**Intergovernmental Oceanographic Commission**
*Training Course Reports*
**16**

# First IOC Training Course on the Applications of Satellite Remote Sensing to Marine Studies

University Simón Bolivar
Caracas, Venezuela, 24-28 September 1990

UNESCO

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## 1. INTRODUCTION

The First IOC Training Course on the Applications of Satellite Remote Sensing to Marine Studies took place at the University Simon Bolivar, 15 km from Caracas. It was attended by 24 trainees from eight Caribbean countries and seven lecturers.

The content and progress of the course were placed under Dr. Tom Allan's responsibility on behalf of IOC. The general organization was provided by the IOC and IOCARIBE Secretariats through Mr. Yves Tréglos and Dr. Fernando Robles, respectively. As for local arrangements, they were organized by INTECMAR, University Simón Bolivar, through MSc Ricardo Molinet.

The Chairman of IOCARIBE, Prof. Hernán Perez Nieto, and the Head of the Department of the Environment's Image Processing Laboratory, Venezuela, sat in on much of the course.

The List of Participants is included as Annex II to this Report.

## 2. COURSE PROGRAMME

The five-day programme was modified on the last day to accommodate presentations from participants who had been encouraged to come prepared to make brief presentations of their own work; therefore, during the final morning, reports were heard from Colombia, Cuba, Mexico, Trinidad and Venezuela. The complete programme of the Course is given in Annex I.

## 3. TRAINEES AND LECTURERS

The trainees were enthusiastic and very willing to learn.

The teachers were acknowledged experts in their own fields and had been carefully selected to provide comprehensive coverage of all major aspects of remote sensing of the marine environment.

The interaction between teachers and students worked well. Not only were the students introduced to a number of new techniques but in several cases, they were able to take away copies of the software on floppy disks.

It was a distinct advantage having a "regional" teacher in the team. Mr. Frank Müller-Karger reported his satellite investigations on the fate of the effluents discharged from the Orinoco which were of direct interest to many of the countries represented.

Likewise all teachers had taken pains to direct their presentations towards Caribbean applications. For example, special analyses of the annual and semi-annual wind and wave fields, derived from GEOSAT over the Caribbean area had been commissioned.

## 4. COURSE EVALUATION

The standard of the lectures was high - a fact readily recognized by the participants.

The course succeeded on several levels:

It was extremely well-organized. Logistics - from setting up 3 computers (2 IBM PC's + 1 Apple Mac) for demonstrations, to arrangements for photocopying, transport, lunch and receptions - ran smoothly. The setting of the University campus was particularly pleasant. A programme of lectures to avoid duplication and ensure adequate coverage had been agreed with each lecturer in advance.

The computer-based UNESCO teaching manual "Some Marine Applications of Satellite and Airborne Remote Sensing" (presented on 5 floppy disks) proved very popular and a copy was requested by every trainee.

The two videos shown - one (in Spanish) on ESA's ERS-1 and the other on GEOSAT were well received. There was considerable interest in the forthcoming ERS-1 programme and general feeling that Caribbean countries may be missing out.

One of the major goals of these courses must be to create opportunities for people engaged in regional environmental research and management to participate in co-operative programmes with laboratories already advanced in remote sensing techniques. At this course, several useful contacts were made and collaborative projects discussed - in particular, future use of ocean colour and temperature measurements in the Caribbean, and the participation of Caribbean countries in future satellite calibration/validation programmes.

The opportunity was also taken to examine ways in which the participants thought a greater degree of co-ordination could be achieved in the area of the Caribbean and these were discussed in open forum during the final day. General Conclusions and Recommendations agreed are listed in section 7 and 8 respectively.

In summary, all participants were anxious to become more closely involved in on-going remote sensing programmes. Suggestions included the installation of a dedicated Caribbean satellite receiving station (limited initially to NOAA AVHRR reception); and establishing a regional network of marine information centres to archive high level satellite products.

The course would not have been the success it undoubtedly was, without a well-co-ordinated effort within the IOC and IOCARIBE Secretariats, and within the lecture team - and between these two activities. In retrospect, it seems almost to have been an advantage to be constrained to operate in a short time-frame, since the decision of holding the course was taken on 27 April 1990 only, which left less than 5 months to organize it altogether. There was little time for prevarication - especially when compromises had to be found to overcome a few initial misunderstandings. Starting only at the beginning of May the lists of potential trainees and teachers were quickly over-subscribed and by mid-July a line had to be drawn.

Towards the end of the course, a questionnaire was circulated (Annex III) designed to gauge the reaction of the students to the course and to try to benefit from any suggestions they could make for future improvements. Their responses are analyzed in Annex IV. In summary, they demonstrate that the participants were pleased with the content of the course - but more than half thought the duration should be extended from one to two weeks.

## 5. GENERAL CONCLUSIONS

Courses like this, that combine specialists from countries well-developed in remote sensing technology with people involved in regional environmental investigations, are essential if these regional scientists, managers and teachers are to benefit fully from the newly emergent satellite-derived information which will continue to increase throughout the coming decade.

Where possible, courses should be planned to last for two weeks rather than one, and involve an introduction to some of the basic theory as well as specialized presentations directed to the region, plus presentations of the participants on investigations. Where appropriate - and time permitting - the courses should address specific areas of application such as fisheries, pollution control and aquaculture, with which they are associated.

The Course participants concluded that involvement of Caribbean countries in satellite programmes would be greatly enhanced if:

(i) a dedicated Caribbean satellite receiving station were installed;

(ii) a network of Caribbean regional satellite data archives were created.

Satellite calibration and validation programmes could create opportunities for a greater participation by regional centres in on-going satellite programmes.

Steps should be taken to initiate more joint programmes between the different Caribbean research institutes. By forming a Caribbean grouping - possibly recognized at a political level - it may be easier to negotiate access to satellite-derived marine information.

## 6. RECOMMENDATIONS

A feasibility study should be carried out to assess the costs and benefits of installing an AVHRR station in the Caribbean. If this were to be a joint study involving the participation of several countries, the IOCARIBE Secretariat could play an important co-ordinating role.

Individual research centres with the necessary facilities should be encouraged to investigate how they might participate more actively in satellite validation programmes. Already a number of research organizations in Europe and the USA are involved in these programmes, and contact with them should be encouraged.

IOCARIBE should initiate a feasibility study on the creation of a network of satellite data archives using facilities that already exist or that could be enhanced at modest cost.

As a first step IOCARIBE should commission a global inventory of remote sensing data archive and distribution centres relevant to Caribbean marine activities.

The momentum and interest created by this first course should not be allowed to wither. The possibilities for holding further courses in other developing regions of the world should be studied without delay.

Within the South American continent, investigations should be made in countries bordering the Eastern Pacific (Chile, Peru) to ascertain their potential interest in the application of current satellite remote sensing technology and the extent of their support for a course directed to the particular marine activities of that region.

## ANNEX I

## COURSE PROGRAMME AND TIMETABLE

**Monday 24 September**

| | |
|---|---|
| 08.30 | Introductory words by:<br>Dr. Freddy Malpica, Dean of U.S.B.<br>Dr. Fernando Robles, IOC Senior Assistant Secretary for IOCARIBE<br>Dr. Hernán Perez Nieto, Chairman IOCARIBE |
| 09.45 - 10.30 | Overview of marine remote sensing (Tom Allan) |
| 10.30 - 11.00 | COFFEE BREAK |
| 11.00 - 11.55 | Evolution or remote sensing Systems (William Emery) |
| 12.00 - 12.55 | Fundamentals of RS - Visible/IR (Vittorio Barale) |
| 13.00 - 14.30 | LUNCH |
| 14.30 - 15.30 | Analysis techniques - Visible IR data (Frank Müller Karger) |
| 15.30 - 16.00 | Discussion |

**Tuesday 25 September**

| | |
|---|---|
| 09.30 - 10.30 | Applications of ocean colour (phytoplankton, patchiness) (V. Barale) |
| 10.30 - 11.00 | COFFEE BREAK |
| 11.00 - 11.55 | Applications of ocean colour (global CZCS & N Atlantic) (F. Müller Karger) |
| 12.00 - 12.55 | Applications of sea surface temperature (W. Emery) |
| 13.00 - 14.30 | LUNCH |
| 145.30 - 15.30 | Ocean colour data - Demonstration (F. Müller Karger) |
| 15.30 - 16.30 | SST data - Demonstration (W. Emery) |

**Wednesday 26 September**

| | |
|---|---|
| 09.30 - 10.00 | Introduction to microwave RS (T. Allan) |
| 10.00 - 10.30 | Synthetic aperture radar & theory of scatterometry (William Alpers) |
| 10.30 - 11.00 | COFFEE BREAK |
| 11.00 - 11.55 | Surface features imaged by SAR (W. Alpers) |
| 12.00 - 12.55 | Overview of microwave sensors - past and future programmes (Trevor Guymer) |
| 13.00 - 14.30 | LUNCH |
| 14.30 - 15.30 | Applications of SAR & airborne measurements (W. Alpers) |

| | |
|---|---|
| 15.30 - 16.00 | Video of ERS-1 + demonstrations |

**Thursday 27 September**

| | |
|---|---|
| 09.30 - 10.30 | The radar altimeter and the measurement of surface topography (Robert Cheyney) |
| 10.30 - 11.00 | COFFEE BREAK |
| 11.00 - 11.55 | Measurements of waves and wind (T. Guymer) |
| 12.00 - 12.55 | Ocean circulation (R. Cheyney) |
| 13.00 - 14.30 | LUNCH |
| 14.30 - 15.30 | Regional studies: (R. Cheyney)<br>- El Niño<br>- Caribbean<br>- Gulf Stream |
| 15.30 - 16.00 | Demonstrations |

**Friday 28 September**

| | |
|---|---|
| 09.30 - 10.30 | Regional programmes |
| | Presentations from: Colombia, Cuba, Mexico, Trinidad & Tobago, Venezuela |
| 10.30 - 11.00 | COFFEE BREAK |
| 11.00 - 11.30 | Orbits sampling, synergy & models (T. Allan) |
| 11.30 - 12.00 | Future programmes (T. Guymer, V. Barale, R. Cheney) |
| 12.00 - 12.30 | Caribbean requirements for: Marine information, Data reception and Regional centres |
| 12.30 - 13.00 | Recommendations |

## ANNEX II

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## ANNEX III

## QUESTIONNAIRE FOR COURSE EVALUATION BY TRAINEES

This is the first IOC Course on Remote Sensing. Your comments will help us determine how useful it was to you and how it might be improved in future. You may remain anonymous if you wish. Thanks for your help.

Please tick one box:

1. I found the course:
   a) very useful
   b) satisfactory
   c) of limited usefulness

2. I was satisfied with the overall balance

   or

   I would have preferred more emphasis on:
   a) VIS/IR
   b) microwave

3. I found the demonstrations:
   a) very useful
   b) satisfactory
   c) of limited usefulness

If (c), demonstrations could be improved by:

_____
_____
_____
_____
_____
_____
_____

4. I found the technical level of lectures:
   a) just about right
   b) too high
   c) too low

5. The duration of the course was:
   a) just about right
   b) too short
   c) too long

If (b) or (c) what should the duration be:

_____
_____
_____
_____

6. What sort of additional aids would you prefer (tick more than one if you wish):
   a) list of references
   b) copies of all lecture notes
   c) a selection of copies of visual aids
   d) a course "textbook" distributed beforehand
   e) a collection of short abstracts of each talk

7. My main field of interest is in the area of:

a) coastal studies
b) coastal management
c) marine biology
d) physical oceanography
e) education
f) other
please specify _____

8. How could this interest be enhanced through regional/sub- regional co-operation (please comment):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

## ANNEX IV

## ANALYSIS OF ANSWERS TO THE QUESTIONNAIRE

1. All trainees expressed satisfaction with the course; a majority found it "very useful".

2. 70% thought the balance of the contents right; 24% would have liked more on visible/IR and 6% more in microwaves.

3. 82% found the computer demonstrations useful. Suggestions for improvements included:

   * Specially prepared manuals to accompany some of the demos.

   * More basic information on how to generate the images used in the majority of demos.

   * More examples directed to specific applications.

4. 94% found the level of lectures OK, 6% too high.

5. 55% thought the duration of the course should be two weeks rather than one. None thought it too long.

6. This question was probably incorrectly framed; it should have asked for a preferred priority. Instead, not surprisingly, the students between them opted for every sort of additional aid.

7. The majority of students listed more than one field of interest. They broke down as follows:

| | |
|---|---|
| Coastal studies | 31% |
| Coastal management | 21% |
| Marine biology | 18% |
| Physical Oceanography | 18% |
| Education | 5% |
| Image processing | 5% |
| Fisheries | 2% |
| | 100% |

8. The many and varied answers to this question was discussed in open forum following presentations from five of the countries represented. Most of these are incorporated in the Conclusions and Recommendations.

# ANNEX V

## LIST OF "NATIONAL REPRESENTATIVES" TO WHOM COPIES OF DEMONSTRATION SOFTWARE AND VIDEOS WERE SENT

*For full address of the contact points, see Annex II (List of Participants).*

| | |
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| PARRA LLANOS, Carlos | Colombia |
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# ANNEX VI

## LIST OF ACRONYMS

| | |
|---|---|
| AO | Announcement of Opportunity |
| AVHRR | Advanced Very High Resolution Radiometer |
| CZCS | Coastal Zone Colour Scanner |
| GSFC | Goddard Space Flight Centre (USA) |
| ERS-1 | Earth Remote Sensing Satellite |
| ESA | European Space Agency |
| IOCARIBE | IOC Sub-Commission for the Caribbean and Adjacent Regions |
| IR | Infra-red |
| NOAA | National Oceanographic and Atmospheric Administration (NOAA) |
| PI | Principal Investigator |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |