

International Group of
Funding Agencies for
Global Change Research

IGFA

National Highlights

EC Joint Research Center
Ispra, Italy
October 26 - 29, 1998

The International Group of Funding Agencies for Global Change Research (IGFA) is an informal group of representatives of agencies and ministries of 21 countries and the EU, responsible for the funding of global change research. The purpose of the Group is to facilitate international global change research in the natural, social and economic sciences by bringing the perspective of these national funding agencies to strategic planning and implementation of such research.

IGFA's goals are:

- (i) internal communication about funding issues;
 - (ii) communication with the international organizations dealing with global research issues;
 - (iii) addressing specific issues related to global change research and its funding.
- Once a year IGFA has a plenary meeting

Additional copies of this report may be obtained upon request from:

The IGFA secretariat, c/o The Research Council of Norway

P.O. Box 2700, St. Hanshaugen

OSLO N-0131

Norway

tel.: +4722037207

fax: +4722037278

E-mail: igfa@forskningsradet.no

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INTRODUCTION

26-29 October 1998 IGFA had its annual plenary meeting at the EC Joint Research Center at Ispra, Italy. The meeting was attended by representatives of research funding organizations in 18 countries and the EC, and representatives of the international research programmes WCRP, IGBP, IHDP and DIVERSITAS.

Presentations on relevant developments in the countries have a prominent place on the agenda of the annual plenary meeting of IGFA. Representatives submit brief written communications and deliver brief oral presentations. The presentations give insight in the position of global change research on the national policy agendas, in the funding structures and trends in the funding of global change research in IGFA member countries.

At the 1998 meeting IGFA paid special attention to the research activities and funding on biodiversity and human health related to global change. In many of the national presentations these issues were explicitly dealt with.

AUSTRIA

GLOBAL CHANGE RESEARCH

1. General information/Highlights 1998

Austria does not have a separate program for Global Change (GC) Research; projects concerning GC research are part of other research programs. Plans are to bring together the various existing interest groups, involved organizations and activities under one umbrella coordinating structure, a council for GC research. At present, public funding for GC research comes mainly from the Austrian Federal Ministries for Science and Transport, for Agriculture and Forestry and the Environment, Youth and Family, the Austrian Academy of Sciences and the Austrian Science Fund.

1.1 Human Dimensions of Global Change Research in Austria

In the context of the upcoming joint IHDP/ENRICH Human Dimension Symposium in Bonn in November 1998, an extensive survey on existing and proposed research projects, analysis and strategic implications concerning IHDP research in Austria has been carried out under the initiative of the Ministry of Science and Transport (Study: Albrecher, H., S. Hasenhüttl, R. Königseder, F. Ott, F. Pretenthaler, K. Steininger 1998, *The Human Dimensions of Global Environmental Change: A Survey on Austrian Research Activities*). 220 researchers were contacted; about 56 projects were identified that comply with so far defined IHDP projects in the programs LUCC, GECHS, IDGC, IT, HDWATER, HEALTH&GEC or START. Project finance volume of these projects aggregates to about 20 mio. ATS (1.7 mio. US\$) per year.

Particular IHDP research expertise was identified in the following areas:

- Sustainability: concepts, measurements and implementation;
- Climate change and mitigation measures, with special focus on biomass use;
- Human dimension research of global change in alpine regions;
- Environmental political sciences, risk and uncertainty; and
- Industrial Transformation.

Concerning the institutional backing of the growing community in this field, the report recommends close cooperation with existing institutions, partic. the Austrian Network for Environmental Research (ÖNUF), the Austrian Global Change Committee at the Austrian Academy of Sciences and IIASA.

As a result of this study, IHDP will be focus point of the socio-economic node of the Austrian Network for Environmental Research for the next 2 years, starting January 1999. The node itself will be designed as a conglomerate of 4 active institutions involved in IHDP research in order to get strong expertise in this broad field of research.

1.2 Workshops/Symposia

Under the auspices of the Austrian EU-Presidency, activities during 1998 focused on international workshops and conferences rather than on new projects. Examples are the European Climate Science Conference in Vienna, 19-23 October 1998, an event jointly organized by the European Commission and the Austrian Ministry for Science and Transport. Results of some 120 projects from the area of natural climate system and natural hazards were presented and discussed, which will provide input for the working paper on the 5th Framework Program of the European Union.

Parallel to this event, the 2nd European Conference on Applied Climatology was held in Vienna, organized by the Austrian Central Institute for Meteorology and Geodynamics, supported by the Austrian Ministry for Science and Transport, the European Commission, WMO and the European Climate Support Network (ECSN). Aim of this conference was to provide a platform for exchange with the user community, e.g. tourism, utilities, insurance companies, planners.

2. Health and Biodiversity

The research field of biodiversity is a national focal point in the research agenda of the Austrian Ministry of Science and Transport involving various biodiversity topics. Coordinative support for biodiversity research is provided by the node Biodiversity of the Austrian Network for Environmental Research. The Austrian Academy of Sciences together with the Austrian Ministry for Agriculture and Forestry funded research in the field of Heremoby of Austrian forest ecosystems within the MAB program. This project was designed to provide a survey of the naturalness of Austrian forests covering the entire Austrian territory, which makes it a unique project. The Austrian Ministry of the Environment, Youth and Family supports biodiversity research connected with research areas on protected natural areas in connection with policy and implementation issues.

GC Research in the health sector has not been a major point so far. Austria is involved in Health &GEC research with two projects (HEALTH&GEC.1.Kollmann/Porta and HEALTH&GEC.2.Matuschek). Recently, the Ministry of Environment, Youth and Family initiated a project Austrian Project on Health Effects of Particulates, with support from the Ministry of Science and Transport and all Austrian provinces, that is planned to run 4 years.

3. Glue Money

Glue money is provided at various levels:

- Austrian Academy of Science: the committee on GC research has operating money for organizing IGBP and WCRP related projects within Austria.
- The Austrian Ministry for Science and Transport provides glue money for feasibility studies and activities regarding the organization of GC research in Austria.

Examples include:

- in context with the set-up of IHDP research in Austria, initiative money was provided for the status quo report on Human Dimensions of Global Environmental Change. A survey on Austrian Research Activities. Results of this study have shown a higher potential of researchers involved in IHDP themes than expected. Therefore, as mentioned in point 1, the socio-economic node of the Austrian Network for Environmental Research will emphasize on IHDP for at least 2 years. Glue money for this node is provided for personnel and organizational activities.
- The Austrian Ministries for the Environment, Youth and Family and for Agriculture and Forestry also support GC activities with glue money for organizational matters and specific policy-related topics.

4. Global observing systems

In the frame of the Global Atmospheric Watch Program of the WMO, Austria runs several measurement stations, e.g. the station Sonnblick, that focuses on the collection and analysis of global and supraregional meteorological and air chemistry data, and the stations in Kremsmünster, Vienna and Linz, that provide data series to the network. The Austrian Federal Environment Agency (Umweltbundesamt), which is directly linked to the Austrian Ministry for Environment, Youth and Family is in charge of the station Sonnblick. Further, the southern Laboratory of the Austrian Federal Environment Agency in Klagenfurt should be mentioned, since it turned out to be one of the 7 best laboratories in a contest of the Atmospheric Science Research Center concerning analytical methods and quality management, is specialized on precipitation and air-emission measurements.

Austrian research activities in the area of global observing systems involve:

- Organization of a global observation system related to the monitoring of climate related changes in high alpine ecosystems by the University of Vienna (Prof. Grabherr); the projects focus is on fostering results on the mechanisms leading to such changes. This project is part of IGBP's activities to prepare a mountain research agenda for IGBP. Prof. Grabherr is part of the international working team in IGBP. The Austrian Ministry of Science and Transport will provide glue money for a feasibility study in that context;
- EUREKA project ALPTRAC, that focuses on the large-scale transport of pollutants in Alpine regions;
- Research efforts of the two Austrian research institutions Joanneum Research and Seibersdorf, that focus on the area of remote sensing (GIS, application of GIS for environmental questions such as sustainable landuse and –management, etc.); and
- Project ‚Austrian Carbon Balance Model‘ (part 1 is concluded; part 2 starts soon). The overall aim of this project is, to assess all reservoirs and flows of carbon compounds in Austria, based on dynamic simulation models. Coordinating contractor: Austrian Research Center Seibersdorf; partners: Joanneum Research Austria and Institute for Industrial Ecology. The project is funded jointly by the Austrian Ministries for Science and Transport, for Environment, Youth and Family and for Agriculture and Forestry.

5. Research activities with developing countries

- The Commission for Development Issues, organized by the Academy of Sciences, supports small local projects in developing countries, partially related to GC.
- The Austrian Federal Ministry for Foreign Affairs supports applied research concerning development co-operation for some years. Specifically, these activities include a program for protection of tropical forests and indigenous communities (e.g. applied research on fish- and fauna management in over-stressed rain forest environments; studies for the marketability of non-timber forest products). All of these projects are NGO driven and organized directly in co-operation of an Austrian or European NGO and the operating NGO in the target country.

6. Evolution of funding levels for global change research - new priorities

Most likely, funding for GC research will not increase significantly in Austria for the next years. Better organization and coordination of GC research under the planned umbrella structure should however lead to a better use of available funds. New research priorities in GC research will be funded by the Austrian Ministries for Science and Transport, for Agriculture and Forestry and for Environment, Youth and Family and will include the following topics:

- Greenhouse gas emissions in the field of agriculture and forestry (in accordance with international activities, e.g. Alpine Protection Convention, Ministerial Conference on the Protection of Forests in Europe, co-ordination of the implementation of the Helsinki Resolution H4 Strategies for a process of long-term adaptation of forests to climate change);
- Computer-aided simulation of forest developments and development of computer-based risk-rating systems;
- C-balance in close to natural forest ecosystems;
- Biodiversity issues;
- Global change and impacts on hydrology with special emphasis on Alpine regions.
- Human dimension issues;
- Topic of regionalization as a diverse research field (e.g. regional impacts of climate change/sustainable regional development, cultural landscape research, sustainable landuse and GC); and
- Special Research Program: ‚Restoration of Forest Ecosystems‘. Analysis and Modeling of the Processes and Measures regarding Forest Restoration.

AUSTRALIA

An Australian policy maker's perspective on global environmental change research

Introduction

In Australia we are acknowledging global change as a rapidly developing field of science, which is interdisciplinary, international and policy related. Australia, because of its size and geographical location, encompassing the tropics, coastline fronting three oceans, links to Antarctica, its status as 'megadiverse' and because it is sole occupant of a continent, achieves a globally relevant scale in its domestic effort on data gathering and research on global environmental change.

Given Australia's pluralistic science system, encompassing six states, and several territories as well as a number of federal funding programs and research agencies, global change research activities in Australia are very dispersed. Comprehensive data on these is not compiled in a coordinated way at the federal level. An organizing framework for global change research is provided in the non-Government sector by the Australian Academy of Science's National Committee for Global and Climate Change, chaired by Dr. Graeme Pearman of the CSIRO Division of Atmospheric Research.

We have a number of researchers contributing to international programmes in global change. The emphasis in recent years by the Australian scientific community has been to participate actively in the core international global change programmes of IGBP, WCRP and IHDP but to work very actively in strengthening regional programmes particularly in southeast Asia and Oceania.

Some highlights of current research related to global change and remarks in response to the Chairman's prompts are given below:

- Climate change and variability,
Climate change research continues to be the focus of funding in Australia. Whilst there are several budgetary processes under which global change research can be funded, the National Greenhouse Research Programme (NGRP) continues to be the main funding program, with the NGRP distributing AUD\$3.9M in 1998/99 and AUD\$1.6M 1999/00. However this programme terminates thereafter.
The National Greenhouse Gas Inventory Programme is expecting to spend AUD \$1.0M for research related to preparation of the inventory in 1998/99, with effort focusing on reducing the high level of uncertainty in the emissions resulting from land-use change and forestry activities, including measurement of vegetation cover using satellite monitoring.
A three year collaborative project between the Commonwealth and Australian States on remote sensing of agricultural land cover will conclude this year at an approximate total cost of AUD\$6M. CSIRO expenditure on climate related research amounts to around AUD\$14M this year. Similarly the Bureau of Meteorology spends around \$7M on climate related research, of which AUD\$.7M is specifically for climate change research, sourced from the NGRP.

The Bureau's research is closely linked to the international global research programs, especially the WCRP, in which Australian scientists are very active.

For example, BOM recently hosted the annual meeting and workshop of the Joint Steering Committee of the Working Group on Coupled Modelling, and a BOM officer is the lead author for the model validation chapter of the IPCC Third Assessment Report.

Earlier this year the Australian Greenhouse Office was formed, to bring together in one agency, all the federal policy groups and programs responsible for implementing Australia's obligations under the Framework Convention on Climate Change (FCCC), and domestic Greenhouse policy. The Greenhouse Science Advisory Committee, a Government-appointed high level committee which provides science-based advice to the Minister for the Environment, is currently preparing for Government a 'business plan' for greenhouse research priorities in Australia for the next five years.

- Ozone depletion

Of interest is that the Cooperative Research Centre for Southern Hemisphere Meteorology is conducting a world first - a programme to measure CFC replacement chemicals in the Southern Hemisphere; the measurements will determine the atmosphere lifetimes of these chemicals and their effects.

- Biodiversity

Biodiversity research though extensive in Australia is not organized in a global change reference framework, so I am not able to give details of total funding and trends. An organizing framework is provided by the National Strategy for Conservation of Australia's Biodiversity. Internationally, the Biodiversity Convention and related groupings such as Ramsar, the Convention on Migratory Species and the Valdivia Group provide a framework. Australia is very active in DIVERSITAS.

- Environmental health

This field is growing in importance in Australia, although it is not well linked into other global change programs. Within the Health portfolio we are doing some research to determine the character of the UV environment in Australia and to assess the impact of damage to the ozone layer on UV levels and its consequences for human health.

Other research related activity targets health risk assessments of water and various contaminants; we are also monitoring and conducting research on electromagnetic radiation in urban areas.

Environmental health is an area that we hope to focus on more in Environment Australia in the next few years, to achieve better coordination with other Portfolios.

- Glue Money

Australia continues to host the GCTE Core Project Office at the Commonwealth Scientific Industrial Research Organization (CSIRO) Division of Wildlife and Ecology in Canberra with a substantial grant from the NGRP. This has been valuable in providing a stimulus for Australian research in the field of global change in terrestrial ecosystems. Funds for 'glue money' may be available from several sources, including the Industry, Science and Resources portfolio, AusAid in the Foreign Affairs and Trade portfolio and from Environment Australia.

Given political realities in Australia at the moment, and reducing budgets in many Portfolios, we are unlikely to see an increase in availability of 'glue money', beyond what is provided at present to support the GCTE Core Project Officer, for national contributions and to enable Australians to participate in international programmes.

- Data gathering/observation

Australia is expecting to be an active participant in GOOS and GCOS. Australia hosts the international project office of the Global Ocean Data Assimilation Experiment (GODAE) which is the operational extension of GOOS. An Australian GCOS/GOOS Joint Working Group has been established to coordinate Australian input. The Australian Climate Observing System (ACOS) has been initiated, and has presented a scientific plan for a possible Australian contribution. The Australian Steering Committee has agreed to gradually extend the membership of the Joint Working Group to better allow for coverage of GTOS interests, especially those involving land management, water and carbon inventory aspects. However, I would have to say that at present GTOS I do not think that GTOS is adequately linked to any Australian research or planning agendas in the way that ACOS and AOOS are.

Australia has a number of reporting frameworks and data agencies collating observations and undertaking synthesis at the continental level, including the State of the Environment reporting frameworks; the Environmental Resources Information Network (ERIN), the National Forest Inventory, and the National Land and Water Resources Audit. Such frameworks could be drawn upon in establishing an Australian contribution to GTOS.

- Research in developing countries

Australia's overseas aid programme is funding programmes and projects which help abate greenhouse gas emissions and facilitate adaptation to climate change, while simultaneously assisting developing countries to reduce poverty. Currently these projects have a total value of approximately AUD\$154M. There is a substantial program of aid worth some \$18.5M in sustainable forestry, for example.

Research is not a significant direct component of the Australian aid program; where environmental issues have been addressed the emphasis has been on environmental management and institutional strengthening. In the recent past AusAid has funded a sea level monitoring network in the South West Pacific area and studies into the needs of South West Pacific Island states in the area of climate monitoring and impact assessment. Environment Australia has not been influential in determining overseas aid priorities ; this issue is being examined at present and we are expecting stronger links.

- Prospects for the future

We will have a clearer view of the medium term prospects for global change research in Australia when the Government has considered the Greenhouse Science Advisory Committee's 'business plan' for 'greenhouse science priorities'. This is expected before the end of the year.

If, as the scientists tell us in the First IGBP Science Report, we are in a situation where, for terrestrial ecosystems at least, we must 'expect the unexpected (and unpredictable), and keep open as many response options as possible', then policy makers need to be able to communicate as widely and openly as possible, not only with the scientific community but with the public at large.

An issue from my point of view that will require attention by IGFA in the medium term is that of promoting adequate communication between the scientists and the policy makers; how do we ensure that we are all talking about the same thing when we talk about global change.

Encouraging the scientists to communicate with the public in a language that the public can understand will also be important. Because finally, the issues of climate and global change are, as John Zillman has said 'at least as much social and economic as they are scientific'. Government intervention in Australia in coordinating and directing programmes relevant to global change research has been low key and distributed across a number of committees. There are currently proposals in Australia for a national coordination and communication mechanism in the Governmental sector for climate and global change issues. It will be a key theme pursued over the next three years in Environment Australia to increase the visibility of global change as an issue including better coordination with issues of human dimensions.

BELGIUM

1. Global Change, Biodiversity and Health

1.1. Global Change and Biodiversity

Belgium has no national research programme on biodiversity. Belgium is a federal State consisting of three Regions and three Communities. With respect to biodiversity the competence of the Regions covers important parts of the Convention on Biodiversity. This of course has some implications for research. The Federal Ministry for science Policy however is in charge of the scientific aspects of Sustainable Development at the federal level. Its administration, the OSTC has launched and is managing the “Scientific support plan for a sustainable development policy” (hereafter “the Plan”).

This plan, based upon a budget of 75mEURO, funds research activities and makes **156 MBEF (3,0 mEURO)** available for the implementation of the convention through the thematically research programmes on

- Global Change and Sustainable Development (1996-2000);
- Sustainable Management of the North Sea ;
- Scientific Research Programme on the Antarctic – Phase IV (1997-2000);
- TELSAT (Earth Observation by Satellite); and
- Prenormative research in the agro-food sector

Projects under the Global Change programme address biodiversity in line with climate change. Therefore the links with IGBP are stronger than with DIVERSITAS.

Within the North Sea and the Antarctic programme biodiversity is rather dealt with according to the guidelines of ICSU (DIVERSITAS, SCAR,...). For these three programmes the systemic approach is applied: biodiversity versus functioning, structure, resilience and production of ecosystems.

The TELSAT projects aim at the development of information systems for monitoring, analyzing, improving management and planning of ecosystems or protected areas in terms of nature conservation and/or sustainable development.

In the pre-normative research in the agro-foodsector, molecular detection methods are developed to monitor food products derived from genetically modified organisms.

Annex 1 provides an overview of the projects.

The “Plan” includes the so-called horizontal “supporting actions” . Activities related to biodiversity that are spread over several OSTC initiatives are coordinated by means of the **Biodiversity Platform** .

The Federal Ministry of Science Policy overarches ten scientific research institutes including the **Royal Belgian Institute of Natural Science (RBINS)** and the **Royal Museum for Central Africa (RMCA)**. These institutions have an important part of the Belgian expertise in the area of biodiversity, in particular in terms of taxonomy. They manage collections.

The **National Focal Point** for the Convention on Biological diversity, based at the RBINS) manages the Belgian Clearinghouse Mechanism.

Other relevant actions within the OSTC are:

- The **Belgian Coordinated Collections of Micro-organisms** (BCCM), a consortium of 4 Belgian collections: bacterial strains, filamentous fungi (yeast strains), and plasmids. The BCCM is setting up a programme for technology transfer and capacity building in the spirit of the convention and is coordinating the international MOSAIC-project (Micro-organisms Sustainable Use, Access Regulation and International Code of Conduct), financed by the EC;
- The set up of an on line scientific biodiversity information system in Belgium (The Belgian Biodiversity Resources) with information on experts, projects, collections, botanical gardens, zoos, bibliographies; and
- **Joint research projects** in the framework of bilateral agreements with China, Poland and Russia, and **granting of research fellowships** to post-doc scientist from Central-and Eastern-European Countries, allowing them to stay 6 to 12 months in host units which are involved in OSTC activities.

The total budget is about 145MBEF (33mEURO) per year. (BCCM:100 + FP 1,5+ Belnet 24,5+ Plan 40)

1.2. Global Change and Health

Global Change and Health is not tackled within the Global Change programme. Within the TELSAT however, there is one Global Change relevant pilot project indirectly related to health. The methodology developed in “**Contribution of spatial information techniques to the monitoring and support of a sustainable suppression of cattle trypanosomose in Western Africa (case study Togo)**” should be a basis for the suppression of other vector borne diseases such as malaria. It could be a solid basis for the simulation and extrapolation of the habitat of illness-vectors under climate changes. This method is essential for planning land cover use and change (vegetation barriers that could hinder the vector habitat extension). The operational use, the permanent monitoring could be a new opportunity for SPOT VEGETATION with its low spatial resolution but high temporal resolution.

Within the Sustainable Mobility Program, there is one project aiming at the evaluation of toxic risk generated by traffic pollution. The approach is based on molecular epidemiology.

2. Glue Money

Glue money was defined in the Tucson meeting as the funds to support scientific integration activities. Three types of integration activities in the IGBP/WCRP and IHDP system:

- the IGBP,WCRP, IHDP offices/ secretariats;
- a supporting office and officers for core projects
- integrating activities through which the network/consortium develops “added value” for the projects conducted under the umbrella of international programs

From January 1st on, Prof. Lambin of the UCL will be chair of IGBP/LUCC. We are evaluating the possibility of funding a scientist to help him with this task.

We do not have a specific fund for “glue money”, but e.g. TELSAT has calls every year which gives the opportunity for a/o. feasibility studies with respect to integration international networks. The research program on Global Change was inspired on the international research agenda and as a whole was meant as a financial support for teams integrating in international programs. It was intended to have a small yearly budget in order to better match the national and international research agenda but this was cut due to budget restrictions.

3. Global Observing Systems: interaction with CEOS and Data availability and accessibility

The OSTC acts as the national Space Agency and coordinates the Belgian participation to International Space Programs, in particular to ESA. The OSTC contributes to EUMETSAT, ESA, CNES and co-funds ERS-Envisat, MSG (météosat second Generation, Meteop (météorologie operational) and SPOT. Two federal scientific research institutes involved with global observing are the Royal Meteorological Institute (RMI) and the Belgian Institute for Space Aeronomy (BISA).

Belgium recognizes the need for an integrated observing strategy (IGOS). But, it is a small country with limited resources. This makes it difficult to play an active role in the different working parties. In CEOS, Belgium is an observer.

TELSAT, earth observation by satellite links the space community with the user community and demonstrates the usefulness of satellite data. It aims in particular at:

- The anchorage of methods and results of previous research in the user community: other scientists, ministries, economic actors;
- The adaptation and completion of these methods in order to meet the needs of the users, to integrate them in decision supporting systems and to promote technology transfer;
- The support of the divers opportunities of new sensors, developed by the space agencies.

TELSAT consists out of feasibility studies (short term studies, demonstration projects,...) at the request of potential users and/or the accompanying committee. pilot projects (integration research results in an operational environment), CEO projects (co-funding EC funded CEO projects), supporting research (perspectives new sensors, quality control, algorithm development, management data from different origin, ...)

Global Change is one of the four central themes.

Other programs such as Global Change and Sustainable Development (1996-2000), Sustainable Management of the North Sea and Scientific Research Programme on the Antarctic make use of RS data as well as of in situ data It was even promoted in the calls for proposals.

GOOS:

Belgium has a know-how in the areas such as modeling of hydrodynamic processes and the interactions ocean/atmosphere/cryosphere. Participating in a network such as GOOS could lead to applications of the Belgian oceanology. But for the time being, Belgium is only marginally implicated in GOOS.

Through the MUMM, founding member, the federal is concerned with EuroGOOS. The associated member is GEHR-Ulg, lead by Prof. Nihoul.

The Coastal Zone and Waterways Division of the Flemish department for environment and infrastructure contributes for the oceanographic data acquisition of the Belgian coast. This is done in cooperation with 8 other North Sea Countries in the framework of the EU supported Concerted Action SEANET 2000. The developments within SEANET 2000 meet directly EuroGOOS objectives.

Some examples of how the OSTC optimizes access to and utilization of data and provides a basis for international data exchange

1. The earth observation platform

The Earth Observation platform is part of the OSTC program "Information society" which was approved by the Belgian Government late 1995.

The objectives of this platform are:

- to provide scientists and public administrations with permanent access to information on data, images, and products issued from satellite earth observation, and concerning their use;
- to ensure the purchase, archiving storing and distribution of data;
- to provide a help service as well as training to the user community
-

2. Earth observation help desk

Objective

In 1997, the Earth Observation help Desk (EOD) was set up at the RMI by the OSTC to support the user of earth observation data. The Earth Observation Help Desk is part of the Platform Earth Observation.

The assignments

- to provide information on earth observation, a/o. through the TELSAT Guide, which was designed according to the standards of the CEO program
- to assist researchers active within the framework of the "Plan"
- to identify the needs of the users
-

Target groups

For scientists, administrations and private enterprises it intends to act as an interface with Belgian experts, Belgian expertise and distributors of satellite images.

To the public at large it offers general information on earth observation.

At present the possibility is being evaluated of installing here a CEO middle ware node.

3. METAFRO: a catalogue of data sets and data sources on Central Africa

METAFRO (in the framework of supportive actions of “the Plan” and the program “Information society”) is an on line information system aimed at the re-valorization of, in particular, the Belgian collective heritage of data relevant for the sustainable development and research within the Central African region. It is a system for the collection, coordination and harmonization of all information on data related to natural resources, societies and development of Central Africa. It is a tool enabling a better on-line access to the right information for more efficient development and research planning, implementation, monitoring and evaluation.

4. Information system sustainable development

It's a search engine to identify, localize and in some cases consult data in view of supporting decision making in the area of sustainable development, to promote inter-disciplinary and to enhance information accessibility. The system includes a meta database, a database with S.D. indicators and all information available at the OSTC (including research results). The system is not operational yet.

5. Earth Observation and geo-information Systems. From Demonstration to Operation.

This brochure is intended to be a mechanism to foster technology transfer

6. IDOD: Integrated and dynamical oceanographic data management

IDOD is part of the program Sustainable Management of the North Sea. It aims at establishing, managing, promoting a marine geographical information system, ensuring a smooth and scientifically sound flow of data between the data producers (scientists in the field and the lab, modellers, public authorities etc.) and the end users (policy makers, scientists, the general public). The data cover a wide range of natural processes and human activities connected with the North Sea. An important part of the project involves data gathering and supplying to and from the programme.

7. CTIV (VEGETATION image processing center)

The CTIV is located at and operated by VITO (Mol) with the support of the OSTC. The center processes and archives the data and operates the VEGETATION image. The VEGETATION program is a joint initiative by the EC, Belgium, France, Italy and Sweden. The instrument was launched on March 24, onboard the SPOT 4 satellite. Vegetation products are used to monitor the world vegetation cover, to forecast agricultural production, deforestation and desertification, to study effects of climate change. The major asset of the program is the daily coverage of the entire globe together with the rapid delivery of top quality satellite images.

8. C-FIX

In the Global Change programme 1990-1996, a validated methodology was developed for the calculation of the net carbon exchange, based on remote sensing data (NOAA-VHRR) and ecosystem modeling. Within TELSAT a feasibility study was funded for the commercialization of such an instrument.

The instrument is an improvement of the methodology for evaluating the impact of changes in land use (e.g. deforestation), on the net carbon exchange between the atmosphere and vegetation. This is a problem that was considered until recently not be handled appropriately by the IPCC methodology, which is based on emission inventories. The methodology is relevant in the Kyoto context. The main advantage of the approach is that real time earth observation will be used rather than statistical data, which are often unreliable and outdated. An additional bonus to the approach is that now the VEGETATION instrument is available which adds to the consistency and the accuracy and will stimulate the use of VEGETATION products.

9. “vegetation scientific support programme” (see annex 2)

The space department of OSTC established a national research program: “vegetation scientific support programme”, funding in particular feasibility studies. In the area of forest and savannah fires, land cover changes, wetland monitoring, the improvement of the vegetation processing chain etc.

4. Support of research in and/or related to needs of developing countries – relationship OSTC and development assistance agency

The OSTC supports research in and related to the needs of developing countries, in particular with respect to the application of remote sensing techniques. Brigitte Decadt who is managing the TELSAT program is from time to time requested by our development assistance agency to provide expertise on remote sensing for their projects. Some of the TELSAT projects address problems with relation to the agriculture, environment and developing countries and in cooperation with the developing countries and/or the Belgian development assistance agency.

Some examples:

- Morocco: Mapping of stony soils in view of agricultural valorization (Lavreau, MRAC; Ministère Agriculture Maroc, ORMVAD Maroc, DAF Maroc);
- Morocco: Mapping of soil susceptibility to erosion (Dautrebande, FAGEM; Service eaux et forêts et de la conservation des sols (Fez), Morocco; Min. de l’agriculture et de la réforme agraire, Morocco);
- Egypt: Soil salinity and water logging in agricultural land (De Dapper, RUG, NARSS Egypt, IDSC Egypt, Governornate of Ismailia);
- Burkina Faso: Inventory and characterization of lowland valleys (Dautrebande, FAGEM; CIEH,IITA);
- Burkina Faso: Impact assessment of development projects (Wilmet, UCL; FUGN Burkina Faso, OXFAM Belgium);
- China: Panda Habitat Mapping (De Wulf,RUG; WWF International);
- Kalimantan: Information system for management and planning of tropical forests (De Wulf, RUG, WWF International and Indonesian Ministry for Forest);
- Botswana: Elephant habitat mapping (Gulinck,KUL; Goossens (RUG); Botswana Ministry for Wildlife and nature conservation - EC - DG VIII);

-
- Kenya : Mangrove : contribution to environmental accounting (Polck,VUB; Goossens, RUG; UNEP' Oceans and Coastal Areas programme activity Centre, Kenya Fishery Research Institute);
 - C.Africa - ECOFAC sites (Cameroon, Congo, C. African Republic) :contribution to protected area monitoring and management planning;
 - Methodology improvement of the FAO -Forestry assessment programme (1980-1990) – test sites C. Africa; and
 - Set up of a the METAFRO - project: a meta database of all available data sets in Belgium concerning the C. African region (+ Rwanda and Burundi).

In the framework of the international cooperation – bilateral actions with China, two projects are to mention:

- A comparative Study of the Medieval Climate in western Europe and Eastern China based on Narrative Data (Demarree, Alexander, IRM, ZHANG, National Climate Center; YAN ,Institute of Atmospheric Physics; and
- Erosion risk assessment by Remote Sensing and GIS Technology – Land Management in Guizhou, China (Van Camp, De Wulf, RUG).

5. Evolution of funding levels for global change research – new priorities

The 4 years research program on Global Change and Sustainable development is ongoing with a budget of 14 mEURO. There are no changes to the funding level.

Annex 1: Global Change and biodiversity - relevant research projects in the framework of the “Scientific support plan for a sustainable development policy“ and other OSTC activities

1. Global Change

- Species diversity: importance for sustainable ecosystems and impact of climate change (Prof. I. Impens & I. Nijs (UIA), Prof. D. Reheul (RUG))
- Hydrological, soil chemical and ecological effects of climate change in rich fens (Prof. O. Van Cleemput, RUG; Prof. Vlassak, Kul)

2. Sustainable Management of the North Sea

- The structural and functional biodiversity of North Sea Ecosystems: species and their habitats as indicators for sustainable management of the Belgian coastal shelf (Prof. M.Vincx,RUG; Prof. E. Kuijken , INB; Ollevier, KUL;

3. Belgian Scientific Research Programme on the Antarctic – Phase IV (1997-2000);

- Meio-benthic biodiversity and fluxes within the Antarctic bio-geochemical environment (Prof. M. Vincx, RUG)
- Eco-functional biodiversity of benthic crustacean taxocoenoses in the Southern Ocean (Dr. Cl. De Broyer, RBINS)
- Response of the southern ocean global ecosystem to physical and trophic constraints (Dr. J.-H. Hecq ,Ulg ; G. Pichot, MUMM; Prof. V. Demoulin,Ulg)

4. TELSAT:

- China: Panda Habitat Mapping (WWF International)
- Kalimantan: Baseline information system for sustainable (multifunctional) Forest monitoring and management planning (WWF International and Indonesian Ministry for Forest)
- Costa Rica :
- Botswana: Elephant habitat mapping (Botswana : local Ministry for Wildlife and nature conservation - EC - DG VIII)
- Kenya : Mangrove : contribution to environmental accounting (UNEP, Kenyan Coastal Zone)
- C.Africa - ECOFAC sites (Cameroun, Congo, C. African Republic) :contribution to protected area monitoring and management planning
- Methodology improvement of the FAO -Forestry assessment programme (1980-1990) – test sites C. Africa

- Habitat change for wintering birds in Flanders (Belgium) in support of the RAMSAR Convention
 - Support to the concept of the meta database for the REIMP system for C.Africa (World Bank)
 - Set up of a the METAFRO - project: a meta database of all available data sets in Belgium concerning the C. African region (+ Rwanda and Burundi)
 - Contribution to environmental rehabilitation in areas damaged by refugee settlements (Goma, Virunga reserve - cooperation UNHCR)
5. International cooperation
- Joint study of the endemic fauna (invertebrates) of lake Baikal; Since 1990: contribution of 200 000 \$ to the Baikal International Centre for Ecological Research (BICER)
 - The establishment of a forest database , using remote sensing techniques for monitoring of stands in the Kozeniece Landscape Park and Zawierce Forest in Poland
 - The study and conservation of specific groups of actinomycetes and microfungi from the Yunnan Province and Changbai region in China.

Annex 2: Vegetation scientific support programme

Investigations selected after the First Call for Proposals

- VEGETATION data in the monitoring of disturbance patches and Post disturbance succession in natural vegetation in South Africa . (H. GULINCK (Laboratory for Forest, Nature and Landscape Research, Leuven, Belgium)
- Land cover changes in Africa: Multi-temporal change vector analysis at coarse scale and change processes categorization with high spatial resolution data. (E. LAMBIN, Lab Télédétection, Univ Catholique Louvain, Belgium)
- Sensitivity analysis of composing strategies : modeling and experimental investigations. (P. DEFOURNY, Dep Environmental Sciences Univ. Catholique Louvain, Belgium)

Investigations selected after the Second Call for Proposals

- Mapping and dynamic modeling of temporal and bio-physical phenomena of the sahelian wetlands environment using VEGETATION data (R. De WULF, University of Gent)
- VEGETATION data for monitoring woody vegetation in European landscape frameworks (H. GULINCK (Laboratory for Forest, Nature and Landscape Research, Leuven, Belgium).

CANADA

1. Introduction

Canada does not have a centralized funding mechanism for global change research. Typically, funding for global change research has been the responsibility of a number of different federal and provincial agencies, as well as the national granting councils - the **Natural Sciences and Engineering Research Council (NSERC)** and the **Social Sciences and Humanities Research Council (SSHRC)** - which fund university-based research. This has made it difficult to report on the amount of research being performed and has also presented challenges for coordination.

Funding for global change research as a national priority has fluctuated over the last few years. A major increase was implemented in the early 1990's with the introduction of the Green Plan - a Federal initiative. This led to, for example, an injection of funds for many Canadian activities under the IGBP and WCRP programs, as well as a stronger role for the Canadian Global Change Program which attempted to coordinate activities at the science/policy interface. It also led to the establishment of the Eco-Research Program which supported research on Canadian ecosystems over a period of 5 years. In 1994-95, the Canadian Federal Government underwent Program Review and all federal departments received significant funding cuts. Global change research was not high on the list of priorities, and activities were reduced significantly. Another reduction was felt when in 1996 the Green Plan funding ended. This severely impacted the Canadian Global Change Program, which is now in the process moving to a university setting. At the university research level, activities were less severely impacted, but many researchers had problems finding government partners for their global change research activities.

2. Implications of the Kyoto Protocol

Canada has signed the Kyoto Protocol under which its reduction target for greenhouse gases is 6% below the 1990 levels by the period 2008 to 2012. The Protocol also contained explicit and substantial commitments for Canada relating to science.

In April 1998, the federal, provincial and territorial ministers of energy and environment agreed that climate change is an important global problem and that Canada must do its part to address it. A major activity in Canada now is the development of a National Implementation Strategy, which will set out a program for enabling Canada to meet the greenhouse gas emission reduction targets established in the Kyoto Protocol. Canada has also established a **Climate Change Action Fund (CCAF)**.

The **CCAF** is intended to support early actions to reduce greenhouse gas emissions and to increase understanding of the impact, the cost and the benefits of the Protocol's implementation and the various implementation options open to Canada. *It should be noted that the interpretation of climate change is quite broad and it appears to encompass some global change issues.*

The CCAF is set at \$150M over three years, and is expected to lever significant private sector and other government funding. It has four components:

- Technology Early Action Measures (TEAM);
- Science, Impacts and Adaptation;
- Foundation Analysis; and
- Public Outreach.

For this document, details are presented on the Science, Impacts and Adaptation portion, but additional information will be available as hand-outs at the meeting.

Science, Impacts and Adaptation (\$15 million)

The work in the Science, Impacts and Adaptation component of the CCAF will focus on:

- systematic climate monitoring to detect climate change, and to improve and validate our climate models;
- the study of key climate processes, including those related to greenhouse gas sources and sinks;
- regional scale climate modeling for impact and adaptation needs;
- the impacts of climate change on Canada; and
- the development, assessment and implementation of adaptation responses.

The CCAF will therefore help improve climate change knowledge, giving the tools to provide better scientific advice when a greenhouse gas emissions reductions policy is being developed. It will help to identify the most appropriate portfolio of response strategies, including those required to adapt to the impacts of climate change.

The post-Kyoto developments show that climate change has risen up the priority list. The federal agenda is clearly focused on attaining the greenhouse gas reduction targets, but there is an acknowledgment that more resources are needed for the research as well. The availability of additional funding is good news for Canadian research in the short term, but it remains to be seen how the long term aspects will be addressed.

The following paragraphs address the issues requested for the IGFA meeting.

3. Health and global change

Under the Green Plan, some work was done in this area, including an assessment of the *Implications of Global Change for Human Health* (1995) and a *Health Canada Sustainable Development Strategy* (1997). With renewed interest at the Federal level, the area of health is now being formally included in climate change discussions. There is a recognition that the economy, environment and health are closely related and that health issues must be included in the development of government policies.

The lead in this area is being taken by the federal department **Health Canada**, which aims to provide both credible health science and an integrated approach to the direct and indirect effects of climate change on human health.

It will carry out health impact assessments of climate change itself, as well as the impacts of mitigation strategies. It will also engage in public health outreach and education initiatives for climate change and will attempt to coordinate programs and initiatives relating to impacts on human health of climate change.

Health Canada is primarily concerned with the implications for population health of climate change. Global health concerns include heat stress, floods, droughts, severe storms, air pollution episodes, diseases, food production and availability, etc. There are also impacts on public health from technology developments such as ambient air (aerosols, sulphur, etc.), lead/MMT in gasoline, etc.

Research on health and global change is still in the early planning stages. Health Canada is reviewing the current situation and will be holding a workshop in January 1999 on Health Effects and Mitigation Impact. Health Canada aims to produce a research plan involving researchers from Health Canada as well as universities in Canada and abroad.

4. The Canadian Biodiversity Program, and links to global change

Following the signing and ratification of the Biodiversity Convention, Canada completed the Canadian Biodiversity Strategy and the Science Assessment on Biodiversity. In turn, Canadian sectors such as agriculture, forestry, wildlife, parks and the atmosphere have completed their action plans. Some global change research initiatives are worthy of note:

- The Ecological Monitoring and Assessment Network (EMAN), Environment Canada, working with many national partners and the Smithsonian Institute (SI), world-wide, has implemented a network of more than 50 SI/Man and the Biosphere Biodiversity plots in Canada;
- A Workshop on "Decoding Canada's Environmental Past: Climate Variations and Biodiversity Change", in 1996, identified a science agenda and will be followed in early 1999 with a Workshop focusing on "Adaptation Lessons based on changing Trends and Extremes in Climate and Biodiversity";
- Canada is currently formulating a Canadian Biodiversity Science Agenda under the leadership of the Biodiversity Science Board, building on the 1996 Workshop and special journal issue (Environmental Monitoring and Assessment Journal, Vol. 49, No. 2-3, 1998) titled "Atmospheric Change and Biodiversity: Formulating a Canadian Science Agenda". This includes consideration of DIVERSITAS and other international programs; and
- Canada maintains close connections to the capacity of IUCN-The World Conservation Union through its state and many agency memberships, as well as the contact provided by the Director General of the Canadian Wildlife Service, David Brackett, serving as the Chair of the IUCN Species Survival Commission.

University research in Biodiversity is normally funded through the granting councils. The NSERC evolution and ecology community recently identified both global change and Biodiversity as priority areas for the future, and will redirect a percentage of their funds to these areas over the next four years.

SSHRC recently allocated \$130,000 over three years to a research project entitled “Ethical and political evolution of the Convention on Biodiversity”, which will examine the political divergence and convergence and the ethical conflicts that arise from the new relationship created between people and nature.

Canada is seeking partners to develop a fully coordinated Biodiversity Science program with strong international connections to Diversitas, IPCC, IAI, WCRP, IGBP, IUCN and many others. At the moment, the international connections beyond the Biodiversity Convention reporting structure have been largely driven by individual agencies.

5. “Glue money”

NSERC will shortly introduce a new program intended to facilitate the access of Canadians to international programs. The new International Opportunity Fund will promote new international research collaborations of significant benefit to Canada, by supporting the non-research costs associated with Canadian participation. Funds available will increase from \$0.5M in 1998-99 to \$1.5M in future years. The Canadian global change research community could request funds from this program to participate in new opportunities, when these costs are not already covered in their research funding. However, many of the major Canadian projects related to IGBP and WCRP already contain funds for travel and collaboration at the national and international level.

SSHRC has also introduced a new program to support national and international research initiatives aimed at knowledge structuring, transfer and integration activities. SSHRC is investing \$1M per year under this program and recipients can receive funding up to a maximum of three years. Through this program, SSHRC is funding a Canadian network on environment and security lead by Dr. Stephen Lonergan of the University of Victoria. This network will coordinate the Canadian contribution to the GECHS project of IHDP.

SSHRC is also considering establishing a task force on environment and climate change to examine the eventual establishment of a strategic theme or a jointly-funded program of research in this area. If launched, this would stimulate research in the area of global change, and increase the funding available to the community to further develop Canadian and humanities and social sciences participation in the sphere of global change.

Canada has recently been approached to host the International Project Office for the IHDP core project on Global Environmental Change and Human Security. Initial discussions with the proponents at the University of Victoria have gone well, with interest from NSERC, SSHRC and Environment Canada. It is envisaged that funding for this will be requested from SSHRC through the Presidential Fund for Innovation and NSERC (International Opportunity Fund) in due course, with other Federal agencies being asked to contribute as well. The intent is to establish the IPO for an initial period in Canada, and to move it to developing country after three years.

“Glue” activities, such as workshops and support for Canadians participating internationally are also likely to take place under the Science, Impacts and Adaptation portion of the Climate Change Action Fund.

6. Global observing systems

Canada has taken an active role in the development of the GCOS study, with a Canadian member (Doug Whelpdale) on the Joint Scientific and Technical Committee. Kirk Dawson of Canada now chairs the international GCOS committee. The Atmospheric Environment Service (AES) also carried out a Canadian study 2-3 years ago on the scientific and economic benefits of systematic climate observations under the Climate Program Board/GCOS Committee. It determined that such observations are essential for monitoring the state of the climate, detecting climate change, validating and initializing climate models etc. Canadian responsibility for climate monitoring rests mainly with Environment Canada /AES and the Department of Fisheries and Oceans. The Canadian Centre for Remote Sensing has also been involved because of the potential of remote sensing for observing systems. Canada’s monitoring network has declined over the past few years as a result of tighter budgets. Canada’s Arctic networks are sparser than WMO standards - but they are extremely expensive to run (especially if there are few local communities).

A Canadian GCOS Planning effort will be carried out as one of the activities under the federal Climate Change Action Fund. This will hopefully strengthen the case for additional funding to meet Canada’s Kyoto and WMO commitments.

7. Support for research in developing countries

Canada has two lead federal agencies responsible for supporting and delivering assistance to the developing countries – **the International Development Research Centre (IDRC)** and the **Canadian International Development Agency (CIDA)**. The IDRC is a public corporation created by the Canadian government to help communities in the developing world find solutions to social, economic and environmental problems through research. Annually IDRC invests approximately \$6.5M for research related to environment and development through four main initiatives:

- *Research networks of Southern and Northern researchers to address specific research problems and set a multidisciplinary research agenda in the environment and development;*
- The Canadian component of the LEAD (Leadership for Environment and Development) project (\$250,000 per year), an international training program intended to foster a new generation of decision makers in developing countries with the knowledge, values and skills to develop national and international policies that emphasize the sustainable use of the earth’s resources;
- Funding to the EEPSEA (Economy and Environment Program for Southeast Asia) which supports training and research in environmental and resource economics and provides fellowships and research grants to locally based SE Asian researchers. Member countries are Thailand, Malaysia, Indonesia, the Philippines, Papua New Guinea, Vietnam, Cambodia, Lao PDR, China and Sri Lanka.

The network meets biannually in Singapore and is sponsored by Canada (IDRC and CIDA), Sweden (Sida), The MacArthur Foundation, and Denmark, Holland and Norway. Since 1993, IDRC has contributed over \$1.6M (\$300,000 per year). CIDA allocates \$350,000 annually; and

- *Discussions are underway between IISD (International Institute on Sustainable Development), the North and South Institute and IDRC to help financially the poorest developing countries to prepare their responses to the post-Kyoto protocol. This is linked to the Clean Development Mechanisms (CDM) of the Kyoto protocol. IDRC and IISD aim to set up research networks of developing countries on climate change. This will require considerable funds and details have not yet been finalized.*

CIDA is heavily involved in training - its funding to students in developing countries in the area of environment is just over \$ 774,000 in 1997. Almost 80 students involved in research on the environment benefited from CIDA's support last year.

8. Evolution of funding levels for global change research

The major change on the funding scene has been the introduction of the CCAF, described earlier. This should lead to some enhanced activities in existing global change research of relevance to IGBP, WCRP and IHDP, as well as new programs. In the meantime, Canada continues to contribute to the international programs at approximately the same level as before.

Some NSERC highlights include:

- Renewal of funding for another 4 years of Canada's contribution to Climate System History and Dynamics, which feeds directly into PAGES and GAIM;
- Support for university activities related to Canadian JGOFS was not renewed; and
- Ongoing coordinated support for Canadian GLOBEC and GEWEX.

Some SSHRC highlights are:

- A project on reconciling ecological limits with increasing human welfare at \$2.5M over 5 years. This project will study the global question regionally, by producing and analyzing a series of alternative scenarios by which sustainable conditions might be achieved for the Georgia Basin in 2040. It involves 17 Canadian researchers plus 17 collaborators from 10 other countries;
- "Sustainable development in the Arctic-Conditions for food security" involves nineteen scientists and collaborators from five Northern countries at \$1.7M over five years. It addresses knowledge gaps in the relations between economic development, national and political legal frameworks, and human health as related to current nutrition behavior and preferences of the Arctic, and is jointly funded with the Canadian Department of Indian and Northern Affairs and Health Canada; and
- "Legitimation Contests and International Environmental Governance: The Cases of Climate Change" focuses on the international negotiations to be developed for climate change and forests. It will look at free market values and environmental protection and see how they are reconciled, as well as the evolution of scientific knowledge and the complex patterns of interests among states and firms involved in the bargaining process.

CHINA, TAIPEI

Highlights of National Programmes on Global Change Research

1. Policy Changes

Geographically, Taiwan is located at a very good position to observe the effects and interactions of monsoons, the Tibet Plateau, the Kuroshio and the Western Pacific Warm Pool. Socio-economically, Taiwan has been experiencing a rapidly changing society, witnessing seriously human impacts on natural environment, and now, becoming a newly industrialized economy, can be a very good case study area for research on sustainable development. A simple chronicle concerning the global change research (GCR) in China, Taipei is shown in Table 1.

Two policy changes relating to GCR have implemented in 1997. Firstly, the cabinet level Committee on Global Change Policy, Executive Yuan (the cabinet) was restructured to become the National Sustainable Development Committee (NSDC), Executive Yuan. Secondly, Chairman of the National Science Council (NSC), sitting as a member of the NSDC, has also restructured his Environment and Development Committee. It was added a human dimension research working group, renamed as Commission on Sustainable Development Research (CSDR), and now convened by a Vice-Chairman and, among the others, included several related directors of NSC academic programme offices.

2. GCR Funding Agencies, Programmes and Links

Although member ministries in NSDC, such as Environment Protection Administration, Ministry of Economics Affairs, Council on Agriculture, Ministry of Communication and Transportation, all have their own global change related intramural or extramural research, NSC is the major funding agency for GCR in China, Taipei. The principal offices in NSC running GCR funding programs comprise of Natural Science and Mathematical Division, Life Science Division, Humanity and Social Science Division as well as CSDR.

China, Taipei has a membership in the IGBP. The National IGBP Committee and subcommittees for core projects, such as GCTE, IGAC, JGOFS, LOICZ and PAGES, have formed under the auspices of Academia Sinica China, Taipei. National IGBP Committee serves to coordinate the development of the major national GCR programmes as well as to interact with the international GCR programmes.

Organized research on global change was first initiated in 1989 by a group of university scientists, under the support from the NSC. Currently, more than one hundred scientists are involving in GCR programmes. The basic philosophy of GCR programmes implementation in China, Taipei is to “think globally, act locally” and is aiming to understand changes occurring in Taiwan and its surrounding areas, as well as : (1) to understand the effect of global change on the local natural environment, (2) to collect regional data contributing to the understanding of the processes of global change, (3) to construct regional environmental and climatic models with predictive capabilities, (4) to assist government and industry of complying with the international requirements related to globe change, (5) to assess the impact associated with climate and environmental change, and to outline viable strategies that will lead to a sustainable future.

In 1994, an effort to plan the GCR in Taiwan for the next five years was initiated by NSC. Several subject areas have been paid special attention including the climate and environmental studies

directly related to the international global change programmes and the development of national action plans for meeting international convention requirements, such as that of the Framework Convention of Climate Change for counteracting the consequences caused by global warming. Guided by the five-year plan, major GCR subjects executed in Taiwan can be categorized as following ten areas:

1. Atmospheric chemistry and radiation study: aiming to study the regional environmental changes focusing on the monitoring and modeling of the local sources and sinks of greenhouse gases.
2. Ocean circulation study: such as that in the World Ocean Circulation Experiment (WOCE) Programme in Taiwan.
3. Oceanic flux study: such as that in the Kuroshio Edge Exchange Processes (KEEP) programme of the Joint Global Ocean Flux Study (JGOFS).
4. Climate change and prediction study: such as that in the East Asian Monsoon Study Programme.
5. Past environmental change study: such as that in the PAsT Global changES (PAGES) programme in Taiwan.
6. Coastal change study: such as that in the Land-Ocean Interactions in the Coastal Zone (LOICZ) of Tseng-Wen River and the Environmental Study along the Southeastern Coast.
7. Ecosystem study: such as that in the Taiwan Long-Term Ecological programme.
8. Hydrological cycle and global change study: such as that in the Hydrological Cycle and Local Climate Study programme.
9. Land use and environmental change study: such as that in the Land Use and Land-Cover Change (LUCC) programme in Taiwan.
10. Human dimension study of global change: aiming to study the cost-benefit of the reduction of greenhouse gas emissions.

3. Highlights of IGFA Key issues

3.1 Health and biodiversity

Biodiversity is becoming an important issue in Taiwan. Government is paying special attention to biodiversity in the Cabinet level. National Science Council also supports research project related to the biodiversity issues. A project entitle "Biodiversity Policies Studies" by H. B. King will focuses on (1) investigating public understanding of the importance of maintaining biodiversity; (2) reviewing current laws relating to biodiversity; (3) understanding the difficulties of implementing biodiversity related laws by governments at various levels; (4) reporting efforts that have been made by non-governmental organizations regarding biodiversity; and (5) formulating recommended governmental policies to effectively maintain biodiversity resources for the future. Another project entitle "Uses of Biodiversity in Taiwan" by R. T. Chao will analyze the use values (e.g., timber, tourism, waste disposal) of biodiversity in Taiwan. This would increase the understanding of the goods and services that biodiversity provide to the people of Taiwan. The proposed study will be able to identify users and markets of biodiversity. Users needs should help set biodiversity policy and research priorities in Taiwan.

3.2 *Glue money for the international global change research programmes*

National Science Council provides traveling money for scientists in Taiwan to attend steering committee meeting or working group meeting of IGBP, WCRP core projects during 1997 for a total of US 50,000 dollars and will continue support this glue money for 1998.

3.3 *Participation in the global observing systems*

- IMAGES (International Marine Past Global Change Study) project aims to study the history of ocean variability of the past 300,000 years. Consistent with the international objects and interests, Taiwan IMAGES projects will focus on the paleoceanographic analyses for the South China Sea marine sedimentary core records obtained from IMAGES III – IPHIS cruise (June 1997 – July 1997), primarily emphasizing the following five working objectives: (1) High-Resolution Stratigraphy and Chronology of IMAGES III Cores Last Glacial Maximum (LGM); (2) Ocean Environments and Surface Circulation Patterns of the South China Sea; (3) High-Resolution Records of the Last Deglaciation Patterns of the South China Sea; (4) Climatic Teleconnection Between East Asia Monsoon and High-Latitude Climate; (5) The South China Sea Climatic Stability in the Holocene and the Last Interglacial Stage. This project provides detailed documentation for the content and scientific significance of these five working objectives, and their relationships with IMAGES individual projects. It also discusses the planning of coordination, exchange of information, consultation, data base management, and core sampling services for national and international IMAGES project participants.
- The major contribution from Taiwan to the international JGOFS program at present is the Kuroshio-East China Sea Shelf Exchange Processes study, which is the second phase of the Kuroshio Edge Exchange Processes program (KEEP-II). KEEP-I (1989-1994) was originally developed out of the interest of Taiwanese oceanographers in the water exchange across the Kuroshio frontal zone in the East China Sea northeast of Taiwan and the concomitant biogeochemical fluxes. As the significance of carbon fluxes at the continental margins was increasingly recognized, KEEP had been included in the JGOFS implementation plan and the second phase was developed and supported by the National Science Council located in Taipei. The goals of KEEP-II are three fold:
 1. to observe and determine the water and material (especially, carbon) exchange fluxes between the Kuroshio and the East China Sea shelf;
 2. to assess the biological resources in the East China Sea;
 3. to trace the transport of sediments and anthropogenic materials in the East China Sea.

3.4 *Research related to developing countries*

Taiwan scientists will participate the Southeast Asia Regional Committee for START (SARCS) Integrated Science Plan which is focused to describe, understand, integrate and predict Southeast Asia environmental changes, the natural and socio-economic factors that drive them, and their consequences for the sustainable development and management of the humid tropical marine, coastal and terrestrial ecosystems of Southeast Asia, with the primary focus on the coastal zones and continental shelf seas.

Scientists from Taiwan have actively participated in many meetings of international GCR programmes, such as IGBP, WCRP and IGFA, for developing core projects or other activities. The most recent decision of NSC is to make a contribution of US \$ 20,000 to the Staff Bureau of START-SARCS and to host an international workshop on synthesis of greenhouse gas emissions, aerosols and land use and cover change in Southeast Asia in Nov. 1997. Taiwan may serve as a link between the developing countries of southeastern Asia and the developed nations to promote the common goals of GCR.

3.5 Funding levels for global change research

Funding levels for global change research in Taiwan is gradually increased in recent years. Total budget allocated to GCR programmes by NSC has increased from around US\$ 1 million in FY 1990 to around US\$ 5 million in FY 1998. Other member ministries of NSDC also have trusted about another US\$ 5 million on global change related researches in FY 1998.

4. Highlights of New Research Programmes

The steady support of government and the organized efforts of the academic community have made Taiwan a good head-start on its GCR programmes. NSC had finished a new plan for its GCR programmes. Two new research programs related to the sustainable development research are worthwhile mentioned here.

The first new research program entitled "Sustainable Taiwan Vision and Strategy" was launched in 1998 under the funding of CSDR. The first phase of the program is planned for three years from 1998 to 2000. The program recruits over 30 top scientists in Taiwan to plan the sustainable future of Taiwan. Three subprojects are under this program which are (1) Sustainable Taiwan 2011, (2) An Assessment System for Sustainable Taiwan, and (3) An Information System for Sustainable Taiwan.

The second research program is the National Science and Technology Program for Hazards Mitigation launched in 1997 under the funding of CSDR. Natural hazards such as earthquake, flood, and landslide occur frequently in Taiwan. Studies show that natural hazards casualty and property loss are gradually increasing in recent years. The basic goal of the program is to reduce the risk of individual citizens and the society from hazards. The first main objective of the National Science and Technology Program for Hazards Mitigation is to provide a sound technological basis for practical hazards mitigation efforts. Thus, development of effective hazards mitigation measures will be its central task. Through implementation of these measures it should be possible to reduce significantly the fatalities of people, loss of properties and destruction of the environment caused by natural hazards.

5. Communication on Scientific Results

One of the ultimate goals of GCR is to invoke the public awareness of the causes and consequences of global change, so that they will be willing to adjust lifestyle and support the idea of developing a sustainable future. The newly established NSDC invites several distinguished GCR scientists as committee members.

They are sitting together with ministers from Ministry of Interior, Ministry of Foreign Affairs, Ministry of Education, Ministry of Economic Affairs, Ministry of Communication and Transportation, Council on Economic Planning and Development, National Science Council, etc. The Advisory Panel consulted by NSDC also comprises of scholars and professionals qualified as experts to address the global change and sustainable development issues as well as international conventions and protocols requirements. So, the communication or dialogue channels for passing the GCR results to public decision makers in high ranking level are thought to be fairly well established in China, Taipei.

A series of government supported activities entitled “ Forum on National Sustainable Development” have just finished the first year programme, which is organized by the Sustainable Development Society of China, Taipei and have attended by a wide range of public and private sectors’ celebrities. The second year programme is under planning and targeting a more grass-rooted participation and ways of communication on disseminating GCR results and developing consensus for addressing sustainable development issues. It is to be hoped that the forum will continuously serve as bridges among GCR communities, public decision makers and private sectors in the future.

6. Major Findings

Kuroshio Edge Exchange Processes (KEEP) programme has established an extensive data base and discovered important phenomena since its inception in 1989. Induced by enormous nutrient input from subsurface Kuroshio intrusion and Changjiang runoff, the East China Sea is found to be an carbon sink with an estimated CO₂ flux of 3×10^{12} mol/y.

“LOICZ-Tseng-wen Estuary and Coastal Dispersal Zone” has defined the boundaries and understood the transport processes and pathways of terrestrial materials within the coastal zone during 1994-1997. We also determined their temporal and spatial variations of the hydrological, geological and biological distribution patterns. Conclusively, the biological resources are abundant, but has been affected by anthropogenic factors.

Research on Atmospheric Environments in Taiwan Area have focused on the flux of greenhouse gases in paddy soils, wetlands, uplands, forest soils, landfills, river, seashore and ruminant animals. Major findings include the estimation of the total annual methane flux 13,755 tons from 196,317 ha of rice paddy in the first crop season, which was lower than the 24,953 tons from 169,520 ha of rice paddy in the second crop season.

Table 1: Chronicle for the Global Change Research Related Events in China, Taipei.

- 1988. National IGBP Committee was established under the auspices of Academia Sinica.
- 1989. First IGBP research program (JGOFS-KEEP) was initiated.
- 1992. Attended the Earth Summit Meeting at Rio de Janeiro, Brazil.
- 1993. Established the Environment and Development Committee (CED) under the National Science Council.
- 1994. Established the Committee on Global Change Policy (CGCP), Executive Yuan. Published National Report on ‘ Global Change Research in Taiwan’.
- Since 1994. Actively attended the 6th, 7th, and 8th SARCS meeting for START, the 4th IGBP SAC meeting and the 1st IGBP Congress.
- 1995. Hosted the 6th SARCS Meeting.
- 1996. Published National Report on ‘ Global Change Research in Taiwan’.
- 1997. Restructured the Environment and Development Committee (EDC) into the Commission on Sustainable Development Research (CSDR) under National Science Council.
- 1997. Restructured the Committee on Global Change Policy (CGCP) into the National Sustainable Development Committee (NSDC), Executive Yuan.
- 1997. Launched the National Science and Technology Program for Hazards Mitigation
- 1998. Launched the “Sustainable Taiwan Vision and Strategy” project.

EUROPEAN UNION

European Union Research and Science Policy Highlights 1998

1. Fifth Framework Programme for Research and Technological Development (FP 5)

1.1 *Legal and Budget Background*

1998 has been marked by intensive discussions on, and development of, the EU Fifth Research Framework Programme, known as FP 5. This Programme is due to commence in 1999 and end in 2002. The legal instruments to implement FP 5 require tripartite agreement between the Commission, European Parliament and European Council of Ministers (representing EU Member States). This long and complex procedure is still ongoing at the time of the IGFA meeting, with budget issues proving the most contentious issue to resolve. Subject to final agreement on the budget issue, it is still hoped that final agreement can be reached before the end of 1998 which will permit the first calls for proposals in early 1999.

The Commission and Parliament have proposed 16.3 billion ecus, the Council of Ministers favor a lower sum of around 14 billion ECU's. Of the 16.3 billion ECU's in the Commission proposal, just under 1.3 billion ECU's is proposed for four key actions and associated generic activities which are included in the environment component of the fourth thematic programme, Preserving the Ecosystem (see section 1.2 below on thematic contents). This amount includes about 400 million ECU's for the key action on Global Change, Climate and Biodiversity, although the actual amount available could be less if the final budget settlement is less than the Commission and Parliament proposal.

1.2 *Thematic Structure and Rationale*

There is, however, broad consensus on the thematic substance of the new Framework Programme, as well as Preserving the Ecosystem, following political agreement between the three institutions in February 1998 on the rationale and structure of FP 5. The key objective of FP 5 is put science at the service of society by targeting research on problems and issues in the economic, social and environmental domains. These include job and wealth creation, industrial competitiveness, quality of life and health of citizens, and last but not least, environmental protection. There will be four thematic programmes and three horizontal programmes, with the main focus for global change issues coming in the fourth thematic programme, Preserving the Ecosystem. Each thematic programme will consist of a series of key actions and generic activities. In Preserving the Ecosystem (which covers Energy, Environment and Sustainable Development) the key actions are: Sustainable Management and Quality of Water; Global Change, Climate and Biodiversity; Sustainable Marine Ecosystems; City of Tomorrow and Cultural Heritage; Cleaner Energy Systems including renewables; and Economic and Efficient Energy for a competitive Europe.

Whilst most opportunities for global change research will occur in the key action on Global Change, Climate and Biodiversity, there are also important global change issues addressed in other key actions, notably Sustainable Marine Ecosystems which will address coastal issues, shelf and deep sea marine environments, including marine ecosystem and biodiversity issues. Earth system integration issues will be addressed in the Global Change key action.

The rationale and scope for each specific key action is contained in the Specific Programme proposal of the Commission presented to the Council of Ministers and Parliament in June 1998. The full Commission proposal is available on the EU website, but **the key actions on Global Change, Climate and Biodiversity, and on Sustainable Marine Ecosystems, are attached as Annex A to this report.** In addition, there will be a number of generic activities (on natural hazards, earth observation, socio economic research and research infrastructures), and there will be further support for the ENRICH initiative. Political agreement was reached on the content of the Specific Programme by the Council on 13 October but the Council cannot adopt the Specific Programme until the Parliament has given its formal opinion (expected in December) and the outstanding budgetary issue for the Framework Programme has been resolved. The Joint Research Centre (JRC) is also currently revising its Work Programme as part of FP 5. One element being discussed is development of a post-Kyoto cluster of JRC projects and activities covering both environmental and other sectoral domains.

1.3 Framework 5 Management and Organization

In defining a new approach for EU research into the new millennium, the Commission has also proposed changes to the organization of DG XII and to management of the new programme. Precise details are still under development, but the changes include the creation of a Board of Directors for the Preserving the Ecosystem programme; the establishment of Expert Advisory Groups to advise the Commission and Management Committees on strategic direction and implementation; new arrangements to improve evaluations and decision making processes and better assistance to unsuccessful applicants.

The overall effect of these activities will be to ensure that the European Union continues to play a strong and leading role in international global change research.

2. EU Research and Science Policy Highlights 1998

2.1 Climate Change; Interactions with policy pre- and post- Kyoto

The end of 1997 and most of 1998 has seen considerable interaction and valorization of climate change science. DG XII-D had extensive collaboration with DG XI (Environment Directorate General) in the preparation of the EU position and in the production of the Commission's post-Kyoto strategy. In the build-up to Kyoto a number of policy research interface workshops were held with invited experts and colleagues from DG XI. In 1998 a report of these workshops was published and will be available at the IGFA meeting. The value of these workshops was acknowledged by DG XI. The implications of Kyoto has seen an intensification of these activities. With regard to greenhouse gases sink approach, an expert meeting was held in Brussels in February 1998. This meeting brought together leading European scientists working on both Environment and Climate projects and also involved in IGBP. This workshop then provided the basis for collaboration with IGBP Terrestrial Carbon Working Group on the production of an article published in *Science* (Volume 280, 29 May 1998). Copies of the Brussels Workshop Summary Report will be available at the IGFA meeting.

February 1998 also saw a successful workshop held in Brussels on Stakeholders' perspectives on climate change policies.

The workshop brought together researchers, EU policy makers and key industrial companies to discuss the implications of Kyoto for research and policy. Copies of the report will be available at the meeting.

Since February three further workshops have been held on related issues and reports published which will be available at the meeting. These cover: Lifestyles, participation and environment; Criteria and Methods to integrate Equity, Efficiency and Effectiveness in EU and Global Climate Policy; and Domestic Tradable Quotas as an Instrument to reduce Carbon Dioxide Emissions.

2.2 European Climate Science Conference; Vienna, Austria, 19-23 October 1998 – this major Conference was organized by DG XII-D in collaboration with the Austrian Federal Ministry of Science and Transport in their capacity as President of the Council of Ministers. All aspects of the natural sciences were covered, from basic processes to climate modeling to climate impacts. 120 EU Climate projects funded under FP 4 presented the research results and their implications to more than 300 participants. A major publication will be produced as soon as possible to disseminate these results in the widest possible domain. A booklet outlining the Conference programme and speakers will be available at the IGFA meeting or from DG XII-D.

2.3 Some other key developments in 1998

March 1998 saw the launch of the **VEGETATION** instrument on board the SPOT 4 satellite. This instrument is the first instrument specifically designed to look at vegetation on a global scale. It should provide a powerful new tool of real value to ecosystem and land use researchers around the world. The mission is a result of cooperation between the European Commission and four EU member states, Belgium, France, Italy and Sweden.

In response to the carbon sink issue arising from Kyoto the **EUROFLUX** network is examining ways to increase the extent and resolution of tower flux sites to complement the current network. EUROFLUX is a complementary activity with AMERIFLUX which aims to quantify and understand the fluxes of carbon between forests and the atmosphere. A significant development is the extension of EUROFLUX eastwards, partly through funding for the ENRICH phase II project EURASIA-NET, which marks a European collaboration with Russia, China and Japan. It is hoped that this network, which eventually will form an in-situ global network called FLUXNET, will assist in resolving some of the central questions about the ability of forests to store carbon. For instance, early EUROFLUX results suggest that European boreal forests may alternate from source to sink during their annual cycle. This has obvious implications for Kyoto implementation and verification.

2.4 European Technology Assessment Network (ETAN)

This activity is sponsored by the Targetted Socio-Economic Research Programme under FP 4. During 1998 this programme has collaborated with the Environment and Climate Programme in the commissioning of an ETAN assessment into the implications of climate change issues for RTD policy and innovation.

An Expert Panel, chaired by Uno Svedin of Sweden, has met four times and their final report is imminent. As well as its long term reflections it will make an immediate contribution to a Communication on Climate Change from Madame Cresson (Commissioner for RTD), which is currently in preparation and is expected around the end of the year.

2.5 Oceans and the Lisbon Exhibition

The EU had a considerable presence at the Lisbon Exhibition on the Oceans, and research efforts were prominent through the 3rd European Marine Science and Technology Conference, jointly organized by MAST and EUROMAR. To coincide with the Conference and Exhibition, RTD Info published a special brochure on the oceans which addresses the critical issues confronting the oceans and the role of the oceans in the Earth system. Key EU projects supported by the FP 4 MAST programme are highlighted. Copies of this publication will be available at the meeting or from DG XII-D.

2.6 EU-US Bilateral talks on S&T Cooperation

Discussions continued throughout 1998 to finalize a bilateral agreement on S&T cooperation between the US and EU. Final ratification of this agreement took place in October and it is now in operation. This agreement complements those already in force with Australia, Canada and South Africa. Global change issues are covered by the agreement.

3. Specific IGFA Policy issues

3.1 Biodiversity and Human Health

Both of these issues will be addressed via the Fifth Framework Programme. **Biodiversity** forms a core element of the key action on Global Change, Climate and Biodiversity. However, it must be stressed that this is not biodiversity in isolation, but rather the links and relevance of biodiversity to ecosystems and the operation of the integrated Earth system. The sorts of research questions likely to be addressed include the rate and extent of biodiversity losses, interactions with ecosystems and the Earth system, vulnerabilities of habitats and specific species, the roles of different species in the system, monetary and non monetary valuation, and the development of strategies to reconcile preservation of biodiversity with the demands for economic exploitation. There is much support for this approach to biodiversity from all three European Institutions (Commission, Council of Ministers and Parliament). In the summer of 1998 the Commission published a research strategy for Understanding Biodiversity (Executive summary available at the IGFA Meeting; copies of full report available from DG XII-D). This Strategy was the product of the European Working Group on Research and Biodiversity (EWGRB). As part of their reflection an electronic conference was held which proved successful in engaging various sectoral interests (such as agriculture, forestry, etc.) in debating and defining their research needs. The report provided the basis for a substantive consultation and cooperation with DG XI (Environment Directorate General), and contributed to the production by DG XI of an EU Strategy for Biodiversity presented to the Council of Ministers and Parliament in June of this year.

This was the first time that a research mandate and strategy was articulated in the context of biodiversity discussions. Alongside the Climate Change deliberations outlined above, these two examples illustrate the possibilities of collaboration between the sectoral policy makers and science funding agencies.

A recent internal exercise by INCO revealed a number of biodiversity related INCO projects which were context driven and related to the role of specific species either in terms of conservation or in terms of their economic potential. See Annex B for example list which illustrates the approach taken in INCO.

The other major contribution to biodiversity research this year has been in the marine domain, with the production of a Science Plan for EuroGLOBEC. Produced in February 1998 following an earlier Workshop in October 97, this plan outlines current EU work relevant to GLOBEC and also some potential future activities and contributions. Coverage is comprehensive and includes research issues, data collection and collation and development and utilization of technologies. Copies of the Science Plan will be available at the IGFA meeting or from DG XII-D.

Human health - the potential health impacts of global change, and possible options for ameliorating those impacts, are to be addressed in the Global Change key action. Epidemiological and medical treatment options will be addressed in thematic programme 1 covering the Life Sciences. As a precursor to these activities, a project from phase II of the ENRICH call has been approved for funding in order to define a precise research agenda and priorities. Also, one of the Advanced Study Courses for 1999 will cover human health issues (see section 2.2.1 below). Both activities are currently subject to contract negotiation.

3.2 "Glue Money"

As IGFA recognized in 1997, glue money has many different dimensions. It can be thought of as research funding for synthesizing disparate research activities. In this context the main shared cost research projects in FP 4 and prospective opportunities in FP 5 have been highlighted in both the IGFA Resource Assessment and in this report. Hence, specific glue money referred to here covers the wider networking, agenda formation, science planning and integration, results exploitation, training activities and data collation and harmonization. Through various concerted actions and accompanying measures the EU has been able to support specific activities related to international global change science programmes, and these opportunities will continue in FP 5. There are four groupings covered by this report; Advanced Study Courses; ENRICH activities, accompanying measures attached to the Environment and Climate Programme and to the Marine Science and Technology Programme, and the Joint Research Centre.

3.2.1 Advanced Study Courses

The EU Environment Programme has supported a series of annual calls for Advanced Study Courses. The Commission decision on the 1998 call was announced in September and provided 800 kecus for 12 Advanced Study Courses (out of 60 proposals submitted), of which 8 are related to global change issues. The full list of titles is attached at Annex C.

Themes covered include human health, climate change modeling and impacts, vulnerable ecosystems, global change impacts in the Arctic, desertification, impact of aircraft emissions on the troposphere, integrated assessments, and legal aspects of Kyoto implementation.

In 1997 the EU Environment and Climate Programme funded 13 Advanced Study Courses to be held in 1998, of which 5 are global change related. A booklet outlining each of these will be available at the IGFA meeting or from DG XII-D. Issues addressed include ozone depletion, impacts of UV on ecosystems and human health, paleoclimate reconstruction and assessment of wetland functioning.

It is intended that all Study Course will eventually publish their proceedings, as for instance the 1996 Course on Climate change impact on agriculture and forestry; and the 1997 Tropospheric chemistry and space observation Course, both of which published their proceedings in 1998.

3.2.2 ENRICH Phase II Call

This call closed in December 1997 and 62 proposals were evaluated in the first half of 1998. Following this evaluation fourteen projects have been selected for funding. These projects are now subject to contract negotiations which should be finalized in November. A list of project titles is attached at Annex D and full details will be available from the ENRICH Secretariat on completion of the negotiation phase. It is important to note that several of these projects relate directly to contributions to international global change projects or involve researchers who themselves are prominent in the international programmes. Once again this process has shown its international dimension and also its flexibility in terms of the wide range of activities supported. It is envisaged that ENRICH will continue in FP 5, subject to agreement on the Specific Programmes under the Thematic Programme on Preserving the Ecosystem.

3.2.3 Other accompanying measures

The ENRICH call was focused on specific issues and had very specific participation rules reflecting its sponsorship by three programmes including the International Cooperation Programme. However, a number of other important activities or conferences received support from the EU through accompanying measures supported by individual programmes. In addition to those mentioned elsewhere in this report, attention is drawn to the EU sponsorship of the Joint GCTE-LUCC Open Science Conference on Global Change held in Barcelona in March 1998. In preparation for this Conference, DG XII-D supported an electronic conference which brought new people and insights into the LUCC reflections and also produced a catalogue of selected Environment and Climate and ENRICH projects relevant to GCTE and LUCC. Copies of this catalogue will be available at the meeting. This marked a very useful cooperation exercise not only for the scientific community, but also for the internal DG XII staff group which collaborated on the catalogue.

1998 has also seen workshops and conferences which addressed European contributions to major international science programmes. ELOISE has been formally accepted as a European contribution to IGBP-LOICZ and this relationship will be cemented through a joint Workshop in mid-January 1999 which will focus on areas 1 and 4 of each programme; biogeochemical cycles & fluxes, and integrated coastal zone management. Under FP 5 primary responsibility for ELOISE will probably switch from joint implementation by the Environment and Climate and MAST programmes to the new key action on Sustainable Marine Ecosystems.

Following the drafting of its Science Plan in 1997, a new project network on Wetland and Aquatic Ecosystem Research (WAtER) was created in September 1998 which will contribute to the envisaged IGBP core project on Continental Aquatic Systems. It will also complement the ELOISE network regarding inputs from catchments draining into the coastal zone.

Following a successful EU Workshop in Sea-Air Exchange: Processes and Modeling, the EU is co-sponsoring EU scientists to attend a workshop in December 1998 which will investigate a possible contribution to the future JGOFS agenda. Copies of the Sea-Air Exchange Workshop will be available at the IGFA meeting.

3.2.4 Joint Research Centre

The JRC Environment Institute hosts the European Offices for both IGAC and ELOISE, and also provides the chair of the IGBP Data and Information Systems Scientific Committee.

In October a Memorandum of Understanding was concluded between DG XII-D, JRC Environment Institute and IGAC to continue the EIPO until the end of the 5th Framework Programme. This is considerable investment by the JRC. The JRC and DG XII-D have also agreed that JRC will also host the ELOISE Office for the remainder of FP 4, with future decisions taken when FP 5 is implemented. Finally, Jean-Pierre Malingreau is chairman of IGBP DIS until next February. This investment of time and effort has facilitated the distribution of JRC land cover products (see section 3.3.2 below) into the IGBP community.

3.3 *Global Observing Systems*

3.3.1 Future approach and opportunities

Recognizing the need to ensure an appropriate EU contribution to the global observing systems, specific opportunities in this regard are addressed in the fourth area of both the Global Change, Climate and Biodiversity key action and the Sustainable Marine Ecosystem key action (see Specific Programme texts in annex A). In addition there will be a generic activity on Earth Observation dealing with cross-cutting issues.

Underlying the Commission thinking is a comprehensive approach to the issues confronting the global observing systems. The approach covers: making better use of existing data and observing capacity, innovative use of such capacity for new applications, and the development of new capacity and instruments where the other options are insufficient. Finally the area will address the issue of collation and dissemination of data and information in a form usable by non scientific stakeholders. For the Global Change key action it is intended that these observing system and data issues will be relevant to the global change problems to be addressed by research in areas 1-3 of the key action.

3.3.2 Joint Research Centre (JRC), Ispra

The JRC has a number of programmes within the Space Applications Institute and the Environment Institute which contribute directly or indirectly to the global observing systems and their associated international programmes. The Space Applications Institute has several projects relating to both marine and terrestrial environments. OCEAN and OCTOPUS are focused on marine primary productivity.

Tropical deforestation and global fire maps provide contributions to both GTOS and to IGBP DIS and LUCC. The Environment Institute has been active in the collection and provision of data relating to global aerosols, particularly in the context of the ACE-2 project (contributor to IGAC) and the Biogenic emissions project also covering biomass burning. Examples of these activities will form part of the JRC presentation to the IGFA delegates. Alan Belward chairs working groups of the Committee on Earth Observation Satellites.

3.4 Research related to developing countries

3.4.1 INCO Programme

Within DG XII primary responsibility for interactions with developing countries has rested with the International Cooperation programme known as INCO. The focus has very much been on supporting science relevant to the key socio-economic and development issues facing specific countries. As a result, global change has not been a primary focus for research, but rather, it has been one component addressed whilst considering problems related to agriculture, water resources and the like.

A catalogue of projects relating to Agriculture and Natural Resources (1998 edition) will be available at the meeting. This includes projects such as Global change and Subsistence Rangelands in Southern Africa (see page 62) which is a recognized project in START-Africa. This focus on developmental issues is expected to continue in the new FP 5 international cooperation programme.

3.4.2 Thematic Programmes and ENRICH

Within the FP 4 thematic programmes the involvement of non-EU participants in research projects has been very much ad hoc and dependent on specific circumstances. This is likely to continue in FP 5. ENRICH provides a very important focus for encouraging and enhancing European scientific cooperation with the wider international community, but ENRICH only supports networking and capacity building activities, and not research itself. This approach is proposed to continue in the Commission proposal on FP 5, and it is likely that this will be accepted by the Member States. In total ENRICH has provided around 5 million ECU's over two years in FP 4, but in FP 5 the precise amount has yet to be determined.

Under FP 5, support for important non-EU participation in research projects will be provided directly by the Preserving the Ecosystem key actions and not by the new INCO programme. This will facilitate the evaluation of projects and the consequent managerial arrangements for contract negotiation and funding commitment.

4. Other useful publications not mentioned in previous sections

EU Framework Programmes – Joint Actions Environment – a special newsletter produced in collaboration with CORDIS Focus (No 118, 21 Sept); includes good examples of web pages on Environment and Climate and MAST programme and project information.

Environmental Change Impacts and Environmental Technologies – Activities and Recent Results; December 1997; - Summarizes research work and findings on stratospheric ozone depletion, tropospheric chemistry, biodiversity, and on aquatic, terrestrial and coastal ecosystems. This volume complements the similar booklets on Climate Change Highlights and Marine Science and Technology Highlights distributed at the 1997 IGFA Plenary in Tucson.

Scientific Report of the First European Conference on Progress in Oceanography of the Mediterranean Sea; report published in 1998 of Conference held 17-19 November 1997 – provides a good summary of the scope and extent of all marine research focused on the Mediterranean Sea and its environs. Not exclusively global change but includes useful contributions on global change issues and their links to other more regional and in-situ issues.

Remote Sensing of Mediterranean desertification and environmental changes (Resmedes); 1998 – published report from a completed research project which links detection of desertification issues to various remote sensing instruments and datasets. Relevant to the Desertification Convention and to core projects within WCRP and IGBP.

Atlas of Mediterranean Environments in Europe: The Desertification Context – based on the output of the EU MEDALUS Project; a comprehensive examination of the desertification issue in the Mediterranean; published by John Wiley and sons

3rd European Marine Science and Technology Conference, Lisbon; - in 5 volumes, project descriptions for all marine research projects from the MAST 3, Environment and Climate, and Fisheries Programmes and covering inter alia projects on physical and biogeochemical cycles, marine biodiversity, and global change impacts on marine ecosystems

Global Change in Europe's cold regions – Ecosystems Research Report 27 – one volume with two parts covering scenarios for ecosystem responses to global change, and impacts of global change on tundra soil biology

Quantification of the west European methane emissions budget by atmospheric measurements – Executive Summary of the final report from this Framework 4 project.

5. IGFA Contact points in DG XII-D

EU representative to IGFA:

Christian Patermann, Director of Environment Programme, DG XII-D, SDME 7/62

Scientific officer responsible for IGFA liaison:

Steve Morgan, DG XII-D, SDME 7/23

Scientific officer responsible for information and dissemination activities:

Martin Bohle Carbonell, DG XII-D, SDME 7/82

Address in all cases: Name and location as above followed by:

European Commission, rue de la Loi 200, B-1049 Bruxelles, Belgium

FRANCE

1. Climate Research

A new organization of our national programmes on Climate has been set up to focus research on the understanding of climate variability at all time and space scales and on impact assessment. It is now organized under three axis:

1.1 *Research programmes on basic processes*

Atmosphere and ocean physics and dynamic at all spatial scales including cloud physics, precipitation and radiative transfer questions. It contains the atmospheric part of France participation to GEWEX;

Atmospheric chemistry, partly France-IGAC, with two strong actions on stratospheric chemistry and on atmospheric chemistry/climate interaction, including research on aerosols;

A comprehensive programme on carbon cycle, partly France-JGOFS, which is essentially concerned by atmosphere and ocean parts of the cycle. It will have to extend its interest to continental biosphere; and

Continental water cycle, partly France-GEWEX and France-BAHC.

1.2 *Climate variability at all time and space scales*

Partly France-CLIVAR

1.3 *Management and Impacts*

Based on risk assessment, which includes the expertise for international negotiations.

This programme is an entirely new one.

2. France-Diversitas

In 1993, soon after the Rio conference, the CNRS launched the “Programme National Dynamique de la Biodiversité et Environnement”.

This programme had three main objectives :

- identify the factors which determine biodiversity composition and change;
- evaluate, model and predict the role of human intervention in biodiversity dynamics and ecosystem function;
- understand and benefit from the functions which biodiversity fulfills for human society, whether economic, ethical or cultural.

The programme promoted the implementation of several scientific networks such as :

- mechanisms of evolution and maintenance of biodiversity;
- National systematic network;
- ecology and sustainable interactions (devoted to host-parasite relationships);
- perceptions, valuation and uses of biodiversity; and
- biodiversity and ecosystem functions.

Most of these networks have been able to find funds to launch field research activities.

Initially imbedded in France in the field of biological sciences, biodiversity has turned into a programme for finalized research institutions because of its relevance to sustainable development and economic valuation of biological resources. It prompted a new and constructive dialogue between scientists and managers.

As a result, the other French research Institutions formerly joined the initiative in 1997 and a scientific platform of shared interests and objectives was elaborated. The French National Biodiversity Programme (PNDB) aims at covering the whole field of biodiversity, from basic science to social and economic stakes.

The French National Biodiversity Programme (PNDB) developed under four axis:

2.1 Origin, distribution and dynamics of biodiversity

Including the knowledge of evolutionary mechanisms, host-parasite relationships, functional role of biodiversity;

2.2 Conservation and restoration of Biodiversity

Covering the questions related to protected areas, the fragmentation of habitats and their consequences for conservation, the restoration of degraded habitats, the sociological basis for an integrated conservation policy;

2.3 Biodiversity and sustainable development

Giving special attention to the importance of traditional knowledge and uses in the conservation of biodiversity, the long term viability of ecosystems in relation to social practices in the management of biological resources. Specific questions such as biological indicators and quality norms, or the role of NGO in the conservation of Biodiversity will also be treated; and

2.4 Economic valuation of biodiversity

This axis cover the questions of genetic resources for agriculture, the identification and industrial valuation of new natural substances, the problems of economic valuation of functions of biodiversity in ecosystems and for human welfare.

The terms of reference of the PNDB are :

- * identification of national research priorities;
- * development of the information transfers between scientists, managers and administrations; and
- * representation of the scientific community in international arenas and negotiations.

The PNDB is a national contribution to the programme DIVERSITAS International.

3. Climate Change and health

Nothing is coordinated up to now in France. A reflection is under way under the umbrella of the French Academy of Sciences. Preliminary conclusions indicate that a research programme could be launched aiming at understanding and monitoring climate health related questions in developing countries.

It has been difficult to get an active interest from medical sciences communities. There is clearly a need to identify key research areas prior to the launch of any actions.

4. Research in/with Developing Countries (DC)

Through Orstom and inter-agency coordination, France has greatly participated to research in or with DC:

Participation to TOGA and El Nino research;

Several participation to continental experiment such as Hapex-Sahel and Salsa-Mex; and
Participation to Pirata pilot experiment in equatorial Atlantic.

France is also supporting MEDIAS-France which aims at helping research and capacity building in the Mediterranean and sub-sahelian Africa.

In the future, France will continue on the same line, namely we will:

Continue its involvement in ENSO related activities in the Pacific;
Work to develop the PIRATA pilot network into a more wide one after 2000;
Promote a GEWEX continental scale experiment in sub-sahelian region, CATCH experiment which could be implemented within a 50000 km² sub basin of the river Niger;
and
Participate to several experiments in the Amazon region like LBA or an experiment on deep convection and troposphere/stratosphere exchanges and related atmospheric chemistry.

5. Global Observing Systems

During the last 10 years or so, France participated strongly to the deployment of several 'global observing systems', especially in the frame of WOCE and in participating to other 'global' networks like the ones on stratospheric ozone or atmospheric CO₂. France has a national space programme (Topex and Jason, SPOT) and is participating to the European one

In the future, France will :

Continue to support easy access to satellite observations by participating to CEOS and IGOS pilots activities;
Be involved in the deployment of a future global ocean observing network, including in situ measurements, in the frame of GODAE (Global Ocean data Assimilation Experiment) in particular;

- * Continue its participation to other global networks; and
- * Participate to reflections on a network of observatory for the biosphere.

6. Budget overview

The total amount of seed money which could be used for basic research related to climate is strongly decreasing : about 7MF in 1998 to be compared to more than 10MF 5 years ago (excluding personal, satellites and ships).

Apply research looking at risk assessment will receive more attention: at least 5MF per year are foreseen for the next 3 years. This is an entirely new budgetary effort from the French Ministry of Environment.

'Glue money' is difficult to provide, but France is:

Supporting 2 core project offices, DIS and SPARC;
Supporting MEDIAS-France, which is a part of START; and
Supporting participation of its nationals to IPCC and other climate related scientific meetings.

France intends to develop its participation to CLIVAR International Programme after 2003.

GERMANY

Global change research in Germany is mainly funded by the Federal Ministry of Education, Science, Research and Technology (BMBF), the Deutsche Forschungsgemeinschaft (DFG) and the Max Planck Society (MPG). Additional funds are available from the Volkswagen foundation and the Federal Foundation for the Environment.

With all funding agencies, total funds for global change research have remained stable. For a number of programmes funding is secured for the next 2-3 years. Because of the recent change of government no details can be given as to prospects of funding.

Some major areas of global change research are in a transitory phase of being redefined and focused. The DFG National Committee on Global Change Research has proposed a new framework consisting of recommendations for contributions to the international programmes including biodiversity and two integrative programmes. The concept follows the philosophy “more international”, “more interdisciplinary” and “more integrative”.

As a new priority area a proposal for an integrative programme on “Water availability, quality and allocation” has been submitted to the BMBF. Funding concepts are also developed for topics of biodiversity and climate research. Biodiversity will be dealt with both as integral part of global change research and separately. The discussions about the future orientation of global change research have led to a significant increase of interest in and attention to biodiversity research. The DFG will establish a new programme on the environmental problems linked with potential future global change in industrialized areas. The state of the art of global change research by the end of 1997 is documented in a publication.

The Federal Government is supporting international research collaborations in the field of global change research by contributing funds to four international secretariats: the EUROTRAC-2 International Scientific Secretariat, the BAHC Core Project Office, BALTEX and IHDP. In addition, two national coordinating units (one for the IPCC and one for IGBP/IHDP/WCRP/DIVERSITAS) have been set up to achieve better incorporation of German global change research into international programmes.

Glue Money can be provided mainly through funding workshops, to a limited extent through IPO and project funding. Funding agencies tend to rather keep control over well defined and peer reviewed activities than to grant global funds.

National contributions towards observation tasks are made by the Federal Government via the German Meteorological Service (DWD), the Federal Institute for Navigation and Hydrography (BSH) and the Federal Institute for Water Science (BfG). As part of the WMO's Global Atmosphere Watch (GAW) programme, the Federal Government has established one global station and several regional stations via the DWD. In addition, DWD makes a national contribution to the Global Climate Observing System (GCOS) and maintains the Global Precipitation Climatology Centre in addition to other data centres (e.d. for BALTEX or ACSYS and furthermore a Global Collecting Centre (GCC) in Germany). A German climate monitoring centre is currently being set up.

In this context further contributions are made by BfG (Global Runoff Data Centre) and through the BSH, which maintains a network of oceanographic stations in the German Bight and the Western Baltic (linked to the Global Ocean Observing System GOOS). The DFG has set up a task force to further develop GOOS. The National Committee has started to bridge the gap between science and organizations responsible for planning and operation of global observation and data systems. Funds are also allocated to preparations for the ENVISAT mission which is expected to make major contributions at atmospheric and climate research. The above mentioned programme initiatives in climate research will partly take into account the potential of this new satellite. A task force of the DFC Senate's Commission for Atmospheric Sciences has just published a memorandum on remote sensing of the atmosphere and climate system containing a number of recommendations to improve the cooperation of system providers/operators and scientific users and to secure funds for scientific users.

The DFG has a bilateral funding agreement with the Federal Ministry for Economic Cooperation (BMZ) enabling scientists to apply for funds for capacity building and cooperation with partners in developing countries. So far, this potential has been used only to a limited extent for global change research.

ICELAND

New funding

In April 1998, the Icelandic Research Council (IRC) presented a plan for a new targeted research programme to the government. This was a six-year plan and focused on two major themes: Information technology and Environment. The government has now approved the plan and incorporated proposed funding for the next year's budget.

The budget for the six years is 580 million Icelandic kronur (ISK) or 8.4 million USD. This represents approximately 20% increase in the funds available in competitive grants from the IRC. The unique aspect is that this is new money and that the IRC and the government decided to use this for targeted research. The general policy of the Council has been to use most of its funds for open calls.

The programme is 40% environment and 60% information technology for the first phase of three years (1999-2001). The following table shows the indicative breakdown of the funds going to environmental research for the first three years.

		mISK	kUSD
Sustainable use of resources		21	305
Global change and climatic variability	30		435
Environment and industry		18	260
Environment and health		27	390
Genetic resources and biodiversity		16	230
Remote sensing		5	75
Total		119	1,725

The first bid for the programme will be announced shortly. The IRC expects that this new programme will stimulate research in these areas in government research institutes and universities resulting in multiplication effects.

New panel of experts on global change

As a part of the government's post-Kyoto strategy, the Ministry for the Environment has established a panel of experts to advise the government on the implications of global change for Icelandic nature, economy and society. This panel responds to questions from a new high-level inter-ministerial committee on climate policy. The first task for the panel is to analyze the implications of IPCC's second assessment with special reference to the North Atlantic region and Iceland. Their report will include basic information on climate change in an assessable format for policy makers and the general public.

International workshop on the North Atlantic climatic variations

The IRC organized an international workshop on the **Environmental and Climatic Variations and their Impacts in the North Atlantic Region** in Reykjavik in September 1998. This workshop was co-sponsored by the US National Science Foundation (NSF) and the EU Environment and Climate Programme.

The workshop was very successful and demonstrated the strong interest in the North Atlantic processes among scientists and policy makers on both sides of the Atlantic. The final session focused on the “implications for the science agenda for the next decade”. The results of this session are being edited and will be made available on the Internet (www.rannis.is). This intention was not to rewrite the science agenda of international or national programmes. The aim of the session was to develop a common vision for research and research cooperation in this region within the existing programmes. The session was characterized by a strong willingness to cooperate fueled by the conviction that this region has a lot to offer to science in general due to its special features and importance.

Examples of issues identified:

- The North Atlantic represents a unique point in the earth’s climate system and impacts a broad geographic area.
- The deep-water formation north of Iceland is of key importance in the global thermohaline circulation of the oceans.
- The North Atlantic Ocean oscillates between two quasi steady states. The understanding of the North Atlantic Oscillation (NAO) is at a similar point to day as the understanding of ENSO was five years ago.
- The NAO can be used as a test bed for coupled climate models. Their ability to simulate NAO is a good indicator of their general level of sophistication.
- The scale and complexity of the dynamics of the North Atlantic climate and ocean system calls for a major modeling and synthesis effort. The lessons learned from such an effort will benefit climate change research globally.
- The existing monitoring capacity in the area is insufficient in particular over the oceans.
- Living marine resources in the region respond in a dynamic way to the variable environment. Functional understanding of the response of the ecosystems to physical forcing is needed.
- The steady state assumptions in fisheries management have to be replaced by more dynamic modeling of the physical driving forces. Explanations of causal relationships can be useful for managers even though prediction is not possible.

Transatlantic cooperation

Iceland is committed to transatlantic cooperation in science. This is particularly important in the area of global change. No one nation has the capacity to tackle the issues in isolation. Iceland is a full partner in the EU framework programmes.

There is a long history of cooperation with the USA and Canada. The IRC is making a special effort to strengthen the cooperation with the USA. A delegation from the IRC visited the US in October 1997 and in September US/Icelandic Science days were held in Reykjavik. At this occasion the IRC and NSF exchanged letters of intent. Cooperation in the area of global change research will surely be an important component of this effort.

The Icelandic government considers it of high importance that the inclusion of North American scientists in projects under the EU's Fifth Framework Programme will be facilitated. Their participation would be funded by North American sources.

Other issues relating to the IGFA 1998 agenda

- **Health and biodiversity** are both covered in the new programme. Both are relatively new issues for research in Iceland and it is premature at this point to predict what the response to the call will be. Persistent organic pollutants and ozone depletion are among the most important health issue related to global change in Iceland.
- The hosting of the international workshop was supported directly by funding from the government. One of the aims of the workshop was to facilitate the interaction among different programmes such as CLIVAR and GLOBEC. This is an example of effort falling under the concept of “**glue money**” as used by IGFA. Iceland hosts the secretariat of CAFF (Conservation of the Arctic Fauna and Flora) which is a part of the Arctic Environmental Protection Strategy, which now falls under the new Arctic Council. Iceland will also host the secretariat for the PAME (Protection of the Arctic Marine Environment) starting in 1999.
- The Icelandic agencies have been following the development of the **global observing systems** through their involvement in WMO and ICES. The lack of observing capacity over the oceans is of particular concern to Iceland.
- Iceland supports effort in the area of climate change mitigation in the area of geothermal energy. This is an under-utilized source of renewable energy with minimal environmental impact. In terms of **development cooperation**, Iceland hosts the UN University's department on geothermal energy and sponsors students from the developing countries. Last year a new UNU department on Fisheries Management was established in Iceland. The IRC has good relationship with the Icelandic Development Agency.
- On evolution of funding levels and priority areas see above.

INDONESIA

INDONESIAN CURRENT AND FUTURE ACTIVITIES IN THE GLOBAL CHANGE PROGRAM

1. Background

The Republic of Indonesia is the world's largest archipelagic country with 17,508 islands stretching 5,100 kilometer from West to East, in the equator. It is also known as the only world's maritime continent right at the equator. With a population of 210 millions people, Indonesia is the world's fourth most populous nation on earth. The country is also rich in natural resources. The tropical forest of Indonesia is a source of biodiversity with approximately 120 million hectares, in it lives:

- a. 10 % of the world plants species;
- b. 200 of the 500 (40 %) of the world mammal species;
- c. 16 % of the world reptile and amphibian species; and
- d. 430 of the 1,500 (28 %) of the world bird species.

Also, nearly 7,000 species of fish live in the marine and coastal zones of Indonesia, along with approximately 700 types of coral-reefs. Geologically, three plate tectonics collide in the Indonesian region. Those are the Eurasian Plate, the Indo-Australian Plate and the Pacific Plate. These are the reasons of many volcanoes, 129 are actives, and the country is also the place of earthquake occurrences. On the positive sides, however, the geologic and tectonic conditions of Indonesia has made the country very rich in mineral resources, such as: tin, bauxite, copper, silver and gold, and also rich in energy resources of oil, natural gas and coal. Rich soils in Java and Bali, good soils in Sumatera, Sulawesi and many other islands are most suitable for agricultural activities

The Indonesian region is also known as the “*heat engine*” of global atmospheric circulation. Its complex physiography and its abundant of energy sources result in a *complex ocean-atmospheric dynamics*. Furthermore, the influence of the interactions among global phenomena (*El Nino*, *La Nina*, the Australian Monsoon and the Asian Monsoon) and local processes is still unresolved. Therefore, the area is becoming an important place for *the global climatological change research activities*.

Considering the above mentioned positions and conditions of the Indonesian region, four major global change research activities are currently on going, and some are being proposed. The four major activities are:

1. Climate Variability Research in the Indonesian Region;
2. Land Use and Land Cover Change of The Indonesian Region;
3. Throughflow Studies of The Indonesian Seas; and
4. Marine Geotectonic Studies in The Indonesian Regions.

2. Indonesian readiness to participate in the Global Change Research Programs

On November 10, 1997, in Jakarta, on the opening address of the international conference science and technology for the assessment of global environmental change and its impact on the maritime continent of Indonesia, the President of The Republic of Indonesia stated, among others, that: " Well aware of the importance of Indonesia's territory in understanding global climate, we are pleased to open ourselves and offer the uniqueness of our territory, weather at sea, on land and in the atmosphere for scientific studies on climate, weather and the environment".

The President's statement received very positive response from the Conference participants coming from the USA, Germany, France, Australia, Japan, Israel, Belgium, The Netherlands, Canada, Taiwan, Norway, The Philippines and scientists from the host country, Indonesia. The Conference participants also declared a FORUM STATEMENT which recommend Indonesia to promote the establishment of an International Research Center (as attached) to serve the countries within the region. This center, named *The Indonesian Research Institute for Climate, Environment and Society (INRICES)*, and it will conduct various researches related to climate prediction, crop estimation, disaster mitigation and their impacts to the environment and society. INRICES, and its scientists, will link up to the International bodies and individuals from all over the world.

Indonesia's readiness to participate in the Global Change Program are also exemplified by the provisions of various global change research facilities, such as:

1. The availability of six Baruna Jaya Class very modern research vessels dedicated for marine global change research activities;
2. The availability of six NOAA satellite groundstations and a SPOT, LANDSAT ERS-1, JERS-1 remote sensing satellite groundstation in Parepare, South Sulawesi for remote sensing satellite data facilities;
3. The establishment of three Radar Observatories in Biak-Irian Jaya, Serpong-West Java, and Koto Tabang-West Sumatera for climate research;
4. The establishment of Global Atmospheric Watch Station in Koto Tabang - West Sumatera;
5. The establishment of 112 meteorological stations, 16 climatological stations, 94 agricultural monitoring stations, 5038 rain gauge stations and 173 humidity measurement stations for weather and climate modeling;
6. The availability of land, coastal and marine data for further scientific researches; and
7. The availability of scientific human resources within the *Scientific Community on Atmospheric Dynamics (SCAD)* from different research institutes and universities who will support the research activities. Meanwhile, the Indonesian scientists involve in atmospheric dynamic researches, ocean science research and in land-use land-cover change studies are very active working with their International counterparts.

During the Celebration of the United Nations International Year of The Ocean 1998, in Manado Bay, North Sulawesi, on September 26, 1998, the President of the Republic of Indonesia signed an OCEAN CHARTER 1998 (as attached) and reiterate Indonesia's commitment, among other:

1. The Goal To Protect the Ocean Environment Is To be Pursued both National and Internationally;
2. Indonesia and other countries should work together to achieve common goals for the oceans; and
3. Indonesia and other Ocean States should make use of International and intergovernmental organizations to generate global programs and agreements.

The above mentioned programs, commitments and facilities offered by Indonesia should be responded by its International counterparts to work together in order to strengthened the common objectives on implementing the Global Change Program.

3. The current Global Change Programs in Indonesia

It is very encouraging to witness the International positive responses on Indonesia's readiness to work together on the Global Change Programs.

Some International cooperative programs are currently underway, such as:

The ARLINDO Program:

The ARLINDO Program is the Sea-Through Flow Studies of the Indonesian oceans. This program, started in 1990, is being jointly coordinated by: BPPT-Indonesia, Lamont Doherty Earth Observatory-USA, SCRIPP Institution of Oceanography, San Diego-USA, University of Washington, University Marie et Currie, France and CSIRO-Hobart, Australia. This study is being aimed toward unraveling the scientific phenomena of the ocean-through flows on the Strait of Makassar, the Strait of Lombok and the Banda Sea. The ARLINDO Phase II and Phase III are currently underway.

A significant result of the program to global change research has been demonstrated through Reprinted Publication from the *Journal of Geophysical Research*, 1996 and it was suggested that sound scientific plan for new observational and modeling efforts is very important to determine the roles of the Indonesian throughflow in order to understand global ocean-atmosphere land system of the Asian-Australian monsoon system.

The Indonesian Climate Variability Program (CLIVAR):

The initial CLIVAR program in Indonesia was started in 1992, when Indonesia participated in the planning stage of the *TOGA-Intensive Observation Period (IOP)* in the *TOGA-COARE International Project Office (TCIPO)* in Boulder, Colorado. Since then, Indonesia through BPPT has been actively participated in the field of ocean climate, such as *Tropical Ocean Climate Studies (TOCS)*, in collaboration with The *Japan Marine Science & Technology Center (JAMSTEC)*.

Through the *Indonesian Climate Variability Program*, Indonesia, BPPT has also been in contact with Asian-Australian Monsoon Panel of *CLIVAR-WCRP* Programs, and ready to participate in the International collaborative work in order to have a better understanding on how the global climate operate. In collaboration with the Indonesian Meteorological & Geophysical Agency (BMG), climate database is developed within this program to look at climate regulator within the Maritime Continent.

With JAMSTEC, BPPT plan to extent the western Pacific TAO-array into the Indonesian region, and Indian Ocean. In relation to the expansion of Indonesian CLIVAR program, negotiations between BPPT-Indonesia, JAMSTEC-Japan and LDEO-USA are currently underway for the deployment of Triton Buoys in Banda Sea and in the Halmahera Sea.

Climate Variability study related to El-Nino, La Nina, Asia Monsoon, Australia Monsoon, Madden-Julian Oscillation and local processes is performed by Indonesia CLIVAR program by implementing data from Boundary Layer Radar Stations

The Global Research Network System (GRNS):

The GRNS Program was initiated by NASDA-Japan in 1993 and will last until 1998, to encourage research networks among scientists from various countries. In Indonesia, BPPT and LAPAN (The Indonesian Space Agency) were the active participants of this GRNS Program. The studies include the applications of NOAA, JERS, MOS and ADEOS satellite data for ocean color studies, sea surface temperature studies, ocean productivity studies and ocean pigment studies. The Indian Ocean south of Java, Bali and Lombok islands were selected as the locations for sea truthings. BPPT's Baruna Jaya research vessels were deployed to support the ocean verifications of the satellite data.

Atmospheric Research - Boundary Layer Radar Atmosphere Program:

This cooperative program was initiated by BPPT, The Indonesian Meteorological & Geophysical Agency (BMG) and LAPAN of Indonesia, and the University of Kyoto, Kobe University of Japan and NOAA-USA. The atmospheric research activities were conducted by the establishment of the Atmospheric Radar Observatory in PUSPIPTEK, Serpong, West Jawa, and in Biak, Irian Jaya since 1992. *Boundary Layer Radar (BLR)*, *Meteor Wind Radar (MWR)*, *Wind Profiler* and different kinds of automatic surface measurements have been installed in the Observatories. Recently, *Boundary Layer Radar* has also been installed in Bukit Kototabang-West Sumatera. The station's positions along the equator making them very strategically located for equatorial climatic researches.

BLR data will be utilized to identify the equatorial Planetary Boundary Layer as a major source of kinetic energy in the EARTH'S ATMOSPHERE and to understand the characteristic of Boundary Layer Climate over Indonesia through analyzing of boundary layer thickness fluctuation, land sea interaction, vertical wind vector and analysis of land morphology.

In the same area, *Global Atmospheric Watch (GAW)* equipped with different kinds of atmospheric instrumentation have been established as part of the International program.

The Land-Use and Land Cover Change In IGBP-SARCS-START Program:

Under the International Geosphere-Biosphere Program (IGBP) in Southeast Asia, The SARCS Program, Indonesia participated in the prototyping of Land-Use & Land-Cover Change Studies in West Java. This program assessed the impact of land-use and land-cover due to natural conditions and human dimensions. Results of the study was presented in SARCS-START meeting in Bangkok, in early 1998.

The Marine Geology & Geophysical Program:

Considering the tectonic conditions of land-ocean of Indonesia, International geological and geophysical research activities in the Indonesian seas are very active. The past and present marine geological research, include:

- a. Paleo-climatological studies of the Arafura Sea, Between Irian and Australia. This study was coordinated by BPPT and US Geological Survey;
- b. Geological and Geophysical Studies of Sunda Strait. This study was coordinated by BPPT and The French Research Institute;
- c. Geological and Geophysical Studies of the Sulawesi Sea. This study was coordinated by BPPT dan BMG-Germany;
- d. Geology and Geophysical Studies of Banda Sea. This study was coordinated by BPPT and the French Research Institute; and
- e. Geophysical Studies of Java Trench. This study will start on November 1998, and will be coordinated by BPPT and BMR-Germany. The SONNE research vessel from Germany will conduct the Expedition.

4. Proposed Global Change Activities in Indonesia:

Results coming from the past and present Global Change Program in Indonesia open new avenues for further research activities and Conferences in Indonesia under IGBP auspices in the coming years.

Various proposed program activities for IGFA considerations are:

Climate Modeling of the Indonesian Region:

Preliminary results and conclusions coming from the ARLINDO, CLIVAR and GRNS programs showed that the climatic conditions of the Indonesian region affect the regional climates. The climatic variability in this region are the results of ENSO, Asian Monsoon and Australian Monsoon. An Indonesian Monsoon concept is being proposed to be assessed. This activity will also geared toward supporting the establishment of Indonesian Research Institute for Climate, Environment and Society (INRICES) mentioned earlier.

Land-Sea-Air Interaction of the Indonesian Region (ILUDWINA):

The Land-Sea-Air Interaction coming from an archipelagic nations, like Indonesia, produced scientific phenomena related to wind patterns, ocean current directions, coastal plain configurations, island topographic configurations and inter-island ocean characteristics. The ILUDWINA program will implement various earth observation satellite data, such as: ERS-1, ERS-2, JERS-1, JERS-2, MOS, Landsat, SPOT, RADARSAT, Topex-Poseidon, ADEOS, NOAA, for sea-air-land interaction studies. This ILUWINA Program will also geared toward the establishment of INRICES.

International Ocean Conference, in Jakarta, on September 1999:

Results of various ocean scientific research, living and non-living, will be presented in the International Ocean Conference in BPPT venue, Jakarta, on October 1999. In conjunction to the Seminar, there will be an International Exhibition which will exposed various science & technological products for ocean and maritime industries.

International Conference On Climate, in Bukittinggi WestSumatera, Indonesia, on November 1999:

Various research result related to climate modeling, ENSO, La Nina, Asian Monsoon, Australian Monsoon, atmospheric research will be presented in an International On Climate in Bukit Tinggi, West Sumatra, November 1999. The Conference location is also the site of the Boundary Layer Radar Facility and the Global Atmospheric Watch in the equatorial Indonesia.

THE NETHERLANDS

Policy

NL becomes careful, not any more in the forefront of ambitious emission reduction targets. In Kyoto 1997 the EU committed 8% emission reduction in 2007/2008 compared to 1990. NL aims at a slightly less reduction. The budgets for CO₂-reduction policy measures has been raised again by several hundreds of million guilders (1 NLG = 0.5 USD). The change of government in summer 1998 is not likely to influence the policy since the same parties are involved and the economic constraints are unchanged.

Funding of research

Also under the new government basic research has a low priority. Total research budgets are still under pressure, taking about 1.8% of gross national product, which is lower than the average of OECD countries (2.2%).

However, the funding level of GC research is slightly increasing. After two GCR programmes of the science foundation NWO with earmarked funding and two National Research Programmes on Climate Change (NRP: 1990-1995, 1996-2001), there is a tendency that smaller, more focused GCR programme proposals are submitted and funded by NWO. GCR is becoming part of the normal funding systems.

Dutch research is as much as possible immediately contributing to the international programmes. Representation of Dutch scientists in SSCs, task groups etc. is satisfactory.

Specific research programmes

NWO/NRP ongoing: 75 projects, funding level 5 M USD/y 1996 through 2001. Most of the projects contribute to the key issues of WCRP, IGBP or IHDP.

IHDP: Dutch research activities contribute considerably to IHDP.

NWO-CLIVAR: MUSD 2.25 committed (1998-2003)

EUROCLIVAR: Dutch initiative to collaboration

LOICZ: commitments to SARCS/WOTRO/LOICZ programme (Malaysia, Philippines, Vietnam, Thailand) terminating in 1999.

LOICZ: *NWO/WOTRO* programme SW Sulawesi (Indonesia) terminating in 1999

LOICZ: *NWO/WOTRO* programme Teluk Banten (Indonesia) phase 2: 1998-2001 MUSD 2

LOICZ: national research programme is being developed. Planned 1999-2004 about MUSD 8. (Min. Educ. & Science, NWO, Min. of Agriculture, Fisheries and Nature, Min. of Public Works.

NWO-NEESDI: a geological programme with considerable parts relevant to GC, 1997-2001 MUSD 2

NWO-EPICA (European project ice core drilling Antarctica from Eur.Science Foundation): continued participation

NWO-IMAGES (ocean drilling, IGBP-PAGES): started to participate 1998-2000.

The Min. of Educ. & Science and NWO have reserved a budget for "Intercore project activities", according to the recommendations of IGFA-Kyoto 1995. Very recently kUSD 75 was granted to the new IGBP Carbon Cycle Project.

Glue money

LOICZ: the funding of the IPO LOICZ will be continued 1998-2002 MUSD 0.5/y; sources: Min of Educ.& Science, NWO, Min. of Public Works, and the host institute NIOZ. Inter-core project activities: a budget of kUSD 50 /y, funded by the Ministry of Educ.& Science and NWO.

Biodiversity

Biodiversity has grown as a policy issue outside the classical domain of nature conservation. The environmental policy has adopted it as an issue already more than a decade ago, but now it has become a policy target of Public Works, Water Management and Agriculture as well. Research: There are large groups of volunteers involved in monitoring birds, plants, butterflies, dragonflies, sea shore organisms and so on. Their importance as sources of basic information is rapidly increasing.

Funding of basic research:

NWO Programme Biodiversity in disturbed ecosystems. 1997-2002, MUSD 4. The programme focuses at tropical lowland forest.

NWO Programme Biodiversity. 1998- 2004, MUSD 7. The programme aims at 4 key themes, more or less relevant to GC.

An interesting aspect is that there are few young scientific taxonomists.

GC and Human Health

Long time no issue. Recently pushed forward in the NRP: impact of UV-B on human health and changes in vector borne diseases. There are no indications yet that the issue gains much attention in policy nor in funding of research in the near future. If an international programme would be established this could change fast.

Participation in observing systems

The met.office KNMI participates in the standard observing networks of WMO.

Ocean obs: not known.

Terr. Obs.: not known

Support developing countries

Part of the funding for the NWO foundation for tropical research WOTRO comes from the Dutch Development Aid Agency. A note on the mode of operation is in the meeting documents (item 8-1).

NEW ZEALAND

1. Introductory and Contextual Issues

New Zealand's geographic position and history place both demands and constraints on its role in relation to global change issues. They also provide opportunities.

New Zealand is a small nation, both in land area, and population (3.6m people, only the size of a medium city in many nations). Also, it was settled relatively recently (1000–150 years ago) and is sparsely populated compared with many nations. New Zealand's islands stretch from the sub-tropics to the sub-antarctic, sit on boundary of two continental plates, and have been isolated from Australia for 70–80m years.

Points to note are:

- NZ has the 8th largest coastline of all nations;
- NZ has the 4th largest Exclusive Economic Zone (483m hectares). This means that issues to do with ocean/atmosphere work and climate change are important to us. We also have an Antarctic research programme;
- Our flora and fauna is highly endemic and vulnerable to the recent effects of colonization. This means we have a strong interest in Biodiversity and biosecurity issues;
- While issues related to sustainability and environment may seem less pressing (NZ has a reputation for being “clean and green”), there is a strong commitment to sustainability research, including legislation and the development of indicators, and some research relating to environmental health issues;
- NZ's isolation and size mean that we are very dependent on international collaboration in science endeavors — and we can contribute unique data;
- Our Overseas Development Assistance Programme focuses on South Pacific; and
- Because our population is small and resources are limited it is difficult for NZ to be involved in a wide range of international programmes and fora. Therefore, we have to decide on priorities.

2. The NZ Science System

New Zealand operates a science system that separates policy (Ministry of Research, Science and Technology, MoRST), funding (mostly through the Foundation for Research, Science and Technology, FRST), and research provision (Universities, 9 Crown Research Institutes, and other research organizations).

Government expresses its priorities at a higher strategic level, with detailed funding decisions made by FRST. The current government priorities statement (the intentions of which have been in effect for the last 4 years) has given large increases to funding of environmental and social areas. A new priorities statement will follow a foresight project currently underway. International science and global issues are being considered as part of this.

Government has increased its investment in science every year since 1990, though less so most recently — government investment is slightly below OECD average; but private sector investment is well below (mainly because our economy is still largely based on agriculture/horticulture/forestry commodities rather than industries that invest strongly in R&D).

3. Biodiversity

Research funding for biodiversity is well coordinated as few agencies are involved:

- Levels of endemism are very high: all 60 reptiles, 2 bats, 4 frogs are endemic, while 90% of insects and 80% of higher plants are endemic;
- Diversity of ecosystems and recent disturbance means that many species are localized, rare or vulnerable. There already have been many species extinction and a considerable loss of species habitat;
- Research and conservation has to be carried out in NZ because of the uniqueness of species and ecosystems;
- NZ has just completed a draft biodiversity strategy - this is largely focused on management. This goes to the government next month before public consultation. The agency responsible is our Department of Conservation (DoC); and
- Funding for biodiversity from all sources was estimated at NZ\$44.2m for 1995/96; of this FRST (NZ\$22.9m) supports a range of strategic research from description of species (a large of NZ species are unnamed) to conservation biology research underpinning management to ecosystem studies - especially weed and pest mitigation and control. Also a significant amount of more applied research is carried out by DoC.

4. Health

Funding for strictly health issues is administered by a separate funding body, the Health Research Council, although some health-related issues are also funded by FRST. New Zealand does not face health issues related to over-population, but is involved in or is initiating research in a number of areas related to other global issues:

- A particular concern is health disparity as it related to income disparity resulting from economic globalization. NZ is looking at the social and economic determinants of health;
- There is an increased interest in risk assessment - we are looking at the probability of the introduction of more topical diseases and their vectors;
- There is some research in the area of environmental contamination, and on the impact of land use changes on water quality and human health; and
- We are about to fund a large project on skin melanomas in collaboration with Australia, and also have a system in place for monitoring UV-B levels.

5. Glue Money

The NZ government recognizes the need for glue money and has established the following sources of funding to support the involvement of NZ researchers in international research programmes:

International Science and Technology Linkages

This is administered by MoRST and the Royal Society of NZ and supports commitment to treaties and treaty level agreements and other international science related to NZ's interests. This includes:

- Bilateral Research Collaboration
- International Academy Linkages
- Strategic Linkages, inputs to Government S & T, and relationship building.

International Technical Input Programme

This is new this year. It funds international input into issues of importance to NZ government policy (to date funding related to climate change has been for IPCC (International Panel on Climate Change), Valdivia group, World Meteorological Organization, Montreal Protocol).

In addition, all major sources of research funding now adopt a full-cost approach so that the costs of any international linkages are expected to be built into research programmes (this is explicit in the latest government priorities statement). The issue then becomes one of priorities for researchers and their managers, and as noted above there are difficulties for a small country such as NZ as we have few researchers and there are many international programmes.

6. Global Observing Systems

New Zealand has a strong involvement in the atmospheric area through the Global Atmospheric Watch Programme and the Network for the Detection of Atmospheric Change. NZ has site responsibility for the southern hemisphere mid-latitude. In addition the NZ Metrological Service is funded to collect data that feeds into other programmes. In the area of climate change there are strong links with IGBP (particularly GCTE, JGOSF, LOICZ, START, BAHG, IHDP, IGAC, and PAGES), with links also to national research programmes through out National Science Strategy Committee for Climate Change. The NSSCC has reports annually, provides strategic directions and coordinates research. NZ also some involvement in the Global Ocean Observing System (GOOS) especially in the coastal area.

New Zealand's Ministry for the Environment (MfE) completed a State of the Environment Report in 1997 which describes the interaction between NZ society and the natural environment, and documents the state of the environment itself.

MfE are also working on environmental indicators with the aim of developing key indicators that will allow assessment of progress being made towards environmental goals. This will include: ozone, climate and biodiversity, and later hazardous substances, transport, weeds and pests. There is the potential to link this work into global programmes.

7. Overseas Development Assistance

This areas is administered by NZ Ministry of Foreign Affairs and Trade.

The NZ overseas development aid policy statement on Development and the Environment has four components:

- The effective integration of environmental protection into all aspects of New Zealand's programme of development assistance;
- The implementation of procedures for assessing and monitoring the environmental impact of development activities for which New Zealand provides assistance;
- Cooperation with developing countries to strengthen their capacity to anticipate, identify, assess, and resolve issues of environmental protection, natural resources management and nature conservation; and

- Cooperation with other donors to ensure that aid programmes and projects contribute to social and economic development which is environmentally sustainable.

The New Zealand Government applies this policy in both its bilateral and regional/multilateral programmes.

NZ Development Assistance focuses on the Pacific, especially South Pacific, and includes specific support for the development in some countries of National Parks, reforestation, and ecotourism projects.

NZ also contributes to a number of international programmes including Global Environment Issues Strategy for the South Pacific (GESSP) which aims to assist South Pacific countries in the areas of:

- capacity development for environmental management;
- protection of biodiversity;
- climate change;
- waste management; and
- phase-out of ozone depleting substances.

Most NZ aid is via consulting and assistance rather than research — however this is often based on NZ or international research.

8. Funding Levels and Emerging Trends

- Funding for nearly all global research issues has increased over the last 4 years in NZ in recognition of their importance;
- NZ has in place a Resource Management Act (1991). This very broad in scope and places responsibility on regional government for the wise management of resources in their areas. While the intentions of the Act are good there have been some difficulties with implementation, and the Act is currently being reviewed by government;
- Issues relating to biosecurity have recently been highlighted. A Biosecurity Act has been passed, a Biosecurity Council formed, and a draft research strategy has been completed;
- NZ has also recently established an Environmental Risk Management Authority under the Hazardous Substances and New Organisms Act (1996). ERMA has responsibility for approving or declining applications to import or develop new organisms, or to import or manufacture hazardous substances; and
- The RMA, the Biosecurity Act and work toward a Biodiversity Strategy have all lead to the identification of information gaps and stimulated a considerable amount of research as a result.

NORWAY

Highlights and trends in national support of and attitudes towards global change research

Norway established a National Global Change Committee, approximately one year ago. The mandate of the Committee is to serve as a national contact point as well as coordinate national activities related to IGBP, IHDP, IASA and the EU 5th Framework Programme.

Norway became member of IASA in 1997 and is aiming at having more scientists involved in the IASA institute. The Global Change Committee has formed a sub committee acting as NMO committee for IASA. The Norwegian NMO visited IASA 21-22 September 1998 and had discussions with the Director and several scientists at IASA.

1. Health and biodiversity.

Biodiversity is considered a central part of the national global change research. In 1998, The Research Council of Norway established a new 10-year research programme entitled Biological Diversity - Dynamics, Threats and Management.

The programme committee of the Biodiversity Research Programme is also the Norwegian national contact point for **DIVERSITAS**. The contact and cooperation with DIVERSITAS is, as of yet, preliminary. However, the Programme committee has expressed great interest for DIVERSITAS and look forward to closer cooperation with the international programme.

In Norway, the coordination of health research and global change research is limited.

2. Norwegian "glue money" for the international global change research programmes

IGBP

The Research Council of Norway contributes approximately US \$ 18 000 annually to the secretariat in Stockholm.

The Joint Global Ocean Flux Study (JGOFS) core project office was established in February 1996 at the University of Bergen. The Research Council of Norway funds the core Office for a four-year period. The office is well established and well integrated with the rest of the University.

In addition, Norway (by The Norwegian Polar Institute) hosts the Secretariats for the **International Arctic Science Committee (IASC)** and **The Arctic Climate System (ACSYS/WCRP)**.

IHDP: The annual contribution from The Research Council of Norway is 7 000 US\$, The Council might also contribute to ad hoc activities like conferences and paying for scientists from developing countries and Eastern Europe.

3. Participation in the global observing systems at the national level. The role of national agencies/ministries. How is the planning and development of such observing systems linked to our research efforts?

Norway does not have a central mechanism or formal body that provides a link to the international activities on global observing systems.

The Norwegian contribution to global space observing systems is done mainly through the ESA membership. The Norwegian Space Centre also participates as an observer in CEOS due to its provision of the ground stations in Tromsø and Svalbard. The Tromsø station has for many years been acquiring data from various polar orbiting satellites, while the Svalbard Station with its unique localization at almost 80 degrees north will be an important receiving station for global data dumps from earth observation satellites in polar orbits. The Svalbard Station is able to acquire data from all daily passes of polar satellites.

The Norwegian Space Centre is leading a national coordination and advisory group with representatives from the major earth observation actors in Norway, including The Research Council of Norway, The Norwegian Meteorological Institute, The Ministry of Environment and representatives from research institutes, service providers and industry. The Group is in the process of investigating how Norway may contribute to some of IGOS Pilot Projects.

4. Norwegian support to research in and/or related to needs of developing countries?

What is the relationship to your development assistance agency?

We have spent a lot of time and efforts to establish a positive collaboration between START and the Norwegian aid agency "NORAD". We have frequent contact with our aid agency about this and other matters related to research collaboration with the developing countries. We are just discussing NORAD's potential contribution to our new research programme on Globalisation and Marginalisation to secure participation from the South.

Furthermore, several of the thematic research programmes at the Research Council of Norway may include projects in the South. One example of such a programme is the above-mentioned Biodiversity programme.

The programme on Globalisation and Marginalisation was established 1998 for a period for 10 years, which is quite exceptional in Norway. The funding comes from our Ministry of Foreign Affairs – when the programme is in full operation we hope to secure a budget of about 20 million NOK annually.

We have also established a Research Programme on Multilateral System in the Field of Development. The programme is established for a period of 5 years with an expected total budget of 30 million NOK.

This comes in addition to already existing programmes and projects within this field. The annual budget related to research and competence building in relation to developing countries is approximately 40 million NOK.

The Royal Ministry of Foreign Affairs has just made a new strategy for Research, Competence building and Collaboration within this field.

5. Funding levels for global change research. What new priority areas are emerging?

Global Change research is given top priority within environmental research in Norway.

The most relevant programmes at the Council are:

- 1) The Climate and Ozone Research Programme (Duration: 1998 – 2002, approx. 18 mill. NOK/year);
- 2) The research programme on Biological Diversity – Dynamics, Threats and management. (Duration: 1998 – 2007. Funding approx. 15 mill. NOK/year);
- 3) Norwegian Energy and Environmental policy: Constraints, Opportunities and Instruments (1996 –2000, 10 mill. NOK/year);
- 4) Sustainable Production and Conson (1996 –2001, 8 mill. NOK/year); and
- 5) ProSus (Program for Research and Documentation for Sustainable Society (1996 – 1998).

These programmes are mainly funded by The Ministry of Environment. Overall there is a moderate increase in funding. The increase is mostly due to the follow-up of the conventions/protocols (Kyoto and Biodiversity). Climate change has been a particularly "hot" subject recently, and this year, The Research Council established a committee for climate change research. The committee will deal with research priorities and coordination in all branches of climate research, including the natural sciences, the social and economic sciences, as well as technological R&D. Funding of climate change is generally increasing. However, although some of the extra funds have gone to global change related research, technological R&D has accounted for most of the increase.

New trends – multidisciplinary research programmes. We try to include social science horizontally in the programmes. There is a focus on the development aspects within the programmes, and we have asked the programme committees to consider whether it is relevant also to include comparative research in their working documents.

Norway focuses on international research collaboration with international organizations and international research programmes, e.g. EU programmes. The Council plans to create mechanisms with the aim of connecting Norwegian scientists more actively to research undertaken by multilateral organizations. Right now, we are working on a revision of our strategic plan, and in this connection, special focus will be given to international collaboration.

SPAIN

The Spanish National RTD Plan is actually in its fourth revision for the period 2000-2003. This means that for the year 1999 the national RTD priorities are still the same as included in the III National Plan (1996-1999). New priorities and new programmes will be designed for the forthcoming four-year period.

The Spanish Oficina de Ciencia y Tecnología (OCYT), within the Ministry of the Presidency, is the new organization in charge of reorganizing the Spanish system of Research and Technological Development.

The objectives of the new reorganization are:

- i) to integrate and to coordinate, through the Office of Science and Technology (OCYT), all the activities of RTD financed with funds from the budget of the Central Government - these research funds are actually shared among a dozen of Ministries;
- ii) to increase the percentage of the Gross National Product (GNP) from the actual 0.8 to 1.0 % by year 2000;
- iii) to promote the participation within the research system of private enterprises; and
- iv) to establish new strategies and priority lines.

The first actuation of the OCYT is focused to two technological areas (energy and transport), and to the reinforcement of basic research, but also the increase of funds for biotechnology, health and pharmacy, and the promotion of the information technologies.

Health and biodiversity are two important key research priorities that have been addressed separately in the national research programmes. Although Health is not seen as a part of the global change system, Biodiversity is clearly addressed from this point of view, and its importance in the maintenance of the ecosystems structure, complexity and functioning is a main goal for the Environmental National Research Programme. Also, within the Programme for Promotion of Basic Research, the studies conducting to the inventory, systematic and taxonomy of Fauna, Vascular Plants, Fungi, Algae, Mosses and Lichens of the Iberian Peninsula and Balearic Isles are being funded.

“Glue money” has represented a very important instrument in the 3rd National Plan, allowing the formation of several thematic networks, supporting the organization of congresses, meetings and conferences, and specialized courses. This will constitute an important key action within the 4th National RTD Plan (2000-2003).

The new office OCYT is in charge of the coordination with the international research programmes and global change programmes. Moreover, the INM (Instituto Nacional de Meteorología), IEO (Instituto Español de Oceanografía) and other Spanish organizations are participating actively in some of the global observing systems.

The Spanish Government is actively participating in support research of developing countries. This is specially focused to Iberoamerica, and to India, China and Arabian Countries, through the Agencia Española de Cooperación Internacional (AECI). Within this context, the CYTED program is an important tool for scientific and technological cooperation and innovation in Iberoamerica. The Iberoamerican Program for Scientific and Technological Development (CYTED) is an international multilateral programme created in 1984 by means of the Interinstitutional Framework Agreement ratified by the 21 Iberoamerican countries. CEPAL, OEA, UNESCO and BID take part as International Observers. Under the CYTED umbrella several networks have been constituted.

General Background

The general election in September this year resulted in a continued cabinet formed by the Social Democratic Party. However, the parliamentary back up in the new Parliament has eroded for the governing party which needs a more or less formal alliance with the left party (Vänsterpartiet) and the green party (Miljöpartiet). No ministers from these parties have been assigned and the cabinet thus only has ministers from the Social Democratic Party. The Minister of Environment is new (Kjell Larsson) replacing Anna Lindh who has been shifted to the position of Minister of Foreign Affairs. The Minister for Education (including research to a large extent) is new. It is the old Minister of Taxation that now is shifted into this position (Mr. Thomas Östros). If these changes imply changes in the overall policy, either in the environmental realm or in the research policy realm or in both is difficult to say at this moment.

A first test could be the reaction to a Parliamentary Commission, headed by the Chancellor of Swedish Universities (Prof. Stig Hagström) which is supposed to deliver its final report by November 1st, 1998 on changes in the entire institutional state RTD realm. Key issues seem to be institutional balance between concentration and diversity, the role of sectorial research, university policy issues. (No results have been provided so far from the Commission).

In the environmental policy field the issues of indicators (“green indicative figures”) and issues about environmental goals have presently been debated.

2. Environment and Health

Issues are moving (slowly) up in formal interest. A royal investigation, last year, generated by the National Board of Health and Welfare (Socialstryelsen) was quite thorough, although the research part was fairly restrained. The new European Science Foundation (ESF) programme, concerned with this topic, has attracted some Swedish interest. A special governmental request to FRN to address issues about research on environmental toxicology touches on the health and food domains.

Biodiversity was one of the three chosen case study topics for the MegaScience Forum conference in the OECD, which took place in Stockholm in March 1998 on the invitation of the Swedish Government. A special unit devoted to biodiversity issues at the international level is now operating in Uppsala, close to the Swedish Agricultural University. Biodiversity has also been discussed in connection to the development of the new EU 5th framework programme.

3. Glue Money

The issue has not been tackled in a research policy climate with regard to international research cooperation in which substantial reductions in this overall domain has been suggested, including the withdrawal from some international cooperative schemes (in non-environmental realms). Finally the outcome was not that drastic, but the pressure is still there.

4. Global Observing Systems

Difficult issue, as the planning and development of such systems particularly is not directly linked to the formation of the research agendas and their implementation.

5. Developing Countries

Swedish RTD efforts continue in this field. Some 10 years ago a so-called 5th development goal was added to the earlier foreign aid goals, thus covering the new environmental dimensions. This has had quite some impact on programming. Swedish aid to sub-Saharan Africa has a distinct profile in SIDA/Sarec activities. Water issues, among others, are of quite some importance.

6. Funding Levels

The total environmentally oriented research budget has not decreased drastically the last few years. What has happened is that the new from the state independent Research Foundations have taken over some of the research tasks from the old arrangements at the Environmental Protection Agency especially MISTRA. This institutional shift has also meant some shifts in emphasis on content as well as a shift towards more strategic efforts to remedy environmental problems in the semi-long term. If this will, in the near future, also mean that funding for global change research will be affected is difficult to say. Some efforts in the climate change domain do not have “new” Foundation money. In other global change areas the outcome has been more unclear, especially as there is some “national” touch in the selection of items. In the natural science domain funding has continued via the Natural Science Funding Agency (NFR) but within a generally squeezed overall budget.

SWITZERLAND

Overview of the main Global Change Research activities in Switzerland and future trends in research policy

Current and future research orientations

Switzerland has a long-standing tradition in Global Change Research (GCR). There are several individual research projects focusing on the development of new techniques and instruments, process studies (biosphere, hydrosphere, biogeochemical cycles), the detection of trends via monitoring and the analysis of existing time-series data. The Swiss social scientists involved in GCR are mainly tackling social processes and institutions, public perception and policy formation and implementation.

There is also a major GCR component in the Swiss Priority Programme "Environment" (SPPE), which places a strong emphasis on climate (notably in alpine regions), biodiversity, sustainable development in the economy and society, research cooperation with developing countries as well as transdisciplinary research and network building. Some additional activities dealing with the reduction of greenhouse gases such as CO₂ and human health problems (linked to particle emissions) are further supported through the National Research Programme "Transport and Environment" (NRP 41). The NRP 31 "Climate Changes and Natural Disasters" was successfully concluded in December 1997.

A new series of National Research Programmes, which should be launched towards mid 1999, is actually being prepared. Alpine research has been submitted as a new research subject, but the selection has not yet been terminated.

In replacement of the Swiss Priority Programmes - being progressively phased out - a new instrument for supporting long-term oriented research will be launched. The "National Centres of Competence in Research and Education" (NCCR) will promote interdisciplinary approaches, international cooperation and research networks, transfer of knowledge and education. Sustainable development and environment is among the priority areas for the first series. The programme will be managed by the Swiss National Science Foundation (SNSF).

Funding situation and "glue money"

Global Change Research (GCR) is an important issue on the Swiss research agenda. However, being an integral part of environmental research, there is no special budget line available for GCR. Based on data available for 1995, the total Swiss funding for physical climate system research amounted to 8.7 million Swiss francs (CHF), research on biogeochemical processes in global change was funded at a level of 30.8 million CHF and 16.1 million CHF were provided for human dimensions of global environmental change research.

As a matter of comparison, the total public spending for research and development in 1996 amounted to 2 billion CHF (zero growth since 1994).

17% (340 million CHF) of the public research budget are allocated to the Swiss National Science Foundation (SNSF), which supports research on a competitive basis. The SNSF is also the major funding source for global change research in Switzerland, either in the form of individual projects in physical climate research (mainly basic research) or as part of the oriented research programmes (mainly SPP “Environment” and, to a lesser extent, NRP 41 “Transport and Environment”). Other important funding sources are the Federal Government offices, the Federal research institutes and the cantons. In addition, about 15 million CHF were provided annually by the Federal Office for education and science for the participation of Swiss scientists in the EU-programme “Environment and Climate”.

Switzerland further co-finances (on an equal basis with the USA) the PAGES Core Project Office, which is currently located in Berne.

As GCR is generally integrated with other research programmes in Switzerland, no “glue money” has been specifically allocated to GCR activities. There are however various “glue money” opportunities available through the oriented research programmes or the traditional funding schemes of the SNSF.

International cooperation and Swiss participation in the global observing systems

Switzerland contributes to the World Climate Research Programme (WCRP) and the Atmospheric Research and Environmental Programme (AREP) through individual research projects, research conducted at Federal institutes and by operating monitoring stations and networks as well as calibration and data centers. It also contributes, both directly and through relevant research activity, to the International Geosphere-Biosphere Programme (IGBP). Within the IGBP, Swiss scientists are most heavily engaged in GCTE and PAGES. They further contribute to the DIVERSITAS programme. Switzerland also supplies data and develops instruments for the international surveillance programmes (GCOS, GTOS, GAW, GEMS and others).

Support to developing countries and emerging economies

Building on the success of the “research cooperation with developing countries” module of the SPP “Environment”, the Swiss National Science Foundation (SNSF) has developed a new instrument for North-South scientific partnerships. As for the SPPE module, this programme will be co-financed by the Swiss Agency for Development and Cooperation (SDC). The programme is open to researchers from all disciplines. The main objectives are to strengthen the capacity building and institution building of the southern partners. The first calls will be launched in 1999. The SNSF further implements the “scientific cooperation with the CEEC/NIS countries” programme, financed by the SDC. During the last 3 years (3rd phase), 11 million CHF were provided for joint research projects, institutional partnerships and collaboration with partner organizations.

UNITED KINGDOM

Global Change and Government

Climate Change

The Government will publish shortly a consultation paper seeking views on the policy options to meet the UK's legally-binding Kyoto target to cut greenhouse gas emissions by 12.5% by 2008 to 2012 and move towards the domestic aim of a 20% cut in carbon dioxide emissions by 2010.

This will lead to the production of a new climate change programme. The aim is to develop a balanced package of measures which shares responsibility between all sectors of the economy and builds on other Government reviews and initiatives on transport, energy and taxation

Scenarios for Climate Change

The UK Climate Impacts Programme, launched in 1997, has recently published new Climate Change Scenarios, based on the Hadley Centre's Had CM2 climate model. The scenarios provide a range of estimates of likely climatic change, enabling stakeholders to assess a wide spectrum of future conditions which they might have to consider in their long term planning. Among those stakeholders, Local Government is becoming increasingly interested in Climate Change; the Local Authority - Research Council Initiative (LARCI) has been started to allow these research users and providers to work together in developing a research agenda within sustainability.

Economic Instruments and the Business Use of Energy

In his 1998 Budget statement the Chancellor of the Exchequer announced the appointment of Sir Colin Marshall to look at the potential for economic instruments for energy use restriction (Carbon taxes) to offer a flexible and cost effective means to achieve greater energy efficiency and reductions in greenhouse gas emissions. After a consultation process, the final report should be submitted in November.

Government Funding of Science

Comprehensive Spending Review

The results of the Comprehensive Spending Review have been published. This exercise was intended to be a clean sheet of paper review of all Government expenditure. One major result of the review was the announcement by the Office of Science and Technology of £1.1 billion of extra science funding over the next three years. Of this total, £400 million comes from the Wellcome Trust, a research charity. Wellcome will fund a new synchrotron radiation source and half of a £600 million Joint Infrastructure Fund. The balance of the new funds will go to support new research in "priority areas, particularly the life sciences". Additional support for University research infrastructure was announced by the Department for Education.

Changes in OST

In a cabinet reshuffle, Peter Mandelson became Trade and Industry Secretary, the Cabinet post responsible for science. Lord Sainsbury became Minister for Science, while John Battle retains the rest of his portfolio, Energy and Industry. In January, John Taylor, currently director of Hewlett-Packard's European Laboratories, will replace Sir John Cadogan as Director-General of the Research Councils at the Office of Science and Technology.

Technology Foresight Programme

The first phase of the UK Technology Foresight Programme used sectoral panels to generate a knowledge pool' for all parties to access (<http://www.foresight.gov.uk>). Consultation about the next phase is proceeding now, with debate over the fresh agenda for action and the balance between sectoral and thematic approaches. Sustainable Development will certainly be one theme addressed, and Global Environmental Change is being proposed as another.

Supercomputing

In July 1998, a Private Finance Initiative contract was signed on behalf of the Research Councils for the provision of a £26 million supercomputing service for the next six years. The service will be based on Silicon Graphics' T3E-1200E supercomputer, said to have a 700 Gigafllops peak performance. The computer will be upgraded to be twice as powerful in three years' time. The service will be provided by a consortium, Computation for Science (CfS), led by Computer Sciences Corporation (CSC) with Silicon Graphics and University of Manchester.

Global Change in the Research Council

Inter-Research Council Group for Global Environmental Change (IRCGEC)

The Heads of the Research Councils decided that the Global Environment Research Office should close on 31 March 1998. However, recognizing that GER has expanded to address impacts, opportunities and solutions as well as detection and understanding of change, the ongoing need to coordinate global change activities across Research Councils has been addressed with the formation of a new inter-Council group.

Climate Change and Human Health Monitoring Workshop

In December 1997 the Medical Research Council hosted an exploratory multidisciplinary Workshop to examine the potential impacts on human health of climate induced changes. The meeting was organized jointly with WHO and UNEP, who also provided financial support for the overseas delegates. The workshop highlighted the need for incorporating health indices into Global Observing Systems, and foresaw a coordination role for the proposed WHO/WMO/UNEP Network on Climate and Human Health.

Sustainability Research within ESRC

Following a successful review, the Economic and Social Research Council (ESRC) has re-confirmed "Environment and Sustainability" as one of nine priority themes guiding its forward research strategy.

The £15M Global Environmental Change Programme, 1991-2000, has been exploring five main topics:

- attitudes & behavior; business & the environment;
- environment policy; international issues; and
- sustainability & resource management.

The Programme has entered its final phase with the funding of new fellowships addressing environmental assessment techniques, citizens & the environment, and business environmental initiatives. The Centre for Social and Economic Research on the Global Environment (CSERGE), based at the University of East Anglia and University College London, is continuing to work on climate change, biodiversity and institutional dimensions of global change.

The ESRC is making preparations for a new environmental programme to run from the year 2000 onwards. The provisional title "Delivering Sustainability" signals that the programme would concentrate on mechanisms for promoting social and economic changes that will improve the natural environment. In association with the Natural Environment Research Council (NERC), a high priority is being given to the reinforcement of interdisciplinary links between the social and natural sciences.

Looking Forward - the NERC Strategy for Science

Published in May 1998, this outlines the science which the Natural Environment Research Council will address over the next five to ten years. These 'key science areas' are focused on five major issues on the environmental and natural resource agenda: biodiversity; environmental risks and hazards; global change; natural resource management; and pollution and waste. Within 'Global Change', the strategy identifies what is known and what needs to be addressed, and identifies the key science areas. NERC will focus support on integrating its global change programmes and aligning them to address priorities identified in the UK National Strategy for Global Environmental Research. NERC has recently appointed Mr Ian Dwyer to the post of NERC Global Change Focus, both to address this integration and to work with other Global Change players in UK and elsewhere.

UNITED STATES

A majority of the information discussed below is from the U.S. Global Change Research Program publication "Our Changing Planet" for FY99.

Health and Biodiversity in Global Change Research Programs

The U.S. Global Change Research Program (USGCRP) agencies are working to enhance the use of their observing systems, models, and data to explore relationships between human health and changes in climate and the global environment. Research includes studies of heat-wave mortality and winter mortality; the effects of climate change on atmospheric chemistry and the consequences for air pollution and air quality; the relationships between El Niño events and diseases; toxic algal blooms and the relationship between algal blooms and cholera; and the relationship between ultraviolet radiation and the immune system, retinal damage, cataracts, and skin cancers.

USGCRP-sponsored researchers are applying satellite data, geographic information systems, global positioning systems, and computer modeling to the study of diseases such as malaria, Lyme disease, yellow fever, cholera, filariasis and schistosomiasis. The Interagency Research Partnership in Infectious Diseases (INTREPID) is investigating the link between disease and weather patterns, with an initial focus on dengue fever.

Research on the human consequences of global change is also an integral part of the USGCRP's new National Assessment program. Special emphasis is being placed on identifying and analyzing the consequences of climate variability and change for different geographical regions within the United States and for different economic sectors

Through the Subcommittee on Ecological Systems of the National Science and Technology Council's Committee on Environment and Natural Resources, US agencies are developing and/or participating in a range of biodiversity databases that will be of great utility to those studying the interaction of biodiversity and global change.

Some of these databases include:

- The Integrated Taxonomic Information System (ITIS), which is determining the proper scientific names of all species of organisms found in North America and adjacent marine waters and developing an interconnected series of databases containing the information;
- The National Biological Information Infrastructure (NBII), an electronic gateway to biological data and information maintained by federal, state, and local government agencies; private sector organizations; and other partners around the nation and the world;
- The North American Biodiversity Information Network (NABIN), which is being developed by the Commission for Environmental Cooperation of NAFTA. It is developing standards and protocols for the exchange of biodiversity information and assisting institutions and agencies that collect, manage or use biodiversity data to collaborate on providing broader access to information across North America;

- The Inter-American Biodiversity Information Network (IABIN), which promotes compatible means of collection, communication and exchange of information relevant to decision-making and education on biodiversity conservation in the Western Hemisphere; and
- The Global Biodiversity Information Facility (GBIF), which is being proposed as an activity of the Organization for Economic Cooperation and Development as a global set of interoperable databases containing biodiversity information.

NIH-NIEHS (The National Institute of Health - The National Institute of Environmental Health Sciences)

NIEHS funding supports research on health effects of CFC replacement chemicals and ultraviolet radiation, including studies in metabolism and toxicity of HCFCs and halogenated hydrocarbons; effects of UV exposure on the pathogenesis of disease and on target organs, especially skin and eyes; repair of solar UV radiation-related DNA damage in human cells; and effects of shorter wavelength UV radiation on photosensitivity in people who use many commonly prescribed drugs.

Highlights of the FY99 research program include studies to determine how UV radiation-induced immunosuppression and genetic damage contribute to skin cancer in humans and experimental animals; to understand the roles of DNA repair and mutant frequency in cancer susceptibility to UV exposure; and to understand the photobiological mechanisms involved in aging caused by chronic UV damage. Other research projects include the testing of antimalarial drugs in order to determine whether the cutaneous and ocular side effects associated with their use are light-induced, and studies of the photochemistry of all light-absorbing components of the eye in order to determine whether long-term exposure to light contributes to the deterioration of clarity of the lens and functioning of the retina.

In addition to research that is designated as part of the USGCRP, NIEHS conducts research related to other impacts of global change on human health, including the effects of environmental and occupational exposures to air pollution, agricultural chemicals, and materials used in alternative or new technologies to mitigate or adapt to climate change. Exposures of special concern for FY99 include those that contribute to the greatly increased incidence of childhood asthma and that disrupt the normal functioning of the endocrine system. Renewed concern about emerging and reemerging infectious diseases has prompted increased attention to a variety of diseases whose incidence would be affected by environmental change. Other HHS agencies provide significant resources for research on and development of vaccines and treatment for cholera and vector-borne diseases, such as encephalitis, malaria, dengue, and Lyme disease.

NOAA (The National Oceanic and Atmospheric Administration)

One way in which NOAA is addressing climate variability and human health is through a program called the ENSO Experiment, an interdisciplinary research effort to study the human health impacts of the recent El Niño event. One of the objectives of the ENSO Experiment is to facilitate communication across, and foster the fusion between, the disciplines that are becoming the climate variability and health community.

NOAA is also organizing a health and climate initiative for proposals too interdisciplinary for any individual US agency to accept. The initiative will potentially involve participation from NSF (The National Science Foundation), NIH and the EPA (The Environmental Protection Agency) as well as from NOAA.

NSF (The National Science Foundation)

NSF funds a wide range of research in the area of biodiversity and global change, but this research is not grouped under a specific program. Instead, projects pertaining to biodiversity and global change are funded through the regular research avenues supported by NSF.

Global Observing Systems

The overall goal of the USGCRP Observation and Monitoring Program is to ensure the availability of long-term, high-quality observational records of the state of the Earth system, its natural variability, its past history, and changes that are occurring over a broad range of spatial and temporal scales.

This embraces the following objectives:

- To adopt a strategy that will improve the coordination of national and international space-based and in-situ systems for observing and monitoring the Earth's environment and natural resources;
- To coordinate the contributions of the Federal agencies in implementing the U.S. space-based and in-situ components (both operational and experimental) of an internationally coordinated global observing strategy that meets the scientific needs of the USGCRP; and
- To promote the development and demonstration of innovative cost-effective instruments and observing techniques for providing critical environmental information in the future.

Recent advances in observing, data processing, and communications technologies have provided unprecedented opportunities for the development of an integrated global observing system. At the same time, existing key measurements must be maintained to the extent possible to minimize avoidable gaps in the data records.

US participation in national and international surface-based measurement programs include:

- ARM (Atmospheric Radiation Measurements), a program focusing on the improvement of climate prediction and climate parameters by providing data on clouds and their interactions with solar and terrestrial radiation. (DOE);
- ENSO Observing System, an international composite system of ocean and atmosphere observations in the tropical Pacific Ocean. (NOAA);
- Atlantic Observing System, an international pilot program to expand ocean and atmosphere observations in the Atlantic. (NOAA, NSF);
- Global Cooperative Air Sampling Network, a network of air sampling instruments at sites around the world to document changes in certain greenhouse gases. (NOAA);
- AmeriFlux, a network of continuous, year-round CO₂ flux measurements across North and Central America. (DOE, USDA);

- Ground- and Balloon-Based Ozone Measurement Network, a global network which monitors changes in the ozone layer. (NOAA, NASA);
- Surface UV Monitoring Network, a network monitoring a range of radiation variables needed in the studies of human and ecosystem health and of global change; and
- Atmospheric Chemistry Network, several ground-based networks make measurements of concentrations of CFCs and other ozone-depleting compounds and of greenhouse gases.

A new era of satellite observations of the Earth begins in 1999, as crucial data from the first of several Earth Observing System (EOS) missions start to become available. Significant additional steps will be taken in FY99. The EOS spacecraft are a key component of a long-term coordinated research effort to study the Earth as a global system and the effects of natural and human-induced changes on the global environment. The EOS missions will provide data that will make significant contributions to research being conducted throughout the USGCRP.

US participation in space-based measurements include:

- TOPEX/Poseidon, which continues to deliver high-accuracy sea surface height measurements after six years in orbit;
- TRMM (Tropical Rainfall Measuring Mission), a cooperative program with Japan has been delivering data for one year;
- SeaWiFS (Sea-viewing Wide Field-of-view Sensor), a NASA partnership with private-sector enterprises, has been delivering ocean color data for more than one year;
- QuikSCAT, to be launched in early 1999, will provide high-accuracy surface winds measurements over the ocean;
- EOS AM-1, will launch in 1999 as part of NASA's Earth Observing System; and
- Landsat-7, is scheduled to be launched in April 1999.

Glue Money

The USGCRP provides the U.S. funding for the international infrastructure for the three major global change research programs, IGBP, WCRP and IHDP, as well as for a number of their core projects. Four U.S. agencies, DOE, NASA, NOAA and NSF, share in this funding.

The USGCRP supports the IGBP over \$350,000 per year in core support and on average, provides \$30,000-50,000 per year for additional activities. The WCRP receives \$50,000 per year from the USGCRP, over and above the U.S. share of the core support that the WMO provides. We also support IHDP at a level of \$80,000 per year plus, on average, another \$20,000-30,000 for other specific activities. In addition to the core support the USGCRP provides for these offices, it is estimated that we provide at least \$100,000 more per year for workshops, scientific meetings, et cetera.

The U.S. also has or shares lead responsibility for support of some International Project Offices (IPOs):

PAGES

NSF \$150,000 per year
NOAA \$100,000 per year.

GAIM

NSF \$200,000 per year
NOAA \$50,000 per year
DOE \$50,000 per year

Both the PAGES and GAIM IPOs receive additional funds for individual activities, e.g. workshops. Also, both of these projects often receive supplemental awards each year at approximately \$25,000 per year.

IGAC

NSF, DOE, NOAA and NASA have collectively given about \$500,000 over the last two years to the IGAC program.

WOCE

NSF \$75,000-80,000

In addition, travel support for US members of the SSG and its committees as well as US experts to international WOCE meetings is provided by both NSF (\$25,000) and NASA (\$50,000).

CLIVAR

NSF, NOAA, NASA and DOE collectively give about \$200,000 split 4 ways

Support may go up in coming years. This year the office is likely to get an additional \$25,000 to help support the CLIVAR conference in December.

GLOBEC

NSF is putting \$75,000 towards supporting the GLOBEC IPO (through IOC/SCOR)

JGOFS

NSF is contributing \$70,000 towards the JGOFS IPO (through IOC/SCOR)

Research in Developing Countries

The USGCRP mainly supports U.S. scientists to conduct global change research, and the agencies which fund U.S. global change research generally do not support research by scientists in developing countries. An increasing amount of this research, however, is a collaborative effort with scientists in other countries, including developing nations.

The U.S. Agency for International Development sponsors a broad range of projects in developing countries. This includes some programs intended to improve the scientific capabilities of developing countries related to global change, especially climate change and the interaction between climate change and key things in the environment, such as agriculture.

Global Change Research Funding

Funding support for global change research is focused in the USGCRP. The USGCRP budget supports scientific research on key global change environmental issues, including seasonal to interannual climate variability; climate change over decades to centuries; changes in ozone, UV radiation, and atmospheric chemistry; and changes in land cover and in terrestrial and aquatic ecosystems. The USGCRP budget also supports cross-cutting activities, including observing and monitoring global change; global change data, products, and information services; research on Earth system science and on human contributions and responses to global change; international research cooperation; and global change education and communication.

The USGCRP budget is split into two broad components: Scientific Research and Space-Based Observation Programs. This distinction is intended to make clearer the portion of the USGCRP budget that supports scientific research by individual investigators and small groups, as compared with the portion that supports NASA's Earth Science program components relating directly to space missions--particularly the Earth Observing System series of satellites and data information systems, which provide data in support of research activities.

The total USGCRP FY98 budget was \$1.867 billion. Of the total budget, 61% supports Space-Based Observation Programs while 39% supports Scientific Research. Policy level support of the USGCRP and funding support remains strong, and funding levels are expected to remain about the same for FY99.