

IGBP **2** Annual Report **005**

GLOBAL
I G B P
CHANGE

www.igbp.net

Published by:

IGBP Secretariat
Box 50005
SE-104 05, Stockholm
SWEDEN

Tel: +46 8 166448

Fax: +46 8 166405

Website: www.igbp.net

Editor: Bill Young

Technical Editor: John Bellamy

Graphic Designer: Hilarie Cutler



Printed by Bergs Grafiska, Stockholm,
to the official Nordic Ecolabelling criteria.

International Geosphere-Biosphere Programme

Annual Report 2005

IGBP – an international scientific research programme of the International Council of Science which networks scientists around the world to conduct interdisciplinary Earth System science and global change research.

Vision

To provide scientific knowledge to improve the sustainability of the living Earth.

Objective

IGBP studies the interactions between biological, chemical and physical processes and human systems. IGBP collaborates with other programmes to develop and impart the understanding necessary to respond to global change.

Table of Contents

Foreword – Past Chair SC-IGBP	4
Foreword – Chair SC-IGBP	5
Report from the Executive Director	6
Science Highlights of 2005	10
IGBP Projects	18
Fast-Track Initiatives	38
Earth System Science Partnership	40
Other Collaborations	48
National Committee Activities	50
Communications and Outreach	52
IGBP Community	58
Financial Report	64
Acronyms.....	67

Foreword

Past Chair SC-IGBP



Guy Brasseur
Chair 2002 – 2005

Four years as SC-IGBP Chair has been a unique experience for me: guiding the synthesis of ten years of research and helping set new objectives for a broader and more integrative IGBP has been perhaps the most interesting challenge of my scientific career.

IGBP has created a global network of perhaps 20,000 scientists, who collectively have developed the concept of Earth System science. As a result, new research institutes are emerging and established centres are tackling more integrative questions. Funding agencies are reorganising and universities

are offering interdisciplinary curricula. A new generation of Earth System science students is emerging, and political groups are considering global change issues.

Despite progress many challenges remain. It is increasingly clear that in coming decades we will witness substantial effects of climate change, and oil will soon be rare and expensive – within fifty years a more efficient energy system will be required. Economic globalisation and information technology will continue to profoundly modify social systems, cultures and the environment. Sound decisions will require objective science.

Continuing population growth, poverty and poor health care are increasingly intertwined with environmental issues, and hence must be addressed in a broader context. Solutions require international political commitment, but scientific research is also vital. IGBP will continue to contribute research, especially to elucidate how development affects environmental goods and services. To achieve this, IGBP and the other global environmental change programmes must consolidate and mobilise their communities, but also begin to develop the programmatic tools and structure for the next decade.

Foreword

Chair SC-IGBP



Carlos Nobre
Chair 2006 –

The Millennium Development Goals are ambitious targets. They aim to liberate over 500 million people from poverty by 2015 and integrate sustainable development into national and international agendas to reverse the loss of environmental resources. Many of the challenges are political in nature, however, research on global, regional and local environmental change is also essential to meeting the challenges of combining development and sustainability in the context of global change.

Global environmental challenges and development issues have long been concerns of IGBP, which has engaged a growing number of developing country scientists in its research and capacity building activities. Additionally however, it is important to enhance existing research institutions and to establish regional centres of excellence in developing countries. Regional centres of excellence must be of the highest quality, and must promote existing science agendas on global change. They should however, push these agendas in new directions in order to fully address the science-related challenges of sustainable ecosystem management, and research and development.

My career as a research scientist in Brazil – during a period of rapid economic and political development – has taught me the value of high quality research institutions as a key component of development. Only a small fraction of the aid from industrialised nations to developing countries would be needed to create a network of such centres, and I believe IGBP and its ESSP partners can help make this happen. During my term as SC-IGBP Chair, I will work to increase the global change research capacity of developing countries, in order to empower their active participation in the mitigation of, and adaptation to, global change.

Report from the Executive Director



Kevin Noone
Executive Director

The Swedes have a colourful expression for when you feel settled in a new post or organisational structure: you become “warm in your new clothes”. In 2005, IGBP became warm in the new clothes tailored for its second phase. In April, the ICSU Executive Board approved the new IGBP Constitution and by the end of 2005 all IGBP projects had functioning Scientific Steering Committees and most had published science plans and implementation strategies: the day-to-day functioning of the network truly reflected the new IGBP structure.

The IGBP Science Plan will be published in early 2006 and so IGBP has indeed “warmed up its clothes”.

2005 was marked by an important leadership change in IGBP: Guy Brasseur completed a four-year term as SC-IGBP Chair and was succeeded by Carlos Nobre. It is hard to imagine a person more capable and qualified than Guy to navigate IGBP through the first to second phase transition, which was not only an organisational restructuring, but also a change in scope and scientific perspective. Guy spearheaded this transition with great skill and persistence. Besides being a renowned scientist, Guy is a consummate diplomat: I was impressed time and again by his ability to harmonise divergent opinions to a common agenda. As Executive Director, I was privileged to work with a Chair whose scientific interests and perspectives so closely resem-

bled my own. Guy remains with us as Past Chair until the end of 2006, and we very much look forward to his continued input. Carlos Nobre, in addition to his own renown as a scientist, brings a developing-country perspective. IGBP has around 75 National Committees, and if we are to realise our vision – to provide the scientific knowledge to improve the sustainability of the living Earth – we need the full participation and engagement of the scientific community in the developing world. We warmly welcome Carlos and look forward to his leadership in the coming years.

The conclusion of the Land Use and Land Cover Change (LUCC) project was an occasion to celebrate a success, and a time for reflection. LUCC research has underpinned one of the central findings of IGBP research – that global change is more than just climate change. LUCC led the way in integrating human and environmental interactions, and helped forge the growing synergism between IGBP and IHDP. All in IGBP are proud of the superb science undertaken by LUCC in the last decade.

Feeling “warm in its new clothes”, IGBP now stands ready to face future issues and challenges with confidence. Some of these issues concern the very nature of IGBP science. While IGBP has always been multidisciplinary, we are promoting an even more integrative Earth System perspective. This systemic approach will give us the perspective necessary to search out, recognise and understand emergent properties of the Earth System.

IGBP and the global change research community face an increasing challenge to present research results in more accessible and informative ways to stakeholders – particularly those concerned with development. We are frequently expected to answer questions on the effects of global change on regional- and even local-scale development: stakeholders seek strategies to deal with future environmental change.

The need to understand how the natural world works has not diminished, but in fact underpins the answers to development questions. We still must concentrate on first class science involving the interactions and feedbacks between biological, chemical and physical processes and human systems. However, scientists, resource managers and policy makers require a common understanding in order for their interactions to be mutually beneficial. To that end, IGBP participated in an IGFA-ICSU workshop in May on The Interface Between Global Environmental Change and Development-Oriented Research (Krusenberg, Sweden), which assembled global change and development/aid

researchers and funders. While the workshop revealed differences in the approaches, language and spatial and temporal scales between the global change and the development/aid communities, it also identified issues where substantial benefit would accrue from development of a common agenda.

Helping to facilitate global environmental change research in Africa was a focus in 2005, and together with our ESSP partners, we helped arrange a planning workshop in September for an African global environmental change research network (Nairobi, Kenya), which was hosted by Kenyan National Committee, the Pan African START Secretariat and the Kenya National Academy of Sciences. The workshop made recommendations for the further development of the proposed network, and further activities will occur in 2006. IGBP is committed to continuing these efforts.

The Earth System Science Partnership (ESSP) is evolving and finding ways to increase collaboration amongst the partners is crucial. A significant step in this regard has been the appointment of Martin Rice as ESSP Coordinator. As well as helping organise the 2006 ESSP Open Science Conference, Martin is fulfilling a myriad of other functions for ESSP. In many ways, ESSP provides perhaps the best conduit for better linking global environmental change research to stakeholder interests and needs. We must ensure ESSP can realise its potential. Bilateral collaborations between IGBP and our ESSP partners is increasing, with projects cosponsored by IHDP and WCRP, and other collaborative efforts planned between IGBP and WCRP. We look forward to developing collaborative activities with DIVERSITAS in the coming year.

Communication is obviously critical to the transfer of scientific results to stakeholders. The IGBP Communications Strategy – endorsed by SC-IGBP in February – is being implemented, although has been slowed by the departure of Susannah Elliott (Deputy Director, Communications). In addition to reaching out to the scientific community via special sessions at AGU and AAAS conferences, we are targeting other audiences. For example, in November I participated in the World Congress of Science Producers (Tokyo, Japan) which was a very valuable opportunity to interact with professional producers of science documentaries, and to learn how we can better communicate our science to the public. Additionally, we continue to work with the educational sector – developing course curricula and materials, and lecturing at various universities.

Finally, I would like to highlight the need for IGBP to expand its funding base. The financial support for IGBP comes primarily from contributions from about forty countries. This support is absolutely essential, but it is increasingly challenging for contributing countries to maintain level funding, and funding increases are unlikely. At the same time, the IGBP network is becoming larger and more complex, as is the network of related programmes and organisations with which IGBP collaborates. We must augment the generous national contributions we receive with new funding if we are to achieve our second-phase goals.

IGBP has warmed up its organisational clothes – let's get on with the science!

Kevin Noone
IGBP Executive Director
Stockholm, Sweden
June 2005

Science Highlights of 2005

The Global Nitrogen Cycle

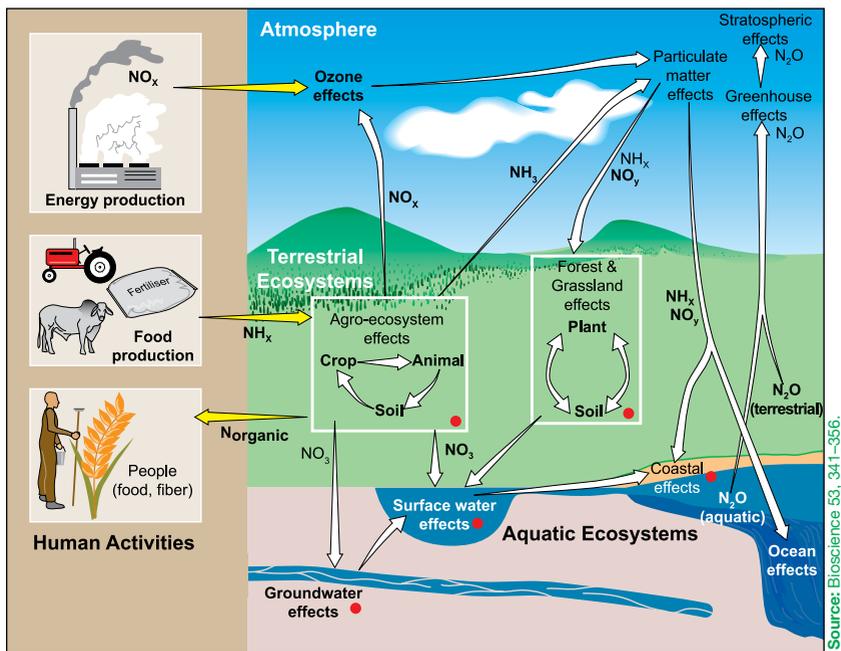
In the late 20th century human activities surpassed natural terrestrial processes in converting unreactive nitrogen gas to reactive nitrogen (Nr), with major implications for ecosystem productivity and environmental degradation.

Around 1860, there were 1.5 billion people in the world, and each year 15 million tonnes of Nr was produced almost entirely for food production via “cultivation-induced biological nitrogen fixation” (CBNF). Natural Nr creation by terrestrial BNF at this time was about ten times higher. By the early 1990s, anthropogenic Nr creation had increased ten-fold while the global population had increased 3.5-fold. Around 15% of the anthropogenic Nr creation was associated with energy production, and most of the remainder with food production. About 25% of the Nr creation for food production was by CBNF, and 75% by fertiliser production via the Haber-Bosch process. Coupled with these increases was a decrease of about 10% in natural terrestrial BNF due to conversion of natural grasslands and forests to agricultural uses.

The benefit from these changes is food production to support an increasing population and a rising *per capita* food consumption. However, problems have arisen due to both shortages and excesses of nitrogen. Many regions of the world (e.g. Africa) have insufficient nitrogen for adequate food production, hence nitrogen supply to these regions must be increased. Conversely, in other regions there is an excess of nitrogen, in part because all the nitrogen mobilised by energy production and most of the nitrogen used in food production is lost to the environment. Nitrogen loss to the environment can contribute to a host of problems, which are all linked through the global nitrogen cycle via the “nitrogen cascade”.

For example, nitrogen released to the atmosphere from fossil fuel combustion can, in sequence, increase atmospheric ozone concentration, decrease atmospheric visibility and increase precipitation acidity. Following deposition it can increase soil acidity, decrease biodiversity, pollute groundwater and cause riverine, estuarine and coastal eutrophication. Finally, once emitted back to the atmosphere it can contribute to greenhouse warming and decrease stratospheric ozone.

Anthropogenic Nr creation will continue to increase with increasing global population and *per capita* consumption of food and energy. The maximum Nr creation rate will largely depend on how we manage nitrogen in food and energy production. The large potential for increase emphasises the need for policies that focus on how to maximise the benefits of nitrogen, while minimising the environmental and human health impacts.



The nitrogen cascade and associated environmental impacts. Red dots indicate denitrification potential.

Article Source: based on the INI – an FTI jointly sponsored by SCOPE. For details see Galloway et al. (2004) *Biogeochemistry* 70, 153–226.

Land Use and Cover Change – Key Findings

Land cover change increased rapidly over the last 300 years, accelerating in the last 30 years. The rapid changes – mostly in humid forests – are clustered in particular locations. Spatially diffuse changes, especially in drylands, are more difficult to observe. In the last 20 years land cover change processes and impacts have differed by location. Subtle land cover modifications are as important as cover conversions. Reliable global data on changes are lacking for (sub) tropical dry forests; selective logging, fires and insect damage; wetland alteration; cropland soil degradation; pastoral lands; dryland degradation; urbanisation; and lifestyle-driven changes. Many regions are poorly represented in land cover change data sets.

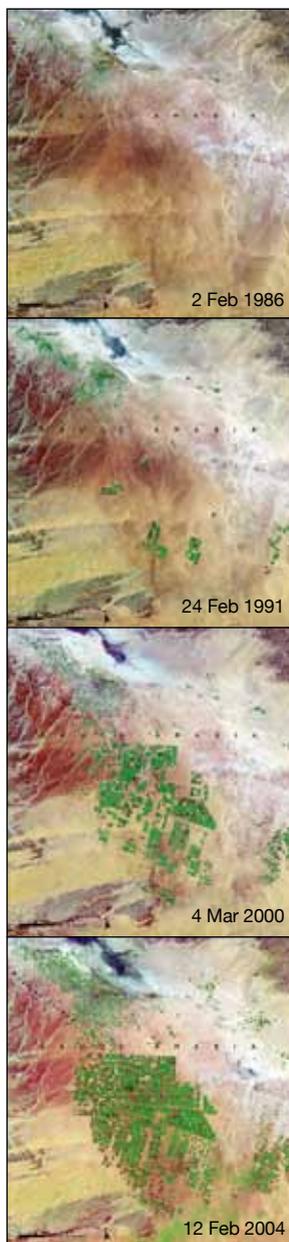
Land use change is caused by multiple interacting factors from different levels of organisation of coupled human-environment systems. The mix of drivers varies according to specific human-environment conditions. At the decadal scale, change mostly results from individual and social responses to economic conditions, mediated by institutional factors. Opportunities and constraints for new land uses are created by markets and policies, and are increasingly influenced by global factors. New technologies can lead to rapid shifts in land use practices. Institutions and their interactions with attitudes, values and knowledge systems, have major impacts. Globalisation can amplify or attenuate the effects of change drivers. At the decadal scale, migration is the most important demographic driver of change, while at the centennial scale population changes are most important. Dominant pathways of change include: development of forest frontiers by weak state economies, loss of land resource entitlements that lead to ecological marginalisation of the poor, induced innovation and intensification, and urbanisation followed by changed consumption and income patterns.

Improved understanding of the complex processes underlying land use change has led to more reliable projections and more realistic future scenarios, and a wide range of models is now available. However, only a few models can generate long-term, global-scale projections, so regional approaches are usually adopted. It is crucial to understand the factors controlling positive and negative feedbacks.

Scenarios of change help explore possible futures and involve policy makers and stakeholders. Existing scenarios suggest long-term and large-scale changes in land use/cover with Earth System implications, and suggest long-term trends may be reversed after some decades. Urbanisation and associated lifestyle changes are likely to become dominant factors in land use change.

Human-environmental systems are complex adaptive systems in which properties, such as land use, emerge from interactions amongst system components. These properties feed back to influence interactions. Land use changes have multiple impacts on ecosystem goods and services at a variety of spatial and temporal scales, with trade-offs between immediate human needs and longer-term sustainability. Considering regional land use change histories is essential for understanding current change and for future predictions. Institutional and technological innovations may lead to negative feedbacks that decrease the rate of change.

Slow and localised land cover conversion occurs against a background of high frequency regional-scale fluctuations caused by climate variability. Abrupt short-term changes, often caused by the interaction of climatic and land use factors, have important impacts on ecosystem processes.



Source: UNEP

Irrigation greening the desert in Saudi Arabia.

Article Source: LUCS SSC (2005) *Global Change Newsletter* 63, 12–14.

Ocean Acidification

Anthropogenic emissions of carbon dioxide have increased rapidly since the industrial revolution, raising atmospheric concentrations to levels that marine records suggest are unprecedented in the last 23 million years. However, the global ocean has absorbed half of these emissions causing ocean acidity to rise (lower pH values). Surface seawater pH has decreased by 0.10 over the past two centuries and is now in the range 8.0–8.2. Although higher surface pH values do occur occasionally – for example, due to intense carbon dioxide drawdown during algal blooms – lower surface values are very rarely encountered. During recent glacial-interglacial cycles pH also remained remarkably stable, and thus marine organisms have adapted to a fairly narrow pH range.

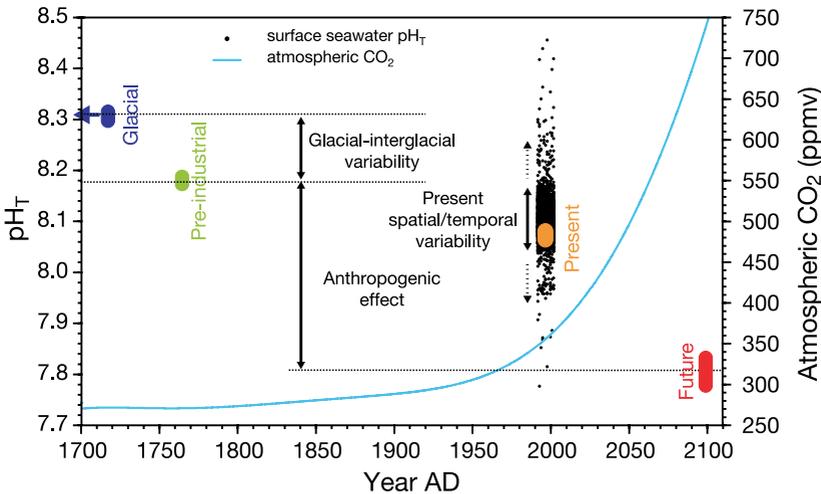
Carbon dioxide emissions are expected to double by the end of this century, which would cause surface pH to fall by a further 0.35. This degree of change has the potential to alter many biogeochemical cycles and directly harm marine organisms; for example, it would make life increasingly difficult for organisms (such as corals or coccolithophorids) that build their hard structures from calcium carbonate. The effects of ocean acidification will depend on whether organisms and ecosystems can adapt quickly enough to cope with rising acidity. This is an important issue in the context of proposals to help control atmospheric carbon dioxide levels by purposeful carbon dioxide sequestration in the deep ocean.

Ocean acidification research is in its infancy, and a coordinated international effort is required. IGBP and SCOR are therefore cosponsoring a study to complement observations of the modern ocean with environmental reconstructions of ocean biogeochemistry over the periods of major change in atmospheric carbon dioxide concentrations of the past 100 million years (see *Fast-Track Initiatives*, page 38). This work (coordinated by PAGES with contributions from SOLAS, IMBER and AIMES) will help palaeo scientists identify research with the greatest potential to improve our understanding of the future ocean.



Photograph: PB. Mortensen, Institute of Marine Research, Norway.

Lophelia pertusa – a cold-water (4–13°C) reef-forming coral which lives in deeper water (typically 200–1000 m) than its better known tropical cousins. *Lophelia pertusa* are widespread across all oceans and they, and other calcareous organisms, are threatened by ocean acidification.



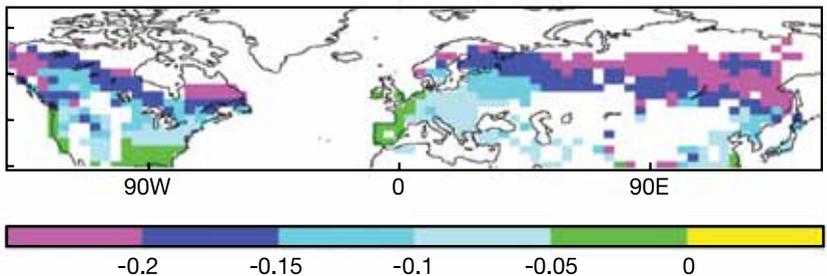
Surface seawater pH values and atmospheric carbon dioxide concentrations with pH ranges indicated for the present, glacial times, pre-industrial times and the future. Prepared by Arne Körtzinger on the basis of data from the World Ocean Circulation Experiment.

Article source: adapted from the IMBER Science Plan and Implementation Strategy and from documentation for the Ocean Acidification FTI.

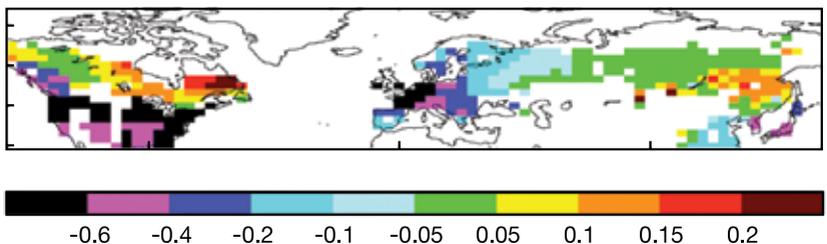
Responding to Climate Change: the Importance of Land-atmosphere Interactions

Responding to climate change requires strategies both for reducing greenhouse gas emissions and for adapting to changing climate conditions. One of the schemes of the Kyoto protocol to offset carbon dioxide emissions is afforestation. While planting trees does reduce net carbon emissions, there are other consequences which differ according to location.

The maps below show the varying effects of afforestation across the Northern Hemisphere. While tree planting does reduce net carbon emissions, on open land it also decreases surface albedo (the fraction of radiation that is reflected by the Earth's surface; top panel). Changes in albedo and atmospheric carbon dioxide combine to alter the net global radiative forcing (bottom panel), such that in some areas the net effect of afforestation is warming rather than cooling.



Albedo difference: converting open land to dense coniferous forest



Change in net global radiative forcing (nW m⁻² ha⁻¹)



Source: www.bigphoto.com

Forests act as significant carbon sinks in the landscape.

The result is very different in the tropics, where vegetation and the hydrological cycle are tightly coupled. Reforestation in the tropics (or avoiding deforestation) could have a double cooling effect, by both sequestering carbon and keeping evaporation high. The cycling of water by tropical forests is coupled to carbon dioxide levels, through changes in the stomatal conductance of the vegetation – adding another feedback between the carbon and water cycles. Evapotranspiration in the tropics affects the surface energy balance as well as tropical convection and cloud properties.

One of the requirements of the UNFCCC is an objective way of comparing human effects on climate. This work illustrates the necessity of considering the whole Earth System when developing adaptation and mitigation strategies.

Article Source: presentation by Richard Betts at the iLEAPS Open Science Conference (Boulder, United States), January 2006.

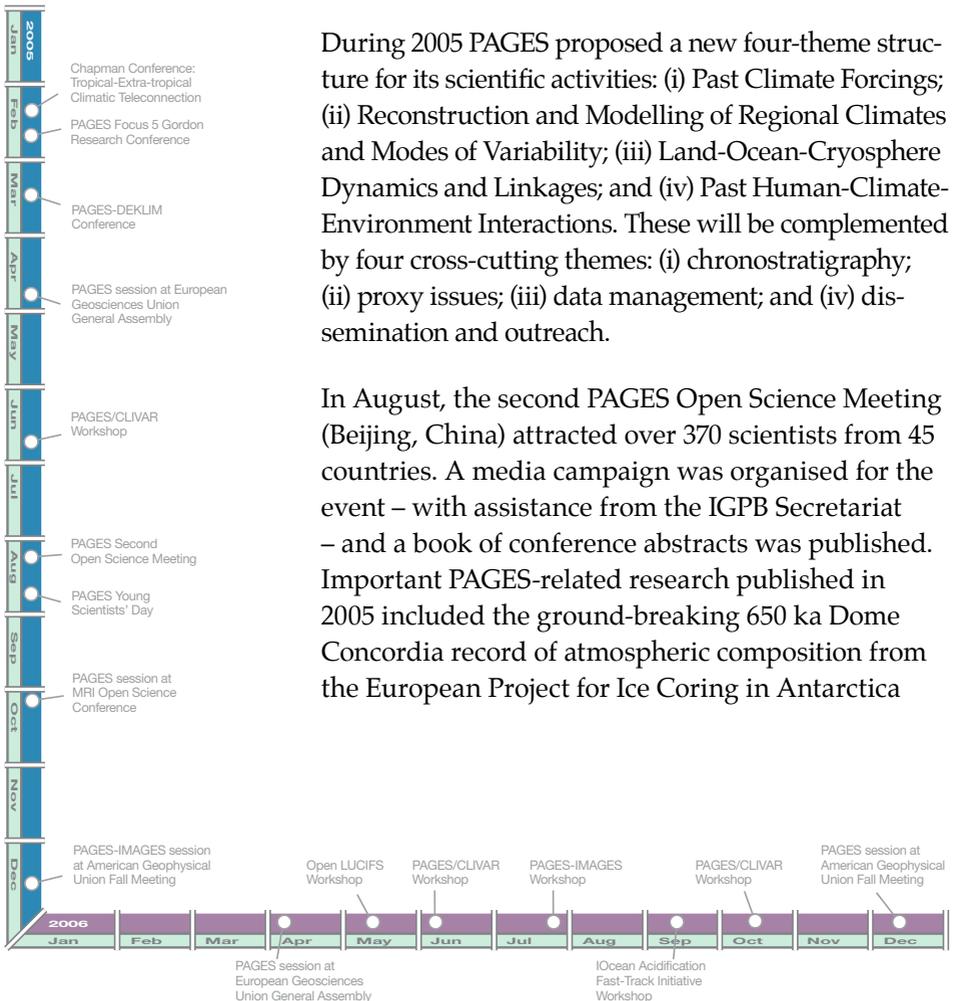


Past Global Changes (PAGES)

In 2005, PAGES continued in service-oriented coordinating mode, helping to develop coherent international collaborations in palaeo science. The research focus remained high-resolution studies of past climatic and environmental change in order to assess the natural and anthropogenic components of environmental variability, and to model future global change and its consequences.

During 2005 PAGES proposed a new four-theme structure for its scientific activities: (i) Past Climate Forcings; (ii) Reconstruction and Modelling of Regional Climates and Modes of Variability; (iii) Land-Ocean-Cryosphere Dynamics and Linkages; and (iv) Past Human-Climate-Environment Interactions. These will be complemented by four cross-cutting themes: (i) chronostratigraphy; (ii) proxy issues; (iii) data management; and (iv) dissemination and outreach.

In August, the second PAGES Open Science Meeting (Beijing, China) attracted over 370 scientists from 45 countries. A media campaign was organised for the event – with assistance from the IGBP Secretariat – and a book of conference abstracts was published. Important PAGES-related research published in 2005 included the ground-breaking 650 ka Dome Concordia record of atmospheric composition from the European Project for Ice Coring in Antarctica





Photograph: G. Kaser

A Peruvian-French-Austrian team carrying out accumulation measurements at 5350 m on Glaciar Artesonraju (Cordillera Blanca, Peru)

(Spahni et al., 2005) and results on Northern Hemisphere temperature variability over recent millennia (Moberg et al., 2005).

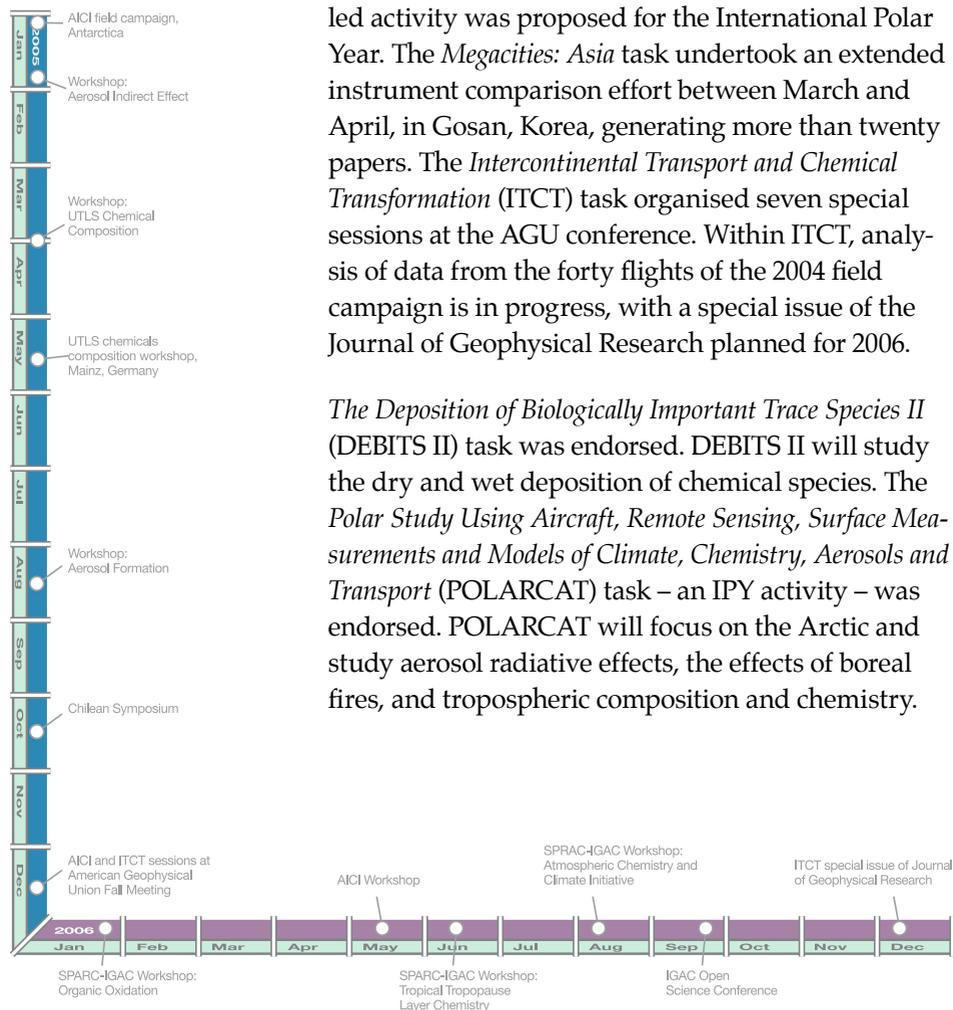
The IPO continued to serve as the primary communication hub for the SSC, project activities and partner global change organisations. IPO activities and services included writing funding proposals, organising and funding international meetings, writing and editing publications and outreach activities. Transitional IPO funding was obtained from US NSF for 2005–06 and a proposal submitted for IPO funding from 2006–10. Communication and outreach activities included publication of the newsletter, maintenance of the website and researcher and product databases, and capacity-building efforts including integrating developing-country scientists into the international palaeo research community.



International Global Atmospheric Chemistry (IGAC)

IGAC research is organised into “tasks”. During the Austral summer of 2004–05, the *Air-Ice Chemical Interactions* (AICI) task conducted a field experiment at Halley Bay, Antarctica, focusing on the “reactive odd nitrogen” budget and the halogen and oxidant chemistry of the region. Special AICI sessions were held at the AGU and EGU conferences, and an AICI-led activity was proposed for the International Polar Year. The *Megacities: Asia* task undertook an extended instrument comparison effort between March and April, in Gosan, Korea, generating more than twenty papers. The *Intercontinental Transport and Chemical Transformation* (ITCT) task organised seven special sessions at the AGU conference. Within ITCT, analysis of data from the forty flights of the 2004 field campaign is in progress, with a special issue of the *Journal of Geophysical Research* planned for 2006.

The Deposition of Biologically Important Trace Species II (DEBITS II) task was endorsed. DEBITS II will study the dry and wet deposition of chemical species. The *Polar Study Using Aircraft, Remote Sensing, Surface Measurements and Models of Climate, Chemistry, Aerosols and Transport* (POLARCAT) task – an IPY activity – was endorsed. POLARCAT will focus on the Arctic and study aerosol radiative effects, the effects of boreal fires, and tropospheric composition and chemistry.





Photograph: T. Bates

Ronald H. Brown – the NOAA research vessel that has been involved in many IGAC campaigns.

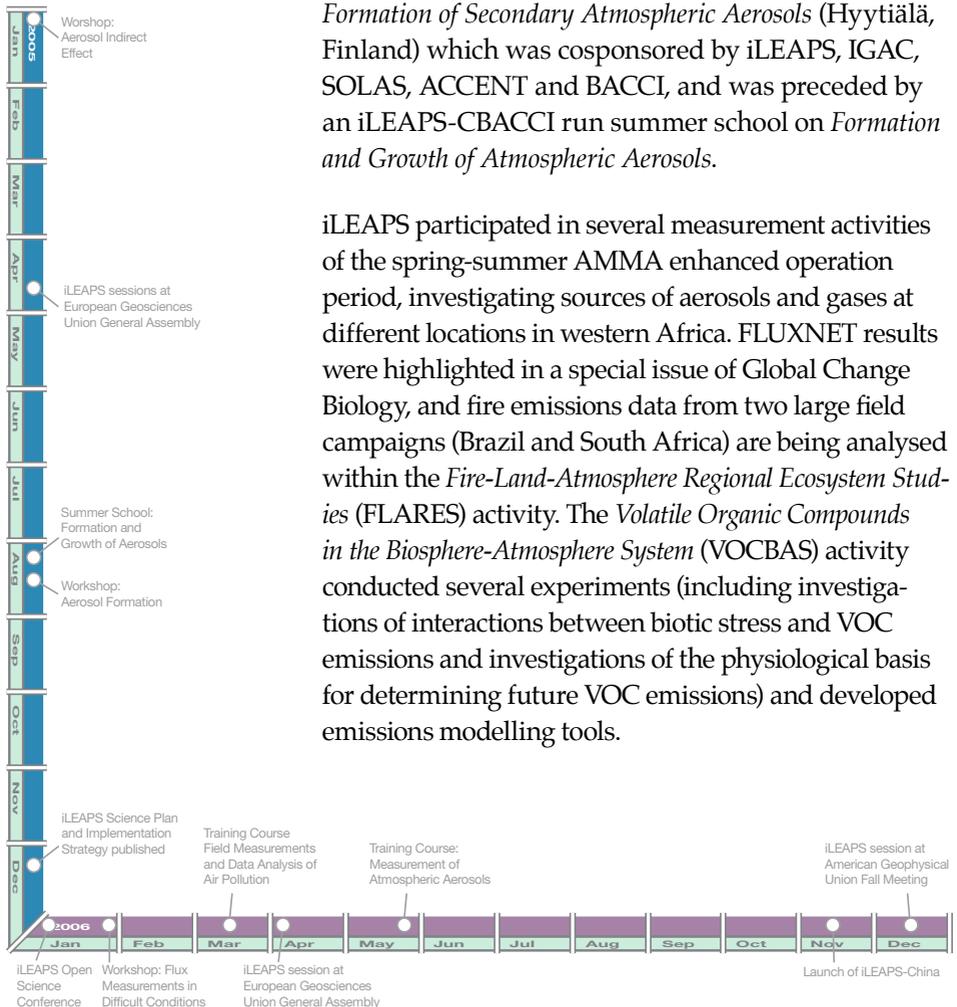
IGAC is actively involved in the *African Monsoon Multidisciplinary Analysis (AMMA)*, and supported the participation of five African scientists in the 2005 AMMA planning workshop. IGAC organised three workshops in 2005: (i) the IGAC-NOAA-NASA sponsored *Aerosol Indirect Effect Workshop* in January (Manchester, United Kingdom); (ii) the IGAC-SPARC *Processes Controlling the Chemical Composition of the Mid-latitude UTLS Workshop* in May (Mainz, Germany); and (iii) IGAC-iLEAPS-SOLAS-ACCENT-BACCI sponsored *Aerosol Formation Workshop* in August (Hyytiälä, Finland). The first of these workshops generated a comprehensive peer-reviewed publication, while the third spawned a new IGAC task expected to begin in 2006.



Integrated Land Ecosystem–Atmosphere Processes Study (iLEAPS)

iLEAPS, together with IGAC, NOAA and NASA, organised a workshop in January on the *Indirect Effects of Aerosols in Climate* (Manchester, United Kingdom) which resulted in two peer-reviewed publications. The EGU conference (April) included one solely iLEAPS session and eight other iLEAPS cosponsored sessions. A workshop was held in August on the *Formation of Secondary Atmospheric Aerosols* (Hyytiälä, Finland) which was cosponsored by iLEAPS, IGAC, SOLAS, ACCENT and BACCI, and was preceded by an iLEAPS-CBACCI run summer school on *Formation and Growth of Atmospheric Aerosols*.

iLEAPS participated in several measurement activities of the spring-summer AMMA enhanced operation period, investigating sources of aerosols and gases at different locations in western Africa. FLUXNET results were highlighted in a special issue of *Global Change Biology*, and fire emissions data from two large field campaigns (Brazil and South Africa) are being analysed within the *Fire-Land-Atmosphere Regional Ecosystem Studies* (FLARES) activity. The *Volatile Organic Compounds in the Biosphere-Atmosphere System* (VOCBAS) activity conducted several experiments (including investigations of interactions between biotic stress and VOC emissions and investigations of the physiological basis for determining future VOC emissions) and developed emissions modelling tools.



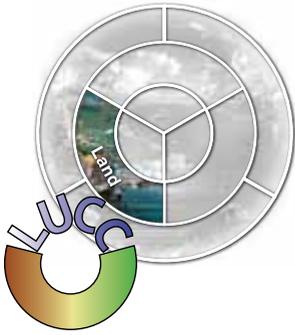


Photograph: M. Welling

Smoke plume and pyrocumulus cloud over a deforestation fire in Rondonia, Brazil. Taken during the LBA-SMOCC field campaign in September 2002.

Planned activities include the *Inter-American Network for Atmospheric/Biospheric Studies (IANABIS)*, *Land Ecosystem-Atmosphere Reactive Nitrogen (LEARN)* and *Polar Study using Aircraft, Remote Sensing, Surface Measurements and Models of Climate, Chemistry, Aerosols and Transport (POLARCAT)*.

In September, iLEAPS hosted the 2005 meeting of the IGBP IPO Officers at the University of Helsinki and at the Hyytiälä Forestry Field Station. The iLEAPS Science Plan and Implementation strategy was published in December, in time for the 1st Open Science Conference in January 2006. During 2005 the project website was established including downloadable versions of the project poster, brochure and slide presentation. The first project newsletter was published in November.

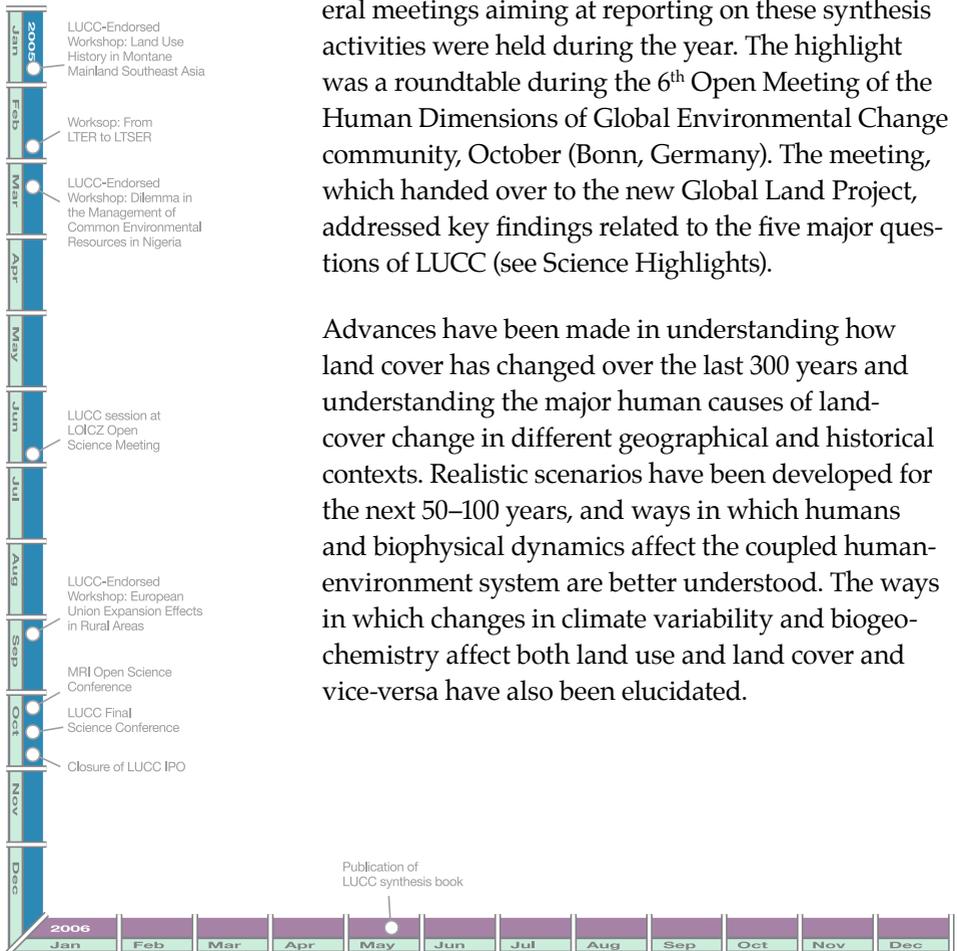


Land-Use and Cover Change (LUCC)

When LUCC began in 1995, there was much debate in the global change community about whether land use and land cover were important in Earth System dynamics. A decade later, LUCC research has proved seminal to one of the central findings of IGBP – that global change is more than climate change.

2005 was a year for synthesis activities for LUCC. Several meetings aiming at reporting on these synthesis activities were held during the year. The highlight was a roundtable during the 6th Open Meeting of the Human Dimensions of Global Environmental Change community, October (Bonn, Germany). The meeting, which handed over to the new Global Land Project, addressed key findings related to the five major questions of LUCC (see Science Highlights).

Advances have been made in understanding how land cover has changed over the last 300 years and understanding the major human causes of land-cover change in different geographical and historical contexts. Realistic scenarios have been developed for the next 50–100 years, and ways in which humans and biophysical dynamics affect the coupled human-environment system are better understood. The ways in which changes in climate variability and biogeochemistry affect both land use and land cover and vice-versa have also been elucidated.





Photograph: Christoph Bürki Source (inset): REVUE 10/1990

Arable cropping in Switzerland comparing modern land management to that of around 1900 (inset).

Late in 2005, the LUCC synthesis book for the Springer IGBP Series – *Land-Use and Land-Cover Change: Local Processes and Global Impacts* – was completed for publication in 2006. The book provides a thorough, comprehensive and lasting account of the achievements of LUCC. The LUCC synthesis helped to better understand an emerging theory of land-use change, its policy implications, land use transitions and vulnerability issues, long-term social-ecological research needs, and, last but not least, helped to refine tools and methods.

Many scientists from LUCC have spearheaded GLP while others are playing key roles in GECAFS. Additionally, LUCC has contributed to the reformulation of AIMES and PAGES, and to the emergence of an integrated Earth System perspective in IGBP. IGBP is grateful to all those who contributed to LUCC over a decade – especially those who served on SSC and staffed the IPO and foci offices. LUCC was sponsored by IHDP.

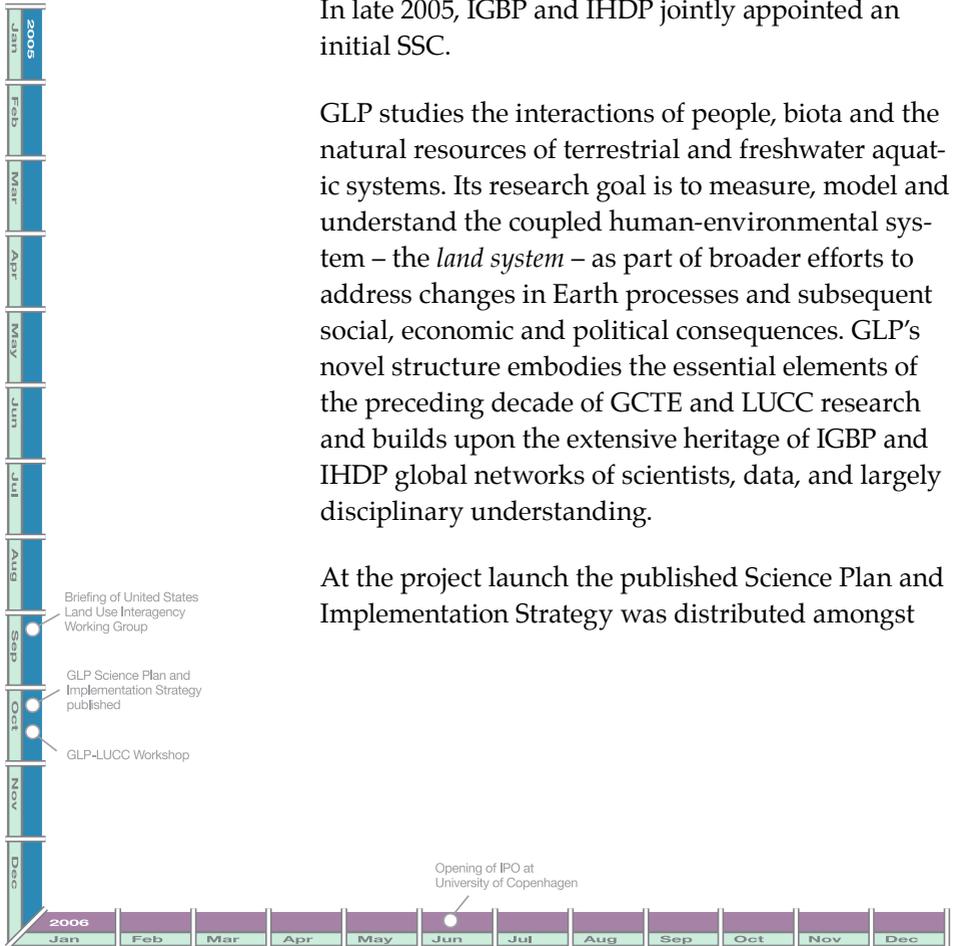


Global Land Project (GLP)

GLP – which is sponsored by IGBP and IHDP – was formally launched in October at the 6th Open Meeting of the Human Dimensions of Global Environmental Change community (Bonn, Germany). The project is the successor to LUCC and GCTE; until a more recent appointment of Anette Reenberg as SSC Chair, the initial Executive Committee included Dennis Ojima, Emilio Moran and Richard Aspinall. In late 2005, IGBP and IHDP jointly appointed an initial SSC.

GLP studies the interactions of people, biota and the natural resources of terrestrial and freshwater aquatic systems. Its research goal is to measure, model and understand the coupled human-environmental system – the *land system* – as part of broader efforts to address changes in Earth processes and subsequent social, economic and political consequences. GLP's novel structure embodies the essential elements of the preceding decade of GCTE and LUCC research and builds upon the extensive heritage of IGBP and IHDP global networks of scientists, data, and largely disciplinary understanding.

At the project launch the published Science Plan and Implementation Strategy was distributed amongst





Source: www.morguefile.com

Increasing urbanisation is having global consequences; Mexico City, Mexico.

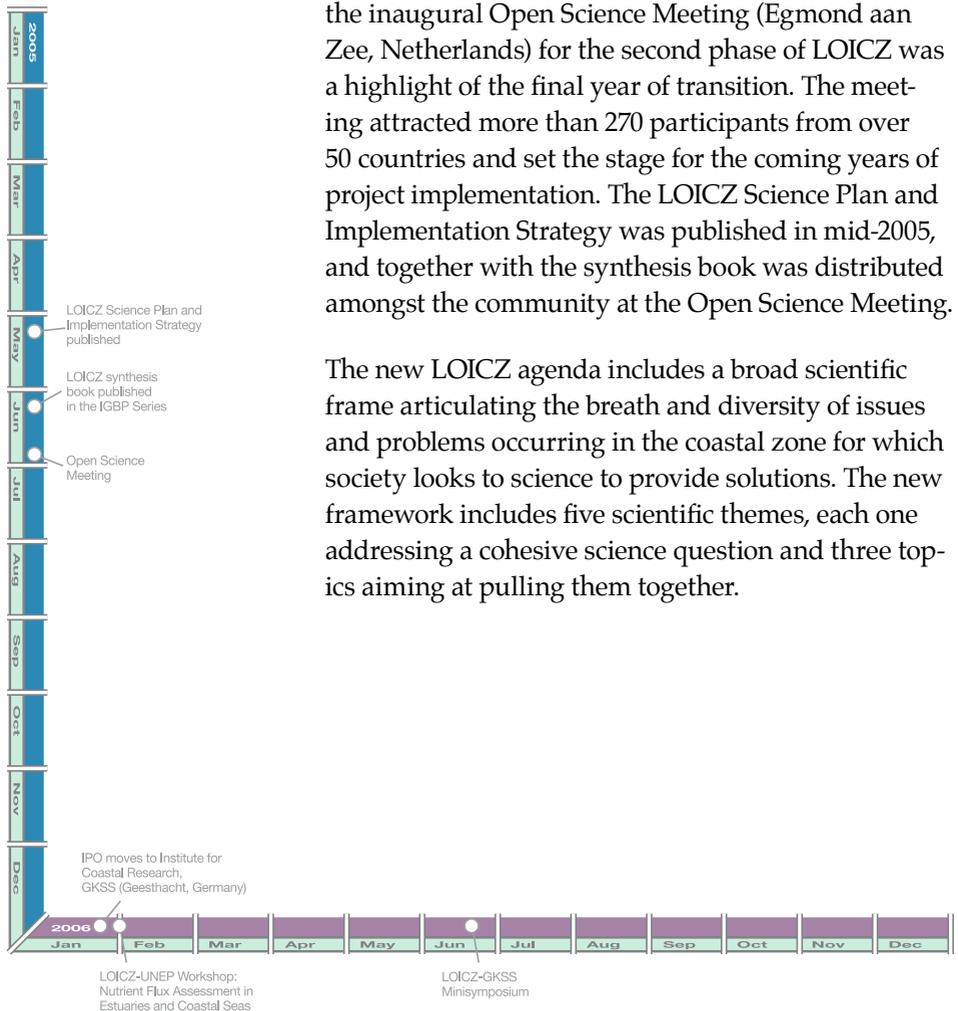
the research community. The finalisation of this document was the culmination of four years of effort with input from over 150 scientists. 2005 was a year of wide consultation for GLP, amongst the many potential organizations and projects, which may collaborate to implement the GLP agenda.



Land-Ocean Interactions in the Coastal Zone (LOICZ)

2005 was the second year of joint IGBP-IHDP sponsorship of LOICZ, and this has fostered a growing collaboration with other IHDP projects. In the first half of 2005, the LOICZ synthesis book – *Coastal Fluxes in the Anthropocene* – was published in the Springer IGBP Series, summarising the major contributions to coastal science of the first phase of LOICZ. In June, the inaugural Open Science Meeting (Egmond aan Zee, Netherlands) for the second phase of LOICZ was a highlight of the final year of transition. The meeting attracted more than 270 participants from over 50 countries and set the stage for the coming years of project implementation. The LOICZ Science Plan and Implementation Strategy was published in mid-2005, and together with the synthesis book was distributed amongst the community at the Open Science Meeting.

The new LOICZ agenda includes a broad scientific frame articulating the breadth and diversity of issues and problems occurring in the coastal zone for which society looks to science to provide solutions. The new framework includes five scientific themes, each one addressing a cohesive science question and three topics aiming at pulling them together.





Photograph: M. Le Tissier

Erosion on north coast of Chennai, India.

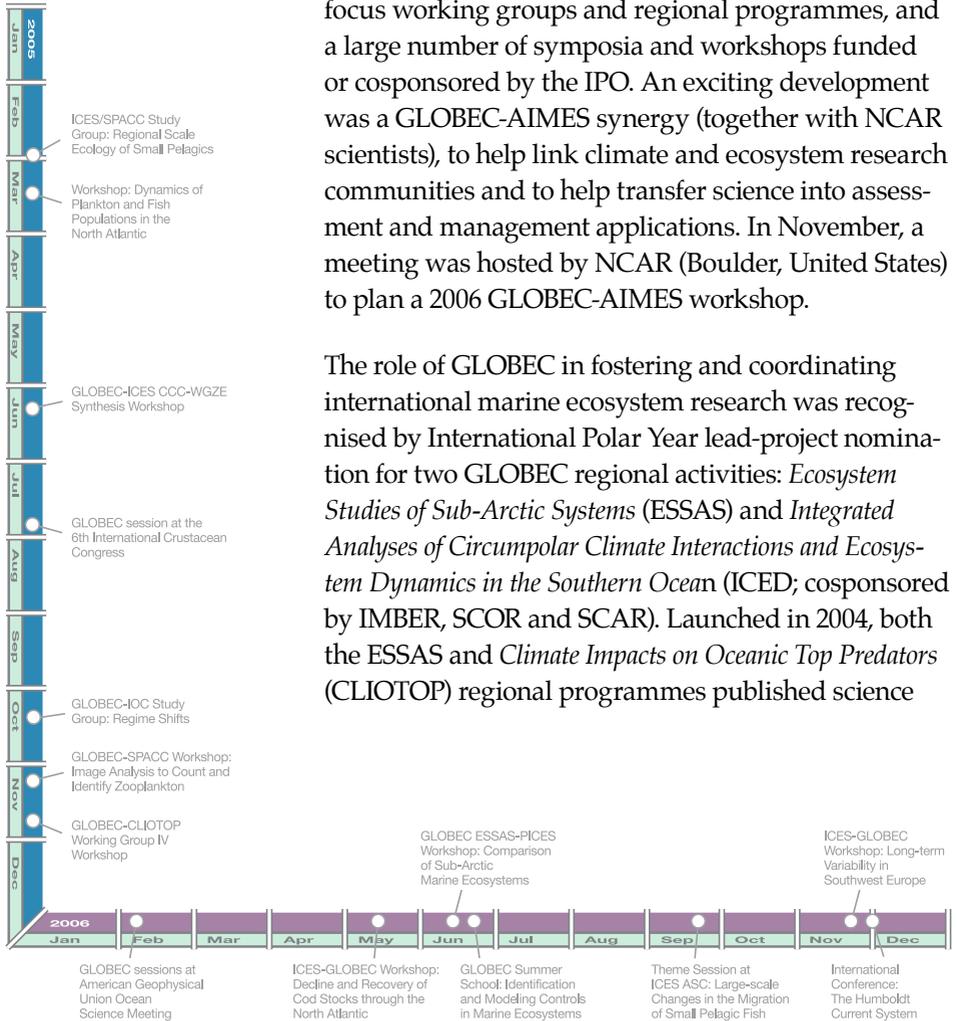
IGBP and LOICZ are extremely grateful for the generous funding from Dutch funding agencies that supported the IPO for 13 years up until the end of 2005. From 2006 the IPO will be at the Institute for Coastal Research, GKSS Research Centre (Geesthacht, Germany); initially for a five-year term, with a second term subject to a review in 2010. Regional offices have been established in Singapore and Sri Lanka and are helping to build momentum for regional activities. As more than half of all LOICZ scientists are from less-developed countries, capacity building and regional activities are receiving increasing attention.



Global Ocean Ecosystem Dynamics (GLOBEC)

GLOBEC remained very active during 2005, initiating new activities and beginning a detailed programme of integration and synthesis. The SSC developed a blueprint for integration and synthesis identifying goals, milestones and timelines that will guide GLOBEC towards its conclusion in 2009. Integration and synthesis activities included meetings of the GLOBEC focus working groups and regional programmes, and a large number of symposia and workshops funded or cosponsored by the IPO. An exciting development was a GLOBEC-AIMES synergy (together with NCAR scientists), to help link climate and ecosystem research communities and to help transfer science into assessment and management applications. In November, a meeting was hosted by NCAR (Boulder, United States) to plan a 2006 GLOBEC-AIMES workshop.

The role of GLOBEC in fostering and coordinating international marine ecosystem research was recognised by International Polar Year lead-project nomination for two GLOBEC regional activities: *Ecosystem Studies of Sub-Arctic Systems (ESSAS)* and *Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICED)*; cosponsored by IMBER, SCOR and SCAR). Launched in 2004, both the ESSAS and *Climate Impacts on Oceanic Top Predators (CLIOTOP)* regional programmes published science





Photograph: N. Pope, Plymouth Marine Laboratory

Preparing a rosette of Niskin bottles for deployment during an Atlantic Meridional Transect cruise on board RRS Discovery in the fall of 2005.

plans in 2005. Both of these programmes are expected to continue within IMBER after the conclusion of GLOBEC. Together with EUROCEANS (an EU-funded project endorsed by GLOBEC and IMBER), GLOBEC is organising a summer school for 2006 (Dragerup, Denmark).

In 2005 GLOBEC held its first joint Executive Meeting with IMBER to facilitate interactions and to establish a strategy for incorporating continuing aspects of GLOBEC into IMBER at the conclusion of GLOBEC. During 2007–09 a joint GLOBEC-IMBER Task Team will prepare a detailed addendum for the IMBER Science Plan and Implementation Strategy. A Chinese GLOBEC-IMBER programme is under development. GLOBEC is cosponsored by SCOR and IOC.



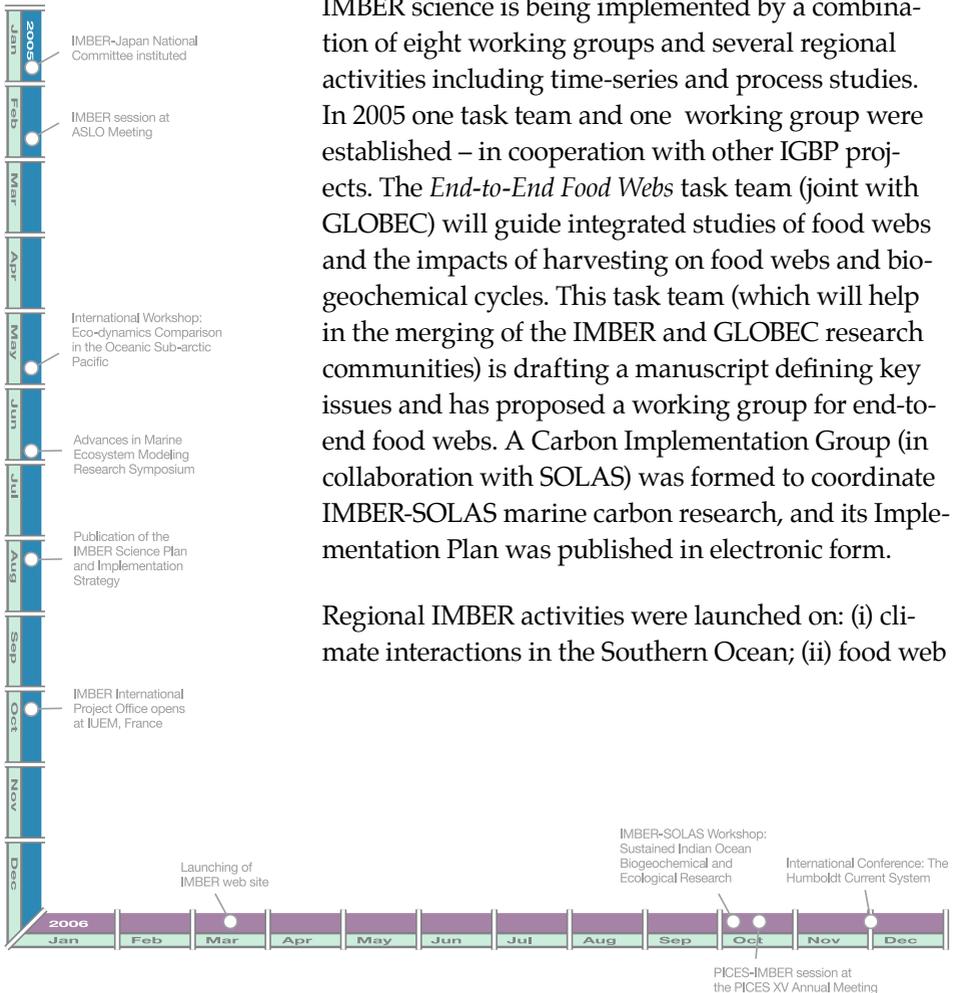
Integrated Marine Biogeochemistry and Ecosystem Research

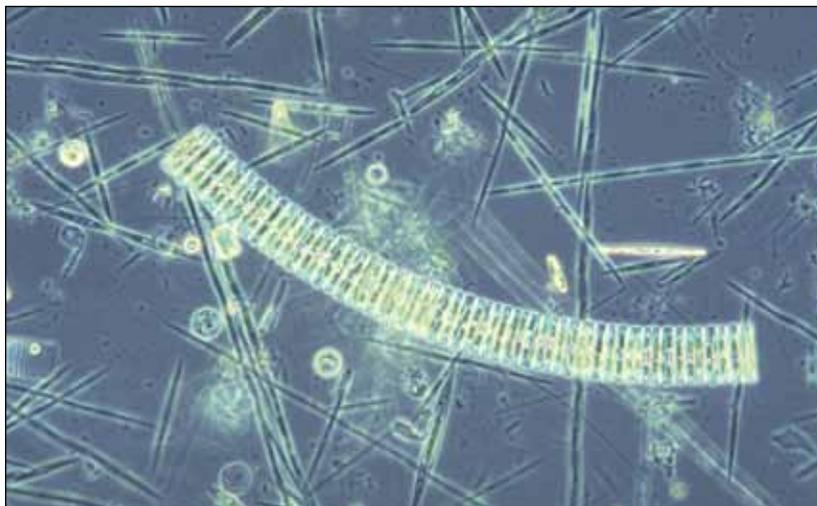
Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)

In 2005 the IMBER IPO (funded by a consortium of French agencies) was formally opened in Brest, France, and the Science Plan and Implementation Strategy was published and distributed. The IPO has three full-time staff who are energetically coordinating the project and its communication activities.

IMBER science is being implemented by a combination of eight working groups and several regional activities including time-series and process studies. In 2005 one task team and one working group were established – in cooperation with other IGBP projects. The *End-to-End Food Webs* task team (joint with GLOBEC) will guide integrated studies of food webs and the impacts of harvesting on food webs and biogeochemical cycles. This task team (which will help in the merging of the IMBER and GLOBEC research communities) is drafting a manuscript defining key issues and has proposed a working group for end-to-end food webs. A Carbon Implementation Group (in collaboration with SOLAS) was formed to coordinate IMBER-SOLAS marine carbon research, and its Implementation Plan was published in electronic form.

Regional IMBER activities were launched on: (i) climate interactions in the Southern Ocean; (ii) food web





Photograph: P. Assmy.

Characteristic diatoms from the Southern Ocean (needle-like chains of *Pseudonitzschia* spp. and a chain of *Fragilariopsis kerguelensis*) which are important food items for copepods, salps and krill.

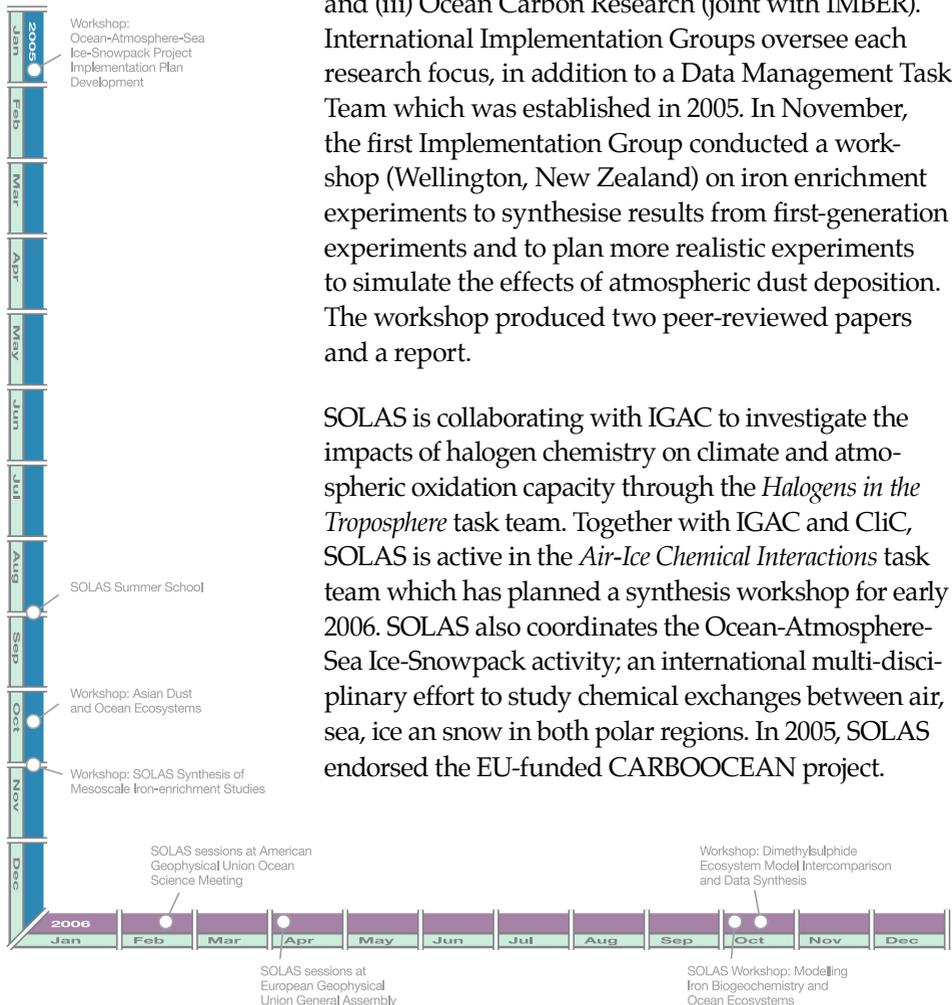
interactions in the high-nutrient-low-chlorophyll Sub-Arctic Pacific region; (iii) the oxygen minimum zone in the Peru-Chile Current system; and (iv) biogeochemical and ecological research in the Indian Ocean. Two major EU-funded projects contribute to IMBER: EUR-OCEANS and CARBOOCEAN. As of 2005, 13 nations were developing IMBER activities and had active national contact points. IMBER is cosponsored by SCOR.



Surface Ocean–Lower Atmosphere Study (SOLAS)

In 2005, a new Executive Officer and a Scientific Officer were appointed to the IPO. Implementation progressed in line with the implementation plans for each of the SOLAS research foci, which were published in electronic form in 2005. These are: (i) Biogeochemical Interactions and Feedbacks between Ocean and Atmosphere; (ii) Exchange Processes at the Air-Sea Interface and (iii) Ocean Carbon Research (joint with IMBER). International Implementation Groups oversee each research focus, in addition to a Data Management Task Team which was established in 2005. In November, the first Implementation Group conducted a workshop (Wellington, New Zealand) on iron enrichment experiments to synthesise results from first-generation experiments and to plan more realistic experiments to simulate the effects of atmospheric dust deposition. The workshop produced two peer-reviewed papers and a report.

SOLAS is collaborating with IGAC to investigate the impacts of halogen chemistry on climate and atmospheric oxidation capacity through the *Halogens in the Troposphere* task team. Together with IGAC and CliC, SOLAS is active in the *Air-Ice Chemical Interactions* task team which has planned a synthesis workshop for early 2006. SOLAS also coordinates the Ocean-Atmosphere-Sea Ice-Snowpack activity; an international multi-disciplinary effort to study chemical exchanges between air, sea, ice and snow in both polar regions. In 2005, SOLAS endorsed the EU-funded CARBOOCEAN project.





Photograph: Y. Iwamoto

In summer 2005, marine atmospheric and biogeochemical measurements were carried out on the Hakuho-Maru in the Pacific Ocean.

SOLAS, IMBER and the International Ocean Carbon Coordination Project continue to (i) develop, evaluate and evolve strategies for a sustained ocean carbon observing system; (ii) conduct basin- and global-scale data synthesis and interpretation and (iii) develop an ocean carbon data management system. In collaboration with the International Nitrogen Initiative, SOLAS will investigate human alterations to the marine nitrogen cycle. SOLAS has been invited by CLIVAR to cosponsor the *Variability of the American Monsoons System Ocean-Cloud-Atmosphere-Land Study*.

In August, the 2nd SOLAS summer school (Corsica, France) was attended by 75 students from twenty countries. Plans for the 3rd summer school and the next Open Science Conference (Xiamen, China) – both scheduled for 2007 – are well underway. As of 2005, SOLAS had activities in 23 countries. SOLAS is cosponsored by SCOR, CACGP and WCRP.

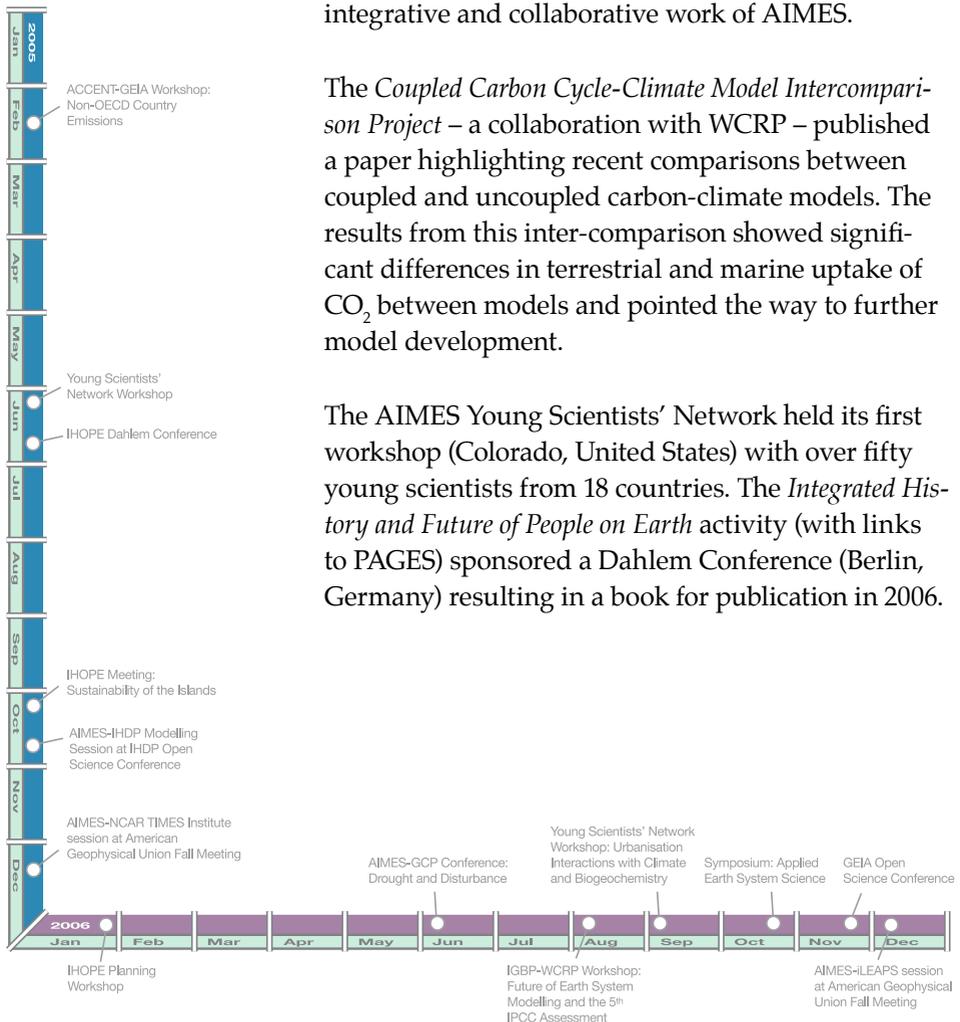


Analysis, Integration and Modelling of the Earth System (AIMES)

In 2005 – the first year of AIMES, the project interacted and established collaborations with IGBP and ESSP projects. An AIMES representative attended most IGBP project SSC meetings, and all IGBP projects and most ESSP projects were represented at the first AIMES SSC meeting (Colorado, United States). These linkages will provide a strong basis for the integrative and collaborative work of AIMES.

The *Coupled Carbon Cycle-Climate Model Intercomparison Project* – a collaboration with WCRP – published a paper highlighting recent comparisons between coupled and uncoupled carbon-climate models. The results from this inter-comparison showed significant differences in terrestrial and marine uptake of CO₂ between models and pointed the way to further model development.

The AIMES Young Scientists' Network held its first workshop (Colorado, United States) with over fifty young scientists from 18 countries. The *Integrated History and Future of People on Earth* activity (with links to PAGES) sponsored a Dahlem Conference (Berlin, Germany) resulting in a book for publication in 2006.



Photograph: www.bigphoto.com.

Change in the Polar regions is affecting indigenous communities and regional ecosystems and indeed the entire Earth System.

The goals of the IHOPE project include to map, model and understand the integrated record of biophysical and human system change on the Earth over the last several thousand millennia, with higher temporal and spatial resolution in the last 1000 and 100 years.

The *Global Emissions Inventory Analysis* (with links to IGAC, ACCENT and the Fast-Track Initiative on the Global Nitrogen Cycle) continued within AIMES.

Fast-Track Initiatives

The Global Iron Cycle

The major activities for 2005 were the November workshop on Synthesis of Meso-scale Iron-Enrichment Studies (Wellington, New Zealand) cosponsored by SOLAS, and manuscript preparation. The FTI culminated in a review paper published in *Science*, which describes research priorities for the future, as well as a paper on the deposition of dust to the oceans and a paper on the palaeo record of dust transport and deposition. The FTI cooperated with most IGBP projects and promoted the Ocean Acidification FTI. The knowledge generated will contribute to modelling within AIMES.

Contact: Tim Jickells, Zhisheng An
Email: t.jickells@uea.ac.uk, anzs@loess.lqg.ac.cn

The Role of Fire in the Earth System

Activity peaked in 2005 with workshops focussing on (i) assembling global and regional data for fire model development and testing (and for improving emission estimates) and (ii) improving the ability to upscale from landscape fire models to regional and global fire models in ways that account for spatial heterogeneity. Products to date include a booklet of abstracts from the Fire History Workshop, an article in the newsletter *Quaternary Times*, method standardisation, establishment of a list-server for the palaeo fire community, establishment of a central access point for modern fire history data, and several articles. Synthesis manuscripts and special issues of high-profile journals are in preparation. The FTI will conclude in 2006 after products in preparation (fire regime maps, journal articles, fire regime synthesis from last glacial maximum to the present, and guidelines for future global fire research) are completed. It is anticipated that fire research will continue within AIMES and GLP.

Contact: Sandra Lavorel
Email: sandra.lavorel@ujf-grenoble.fr

The Global Nitrogen Cycle

This FTI – known as the International Nitrogen Initiative (INI) – has regional centres (Africa, Asia, Europe, Latin American and North America) which were very active in 2005. Workshops/meetings were held in January (Uganda), May (Brazil), November (Germany) and December (Uganda). The European centre received EU funding to coordinate nitrogen research in Europe. During 2005 the INI made important contributions to activities of UNEP, FAO and the Convention on Biodiversity, and produced a series of publications on denitrification (in terrestrial, freshwater and marine systems) and papers on nitrogen cycling. This FTI concluded in 2005, however, some continuing activities of the INI are now managed by AIMES. The INI will organise the 4th International Nitrogen Conference in 2007 (Brazil).

Contacts: Mary Scholes, Jim Galloway

Email: mary@biology.biol.wits.ac.za, jng@virginia.edu

Atmospheric CO₂ and Ocean Biogeochemistry: Modern Observations and Past Experiences

New in 2005, this FTI is investigating past changes to better understand the consequences of ongoing ocean acidification. Modern observations and modelling results will be compared with palaeo environmental reconstructions from periods of major atmospheric CO₂ change. Analyses will be made of ocean pH changes, the buffering effect of carbonate sediments, the effect of weathering rates and fluvial input, the effects on marine plankton (especially carbonate producers) and overall marine productivity, and the tolerance of corals to changing chemistry. The FTI builds on the 2004 SCOR-IOC Symposium *Oceans in a High CO₂ World* and the UK Royal Society study on surface ocean acidification. Planned products include articles on workshop results, special journal issues and synthesis publications in high-profile journals.

Contact: Robert Duce

Email: rduce@ocean.tamu.edu



Earth System Science Partnership

The Earth System Science Partnership (ESSP) is a partnership of the four international global change research programmes of ICSU: DIVERSITAS, IGBP, IHDP and WCRP. It undertakes integrated studies of the Earth System, the changes that are occurring to the system and the implications of these changes for global sustainability. The central activities of the ESSP are projects on issues of global sustainability, designed to address the global change aspects of four critical issues: energy and the carbon cycle, food systems, water resources and human health. The progress of these four projects in the last year is described on the following pages.



Martin Rice
ESSP Coordinator

During 2005, preparations began in earnest for the 2006 ESSP Open Science Conference – *Global Environmental Change: Regional Challenges*, scheduled for 9–12 November, Beijing, China. In September, the first ESSP Coordinator – Martin Rice – was appointed; he is based at the DIVERSITAS Secretariat (Paris, France). During May, IGBP had the pleasure of hosting the annual ESSP Chairs and Directors meeting in Stockholm.



Global Carbon Project (GCP)

The high point of 2005 for GCP was the 7th *International CO₂ Conference* (Broomfield, United States) in September. The conference included a session on “managing the carbon cycle” aimed at stakeholder interaction. GCP also coordinated several sessions at the 6th Open Meeting of the Human Dimensions of Global Environmental Change community (Bonn, Germany) in October, on topics including urban and regional carbon management, science journalism and integrated modelling.

An international team of 18 lecturers from eight countries provided training for 33 junior faculty and senior technical staff from 13 countries in South and Southeast Asia. In June, GCP partnered with journalists and scientists from several Southeast Asian countries in the *First International Forum and Workshop on Science-Journalism Partnerships* (Tokyo, Japan). In November, a GCP-sponsored training workshop (organised by START) on Southeast Asian regional carbon and water issues was held in Taiwan.



Photograph: Brian Stocks

Emissions from boreal forest fires are a major source of carbon to the atmosphere.

Global Environmental Change and Food Systems (GECAFS)

In 2005, the GECAFS Science Plan and Implementation Strategy was published. Funding was secured for research planning in the Caribbean; Caribbean planning workshops were conducted in June (Georgetown, Guyana) and August (Kingston, Jamaica) and prototype “Caribbean Scenarios” were prepared. Funding was also secured for initial research on the Indo-Gangetic Plains, and workshops for this activity were conducted in March (Dhaka, Bangladesh), May (New Delhi, India) and December (Kathmandu, Nepal).

The *food systems* concept was established, a committee was established to develop and guide a new GECAFS activity and network on *Food Systems and Vulnerability*, and a science plan for work in southern Africa was drafted for publication in 2006. Major challenges for 2006 include securing funds for regional projects and for a “Scenarios” Science Officer at the IPO.



Source: AA World Travel Library

GECAFS research products will help inform policy formulation regarding GEC interactions with food availability, food access and food utilisation.



Global Water System Project (GWSP)

GWSP implementation began in earnest in 2005, with a full SSC established and meeting twice during the year. The first meeting immediately preceded the GWSP-sponsored International Conference on Integrated Assessment of Water Resources and Global Change (Bonn, Germany), and the second coincided with a meeting of the newly established GWSP-Asia network. The Science Framework and Implementation Activities report was published and distributed, as were a project brochure and two newsletters. A communications strategy was developed in cooperation with IGBP and IHDP.

Implementation was accelerated with the initiation of ten “fast-track activities” which will continue into 2006. A fast-track activity coordinator was appointed to the IPO late in the year. Fast-track activities include (i) development of a digital water atlas; (ii) establishment of an advanced training “institute” on global environmental change and water; (iii) a global study of environmental flows; (iv) a harmonised comparison of world water balance estimates; (v) development of global water system indicators; and (vi) a workshop on global water governance (for 2006). GWSP-LOICZ interactions (another fast-track activity) were initiated with a joint workshop at the LOICZ Open Science Conference.



Photograph: L. Weber, GWSP IPO

Many local communities in Indonesia rely directly on goods and services provided by aquatic ecosystems.

Global Environmental Change and Human Health (GECHH)

GECHH remains in the planning stages. The scientific challenge for GECHH is to bridge between ecological, epidemiological, medical and social sciences with a focus on cultural and socio-economic contexts of human health systems. During 2005, the 18-member planning committee, co-chaired by Tony McMichael and Ulisses Confalonieri advanced the drafting of a project science plan, for completion and approval in 2006.

Activities for 2005 included participation in a panel on Globalisation, Megacities and Health at the 6th Open Meeting of the Human Dimensions of Global Environmental Change community (Bonn, Germany) in October, and participation in the IHDP-endorsed workshop Globalisation, Health and the Environment – Urban Issues and Policies, in December. The latter workshop was organised by the Sino-German Cooperation Centre of the German Science Foundation and the Chinese Academy of Sciences. Both events had inputs from the IGU Commission on Health and the Environment.

A formal launch of GECHH is expected to occur during the ESSP Open Science Conference (Beijing, China) in November 2006.



Air pollution over the Phoenix skyline, United States.

Global Change System for Analysis, Research and Training (START)

Two major START activities neared completion in 2005. About half of the 24 regional assessments in the Assessment of Impacts and Adaptations to Climate Change (AIACC) in Multiple Regions and Sectors project were completed. AIACC has produced nearly fifty peer-reviewed publications, including over twenty in 2005. Two AIACC books are planned: one on vulnerability and one on adaptation to climate change.

In June, the Climate Prediction and Agriculture (CLIMAG) project held a three-day international workshop on *Climate Prediction and Agriculture: Advances and Challenges* at WMO headquarters (Geneva, Switzerland). The planned workshop products include a special issue of *Climate Research*, a synthesis book and a popular science brochure on climate prediction and agriculture.

During 2005, approximately 1000 scholars from developing countries were involved in START activities as part of more than seventy regional research projects. For example, 18 research projects (in 16 countries) were supported as part of the *Packard Advanced Institute on Vulnerability to Global Environmental Change*.



Source: www.marshome.org

Coastal pollution – a symptom of global change



Monsoon Asia Integrated Regional Study (MAIRS)

During 2005, the MAIRS IPO was established in Beijing, China, at the Institute of Atmospheric Physics of the Chinese Academy of Sciences (for formal opening in early 2006). Frits Penning de Vries was appointed as Director of the IPO and a SSC was established. The first formal SSC meeting is scheduled for April 2006, to initiate drafting of an initial science plan.

MAIRS will build on a lead-in phase of three sub-regional rapid assessment projects for China/East Asia, South Asia and Southeast Asia. These assessments will review the understanding of the regional aspects of global change in Monsoon Asia, and identify knowledge gaps so as to define research priorities for MAIRS. Each of the assessments is expected to produce a synthesis book for the respective sub-regions. Workshops in support of the assessments were held in Hangzhou (China), Chaing Mai (Thailand) and Colombo (Sri Lanka).



Traditional rice harvesting in Vietnam.

Source: www.bigphoto.com

African Global Change Research Network

In September, around 80 scientists and science managers – primarily from Africa – met for three days in Nairobi, Kenya, to discuss a formal regional network to coordinate and promote Earth System science and global change research in Africa. The workshop was organised with support from the US National Science Foundation, the New Partnership for African Development and the National Research Foundation of South Africa. The majority of the three days was spent in workshop sessions: (i) governance and structural organisation, (ii) funding and partnerships, (iii) key thematic global change research issues, and (iv) the policy-science-practice interface.

It was concluded that a formal regional network is needed for African global change research in order to: (i) provide new significant, independent funding opportunities; (ii) facilitate access to funding; (iii) facilitate knowledge transfer; (iv) provide Africa-wide research prioritisation and advocacy; (iv) help coordinate and focus research agendas; and (v) provide a unified voice to policy. The network should focus on issues of greatest relevance to sustainable development in Africa: (i) water and climate modelling; (ii) desertification; (iii) land degradation, biodiversity and food security, and (iv) health, pollution and aquatic ecosystems. A steering committee with broad regional representation has been established to further progress the network. For further information contact Eric Odada (pass@unobi.ac.ke).



Source: www.bigphoto.com

In Africa, the human and environmental dimensions of global change are inseparable.

Other Collaborations

The Observing Community

The research of the IGBP network includes studies and modelling of Earth System processes. Connecting these to the increasing number – and sophistication – of global observing systems is a central part of the IGBP strategy. With the advent of the Group on Earth Observations (GEO), the landscape for the global observation community is changing rapidly. IGBP is actively participating in this process.

As a “participating organisation” of GEO, IGBP took part in the GEO-I (May) and GEO-II (December) plenary meetings and provided input to meeting preparations. IGBP is currently developing a web-based survey for GEO to seek the views of the research community involved in *in situ* observations and modelling, on new platform and sensor requirements and on the improved use of existing systems.

During 2005 IGBP continued its involvement in the Integrated Global Observing Strategy (IGOS) and the Committee on Earth Observation Satellites (CEOS). As in previous years, Berrien Moore III represented IGBP at IGOS and CEOS activities. The European Space Agency (ESA) grant to IGBP was renewed at the end of the year, allowing Stephen Plummer from the European Space Research Institute in Italy to continue to work with IGBP for the coming three years.

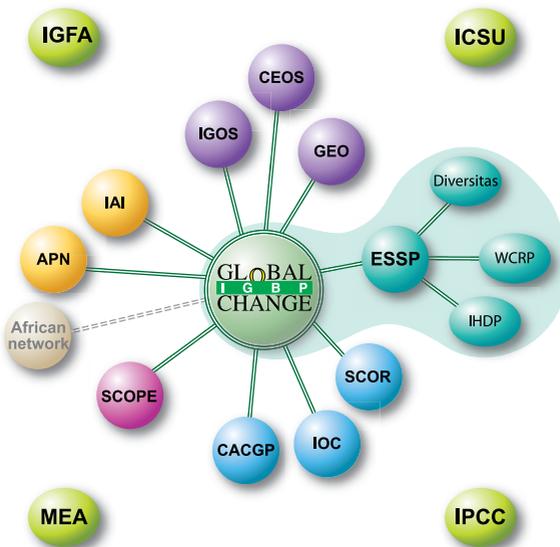
The IGBP-ESA initiative has focussed on contributions to the ESSP Global Carbon Project via the activities of GLOBCARBON, which aims to generate fully calibrated estimates of land data products primarily for use in dynamic global vegetation models. During 2005 a GLOBCARBON paper was accepted for publication.

Research and Capacity Building Partners

In addition to collaborations with ESSP partners and projects and links to the global observing community, IGBP collaborates on research and capacity building with several other international and regional organisations.

SCOR cosponsors GLOBEC, IMBER and SOLAS, and CACGP cosponsors SOLAS and IGAC. These collaborations are very important for IGBP, since these cosponsors provide significant scientific input and guidance to projects and Fast-Track Initiatives. An IGBP representative routinely attends the annual SCOR General Meeting and IGBP benefits greatly from SCOR representation at SC-IGPB meetings. A second symposium on *Oceans in a High CO₂ World* is being planned for 2007, cosponsored by SCOR, IOC and IGBP.

IGBP works closely with the Asia-Pacific Network for Global Change Research (APN) and the Inter-American Institute for Global Change Research (IAI), which support IGBP-related research and training activities. Collaboration with APN and IAI is very important in terms of helping to develop the scientific agenda for research within IGBP in Asia and the Americas. IGBP was represented at the APN 2005 Inter-governmental and Scientific Planning Group meetings.



The inter-organisational structure within which IGBP operates.

National Committee Activities

IGBP has around seventy-five National Committees which continue to be essential in the scientific planning and implementation of IGBP. National Committees contribute nominations for new members of IGBP scientific committees, and facilitate dialogue between national and international global change research.

At the 2005 meeting of the SC-IGBP the **Chinese National Committee** for IGBP (CNC-IGBP) organised a one-day workshop describing global change research in China, highlighting the Asian monsoon, the hydrologic cycle, land use, atmospheric teleconnections and marine systems. CNC-IGBP plans to merge with the Chinese National Committees for WCRP, IHDP and DIVERSITAS to form a Global Change National Committee.

The **Israeli National Committee** helped organise the 6th International Conference of the Israeli Society for Ecology and Environmental Sciences. Entitled *Living With Global Change: Challenges in Environmental Sciences*, the conference highlighted thirty invited or plenary presentations, including an opening presentation by the IGBP Executive Director. The conference was attended by more than 500 people and featured several special events, including (i) a *Forum for Environmental Education* that assembled 700 primary school children to present environmental projects and (ii) a *Symposium on Environmental Law*. The conference was cosponsored by IGBP.

In July, the **Romanian Global Environmental Change Committee** held a successful summer school entitled *Environmental Hazards and Sustainable Development in Mountain Regions*. The **Egyptian National Committee** (for IGBP and SCOPE) agreed upon an action plan for the coming three

years including (i) conducting five workshops in Upper Egypt and the Nile Delta on *Global Change and its Impact on the Egyptian Environment*; (ii) establishing two websites for SCOPE and IGBP; (iii) issuing a non-periodical newsletter for IGBP and SCOPE in English and Arabic; and (iv) forming an Arab Committee for IGBP and SCOPE with concerned organisations. In December, a symposium was held on *Global Change and its Effect on the Environment in Egypt*, with 250 participants across science, media, industry and non-government organisations.

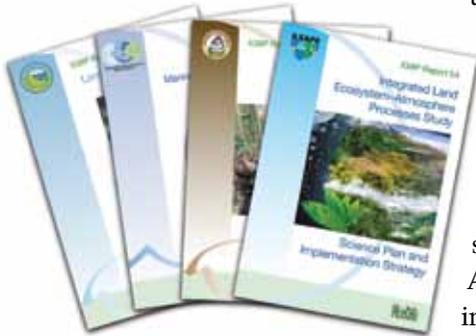
In April, the **Pakistani National Committee** held a workshop entitled *Global Change: Challenges, Impacts, Opportunities and Prospects*. The workshop assessed the status of global change research in Pakistan, began preparation of a directory of national institutions and individuals engaged in global change research, and considered national funding opportunities for new research. The proceedings of the workshop have been printed in book-form.

The **Korean National Committee** (together with the Korean Meteorological Administration) sponsored the *5th International Symposium on Asian Monsoon System*. Held in October, and attended by more than 120 participants from 11 countries, the conference was organised by the Korean Meteorological Research Institute, the Institute of Atmospheric Physics of the Chinese Academy of Sciences and the Centre for Climate System Research of the University of Tokyo.

Communications and Outreach

Summary of Activities and Products

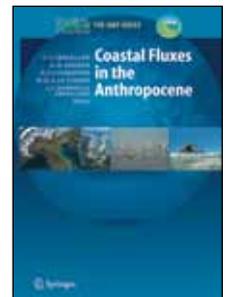
During 2005 the communication and outreach activities at the IGBP Secretariat focussed on promotion of the second phase of IGBP and its new suite of projects (including publication of project Science Plans), promotion of Earth System science and increased outreach to the wider scientific community and to policy audiences.



Major efforts during 2005 included production and publication of four project science plans and a comprehensive redesign of the IGBP website for launch in 2006. Additionally, outreach activities and policy interactions were undertaken including an initial mail-out to National Committees of an

IGBP information package. During the year the IGBP Earth System illustration and the LOICZ and iLEAPS project illustrations were completed, and an IGBP PowerPoint presentation was updated.

The Secretariat continued publication of the quarterly Global Change Newsletter, media work in association with major international conferences, collation and distribution of the IGBP Email Bulletin and maintenance of the existing IGBP website. The LOICZ synthesis book was published by Springer around mid-year, and due to



high demand a reprint of the Executive Summary of the IGBP synthesis book was undertaken. A paper summarising the plans for the second phase of IGBP was published in Eos – Transactions of the American Geophysical Union.



In line with the IGBP Secretariat's commitment to promoting core project science, media campaigns were organised for the LOICZ and PAGES Open Science Conferences (Netherlands and China, respectively). More than ten press releases were sent out during the year, mostly piggy-backing on major events and reports with which IGBP was involved. A media campaign was organised in September for the Nairobi scoping workshop on an African network for global environmental change research, including a press briefing at the event; articles in the local and international media resulted.



IGBP Earth System illustration and the LOICZ and iLEAPS project illustrations.



Publications List

- Anderson NJ, Jeppesen E, Sondergaard M and Battarbee RW (Ed.s) (2005) Lake Oligotrophication. *Freshwater Biology* 50(10).
- Artaxo P, Gatti LV, Leal AMC et al. (2005) Química atmosférica na Amazônia: A floresta e as emissões de queimadas controlando a composição da atmosfera amazônica. *Acta Amazônica* 35(2): 85–196.
- Batchelder HP, Strub PT, Lessard EJ and Weingartner TJ (Ed.s) (2005) US GLOBEC Biological and Physical Studies of Plankton, Fish and Higher Trophic Level Production, Distribution, and Variability in the Northeast Pacific. *Deep-Sea Research II* 52(1–2).
- Bathmann U (2005) Ecological and biogeochemical response of Antarctic ecosystems to iron fertilization and implications on global carbon cycle. *Ocean and Polar Research* 27(2): 231–235.
- Beaugrand G (2005) Monitoring pelagic ecosystems using plankton indicators. *ICES Journal of Marine Science* 62(3): 333–338.
- Borges AV, Delille B and Frankignoulle M (2005) Budgeting sinks and sources of CO₂ in the coastal ocean: diversity of ecosystem counts. *Geophysical Research Letters* 32(14): L14601, doi 10.1029/2005GL023053.
- Boyd PW, Law CS, Hutchins DA et al. (2005) Fe Cycle: attempting an iron biogeochemical budget from a meso-scale SF₆ tracer experiment in unperturbed low iron waters. *Global Biogeochemical Cycles* 19(4): GB4S20, doi 10.1029/2005GB002494.
- Brown R, Bollens SM, Madin LP and Horgan EF (2005) Effects of warm water intrusions on populations of macrozooplankton on Georges Bank, Northwest Atlantic. *Continental Shelf Research* 25(1): 143–156.
- Calbet A, Alcaraz M, Atienza D et al (2005) Zooplankton biomass distribution patterns along the western Antarctic Peninsula (December 2002). *Journal of Plankton Research* 27(11): 1195–1203.
- Chang CC, Chen TY, Lin C-Y et al. (2005) Effects of reactive hydrocarbons on ozone formation in southern Taiwan. *Atmospheric Environment* 39(16): 2867–2878.
- Chang CC, Chen T-Y, Chou C and Liu SC (2004) Assessment of traffic contribution of hydrocarbons by using 2,2-dimethylbutane as a vehicular indicator. *Terrestrial, Atmospheric and Oceanic Sciences* 15(4): 697–711.
- Chu D and Wiebe PH (2005) Measurements of sound-speed and density contrasts of zooplankton in Antarctic waters. *ICES Journal of Marine Science* 62(4): 818–831.
- Chuck AL, Turner SM and Liss P (2005) Oceanic distributions and air-sea fluxes of biogenic halo-carbons in the open ocean. *Journal of Geophysical Research: Oceans* 110(10): doi 10.1029/2004JC002741.
- Curchitser EN, Haidvogel DB, Hermann AJ et al. (2005) Multi-scale modeling of the North Pacific Ocean: assessment and analysis of simulated basin-scale variability (1996–2003). *Journal of Geophysical Research* 110, C11021, doi 10.1029/2005JC002902.

- de Baar HJW, Boyd PW, Coale KH et al. (2005) Synthesis of iron fertilization experiments: from the iron age in the age of enlightenment. *Journal of Geophysical Research: Oceans* 110(9): doi 10.1029/2004JC002601.
- Drinkwater KF, Loeng H, Megrey B, et al. (Ed.s) (2005) The influence of climate change on North Atlantic fish stocks. Proceedings of an ICES Symposium, Bergen, Norway. *ICES Journal of Marine Science* 62(7).
- El-Sayad SZ (2005) History and evolution of primary productivity studies of the Southern Ocean. *Polar Biology* 28(6): 423–438.
- Fuzzi S, Andreae MO, Huebert BJ et al. (2005) Critical assessment of the current state of scientific knowledge, terminology, and research needs concerning the role of organic aerosols in the atmosphere, climate and global change. *Atmospheric Chemistry and Physics Discussions* 5: 11,729–11,780.
- Grosskurth J, Ross K and Alverson K (Ed.s) (2005) International Young Scientists' Global Change Conference. *Global and Planetary Change* 47(2–4).
- Herget J and Dickau R (Ed.s) (2005) Natural and Human Impacts in the River Rhine Catchment. *Erdkunde* 59(3–4).
- Jickells TD, An ZS, Andersen KK et al. (2005) Global iron connections between desert dust, ocean biogeochemistry and climate. *Science* 308(5718): 67–71.
- Johns DG, Edwards M, Greve W and John AWG (2005) Increasing prevalence of the marine cladoceran *Penilia avirostris* (Dana, 1852) in the North Sea. *Helgoland Marine Research* 59(3): 214–218.
- Jones CE and Carpenter JL (2005) Solar photolysis of CH_2I_2 , CH_2ICl , and CH_2IBr in water, saltwater and seawater. *Environmental Science and Technology* 39(16): 6130–6137, doi 10.1021/es050563g.
- Kim S, Kishi MJ, Sugimoto T and Wei H (2005) Introduction: processes and dynamics in the northwestern Pacific ecosystems (from China-Japan-Korea Joint GLOBEC Symposium, 13–15 December 2002 at Ansan, Korea). *Journal of Oceanography* 61(2): 303–304.
- Kucera M, Schneider R and Weinelt M (Ed.s) (2005) Multiproxy approach for the reconstruction of the glacial ocean surface. *Quaternary Science Reviews* 24(7–9).
- Kulshrestha UC, Granat L, Engardt M and Rodhe H (2005) Review of precipitation monitoring studies in India – a search for regional pattern. *Atmospheric Environment* 39(38): 7403–7419.
- Langlois RJ, LaRoche J and Raab PA (2005) Diazotrophic diversity and distribution in the tropical and subtropical Atlantic Ocean. *Applied and Environmental Microbiology* 71(12): 7910–7919: doi 10.1128/AEM.71.12.
- Lara LBL, Artaxo P, Martinelli LA et al. (2005) Properties of aerosols from sugar cane burning emissions in southeastern Brazil. *Atmospheric Environment* 39(26): 4627–4637.
- Leterme SC, Edwards M, Seuront L et al. (2005) Decadal basin-scale changes in diatoms, dinoflagellates, and phytoplankton colour across the North Atlantic. *Limnology and Oceanography* 50(4): 1244–1253.

- Li Q, Jacob DJ, Park R et al. (2005) North American pollution outflow and the trapping of convectively lifted pollution by upper-level anticyclone. *Journal of Geophysical Research* 5: 8507–8646.
- Lindley JA and Daykin S (2005) Variations in the distributions of *Centropages chierchiae* and *Temora stylifera* (Copepoda: Calanoida) in the north-eastern Atlantic Ocean and western Atlantic Ocean and western European shelf waters. *ICES Journal of Marine Science* 62(5): 869–877.
- Maldonado MT, Strzepek RF, Sander S And Boyd PW (2005) Acquisition of iron bound to strong organic complexes, with different Fe binding groups and photochemical reactivities, by plankton communities in Fe-limited subantarctic waters. *Global Biogeochemical Cycles* 19(4): GB4523, doi 10.1029/2005GB002481.
- Mahowald NM, Baker AR, Bergametti G, Brooks N, Jickells TD, Duce RA, Kubilay N, Prospero JM and Tegen I (2005) The atmospheric global dust cycle and iron inputs to the ocean. *Global Biogeochemical Cycles* 19: GB4025, doi: 10.1029/2004GB002402.
- Marchant R and Behling H (Ed.s) (2005) Late Quaternary Tropical Ecosystem Dynamics. *Quaternary Research* 64(3).
- McFiggans G, Artaxo P, Baltensperger U et al. (2005) The effect of physical and chemical aerosol properties on warm cloud droplet activation. *Atmospheric Chemistry and Physics Discussions* 110, D10301, doi 10.1029/2004JD005039.
- McKay RML, Wilhelm SW, Hall J et al. (2005) Impact of phytoplankton on the biogeochemical cycling of iron in subantarctic waters southeast of New Zealand during FeCycle. *Global Biogeochemical Cycles* 19(4): GB4S24, doi 10.1029/2005GB002482.
- Meyer B and Oettl B (2005) Effects of short-term starvation on composition metabolism of larval Antarctic krill, *Euphausia superba*. *Marine Ecology Progress Series* 292: 263–270.
- Mioni CE, Handy SM, Ellwood MJ et al. (2005) Tracking changes in bioavailable Fe within high-nitrate low-chlorophyll oceanic waters: a first estimate using a heterotrophic bacterial bioreporter. *Global Biogeochemical Cycles* 19(4): GB4S25, doi 10.1029/2005BG002476.
- Moberg A, Sonechkin DM, Holmgren K et al. (2005) Highly variable Northern Hemisphere temperatures reconstructed from low- and high-resolution proxy data. *Nature* 433: 613–617.
- Momin GA, Ali K, Rao PSP et al. (2005) Study of chemical composition of rainwater at an urban (Pune) and a rural (Sinthagad) location in India. *Journal of Geophysical Research* 110: doi 10.1029/2004JD004789.
- Paffenhofer GA, Ianora A, Miralto A et al. (2005) Colloquium on diatom-copepod interactions. *Marine Ecology Progress Series* 286: 293–305.
- Rangama Y, Boutin J, Etcheto J et al. (2005) Variability of the net air-sea CO₂ flux inferred from shipboard and satellite measurements in the Southern Ocean south of Tasmania and New Zealand. *Journal of Geophysical Research C: Oceans* 110(9): doi 10.1029/2004JC002619.

- Scholze M, Mahowald N and Hibbard K (2005) Young Scientists' Network Holds Inaugural Workshop. *Eos* 86(45): 447–448.
- Smetacek V and Nicol S (2005) Polar ocean ecosystems in a changing world. *Nature* 437(7057): 362–368.
- Smith K and Schlitz R (2005) Structure and timing of recirculation around Georges Bank: an observational and modelling study at the Great South Channel: Part I – ensemble smoother. *Continental Shelf Research* 25(11): 1415–1432.
- Southward AJ, Langmead O, Hardman-Mountford NJ et al. (2005) Long-term oceanographic and ecological research in the western English Channel. *Advances in Marine Biology* 47: 1–105.
- Spahni R Chappellaz J, Stocker TF et al. (Ed.s) (2005) Atmospheric methane and nitrous oxide of the late Pleistocene from Antarctic ice cores. *Science* 310: 1317–1321.
- Speirs DC, Gurney WSC, Heath MR and Wood SN (2005) Modelling the basin-scale demography of *Calanus finmarchicus* in the north-east Atlantic. *Fisheries Oceanography* 14(5): 333–358.
- Stramma L, Huttel S and Schafstall J (2005) Water masses and currents in the upper tropical northeast Atlantic off northwest Africa. *Journal of Geophysical Research: Oceans* 110(2): doi 10.1029/2005JC002939.
- Strzepek RF, Maldonado MT, Higgins JL et al. (2005) Spinning the 'Ferrous Wheel' – the importance of the microbial community in an iron budget during the FeCycle experiment. *Global Biogeochemical Cycles* 19(4): GB4S26, doi 10.1029/2005GB002490.
- The UK Royal Society (2005) Ocean acidification due to increases in atmospheric carbon dioxide. *The Royal Society, London*. 60pp.
- Trebs I, Lara LL, Zeri MM et al. (2005) Dry and wet deposition of inorganic nitrogen compounds to a tropical pasture site (Rondônia, Brazil). *Atmospheric Chemistry and Physics Discussions* 5: 3131–3189.
- Verheye HM and Ekau W (2005). Maintenance mechanisms of plankton populations in frontal zones in the Benguela and Angola Current systems: a preface. *African Journal of Marine Science* 27(3): 611–615.
- Wolff E, Kull C, Chappellaz J et al. (2005) Modeling past atmospheric CO₂: results of a challenge. *Eos* 86(38): 341–345.
- Yoboué V, Galy-Lacaux C, Lacaux JP and Silué S (2005) Rainwater chemistry and wet deposition over the west savannah ecosystem of Lamto. *Journal of Atmospheric Chemistry* 52(2): 117–141.
- Zulicke C (2005) Air-sea fluxes including the effect of molecular skin layer. *Deep-Sea Research Part II: Topical Studies in Oceanography* 52(9–10): 1220–1245.

IGBP Community

IGBP Scientific Committee (2006)

ICSU-Appointed Members

Carlos Nobre (Chair)
National Institute of Space Research
BRAZIL

Guy Brasseur (Past Chair)
National Center for Atmospheric Research
UNITED STATES

Zhisheng An (Vice-Chair)
Chinese Academy of Sciences
CHINA (BEIJING)

Karin Lochte (Vice-Chair)
University of Kiel
GERMANY

Mary Scholes (Vice-Chair)
University of the Witwatersrand
SOUTH AFRICA

Robert Duce (Treasurer)
Texas A & M University
UNITED STATES

Henry Jacoby
Massachusetts Institute of Technology
UNITED STATES

Takashi Kohyama
Hokkaido University
JAPAN

Sandra Lavorel
Joseph Fourier University
FRANCE

Kon-Kee Liu
National Central University
CHINA (TAIWAN)

Taroh Matsuno
Yokohama Institute for Earth Sciences
JAPAN

Steven Running
University of Montana
UNITED STATES

Lynn Russell
University of California (San Diego)
UNITED STATES

Sybil Seitzinger
Rutgers University
UNITED STATES

Olga Solomina
Russian Academy of Sciences
RUSSIA

Mark Stafford Smith
CSIRO Sustainable Ecosystems
AUSTRALIA

Project Chairs and Co-Chairs

Meinrat Andreae (iLEAPS)
Max-Planck Institute for Chemistry
GERMANY

Richard Aspinall (GLP)

Arizona State University
UNITED STATES

Julie Brigham-Grette (PAGES)

University of Massachusetts
UNITED STATES

Sandro Fuzzi (IGAC)

Institute of Atmospheric Sciences and Climate
ITALY

Julie Hall (IMBER)

National Institute of Water and Atmospheric Research
NEW ZEALAND

Pavel Kabat (iLEAPS)

Climate Change and Biosphere Centre
THE NETHERLANDS

Peter Liss (SOLAS)

University of East Anglia
UNITED KINGDOM

Dennis Ojima (GLP; until April)

Colorado State University
UNITED STATES

Jozef Pacyna (LOICZ)

Norwegian Institute for Air Research
NORWAY

Colin Prentice (AIMES)

University of Bristol
UNITED KINGDOM

Philip Rasch (IGAC)

National Center for Atmospheric Research
UNITED STATES

Anette Reenberg (GLP; from May)

University of Copenhagen
DENMARK

David Schimel (AIMES)

National Center for Atmospheric Research
UNITED STATES

Francisco Werner (GLOBEC)

University of North Carolina
UNITED STATES

International Partner Chairs

John Church (WCRP)

CSIRO Marine Research
AUSTRALIA

Michel Loreau (DIVERSITAS)

McGill University
CANADA

Oran Young (IHDP)

University of California
UNITED STATES

The following people served on the SC-IGBP until the end of 2005:

Dagoberto Arcos

ICSU-Appointed, CHILE

Seth Krishniswami (Treasurer)

ICSU-Appointed, INDIA

Eric Lambin

LUCC, BELGIUM

Schaw Liu

IGAC, CHINA (Taiwan)

Ulrike Lohmann

ICSU-Appointed, SWITZERLAND

Liana Talaue-McManus

LOICZ, UNITED STATES

National Committee Chairs

Chairs (or contacts) of IGBP (or Global Change) National Committees

ARGENTINA

Mario Nuñez
Inter-America Institute

AUSTRALIA

Michael Manton
Bureau of Meteorology Research Centre

AUSTRIA

Georg Grabherr
University of Vienna

BANGLADESH

A. Choudhury
National Science and Technology Museum

BELGIUM

Jurgen Tack
Institute of Nature Conservation

BENIN

Sikirou Kola
University of Lomé

BOLIVIA

Jaime Argollo
University Major de San Andrés

BOTSWANA

Pauline Dube
University of Botswana

BRAZIL

Eduardo Krieger
São Paulo University

BULGARIA

Nadezda Petrova
Bulgarian Academy of Sciences

CAMEROON

Maurice Tsalefac
University of Yaoundé

CANADA

Thomas Pedersen
University of Victoria

CHILE

Francesco Rothhammer
Chilean Academy of Sciences

CHINA (Beijing)

Jiayang Li
Chinese Academy of Sciences

CHINA (Taipei)

Chao-Han Liu
National Central University

COLOMBIA

José Lozano
Columbian Academy of Exact, Physical and Natural Sciences

COMOROS

Ainouddine Sidi
National Centre for Scientific Research

CONGO, DEMOCRATIC REPUBLIC OF

Philippe Noki Vesituluta
University of Kinshasa

CZECH REPUBLIC

Jan Safanda
Academy of Sciences of the Czech Republic

DENMARK

Henrik Sogaard
Institute of Geography

EGYPT

Mohammad Ismail
National Research Centre

ESTONIA

Rein Vaikmäe
Ministry of Education

FINLAND

Markku Löytönen
University of Helsinki

FRANCE

Robert Delmas

*Laboratory of Glaciology and
Environmental Geophysics*

GERMANY

Wolfram Mauser

University of Munich

GHANA

Charles Biney

Water Research Institute

GREECE

George Contopoulos

Academy of Athens

HUNGARY

Joseph Tigyi

University of Pecs

ICELAND

Halldor Thorgeirsson

Ministry for the Environment

INDIA

Jai Singh

Banaras Hindu University

INDONESIA

Mahdi Kartasasmita

*National Aeronautical and
Aerospace Agency*

IRELAND

John Sweeney

National University of Ireland

ISRAEL

Zev Levin

Tel Aviv University

ITALY

Riccardo Valentini

University of Tuscia

IVORY COAST

Amoïn Konan-Brou

Centre for Oceanographic Research

JAPAN

Isao Koike

University of Tokyo

KENYA

Joseph Malo

Kenyan National Academy of Sciences

KOREA, REPUBLIC OF

Chae-Shik Rho

National Academy of Sciences

LEBANON

Mohamad Khawlie

National Council for Scientific Research

MALAYSIA

Kok Kee Chow (Co-chair)

Malaysian Meteorological Service

Ah Hin Lelong (Co-chair)

*Ministry of Science Technology
and Environment*

MONGOLIA

Tserendulamiin Shiirevdamba

Ministry of Nature and the Environment

MOROCCO

Ahmed Iraqi

University Hassan II

NETHERLANDS

Joyeeta Gupta (Co-chair)

Vrije University

Rik Leemans (Co-chair)

*Wageningen University and
Research Centre*

NEW ZEALAND

Julie Hall

*National Institute of Water and
Atmospheric Research*

NORWAY

Oystein Hov

Norwegian Institute for Air Research

PAKISTAN

Amir Muhammed

National University

PERU

Alberto Matto

*Regional Centre Seismology in
South America*

PHILIPPINES

Felino Lansigan (Contact)
University of the Philippines

POLAND

Malgorzata Gutry-Korycka
University of Warsaw

PORTUGAL

Miguel Reis
Institute of Nuclear Technology

ROMANIA

Dan Balteanu
Romanian Academy of Science

RUSSIA

Vladimir Kasyanov (deceased 2005)
Russian Academy of Sciences

Olga Solomina (Contact)

Russian Academy of Sciences

SENEGAL

Diafara Touré
Senegal Institute for Agricultural Research

SIERRA LEONE

N. Ayodele Cole
Fourah Bay College

SINGAPORE

Karina Gin
Nanyang Technological University

SLOVAK REPUBLIC

Július Sútör
Slovak Academy of Sciences

SOUTH AFRICA

Guy Midgley
National Botanical Institute

SPAIN

Aida Rios
Institute of Chemical and Environmental Research

SRI LANKA

Janaka Ratnasiri
Sri Lanka Association for the Advancement of Science

SWEDEN

Michael Tjernström
Stockholm University

SWITZERLAND

Christian Körner
University of Basel

SYRIA

Maamoun Malakani
Ministry of Irrigation

THAILAND

Kasem Chunkao
Kasetsart University

TOGO

Ayéchoro Akibode
University of Lomé

TUNISIA

M'hamed Brini
Tunisian Institute for Agronomy

UNITED KINGDOM

Roger Harris
Plymouth Marine Laboratory

UNITED STATES

Gregory Symmes (Contact)
National Research Council

VENEZUELA

Federico Pannier (Co-chair)
Academy of Mérida

Lelys Bravo de Guenni (Co-chair)

Simón Bolívar University

VIETNAM

Dao Trong Thi
Vietnam National University

ZAMBIA

H. Chabwela
University of Zambia

ZIMBABWE

Rindayi Chimonyo
University of Zimbabwe

IGBP Ambassadors

Zhisheng An

*Chinese Academy of Sciences
CHINA (Beijing)*

Bert Bolin

SWEDEN

Paul Crutzen

*Max Planck Institute for Chemistry
GERMANY*

Seth Krishniswami

*Physical Research Laboratory
INDIA*

Sandra Lavorel

*Joseph Fourier University
FRANCE*

Karin Lochte

*University of Kiel
GERMANY*

Berrien Moore III

*University of New Hampshire
UNITED STATES*

Carlos Nobre

*National Institute of Space Research
BRAZIL*

Thomas Pedersen

*University of Victoria
CANADA*

Katherine Richardson

*Århus University
DENMARK*

John Schellnhuber

*University of East Anglia
UNITED KINGDOM*

Mary Scholes

*University of the Witwatersrand
SOUTH AFRICA*

IGBP Secretariat

John Bellamy

Technical Editor (on leave from August)

Britta Boström-Huáman

Finance Coordinator (from August)

Wendy Broadgate

Deputy Director, Natural Sciences

Hilarie Cutler

Graphic Designer (from August)

Susannah Elliott

Science Communicator (until August)

João Morais

Deputy Director, Social Sciences

Kevin Noone

Executive Director

Sofia Roger

Information Coordinator

Will Steffen

Chief Scientist

Clemencia Widlund

Administrative Officer

Charlotte Wilson-Boss

Database Coordinator

Elise Wännman

Director for Finances (until August)

Bill Young

Science Editor

Financial Report

IGBP activities are predominantly funded by contributions from member countries. Central funds support the operation of the IGBP Secretariat and SC-IGBP and SSC meetings, IGBP contributions to the activities of ESSP and other partners, and communication and outreach activities.

Income and Expenditure

In the year ending 31 December 2005, financial contributions were received from 38 countries, listed below in order of level of contribution.

1	USA (04/05)	14	China (Taipei)	27	Israel
2	Sweden	15	Canada	28	Ireland
3	Germany	16	China (Beijing)	29	Hungary
4	Japan	17	Austria	30	Malaysia
5	France (04)	18	Denmark	31	Singapore
6	United Kingdom	19	Korea, Republic of	32	Thailand
7	Italy	20	Finland	33	Sri Lanka
8	Russia	21	South Africa	34	Iceland
9	Norway (04/05)	22	Portugal	35	Kenya
10	Spain	23	Greece	36	Lebanon
11	Netherlands	24	India	37	Romania
12	Australia	25	Poland	38	Colombia
13	Switzerland	26	New Zealand		

Income

US Dollars

National Contributions	1,538,701
Contracts	108,847
Other income (including NSF grant to PAGES)	336,143
Royal Swedish Academy reserve fund	223,214
Operating Assets from 2004	205,330
TOTAL INCOME	2,484,235

Expenditure

US Dollars

Scientific and communication activities	612,936
NSF grant to PAGES	166,194
NSF grant for African network workshop	75,590
Secretariat scientist salaries	584,209
Secretariat administration salaries	287,894
Operating: publications and website	71,278
Other Secretariat operating	197,013
Royal Swedish Academy Reserve fund	186,104
Loss due to exchange rate	70,356
TOTAL EXPENDITURE	2,251,574

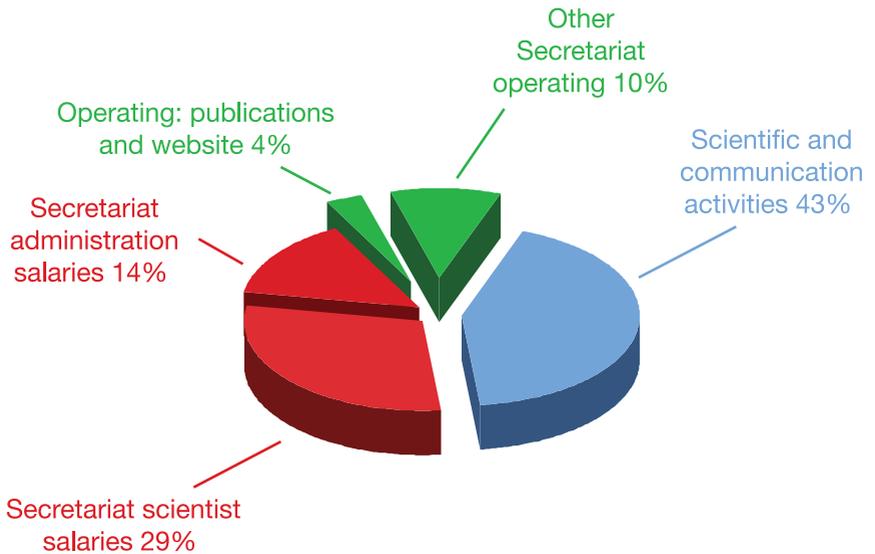
Operating assets 2006

232,661

Since the operating assets carried forward to 2006 are similar to those of 2005 – and the contractual commitments on these assets are also similar – the 2005 budget was very close to balanced. The “operating assets to 2006” cover contractual commitments from 2005 and also provide a cash-flow reserve for 2006 in months when expenditure exceeds income.

Proportional Expenditure for 2005

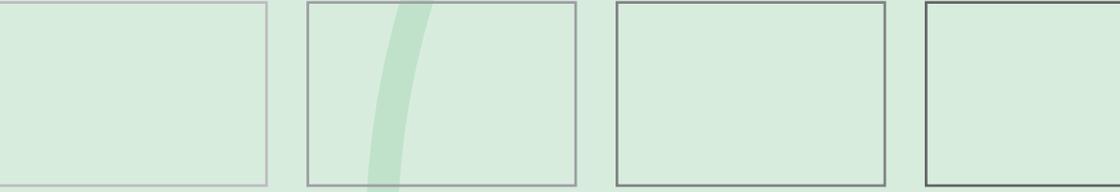
Proportional expenditure for 2005 was similar to previous years. A significant fraction of the IGBP Secretariat salary and operating costs directly supports the scientific and communications activities of the network.



Acronyms

ACCENT	Atmospheric Composition Change: European Network of Excellence
AGU	American Geophysical Union
AIACC	Assessment of Impacts and Adaptations to Climate
AICI	Air-Ice Chemical Interactions
AIMES	Analysis, Integration and Modelling of the Earth System
AMMA	African Monsoon Multidisciplinary Analysis
APN	Asia-Pacific Network for Global Change Research
BACCI	Biosphere-Atmosphere-Cloud-Climate Interactions
C4MIP	Coupled Carbon Cycle-Climate Model Intercomparison Project
CACGP	Commission on Atmospheric Chemistry and Global Pollution
CBACCI	Biosphere-Carbon-Aerosol-Cloud-Climate Interactions
CEOSS	Committee on Earth Observing Satellites
CLiC	Climate and Cryosphere
CLIMAG	Climate Prediction and Agriculture
CLIOTOP	Climate Impacts on Oceanic Top Predators
CNC-IGBP	Chinese National Committee for IGBP
CLIVAR	Climate Variability and Predictability Study
DEBITS	Deposition of Biologically Important Trace Species
DIVERSITAS	An international programme of biodiversity science
EGU	European Geophysical Union
ESA	European Space Agency
ESSAS	Ecosystem Studies of Sub-Arctic Systems
ESSP	Earth System Science Partnership
FLARES	Fire-Land-Atmosphere Regional Ecosystem Studies
FTI	Fast-Track Initiative
GAIM	Global Analysis, Integration and Modelling
GCP	Global Carbon Project
GECAFS	Global Environmental Change and Food Systems
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GLP	Global Land Project
GLOBEC	Global Ocean Ecosystem Dynamics
GWSP	Global Water System Project
IAI	Inter-American Institute for Global Change Research
IANABIS	Inter-American Network for Atmospheric-Biospheric Studies
ICED	Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean
ICSU	International Council for Science

IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere-Biosphere Programme
IGCO	Integrated Global Carbon Observing theme
IGOS	Integrated Global Observing Strategy
IHDP	International Human Dimensions Programme on Global Environmental Change
IGU	International Geographical Union
iLEAPS	Integrated Land Ecosystem–Atmospheric Processes Study
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
INI	International Nitrogen Initiative
IOC	Inter-governmental Oceanographic Commission (of UNESCO)
IPO	international project office
IPY	International Polar Year
ITCT	Intercontinental Transport and Chemical Transformation
LEARN	Land Ecosystem-Atmosphere Reactive Nitrogen
LOICZ	Land-Ocean Interactions in the Coastal Zone
LUCC	Land Use and Cover Change
MAIRS	Monsoon Asia Integrated Regional Study
NASA	US National Aeronautics and Space Administration
NC	national committee
NCAR	US National Center for Atmospheric Research
NOAO	US National Oceanic and Atmospheric Administration
NSF	National Science Foundation (United States)
PAGES	Past Global Changes
POLARCAT	Polar Study Using Aircraft, Remote Sensing, Surface Measurements and Models of Climate, Chemistry, Aerosols and Transport
SCAR	Scientific Committee on Antarctic Research
SCOPE	Scientific Committee on Problems of the Environment
SCOR	Scientific Committee on Oceanic Research
SOLAS	Surface Ocean–Lower Atmosphere Study
SPARC	Stratospheric Processes and their Role in Climate
SSC	scientific steering committee
START	Global Change System for Analysis, Research and Training
UN	United Nations
US	United States
UNFCCC	United Nations Framework Convention on Climate Change
VOCBAS	Volatile Organic Compounds in the Biosphere-Atmosphere System
WCRP	World Climate Research Programme
WMO	World Meteorological Organization



ICSU

International Council for Science