

# GLOBAL CHANGE NEWSLETTER

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THE INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME: A STUDY OF GLOBAL CHANGE (IGBP)  
OF THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

## SAC IV

Fourth Meeting of the Scientific Advisory Council for the IGBP  
23-27 October 1995, Beijing International Convention Centre

*The Chinese National Committee for the IGBP has graciously invited the highest body of the IGBP, the Scientific Advisory Council (SAC), to hold its fourth session in Beijing. The Council, composed of National IGBP and ICSU Union representatives, advises on the scientific contents of the programme, assesses its results, and makes recommendations. The IGBP, now at its fourth SAC, is well established, with its initial Core Projects and Framework Activities in their implementation phase, and with numerous cross-project and interdisciplinary links being actively developed. It is timely that SAC IV will be held in Asia, and that the topic of the associated scientific symposium (23-25 October) to which all are invited will be:*

### Asian Change in the Context of Global Change

#### Natural and Anthropogenic Changes: Impacts on Global Biogeochemical Cycles

The Earth's biogeochemical cycles of Carbon, Oxygen, Nitrogen, Phosphorus, and Sulphur (CONPS) exhibit significant natural variability on time scales of relevance to mankind. Furthermore, these cycles are being increasingly affected by the activities of mankind, including combustion, agriculture, and industry.

These activities have accelerated the mobilisation of CONPS from inert (e.g.,  $N_2$ ) and sequestered (e.g., fossil carbon) forms into chemical species that can impact critical processes of our biogeochemical environment, such as ecosystem productivity, and atmospheric energy adsorption and photochemistry. Historically, changes in the natural cycles of CONPS have occurred in the more developed countries of the western portion of the northern hemisphere. Over the past few decades however, combustion, agriculture and industry in Asia have grown to the level that mobilisation rates in some Asian countries are now among the highest in the world and are having a significant affect on natural cycles. In addition, projections are for significant growth in Asian energy use, agriculture and industry over the next few decades, leading to even further changes in natural cycles.

The Symposium will include plenary and poster sessions. The plenary session will consist of presentations by 12 to 16 invited speakers. The poster session will have its own designated time and will consist of posters selected from submitted abstracts. Both plenary and poster presentations will focus on how natural and anthropogenic changes in Asia impacts on global biogeochemical cycles. The plenary presentations will be reviews and will take a broad view of the topic.

It is expected that the poster presentations will consist of broad view and more narrow approaches. The poster session is an opportunity to showcase, to the IGBP community, the Asian perspective on work on global change and biogeochemical cycles.

Topics will include all aspects of IGBP and will include processes that mobilise, transform, transport and sequester CONPS as well as environmental processes that are affected by the increased concentrations of active CONPS species. In addition to a focus on the current impacts of Asia on global cycles, plenary and poster presentations are encouraged to examine future scenarios of CONPS cycling. Interested scientists should submit poster abstracts of no longer than 250 words to the Organising Committee of the Scientific Symposium: James N. Galloway, Chair, or Jerry M. Melillo, Vice-Chair, at The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA 02543, USA. Abstracts are due 1 April, 1995; and should be sent via E-mail to "asia@lupine.mbl.edu". Notification of acceptance will be made by 1 June, 1995.

The invited papers will be published in a peer-reviewed collection of papers by Cambridge University Press (IGBP Book Series). Poster presentations will published in a journal such as *Global Biogeochemical Cycles*, following the standard peer-review process.

## CONTENTS

1

SAC IV

2

LOICZ gets underway

4

World Ocean Atals

7

IGAC: ACE

8

People and Events

10

IGBP-DIS on the Internet: The Web  
A Global Change Sampler  
Personal Experiences

14

Science Task Team

16

Open Science Conferences

18

Publications

19

Announcements

## LOICZ Gets Underway

One of the areas of the Earth's surface in which humanity is most concentrated and which we can least afford to damage is the coastal zone, the object of study of the IGBP Core Project LOICZ (Land-Ocean Interactions in the Coastal Zone). This, the sixth and newest Core Project of the IGBP, is now entering its implementation phase and the 9th meeting of the SC-IGBP in Canberra in December will consider the draft Implementation Plan which has been developed over the last eighteen months since the publication of the LOICZ Science Plan (IGBP report No. 25).

### Sea-level changes

In the context of global change impacts in the coastal zone, sea level rise has received considerable attention from the international community and public media. Eustatic sea level rise is, however, relatively small ( $1-2 \text{ mm a}^{-1}$ ) at present, and even with a warming and expansion of the mixed ocean surface layer and the melting of temperate land-based glaciers, global mean sea level will not rise more than a few decimetres in the next century. Of more immediate concern, however, is the subsidence and recession of certain coastlines through natural or anthropogenically caused processes. The mining of oil, gas and water from deltas, and the sediment starvation of rivers through the world-wide increase in the number of reservoirs, and large scale irrigation and water diversion

projects, causes regional, relative sea level changes which are an order of magnitude higher than eustatic sea level rise. Many highly productive and densely populated low-lying lands are currently threatened by such changes. Undisturbed coastlines counteract such recession by building beaches, sand spurs or coral platforms and filling lagoons with mangroves, peat or marsh. These interactions are the subject of biogeomorphological research which forms the topic of LOICZ Focus 2.

As a consequence of the flooding of the continental shelves by sea-level rise at the end of the Last Glacial, the continents are surrounded today by shallow seas, some of them over 1,000 km wide. Many of the inland seas, like the Baltic Sea and the Hudson Bay, did not exist 10,000 years ago, or like the Black sea have become filled with saline water. The Black sea, during the Pleistocene, was the largest fresh water body on Earth, surpassing by far all the freshwater existing on land today. This fringe of shallow sea, serves as a reaction vessel for all the material delivered both naturally and anthropogenically to the ocean, which in times of lower sea level, were discharged almost directly from land to the open ocean. In shallow water, nutrients for example, can be recycled many times, before becoming finally fixed in the sediments or being exported to the open ocean. Therefore, a far higher productivity is maintained in the shallow seas

of continental margins, than in most of the open ocean with positive effects on the harvest of fish and other "fruit of the sea". Annually, roughly 0.4 gigatons of organic carbon in dissolved and particulate form, reach the ocean via river discharge and may be partly or totally respired, thus forming a potential natural source of  $\text{CO}_2$  for the atmosphere. How much is actually respired is unknown, since apparently much of the riverine carbon (specifically the dissolved organic carbon) is highly inert and is mixed into ocean water conservatively. Furthermore, the anthropogenic input of nutrients (nitrate and phosphate) to the coastal sea via rivers and through direct waste discharge can now produce more biomass and may therefore constitute a new, additional sink for atmospheric carbon of the order of  $0.07-0.12 \text{ Gt C a}^{-1}$ . Many of the uncertainties in global carbon flow models may represent unquantified processes occurring in the coastal zone.

### Critical thresholds

Observations show that over the past few decades highly eutrophicated coastal seas, such as the North Sea, have significantly increased their seasonal amplitude (i.e., the difference between the winter and summer conditions) for almost all ecological and carbon cycle related parameters. The amplitudes of natural cyclic processes cannot be increased indefinitely and it must be recognised that there may be a

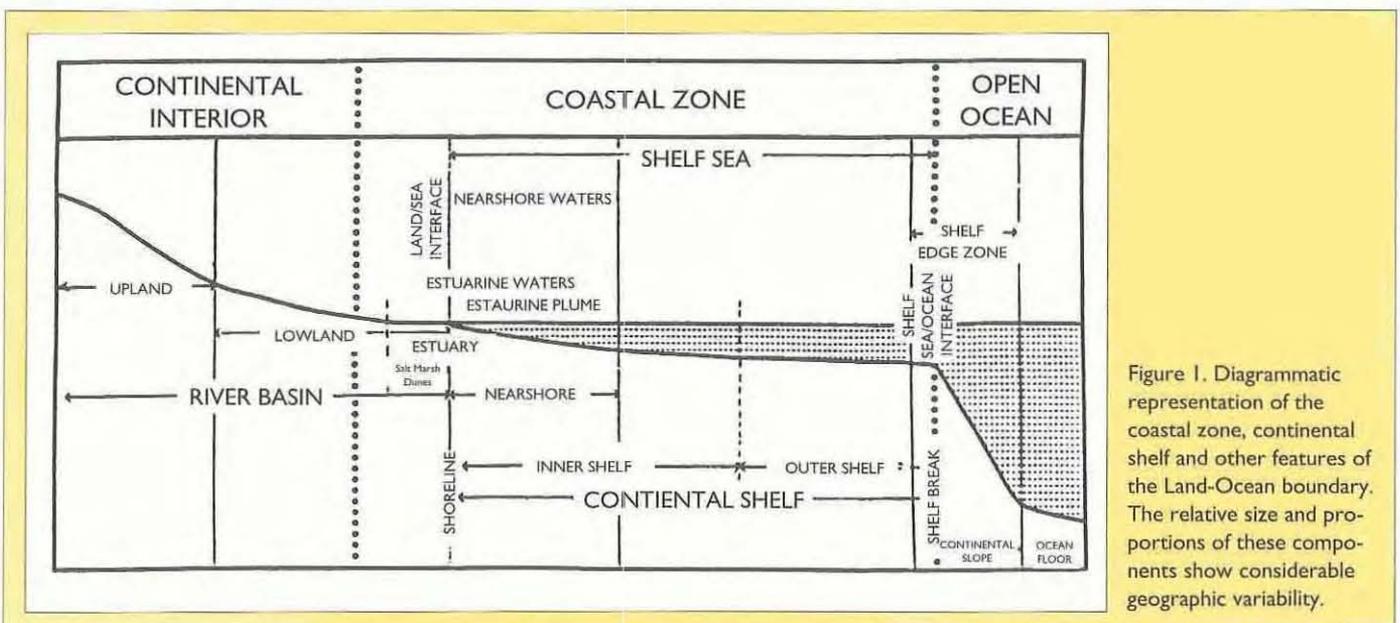


Figure 1. Diagrammatic representation of the coastal zone, continental shelf and other features of the Land-Ocean boundary. The relative size and proportions of these components show considerable geographic variability.

critical threshold, beyond which the system shifts suddenly to some other mode of functioning. If high rates of production occur during summer for example, organic matter can accumulate on the sea floor, where it is respired, until all the oxygen is depleted. At this threshold the system shifts from oxic to anoxic respiration, and sulphate is used as an oxygen donor. In this process  $H_2S$  is generated, which kills all higher life in and on top of the sediment and in bottom waters as well.

Another threshold occurs when rapid photosynthesis draws the free  $CO_2$  from the water, increasing the carbonate ion concentration and the pH. Again, certain parts of the marine biota cannot tolerate such conditions and disappear from the water column, giving rise to the opportunity for massive blooms of a few species such as flagellates. The ability to effectively produce calcium carbonates is lost at too high a pH in many biomineralising organisms. Thus, potentially the narrow balance of alkalinity, supersaturation and total dissolved carbonate can be disturbed, with possible severe consequences for reefs, shell producing invertebrates and calcareous plankton. The processes involved, the cycling of carbon and nutrients, and the global significance of the coastal seas for the carbon cycle, are therefore the primary research targets of LOICZ Focus 1 and 3.

#### Basic river data

Land-derived carbon, nutrients, freshwater and sediments all enter the coastal zone at point inputs, the river mouths. Changes in these inputs have major consequences not only for the mixing zone between fresh and sea water, the estuary in the wider sense, but also for the entire sediment, carbon and nutrient balance of the coastal sea, down current of the river mouths. Understanding the mechanisms which mobilise these materials in the catchment basin is a natural task of LOICZ, and in the first activity of Focus 1, one of the aims will be to build a model linking the continental water discharge with material transport. This will be based on a similarity analysis of river discharge behaviour, seasonally and inter-annually, and will involve assembling a large data base of GIS-based river networks, long-term discharge curves, and material transport. As a start, LOICZ is already assembling basic river data in a database GLORI (Global Land-Ocean River Inputs).

#### Modelling

In addition to developing a typology of river catchment behaviour, coastal zones themselves must be discriminated into

#### The coastal domain (Figure 1)

- occupies 18% of the surface of the globe
- is the area where around a quarter of global primary productivity occurs
- where around 60% of the human population lives
- where two thirds of the world's cities with populations of over 2 million people are located, and
- supplies approximately 90% of world fish catch

#### The coastal ocean accounts for

- 8% of the ocean surface
- <0.5% of the ocean volume
- between 18 and 33% of global ocean production
- 80% of the global organic matter burial
- 90% of the global sedimentary mineralisation
- 75-90% of the global sink of suspended river load and its associated elements/pollutants, and
- in excess of 50% of present day global carbonate deposition

classes of high similarity, in order to later sum the results of total carbon budgets, or to construct box or dynamic models to serve as modules for a future Earth system model. This task will be taken up through the LOICZ Core Project Office (CPO) as an initial major, scientific effort. LOICZ will conduct and encourage modelling of coastal zone processes at all levels: from process models, which investigate ecosystem reactions to physical and chemical forcing; to budget models, which try to elucidate the mass balances in specific geographic regions and time frames; to system models, which couple advanced regional general circulation models with biogeochemical, sedimentological, or meteorological process models. For most of these models, carbon will be the major currency, alongside sediments and the macronutrients nitrate, phosphate and silicate.

#### Human dimensions

Because of the central importance of the coastal zone for humanity, and the ICSU policy of fostering co-operation between natural and social scientists, LOICZ Focus 4 has been designed as a forum for collaboration between IGBP and HDP (Human Dimensions of Global Change Programme). The experience of the first three foci will be used to develop scenarios of coastal zone development under changing climate, changing river inputs and changing biogeochemical and biogeomorphological forcing functions. This information will be used to investigate possible feedback on coastal populations and envi-

ronment. Finally, LOICZ will assess the extent to which scientific understanding of coastal zone changes could contribute to the formulation of integrated management strategies for sustainable use of coastal environments and resources.

#### Core research

To compile the results of nationally funded research into regional and global, models and scenarios, will require considerable investment from the Core Project Office (CPO) and Scientific Steering Committee (SSC) in terms of methods, database and model development, networking and liaison. Even with a comprehensive investment by the CPO and SSC in these Framework Activities, the possibility remains that the regional and global goals of LOICZ will not be met without substantial additional investment in the Integrative Activities (Core Research). Since the compilation and synthesis of results from small studies (small in terms of either spatial domain or subject area) will not necessarily provide insight and answers to scientific issues and uncertainties involving the inter-relations between wider sub-sets of the total coastal system, significant new research funds will be required to support larger scale regional and global level research in order to achieve the goals and objectives of LOICZ and ultimately the IGBP as a whole.

**John Pernetta**, LOICZ Core Project Officer, Netherlands Institute for Sea Research, Texel, The Netherlands.

# World Ocean Atlas 1994

by Sydney Levitus, Margarita E. Conkright, Robert D. Gelfeld, Tim Boyer  
Ocean Climate Laboratory, National Oceanographic Data Center, Washington, D.C.

## Introduction

The international oceanographic and climate scientific communities need research quality data sets in order to describe the temporal and spatial variability of physical, chemical and biological parameters in the ocean. A research quality database requires development of procedures which provide an evaluation of the data. The Ocean Climate Laboratory (OCL) at the National Oceanographic Data Center (NODC) is supported by the U.S. National Oceanic and Atmospheric Administration Climate and Global Change program to produce scientifically quality-controlled oceanographic databases. Work to date includes quality control of historical *in situ* temperature, salinity, oxygen, phosphate, nitrate, and silicate data, and the preparation of objectively analysed fields of these parameters on a one-degree latitude-longitude grid for selected standard depth levels from the sea surface to 5500 m depth. Specifically to date, this project has produced four ocean atlases describing the objectively analysed fields and two technical reports describing the quality control and processing procedures. The atlases include global distributions of *in situ* temperature, salinity, oxygen, oxygen saturation and Apparent Oxygen Utilisation (AOU), and the nutrients phosphate, silicate, and nitrate. Table 1 is a listing of the atlases and papers produced as a result of this work. An atlas of the Indian Ocean was prepared specifically to support the JGOFS measurement program in the Indian Ocean (Conkright et al., 1994).

Observed and standard level profile data, along with quality control flags used in the production of these atlases, are being made available to the international oceanographic community on the World Ocean Atlas 1994 (referred to as WOA94 in the rest of the text) CD-ROM series and Exabyte tapes. The CD-ROM discs and Exabyte tapes also contain the objectively analysed one-degree latitude-longitude mean fields and five-degree square statistics of standard level values for each of the

above mentioned parameters. All data sets and products are being distributed internationally without restriction.

## Background

The WOA94 series represents an extension and continuation of Climatological Atlas of the World Ocean which was published twelve years ago (Levitus, 1982). This atlas (manuscript and magnetic tapes) described the results of a project to quality control and objectively analyse the historical data sets of temperature, salinity, and oxygen that were on file at the National Oceanographic Data Center (NODC), Washington, D.C. The quality controlled versions of these NODC data sets were used as input to an objective analysis scheme that produced global, smoothed climatological fields of various parameters on a one-degree latitude-longitude grid at standard depth levels from the sea surface through 5500 m depth. The analyses were published and made available in digital form to the international research community, without restriction. In the twelve years since being released, these analyses have been used in numerous ways by the oceanographic and climate research community. For example the analyses have been used to provide both initial and boundary conditions in numerical models of the Earth's climate system and to perform diagnostic studies to determine the role of the ocean as part of the Earth's climate system. In particular the satellite altimeter community has used fields of steric sea level computed from these objective analyses as sea-truth for studies evaluating altimetric measurements of sea level. Five-degree square statistics of the quality controlled version of the data sets were also made available and have been used in a variety of ways for climate studies and operational purposes such as quality control of synoptic ocean data. For example these five-degree statistics are being used to quality control new or existing data being processed by the National Ocean Service at their Ocean Products Center in Camp Springs, Maryland, and by the Marine Environmental Data Service of Cana-

da (as part of the Global Temperature-Salinity Pilot Project). The older analyses have been used in planning expeditions. Based on the utility of these analyses and data sets, work has continued and expanded on this project. In particular, the project has expanded to include additional parameters such as nitrate, phosphate, and silicate.

## Data Sources

Since 1982 a great number of additional oceanographic profiles have accumulated in the archives. In particular substantial numbers of older historical data (e.g. 450,000 mechanical bathythermograph profiles) have been submitted to the NODC. The data used in this project are all the data found in the NODC archives as of the first quarter of 1993. Levitus and Gelfeld (1992) show global distribution maps of the data held in these files for all years (1900-1992).

In addition, data gathered as a result of the NODC's National Oceanographic Data Archaeology and Rescue (NODAR) and the IOC/IODE Global Oceanographic Data Archaeology and Rescue (GODAR) projects, not yet incorporated into the NODC master archives, were included in this study. GODAR seeks to: (1) catalogue and digitise data available only in manuscript or analogue form, as well as digital data not currently available at one of the oceanographic data centres; (2) ensure that all oceanographic data are available for international exchange and are archived in digital form at two or more data centres; (3) perform quality control on all data. Data targeted for rescue include physical parameters (i.e. temperature, salinity), chemical parameters (i.e. oxygen, nutrients), biological parameters (i.e. chlorophyll, biomass), and surface marine meteorological observations. A description of the NODAR and GODAR projects can be found in Levitus et al (1994: Results of the NODC and IOC Data Archaeology and Rescue Projects). In brief, more than one million temperature profiles and 300,000 salinity profiles have become available internationally as a result of this project.

### Quality Control Procedures

The quality control procedures applied to the historical data sets have been documented in two NOAA Technical Reports (Boyer and Levitus, 1994; Conkright et al., 1994). Procedures include flagging individual observations or pairs of observations for failing range checks, exceeding standard deviation criteria, being hydrostatically unstable, or exceeding vertical gradient criteria among others. Profiles that were flagged for one or more possible problems are flagged with a special "whole profile" indicator.

### Products

The philosophy of this project is to produce a hierarchy of documented, value-added, data sets and products so that investigators can 1) use these data sets and products with an understanding of how the data have been analysed and processed; 2) process the data using different methods if desired. For example the most basic data set products by this project are the observed level profiles with quality control flags. The quality control procedures used are well documented so individual investigators can choose for themselves whether to accept the results of the quality control criteria we have developed. For example, scientists who want to use different criteria for quality control can do so. Profiles of the data interpolated to standard depth levels are provided in digital form as well as profiles of the observed level data. Products such as seasonal five-degree square statistics of the data values

at standard levels, the objective analyses of various parameters at standard levels for different compositing periods are provided. Figure 1 shows the objectively analysed field of phosphate for the world ocean at a depth of 100 m. This field represents an analysis of all phosphate data contained in the historical archives regardless of year or season of observation.

It is important for investigators to recognise the limitations of the data sets and the analyses based on these data sets. However, even with these limitations, scientists have found such digital fields useful for different types of studies. If an investigator wants to produce a high resolution analysis for a part of the world ocean they can do so, since all data are available internationally without restriction.

In order to maximise the utility of these data sets and analyses we are distributing them digitally in two different ways. We have prepared a set of CD-ROMs in which all digital products are available as ASCII files, with the largest file being about 20 megabytes in size. Profiles are organised by 10 degree squares (WMO system) so that investigators can select data by relatively small geographic regions if desired. The international availability of relatively inexpensive CD-ROM readers with recording formats governed by international standards makes this technology the medium of choice for distribution. For investigators with more powerful computer systems and a need to access all profiles as data sets by instrument type (e.g. all Nansen cast profiles), we have made all

our profiles available in large compressed ASCII data files on Exabyte tapes. Substantial hard disk resources are necessary to decompress these files. Response and suggestions from users will assist in determining other schemes for distributing the data. For example we could produce a set of CD-ROMs or Exabyte tapes that contained the profile data stored in individual yearly files for each instrument type.

All products may be accessed by contacting the NODC User Services Branch:

E-mail: [services@nodc.noaa.gov](mailto:services@nodc.noaa.gov)  
Phone: (+1-202) 606 4549  
Fax: (+1-202) 606 4586

Address:

National Oceanographic  
Data Center  
User Services Branch  
NOAA/NESDIS E/OC21  
1825 Connecticut Ave., NW  
Washington, D.C. 20235

### Future Work

Future work will focus on producing data sets and products for additional parameters such as chlorophyll, primary productivity, and nitrite among others. In particular, we hope to acquire enough data so that we can produce seasonal analyses of nutrients. If the international research community has access to seasonal analyses of nutrients, chlorophyll, and other biochemical parameters, we believe a great deal could be learned about biogeochemical cycles in general that might apply to inter-annual variability of the parameters in-

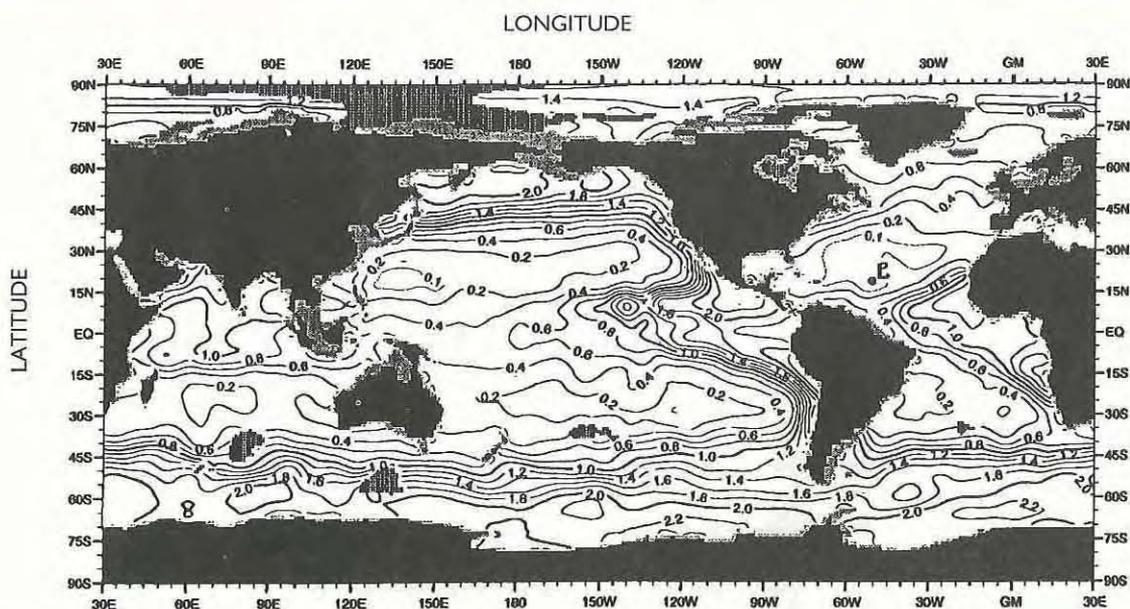


Figure 1. Annual mean phosphate (mM) at 100 m. depth

volved. We have begun efforts to archive biological data such as phytoplankton and zooplankton measurements. This is an effort that is hampered by the lack of metadata with which to document such measurements as well as the lack of digital data.

Quality control and processing procedures will be improved in response to what the Ocean Climate Laboratory has learned in producing this work, and in response to suggestions from investigators using the WOA94 data sets and products. In addition, substantial amounts of previously unavailable historical oceanographic data are becoming available which justify repeating the WOA94 series or a similar series, within one or two years. A global high-resolution spatial analysis of temperature and perhaps salinity will be produced.

For ordering information please contact:  
 E-mail: [services@nodc.noaa.gov](mailto:services@nodc.noaa.gov)  
 Fax: (+1 -202) 606 4586  
 For comment or suggestions on any of these products please contact:  
 E-mail: [atlas94@nodc.noaa.gov](mailto:atlas94@nodc.noaa.gov)

**Acknowledgements**

This work was made possible by a grant from the NOAA Climate and Global Change Program which established a research group at the National Oceanographic Data Center to focus on the preparation of research quality oceanographic data sets, objective analyses, and diagnostic studies with these data sets. Substantial amounts of historical oceanographic data used in this study were located and digitised with support from several agencies. Data Archaeology and Rescue projects were supported with funding from the NOAA Climate and Global Change (CGC) Program, the NOAA Environmental Science Data and Information Management Program, the National Science Foundation, and the Office of Naval Research. Analysis of these data has been supported in part by the Atlantic Climate Change element of the NOAA CGC program. The IOC/IODE Global Oceanographic Data Archaeology and Rescue project has been responsible for the location and "rescuing" (digitisation) of substantial amounts of historical oceanographic data. We would like to acknowledge the international community of scientists who have submitted their data to national and regional data centres, and the data managers at the various data centres.

**Table 1. Atlases and Technical Reports**

**Atlas Series**

- Conkright, M.E., S. Levitus, and T.P. Boyer (1994). World Ocean Atlas 1994, Vol. 1: Nutrients. NOAA Atlas NESDIS 1. U.S. Department of Commerce, NOAA, NESDIS. 150 pp.
- Conkright, M.E., S. Levitus, T.P. Boyer, D.M. Bartolacci, and M.E. Luther, (1994). Atlas of the Northern Indian Ocean. University of South Florida (unpublished manuscript).
- Levitus, S. and T.P. Boyer (1994). World Ocean Atlas 1994, Vol. 2: Oxygen. NOAA Atlas NESDIS 2. U.S. Department of Commerce, NOAA, NESDIS. 186 pp.
- Levitus, S., R. Burgett, and T.P. Boyer (1994). World Ocean Atlas 1994, Vol. 3: Salinity. NOAA Atlas NESDIS 3. U.S. Department of Commerce. 99 pp.
- Levitus, S., and T.P. Boyer (1994). World Ocean Atlas 1994, Vol. 4: Temperature. NOAA Atlas NESDIS 4. U.S. Department of Commerce, NOAA, NESDIS. 117 pp.

**Quality Control Documentation**

- Boyer, T.P. and S. Levitus (1994). Quality Control and Processing of Historical Oceanographic Temperature, Salinity and Oxygen Data. NOAA Technical Report No. 81. U.S. Department of Commerce, NOAA, NESDIS. 65 pp.
- Conkright, M.E., T.P. Boyer, and S. Levitus (1994). Quality Control and Processing of Historical Oceanographic Nutrient Data. NOAA Technical Report NESDIS 79, U.S. Department of Commerce, NOAA, NESDIS. 75 pp.

**Documentation for Non-Archived Data**

- Levitus, S., R. Gelfeld, T.P. Boyer, and D. Johnson (1994). Results of the NODC and IOC Data Archaeology and Rescue Projects. Key to Oceanographic Records Documentation No. 19, National Oceanographic Data Center, Washington, D.C. 67 pp.

**Documentation for Archived Data**

- Levitus, S. and R. Gelfeld (1992). National Oceanographic Data Center Inventory of Physical Oceanographic Profiles. Key to Oceanographic Records Documentation No. 18, National Oceanographic Data Center, Washington, D.C. 242 pp.

**Table 2. World Ocean Atlas CD-ROM Series 1994**

|                |  |
|----------------|--|
| Disc 1         | Objectively analyzed temperature fields  |
| Disc 2         | Objectively analyzed salinity fields<br>Five-degree square statistics  |
| Disc 3         | Objectively analyzed oxygen, apparent oxygen utilization, oxygen saturation, phosphate, silicate and nitrate fields; |
| Disc 4         | Observed level profile data for the North Atlantic (0-40°N), North Indian and South Indian Oceans                    |
| Disc 5         | Observed level profile data for the North Atlantic (40-90°N), and South Atlantic Oceans                              |
| Disc 6         | Observed level profile data for the North Pacific (0-30°N) and South Pacific Oceans                                  |
| Disc 7         | Observed level profile data for the North Pacific (30-90°N)  |
| Disc 8         | Standard level profile data for the Atlantic and Indian Oceans   |
| Disc 9         | Standard level profile data for the Pacific Ocean  |
| Future Disc 10 | Upper ocean thermal structure (1942-1990)  |

## Atmospheric Chemistry Education in Global Change (ACE) Enters Implementation Phase

The need to understand the composition of the Earth's atmosphere and how and why it changes has become increasingly apparent during the last decade. Stratospheric ozone depletion, the "greenhouse" effect and global climate change, and regional air pollution are problems of great interest to today's society that require substantial scientific insight to address them in a meaningful and cost effective manner.

Scientists trained and educated in atmospheric chemistry and related physical and biological sciences are in limited supply, especially in developing countries. There is an urgent additional need to create the appropriate infrastructure within developing countries in order to enhance their scientific capacities, to enable them to realise the full benefits of participation in IGAC and other components of the IGBP, and to deal with the scientific and environmental policy challenges facing the global community.

To begin this ambitious effort, IGAC's ACE Activity has been reorganised during 1994 under new Convener Professor Kenneth L. Demerjian of the State University of New York at Albany. ACE has joined with START, the World Meteorological Organisation's (WMO) Global Atmosphere Watch (GAW), the InterAmerican Institute (IAI), the European Experiment on the Transport and Transformations of Environmentally Relevant Trace Constituents in the Troposphere over Europe (EUROTRAC), and several other national and international organisations to design and execute an integrated approach to academic capacity building in atmospheric-biospheric chemistry in developing countries. The initial emphasis will be linked closely to the enhancement of the GAW global observatory network that is underway.

### Global Atmosphere Watch

The GAW programme evolved mainly from the Global Ozone Observing System (GO<sub>3</sub>OS) and the Background Air Pollution Monitoring Network (BAPMoN). When fully implemented, the GAW will consist of about two dozen full-capability global observatories embedded within a larger regional network of a few hundred

stations with more limited capabilities. It has been endorsed as an integral activity related to the World Climate Programme. The GAW will feed into the Global Climate Observing System (GCOS) as well as provide basic information on the status of the changing chemical composition and related physical characteristics of the global atmosphere. As such, it plays a seminal role in determining whether the composition of the atmosphere is changing and, if so, where and in what ways.

To ensure that observations are being made properly and that the measurements can be depended upon by the world's scientific community, Quality Assurance/Scientific Activity Centers (QA/SACs) have been established under the GAW to monitor the observational programme and assure that the data are of high quality. Europe and Africa are overseen by a QA/SAC located at the Fraunhofer Institute for Environmental Research in Garmisch-Partenkirchen, Germany. The Americas are overseen by the U.S. National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory. A third QA/SAC will be established by the Japanese Meteorological Agency in Tokyo and will be responsible for Asia and Oceania.

The WMO has decided that six new baseline observing stations need to be established at appropriate locations in Algeria, Argentina, Brazil, China, Indonesia, and Kenya to enhance global coverage (see map). These stations are being implemented through a Global Environmental Facility (GEF) grant made to the WMO. These new stations will be similar to the station at Mauna Loa, Hawaii, that was established in the 1950's and is operated currently by NOAA.

### Volunteer Teaching Core

Within the GAW framework most of the impetus for education and training is centered around atmospheric chemistry, a relatively young, but technically demanding discipline whose vitality is essential to our ability to respond to society's need to understand the future of planet Earth. The source of this vitality is, and always will be, the continued entrance of an adequate number of young scientists into the field. Thus, the education/training component

of the QA/SACs must attract high calibre individuals, nurture their creativity, and effectively prepare them for professional careers.

To address this need a partnership has been formed with non-governmental, international research, multinational, and governmental organisations to develop and implement an academic/research capacity building programme. The American Geophysical Union (AGU) with its international membership and in co-operation with the International Union of Pure and Applied Chemistry (IUPAC) has begun to recruit and establish an international Volunteer Teaching Corps. This will enable the establishment of atmospheric chemistry curricula and undergraduate level programmes at universities in developing countries. Stipends will be available through the GAW for a select number of successful students in the programme to pursue graduate education at co-operating universities around the world. After graduation, students will be able to gain initial experience through IGAC and EUROTRAC research before returning to their home countries with the challenge of contributing to START, GAW, and/or research activities of IGAC. In addition, atmospheric chemistry education programmes will be developed for professionals in national meteorological services who are increasingly challenged with complex assessment tasks outside their traditional areas of expertise and training.

The focus of this integrated approach to academic/research capacity building is for participants to be offered increased employment opportunities in developing countries commensurate with their experience. This programme will establish long-term co-operative arrangements with academia, global research and monitoring programmes, and professional societies, all brought together under the framework of the Volunteer Teaching Corps.

Funding has been awarded by the U.S. National Science Foundation's Atmospheric Chemistry Program to demonstrate the feasibility of this approach. This "proof of concept" grant will enable the atmospheric chemistry community to convene a workshop during which an atmospheric chemistry curriculum will be developed

and to offer it initially in Argentina where one of the new GAW observatories is currently being established. It is anticipated that the first courses will be presented in late 1995. The objective of this effort is to train and educate chemistry faculty in Argentina and other South American nations so they can teach the subjects and offer courses in various aspects of atmospheric chemistry at their home institutions. In this way a solid infrastructure in atmospheric chemistry can eventually be built. It is encouraging to note that even as the ideas for this pilot project were first beginning to gel, inquiries were received from Chile and Venezuela about initiating similar efforts in those countries.

The courses for the chemistry faculty will be taught by Volunteer Teaching Corps members selected by a committee representing START, IGAC, and GAW. Each lecturer will be an expert in his or her aspect of atmospheric chemistry and many will be multilingual so that courses can be taught in Spanish and English. Individuals will teach for 2 to 4 weeks, after which another lecturer will take over the class. Lecturers will receive no honoraria, but only travel and per diem reimbursement. With only one announcement in IUPAC's journal, there are already more than 40 applicants.

The experience gained from this pilot project in Argentina will be the basis for an institutionalised programme that could be implemented elsewhere. Because most U.S. atmospheric chemists and many from other countries belong to the AGU and thus can be easily informed and recruited for the programme, the AGU will oversee the operation and will handle the necessary logistical support. An information form for those interested in being considered for the Volunteer Teaching Corps is found on page 19 of this Newsletter.

**E.W. Bierly**, Education & Research, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC, 20009-1277, USA; Tel: (+1-202) 939-3202; Fax (+1-202) 328-0566; E-mail: ebierly@kosmos.agu.org

**K.L. Demerjian**, Atmospheric Sciences Research Center, State University of New York at Albany, 100 Fuller Road, Albany, NY, 12205, USA; Tel: (+1-518) 442-3820; Fax: (+1-518) 442-3867; E-mail: kld@atmos.albany.edu

**A. Pszeny**, IGAC Core Project Office, Bldg. 24-409, Massachusetts Institute of Technology, Cambridge, MA, 02139-4307, USA; Tel: (+1-617) 253-9887; Fax: (+1-617) 253-9886; E-mail: pszeny@mit.edu

**H. Virji**, International START Secretariat, Suite 200, 2000 Florida Avenue, N.W., Washington, D.C., 20009-1277, USA; Tel: (+1-202) 462-2213; Fax: (+1-202) 457-5859; E-mail: hvirji@kosmos.agu.org

## People

### Dunxin Hu joins the Scientific Committee for the IGBP

Professor Hu brings to the SC-IGBP his expertise in physical oceanography, and years of experience as a driving force in organising international co-operative scientific projects involving principally China, USA and Japan. His interests lie in ocean circulation, air-interaction, sediment dynamics and multidisciplinary studies, and he has contributed significant advances in understanding the role played by upwelling.



Dunxin Hu

He has participated in numerous international conferences and science commissions, among them as Chair of the Chinese National Committee for JGOFS, a position he holds at present. He is a member of the PICES Committee on Physical Oceanography and Climate, and was a member of the WOCE Core Project, the SCOR Committee for JGOFS, and the IOC/SCOR CCCO Pacific Panel.

Since 1991 Professor Hu is Vice-Director and Research Professor at the Institute of Oceanology in Qingdao, Academia Sinica, where he has been Chairman of the Laboratory of Ocean Circulation and Air-Sea Interaction and Chairman of the Department of Physical Oceanography. In addition, he is Adjunct Professor of Old Dominion University since 1990, and was Director of the Institute of Air-Sea Interaction, Ocean University of Qingdao, China.

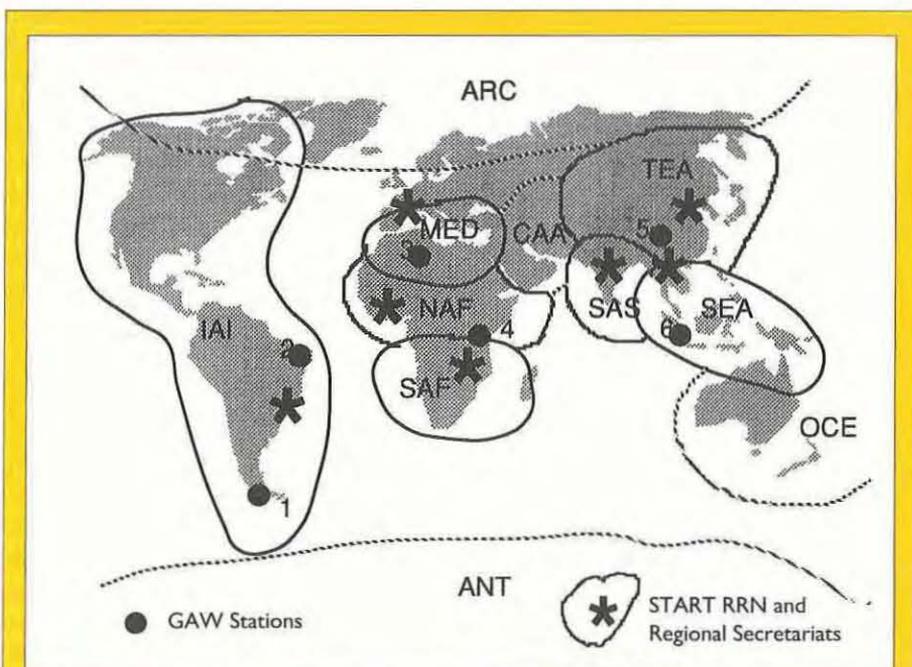


Figure: Schematic illustration of the START Regional Research Networks under development, including the locations of the START regional Offices (\*) and the new GAW/WMO stations (●). Dashed outline indicates planned regional research networks. Also shown is the Inter-American Institute for Global Change Research and its regional office; a parallel inter-governmental effort will perform networking functions in the indicated regions of the Americas. The GAW stations being established under a grant from the Global Environment Facility are: 1 = Ushuaia, Argentina; 2 = Natal, Brazil; 3 = Tamanrasset/Asseskerem, Algeria; 4 = Mount Kenya, Kenya; 5 = Mount Waliguan, Bukit Koto Tabang, Indonesia

## Events

### Soon to be published:

### IGBP Book Series

Scientific results need to be communicated. Papers in specialist journals provide the main mechanism for IGBP researchers to subject their work to scrutiny, and inform each other of their individual progress. But to reach a wider audience, and to show how broader advances are being made, there is also need for integrative publications - providing up to date state-of-the-science reviews and syntheses. At its 8th meeting in Bonn, March 1994, the Scientific Committee for IGBP decided that it was now timely to start a book series, specifically for that purpose.

After short listing several possibilities, the UK-based Cambridge University Press (CUP) has been chosen as publishers of the International Geosphere-Biosphere Programme Publication Series. CUP is a non-profit publishing house that describes itself as the oldest press in the world, receiving a royal printing warrant in 1534. More importantly, it has a strong reputation in environmental titles at affordable prices, with world-wide marketing capabilities through its branches in New York, Stanford and Melbourne, and with offices and agents in more than 20 other countries.

A formal agreement has recently been concluded between IGBP and CUP, and the first two titles, to appear in 1995, can now be announced:

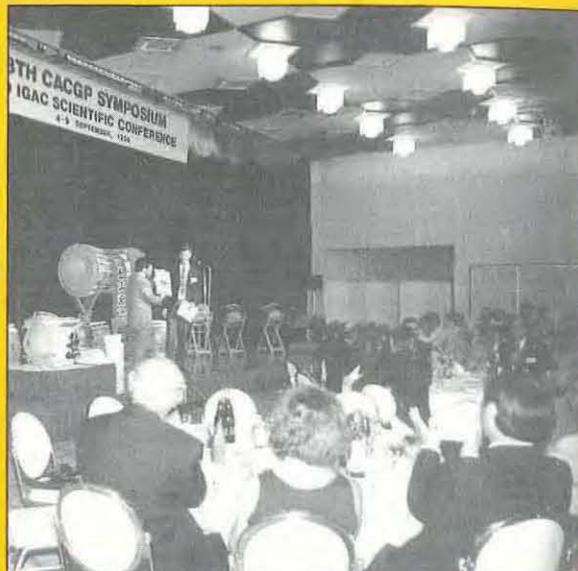
- *Towards the Development of a Functional Classification of Plants*, edited by T. M. Smith, H. H. Shugart, and F. I. Woodward
- *Global Change and Terrestrial Ecosystems*, edited by W. Steffen and B. H. Walker

As the IGBP book series develops, it will provide the opportunity for all Core Projects to present the very best of their achievements in an integrated fashion. More importantly, it will also encourage cross-cutting publication initiatives, between Core Projects and for the programme as a whole.

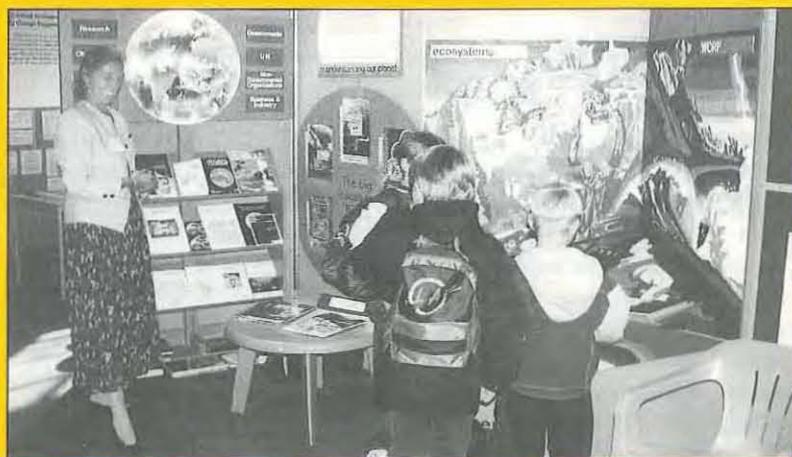
Proposals for volumes in the series will be reviewed both by an IGBP Editorial Board (the Officers of the IGBP Scientific committee) and by the CUP, through its press syndicate. Phillip Williamson has been appointed Series Editor, to provide liaison with the publishers, and guidance for the editors of specific volumes. He may be contacted at the School of Environmental Sciences, University of East Anglia, Norwich NR4 7TJ, UK.

The Second Scientific Conference of the International Global Atmospheric Chemistry Project, took place in Fuji-Yoshida, Japan, on 5-9 September 1994.

Themes of the Symposium, organised in conjunction with the 8th Symposium of the Commission on Atmospheric Chemistry and Global Pollution, addressed greenhouse gases, tropospheric ozone, sulphur and nitrogen cycles, and aerosol and cloud chemistry. Picture from the archive of the Chair of the Organising Committee, Professor Toshiro Ogawa, University of Tokyo.

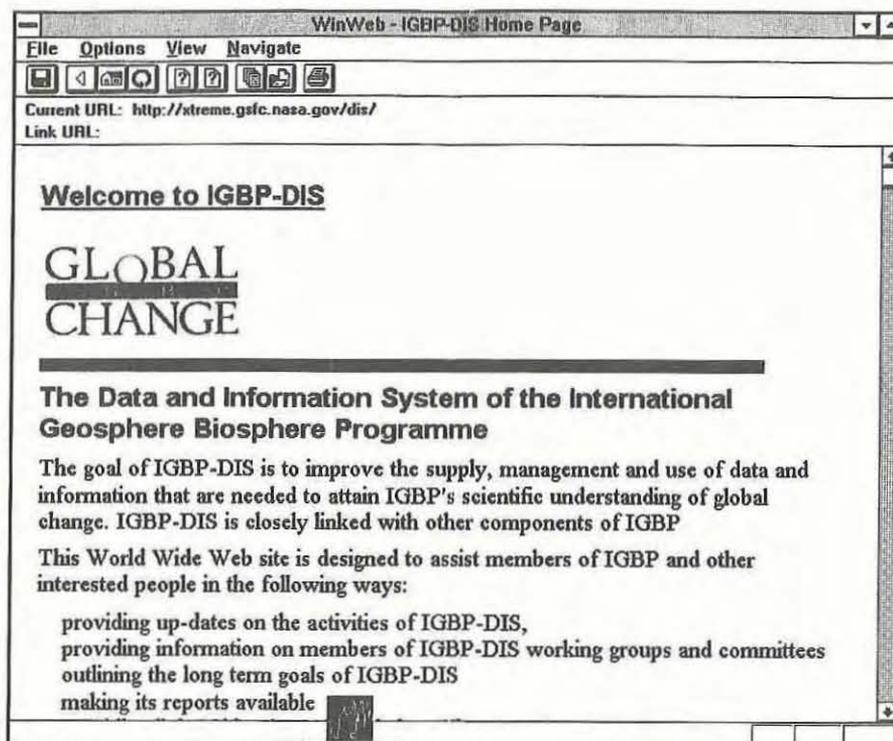


Participating at the 3rd Session of the Coordinating Committee of the World Climate Programme, Geneva, 5-7 October, 1994. From left to right: Gordon McBean (Deputy Minister for the Environment, Canada), René Gomme (Coordinator, Agrometeorology Group, Food and Agricultural Organisation), Gisbert Glaser (Director, Bureau for Coordination of Environmental Programmes, Unesco)



The three dimensions of global change - climate, ecosystems and people - was the theme of the IGBP/ICSU exhibit at the UK festival of science in September 1994. This event, held at Loughborough by the British Association for the Advancement of Science, included a four-day programme of public lectures on global environmental research. Among the speakers was Julia Marton-Lefevre (Executive Director of ICSU), shown here at the exhibit prepared by the UK National IGBP Committee.

## IGBP-DIS on the Internet



The International Geosphere-Biosphere Programme's Data and Information System, in co-operation with the University of Maryland Department of Geography, has produced a World Wide Web (WWW) server on the INTERNET.

The Uniform Resource Locator (URL) is:

<http://xtreme.gsfc.nasa.gov/dis/>

The IGBP-DIS World Wide Web site is currently capable of disseminating information regarding IGBP-DIS as well as linking users to related information across the globe.

From the Home Page pictured here, the user can link to important information regarding IGBP-DIS on a "what's new" page, and further to related information regarding IGBP meetings and committees.

Users interested in more information will be capable of downloading IGBP-DIS working papers in their original form, with no other intervention. Plans are now underway in IGBP for a broad extension of the information provided.

## The World Wide Web

First developed for the US Defence research laboratories, the remote network Internet is today largely widespread to university centres. Rapidly adopted as a strategic means for international communications, its widespread use began with electronic mail, but this has grown to include data transfer and the possibility to work on a remote computer from one's own work station. All of these applications are made available through software specific to the Internet world, such as the File Transfer Protocol (FTP) - for data transfer - and the Telnet program - for work sessions on remote machines. In the same way, the European Laboratory for Particle Physics (CERN) in Geneva, Switzerland, created in 1989 an even faster-growing technology as a way for scientists to publish and search for complex documents on

the Internet. It was called the World Wide Web - known as WWW, W3 or simply the Web.

### What is the Web?

The WWW model is designed around the idea of open data transfer systems capable of operating on and transferring data between multiple platforms, all connected to the Internet. It is based on two fundamental principles: on the one hand, the servers which give out information, on the other hand, the potential clients who search, find, and finally access this information through Client software - commonly named Browsers.

It was not until early this year that the National Center for Super Computing Applications (NCSA) revolutionised the world of the WWW by developing the first Graphical User Interface (GUI) Browser offering a very powerful and convenient tool. First the commands are given through

pull down menus and "hot links", rather than complex command line strings (used by the old browsers). Second, the WWW can be organised around a series of pages, including a Home Page with BOTH text and pictures (see the IGBP-DIS Home page above). Indeed, the pages can contain text, as well as pictures, forms, movies or any disparate binary data type possible. Once a WWW page has been transferred, it is stored on the client machine where it can be saved, printed, etc.

Navigating on the WWW is easy even for inexperienced computer users thanks to the HyperText Links. HyperText Links are highlighted blue text or picture areas that instruct the WWW browser where to find more information on the related area. Just a click of a mouse button on the blue area, and the browser jumps quickly from this related source of information to another, regardless of where in the world this information resides, no matter which computer the data was created on, or served

by. This is called the HyperText Transmission Protocol (HTTP).

This very innovative protocol allows for great economy of data storage, since data need only reside in one place, but can be accessed from several server sites. Users can easily make their data available to their comrades as well as the User Community without need to transfer and store large amounts of data in several places. Users can contact the needed WWW server and access whatever data they need, knowing that data will always be stored at one WWW server.

### How can we use the Web for obtaining information ?

If you want to access information from anywhere in the world, the first step in joining the WWW community is to become a Client with a WWW client software. WWW client software, or Browsers, are available for nearly every platform. This allows most users, irrespective of the type of computer they are using, access to WWW data.

In order to become a WWW client you must 1) have a computer connected to the Internet (if you use a modem, the speed the information travels the telephone line should not be slower than 9600 bits per second), 2) have a copy of a WWW client software.

Actually two popular versions of WWW client software exist: one is created by the NCSA at the University of Illinois Urbana/Champaign. The client software is NCSA's Mosaic. The other one has just been created by Netscape Communication - by Marc Andressen who created the Mosaic software and then left the university to create his own company. The client software is Netscape. Both are Graphical User Interface Browsers. Both can receive information from WWW servers. Mosaic is in the public domain (free) but made of bits and pieces which require installation by people within your organisation already familiar with the WWW. Netscape is also in the public domain but may be commercial in the future. The software is in one piece, and very easy to install. Since its launch two weeks ago, 45% of client software programmes are now Netscape.

For more technical information, please follow the "Client" procedure described in What to do to get on.

### How do you make information available via the Web?

If you want to make information available via the WWW, you have to create your personal WWW server.

Actually two WWW servers are recognised throughout the world: the NCSA

server and the CERN server which will be soon joined by a third one, the Netsite server from Netscape communication. It is based on a very simple principle: the WWW CERN or NCSA servers spawn new WWW servers (for example yours) initiated by the client software (described above). In order to help you in installing your server, the CERN or NCSA servers offer you WWW server software for Macintosh, PC's VMS, and nearly every flavour of UNIX operating system. The software programmes are in the public domain, and appear to be rather robust. They require very little CPU time and disk space.

The WWW servers are also able to serve existing data and information through Internet protocols such as FTP, Telnet, Gopher (an alternative transfer protocol). This backwards compatibility offers the Users one of the least painful alternatives for making information available.

In order to create a WWW server you must 1) have a computer connected to the Internet (if you use a modem, see paragraph above), 2) have a copy of a client software (Mosaic or Netscape), 3) have a copy of the WWW NCSA or CERN server software, 4) configure your personal server from your Mosaic or Netscape software.

### What to do to get on

Users wishing to receive and install a copy of NCSA's Mosaic or Netscape can follow two paths:

1) receive Mosaic from the anonymous FTP NCSA server at <ftp.ncsa.uiuc.edu>, name: anonymous, password: your e-mail address. For a SUN workstation, the pre-compiled compressed version is located under the Web/Mosaic/Sun/binaries directory. The more recent version is the 2.4 one. Because Mosaic is made of bits and pieces, you need to download the utility programs (in the viewers directory) in order to load pictures, sound, etc..

2) receive Netscape from the anonymous FTP Netsite server at <ftp.mcom.com>, name: anonymous; password: your e-mail address. For a SUN workstation, the pre-compiled compressed version is located under the Netscape/UNIX directory. More recent version is the 0.96 one. All utility programs are included in the software which do not need a particular installation.

The Client software can obtain information from WWW servers by a Uniform Resource Locator (URL) or by another protocol (such as FTP) if the target server is not a WWW one. URLs are merely a convention being accepted to describe and cite the location and transfer method for receiving data. A URL consists of the protocol name, followed by a colon and two slashes. Next, the server name and the

directory path of the resource are listed. For example, the URL for NCSA and their WWW software is, <ftp://ftp.ncsa.uiuc.edu/Web/>, where <ftp://> is the protocol, <ftp.ncsa.uiuc.edu> the server name and [/Web/](#) the target resource. Unfortunately, downloading time can not be foreseen. It can take time to access to WWW data either because your modem speed is too slow or because you are travelling virtually around the world a lot of times!

Documentation for NCI Mosaic can be found on-line from NCSA Home Page at <http://www.ncsa.uiuc.edu> if you already have the HyperText Transmission Protocol. For those users having difficulty finding expertise in the WWW or installing the browser Mosaic, "The Mosaic Handbook" can be obtained from Digital Media Group, O'Reilly and Associates, Inc, 103A Morris Street, Sebastopol, CA 95472-9902, USA. This text also includes a disk or CD with a copy of Enhanced NCSA Mosaic created by Spyglass Inc. The text exists for PC's, Macintosh and Unix with W-Windows.

Users wishing to receive a copy of CERN or NCSA server software, can find information at <ftp.info.cern.ch> with the list of WWW servers and clients around the world.

E-mail addresses: [info@mcom.com](mailto:info@mcom.com) for Netscape  
[info@ncsa.uiuc.edu](mailto:info@ncsa.uiuc.edu) for Mosaic  
[info@cern.ch](mailto:info@cern.ch) for Cern

### The way ahead

The WWW model holds great promise for the user community looking to make information and data available to the estimated 3 million Internet users worldwide, in an easy system to understand and manage. Browsers such as NCSA Mosaic and Netscape are on the ramp to the Information Superhighway, that will speed up the distribution of data and information to the global community. Through the decision in IGBP for a broad extension of the information provided on WWW, a mechanism has been established to make sure that information will be spread and available from anywhere in the world.

David Lance Wolf, AVHRR Pathfinder Coordinator,  
Department of Geography, University of Maryland,  
College Park, 1138C LeFrak Hall, College Park,  
MD 20742, USA, E-mail: [dwl137@umail.um.edu](mailto:dwl137@umail.um.edu)

Blandine Lurin, System Analyst IGBP-DIS,  
4 Place Jussieu, F-75252 Paris Cedex, France,  
E-mail: [lurin@biogeodis.jussieu.fr](mailto:lurin@biogeodis.jussieu.fr)

## A Global Change Sampler on the Internet

### EcoNet

Network of mainly environmental, non-profit, non-governmental organisations, available locally in many countries for a low fee. Send a blank message to econet-info@igc.apc.org for information, telnet igc.apc.org or use the URLs: gopher://igc.apc.org or http://www.econet.apc.org.

#### *Econet-newsgroups relevant for Global Change.*

**climate.news:** Newsletters and news items on climate change issues  
**africa.ghg:** Group to facilitate regular communication amongst the African country teams carrying out green-house gas inventories under the GEF/UNEP project on country case studies on sources and sinks of greenhouse gases.  
**climate.forum:** Discussion of earth climate, and the effects on it of pollution and other hazards. Discussion of global warming.  
**iucc.climfacts:** UNEP Information Unit's factsheets on Climate Change  
**gef.report:** Documentation on the Global Environment Facility  
**inc.climate:** This UNCED-related conference contains information about the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change.  
**apc.climate:** To plan and discuss APC's work on Climate Change activities, especially but not exclusively the upcoming events.  
**env.newsletter:** This is a read only full-text library of periodicals, occasional publications and papers published by organisations active in local, regional, national, and international environmental issues.  
**energy.mdb:** News and discussion of the energy policies and practices of the multilateral development banks (The World Bank and the development banks); the Global Environmental Facility (GEF); and bilateral lending agencies.

#### *Other discussion groups on the internet (Newsgroups, free of charge):*

**sci.geo.meteorology** (meteorology, low volume)  
**sci.environment** (general environmental issues, high volume, lower quality)  
**sci.geo.hydrology** (hydrology, low volume)  
**sci.bio.ecology** (ecology, low volume, high quality)  
**sci.bio** (general biology, high volume)

### Documents and Texts

(URL = Uniform Resource Locator)

#### *General Introduction to the Internet:*

Gaffin, Adam. "Big Dummy's Guide to the Internet", available at many computing centers or by FTP:

**ftp.eff.org/pub/Net\_info/Big\_Dummy/bigdummy.txt**,  
 URL for WWW (World Wide Web)  
**file://ftp.eff.org/pub/Net\_info/Big\_Dummy/bigdummy.txt**

#### *Subject Guides:*

Subject guides are thematic guides to the resources of the internet, they are regularly updated. An overview is given through anonymous FTP from host: **una.hh.lib.umich.edu**, the path is: **/inetdirsstacks**, by URL for WWW: **gopher://una.hh.lib.umich.edu/00/inetdirsstacks**.

#### *Subject guides for biology and environmental sciences:*

Briggs-Erickson, Toni Murphy: A Guide to Environmental Resources on the Internet. Available by anonymous FTP from **una.hh.lib.umich.edu** path: **/inetdirsstacks**, file: **environment:murphybriggs** or URL: **gopher://una.hh.lib.umich.edu/00/inetdirsstacksenvironment%3Amurphybriggs**

Nickerson, Gord. "Environment Resources." URL: **file://hydra.uwo.ca/libsoft/ENVIRON.WFW**

Smith, Una. "A Biologist's Guide to the Internet." URL: **file://rtfm.mit.edu/pub/usenet/news.answers/biology/guide**

Drew, Bill. "Not Just Cows.", subject guide for agriculture, URL: **gopher://snymorva.cs.snymorva.edu/hh/GOPHER\_ROOT1: not\_just\_cows.html**

#### Global Change Publications

Jan Schloerer: "Where to Read about Climate Change?", available from the author, **SCHLOERER@rzmain.rz.uniulm.de**, updated every 6 months, posted in **sci.geo.meteorology**.

Agenda 21 and other documents from the Rio Conference can be retrieved from the gopher of the United Nations Environment Programme (UNEP), URL: **gopher://nywork1.undp.org**

### Information Systems (World Wide Web, Gopher etc.)

*A good starter is:*

**http://www.einet.net/galaxy/Community/The-Environment.html**

**http://www.gsfc.nasa.gov/GSFC\_homepage.html**

The home page of the Goddard Space Center, producer of the Global Change Master Directory (GCMD) offers a comprehensive source of information about worldwide Earth science data holdings

**http://gcmd.gsfc.nasa.gov/gcmdonline.html** takes you to the Directory

**gopher://gopher.ciesin.org**, URL: **http://www.ciesin.org**  
 Consortium for International Earth Science Information Network (CIESIN), contains environmental policies, conference information, full text of world treaties, searchable environmental sources and unpublished papers.

**http://kaos.erin.gov.au:80/erin.html**,

**gopher://kaos.erin.gov.au**

ERIN: Network linking the Australian Nature Conservation Agency, the Australian Heritage Commission, the Commonwealth Environment Protection Agency, and the Department of the Environment, Sport and Territories.

**gopher://lternet.edu**

LTER - (Long Term Ecological Research gopher) Includes datasets, conferences, bibliographies, meeting abstracts, etc.

**telnet://envirolink.org**, login: gopher. URL: **http://envirolink.org**

Envirolink Network: Bibliographies on statistical resources and other documents relevant for researchers and environmentalists

**http://www.dkrz.de/**

Max Plack Institut for Meteorology in Hamburg, climate research,

**http://www.met.fu-berlin.de/english/IGBP/index.html**

IGBP Berlin, German IGBP Committee Newsletter

**http://www.met.fu-berlin.de/Datasources/metServer.html#www**

Overview about meteorological information on the web

**http://info.cern.ch/hypertext/DataSources/bySubject/Overview.html**

The Subject Guides to the World Wide Web

and of course IGBP DIS at: **http://xtreme.gsfc.nasa.gov/dis/**

#### *Information provided by:*

Georg Hoermann, Hydrologist and Co-ordinator at the Ecosystem Research Centre of Kiel University, Schauenburger Str. 112 - D-24118 Kiel, Fax: (+49-431) 880-4083. He is also the founder of TopPoint Mailbox, a non-profit, public access to the Internet. E-Mail: **georg@geki.toppoint.de**, **schorsch@pz-oekosys.uni-kiel.d400.de**

## Personal Experiences on the Internet

### Global Networks for Global Change Research

*Georg Hoermann, Ecosystem Research Centre,  
Kiel University*

In 1987 I started to get on to what is now called the information highway. There was no highway at this time, just a few small, narrow roads linking different houses. Bit-Net/Earn was a privilege for physicists. It was the middle-ages of telecommunication. However, at this time it was clear that there was no fundamental difference between a modem link to the next building and a link to the United States. The UUCP software was free, the costs for the phone link were the only problem. In 1990, we founded a non-profit organisation in Kiel to share the costs of the phone link and for two years we have participated directly in the German Science Network. At about the same time, the computer centre of Kiel University offered e-mail, Telnet and FTP for all scientists. Netnews (world-wide distributed public discussions) were officially introduced in 1992 - four years after the first private mailbox introduced netnews. In 1988 I read my first Usenet message. It was clear to me that this medium would be the future of science and politics, shortly, the world as we know it. On the network I found all aspects of life, from rec.music.acapella (discussion group about choral music) to sci.geo.meteorology (newsgroup for meteorologists) and I still think that the Internet is the best thing ever invented since Bavarian Weizenbier (wheat beer).

The Internet's potential is enormous. Even without World Wide Web, the so called "killer application" of the network, the Internet would be the best tool to coordinate global change research. It can not only integrate scientists working on the same subject all over the world, but it can facilitate exchange between the disciplines, too. It can serve as a medium where new papers are published, data are freely available, models are distributed, curricula can be shared, advice is given etc. The technical equipment needed for e-mail and netnews is a simple PC, a modem and a phone. Many world-wide organisations use it, like EcoNet, the network of non-governmental ecological organisations. Free exchange of information has generally worked better in these networks than in science. The question is, why this potential isn't used to its full extent.

Our experiences in Kiel are to some extent typical of the practical problems linked with the introduction and use of computer networks. In Germany, our communication costs are nearly the highest in the world. The public use of computer networks was blocked in the past by a public administration which focused e.g. on X400 (ISO/OSI) standards instead of the more common TCP/IP protocols. The problems actually shift from the level of technology to the level of contents, and social implications become visible. Internet providers can easily be found, configuration of a node no longer requires a substantial knowledge of obscure UNIX-like configuration files, and PCs can be found on most scientific desktops. In past years I have had to learn that technical problems are always solved more easily than the others: organisational, financial and social.

The first problem is to get network access. Networks, as we still know them, mean a uncensored free flow of information. It is written in the netiquette, the unofficial code of conduct, that "contents are censored by the end-user" by simply ignoring it and not by the provider. This means that old authorities may lose control and may be criticised in a world wide public.

I started to use the Internet because I thought it would be a great step forward for science. Data, papers, and models could be shared over the network. The reality is pretty far from the real potential, and this is the second problem with computer networks. The most important factor for a scientific journal is peer review and there is no obstacle that limits peer review to printed paper.

Most manuscripts are already prepared electronically with word processors and could easily be distributed electronically. In the humanities, several electronic peer-reviewed journals already exist. There is no technical reason why papers typed with word processors are not distributed in (colour) postscript format or with one of the modern varieties like Adobe Acrobat. Pictures can be scanned and public domain interpreters are available at no cost. The integrity of papers could be maintained and checked by different control mechanisms from simple check-sums to encoding methods. The tasks of the publishers would shift from the production of a paper copy to information and content processing.

The third problem is easy to solve, provided there is enough money. If we want to establish global networks for global change research, we should make sure that all countries can really participate. Discussions in the netnews are limited mostly to industrialised countries. The information highway

should have slow speed lanes and should link remote areas as it does big cities. If not, the knowledge gap between rich and poor countries will grow. Computer networks could provide the means to form a true global scientific community between students, scientists, decision-makers and the general public.

### The information highways and byways: virtual travelling on the Internet

*Arne Spekat, German IGBP Sekretariat, Berlin*

Once upon a time there was a Professor, who among other so-called marvels of our modern times, detested the use of a computer. Not that he found the square/flat/colourless aesthetics of the machinery involved displeasing. His reason was simple enough though still an aesthetic one: he was unwilling to sit in front of a given object, waiting for it to do something. So, he stuck with his sharp mind and pen, plus an occasional typewriter; and lived happily ever after.

I always found this oddity amusing, if not thought-provoking. Obtaining access to the modern marvels of telecommunication does indeed put me into a comparable situation, resulting in sympathy or understanding of his point. To a degree, at least. Since I share the fate of many scientists who are less rich than they look, there is not a shiny super-fast workstation sitting on my desk, but a reasonably-priced, mid-size 486, the office counterpart to a family sedan. The only privilege - quite a large one - is a small socket in my office's wall marked EDV LINE 3. This leads me (via a whole host of expensive gadgets) into the wide world of world wide services; enough reason to be enthusiastic. Asking around in the neighbourhood had revealed to me the existence of such miracles as e-mail, the file transfer protocol (FTP), gopher, and the World Wide Web (WWW). However, I am not completely free from tortures: it always took patience and time to tune in my PC to one of these services.

My first experience was gained with e-mail, a medium I can recommend without hesitation. The ability to have a recording system for messages, accessible (in principle) from everywhere, regardless of local time, which is less expensive than using a telephone is very suitable to my personal needs. And it is (again, in principle) not a problem to mail programs, wordprocessed files or digitized pictures, as long as you are connected to a reliable host computer. Repeatedly trying to reestablish a broken connection can be very nerve-wracking.

Modern host computers have software

packages that not only enable one to put something in an electronic envelope and let the system work out how to deliver it; they allow the user to enter an active mode where (s)he has to do the searching. What a smart move! There are documents posted somewhere - and ready to be retrieved, but, beside gossip and some other programs one has to get accustomed to, like "Archie" or "Veronica" the initiative is shifted to the user. The hours seem to fly by. Connections are established and pick lists upon pick lists, some consisting of one single item: a link to another list (!). Since the word LIST starts with L it seems appropriate for some list-providers that their badly maintained alphabetic indexes already end with the letter L. Eventually, the point is reached where the actual documents are ready to be read or downloaded, would there not be a weak link or the frustrating message: LINES BUSY, TRY AGAIN SOON. HAVE A NICE DAY. Ready for another tantrum?

Newlists are another Internet-related activity. Once subscribed to an electronic bulletin board (ranging from Aardvark Sounds to ZZZCopernock) the user may participate in open discussions - something that calls for "netiquette", an adjustable ability to restrict oneself to conversation-like behaviour. And don't forget how to unsubscribe! The author has witnessed several distribution and discussion lists that emerged from workshops, all enthusiastically hailed by the participants, that ended like fish on dry land.

Commercialism has found its way into the Internet as well. Aside from the much-debated flooding of *all* newlists with advertisements by attorneys offering their services, representative of the active side of the net-commercializing spectrum, a lot of companies offer on-line access to their catalogues. Why not try Windows-3.1- shopping for some birthday presents or the computer equipment that takes advantage of over 16 million colours (and let you henceforth see all the flaws in the scanned catalogue pictures)? Even the basic reproduction of on-line pictures on the WWW, for example, requires such a high degree of expensive and commercially exploitable-computer sophistication that many countries (let alone institutions) are neither willing or able to afford this "progress".

As the bottom line of my experience I agree with the old pilot who says "If you are in a hurry, don't fly". It is very useful to keep that skeptical mind that made us become scientists in the first place.

Institut für Meteorologie, Freie Universität Berlin  
Carl-Heinrich-Becker-Weg 6-10,  
D-12165 Berlin, Germany.  
E-mail: as@zedat.fu-berlin.de

## The BAHC-IGAC-GCTE Science Task Team

*Biospheric Aspects of the Hydrological Cycle, the International Global Atmospheric Chemistry Project, and Global Change and Terrestrial Ecosystems, join in collaborative planning*

Biosphere-atmosphere exchange of certain elements and compounds is a controlling factor in climate and in terrestrial productivity. Exchanges between the atmosphere and terrestrial ecosystems are complicated because they involve physical, biological and chemical processes at the land surface, chemical and radiative processes in the atmosphere, and transport processes in both the atmosphere and terrestrial ecosystems. There are, however, many gaps in the understanding of these processes. Some of these gaps can be addressed best through co-operative field experiments and modelling efforts involving scientists with expertise in biogeochemistry and ecology of terrestrial environments and in the atmospheric and hydrological sciences. Specifically, the potential exists for beneficial collaboration among researchers involved in the BAHC, IGAC and GCTE Core Projects of the IGBP. It is necessary for these projects to identify how collaborative planning and execution of field work, modelling efforts, and partnerships with developing country scientists might lead to scientific advances and to benefits to the global community greater than an individual Core Project could achieve alone.

In recognition of this, in September 1993, the IGBP Officers accepted a proposal from the Core Project Offices to establish and hold a first meeting of a joint "BAHC-IGAC-GCTE Science Task Team". The goal of the Task Team is to ensure effective communication between the terrestrial, hydrological, and atmospheric research communities and to assist with the planning and co-ordination of joint studies.

### First Task Team Meeting identifies research areas

At its first planning meeting in Cambridge, Massachusetts, USA, hosted and organised by the IGAC Core Project Office, the Task Team discussed and developed rec-

ommendations for multi-core Project collaboration within the IGBP under three headings:

- Process studies in terrestrial environments
- Integrated modelling efforts
- Partnership with developing country scientists

Three interrelated themes were considered under process studies:

- Transects and large-scale land surface experiments (T/LSEs)
- Fire
- Wetlands

The Task Team identified three categories of T/LSEs: active/complete, planned, and conceptual. For one example T/LSE in each category, the Task Team identified actions that should be taken to insure maximum scientific benefit. The examples and underlying strategic concepts for each are:

#### *Savannas in the Long Term (SALT)*

SALT conducts water budget studies both at the site level (either detailed or simplified according to facilities available), and at the regional scale using remote sensing. Such studies might be conducted in association with BAHC in order to develop the best possible upscaling approach of local to regional water budgets. Significant added value may be realised by commingling the results of this ongoing effort with those from past BAHC (HAPEX-SAHEL) and IGAC (DECAFE) field studies that have been conducted in the same region of West Africa.

#### *LAMBADA/BATERISTA/AMBIACE*

Representatives of BAHC, IGAC and GCTE should become involved formally as soon as possible in planning for this linked land-surface experiment and biogeochemical cycling study in the Amazon region (see *Global Change Newsletters* nos. 18, June, and 19, September, 1994). Urgent action is required to avoid counter-productive duplication of effort that would result from independent planning within the Core Projects of the IGBP for related research, and from uncoordinated interac-

tion with other groups working in the Amazon.

#### *IGBP Siberian Boreal/Tundra Study*

Because of Siberia's size and uniqueness with respect to wetland and bog environments, its susceptibility to future land use change, and its potential for extensive biomass burning, this Task Team should, during the next 6 to 9 months, lead initial development of a prospectus for a co-ordinated IGBP research project in the Siberian boreal/tundra region.

The Task Team noted four aspects of fire research that would benefit from increased joint attention by BAHC, IGAC and GCTE: (1) the long-term effects on soil chemistry of burning versus protection, (2) the composition of fire plumes from a variety of regions, (3) collection and sharing of satellite data and field data for their interpretation, and (4) development of predictive capabilities for future fire frequency and extent with changing climate and land-use patterns.

The Task Team identified two main themes under which BAHC, IGAC, and GCTE research in wetlands potentially could be linked: (1) the carbon cycle in wetlands and associated stream systems, and (2) trace gas emissions, in particular those of methane and nitrous oxide.

The Task Team identified an increasingly urgent need to bring together the modelling communities within BAHC, IGAC and GCTE, and recommends that this be done in the format of a science conference on terrestrial systems modelling. The goals of such a conference should be (1) to inventory key data requirements in each of the Core Project modelling efforts, (2) to identify and develop model components for processes of common interest (e.g., C and N cycles, phenology), and (3) to develop a co-ordinated and detailed methodology for applying models across the full spectrum of scale, from point through patch and landscape to regional and global domains. The Task Team noted that it would be highly desirable for GAIM to take the lead in organising this conference in consultation with IGBP-DIS.

The Task Team agreed that BAHC, IGAC, and GCTE (and perhaps other Core Projects) can benefit from collaboration with each other in respect to their developing country interaction in several ways. Many developing countries have to be approached in a top-down fashion wherein a single, co-ordinated approach from a group of Core Projects would be better than several individual approaches. A crucial first step is often to establish functional contact networks in developing coun-



Cecilia Nyström

tries: Core Projects should share contacts and experiences. Core Projects must ensure that the three-way interaction among Core Projects, developing countries, and START, is functional and that it achieves mutual objectives.

#### **Follow-up Meeting Focuses on Northern Eurasia**

A meeting held on 2-4 November 1994 at the Royal Swedish Academy of Sciences, in Stockholm, focused on the need to de-

velop an integrated science plan for IGBP research in the Siberian boreal/tundra region. A group of 21 scientists representing BAHC, IGAC and GCTE, as well as several interest groups, worked intensively for three days to produce a draft "prospectus" for an integrated IGBP global change study for the region.

Early during the meeting it became evident that all of Northern Eurasia should be considered in developing plans for future studies of boreal/tundra systems. Although each of the three Core projects has its own set of interests in the Northern Eurasian region, all are interested in various aspects of the carbon cycle, and so this forms the unifying theme of the proposed IGBP study. The prospectus outlines a number of potential observational strategies, such as networks and latitudinal transects, and places them in the context of the biogeographical characteristics of Northern Eurasia. The Task Team also stressed the importance of simulation and aggregation tools, and described several modelling approaches and techniques, including pre-project modelling sensitivity studies to help fine-tune the observational and experimental design.

The prospectus also provides the framework for the three Core Projects to undertake related research at the same sites in a collaborative fashion. For example the proposed tundra land surface experiment, which BAHC is involved with, and GCTE's planned research on global change and ecological complexity, could both fit in nicely under the prospectus. In addition, collaboration with other IGBP Core Projects and Framework Activities, such as Past Global Change, Data and Information System, Land Use/Cover Change, and the Global Change System for Research, Analysis and Training (START), was flagged at various points. Finally, the proposed IGBP study offers a useful framework within which groups interested in the impacts of global change on specific aspects of Northern Eurasia can undertake their work.

The prospectus is still in draft form, and must be approved by the BAHC, IGAC and GCTE Scientific Steering Committees before it can be circulated more widely. Once approval is given, several activities, as recommended by the Task Team, will be undertaken to publicise the prospectus within the Russian and international global change research communities.

More information on the prospectus will be given in future editions of the *Global Change Newsletter*.

IGBP Secretariat, Stockholm

## Open Science Conferences

Several IGBP Core Projects are holding important open science conferences and symposia in 1995, and one national IGBP Committee is holding a major regional conference. They are listed here in chronological order. All interested scientists are invited to attend. Other national or more specialised open meetings planned for the second half of the year will be listed in the March Newsletter.

### Biospheric Aspects of the Hydrological Cycle (BAHC)

**3-7 April 1995,  
Congress Centre Hamburg,  
Hamburg, Germany**

#### Atmospheric and Hydrological Processes and Models at the Soil- Vegetation-Atmosphere Interface

This 5-day joint symposium held in conjunction with the XX General Assembly of the European Geophysical Society, in which the First IGBP/BAHC Science Conference is fully integrated, will address the interaction of processes and scales in an interdisciplinary way. The Symposium is co-sponsored by the International Satellite Land-Surface Climatology Project (ISLSCP).

During the first part, the general progress in the area of biospheric aspects of the hydrological cycle will be reviewed, following the overall structure of the BAHC Core Project, comprising the four research foci.

1. Development, Testing and Validation of 1-Dimensional Soil-Vegetation-Atmosphere transfer (SVAT) Models
2. Regional-Scale Studies of Land surface Properties and Fluxes: Experiments, Interpretation and Modelling
3. Diversity of Biosphere-Hydrosphere Interactions: Temporal and Spatial Variability
4. The Weather Generator Project

The second part of the symposium will be devoted to the presentation and discussion of preliminary results of two recent large-scale field experiments in boreal forest areas, carried out in Scandinavia and

Canada during 1994: BOREAS (Boreal Ecosystem-Atmosphere Study) and NOPEX (Northern Hemisphere Climate Processes Land-Surface Experiment).

Registration by 1 March 1995 to: EGS Office, Postfach 49, Max-Planck-Str. 1, 37189 Katlenburg-Lindau, Germany. Fax: (+49) 5556 4709, E-mail: [egs@linax1.dnet.gwdg.de](mailto:egs@linax1.dnet.gwdg.de), or BAHC CPO, Institut für Meteorologie, Freie Universität Berlin, Carl-Heinrich-Becker-Weg 6-10, 12165 Berlin, Germany. Fax: (+49-30) 838 71185, E-mail: [bahc@zedat.fu-berlin.de](mailto:bahc@zedat.fu-berlin.de). The registration fee for non-EGS members: 410 DM.

### Land-Ocean Interactions in the Coastal Zone (LOICZ)

**24-27 April 1995, Marine  
Science Institute, University  
of the Philippines, Quezon  
City, The Philippines**

#### The Dynamics of Global Change and the Coastal Zone

The Open Science Meeting is intended to provide an opportunity for an open review of the LOICZ Implementation Plan and to secure the commitment of scientists to participating in the research planned over the next ten years. It will not only provide a forum for scientists to report the results of on-going research, but also encourage a dialogue and initiate collaboration among individuals from the global community of coastal zone scientists interested in global change.

The meeting should result in a clearly articulated statement concerning the development and implementation of the LOICZ Project through individual, institutional and other contributions, that can be used by the Project Steering Committee to guide the implementation of this global project. Written contributions are welcome, but will not be formally presented. They will be made available to participants at registration as background documents during both plenary and small group discussions.

Contact John Pernetta, LOICZ Core Project Manager, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg, Texel, The Netherlands. Fax: (+31) 222 69430, E-mail: [pernetta@nioz.nl](mailto:pernetta@nioz.nl)

### South African National Committee for the IGBP

**24-26 April 1995, CSIR  
Conference Centre, Pretoria**

#### Regional Conference on Global Environmental Change: Implications for Southern Africa

This conference aims to present an overview of southern Africa's scientific input to global environmental change. The themes addressed are: Hydrological Systems; Climate; Oceans; Past Global Changes; Terrestrial Ecosystems; Human Dimensions - International, and Local. A Plenary Session will address IGBP/START in Southern, Central and Eastern Africa. The registration fee is R400.

Contact Mrs. Louise Botten, The SA IGBP Secretariat, Foundation for Research Development, PO Box 2600, 0001 Pretoria South Africa, Fax: (+27-12) 841 3791, or E-mail: [louise@frd.ac.za](mailto:louise@frd.ac.za) by 24 February 1995

### Joint Global Ocean Flux Study

**9-12 May 1995,  
"La Citadelle",  
Villefranche, France**

**First JGOFS Scientific Symposium.** JGOFS is organising a Scientific Symposium to synthesise the main findings since its inception in 1988 in a series of invited key-note addresses. In addition, some of the more recent results will be presented in shorter invited oral papers and there will be considerable time allocated to discussion. Provision is being made for contributed poster sessions. There will be demonstrations of databases and models.

The symposium is also designed to serve as one means of evaluating JGOFS for its sponsors SCOR and IGBP, as part of the overall ICSU and IGFA review of the IGBP. This review provides an outstanding opportunity for JGOFS to demonstrate

to a wide and critical scientific community the depth and breadth of the advances it has made. The meetings will be hosted by the French National Committee for JGOFS. Applications to participate in the Symposium will be treated on a first-come first-served basis, with consideration for regional and global representation.

Contact: Ms. Aida Starke, JGOFS Core Project Office, Institut für Meereskunde, Dusternbrookerweg 20, 24105 Kiel, FRG. Internet: jgofs@ifm.uni-kiel.d400.de Fax: +49-431-565-876 or Prof. John Field, Zoology Department, University of Cape Town, 7700 Rondebosch, South Africa. Fax: (+27-21)-685-3937, Internet: jgfield@ucthp.xuct.ac.za

## Global Analysis, Interpretation and Modelling (GAIM)

**21-25 September 1995,  
Kongresshaus in Garmisch-  
Partenkirchen, Germany**

### First International Science Conference

The GAIM conference will present global change research results of investigators in the areas of global data analysis and assessment, modelling of biogeochemical systems and their relationship to physical climate and hydrologic systems, and interpretation of current trends as indicated by global data bases and model results. Oral and Poster session topics will be grouped by time periods, including "Palaeo" (<20 k yrs), "Historical" (<2k yrs), "Contemporary" (<20 yrs), and "Future".

There will be an additional session concerned with global systems integration through Earth system models. Abstracts are being solicited from all those conducting research pertaining to the above broadly defined topics. Papers presented at the Science Conference will be published in a special section or issue of a professional journal such as *Global Biogeochemical Cycles*, or the *Journal of Geophysical Research*. The German National IGBP Committee is hosting the Conference, and arranging local logistics. The registration fee is 100 DM.

To submit an abstract for a paper presentation (deadline 1 May 1995), send a 1/2 page abstract in hard copy and a diskette or e-mail, along with pre-registration to:

the IGBP Secretariat in Berlin, Institut für Meteorologie, Freie Universität Berlin, Carl-Heinrich-Becker-Weg 6-10, 12165 Berlin, Germany. Fax: (+49-30) 8387 71217, E-mail: igbp@zedat.fu-berlin.de, or

Dork Sahagian, Complex Systems Research Center, Institute for the Study of Earth Oceans and Space (EOS), Morse Hall, 39 College Rd., University of New Hampshire, Durham, NH 03824-3525, USA. Fax: (+1 603) 862 1915, E-mail: gaim@unh.edu

## International Global Atmospheric Chemistry Project (IGAC)

**9-13 October 1995,  
Beijing, China**

### WMO/IGAC Conference on the Measurement and Assessment of Atmospheric Composition Change

Under the auspices of the World Meteorological Organisation and the International Global Atmospheric Chemistry Project, and hosted by the China Meteorological Administration, this scientific and technical conference has been called to review the progress made under the Global Atmosphere Watch (GAW) and IGAC activities to measure and to assess the impacts of world-wide change of atmospheric composition and its relation to the climate and the environment.

The conference, one of a series held every four years by the WMO, and the third annual conference of IGAC, will provide an international forum for the discussion of global issues, especially those relat-

ing to the role of GAW and IGAC measurements of global and regional importance. Special reports from GAW stations are encouraged. Furthermore, assessments of major atmospheric environmental issues will be presented and will include research results from both long-term measurement programmes and process-oriented studies on related topics. From the deliberations of this conference, it is expected that a clearer picture of both the present state of our knowledge concerning the global atmosphere environment and the future research directions of IGAC and GAW will emerge.

Invited speakers will address selected topics. Other presentations and posters will be selected based on review; deadlines for the title of the proposed presentation, by 31 January, and abstracts by 30 April.

For complete information contact: John Miller, Environment Division, AREP, World Meteorological Organisation, 41 Ave. Giuseppe Motta, CH-1211 Geneva 2, Switzerland. Fax: (+41-22) 740 0984, E-mail: john-milton.miller@itu.ch

## ICSU

### Global Change Forum

#### SAC IV

**21-27 October 1995,  
Beijing, China**

IGBP Secretariat, Box 50005, S-104 05 Stockholm, Sweden. Fax: (+46-8) 166405, E-mail: sec@igbp.kva.se.

### Please Note The START Office has moved!

START now occupies offices in the just-finished building of the American Geophysical Union.



The address is:

#### International START Secretariat

Suite 200, AGU Building  
2000 Florida Avenue N.W.  
Washington, DC 20009, USA.

Tel: (+1-202) 462 2213,

Fax: (+1-202) 457 5859

E-mail: hvirji@kosmos.agu.org

## Publications

### Project Publications

#### Past Global Changes.

**PAGES Workshop Report 94-2**  
INQUA-PAGES Workshop on Palaeomonsoons in Africa and Surrounding Oceans: The Last 200,000 Years, edited by Stefan Kroepelin, and PAGES START Workshop on Past Global Changes in Africa, edited by Eric Onyango Odada. Recommendations for Research. 49 pp.

**PAGES Workshop Report 94-3**  
International Marine Global Change Study (Images). Science and Implementation Plan. 37 pp. (Published in collaboration with the Scientific Committee on Oceanic Research).

PAGES Core Project Office, Bärenplatz 2, CH-3011 Bern, Switzerland. Fax: (+41-31) 312 31 68

#### South Asian Planning Committee for START (SASCOM)

SASCOM Global Change News Letter, No. 1, April 1994.

Directory of Scientists Working in Global Change in South Asian Region (First Edition). New Delhi, National Physical Laboratory. (Global Change Series, SASCOM Scientific Reports, No. 1, July 1994)

Issues and Perspectives of South Asian Region, by AP Mitra. New Delhi, National Physical Laboratory. (Global Change Series, SASCOM Scientific Reports, No. 2, July 1994)

START Regional Research Centre, NPL, Dr. K.S. Krishnan Marg, New Delhi, 110 012, India

## National Research

#### Belgium

IGBP and "Global Change" Related Research in Belgium, II. (1994). Edited by O. Vanderborcht & E. Janssens. Brussels, National Committee IGBP, 259 pp.

Elly Janssens, Royal Belgian Academies of Sciences, Palais des Académies, 1, rue Ducale, B-1000 Brussels, Belgium. Fax: (+32-2) 511 0143

#### Germany

IGBP-Sekretariat der Bundesrepublik Deutschland (1994). Report of the 4th Meeting of National IGBP Committees, Bonn-Bad Godesberg (Germany), 13-16 March 1994, edited by Sabine Lütkekeimier. Berlin: Deutsche Forschungsgemeinschaft, 114 pp.

The meeting in Bonn was the largest gathering until now of National IGBP Committees, and has

been the object for the first time of a published report of the national and international science initiatives presented at the meeting, including discussions on interactions between National IGBP Committees and other IGBP bodies. IGBP Sekretariat, Institut für Meteorologie, Freie Universität Berlin, Carl-Heinrich-Becker-Weg 8-19, D-12165 Berlin, Germany.

#### Japan

Global Environment Research of Japan in 1993; 171 pp., Final Reports for Projects Completed in 1993, 224 pp.

Contact Kazuhiko Takemoto, Director, Research and Information Office, Global Environment Department, Japan Environment Agency, 1-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan. Fax: (+81-3) 3504 1634

#### Netherlands

Sustainable Resource Management and Resource Use: Policy Questions and Research Needs. 270 pp.

Council for Research on Nature and Environment, PO Box 5306 NL-2280 HH Rijswijk, The Netherlands. Fax: (+31-70) 336 4310

Global Change and Sustainable Development. A modelling perspective for the next decade. 80 pp.

A. Van der Giessen, RIVM, Antonie van Leeuwenhoeklaan 9, PO Box 1, NL-3720 Bilthoven, The Netherlands. Fax: (+31-30) 74 29 71

#### Poland

Global Change: Polish Perspectives (1994), edited by Leszek Starkeł & Malgorzata Gutry-Korycka. Warszawa, Polish National Committee International Geosphere-Biosphere Programme, 136 pp. (Special series of *Geographia Polonica*), Institute of Geography and Spatial Organisation of the Polish Academy of Sciences, No. 62.

Leszek Starkeł, Polish Academy of Sciences, Sw. Jana 22, PL 31-018, Krakow, Poland.

Newsletter of the Polish National Committee for IGBP, No. 1, May 1994.

This first issue gives an overview of the Polish programme, membership of the committee, a chronicle of IGBP events and plans.

M. Gutry-Korycka, Faculty of Geography and Regional Studies, Warsaw University, 30 Krakowskie Przedmieście Str., PL-09-927 Warszawa, Poland.

#### USA

GOALS (1994) Global Ocean- Atmosphere-Land System for Predicting Seasonal-to-Interannual Climate. A Program of Observation, Modeling, and Analysis. Climate Research Committee, Board on Atmospheric Sciences and Climate, Commission on Geosciences, Environment, and

Resources, National Research Council. Washington, DC: National Academy Press. A limited number of copies are available from the National Research Council, 2101 Constitution Avenue, NW, Washington, DC 10418-0001, USA.

## Related Organisations

#### Intergovernmental Panel on Climate Change

Radiative Forcing of Climate Change. The 1994 Report of the Scientific Assessment working Group of IPCC. Summary for Policy Makers. Meteorological Office, Hadley Climate Centre, Bracknell (UK). 28 pp. IPCC Secretariat, World Meteorological Organisation, 41 Av. Giuseppe Motta, CP 1300, CH-1211 Geneva, Switzerland

#### Human Dimensions of Global Environmental Change

HDP (1994). Human Dimensions of Global Environmental Change Programme: Work Plan 1994-1995. 45 pp. (Occasional Paper, 6).

Ellen Wiegandt, Scientific Director, HDP Office, 11A avenue de la Paix, CH-1202 Geneva, Switzerland. Fax: (+41-22) 733 30 49, E-mail: HDP@hei.unige.ch

#### New Newsletter - from the Global Climate Observing System (GCOS)

The GCOS Joint Planning Office in Geneva has announced the introduction of its Newsletter; the first issue is dated March 1994. To be kept up-to-date on the activities of the Joint Scientific and Technical Committee of GCOS, including the progress of the oceanic and terrestrial observing systems, write for a courtesy subscription of the GCOS Newsletter to: GCOS Joint Planning Office, World Meteorological Organisation, PO Box 2300, CH-1211 Geneva 2, Switzerland, Tel: (+41.22) 730 8401, Fax: (+41.22) 740 1439

## GLOBAL CHANGE NEWSLETTER

Edited by Suzanne Nash  
Newsletter requests and change of address information should be sent to:  
the IGBP Secretariat  
The Royal Swedish Academy of Sciences  
Box 50005, S-104 05 Stockholm, Sweden  
Tel: (+46-8) 16 64 48  
Fax: (+46-8) 16 64 05  
e-mail: sec@igbp.kva.se

## International Project Seeks Volunteer Teachers

Under the auspices of the Global Atmosphere Watch (GAW), a World Meteorological Organisation (WMO) programme, The International Geosphere-Biosphere Programme's International Global Atmospheric Chemistry Project (IGAC) and the Global Change System for Analysis, Research and Training (START), the American Geophysical Union is recruiting an international team of lecturers to help establish atmospheric chemistry programmes at universities and training centres in developing countries. GAW, an integral part of the World Climate Programme, plays a key role in determining whether the composition of the atmosphere is changing and if so, how, where, and in what ways. GAW's primary focus is on atmospheric chemistry.

The new volunteer teaching corps will help build the capacity for atmospheric chemistry in developing countries. The volunteer also will work to establish long-term co-operative arrangements with academia global research and monitoring programmes, and professional societies.

The lecturers will teach for 2-4 weeks of a given location and then turn the class over to another lecturer. Although lecturers will receive no honorarium, they will be reimbursed for travel and per diem.

Lecturers will be chosen by a committee comprised of representatives from GAW, IGAC, and START in collaboration with the Inter-American Institute for Global Change Research (IAI).

The National Science Foundation has granted funds for the first courses to be taught in South America beginning during the Austral Winter of 1995. To volunteer, send in the form below to:

American Geophysical Union  
2000 Florida Ave, NW  
Washington, DC 20009, USA

Attn: Dr. Eugene W. Bierly, Director, Education & Research

### International Programme for Training of Atmospheric Scientists

Yes, I am interested in participating as a volunteer teacher in the international programme for the training of atmospheric scientists and provide the following information which will be added to the data base related to this activity

Name \_\_\_\_\_

Affiliation \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_

Fax \_\_\_\_\_

E-mail address \_\_\_\_\_

Areas of Expertise in which participation as a course instructor/lecturer is possible \_\_\_\_\_

Relevant Teaching Experience \_\_\_\_\_

Language Abilities \_\_\_\_\_

Time periods during the year when your availability is most convenient to you and to your employer (please name months) \_\_\_\_\_

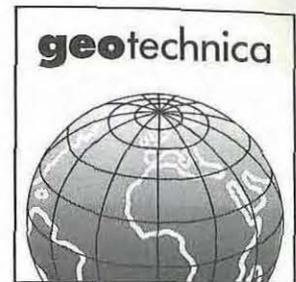
Areas of the world in which you would be prepared to instruct \_\_\_\_\_

# Earth

## conservation

The challenge for science and technology

International Trade Fair and Congress for the Geosciences and Geotechnics



Cologne, 2 - 5 May

# 1995

The preservation of the natural habitats of the earth – both for ourselves and for our descendants – has for some time provided a common global objective for the fields of economics, science and politics and geotechnology. The earth sciences and geopolitics now have a true international forum – geotechnica. geotechnica presents the complete world spectrum of currently available earth science – and geotechnical-related specialist know-how under one roof – from mining to environmental technology, from detection of former waste disposal sites to re-development, from waste disposal to recycling. geotechnica presents it all. In parallel with this specialist event the geotechnica congress will take place once again from 3rd to 5th May. The general theme of the congress will be “Geosciences and geotechnology poised between ecology and economics – from resources to recycling” and will cover in-depth the essential life elements for continued human existence on planet Earth – soil and water, air and climate.

### geotechnica '95: A forum for the world at the heart of Europe

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FairTeam AB, Strandvägen 57, 11523 Stockholm, Tel. 08-6 61 91 41, Telex 14524, Telefax 08- 6 65 10 03

Please send me:  Exhibitor information  
 Visitor information  
 Congress information

Address \_\_\_\_\_

Global Change GB

**Köln Messe**

# Core Project Officer Core Project Scientist

## **Biospheric Aspects of the Hydrological Cycle (BAHC) A Core Project of the International Geosphere-Biosphere Programme**

BAHC invites applications for two positions in the Core Project Office (CPO), to be based at the Potsdam Institute for Climate Impact Research (PIK) in Germany.

BAHC is an interdisciplinary project which was established to study the role of vegetation in hydrological interactions between land surfaces and the atmosphere. As such, it combines and integrates expertise over wide temporal and spatial scales in the fields of hydrology, ecology, soil science, meteorology, modelling and information systems. The project is now being implemented and has operational goals which address specific questions of interactions with physical processes. BAHC co-operates closely with other IGBP, WCRP, UNESCO and IHP projects and programmes.

We are seeking candidates with the following qualities:

- A PhD in a relevant scientific discipline
- Experience in collaborative national/international projects
- proficiency in written and spoken English and another language
- Flexible, well-organised and able to work independently, and in interactive projects
- Able to develop, integrate, generalise and present research programmes and issues

The Core Project Officer will

- Work with CPO staff and the SSC towards development and implementation of BAHC research agenda
- Liaise liaison with the IGBP Secretariat, Core Projects and other programmes
- Represent the Core Project at relevant national and international meetings
- Work closely with other staff in budgeting, funding proposals, and in other administrative aspects of the programme

The position of Core Project Scientist requires candidates with:

- Knowledge and experience in modelling vegetation dynamics
- Knowledge of GIS systems operating under a UNIX environment
- Experience in hydrology with special emphasis on soil hydrology, modelling of land surface-atmosphere interactions
- Contribution to development of aggregated data sets from the large scale land surface-atmosphere interaction experiments
- Contribution to global data set initiative, in co-operation with IGBP-DIS and the International Satellite Land-Surface Climatology project (ISLSCP)
- Development of interactive mesoscale hydrological vegetation-atmosphere models for combined studies of climate and human-induced climate change.

The positions are available from 1 March 1995 and the closing date for applications is 1 February 1995. The appointments may be for a period of two years, with the possibility of renewal. Salary will be within the range BAT IIa and will take account of experience and qualifications of the candidate and the costs and benefits of living in Germany.

Letter of application, including a curriculum vitae and the names of three referees, should be sent to: Dr. Helen Lee, Head BAHC CPO, Institut für Meteorologie, Freie Universität Berlin, Carl-Heinrich-Becker Weg 6-10, 12165 Berlin, Germany. Further information can be obtained from the CPO by phone (+49-30) 838 711 84, Fax: (+49-30) 838 71185, or E-mail: helen@pik-potsdam.de

