remotely sensed measurements; and (v) to determine the requirements for training and other forms of capacity building so as to enable the region to make best use of remote sensing technology.
- (ii) Develop and apply a programme for capacity building in remote sensing for coastal States, focusing in particular on Africa, the Caribbean, Latin America, South East Asia, and the Pacific Islands. The programme should aim (i) to improve access to remotely sensed data and products, and (ii) to train specialists in the use of remotely sensed data in the production of scientifically validated products needed by policy makers and environmental managers, and in the execution of research. The programme should be devised in full cooperation with IOC programme managers,

IOC regional offices, IOC regional bodies, and Member States. It should capitalise on links to relevant IOC and non-IOC capacity building programmes (e.g. those of the WMO and ICSU), developing joint programmes or approaches where possible or appropriate. The programme should include a system for measuring programme performance as the basis for improvements and to ensure that activities are followed up to ensure lasting success.

- (iii) Develop standard methodologies for using remotely sensed data in coastal zoning and classification, fisheries management, pollution control, sea-level and storm prediction services, and other topics as appropriate, defined by the regional communities themselves, as the basis for improving services based on remotely sensed data.
- (iv) Develop proposals to obtain resources necessary to carry out local and regional remote sensing capacity building activities, making full use of joint projects involving donors, regional partners, North-South and South-South linkages.

Capitalising on Existing Training Programmes

10 As noted in table 1, the IOC is currently involved in several training programmes in remote sensing that can be capitalised upon. These include for instance (i) the ocean colour training programme of the International Ocean Colour Coordinating Group (IOCCG) (co-sponsored with SCOR), the regional remote sensing training programmes held under the aegis of various GOOS Regional Alliances (e.g. in recent years in Noumea and in Mauritius), and remote sensing elements within specific ICAM training programmes. Several software packages are available and will need to be evaluated for their cost-effectiveness.

11 A useful starting point will be to capitalise on the UNESCO-developed and recently upgraded Bilko Project to provide the appropriate learning tools and skills. The Bilko Project is described in IOC/INF-1184. The project has a good track record, can tailor-make learning programmes for specific geographic areas, operates at low cost, and can attract extra-budgetary funds for implementation. The project was recommended as a suitable vehicle for this kind of training by the GOOS Capacity Building Panel and the JCOMM Expert Group on Education and Training at their meetings in Geneva in June 2002, and by the African experts participating in the GOOS-AFRICA workshop in Nairobi in November 2001. Tools developed by Bilko are used by UNESCO-CSI (Coastal Regions and Small Islands Project) and by the IOCCG. There are plans for it to be used for courses in ICAM and GOOS-AFRICA. The IOC is considering joining CSI in financing the co-publication Bilko Module No.8 on “Remote Sensing Sensing Applications for Fisheries Science”.

12 The advantages in adopting the Bilko Project are that it is already set up, with pre-developed training materials and methodologies and trainers, and can move quickly to meet Member States' needs; the project does not have to be started from scratch and certainly is open to further development and improvement. All that is required is the involvement of each Member State in the design of the course for its area, so that local materials are used to supplement the training materials (and to ensure that the project has the right focus in each area).

Table 1: A history (non-exhaustive) of IOC involvement in the encouragement of the use of remote sensing from space in support of oceanography in developing countries.

- 1) 1991: The IOC joins the Committee on Earth Observation Satellites (CEOS) as an Associate Member.
- 2) June 1995: IOC Assembly (Resolution XVIII-14) decided to co-sponsor through TEMA the UNESCO computer-based module project for learning in remote sensing that had been developed by the then UNESCO Marine Sciences Training and Education Programme (TREDMAR), and which went under the name of Bilko. The Bilko training programme had begun with its first module in July 1989.
- 3) June 1996: IOC assists in co-sponsoring and establishing with SCOR the International Ocean Colour Coordinating Group (IOCCG), which has sponsored and co-ordinated eight specialised ocean-colour training courses, providing comprehensive training to over 220 students from approximately 55 different countries, and which provides a Fellowship Programme offering the opportunity for young scientists from developing countries to conduct hands-on research, or to receive in-depth training, at a foreign institute.
- 4) November 1997: The first IOCCG training course is held.
- 5) January 1998: The GOOS Initial Observing System is created with satellites as an integral part of it.
- 6) July 1998: The Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM) identifies access to and training in the use of remote sensing as a priority for GOOS-AFRICA.
- 7) EXPO 1998: the IOC organizes and co-sponsors the “Satellites, Oceanography and Society” meeting in Lisbon (proceedings published in 2000 in Elsevier *Oceanography Series*, 63, edited by Dave Halpern).
- 8) November 1998: IOC Executive Council (Resolution EC-XXXI.8) recommended that the IOC becomes a Member of the Partnership for an Integrated Global Observing Strategy (IGOS), along with other UN agencies, ICSU and the space agencies (through the Committee on Earth Observation Satellites - CEOS), and others.
- 9) 29 June – 9 July 1999: IOC Assembly (Resolution XX-7) encouraged the coordination of major space agencies for the development and operation of permanent space-based ocean observing systems.
- 10) 19-30 July 1999: The IOC participated as an IGOS Partner in the 3rd United Nations Conference on the Exploration and Peaceful uses of Outer Space (UNISPACE-III), in Vienna. The Vienna Declaration adopted on July 30th promotes among other things the development and implementation of the IGOS, the creation of long-term global observation data sets, improved management of natural resources by coordination of remote sensing systems, implementation of an integrated global system for managing natural disaster mitigation, improved weather and climate forecasting by using satellite data.
- 11) October 1999: The OceanObs99 meeting in St. Raphael, co-sponsored by IOC, identified specific space-based requirements for ocean observations in support of climate.
- 12) June 2000: 33rd IOC Executive Council noted and endorsed the production by the IGOS Partners of an Ocean Theme document that set out the plans and proposals for ocean observing from space for the next few years. Subsequently the IOC’s lead role in GOOS has involved its staff in working with the IGOS Partners on the development of (i) the

- oceans component of the Integrated Global Carbon Theme (now being finalised), and (ii) the Coastal Theme (development began in 2003).
- 13) December 2000: GODAE Strategic Plan published, with key space agencies as sponsors and implementing agencies.
 - 14) January 2001: IOC (with partners in the Education and the Science Sectors) won significant extra resources in support of remote sensing training and applications, through the UNESCO Cross-cutting Project on “Application of Remote Sensing for Integrated Management of Ecosystems and Water resources in Africa” (initiated in 2001, and to be continued through 2003-4). This led to 9 countries developing comprehensive plans for taking forward the development of remote sensing tools in support of sustainable development (Paris, November 2002). It also led to close linkages with regional specialised groups such as the African Association for Remote Sensing.
 - 15) 2001: Satellite applications workshop organised by Curtin University for PacificGOOS, Noumea.
 - 16) October 2001: IOC becomes a Member of the Coordinating Group for Meteorological Satellites (CGMS). The CGMS is working with WMO on the development of a Virtual Laboratory for Training in Satellite Meteorology.
 - 17) 5 June 2002: The Roger Revelle Memorial Lecture at the 35th session of the Executive Council, provided a further opportunity to consider the growing importance of remote sensing for IOC Member States. Delivered by Dr. Greg Withee (of NOAA), it was entitled “The Increasing Role of Remote Sensing in Ocean Science and in Operational Oceanography”. The Executive Council agreed (para. 24) “...that there was a need for IOC to facilitate access by developing countries to remotely sensed data, and to facilitate training in the use of such data for the development of products useful for decision and policy makers”. The Council further agreed (para. 27) “...that the IOC should encourage more widespread use of remotely sensed data for alerts and warnings of severe events, like hurricanes, storm surges, floods and droughts.”
 - 18) 24-26 June 2002: The First GOOS Capacity Building Panel (GOOS Report 123) recommends that Remote Sensing be a key element of the Action Plan for GOOS capacity building.
 - 19) 26 August – 4 September 2002: The importance of remote sensing for sustainable development was stressed in paragraphs 3c, 38g, 110b, 132a and b, and 133a, b, and c of the WSSD Implementation Plan.
 - 20) Summer 2002: IOC and 22 African partners presented a proposal for a Regional Operational Observing System for Africa (ROOFS-AFRICA) as part of the African Process. The proposal, which involves among other things the acquisition and use of space-based remote sensing data, is now one of a suite of projects under consideration by African States through NEPAD.
 - 21) 1-9 November 2002: Satellite applications workshop organised by Curtin University for Indian Ocean GOOS, Mauritius.