IOC Training Course for the Global Sea Level Observing System (GLOSS) directed to the African and South American Portuguese and Spanish-Speaking Countries

Instituto Oceanográfico da Universidade de São Paulo
São Paulo, Brazil, 1-19 February 1993
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<td>IOC Indian Ocean Region Training Course in Petroleum Monitoring</td>
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<td></td>
<td>Perth, 18 February-1 March 1980</td>
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<td>2.</td>
<td>IOC Regional Training Course for Marine Science, Technicians</td>
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<td>3.</td>
<td>ROPME-IOC-UNEP Training Workshop on Oceanographic Sampling Analysis, Data handling and Care of Equipment, Doha, Qatar, 3-15 December 1983</td>
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<td>Stage COI d'initiation à la gestion et au traitement de l'information scientifique et technique pour l'océanologie, Brest, France, 28 novembre - 9 décembre 1983</td>
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<td>Curso mixto COI-OMM de formación sobre el Sistema Global Integrado de Servicios Oceánicos (SGISO), Buenos Aires, Argentina, 15-26 de octubre de 1984</td>
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<td>UNESCO-IOC-NBO Training Course on Tidal Observations and Data Processing Tianjin, China, 27 August - 22 September 1984</td>
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<td>Stage COI sur la connaissance et la gestion de la zone côtière et du proche plateau continental Talence, France, 18 septembre - 4 octobre 1984</td>
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<td>IOC-UNESCO Summer School on Oceanographic Data, Collection and Management Erdemli, Izel, Turkey, 21 September - 3 October 1987</td>
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IOC Training Course for the Global Sea Level Observing System (GLOSS) directed to the African and South American Portuguese and Spanish-Speaking Countries

Instituto Oceanográfico da Universidade de São Paulo
São Paulo, Brazil, 1-19 February 1993
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1. **INTRODUCTION**

The Global Sea Level Observing System (GLOSS) course was held at the Instituto Oceanográfico da Universidade de São Paulo from 1 to 19 February 1993.

The course was welcomed by the Intergovernmental Oceanographic Commission (IOC) at the Sixteenth Session of the IOC Assembly, Paris, France in 1991, but it had to wait until 1993 to become a reality, due to the lack of funds, which involved IOC, during the period. The Diretoria de Hidrografia e Navegação (DHN) of the Brazilian Navy, the GLOSS co-ordinators in Brazil, were firmly involved with the idea of the course and supported strongly all the actions necessary for it to be given at the Instituto Oceanográfico da Universidade de São Paulo (IOUSP).

The original idea was that the course should have to follow the steps of courses given at the Proudman Oceanographic Laboratory (POL), Bidston, UK, but it evolved to its present form, by considering the variety of cultural aspects and histories of the potential participants. The course was then directed to the Portuguese and Spanish speaking countries of South America and Africa and to only a few participants, the funds of IOC allowed for, and only to persons actively engaged with the GLOSS programme in their countries.

The countries of Argentina, Chile and Uruguay from South America and Angola, Moçambique and São Tomé and Príncipe from Africa were invited by IOC and sent participants to the course. The Brazilian Institutions Instituto Brasileiro de Geografia e Estatística (IBGE) and Universidade do Rio Grande (FURG), also involved with GLOSS, were invited by DHN and sent their representatives.

2. **COURSE PROGRAMME**

The course programme (Annex I) was prepared, with the valuable collaboration of Bidston scientists and the IOC personnel, in the years of 1991 and 1992, as well as, the assistance of the GLOSS people of the Diretoria de Hidrografia e Navegação, by Prof. Titular A.R. de Mesquita from the Instituto Oceanográfico da Universidade de São Paulo. The establishment of the contents of the course and the level of its lectures were largely based on the academic experience and the level of responsibility of the participants at their national institutions.

The programme was organized with the aim of establishing a common knowledge regarding the sea level collection, interpretation and uses, among the participants, by means of theoretical lectures, given by experienced scientists, and by working the basic ideas with the aid of microcomputers, through practical exercises with sea level data.

The practical exercises with microcomputers emphasized the use of the FORTRAN computer language. The participants were encouraged to develop their routines, adequate to their needs, to solve their problems with the work on tides and sea level.

The visit to the Base Norte Research Station of Ubatuba was planned to show, in front of an equipment in operation, the necessary cares and attentions with the choice of the site for the gauge installation, with the maintenance, with the operation of tide gauge for long term continuous observation, including tests of operation, leveling and the establishment of bench marks.

The seminars were planned to know and discuss the problems about sea level measurements of each participant. To allow the presentation of their national network of tide gauges, the tide gauges in use, the needs for development, as well as to give the participants an opportunity to change experiences in measuring the sea level.
2.1 OPENING CEREMONY

Monday morning - 1 February 1993 - 9h to 12h

The participants were welcomed in an "Overture ceremony" by the Director of the Instituto Oceanográfico da Universidade de São Paulo, Prof. Titular Luiz Roberto Tommasi, by Dr. David Pugh, Chairman of the IOC Group of Experts on the Global Sea Level Observing System (GLOSS), by Mrs. Maria Helena Severo de Souza, representing the Diretoria de Hidrografia e Navegação, the Brazilian GLOSS representatives and by Prof. Titular Afranio Rubens de Mesquita, Co-ordinator of the GLOSS course at the Instituto Oceanográfico da Universidade de São Paulo.

Professor Tommasi also made a brief description of the Institute’s activities and distributed to the participants copies of the booklet (written in portuguese language) with the “Plano Diretor das Pesquisas do Instituto Oceanográfico da Universidade de São Paulo”, said that the Institute is very much honored to host the Course for GLOSS and wished to all participants the best of success in their activities.

Dr. Pugh welcomed the participants to the Workshop on behalf of the Secretary and Chairman of the IOC. He said that GLOSS, which had formally started in 1985, was concerned with measurements, with scientific analysis and with the application of sea level data, but first it was necessary to have good data. This Workshop, following another similar one in Tokyo in November 1991, would include discussions about the measurement programmes in the countries of the participants. It was very important to hold this Workshop for Portuguese and Spanish speaking countries in South America. Those countries represented at the Workshop had the responsibility for more than 10% of the gauges included in the primary GLOSS network. In particular he thanked the Diretoria de Hidrografia e Navegação da Marinha do Brasil and the Instituto Oceanográfico da Universidade de São Paulo for their encouragement and for hosting the meeting.

Mrs. Severo de Souza welcomed the participants as the Brazilian Navy’s Diretoria de Hidrografia e Navegação GLOSS representative. She expressed her satisfaction for the outcome of a process, which started in 1991, at various meetings of the IOC, where the course for Portuguese and Spanish GLOSS specialists were recognized as necessary and approved by IOC and that, due the shortage of funds, it was postponed. She reminded the name of Admiral Luis Felipe da Costa Fernandes, former Director of DHN, who encouraged all the actions with IOC, necessary for the course to be held at the University of São Paulo and wished all participants a rewarding course activity.

Prof. de Mesquita welcomed the participants and summarized the activities of the starting course, pointing out that the lectures were planned after a careful examination of the curricula vitae of the participants to insure a greater profitability of the subjects to be treated. He said this was possible thanks to the prompt reaction, to IOC invitations, of the governmental authorities of the countries of Angola, Argentina, Chile, Mozambique, São Tomé and Príncipe and Uruguay, who timely nominated their representation to the course. He also thanked the authorities of the Brazilian Institutions: Diretoria de Hidrografia e Navegação, Instituto Brasileiro de Geografia e Estatística and from Departamento de Fisica da Universidade do Rio Grande, for indicating their participants. He expressed his wishes that the course will start, among the participants, the kind of relationship, which make things to progress, through the establishment of organizational links, between the participants and between their National Institutions, links that will elect the activities of GLOSS as extremely important and that will remain active in the years to come. He informed that the Instituto de Estudos Avançados of the University of São Paulo (IEAUSP), along this line of thought, has put the Course for GLOSS among its events of the year, which is an auspicious fact, which will register the Course for GLOSS in the history of the University of São Paulo.

2.1.1 Inaugural Lecture - Sea Level: Change and Challenge. Dr. David Pugh

In the sequence of the programme the Inaugural Lecture of the course was given by
Dr. David Pugh with title "Mean Sea Level: Change and Challenge". He stressed the importance of the international initiatives towards the monitoring of the ocean such as the Global Ocean Observing System (GOOS) and the Global Sea Level Observing System (GLOSS), and recalled that the countries participating in the course are responsible, within the GLOSS for about 10% of the measurements from all sea level data of the GLOSS network. He mentioned the aspects related to the consequences of the predicted sea level increase as due to the "Greenhouse Effect" and the perspectives, which are open to the sea level observation related to new technologies, such as the Global Positioning System (GPS) and the Satellite Altimetry.

2.1.2 Visit to the Department of Physical Oceanography

Following the programme the participants were invited to visit the laboratories of the Department of Physical Oceanography. They were guided by the Head of the Department Prof. Titular Rolf Roland Weber.

After the visit there was a lunch at the Faculty Club with all participants of the course.

Monday afternoon - 1 February 1993 - 14h to 17h30

Free afternoon.

2.2 LECTURES

2.2.1 Oceanic Waves: Fundamentals. Prof. Titular Afranio R. de Mesquita

Tuesday morning - 2 February 1993 - 9h to 12h

The lecture dealt with the fundamentals of oceanic waves. It started with a broad view of wave oceanic phenomena going from capillary waves to the planetary waves, ending with the tidal wave, the longest wave of all. The period, amplitude, the wave length and the phase. Fundamentals of complex numbers. The formula of Euler and its representation in complex numbers. The complex amplitude of an harmonic function. The analytic forms of the progressive and the stationary waves. The characteristics of the capillary waves, the gravity waves, tsunamis, the inertial waves, and the internal waves were examined, stopping for a closer analysis, on results of the tidal wave numerical models, for the entire world of Hendershot, Zahel, Schwiderski and, from satellite altimetry measurements, on the charts of Cartwright and Ray, all of which will require good GLOSS data to be improved.

Tuesday afternoon - 2 February 1993 - 14h to 17h30

Practical: Introduction to microcomputers. A questionnaire was passed, to be filled by the participants, to access their knowledge of microcomputers. Knowledge of XT 8086, AT 80286, AT 80386 and AT 80486, IBM PC microcomputers and their uses in the course.

2.2.2 The Tidal Phenomenon: Basic Notions. Dr. A.S. Franco

Wednesday morning - 3 February 1993 - 9h to 12h


Wednesday afternoon - 3 February 1993 - 14h to 17h30
2.2.3 The Tide Generating Potential. Dr. D. Pugh

Thursday morning - 4 February 1993 - 9h to 12h

The lecture dealt with the gravitational potential, the tide generating potential. The development of the tide generating potential in series of polynomials of Legendre. The equilibrium tide. Analysis and prediction of tides based in the development of the tide generating potential. Uses of the tide generating potential in the Response Method. Spectrum of the equilibrium tide. Ratio of predicted amplitudes of tide and the observed tide. Phase lags of predicted and observed tides.

Thursday afternoon - 4 February 1993 - 14h to 17h30

Practical: Seminars of the participants - see section 3.

2.2.4 The Principal Tidal Levels. Dr. D. Pugh

Friday morning - 5 February 1993 - 9h to 12h


Friday afternoon - 5 February 1993 - 14h to 17h30

Practical: Seminars of the participants - see section 3.

2.2.5 Field Trip to the Base Norte Research Station I

Monday morning - 8 February 1993 - 9h to 13h

During the morning a bus trip took all participants to the research station, Base Norte, of the Instituto Oceanográfico da Universidade de São Paulo and it lasted from 9 to 13h. The course activities started at 15h with a guided visit to the tide gauge installations and to the site of the meteorological station of Base Norte.

Monday afternoon - 8 February 1993 - 15h to 19h

At 16h started a discussion group on the IOC publication - Manual de Medicação e Interpretação do Nível do Mar, guided by the MSc. Carlos Augusto de Sampaio França. There were discussions on different types of tide gauges, different types of sensors, tide records, archives of tidal data, transmission of data, site for a tide gauge installation, types of cares during the installation, leveling, tidal staff, leveling and operation of the tide gauges, tests of operation, calibration points.

2.2.6 Field Trip to the Base Norte Research Station II

Tuesday morning/afternoon - 9 February 1993 - 9h to 14h

Leveling exercises of the tide gauge relative to bench marks were made. The exercises were guided by the topographer Oswaldo Yoshioka and the use of the leveling equipment made
available by the University of São Paulo.

The group for discussion was guided by Dr. Eduardo Marone who examined the questions about reducing the sea level data from records. The errors caused by the tide gauge. Errors due to the recording device. Errors due to the archiving system. Errors due to the recording pen. Digitization errors. Errors due to the clock device. Errors due to the floating device. Errors due to the sediments in the well. Phenomenon of aliasing. Datum.

Tuesday afternoon - 9 February 1993 - 16h

Return trip to São Paulo city.

2.2.7 Fourier and Spectral Analyses: Fundamentals. Prof. Tit. Afranio R. de Mesquita

Wednesday morning - 10 February 1993 - 9h to 12h

The series of annual rainfall of the city of Fortaleza, State of Ceara, Brazil and its periodogramme; the series of annual sea level of the city of San Francisco, USA and its periodogramme were described and compared, as motivating examples. Periodicity analysis in the time domain. The Fourier integral. The Fourier transform. The inverse Fourier transform. Determination of the coefficients of the Fourier series. Calculus of the coefficients of Fourier at harmonic frequencies. Deterministic and random processes. Realizations of random processes. Stationary random processes. Mean and variance. Autocovariance and autocorrelation functions. Spectral density function. Relation between the autocorrelation function and spectral density function. Periodicity tests. Confidence intervals. Spectrum of sea level data of the city of Cananéia, State of São Paulo, Brazil; the interval of confidence accepted spectral peaks, also found in the periodogramme of rainfall of Fortaleza and the one of the sea level data of San Francisco, as an example of uses of the Fourier and Spectral Analyses.

Wednesday afternoon - 10 February 1993 - 14h to 17h30

Practical: Series generation by using the PC-MATLAB (Matrix Laboratory) package. Calculating Fourier transforms by MATLAB.

2.2.8 The GLOSS Programme of Global Observations: TOGA. Mr. Patrick Caldwell

Thursday morning - 11 February 1993 - 9h to 12h


Thursday afternoon - 11 February 1993 - 14h to 17h30

Practical: Presentation of the computer programmes of TOGA Sea Level Centre. Explanation of their uses. Application of the programmes to real sea level data.

2.2.9 TOGA Sea Level Centre - Data Quality Control. Mr. Patrick Caldwell

Friday morning - 12 February 1993 - 9h to 12h

Friday afternoon - 12 February 1993 - 14h to 17h30

Practical: Presentation of the computer programmes of TOGA Sea Level Centre. Explanation of their uses. Application of the programmes to real sea level data.

2.2.10 The Harmonic Method of Tidal Analysis: Fundamentals. Dr. A.S. Franco

Monday morning - 15 February 1993 - 9h to 12h


Monday afternoon - 15 February 1993 - 14h to 17h30


2.2.11 Seminar/Workshop Discussion

Tuesday morning - 16 February 1993 - 9h to 12h

Seminar/Workshop Discussion - see section 3.

Tuesday afternoon - 16 February 1993 - 14h to 17h30

Practical: Elaboration of the "workshop" reports by the participants.

2.2.12 The Response Method of Tidal Analysis: Fundamentals. Dr. J.M. Vassie

Wednesday morning - 17 February 1993 - 9h to 12h


Wednesday afternoon - 17 February 1993 - 14h to 17h30


2.2.13 Extreme Sea Levels. Dr. J.M. Vassie

Thursday morning - 18 February 1993 - 9h to 12h


Thursday afternoon - 18 February 1993 - 14h to 17h30

Practical: Exercises on prediction of extreme sea levels. Demonstration of programmes
for calculating extreme sea levels. Computer programmes for calculation of the joint probability.

2.2.14 Satellite Altimetry. Dr. J.M. Vassie

Friday morning - 19 February 1993 - 9h to 12h


Friday afternoon - 19 February 1993 - 14h to 16h

Practical: Presentation of altimetric data of the GEOSAT satellite.

2.3 PRACTICAL

All lectures were followed by computer practical exercises, guided by Dr. Eduardo Marone and Mr. Carlos A. de S. França.

3. SEMINARS OF THE PARTICIPANTS

3.1 Mrs. Monica M.E. Fiore - Argentina

The description of operational tide gauges of Argentina in a total of 10 permanent stations were given. The equipment presently in use at Argentina tidal stations is of the floating type, the pressure type of gauge (AANDERAA) and the Next Generation Water Level Measurement System (NGWLMS). Among them 5 stations are in the GLOSS network; 4 are operational and 1 in process of being installed in Antarctica.

3.2 Mr. Ernesto Agustin Forbes - Uruguay

The network of Uruguayan tide gauges is all of the floating type of gauges. Four stations are operational but only one is a GLOSS gauge. There is one more tide station planned for the Antarctica.

3.3 Cmd. Juan J. Fierro Contreras - Chile

The network of Chile has 16 permanent tidal stations, being 9 of them belonging also to the GLOSS network. The network operates float type of gauges, bubbles tide gauges and acoustic tide gauges. They are producing tidal data of good quality and long time series.

3.4 Mr. Jafar Ruby - Moçambique

Moçambique operates on tide gauges of the float type. There is one station which belongs to the GLOSS network that has problems with its site of installation. There are being installed presently, three permanent tidal stations, one of them belongs to the GLOSS network. Funding difficulties are presently delaying the activities.

3.5 Mr. Manuel Teixeira - São Tomé e Príncipe

In São Tomé e Príncipe there are no equipment for measuring tides installed. The unique tidal station, which is mentioned in the GLOSS publications, is no longer operational. Being at the equator, in the Atlantic, the island is of interest for studies on equatorial circulation. São Tomé e Príncipe needs international assistance for restarting sea level measurements.
3.6 Mr. Mauricio M. Mata - Brasil/FURG

The Fundação Universidade do Rio Grande is an institution in the southern coast of Brazil, which takes measurements of tides in the lagunar region of Lagoa dos Patos, in the State of Rio Grande do Sul. They measure tides with the objective of developing a circulation numerical model for that lagoon. They also have plans for installing and operating a tide gauge station in the coast of the Brazilian State of Rio Grande do Sul.

3.7 Mr. Roberto T. Luz, Miss Valéria M. Guimarães and Mr. Victor M. da Matta - Brasil/IBGE

The geodetic work in Brazil is made by the Instituto Brasileiro de Geografia e Estatística (IBGE). They are presently reexamining the chosen site of the city of Imbituba, BR, as the national reference datum. They are also installing a permanent tidal station in Rio de Janeiro in the beach of Copacabana. They are connecting all the Brazilian GLOSS stations to a common datum.

3.8 Ltn. Ana C. da Paula and MSc. Geraldo N. da Silva - Brasil/DHN

The Diretoria de Hidrografia e Navegação of the Brazilian Navy is the Brazilian co-ordinator for GLOSS. They operate 24 tidal stations, 9 of them belonging to the GLOSS network. They use mostly the float type of tide gauge and pressure tide gauges. The DHN is also the National Data Bank of oceanographic data.

3.9 Mr. Kivuna Nkiambby - Angola

There are no tide gauges in operation in Angola. The tide stations mentioned in the GLOSS publications were inactive. There is a project for equipment acquisition and the installation of permanent tidal stations. There is, however, the need for international financial assistance for the job.

4. SEMINARS/WORKSHOP DISCUSSION

Discussions during the seminars indicated that the African participants are in the need of help from IOC through its appropriate channels and from the GLOSS programme in order to install tide gauges and actively produce sea level data of good quality.

The programmes of data collection of countries such as Argentina and Chile were the most advanced ones relative to the other participants and were considered as good examples, where the international collaboration of sea level programmes as the TOGA and the NOAA, both from USA, is fruitful.

As suggested by Dr. Pugh the participants accepted the idea of organizing the contents of the presentation given by the participants, as the results of a Workshop and to consult IOC about publishing it.

Also suggested by Dr. Pugh, it was accepted the idea of having a newsletter to keep the GLOSS Spanish and Portuguese communities informed about the improvements with the GLOSS tide gauges network and results of data analyses. The participants agreed that it should have biannual issues and that its editorial board should be initially constituted by Prof. de Mesquita, Dr. Marone and Mr. França, who would care for the three languages. It will accept articles for publication: Portuguese, Spanish and English. After two years a new board of editors will be elected. The name of the newsletter most accepted was: "Afro-America GLOSS Newsletter" with underwritings in the three languages saying: of the Portuguese and Spanish speaking communities.
5. RECOMMENDATIONS

The participants from their experiences and after having followed the GLOSS course, decided to raise a set of items, which form the recommendations below:

Considering: that the Course for GLOSS has formed a group of specialists devoted to the data collecting activities and in order to further these actions, it is necessary to organize periodical meetings of the GLOSS Portuguese and Spanish speaking community;

that the Chilean GLOSS stations do not cover adequately the great variety of tides along the coast of Chile, it is necessary to make the stations of GLOSS more close to each other geographically;

that one of the GLOSS stations of the Mozambiquean coast is not in an adequate site for operation and that there is the need for a better distribution of the positions of the tide stations, which are now being planned for installation, it is necessary the reallocation of the GLOSS sea level stations in Mozambique;

that São Tomé e Príncipe has a complete lack of known tide gauges installed, it is necessary to assure the means, at IOC level, in order to promote an adequate aid, aiming at recovering all the existing previous information on tides and tide gauges of ST&P and provide the required means for installation of permanent gauges in the islands;

that Angola has a complete lack of known tide gauges installed, it is necessary to assure the means, at IOC level, in order to promote an adequate aid, aiming at recovering all the existing previous information on tides and tide gauges in Angola and provide the required means for installation of permanent gauges along the Angolan coast;

that the "Manual de Medicação e Interpretação do Nível do Mar" is a valuable document for the GLOSS specialists and in order to make it continually useful, it is necessary its revision so that to include, for example, the description and uses of the modern tide gauges, which are now available;

that planimetry and altimetry are a basic knowledge, in order to make the reference of the GLOSS sea level heights to the land, it is necessary the inter-linking of all national altimetric and planimetric networks of each continent;

that communication is an important item to assure the unity of the present group of specialists, it is necessary that the facilities of electronic mail to be made to the reach of all GLOSS participants;

that the example of the sea level data bank of TOGA at Hawaii is a great success, it is desirable that Regional Sea Level Data Banks to be created, so that to allow that regional sea level data to be looked after, in an easier way, with much greater facility for data exchange;

that the activities now proposed will require the continuous endogenous knowledge of the people regionally involved, active in data collection and research, it is necessary the organization of an update File containing their names and addresses, etc.;

that information about gauges and results of data analysis are relevant items to be circulated among the GLOSS Spanish and Portuguese participants, it is necessary the constitution and publication of a "newsletter";

that information given by the participants during the seminars of this course are original and relevant material to the GLOSS programme, it is necessary that the contents of the seminars should be published as a "workshop" results.
ANNEX I

COURSE PROGRAMME

IOC Training Course for the Global Sea Level Observing System (GLOSS) directed to the African and American Portuguese and Spanish Speaking Countries, Sao Paulo, Brazil, 1-19 February 1993

PROGRAMME AND TIMETABLE

Course on "Observation and Analysis of Sea Level Data"

1st Week

MORNING (9h-12h) AFTERNOON (14h-17h)

Monday 1 February 1993

Opening Lecture (9h-10h30) Lunch: Faculty Club
Sea Level: Change and Challenge (US $5)
Dr. D.T. Pugh

visit the IOUSP (11h-17h) Free afternoon

Tuesday 2 February 1993

Oceanic Waves: Fundamentals Introduction to microcomputers
Prof. Tit. A.R. de Mesquita Use of statistical packages

Wednesday 3 February 1993

Tide Generating Potential Seminars of the participants
Dr. D.T. Pugh

Friday 5 February 1993

The Principal Tidal Levels Seminars of the participants
Dr. D.T. Pugh

2nd Week

Monday 8 February 1993

Visiting the North Tidal Station of IOUSP: Tide gauge demonstration and other
bus trip to the town of UBATURA installations, practical exercises, etc.

Tuesday 9 February 1993

Complementary Tidal Measurements General discussion on GLOSS
Seminars of the participants
Dr. D.T. Pugh

Return trip to Sao Paulo city
MORNING (9h-12h)  

**Wednesday 10 February 1993**  
Fourier and Spectral Analysis: Fundamentals  
Prof. A.R. de Mesquita

**Thursday 11 February 1993**  
The GLOSS Programme of Global Observations: TOGA  
Mr. Patrick Caldwell

**Friday 12 February 1993**  
TOGA Sea Level Centre - Data Quality Control  
Mr. Patrick Caldwell

3rd Week  

**Monday 15 February 1993**  
The Harmonic Method of Tidal Analysis: Fundamentals  
Dr. A.S. Franco

**Tuesday 16 February 1993**  
Seminar/Workshop Discussion

**Wednesday 17 February 1993**  
The Response Method of Tidal Analysis: Fundamentals  
Dr. J.M. Vassie

**Thursday 18 February 1993**  
Extreme Sea Levels  
Dr. J.M. Vassie

**Friday 19 February 1993**  
Satellite Altimetry  
Dr. J.M. Vassie

AFTERNOON (14h-17h)  

**Monday 15 February 1993**  
Statistical Computer Software Package  
TOGA Sea Level Centre Software

**Tuesday 16 February 1993**  
Computer Practice

**Wednesday 17 February 1993**  
Response Method Computer Demonstration

**Thursday 18 February 1993**  
Extreme Sea Levels Demonstration

**Friday 19 February 1993**  
Closure

The afternoon practicals were guided by Dr. E. Marone and Mr. Carlos A. de S. França.
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LIST OF COURSE MATERIALS AND INFORMATION DOCUMENTS

The following documents were distributed by the lecturers, listed below, to the participants, as handouts of lecture notes, manuals, scientific paper etc., during the course of the Global Sea Level Observing System (GLOSS), held at the Instituto Oceanográfico da Universidade de São Paulo, Brazil, from 1 to 19 February 1993.

1. **Dr. David Pugh**

Lecture Notes: 1. Tidal analysis and prediction. 2. Tidal dynamics. 3. Shallow water dynamics. 4. Mean sea level. IOS Deacon Laboratory. UK.


2. **MSc. Carlos A. de S. França**

Lecture Notes: Practical exercises. 1. Introdução aos microcomputadores. 2. Introdução a pacotes estatísticos. 3. Introdução a medidas altimétricas de satélite. Instituto Oceanográfico da Universidade de São Paulo.

3. **Dr. E. Marone**

Lecture Notes: Practical exercises. 1. Questionário para avaliação do conhecimento dos participantes no uso de microcomputadores. 2. Exercícios de microcomputador utilizando o programa PC-MATLAB. Laboratório de Física Marinha. Centro de Estudos do Mar, UFPR.

4. **Dr. A.S. Franco**


Manuals: Marés: Programas par previsão e análise.


5. **Prof. Dr. A.R. de Mesquita**


6. **Mr. Patrick Caldwell**


Topex/Poseidon, A United States/France Mission. Lecture Notes: Processamento e Controle de Qualidade de Dados do Nível do Mar pelo "TOGA Sea Level Centre". Joint Archives for the Sea Level of the National Oceanographic Data Centre. University of Hawaii, Honolulu, Hawaii, USA.


7. **Dr. J.M. Vassie**

Lecture Notes: 1. The Response Method of Tidal Analysis. 2. Estimation of Extreme Sea Levels. Proudman Oceanographic Laboratory. UK.


UNIVERSIDADE DE SÃO PAULO
INSTITUTO OCEANOGRÁFICO
COMISSÃO OCEANOGRÁFICA INTERGOVERNAMENTAL

PROGRAMA GLOSS

Certificamos que o Lic. Marco Antonio Corrêa colaborou, como monitor no "Curso de Observação e Análise do Nível do Mar do GLOSS", ministrado neste Instituto no período de 1 de fevereiro a 20 de fevereiro de 1993, sob responsabilidade do Prof. Dr. Afrânio Rubens de Mesquita do Departamento de Oceanografia Física, com um total de 180 horas/sala.

Instituto Oceanográfico da Universidade de São Paulo, aos 20 de fevereiro de 1993.

Prof. Dr. Afrânio Rubens de Mesquita
Prof. Dr. Luiz Roberto Tommasi
### LIST OF ACRONYMS

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<tr>
<td>DHN</td>
<td>Diretoria de Hidrografia e Navegação</td>
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<td>ERS-1</td>
<td>European Remote Satellite No. 1</td>
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<td>Fast Fourier Transform</td>
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