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

The First IGBP Congress

Finding common ground

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All participants assembled in front of the Kurhaus, Bad Münstereifel

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Tyler Prize 1996: more success for IGBP scientists

Adapted from the press release of the Tyler Prize Foundation.

Three scientists whose work has provided profound insights into the relationship between past climate change and the trace gas content of the atmosphere, have won the 1996 Tyler Prize for Environmental Achievement. They are:

Willy Dansgaard, Professor, University of Copenhagen, Denmark

Claude Lorius, Chairman, French Institute of Polar Research Technology, France

Hans Oeschger, Professor Emeritus, University of Bern, Switzerland

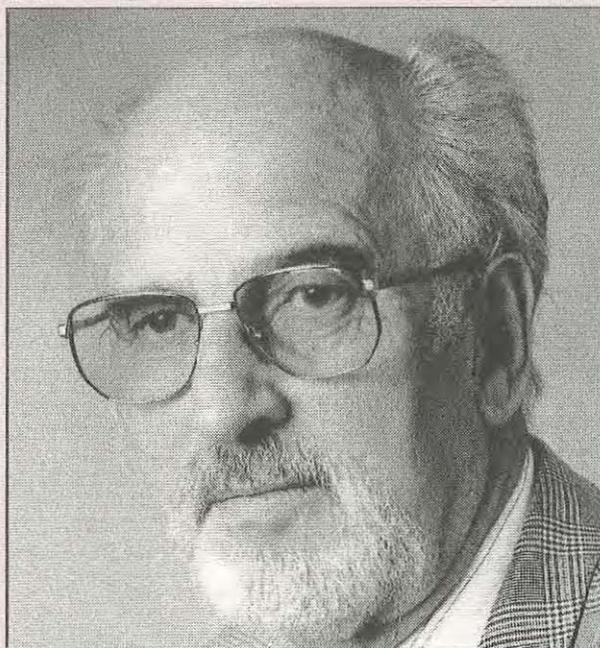
The three prizewinners and their research teams pioneered research on the evolution of the earth's climate covering

the span of human existence, and originated the idea that a quantitative record of past climate change could be reconstructed by analysing ancient polar ice.

The work began in the late 1950s in the harsh environment of Greenland, and later Antarctica, with the drilling of glaciers and polar ice sheets. There followed decades of additional field work and laboratory analysis before the oxygen isotopes and other traces of ancient atmospheres locked in the ice record revealed their story.

"The result of this painstaking work is a detailed look back in time that has demonstrated a strong relationship between global climate and the atmosphere," said Robert P. Sullivan, Ph.D., chair of the 11-member Tyler Prize Executive Committee. "Data from this work are used in virtually all scientific studies and reports about global warming to emphasize the potential of atmospheric pollution to adversely affect climate."

Willy Dansgaard, 73, was the first paleoclimatologist to demonstrate that measurements of the trace isotopes, oxygen-18 and deuterium (heavy hydrogen), in accumulated glacier ice could be used as an indicator of climate change. He proposed and later proved that the isotopic composition of glacier ice provides a physical record of paleoclimatic changes over time. Information on the history of global climate that has emerged from the study of ice cores has made an enormous contribution to understanding the behaviour of the earth system. Claude Lorius, 63, and Hans Oeschger, 68, pioneered the study of past atmospheric gas composition from ancient ice core samples. They demonstrated that atmospheric carbon dioxide, methane, and global temperature variability have been tightly linked during the past 160,000 years. The reconstruction of the increase of those greenhouse gases in the atmosphere during the last century is the most dramatic



Hans Oeschger

In reaction to the award Hans Oeschger said: "To be together with my colleagues W. Dansgaard and C. Lorius a recipient of the 1996 Tyler Prize is a great honor for myself and my dedicated team of scientific and technical collaborators (often called the Bern-Team).

I remember the scepticism we encountered when we explained decades ago the experiments we had in mind, like the reconstruction of the greenhouse gases by the analysis of the air trapped in natural ice of known age and the search of possible natural variations. Such variations of the greenhouse gases parallel to the climatic changes indeed were found and today they are a key example for the interactive physical-chemical and biological control of the earth system.

In view of these unexpected and important findings the early scepticism opposite to paleo-science disappeared and the award of the 1996 Tyler Prize to the three of us demonstrates that our field now receives the full recognition of the Earth system science community and I hope that this event is considered also as a great encouragement for our PAGES community."



Claude Lorius

When asked for his comments on the award of the Tyler Prize, Claude Lorius said:

"It was a great surprise when I was phoned with the news that together with my colleagues Willy Dansgaard and Hans Oeschger I had been awarded the Tyler Prize. I had no idea that my name was being considered for the award and it was a moment of great emotion.

It is obvious that others could have equally deserved such a recognition in the wide field of the environment, but I am certain that this award has a symbolic and special value regarding two aspects close to my heart and activities:

- ◆ the PAGES core project which has its objective so aptly expressed in Winston Churchill's famous words: "The farther backward you can look, the farther you are likely to see";
- ◆ and Antarctica, a continent for peace, research and international co-operation; and hopefully a lighthouse for the environment of our Planet."

and convincing evidence driving recent concerns over the likelihood of future global climate change. Claude Lorius and Hans Oeschger are both long time members of the PAGES Scientific Steering Committee of the IGBP, Hans Oeschger having been the chair from 1989 to 1995.

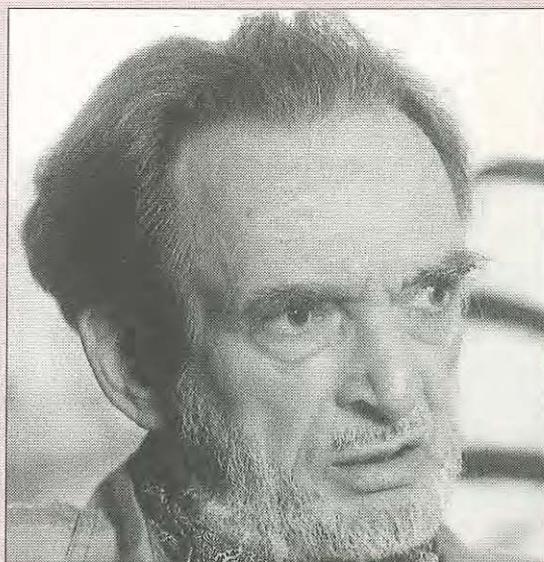
The three scientists shared a cash prize of \$ 150,000 and received gold Tyler Prize medals at a black-tie awards dinner on May 3 in Los Angeles.

Established in 1973, the Tyler Prize for Environmental Achievement is an international award honouring significant scientific achievements in all disciplines of environmental study and environmental protection. Through their work, Tyler Laureates have focused world-wide attention on environmental problems and motivated effective action toward solutions. Three previous winners of the Tyler Prize have subsequently been awarded the Nobel Prize in Chemistry, like the 1996 Nobel Chemistry Laureate Paul Crutzen, also part of the IGBP.

The prize is administered by the University of Southern California. It was established by the late John and Alice Tyler. Mr. Tyler was founder and long-time chief executive officer of the Farmers Insurance Group. The Tylers were lifelong lovers of

the outdoors and the natural world. They created this significant and prestigious honour to help focus world attention on environmental problems and to motivate effective actions and solutions.

The 1996 Tyler award, following Paul Crutzen's 1996 Nobel Prize, provides further evidence of the IGBP's impressive success in attracting the active participation of the world's leading global change researchers.



Willy Dansgaard

The First IGBP Congress

During five days in April, the IGBP's leading researchers assembled in the small medieval town of Bad Münstereifel, Germany, for the First IGBP Congress. This was the first time in the ten year history of the IGBP that all the Programme Element (PE) Scientific Steering Committees (SSC) had met together. As emphasised by Chris Rapley, the IGBP Executive Director, and Peter Liss, the SC-IGBP Chairman, in their opening speeches, a major objective of the meeting was to reinforce the "corporate identity" of the IGBP, and to place ever-greater emphasis on the integration and synthesis of the programme's results.

This theme was expanded in the keynote address, "The International Geosphere-Biosphere Programme: A Study of Global Change and the Human Prospect" delivered by Thomas Malone, one of the originators of the programme. In his speech, Professor Malone maintained that current human activities are inequitable, unsustainable, and probably unstable. He emphasised that the IGBP and related research activities provide essential input for the attainment of a sustainable human society, and outlined some development paths by which the human race could achieve this. He noted the crucial importance of strengthening the involvement of researchers from within the social sciences.

On the first and the last full days of the Congress the Programme Element SSCs held their business meetings. These included special emphasis on inter-Programme Element collaboration, and significant progress was made in terms of planning and specific agreements.

The second full day was dedicated to presentations from the Chairs of each of the eleven IGBP Programme Elements in which they reviewed recent successes and future plans. It was apparent that the programme is continuing to develop rapidly, with the emergence of a wide variety of new results. A presentation was also given by John Marks, the new Chair of the International Group of Funding Agencies (IGFA) (and a previous IGBP Executive Director)

on the current status and plans of IGFA.

For the following two days participants were able to sign up for theme sessions organised by members of the SC-IGBP ("top down") and the Programme Elements ("bottom up") respectively. The SC-IGBP sessions covered the topics of "Ice and Earth System Variability", "Ecological Buffering in Global Change", "Modelling of the Total Earth System", "Global Change and Food Supplies", "Capacity Building", "Scaling", and "Closing the Carbon and Nitrogen Cycles". In each case a series of presentations was followed by open discussion, which were universally lively and productive.

The sessions organised by the Programme Elements covered a wide variety of topics including "The Amazonian Large-scale Biosphere Atmosphere experiment (LBA)", "The ISLSCP Global Datasets", "Mountain Hydrology", "Land Use and Land Cover Change as a driver of Global Change", "Net Primary Productivity modelling", "PAGES-START (PEP III, Africa)", "PAGES and its relation to other Programme Elements", "Research on the Arctic Drainage Basin and its link to Climate Change", "The Weather Generator", "Palaeo-Trace Gas Evolution over the last 150 kyr", "General Interactions between IGAC and GCTE", and "IGBP Oceans Research". Once again, the sessions were lively and resulted in much valuable debate, followed up where appropriate in the subsequent SSC meetings.

The venue of the Congress was the Bad Münstereifel Kurhaus, an old monastery which was renovated and converted only relatively recently. All activities including the plenary and break-out sessions, meetings, breaks, lunches and dinners took place at the Kurhaus, providing a rich opportunity for SSC members to meet with their colleagues in other Programme Elements. Indeed, throughout the proceedings, the development of new contacts, new ideas and new insights into the activities and methods of the different IGBP PES was much in evidence.

In spite of a demanding schedule, there was some time for social interaction and some (brief) relaxation. An opportunity to see the medieval church of the town of Bad Münstereifel was offered on the Saturday night, when the town organised an organ concert for the Congress participants. Organist Margareta Hürholz played pieces of Bach, Beer and Widor in historic and evocative surroundings.

The Congress was concluded by a memorable banquet, following a fascinating address by Nobel Prize winner Paul Crutzen on the development and discoveries of atmospheric chemistry over the past 30 years. Paul's long involvement with the IGBP started with his membership of Co-ordinating Panel 1, which evolved into the IGAC Core Project. He continues as one of the IGAC Vice Chairs.

The Congress was organised by the IGBP Secretariat, especially Neil Swanberg and June Boström, with the help of Helmut Kühr, Sabine Lütke-meier and their team of local organisers. The widely acclaimed smooth-running of the event owes much to their collective dedication and detailed planning. The Congress was financed from the IGBP central budget and with generous support from the German Ministry of Education, Science, Research and Technology (BMBWF) and the Deutsche Forschungsgemeinschaft (DFG).

The Congress was widely acknowledged as a great success. As noted by Chris Rapley in his final summary, it heralded the entry of the IGBP into a new and crucial phase of its development in which unique new forms of research projects are emerging, and in which the programme level integration and synthesis of results is becoming a reality. Now is the time to consolidate the progress and links forged in Bad Münstereifel. Many a challenge still lies ahead, but the spirit of the Congress will ensure that for the future of the IGBP, no obstacle is too high.

Sheila Lunter, IGBP Information Officer

What Did the IGBP Congress Achieve?

by Chris Rapley, Executive Director

"A splendid meeting; a great deal achieved; a necessary injection of energy; a real turning point for IGBP; a landmark event in global change science; quite the best IGBP meeting I have attended"

A flood of messages received at the Secretariat on returning from Bad Münstereifel made it clear that the First IGBP Congress was seen by the participants as an overwhelming success. The planners and organisers of the meeting were equally enthusiastic. So why the euphoria? What did the Congress achieve?

Prior to the event, four objectives had been defined:

- ◆ to carry out an internal review of the status of the entire Programme
- ◆ to identify common issues for collaborative action
- ◆ to identify the key research interfaces between the IGBP Programme Elements
- ◆ to catalyse essential cross-linking research and the integration and synthesis of results at the programme level

The intent was to expand and strengthen networking within the Programme, especially between the 161 individuals who comprise the IGBP science steering committees. Important overarching goals were to reinforce the IGBP's sense of "corporate identity" and to spur new progress in "making the whole greater than the sum of the parts".

The format of the Congress consisted of a combination of SSC and Task Force meetings, review presentations, and parallel science "Theme Sessions", the latter focusing on priority topics identified both by the SC-IGBP and by the Programme Ele-

ments. In spite of a demanding (some said "thoroughly exhausting") schedule, this proved to be very effective. There can have been few present who did not emerge with a significantly clearer and more extensive knowledge of the IGBP research programme and of the opportunities for creative interconnections. Many made new contacts from distant regions of IGBP's research domain, and many important mutual interests were discovered. The boost to interdisciplinary awareness and interaction was a major success, as was progress within the Programme Elements on a variety of cross-linking and integrative research arrangements. The meeting culminated in the announcement by GAIM of a commitment to making a major advance in coupling land-ocean-carbon cycle models in the next three years, a timescale significantly shorter than had previously been considered feasible. In practice, therefore, the stated objectives of the Congress were fulfilled beyond even the most optimistic expectations.

Interestingly, there were also several unanticipated spin-offs: One was the ease with which major progress was made on complicated organisational issues, as a result of the ready availability of all key players over a period of several days.

In addition, and of major significance, was the crystallisation of ideas about the IGBP's unique strengths and assets, and the formulation of a possible new type of IGBP research activity, the "Interproject" (see Box). This derives in part from the rapidly developing IGBP Transect initiatives, and in part from the "Flagship" project concept, first proposed some years ago.

However, none of these individual outcomes can explain the exhilarating feeling, apparently universally shared, of having taken part in a momentous event. This seems to have derived from a heady mixture of profound new insights into the

scientific achievements and future potential of the IGBP, from the challenge of confronting the broader scientific context of each SSC's deliberations, and from the recognition of the exceptional nature of the colleagues involved in the guidance of IGBP's ongoing planning and implementation. Indeed, the intellectual vibrancy of the event resulted in the one widely expressed complaint, that there simply was not adequate time set aside to pursue "offline" discussions.

Will there be another IGBP Congress? On the basis of the responses to the questionnaire circulated at the end of the meeting, the answer has to be a resounding "yes", although the exact timing will be a matter of judgement. In the meantime, extra research momentum has been generated, and there is a wide consensus that the IGBP has entered a new and important phase.

Finally, it is worth noting that, partly fortuitously, senior representatives of the International Group of Funding Agencies (IGFA) attended some of the Congress sessions. At a time when research budgets are increasingly under pressure, the exposure of funding agency representatives to direct evidence of the strength, richness, and vigour of IGBP's research programme is invaluable. If a consequence of the Congress is the maintenance, or even increase, of future IGBP funding allocations, one of its greatest achievements is yet to come.

The First IGBP Congress was funded partly from the IGBP central budget and partly through the generous support of the Ministry of Education, Science, Research and Technology (BMBF), and the Deutsche Forschungsgemeinschaft (DFG), to whom we express grateful appreciation.

The "Interproject"

A New Concept for IGBP Research

IGBP's first decade of planning and research has provided a vehicle for the creation of a set of unique and valuable assets. These comprise:

- ◆ a large research skills pool, which is (a) front ranking, (b) highly interdisciplinary, (c) highly international, and (d) very effectively networked
- ◆ new scientific knowledge
- ◆ new tools and mechanisms for (a) global change research, and (b) the organisation and management of global change research

It is important to consider whether the IGBP is exploiting these assets to the full, and, if not, to adapt accordingly. At the IGBP Congress, this reasoning led to the concept of a potential new type of IGBP research activity: the "Interproject" (referred to tentatively during the Congress as a "Hyperproject").

The key characteristic of an Interproject would be its assembly from a wide range of component parts of the existing IGBP programme. This would involve a level of interaction extending beyond the co-ordination and synergism already being pursued through inter Programme Element (PE) collaboration, and the integration and synthesis being addressed by the IGBP Framework Activities. It would combine a unique mix of the skills, talents and knowledge of a variety of IGBP research teams and individuals to form a new research entity, with its own specific objectives and structure. In many cases, the concept could be usefully extended to include elements of the World Climate Research Programme (WCRP) and the International Human Dimensions Programme (IHDP).

Although the origins of the concept owe much to the IGBP Transects and previous discussion of "Flagship" Projects, the Interproject combines a number of features which make it especially attractive:

- ◆ it draws on the unique assets of IGBP; allowing the *acknowledgement* of IGBP's role and importance to be clear cut
- ◆ it can be tailored to satisfy both basic research and policy objectives; enhancing the benefit to society and therefore allowing the issue of *accountability* to be addressed effectively
- ◆ it can be tailored to link global and regional issues; providing a sound basis for START to expand and enhance the participation of *developing nations*
- ◆ it provides a convenient format for funding agency interactions; assisting IGFA in its important role of the *international co-ordination of national budgetary planning*

Examples of existing activities or activities under consideration which could be developed into Interprojects include major field experiments such the Large Scale Biosphere Atmosphere Experiment (LSA), other proposed or developing Transect activities (e.g. the Miombo study, the Kalahari Transect, the North East Eurasian Transect), a project addressing freshwater issues, a possible joint WCRP-IGBP project on climate variability and agriculture, or a project on global change and human health.

Before embarking on any new form of activity, an important consideration will be the finite limits of the existing skill pool size and funding resources. The development of an Interproject would almost certainly require a careful review of priorities, and the need to trade off new and existing commitments.

Reactions to the First IGBP Congress

by Robert W. Buddemeier

Before going to the Congress, I had only a very vague idea of what the IGBP really was or how it worked. This in spite of the fact that I have been working on topics related to the carbon cycle, the hydrologic cycle, and sea level for my entire career, as well as my association with LOICZ-related activities for some time before being appointed to the SSC at the beginning of this year.

One of my first reactions on arriving at the Congress was pleasant surprise — a lot of people whom I knew, either personally or through the literature, turned out to be involved in the various projects. That was good news to me, but I think it emphasises one of the problems alluded to during the meetings: the IGBP has not succeeded in establishing a widely-recognised organisational identity, or in getting credit for its contributions to scientific accomplishments. It is a challenge for everyone involved in the IGBP to help establish this identity.

Another observation relates to where the IGBP is positioned in the spectrum of "International Science." If you look at organisations with an emphasis on the *science* part of the terminology, they tend to be high-tech, big-programme oriented, and dominated by (usually) white males from developed countries. Their agendas and problem definitions are typically shaped

by the disciplinary structure of Western scientific institutions, and they tend to have explicitly recognised, focused leaders. On the other hand, organisations with a focus on the *international* part of the terminology tend to have much more diverse representation, to operate by consensus in a relatively diffuse (and often bureaucratic) fashion, and to lack both the advantages and the disadvantages of a clearly defined conceptual or cultural framework.

The international *science* organisations tend to be very good at getting solutions or answers, but often marginal when it comes to adequate definition of the problems, and downright dismal in terms of achieving implementation or application of their results. The *international science* approach can be pretty good at realistic problem identification, and it provides a basis for acceptance or implementation of results — but it is often hopeless when it comes to getting effective answers on a reasonable time scale, due to lack of both material resources and an efficient operational mechanism.

It seemed clear to me that the IGBP is a hybrid. Within most projects, the dominant paradigm is that of "*science*" — hence the frequent references to "heroes" (with "heroines" hastily tacked on). As I would have predicted, there were a lot of results of this approach on display; these tended to be fairly impressive but not always exactly on target. The references to "mid-course corrections," the general agreement that water probably was important after all, and the sense that it might be necessary for more than one project to address horizontal fluxes — all these tend to suggest that

some of the original project designs owed more to available technology and existing theory than to thoughtful consideration of the limiting uncertainties in global problem formulation and solution.

However, the *international* approach shows up — in operational style if not in complexion — in the Secretariat and the central organisation. Here it seems that attention to consensus and protocol is the likely explanation for the rather belated attention to project review and inter-project coordination.

Notwithstanding these retrospective criticisms (yes, hindsight is always clearer), I came away from the Congress with a very positive feeling. It was my observation that most of the participants were willing and able, with only a minimum of obligatory posturing, to consider the problems and potentials of their own and other projects, and to seek common ground for co-operation. The "younger" projects (LOICZ, LUCC, and to some extent GLOBEC) have pragmatic objectives that are quite different from the more theoretical-disciplinary foci of the original projects. Neither approach is necessarily "correct," but I am confident that an integration of the two will be far more effective than either alone.

Clearly, many challenges remain. Money is one, and is closely linked to the recognition and identity problem. Some good starts were made at the Congress on internal review and cross-project communication and integration, but these need to be nurtured, reinforced, and rewarded. There are only a few efforts that are doing much to bridge the gap between the natural and social sciences — and there remains the perpetual question of how to combine the strengths, rather than the weaknesses, of the two "*international science*" approaches to achieve something that might be termed *international science* in the best sense.

To me the Congress was educational, enjoyable and productive — and although I'm arriving in mid-performance, I would judge that the meeting went a long way toward achieving its goals. I am looking forward with heightened interest — and even guarded optimism — to the remainder of my term.

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a member of the LOICZ-SSC and will be on
sabbatical leave at the LOICZ Core Project Office from
July to December 1996.



Paul Crutzen during his closing address

The IGBP Congress as a Call for Integrative Science

by Steven Sanderson

Five years ago, the *Chronicle of Higher Education* carried a feature on the uneven development of global change research, remarking particularly on the successes of the physical sciences since the mid-1980s and the relative slowness of social scientists to contribute to the research agenda. Many social scientists remarked on the poor funding for "human dimensions" work, and the lack of fit between natural and social science research agendas and methods. It seemed at the time another vignette in the "two cultures" of science, divided by a common quest for knowledge.

About that same time, seminal articles describing the earth's primary productivity concluded that upwards of 40 percent of the products of photosynthesis is human-managed, and that the proportion is likely to grow substantially within our lifetimes. A consensus began to emerge that the human management of the biosphere meant that global change research had to incorporate the human dimension in more fundamental ways. Whether social scientists would join that effort remained a question. The First IGBP Congress, held in Bad

Münstereifel, Germany from 17 to 23 April, took another step forward in addressing that integration.

The Congress identified many objectives, among them staking out future research challenges and developing an agenda of cross-programme element linkages. This means nothing less than a kind of transdisciplinary scientific effort, which ultimately will integrate the science of *global change* in a way heretofore not possible. The outcome of the Congress, accompanied by the 1996 inauguration of LUCC as the first co-sponsored core project of the IGBP and IHDP, has moved that challenge to the forefront. The need for social science involvement in that integrative effort is clearer now than ever before.

A small sample of discussions at the Congress reinforce that conclusion.

- ◆ Ecological buffering concerned itself with a number of human disturbance problems, including the impact of present and prospective agricultural systems on greenhouse gases, and the understanding of resilience in terms of human disturbance. New scientific efforts, from the nascent "resilience network" associated with the Beijer Institute, to the SCOPE proposal on biosphere services and human utilisation, view disturbance, recovery, resilience, stability, diversity, buffering, and other key concepts in light of human populations and the variety of their economic activities and social organisation.

- ◆ Research on global change and food

supplies reiterated the mandate for regional-scale research within a larger global effort. If the aggregate projections of global food demand can be identified within a set of price, technology and population assumptions, the geographic distribution of food production and its impacts on global change cannot. It is extraordinarily important to incorporate regional- and landscape-scale research into aggregate projections, to attune international commodity trade and agricultural supply-distribution models to likely impacts at those scales, and to integrate those findings into ecological and biogeochemical research.

- ◆ Land Use and Cover Change (LUCC) has identified its scientific objectives to include the explanation of land use and cover change, but also the sources of its variation: not just what land use and cover change, but how and why, and with what impacts? In that quest, it has identified a need for the incorporation of economic, demographic, political and cultural theories that offer explanations of the dynamics underlying land use at the level of the land manager, the cultural context in which land management takes place, and the larger macropolitical and economic driving forces that explain change at the landscape scale.

These and other discussions took on added integrative importance because of the emergence of the IGBP Transects activities. The descriptions of "conceptual transects" — LBA, the Miombo woodlands,

Clockwise from top: an impression of the town of Bad Münstereifel; Hans-Jürgen Bolle, Chris Rapley, the Mayoress of Bad Münstereifel and Christian Patermann during the Opening Ceremony; Jariya Boonjawat and Eric Odada at the banquet.

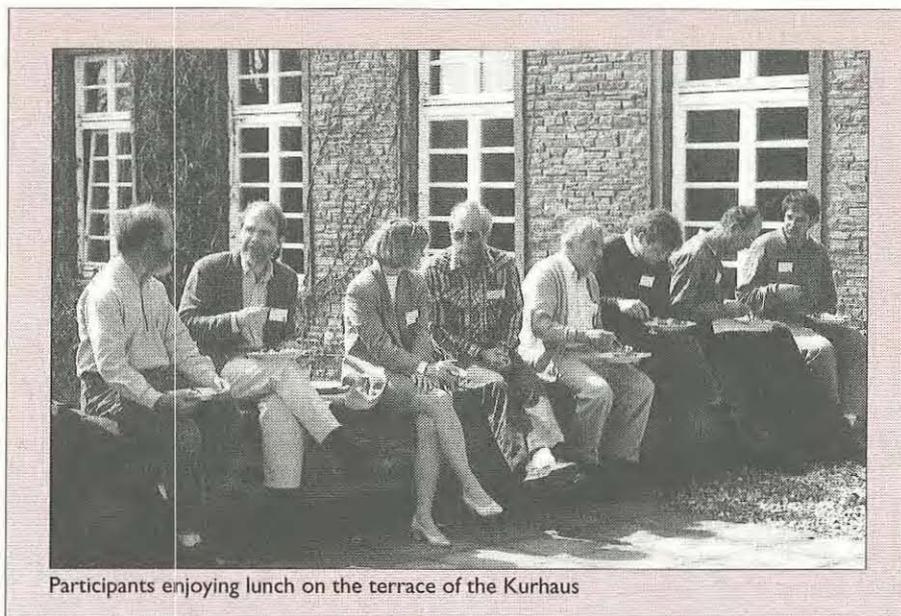


and the Southeast Asian transect—posed fundamental social science questions in a total systems approach that included the physical climate system, atmospheric chemistry, land surface hydrology, biogeochemistry, terrestrial ecology, and land use and cover change. The impacts of human settlements, changes in economic activities, and anthropogenic biomass burning, all become important to the fundamental science of these transects.

IGBP Congress discussions were of obvious importance to a certain kind of social scientist, but those ranks remain thin. The quality and relevance of social science research for the IGBP agenda is only beginning to become apparent, and the gap in global change research remains. Social science is poorly-represented in IGBP science, and the integrative aspects of research are more promising than real, at this point. Indicators of success in closing that gap are unlikely to be led by shifts in funding in favor of human dimensions research. In fact, if the integrative mandate of global change research is genuine, a shift to isolate “purely human dimensions research” in the funding stream would undercut the progress that was so palpable at the Congress.

Some next steps suggest themselves. First, follow-through on the inter-programme element activities can advance the integration of social and natural science. Second, building transects research with social science involvement offers a qualitative improvement in integrative research design in the field. Third, social science can take the discussions of the IGBP Congress as a touchstone for new global change research. The venues for that leadership are the human dimensions research programmes at the national level, the International Human Dimensions Programme (IHDP), the Social Science Research Council Committee for Research on Global Environmental Change, and the 1997 Conference of the Human Dimensions Research Community, to be held at IIASA a year from now. If the Conference agenda includes the kinds of broad-gauged discussions held at the Congress in Bad Münstereifel, the 1997 meeting will advance social science-natural science integration. But the real measure of a successful transdisciplinary global change research agenda will be the disappearance of hyphenated social-natural science research.

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Participants enjoying lunch on the terrace of the Kurhaus

A View from the Noosphere

by *Merrilyn Wasson*

From the perspective of an international environmental lawyer, whose discipline is reliant on scientific evidence of global change, the Bad Münstereifel IGBP Congress was an exhilarating success. It was a success in manifestly fulfilling its goals, notably the cross fertilisation of ideas and results, and the identification of issues requiring core project collaboration.

The exhilaration was inspired by tangible evidence that the IGBP has now attained a new level, a mature phase of its existence. Three key figures in the establishment of the IGBP - Thomas Malone, one of the primary agitators for and instigators of the programme, Jim McCarthy, the first Chair, and John Marks, a former Executive Director - independently volunteered this observation during the Congress. The key feature of the new phase is that the unprecedented international effort is producing results beyond initial expectations.

For this observer, two additional factors characterise the mature phase. The first is the speed with which the START program is having an impact on the research priorities of the Core Projects. This is evident in the emphasis being placed on water research, a paramount environmental concern of developing nations and one firmly entrenched as an IGBP priority since SAC IV in Beijing last year.

From the perspective of international environmental law, this is an important outcome, since the soil and water concerns of developing nations have not been accor-

ded a balanced emphasis with climate change on the international political agenda. The IGBP is a model in this respect.

The second characteristic of the new phase is the collaboration with the social sciences with the aim of improving predictive capacity where those ubiquitous, unpredictable anthropogens are a causative factor!

The sum of these features of the mature phase is that results are now accumulating at an exhilarating rate. *How to communicate the results with maximum impact and minimum cost is already an issue for the IGBP, and one which will require some rapid solutions.*

A Pragmatic Rationale for Communicating Results

A careful reading of recent articles by Chris Rapley and Peter Liss (the IGBP Executive Director and Chair of the IGBP-SC respectively) indicates that this is an issue to which they are devoting considerable attention. Their aim, which is in accord with the IGBP's constitution, is to communicate results directly to decision-makers, national and international.

This aim is somewhat complicated by a conclusion of the External Review of the IGBP, that the programme should not make policy recommendations. It is simply not possible to communicate scientific results to policy-makers, without spelling out the implications of those results. Indeed, it can be argued that the results have implications which cannot be concealed.

The rationale for communicating the results as they are co-ordinated in this new phase is not confined to the IGBP's constitution; it is a pragmatic and philosophical necessity. Unless the IGBP disseminates its

major findings to decision-makers on a regular basis, the prospect of the program losing funding just as it has reached this peak is a real one. The crude reality is that finance for 'public good' science demands a return in the form of results that contribute to the public good.

The Philosophical Rationale: the interdependence of the Biosphere and the 'Noosphere'

The philosophical rationale is just as pertinent. As Chris Rapley observed, the purpose of the IGBP is not just to satisfy human curiosity but to underpin a sustainable global society.

It was perhaps Vladimir Vernadsky, the outstanding Russian scientist who founded the discipline of biogeochemistry and introduced the concept of the biosphere, who best explained the philosophical and practical reasons why global change science has to communicate its findings to the general community.

In his much quoted article, 'The Biosphere and the Noosphere', (33 *American Scientist*, 1945) Vernadsky pointed out that: 'Chemically, the face of our planet is being sharply changed by man...' and that 'for the first time, man becomes a large scale geological force.' That being so, the way men think in the 'noosphere', Vernadsky's term for the realm of human thought, has a direct impact on the biosphere.

Vernadsky's logical conclusion was that scientists had to influence the noosphere to minimise man's harmful impact on the biosphere. He correctly predicted that the biosphere would become an area of social concern requiring public policy regulation and that scientists 'must consider themselves responsible for the consequences of their discoveries.'

This interdependence of the biosphere and the noosphere is acknowledged with the presence of an IHDP/IGBP liaison officer in the IGBP Secretariat and in the natural science/social science collaboration in the LUGG Core Project. But how the scientific community involved in the IGBP communicates its results in the 'noosphere' remains an unresolved issue.

For Maximum Impact, use the Media

The most effective way of communicating results may not be to rely on specialist communications with policy-makers alone. Decision-makers come and go. The reality is that to influence policy, it is necessary to influence those to whom policy-makers are ultimately answerable - the general population. This applies whether or not the polity is organised as a democracy.

When Vernadsky wrote his seminal article, influencing the noosphere entailed permeating polities more dependent on elite decision-makers. Fifty years of tech-

nological change have already altered that.

The media, especially television, enables a simultaneous and direct impact on the public and upon present and future policy-makers. It is worth noting that in the major developing powers of China and India, television and radio are the main means of communication, with greater outreach than the print media and telephonic communication.

Communicating the results of IGBP research:

A Proposal for the Year 2000

The concrete proposal is this: That by the year 2000 a 'Report to the World' on the state of scientific knowledge of the Earth's life support systems be produced by the IGBP as a major Television series.

The advantages are:

1. Such a series would be extremely attractive to the major television networks, given the high profile of global change issues, together with the widespread conviction that the state of the global environment will be the paramount issue going into the 21st Century.
2. The IGBP/IHDP/WCRP maintains control over how the implications of the results are presented in the series, minimising the risk of distortion.
3. The maximum impact is made on the noosphere by reaching a global audience. That audience has the capacity to exert pressure on policy-makers to heed the results.
4. Using the mass media in this way has the advantage over dealing solely with policy-makers because it minimises the risk of the results being buried or distorted.

This recommendation may have an intrinsic appeal to those who have identified communicating research results as a major issue for the post Bad Münstereifel phase. It may also appeal to the flamboyant extroverts and appal the more introverted! It may also perturb those who believe it is still possible to separate science in the biosphere from the noise of the noosphere. But please consider it on its merits.

For this interested observer, the Bad Münstereifel Congress itself was worthy of a documentary. With the confidence that the IGBP has successfully negotiated the initial phases of implementation, now is the time to deal with the outstanding issue of communication.

Merrilyn Wasson, *The Australian National University, Canberra ACT 0200, Australia.* Merrilyn Wasson is currently working on a book on "Politics and Global Change Science"

Left: Thomas Malone during his opening address.
Right: Julia Kundermann making a speech during the banquet.



Global Models: Sooner Rather Than Later

by Berrien Moore III

In less than a decade the scientific community could begin to realise fully coupled, dynamical (prognostic) models of the Earth System (Figure 1), where the temporal scale of analysis is multi-decadal.

What must be done to get there?

When the IGBP Task Force on Global Analysis, Interpretation, and Modelling (GAIM) was formed, it was recognised that a) models of the physical-climate subsystem, General Circulation Models, or GCMs, existed at a variety of institutions around the world and b) prognostic Global Biogeochemical Models were at a relatively primitive stage. As a consequence, the challenge then to GAIM was to initiate activities that would lead to the rapid development and application of a suite of Global Biogeochemical Models that would ultimately be linked to GCMs, and thereby provide models of the Earth system.

There were good reasons to be optimistic (at least for the task of developing Global Biogeochemical Models): enormous progress had been made in the development of process-based models for ecosys-

tem metabolism for a variety of terrestrial and marine ecosystem; crucial data sets were being acquired to extend and evaluate these concepts at continental and global scale, and most importantly, the early years of scientific struggle by the IGBP Core Projects were beginning to bear fruit.

Simply put, we, the IGBP with the World Climate Research Program, have begun to construct the pieces needed for taking a quantum leap in the development of Earth System Models, and yet even with the pieces before us it is not clear how to fit them together. GCMs exist; ocean carbon cycle models are being tested; dynamic vegetation models are undergoing similar comparisons; atmospheric chemistry models are being run at global scales, and the terrestrial landscape is being coupled to the coastal ocean. But how do we achieve models of the entire system; what is the appropriate approach to complete the complex puzzle?

It should be recognised at the outset that "putting this puzzle together" must confront an array of difficulties. An analo-

gy is that one is working with several others who have different parts of the puzzle and some parts of other puzzles; some puzzle pieces appear to be only partially finished and perhaps not too well made; you are working on board a ship on a very rough sea; some puzzle pieces are on the deck—some may have been washed overboard; the light is not too good; several are saying that it is impossible and others are demanding that you finish within the next few minutes. It is not an easy task.

The multi-decadal temporal scale places important constraints and demands upon the character of Earth System Models. Differences in characteristic rates of change and fundamental processes of different components of the system will impose subsystem specific demands and requirements on component models. Ecological systems will likely rest upon functional groups rather than species; understanding biogeochemical fluxes will require process-level models but initial implementation at global scales will certainly require extensive parameterisation. Similarly, the non-linear chaotic dynamics of the fluid subsystems, the oceans and atmosphere, will continue to require a careful, step-by-step build-up in complexity.

The most complex models to date are the atmosphere and ocean GCMs. These have structures largely determined by the need to solve the Navier-Stokes fluid equations, but they are rich in other physical processes as well. The atmospheric models and their climate role are especially strongly governed by water processes; however, it is precisely these aspects, including questions of scale and parameterisation, that are amongst the least satisfactory.

Resolution is a problem. Many of the important water structures have spatial scales poorly resolved by existing models. For example, cloud systems, which are key for atmospheric radiation, have in nature vertical scales less than the thickness of the layers in most existing models. The horizontal structure of precipitating systems suffers not only from inadequate res-

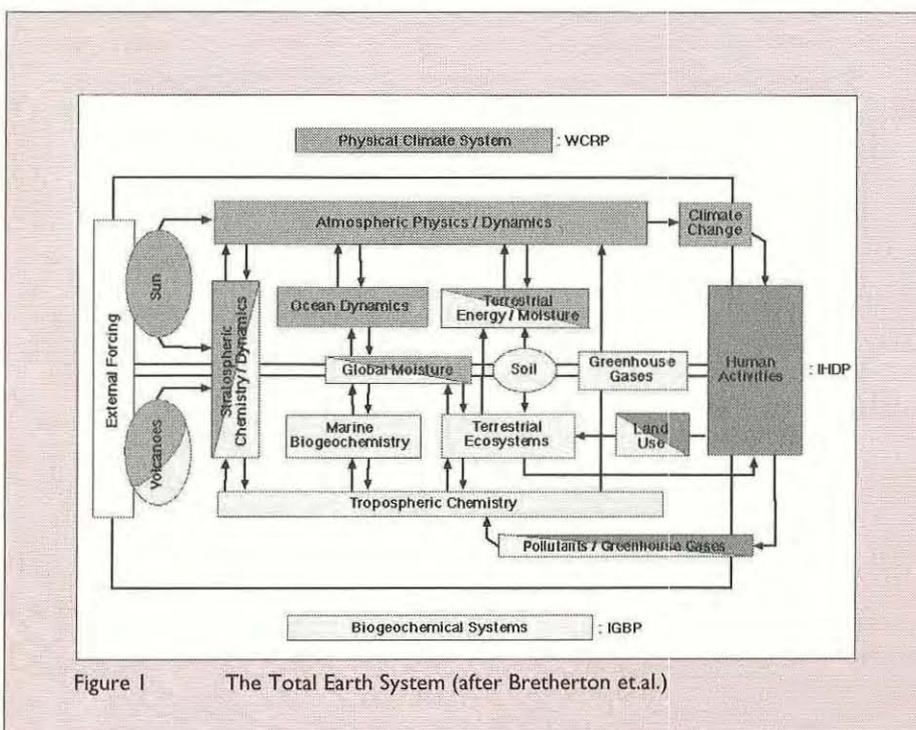


Figure 1 The Total Earth System (after Bretherton et al.)

olution but also is dependent upon clouds and processes that are, themselves, poorly resolved. For instance, there is concern about the treatment of water vapour and vertical transport in various atmospheric GCMs since the process in nature, the real vertical transport, occurs on scales small compared to that of the model.

Adding the important chemical constituents and the reactions to an atmospheric GCM causes the issues of scale and computational challenges to become daunting. Some of the important chemical reactions are concentration-dependent and hence grid-scale dependent; moreover, important processes often occur in the boundary layer which generally is not well enough resolved. Further, the addition of atmospheric chemistry to a GCM places greater demands upon the terrestrial and oceanic boundary conditions and dynamic simulations.

In considering coupling atmospheric GCMs to terrestrial models where the coupling transfers not only energy and water but important gases, such as CO, CH₄, and CO₂ for the carbon cycle, then again temporal and spatial scale issues emerge. The macro-balance of terrestrial carbon stocks, which determine the net flux of CO₂, are difficult to derive by integrating across the short time scales at which energy, water, and CO₂-O₂ are actually exchanged, because of the high degree of variability that these processes exhibit. Longer time-step integrations have generally been more successful. Ecological changes, such as successional sequences of tree species, are not well treated on time-steps that are appropriate for considering photon input and water exchange, or even the intermediate time steps required for CO₂ flux. On the other hand, CH₄ and other short-lived species flux cannot be treated by simple mass balance and crudely time-averaged responses. And this has not enough touched upon the important nitrogen and sulphur gases!

The relatively simple coupling issue of land hydrology-atmosphere remains elusive, and yet it is important. The exchange of many reduced gases (e.g., CH₄ depend on soil moisture conditions) and energy are influenced by water balances. Modelling sensitivity studies have shown that if evapotranspiration were turned off over continental scale areas, then summer precipitation would be severely reduced and temperatures would be as much as 10 degrees (K) higher than with normal fluxes. They also show that over tall vegetation, the integrated resistance to transpiration

implied by the stomata will have a major effect on Bowen ratios over the diurnal cycle. Since the rates of sensible heat exchange over the diurnal cycle determine the height reached by the planetary boundary layer as well as diurnal variations of precipitation in tropical and summer conditions, it is evident that the inclusion of the role of vegetation is of central importance in the hydrological cycle.

The coupling between the ocean and the atmosphere is central to the question of climate change. Atmospheric GCMs with prescribed oceans, long the mainstay of three-dimensional climate modelling, are inherently incapable of simulating the actual time-evolving response of the climate system to increasing greenhouse gases because this response involves heat uptake by the oceans. This is particularly clear when one realises that the heat capacity of the atmosphere is roughly equivalent to that of the upper three meters of the ocean. While it is true that the ocean may, partially, act in a passive manner, studies of the El Niño/Southern Oscillation (ENSO) show that the ocean-atmosphere system responds in a coupled fashion on interannual time scales, and paleo-oceanographic investigations suggest that aspects of longer term climate change are associated with changes in the ocean's thermohaline circulation. The capability to predict these changes in circulation and heat exchange is necessary to describe the future evolution of global climate.

Fortunately, exciting and encouraging progress is being made in coupling key aspects of the major subsystems. Results from linking atmosphere and ocean GCMs have already been reported in the literature and have shown significantly different behaviour than simulations in uncoupled modes. Similarly, interactive simulations between atmosphere and land vegetation have been reported, and these have also exhibited new dynamical characteristics. The inclusion of biology in ocean GCMs has begun, though still simplistic and not yet with climatic feedback in a coupled system. Representations of terrestrial biology are also preliminary and again without critical biogeochemical feedbacks. Finally, progress is being made towards model structures and datasets which will allow implementation of an atmosphere-ocean-terrestrial models that includes key biological-biogeochemical feedbacks.

How then do we best put the pieces together? One puts a puzzle together by putting it together--step by step; piece by

piece. One certainly does not study the puzzle at length and then put it together en masse. For us this means that we need to continue to bridge boundaries not yet breached, and thereby develop still partial but more completely coupled models than presently available. Specifically, we need to advance the coupling across four critical interfaces: terrestrial ecosystems and the atmosphere, the ocean and the atmosphere, the chemistry of the atmosphere and the physics of the atmosphere, and terrestrial ecosystems and the coastal oceans. Advances at these interfaces is essential for progress. As in a puzzle, by completing sections, we gain insight into the whole.

Finally, trial development of the "completely coupled" models should be encouraged or at least not completely resisted. These prototypes will teach us what is needed to realise an Earth System Model, even though these prototypes may themselves not be successful. This could proceed along two parallel paths: one devoted to developing basin and global scale models with increasing levels of coupling, and the second leading to a series of regional fine-scale models that could provide boundary conditions and parameterisation tests for the larger-scale models. Each regional model could include the complexity and dynamics appropriate for simulating the processes in a specific region, and the necessity for maintaining interfaces with the larger-scale models would give the entire enterprise an overall consistent structure.

The importance of experience gained through modelling experiments, including failure, should not be underestimated. Failure when carefully analysed can be highly valuable. Linking atmosphere-ocean-biosphere models, even though costly in terms of human and computer resources, should begin sooner rather than later. These early, relatively primitive attempts will shed light on the difficult issues of scale, both spatial and temporal, and the associated questions concerning the degree to which various process complexities or details are required.

The pieces are now before us, and though the deck pitches and the light flickers and our stomachs are queasy, let us proceed.

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An Evaluation of the Budget of Tropospheric Ozone Over the Western Pacific

APARE: PEM-West A and Related Field Experiments

by H. Akimoto, R.J. McNeal, D.D. Davis, J.M. Hoell, S.C. Liu and R. Newell and PEM-West A, PEACAMPOT A and CATS Science Team

The Pacific Rim region of East Asia is characterised by high and rapidly growing anthropogenic emissions resulting from the high population and rapidly growing energy consumption. The main objective of IGAC's *East Asian-North Pacific Regional Experiment* (APARE) is to study the impact of human activity in this peculiar region on the marine air over the Pacific. One of the targets of APARE is tropospheric ozone (O_3) and this report focuses on this aspect among other themes.

Increase of tropospheric O_3 as observed in various regions of the Northern Hemisphere is of particular concern in regard to East Asia. Firstly, still rapidly growing emissions of O_3 precursors (nitrogen oxides, carbon monoxide and non-methane hydrocarbons (NMHC)) from this region would be a major contributor to the expected O_3 increase on a hemispheric scale in the coming decades. Because it is a greenhouse gas, the resulting O_3 could

affect the global climate. Secondly, increase of near-surface O_3 , together with acid deposition, could be a potential threat to terrestrial ecosystems and to agricultural productivity, which may affect food supply adversely.

In order to study chemical processes and long range transport of trace species in the Western Pacific, the NASA PEM-West (Pacific Exploratory Mission-West), the Japanese PEACAMPOT (Perturbation by East Asian Continental Air Mass to Pacific Oceanic Troposphere), CATS (Climate and Air Quality Taiwan Station) in Taiwan, and the Hong Kong Monitoring Station (Phase B) were co-ordinated under APARE. The major scientific objective was to evaluate the budget of O_3 in the Western Pacific and to characterise long range transport of O_3 in the East Asian Pacific Rim Region. The first phase of these missions, Phase A, was conducted during September-October, 1991, when the region was under the influence of relatively clean Pacific air. The second phase, B, was conducted during February-March, 1994, when the influence of continental outflow was near its

annual maximum. The PEM-West mission included intensive airborne measurements of trace species from the NASA DC-8 aircraft (see Figure 1) co-ordinated with flights of the Japanese Cessna-404 aircraft and ground based stations (see Figure 2) operated in co-ordination with the above three campaigns. This article reports some major findings of Phase A.

The PEM-West A data set is best described in terms of two geographical domains: the Western North Pacific Rim (WNPR) and the Western Tropical North Pacific (WTNP) when examined in terms of photochemical O_3 precursors such as NO_x ($=NO+NO_2$) distributions. The WNPR region is one that was influenced by both natural and anthropogenic continental sources. High-altitude outflow from Asia as well as from other Northern Hemisphere continents appears to have been involved. By contrast, the WTNP regime can be viewed as a region whose chemical fingerprint reflected either relatively clean tropical/ equatorial Pacific air masses or aged, well-processed continental air.

In all cases the photochemical destruc-

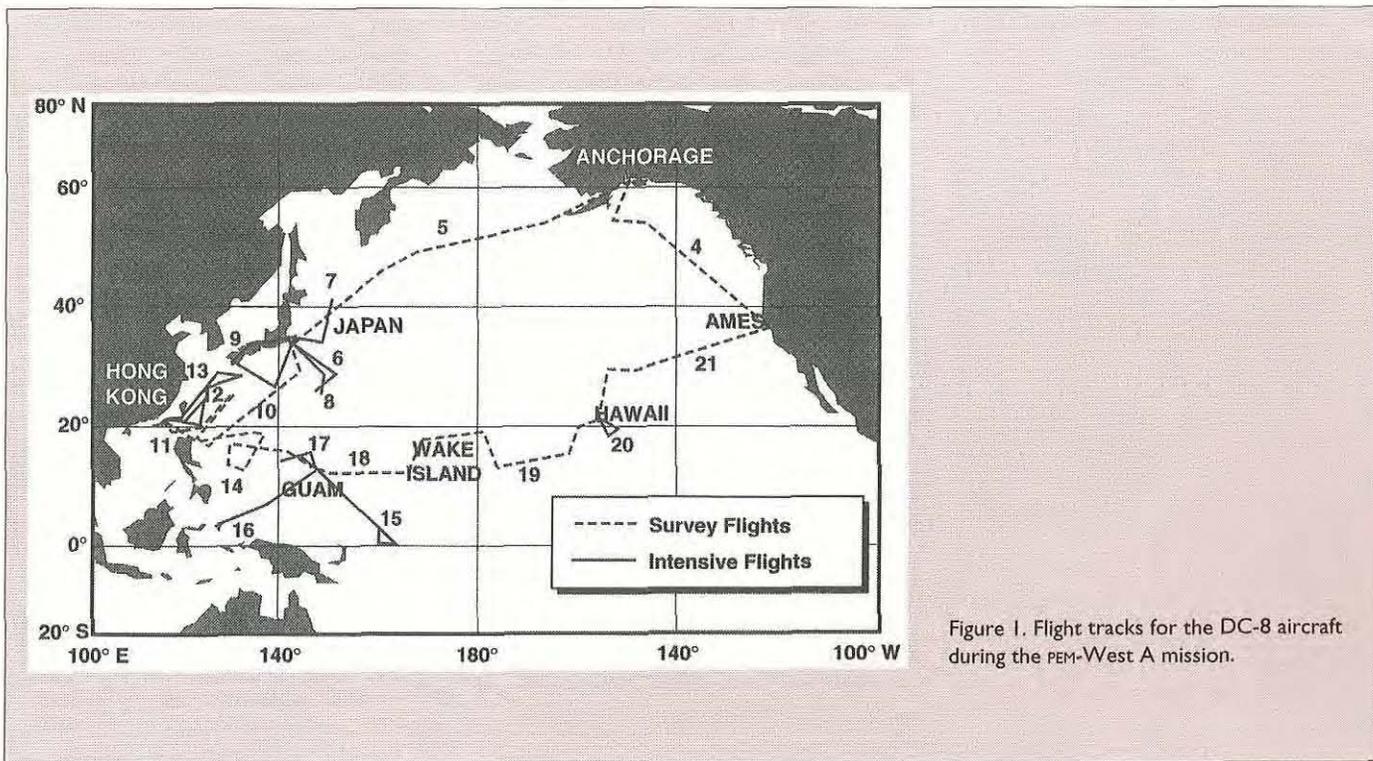


Figure 1. Flight tracks for the DC-8 aircraft during the PEM-West A mission.

tion of O_3 , $D(O_3)$, was found to decrease more rapidly with altitude than photochemical formation, $F(O_3)$. Thus the O_3 tendency, $P(O_3)$ as defined by $F(O_3) - D(O_3)$, typically was negative at low-altitudes (e.g., < 6 km) but positive for altitudes > 6 to 8 km. The most important chemical factor controlling the altitude trend in $D(O_3)$ was the H_2O mixing ratio. The trend in $F(O_3)$ with altitude showed very modest decreases, reflecting the fact that decreases in $HO_x (=OH+HO_2)$ radical levels with altitude were substantially offset by increases in the mixing ratio of NO . For altitudes < 4 km the two most important O_3 formation processes were identified as reactions of NO with HO_2 and CH_3O_2 ; whereas for altitudes > 4 km reaction of NO with HO_2 was the dominant process. This observation indicates that NMHC emissions were typically of minor importance as O_3 precursor species during the time period of PEM-West A.

Diurnal-averaged, column-integrated photochemical formation and destruction fluxes for the WNPR region were shown to exceed those for NH dry deposition and NH stratospheric injection by a factor of nearly 6. For this same region a near balance was found between photochemical O_3 production and destruction, suggesting that this region was near steady state. Ozone column lifetime arguments, together with small seasonal changes in total column O_3 , suggest that the WTNP should also have been near steady state. In fact, the column-integrated fluxes show that photochemical destruction exceeded production by nearly 80%. Two hypotheses were put forward in an effort to explain this deficit. The first involves the possibility that O_3 -rich air could have been transported from mid-latitudes into the tropics; the second proposes that the unsampled atmospheric column from 10 to 17 km might have provided the additionally needed photochemical $F(O_3)$. The latter hypothesis requires relatively high levels of NO (e.g., 150 pptv); however, these do not appear to be totally out of line with those estimated to be produced by tropical lightning. In this context, results from the present study indicate that NO_x would have an extended lifetime of 3 to 9 days at altitudes of 8-12 km and even longer for still higher altitudes. This suggests that for some seasons of the year, NO_x produced from the deep convection over regions of Asia and Malaysia/Indonesia could lead to significant enhancements in high-altitude O_3 formation that might extend well out into the North Pacific.

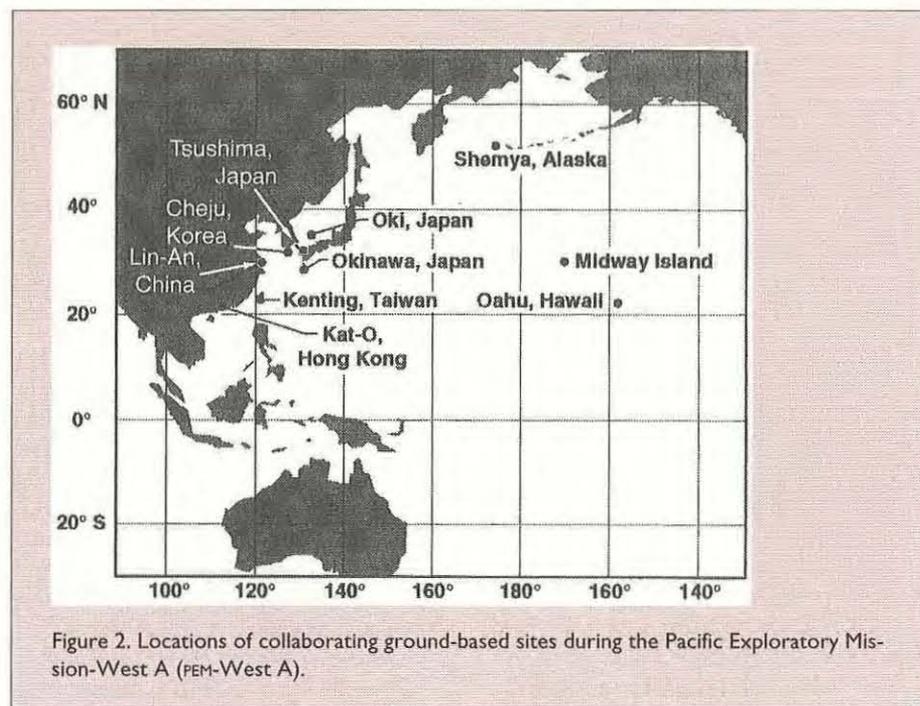


Figure 2. Locations of collaborating ground-based sites during the Pacific Exploratory Mission-West A (PEM-West A).

A synoptic analysis of the PEM-West A database by several different investigating groups resulted in five different air mass classification schemes. These were examined in terms of their respective values of $P(O_3)$. The general trend that emerged showed that the largest positive values occurred for continental boundary layer air, within 2 days of mainland Asia or Japan and for high-altitude air parcels (e.g., > 7 km) influenced by deep convection/lightning. Significant negative values of $P(O_3)$ were found when encountering clean marine boundary layer air or relatively clean lower free-tropospheric air parcels.

The ground based observations at selected remote sites near the East Asian Pacific Rim, including Oki Island (Japan), Okinawa (Japan) and Kenting (Taiwan), revealed that surface O_3 can be characterized essentially by four types of air masses. One is a continental clean air mass (CCAM) coming down directly through the area with relatively low anthropogenic emission intensity over far eastern Siberia. The CCAM is thought to be representative of air unperturbed by strong anthropogenic emissions in East Asia. The second is a continental polluted air mass (CPAM) which passes through high anthropogenic emission areas of either coastal China, the southern part of the Korean Peninsula, and/or a part of Japan. The average mixing ratio of O_3 in the CPAM was higher than that in the CCAM by about 7 ppbv during the campaign period. The difference is thought to be due to O_3 build-up in the boundary layer air after passing through the area of strong anthropogenic emissions, which is in ac-

cord with data based on aircraft measurements described above. The third is a marine Pacific air mass (MPAM) which contained the lowest concentration of O_3 , typically about 10 ppbv but often less than a few ppbv. The fourth is a marine South China Sea air mass (MSAM) which contained typically about 20 ppbv of O_3 during the observed period. The CCAM was sampled only at the northern-most station, Oki Island, while CPAM often covered all the sites from Japan to Taiwan in this season. The MPAM was a common air mass at Okinawa and Taiwan and the MSAM reached only to the southern-most station at Kenting.

In summary, the photochemistry and O_3 budget in western North Pacific were studied in detail for the first time during the APARE campaigns. The findings will provide a scientific base for evaluating the influence of future increase of anthropogenic emissions on the O_3 budget and its concentrations from the upper troposphere to the boundary layer in this region. The scientific papers and the names of science team members who made the measurements and developed the findings summarised in this article can be found in a special section of the January 1996 issue of the *Journal of Geophysical Research - Atmospheres* (Vol. 101, No. D1).

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First GCTE Impacts Centre Opens In Southeast Asia

by Will Steffen

On 7 May 1996 a milestone was reached in GCTE's efforts to translate its research capability into the policy and resource management areas with the official opening of the first GCTE Impacts Centre in Bogor, Indonesia.

The Southeast Asian Impacts Centre, or IC-SEA, is hosted by the Southeast Asian Regional Centre for Tropical Biology (BIOTROP), and serves Brunei, Cambodia, Laos, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. The Centre is supported through a generous grant (US\$ 2.1 million over three years) from AusAID (Australian Agency for International Development).

The rationale for IC-SEA was captured well in the opening address by His Excellency, Professor Dr Ing Wardiman Djojonegoro, the Indonesian Minister of Education and Culture:

"Through IC-SEA the Southeast Asian region is connected to the flow of results, understanding and expertise currently being developed in the GCTE project, as well as in other projects throughout the developed world. In other words, IC-SEA is envisioned as the bridge between global change scientists and researchers in the region, and their counterparts in Australia and other countries in the world."

"Through IC-SEA our own scientists and researchers have access to the state-of-the-art global change research throughout the world. It is through this access that we can leap-frog into a new era of research at a much faster pace, compared to traditional methods of building research capability. We will need to realise that we don't have to 'reinvent the wheel' when it comes to executing our own impact analyses in the region."

The opening of IC-SEA marks the first stage of a global collaborative effort between GCTE and START to assist the developing regions of the world to undertake their own analysis of global change impacts. The theme of the Impacts Project is "living with global change", and it is strongly oriented towards building the scientific expertise within the regions required for the long-term, sustainable management of terrestrial ecosystems in the face of rapid environmental change.

GCTE has been in its implementation phase for five years, and is now in a position to translate its basic understanding of global change impacts into strategies for sustainable development. It is placing special emphasis on the critically important areas of agriculture and forestry production and on the role of ecological complexity (biodiversity) in maintaining ecosystem function. START has made equally rapid progress in establishing regional networks to support global change research. One of the greatest strengths of the GCTE-START partnership lies in its ability to implement an "end-to-end" strategy, with the most up-to-date GCTE global change science carried through, via the START networks, to practical aspects of policy and resource management at the national level.

To achieve the many linkages required for this strategy to succeed, the Project is based on a number of key guiding principles:

Policy driven. The work of the Impacts Centres is strongly driven by direct input from the policy sector in the region. This is achieved through the participation of a policy liaison person in each national research team; through consultation on national priorities, project selection, development and reporting; by personal briefings to policymakers by Impacts Centre scientists; through contributions to technical training courses by policy people; and by open science-policy forums organised by

the Impacts Centres. The START networks play a critical role in facilitating this essential interaction between science and policy.

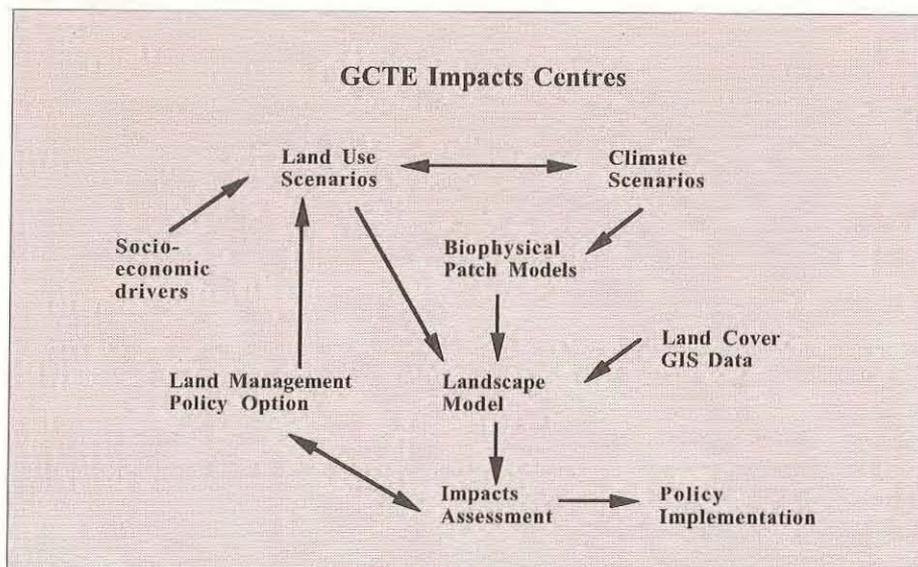
State of the science. Close connections to the international GCTE research programme put the Impacts Centres at the cutting edge of global change science. For example, a steady flow of GCTE scientists to the Southeast Asian Impacts Centre and of regional scientists to GCTE laboratories around the world has rapidly developed, and ensures that the highest quality science is used as the basis for the Impacts Centres' work.

Capacity building for real needs. Although the overall objective of the Impacts Project is to build up the scientific capacity in developing regions to undertake their own global change impact studies, the Project does not undertake capacity building in isolation. It focuses strongly on real-world studies that have a practical outcome, and orients the capacity building activities around these policy- and management-oriented projects.

Integrated package of activities. The Impacts Project employs an integrated suite of activities to achieve its objectives: technical training courses on modelling tools; project development and evaluation meetings; a fellowship programme to allow regional scientists to work in international GCTE laboratories; and an equipment grants programme to upgrade the computing fa-



The Indonesian Minister of Education and Culture, Professor Dr Ing Wardiman Djojonegoro delivering his Opening Speech



cilities of the national teams. These elements are carried out as a co-ordinated package so that the overall effect is strongly synergistic.

Expertise in modelling. A key scientific tool in devising strategies for managing terrestrial ecosystems sustainably is quantitative modelling, which codifies extant knowledge of ecosystem performance and projects how that performance will change under a changing environment. The latter is particularly important for sustainable development under global change. Lack of quantitative modelling expertise has been identified as a critical gap in many developing parts of the world, and the Impacts Project has thus decided to focus its efforts strongly on ecological and agricultural modelling.

IC-SEA, with strong support from the host institution, BIOTROP, is moving quickly to implement this strategy. Although it has been in existence for about six months, IC-SEA has already established a fully functioning ecological modelling centre at BIOTROP and has set up a state-of-the-art computer laboratory to support its work. In addition, it has made strong progress in establishing its programme and has initiated work in all components of its integrated package of activities.

Training courses. Key activities of IC-SEA are technical training courses, with the first course held recently (May 1996) at BIOTROP. The topic of the course focused on the development of ecosystem modelling tools for the sustainable management of tropical forests under global change, and included groups from most national teams in the region.

Three other training courses are scheduled over the next two years; the topics are: (i) global change and crop modelling, primarily rice; (ii) mixed agricultural systems;

(iii) biodiversity conservation/landscape management

Fellowship programme. This component supports regional scientists to undertake study visits to appropriate GCTE laboratories and to participate in relevant international and regional activities. The first round of fellowships has been awarded, and includes support for a scientist from Vietnam National University, Ha Noi to present his country's work at the US Country Studies Climate Variability Conference, Manila; for an Indonesian crop modeller to participate in Crop Simulation Conference, Georgia, USA; for a crop modeller from the Philippines to work with collaborating scientists at the University of Guelph (Canada) and UC-Davis (USA) on an interactive land-use/climate impacts modelling study; for an entomologist from the Philippines to work with the Cooperative Research Centre for Tropical Pest Management, Brisbane, Australia, on modelling crop-insect interactions under global change; and for a Malaysian mathematician/modeller to work at the Australian National University, Canberra, on ecosystem dynamics modelling.

Equipment grants. This feature of the Impacts Centres project is aimed at ensuring that regional groups have appropriate hardware and software to carry out their modelling-based impact analyses. The recipients of IC-SEA's first round of awards were the Bogor Agricultural University, Indonesia (PC, GIS software); the Institute of Environmental Science and Management, University of the Philippines at Los Baños (3 PCs, printer, network cards); and the Department of Biomathematics, University of Ha Noi, Vietnam (PC, modelling software, maintenance).

Additional activities. One of the most encouraging developments has been the

significant number of additional, relevant activities that IC-SEA has already attracted. This suggests that IC-SEA is well on its way to becoming a centre of excellence for global change-related ecological research in Southeast Asia. These additional activities include:

- ♦ IPCC/START/IC-SEA Impacts Assessment Workshop: Linking Science and Policy, August 1996. This small workshop will focus strongly on improving interaction between the science and policy sectors with respect to global change impacts research.

- ♦ GCTE Focus 3 Complex Agro-ecosystems "Time Zero" Workshop, April 1997. This meeting will assess our current understanding of the dynamics, productivity and stability of complex agricultural systems, and will plan a GCTE research effort in this important area.

- ♦ Southeast Asia Fire Experiment (SEAFIRE) Planning Workshop, October 1996. SEAFIRE is a major campaign within the BIBEX (Biomass Burning Experiment) of the IGAC (International Global Atmospheric Chemistry) Core Project; biomass burning also has implications for the sustainable management of tropical forests.

- ♦ START/WCRP/GCTE Climate Variability and Food Security Workshop, December 1996. This pilot study will examine the capability of current crop models, focusing on rice in Asia, to simulate variation in yields due to climate variability. It will likely mark the launch of a major, long-term collaborative effort studying the impact of climate variability on food security.

GCTE and START are adopting a phased approach to establishing Impacts Centres, in concert with the development of the START regions themselves. Thus, IC-SEA is the first in the series and will serve as a model for subsequent Centres. It was the logical starting point given the strong position of the Southeast Asian START network (SARCS), the location of the GCTE Core Project Office in one of the SARCS countries (Australia), and the compatibility of the project with AusAID's priorities.

The impressive development of IC-SEA is solid evidence of the soundness of the Impacts Project concept and the ability of GCTE and START to marshal the highest quality scientific expertise from around the world in support of the work. Now that IC-SEA is established and functioning smoothly, GCTE and START are working to expand the Impacts Project to other regions.

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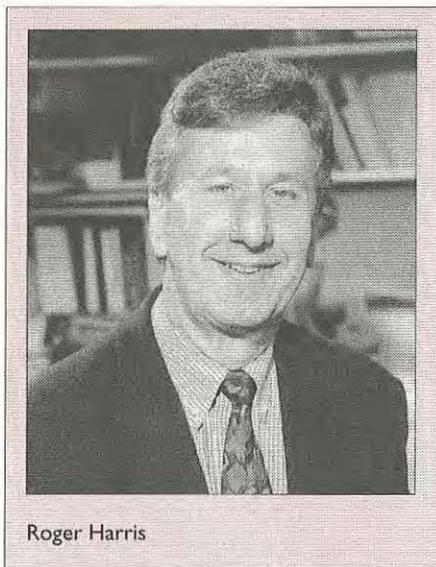
People and Events

James McCarthy elected to the Royal Swedish Academy of Sciences

This spring James McCarthy was elected a member of the Royal Swedish Academy of Sciences. The Academy described him as a pioneer in research on regularisation of marine primary productivity. His research has broadened understanding of the nitrogen cycle, which is the most important limiting factor for the speed of photosynthesis in the oceans.

James McCarthy's research work started in the coastal zones of California and gradually transferred to oceans of low nutrient value. He was one of the leading organisers of "Warm Core Rings Study" under the International Decade of Ocean Exploration. This programme was an early example of interdisciplinary oceanographic studies and was a precursor to JGOFS.

James McCarthy has been with the IGBP from the very start, as the first Chair of the programme, and his leadership has



Roger Harris

been decisive during the implementation of the programme. By focusing on the most important problems while relying on scientific arguments he has obtained the acceptance of the IGBP by the international research community. James McCarthy is still participating actively as member of the JGOFS Scientific Steering Committee.

Chair for the GLOBEC Scientific Steering Committee

Roger Harris is the new Chairman of the Global Ocean Ecosystem Dynamics (GLOBEC) Core Project. He has a Ph.D. in marine biology from the University of London, and is currently Research Project Co-ordinator at the Plymouth Marine Laboratory leading a group working on productivity and physical structure in pelagic ecosystems.

Roger Harris has held previous research positions in Germany, the United States, British Columbia and with the Marine Biological Association in Plymouth. He has carried out biological oceanographic field

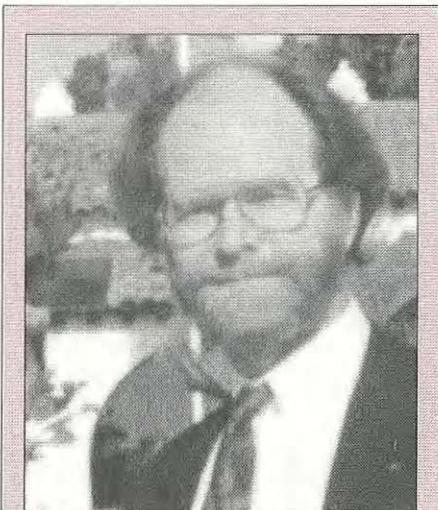
work in a variety of environments ranging from the Bellingshausen Sea, Antarctica to the Patuxent River in Chesapeake Bay. His research interests focus on the control of biological production by physical processes, the role of water-column biology in global oceanic carbon flux, and the laboratory culture and ecology of marine zooplankton.

The GLOBEC Scientific Steering Committee is currently being established.

Piers Sellers selected to be an astronaut

After many years a lifelong ambition is becoming reality for Piers Sellers. In August he will move from his current position at Goddard Space Flight Center to Johnson Space Center to start the astronauts training programme with NASA.

Piers Sellers is Ex-officio member representing the International Satellite Land Surface Climatology Project (ISLSCP) in the BAHC Scientific Steering Committee, and has played a pivotal role in revitalising the ISLSCP. His expertise encompasses model-



James McCarthy



Piers Sellers

ling energy and water fluxes at the land-surface atmosphere interface and the application of satellite data to characterise and quantify land surface features and exchanges. After many years of working within NASA providing scientific support to space missions, he welcomes the challenge of being part of the manned space programme.

MacArthur Award for Pamela Matson

Pamela Matson, currently co-Vice-Chair for the IGAC Core Project, has been awarded a John D. and Catherine T. MacArthur Foundation Fellowship — popularly known as the “genius awards”. The award consists of US\$ 260,000.

The award will help Pamela Matson in her research into the causes and consequences of intensive fertilisation in Mexico with the intention of finding alternative practices which would reduce nitrogen losses from the soil and reduce environmental costs at the same time.



Pamela Matson

The foundation aims to recognise people in different fields whose achievements show promise of even greater accomplishments in the future. The fellowships cannot be applied for; candidates are selected from a pool of initial nominations by an anonymous group of 100 people. The nominees are then reviewed by a 12-member selection committee who create a short list, from which recipients are selected by the foundation's board of directors.

Cameroon establishes National IGBP Committee

The Cameroon National IGBP Committee has been established. At their kick-off meeting in Yaoundé, on 2 February, the assembled voted on Chair, Secretary and Treasurer and an advisory body of twelve members was appointed.

Dr Maurice Tsalefac has been elected as Chair of the committee, Dr Aloys Nkongmeneck as Secretary and Dr Henri Wamba as Treasurer. The committee envisages to involve all global change researchers in Cameroon. Strong links already exist with the six universities in Cameroon and several research institutes, such as Institut des recherches agronomiques (IRA), Institute des recherches géologiques et minières (IRGM), as well as ORSTOM.

The Cameroon National IGBP Committee is the 74th committee to be established within the IGBP Programme and the 18th committee on the African continent.



From 13-15 February this year the CPO meeting was held at the LOICZ CPO on Texel.

IGBP Meetings

Only meetings marked with * are open for all scientists to attend. All other meetings are by invitation only.

27 June - 2 July, São José dos Campos, Brazil
*Large scale Biosphere experiment in Amazonia (LBA) Open meeting, in conjunction with LBA committees: South American Coordinating Committee (SACC), Organising and Implementation Committee (OIC), Scientific Steering Committee (SSC).

Carlos A. Nobre, Center for Weather Forecasting and Climate Research, National Space Research Institute, Rod. Presidente Dutro (Km 40), P.O. Box: 01, 12630-000 Cachoeira Paulista S.P., Brazil. Tel: (+55-125) 612 822, Fax: (+55-125) 612 835, E-mail: nobre@cptec.inpe.br

28 June - 1 July, Copenhagen, Denmark
GCTE Task 3.2.3 (Weeds) presentation at the International Weed Science Society meeting.
Martin Kropff, International Rice Research Institute, PO Box 933, 1099 Manila, Philippines. Fax: (+63-2) 817 8470

July, Barcelona, Spain
LUCC CPO Grand Opening Ceremony.
Peg Shea, LUCC Programme Co-ordinator, Complex Systems Research Center, Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Morse Hall, 39 College Road, Durham, NH 03824, USA. Fax: (+1-603) 862 4247, E-mail: peg.shea@unh.edu

6-10 July, Moscow, Russia
*LOICZ Workshop: International Symposium on Groundwater Discharge in the Coastal Zone.
LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg - Texel, The Netherlands. Tel: (+31-222) 369 404. Fax: (+31-222) 369 430, E-mail: LOICZ@nioz.nl

8-11 July, Amsterdam, Netherlands
*Scientific Meeting on Marine Environment and the Global Change Programs. The Oceanography Society (TOS) in co-operation with WCRP, IGBP, IHDP and SCOR.
TOS, 4052 Timber Ridge Drive, Virginia Beach, VA, USA. Fax: (+1-804) 464 1759, E-mail: jrhdodes@ccpo.odu.edu

13-15 July, Veldhoven, Netherlands
GCTE Potato Network Business Meeting and Dataset standardisation workshop: at the Triennial Conference of the European Association of Potato Research.
John Ingram, GCTE Focus 3 Office, Center for Ecology and Hydrology, Maclean Building, Crowmarsh, Gifford, Wallingford OX10 8BB, UK. Fax: (+44-1491) 692 313, E-mail: j.ingram@ioh.ac.uk

15-17 July, Garmisch-Partenkirchen, Germany
IGAC-ACE-ED Meeting.
Kenneth Demerjian, Department of Atmospheric Sciences/ASRC, State University of New York-Albany, 100 Fuller Road, Albany, NY, USA. Fax: (+1-518) 442 3867, E-mail: kld@atmos.albany.edu

15-19 July, Garmisch-Partenkirchen, Germany
IGAC-GLONET Meeting.
Volker Mohren, Fraunhofer-Institut für Atmosphärische Umweltforschung, FhG/IFU, Kreuzackbahnstrasse 19, D-82467, Garmisch-Partenkirchen, Germany. Fax: (+49-8821) 73573, E-mail: vmohren@ifu.fhg.de

16-17 July, Ispra, Italy
DIS Focus 1: Land Cover Working Group meeting.
Alan Belward, Institute for Remote Sensing Applications, Monitoring of Tropical Vegetation, Joint Research Centre of the Commission of European Communities, Building 44, I-21020 Ispra, Varese, Italy. Fax: (+39-332) 789 073, E-mail: alan.belward@cen.jrc.it

22-26 July, Ohio, USA
SOM Task Business Meeting at the Ohio Carbon Sequestration Conference.
Ted Elliot, Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, Colorado 80523, USA. Fax: (+1-303) 491 1965

July/August, New Hampshire, USA
SARCS Land Use Land Cover Change Training Course.
Beverly Goh, SARCS Secretariat, Bangkok, Thailand. Fax: (+66-2) 255 4967, E-mail: gohbp@netserv.chula.ac.th

13-15 August, Bogor, Indonesia
IPCC/START/IG-SEA (GCTE Impacts Centre) Climate Change Impacts Workshop.
Daniel Murydarso, Head, IG-SEA Southeast Asian Centre for Tropical Biology (NOTROP), PO Box 116, Bogor, Indonesia. Fax: (+62-251) 371 656, E-mail: biotrop@indo.net.id

18-23 August, Mexico City, Mexico
GLOBEC Small Pelagic Fishes and Climate Change Planning Workshop.
Liz Gross, SCOR, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD 21218, USA. Fax: (+1-410) 516 4019, E-mail: scor@jhu.edu

19-23 August, St. Petersburg, Russia
Annual Conference of the International Boreal Forest Research Association (IBFRA) in participation with BAHC.
Anatoly Shvidenko, International Institute for Applied System Analysis, A-2361 Laxenburg, Austria. Fax: (+43-2236) 71313, E-mail: shvidenk@iiasa.at.ac

20-23 August, Bogor, Indonesia
GCTE Focus 3/LUCC Focus 1 Workshop.
Peg Shea, LUCC Programme Co-ordinator, Complex Systems Research Center, Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Morse Hall, 39 College Road, Durham, NH 03824, USA. Fax: (+1-603) 862 4247, E-mail: peg.shea@unh.edu

25-28 August, La Paz, Mexico
GLOBEC Small Pelagic Fishes and Climate Change, Regional Planning Workshop.
Liz Gross, SCOR, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD 21218, USA. Fax: (+1-410) 516 4019, E-mail: scor@jhu.edu

September, Firenze, Italy
GCTE Wheat Network Workshop.
John Ingram, GCTE Focus 3 Office, Center for Ecology and Hydrology, Maclean Building, Crowmarsh, Gifford, Wallingford OX10 8BB, UK. Fax: (+44-1491) 692 313, E-mail: j.ingram@ioh.ac.uk

September, Hawaii, USA
PAGES-CLIVAR Annual Records of Tropical Systems (ARTS) Workshop.
J.E. Cole, INSTAAR, University of Colorado, Campus Box 450, Boulder CO 80309, USA. Fax: (+1-303) 492 6388, E-mail: coleje@spot.colorado.edu

September, Seoul, Korea
IGBP Officers Meeting.
12-13 September, Bergen, Norway
JGOF's Executive Meeting.
Roger Hanson, JGOF's Core Project Office, Center for Studies of Environment and Resources, High Technology Centre, University of Bergen, N-5020 Bergen, Norway. Fax: (+47-55) 324 801, E-mail: jgofs@uib.no

16-17 September, Boulder CO, USA
TEACOM-APN Workshop on Regional Climate Modelling.
Congbin Fu, Laboratory of Climate Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, P.R. of China. Fax: (+86-10) 6204 5230, E-mail: fcb@ast590.tea.ac.cn

16-22 September, Berlin, Germany
GCTE Synthesis Workshop 1.
GCTE Core Project Office, CSIRO, Division of Wildlife and Ecology, PO Box 84, Lyneham ACT 2602, Australia. Fax: (+61-6) 241 2362, E-mail: w.steffen@dae.csiro.au

18 September, Washington DC, USA
6th START Bureau meeting.
International START Secretariat, Suite 200, 2000 Florida Avenue, NW, Washington, DC 20009, USA. Fax: (+1-202) 457 5859, E-mail: start@dis.start.org

19-21 September, Washington DC, USA
START Scientific Steering Committee Meeting.
International START Secretariat, Suite 200, 2000 Florida Avenue, NW, Washington, DC 20009, USA. Fax: (+1-202) 457 5859, E-mail: start@dis.start.org

21-27 September, Washington DC, USA
ICSU Executive Board Meeting, ICSU General Committee Meeting, ICSU Science Symposium and ICSU General Assembly.

23-25 September, Toulouse, France
DIS Focus 1: 3rd High Resolution Satellite Data meeting.
Gérard Szejwach, IGBP-DIS Office, 42 Avenue G. Coriolis, F-31057 Toulouse, France. Fax: (+33) 61 07 85 89, E-mail: gerard.szejwach@igbp.cnrm.meteo.fr

23-28 September, Paris, France
12th Session of the Intergovernmental Council with BAHC participation.
UNESCO, 7 Place de Fontenay, 75352 Paris Cedex 07-SP, France. Fax: (+33-1) 45 67 16 90

23-28 September, Bayreuth, Germany
BAHC small science conference on German BAHC relations.
John Tenhunen, Bayreuth Institute for Terrestrial Ecosystem Research, D. Hans Frisch Str. 1-3, D-95448 Bayreuth, Germany. Fax: (+49-9217) 857 299, E-mail: john.tenhunen@bitok.uni-bayreuth.d400.de

25-28 September, Toledo, Spain
START/ENRICH Mediterranean Meeting.
Jean-Louis Fellous, MEDIAS-FRANCE, CNES, BP 2102, 18, Av. Edouard Belin, 31055 Toulouse Cedex, France. Fax: (+33) 61 28 29 05, E-mail: fellous@medias.cst.cnes.fr

September/October, USA
Joint IGBP-BAHC/GCTE/DIS Workshop on Large-scale Pattern and Process in Root System Structure and Dynamics.
Bhaskar Choudhury, NASA-GSFC, Code 974, Greenbelt, MD 20771, USA. Fax: (+1-301) 286 1758

September/October, Reduit, Mauritius

SASCOM/IGAC Workshop on Aerosol, Biomass Burning and Acid Rain.

A.P. Mitra, SASCOM, National Physical Laboratory, Hillside Road, New Delhi 110 112, India. Fax: (+91-11) 575 2678, E-mail: apmitra@doe.ernet.in

September/October, Reduit, Mauritius

4th SASCOM Meeting.

A.P. Mitra, SASCOM, National Physical Laboratory, Hillside Road, New Delhi 110 112, India. Fax: (+91-11) 575 2678, E-mail: apmitra@doe.ernet.in

September/October, Tucson AZ, USA

DIS Focus 1: Soils Pedo Transfer Function meeting. Sorosh Sorooshian, Dept. of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721, USA. Fax: (+1-602) 621 1422

TBA, Nairobi, Kenya

PAGES/IAEA/WMO/START Workshop on African Contribution to Global Network of Isotopes in Precipitation (GNIP).

Eric Odada, Department of Geology, University of Nairobi, Nairobi, Kenya. Fax: (+254-2) 449 539/446 138, E-mail: odada@uongeo.rio.org

October, Lake Tahoe, NV, USA

GCTE Focus 1 Workshop: Comparative Analysis of Forest Responses to Atmospheric CO₂ Increase and Global Environmental Change.

Boyd Strain, Duke University, Botany/Phytotron Building, PO Box 90340, Durham NC 27708-0340, USA. Fax: (+1-919) 660 7425

October, Victoria Falls, Zimbabwe

Workshop on Reducing Climate-Related Vulnerability in Southern Africa.

Candace Clark, NOAA. Fax: (+1-301) 427 2082, E-mail: clark@ogp.noaa.gov

3-6 October, Paris, France

PAGES PEP III (Pole-Equator-Pole Afro-European Palaeoclimatic Transect) Workshop.

Françoise Gasse, Laboratoire d'Hydrologie et de Géochimie Isotopique, Université de Paris Sud, Bâtiment 504, Orsay, Cedex 91405, France. Fax: (+33-1) 64 46 59 38, E-mail: gasse@geophy.geol.u-psud.fr

7-9 October, Ispra, Italy

GLOBEC Small Pelagic Fishes and Climate Change, Modelling Workshop.

Liz Gross, SCOR, Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD 21218, USA. Fax: (+1-410) 516 4019, E-mail: scor@jhu.edu

14-18 October, Lagos, Nigeria

Joint JGOFs/LOICZ Continental Margins Task Team Workshop on Biogeochemical Budget for Coastal Oceans, Nigeria. To be held concurrently with IOC/JGOFs/LOICZ joint planning meeting for the second IOCEA cruise in the Gulf of Guinea.

Larry Awosika, Nigerian Institute for Oceanography and Marine Research, PMB 12729, Victoria Island, Lagos, Nigeria. Tel: (+234-1) 619 517, Fax: (+234-1) 619 517, E-mail: niomr.nig@lagosmail.sprint.com or LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg - Texel, The Netherlands. Tel: (+31-222) 369 404, Fax: (+31-222) 369 430, E-mail: LOICZ@nioz.nl

16-22 October, Batemans Bay, Australia

GCTE Focus 2 Workshop on Plant Dispersal and Migration in Response to Climate Change.

Lou Pitelka, Ecological Studies Program, Electric Power Research Institute, USA. Fax: (+1-415) 855 2950, E-mail: lpitelka@epri.net

Mid-October, Bangkok, Thailand

SARCS Database Workshop.

Jariya Boonjawan, START-SEA RRC Interim Director. Fax: (+66-2) 251 2951, E-mail: bjariya@netserv.chula.ac.th

21-24 October, Paris, France

GCTE Foci 3 and 4/SCOPE/DIVERSITAS/EU-TERI Collaborative Programme Workshop on Soil Biological Diversity.

Luc Abbadié, Ecole Normale Supérieure, CNRS-URA 258, Laboratoire d'Ecologie, 46 Rue d'Ulm, 75230 Paris Cedex 05, France. Fax: (+33-1) 44 32 38 35

22-24 October, Chicago, USA

International IGAC-TRAGEX Workshop.

Keith Smith, IERM, University of Edinburgh, West Mains Road, Edinburgh EH9 3JG, UK. Fax: (+44-131) 667 2601, E-mail: k.a.smith@ed.ac.uk

Third week October

*SARCS Coastal Zone Open Science Meeting.

Beverly Goh, SARCS Secretariat, Bangkok, Thailand. Fax: (+66-2) 255 4967, E-mail: gohbp@netserv.chula.ac.th

26-30 October, Hanoi, Vietnam

LOICZ Workshop "Integrated socio-economic and biophysical modelling".

LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg - Texel, The Netherlands. Tel: (+31-222) 369 404, Fax: (+31-222) 369 430, E-mail: LOICZ@nioz.nl

Last week October, Hanoi, Vietnam

9th SARCS Meeting.

Beverly Goh, SARCS Secretariat, Bangkok, Thailand. Fax: (+66-2) 255 4967, E-mail: gohbp@netserv.chula.ac.th

31 October - 2 November, Seoul, Korea

6th TEACOM Meeting.

Congbin Fu, Laboratory of Climate Research, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, P.R. of China. Fax: (+86-10) 204 5230, E-mail: fucb@bepc2.ihep.ac.cn

October/November, Durham NC, USA

GCTE Focus 1 Workshop: FACE Technologies: Objectives, Approaches, Progress.

Boyd Strain, Duke University, Botany/Phytotron Building, PO Box 90340, Durham NC 27708-0340, USA. Fax: (+1-919) 660 7425.

November, Barcelona, Spain

LUCC/DIS Data Requirement meeting.

Gai Puigdefabregas, Institut Cartogràfic de Catalunya, Parc de Montjuïc, E-08038 Barcelona, Spain. Fax: (+34-3) 426 7442

November, Ho Chi Min City, Vietnam

SARCS/WOTRO/LOICZ First Principal Investigators meeting "Integrated socio-economic and biophysical modelling".

LOICZ Core Project Office, Netherlands Institute for Sea Research, PO Box 59, 1790 AB Den Burg - Texel, The Netherlands. Tel: (+31-222) 369 404, Fax: (+31-222) 369 430, E-mail: LOICZ@nioz.nl

November, Delhi, India

GCTE Rice Network Business Meeting, at the International Crop Science Congress.

John Sheehy, GCTE Rice Network Leader, International Rice Research Institute, PO Box 933, 1099 Manila, Philippines. Fax: (+63-2) 817 8470, E-mail: jsheehy@irri.cgiar.org

3-7 November 1996, Kyoto, Japan

*BAHC-LUCC Joint Inter-Core Project Symposium on Interactions between the Hydrological Cycle and Land Use/Cover.

Dr. M. Sugita, Environmental Research Center, University of Tsukuba, Ibaraki 305, Japan. Tel: (+81-298) 53-2537, Fax: (+81-298) 53 2530, E-mail: BAHC-LUCC@erc2.suiru.tsukuba.ac.jp

4-9 November, Lima, Peru

GCTE Potato Network International Training Workshop and GCTE Cassava Network Launch.

John Ingram, GCTE Focus 3 Office, Center for Ecology and Hydrology, Maclean Building, Crommarsh, Gifford, Wallingford OX10 8BB, UK. Fax: (+44-1491) 692 313, E-mail: j.ingram@ioh.ac.uk

8-9 November, Kyoto, Japan

TEACOM Workshop on Land Use in East Asia.

Dennis Ojima, NREL, Colorado State University, USA. Fax: (+1-970) 491 1965, E-mail: dennis@nrel.colostate.edu

12-15 November, Santa Barbara CA, USA

GCTE Synthesis Meeting.

GCTE Core Project Office, CSIRO Division of Wildlife and Ecology, PO Box 84, Lyneham, ACT 2602, Australia. Fax: (+61-1) 241 2362, E-mail: wls@cbr.dwe.csiro.au

25-29 November, New Delhi, India

START/APN/IHDP/GCTE Workshop on Human Dimensions of Global Environmental Change in Asia.

A.P. Mitra, SASCOM, National Physical Laboratory, Hillside Road, New Delhi 110 112, India. Fax: (+91-11) 575 2678, E-mail: apmitra@doe.ernet.in

26-29 November, Wageningen, Netherlands

Impacts of Global Change on Tree Physiology and Forest Ecosystems.

G.M.J. Mohren, DLO Institute for Forestry and Nature Research, PO Box 23, 6700 AA Wageningen, Netherlands. Fax: (+31-317) 424 988, E-mail: g.m.j.mohren@ibn.dlo.nl

November/December, TBA

DIS Focus 1: Soils WG meeting.

December, TBA

SARCS/LUCC Synthesis Workshop (tentative).

Beverly Goh, SARCS Secretariat, Bangkok, Thailand. Fax: (+66-2) 255 4967, E-mail: gohbp@netserv.chula.ac.th

December, TBA

Workshop of JGOFs Task Team on Synthesis and Modelling.

Trevor Platt, Bedford Institute of Oceanography, PO Box 1006, Dartmouth, NS B2Y 4A2, Canada. Fax: (+1-902) 426 9388, E-mail: tplatt@ac.dal.ca

2-5 December, Bogor, Indonesia

START/WCRP/GCTE Climate Variability and Rice Production Workshop.

GCTE Core Project Office, CSIRO, Division of Wildlife and Ecology, PO Box 84, Lyneham, ACT 2602, Australia. Fax: (+61-1) 241 2362, E-mail: wls@cbr.dwe.csiro.au

Late 96/early 97, TBA

Land Use and Climate Impacts on Fluvial Systems Workshop.

Robert Wasson, Research School of Pacific Studies, Australian National University, Canberra, Australia. Fax: (+61-6) 249 3770, E-mail: robert.wasson@anu.edu.au

Late 96/early 97, TBA

The Use of Stable Isotopes in selected Paleoarchives Workshop.

Frank Oldfield, PAGES Core Project Office, Bärenplatz 2, 3011 Berne, Switzerland. Fax: (+41-31) 312 3168, E-mail: pages@ubeclu.unibe.ch

Late 96/early 97, TBA

Paleorecords, in spelcochems Workshop.

Frank Oldfield, PAGES Core Project Office, Bärenplatz 2, 3011 Berne, Switzerland. Fax: (+41-31) 312 3168, E-mail: pages@ubeclu.unibe.ch

1997**January/February, Boulder CO, USA**

DIS/WDC: Data Management Requirement Workshop.

Jonathan Overpeck, Paleoclimatology Programme, National Geophysical Data Center-EJGC, National Oceanic and Atmosphere Administration (NOAA), 325 Broadway, Boulder, CO 80303-3328, USA. Fax: (+1-303) 497 6513, E-mail: jto@mail.ngdc.noaa.gov

TBA, JapanGCTE Rice Network: FACE and TGT (Temperature Gradient Tunnel) CO₂ Planning Workshop.

K. Kobayashi, National Institute of Agro-Environmental Science, Tsukuba, Ibaraki 305, Japan. Fax: (+81-298) 38 8211, E-mail: clasman@niaes.affrc.go.jp

First quarter, Argyll, Scotland (UK)

JGOFS Symposium on Synthesis and Modelling.

Trevor Platt, Bedford Institute of Oceanography, PO Box 1006, Dartmouth, NS B2Y 4A2, Canada. Fax: (+1-902) 426 9388, E-mail: tplatt@ac.dal.ca or: Graham Shimmiel, Dunstaffnage Marine Laboratory, PO Box 3, Oban, Argyll, Scotland. Fax: (+44-1631) 65518, E-mail: g.shimmiel@ed.ac.uk

February, Norwich, UK

12 th SC-IGBP Meeting.

February, Mombasa, Kenya

GAIM-START Tutorial Workshop on terrestrial modelling.

10-13 February, Honolulu HI, USA

WCRP/IGBP Joint LSP-SVAT and Hydrology Workshop.

Piers Sellers, National Aeronautics and Space Administration (NASA), Goddard Space Flight Center, Code 624, Hydrological Sciences Branch, Greenbelt, MD 20771, USA. Fax: (+1-301) 286 0239, E-mail: piers@imogen.gsfc.nasa.gov

12-15 February, Hawaii, USA

BALIG Focus 1 SVAT Workshop.

Steven Running, School of Forestry, Montana Forest and Conservation Experiment Station, University of Montana, MT 59812-1063, USA. Fax: (+1-804) 982 2137, E-mail: swr@ontsg.umt.edu

17-19 February, Cotonou, Bénin

START/WCRP/SCOWAR (ICSU) Workshop on Climate Variability, Water and Agriculture in Sub-Saharan Africa: Food Security Issues (tentative).

Abel Afonda. Fax: (+229) 30 08 39

25 February - 5 March, Nairobi, Kenya

African GAIM Modelling Workshop.

Dork Sahagian, GAIM Task Force Office, Institute for the Study of Earth Oceans and Space, University of New Hampshire, Morse Hall, 39 College Road, Durham, NH 03824-3525, USA. Fax: (+1-603) 862 1915, E-mail: gaim@unh.edu

March, TBA

JGOFS Scientific Steering Committee Meeting.

Roger Hanson, JGOFS Core Project Office, Center for Studies of Environment and Resources, High Technology Centre, University of Bergen, N-5020 Bergen, Norway. Fax: (+47-55) 324 801, E-mail: jgofs@uib.no

17-21 March, Cape Town, South Africa

Climate Change Impact Assessment Workshop for Africa.

International START Secretariat, Suite 200, 2000 Florida Avenue, NW, Washington, DC 20009, USA. Fax: (+1-202) 457 5859, E-mail: start@dis.start.org

March/April, TBA

IGAC Conference on "Global Measurement Systems for Tropospheric Composition".

April, Utrecht, Netherlands

GCTE Soil Erosion Network Water Erosion at Catchment Scale Model Comparison and Sensitivity Analysis Workshop.

Christian Valentin, ORSTOM, Institut Français de Recherche Scientifique pour le Développement en Coopération, BP 11416, Niamey, Niger. Fax: (+227) 722 804

April, Bogor, Indonesia

GCTE Activity 3.4 Workshop: Complex Agroecosystems - "Time Zero" Workshop.

John Vandermeer, Division of Biological Sciences, University of Michigan, Ann Arbor, Michigan 48109, USA. Fax: (+1-313) 747 0844, E-mail: john.vandermeer@um.cc.umich.edu

28-30 May, Missoula MT, USA

BAHC SSC-Meeting.

BAHC Core Project Office, Potsdam Institute for Climate Impact Research, PO Box 601 203, 14412 Potsdam, Germany. Fax: (+49-331) 288 2547, E-mail: bahe@pik-potsdam.de

June, Potsdam, Germany

Net Primary Productivity Model Intercomparison workshop.

Dork Sahagian, GAIM Task Force Office, Institute for the Study of Earth Oceans and Space, University of New Hampshire, Morse Hall, 39 College Road, Durham, NH 03824-3525, USA. Fax: (+1-603) 862 1915, E-mail: gaim@unh.edu

July, Birmensdorf, Switzerland

GCTE Focus 2 Workshop on Comparison of Forest Patch Models.

Dr Harald Bugmann/Dr Felix Kienast, Swiss Federal Institute for Forest, Snow and Landscape Research, Zürcherstrasse 111, CH-8903 Birmensdorf, Switzerland. Fax: (041-1) 739 2215

1-9 July, Melbourne, Australia

4th IGAC Scientific Conference in association with the IAMAS General Assembly.

Official information for the IAMAS Assembly is available on <http://www.dar.esiro.au/pub/events/assemblies/info.html>

13-19 July, Suva, Fiji

START Planning Meeting for Oceania (tentative).

August, Longyearbyen, Svalbard

JGOFS Symposium on Photosynthesis Measurement.

Egil Sakshang, Trondheim Biological Station, Institute for Marine Biochemistry, University of Trondheim, Erling Skakkesgt. 47, N-7013 Trondheim-North, Norway. Fax: (+47) 7359 1597, E-mail: egil.sakshang@vm.unit.no

24-30 August, TBA

PAGES/GCTE Workshop on Spatial-Temporal Dimensions of High Latitude Ecosystem Changes.

Eugene A. Vaganov, Institute of Forest SB RAS, Akademgorok, Krasnoyarsk, 660036 Russia. Fax: (+7-3912) 43 36 86, E-mail: evag@ifor.krasnoyarsk.su

September, Manhattan KS, USA

GCTE Soil Erosion Network Wind Erosion Model Comparison and Sensitivity Analysis Workshop.

Christian Valentin, ORSTOM, Institut Français de Recherche Scientifique pour le Développement en Coopération, BP 11416, Niamey, Niger. Fax: (+227) 722 804

14-20 September, Niamey, Niger

START/BAHC/GCTE Workshop on Vegetation and the Hydrological Cycle in the Sahel.

Lekan Oyebande, Faculty of Environmental Science, University of Lagos, Nigeria. Fax: (+234-1) 822 644, E-mail: lekan@infoweb.abs.net

October, TBA

Fifth Scientific Advisory Council Meeting (SAC v).

IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden. Fax: (+46-8) 16 64 05, E-mail: sac@igbp.kva.se

October, TBA

JGOFS/LOICZ Continental Margins Task Team Workshop.

Julie Hall, NIWA, Ecosystems, 100 Aurora Terrace, PO Box 11-115, Hamilton, New Zealand. Fax: (+64-7) 856 0151, E-mail: hall@hamilton.niwa.cri.nz

October, UK

JGOFS Arabian Sea Synthesis Workshop.

Peter Burkill, Plymouth Marine Laboratory, Prospect Place, West Hoe, Plymouth PL1 3DH, UK. Fax: (+44-1752) 670 637, E-mail: p.burkill@pml.ac.uk

11-13 November, Nagoya, Japan

IGAC/IGBP Symposium.

Hajime Akimoto, 4-6-1 Komaba, Meguro-ku, Tokyo 153, Japan. Fax: (+81-3) 3481 4562, E-mail: akimoto@atmchem.reast.nk-tokyo.ac.jp

TBA, Lake Tahoe, NV, USAGCTE Focus 1 Workshop: Comparative Analysis of Forest Responses to Atmospheric CO₂ Increase and Global Environmental Change.

Boyd Strain, Duke University, Botany/Phytotron Building, PO Box 90340, Durham NC 27708-0340, USA. Fax: (+1-919) 660 7425.

TBA

Synthesis Meeting for the Planning Group on North Atlantic Ocean.

Mike Fasham, James Rennell Centre, Chilworth Research Centre, Gamma House, Chilworth, Southampton SO1 7NS, UK. Fax: (+44-1703) 767 507, E-mail: miff@ub.nso.ac.uk

1998**First quarter, TBA**

JGOFS Training Course on Synthesis and Modelling.

Trevor Platt, Bedford Institute of Oceanography, PO Box 1006, Dartmouth, NS B2Y 4A2, Canada. Fax: (+1-902) 426 9388, E-mail: tplatt@ac.dal.ca

April, London, UK

*PAGES Open Science Meeting.

Frank Oldfield, PAGES Core Project Office, Bärenplatz 2, 3011 Berne, Switzerland. Fax: (+41-31) 312 3168, E-mail: pages@ubeclu.unibe.ch

19-25 August, Seattle WA, USA

Joint 5th IGAC Scientific Conference and 9th CACGP Symposium on Global Atmospheric Chemistry.

IGBP Publications

IGBP Report Series

IGBP Directory Update: 1996.

The Update is to be used in combination with the 1995 edition of the IGBP Directory. Stockholm: IGBP, 95pp.

Lisa Cronqvist, IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden. E-mail: lisa@igbp.kva.se

Programme Elements

BAHC

Strategies for Long Term Studies of CO₂ and Water Vapour Fluxes over Terrestrial Ecosystems (1996). Global Change Biology 2:3 Thematic Issue. This thematic issue comprises contributed papers from the workshop on "Strategies for Long Term Studies of CO₂ and Water Vapour Fluxes over Terrestrial Ecosystems, held in La Thuile, Italy in March 1995. Order from: Blackwell Science, Osney Mead, Oxford OX2 0EL, UK (price £ 15.00).

GCTE

Global Change Impact on Agriculture, Forestry and Soils: The Work of GCTE Focus 3. 15pp. GCTE Core Project Office, CSIRO Division of Wildlife and Ecology, PO Box 84, Lyneham, ACT 2602, Australia.

LOICZ

Coastal Seas: a net source or sink of atmospheric carbon dioxide? (1995). S. Kempe. Texel: LOICZ, 27pp. (LOICZ/R&S/95-1).

LOICZ Core Project Office, Netherlands Institute for Sea Research (NIOZ), PO Box 59, NL-1790 AB Den Burg - Texel, The Netherlands.

Coastal Zone Resources Assessment Guidelines (1996). R.K. Turner and W.N. Adger. Texel: LOICZ, 101pp. (LOICZ/R&S/96-4).

LOICZ Core Project Office, Netherlands Institute for Sea Research (NIOZ), PO Box 59, NL-1790 AB Den Burg - Texel, The Netherlands.

LOICZ Biogeochemical Modelling Guidelines (1995). D.C. Gordon, Jr., P.R. Boudreau, K.H. Mann, J.-E. Ong, W.L. Silvert, S.V. Smith, G. Wattayakorn, F. Wulff and T. Yanagi. Texel: LOICZ, 96pp. (LOICZ/R&S/95-5).

LOICZ Core Project Office, Netherlands Institute for Sea Research (NIOZ), PO Box 59, NL-1790 AB Den Burg - Texel, The Netherlands.

START

START Network News, Spring 1996

International START Secretariat, 2000 Florida Avenue, NW - Suite 200, Washington, DC 20009, USA

National Research

Netherlands

Research Activities on Nature and Environment: Overview of national and international programmes and organizations (1996). Ed. by M.A.H. Soeters, S.A. Wink. Rijswijk: Advisory Council for Research on Nature and Environment (RMNO), 358pp. (Publication RMNO nr.114, 1996).

Advisory Council for Research on Nature and Environment, PO Box 5306, NL-2280 HH Rijswijk, The Netherlands.

Modelling and Parameterization of the Soil-Plant-Atmosphere System (1995) Edited by P. Kabat, B. Marshall, B.J. van den Broek, J. Vos and H. van Keulen. Wageningen: Wageningen Pers Scientific Publishing Group, 450 pp.

Order from: Wageningen Pers, PO Box 42, NL-6700 AA Wageningen, The Netherlands (price Dfl 250.00)

Crop-Water-Simulation Models in Practice (1995). Edited by L.S. Pereira, B.J. van den Broek, P. Kabat and R.G. Allen. Wageningen: Wageningen Pers Scientific Publishing Group, 352 pp.

Order from: Wageningen Pers, PO Box 42, NL-6700 AA Wageningen, The Netherlands (price Dfl 218.00)

Related Organisations

Policy Making in an Era of Global Environmental Change (1996). Ed. R.E. Munn, J.W.M. la Rivière and N. van Lookeren Campagne. Dordrecht: Kluwer.

Order from: Kluwer Academic Publishers Group, Order Department, PO Box 322, 3300 AH Dordrecht, The Netherlands (price US\$ 49.50)

CICSE

Cambio Global Dimensiones Humanas No.2, Abril 1996.

Consejo Internacional de Ciencias Sociales de España, Calle Pomaret 21, 08017 Barcelona, España.

IAEA/PAGES/WMO/IAHS

GNIP: Global Network for Isotopes in Precipitation (1996). U. Schotterer, F. Oldfield, K. Fröhlich. Bern: PAGES, 48pp.

PAGES Core Project Office, Bärenplatz 2, 3011 Bern, Switzerland.

SCOPE

Sustainable land management in African semi-arid and subhumid regions: Proceedings of the SCOPE Workshop, 15-19 November 1993, Dakar, Senegal (1995). Ed. by F. Ganry and B. Campbell. Montpellier: CIRAD-CA, 406pp.

CIRAD-CA - SPID, BP 5035, 34032 Montpellier Cedex 1, France (price FF 250.00)

SCOPE/UNEP/EAWAG

Proceedings of the SCOPE Workshop on Soil and Groundwater Pollution: Fundamentals, Risk Assessment and Legislation (1995). Ed. by A.J.B. Zehnder. Dordrecht: Kluwer, 164pp.

Kluwer Academic Publishers Group, PO Box 322, NL-3300 AH Dordrecht, The Netherlands

UK GER

The Globe: bi-monthly newsletter covering a wide range of issues relevant to global environmental change.

Christine Rowland, UK Global Environmental Research (GER) Office, DP 1002, Polaris House, North Star, Swindon SN2 1EU, UK (Free of charge).

WCRP

Proceedings of the First International AMIP Scientific Conference (1995). Ed. by L.W. Gates. Geneva: WCRP, 532pp. (WCRP-92, WMO/TD-No. 732)

WCRP Secretariat, WMO, CP 2300, 41 Avenue Giuseppe Motta, 1211 Geneva 2 Switzerland.

Schumacher College

What is the new paradigm?

The Emerging Ecological World View

September 29 - October 19, 1996.

What exactly is meant by new paradigm thinking? How are the values implicit in it important for the creation of a sustainable future? This course aims to provide an introduction to some of the most exciting new ideas of our time: the psychology, ethics, politics and cosmology of the emerging ecological world view.

The course will be given by Warwick Fox, who is the author of more than 40 papers in the area of environmental philosophy and *Toward a Transpersonal Ecology*, and Arne Naess, Professor Emeritus at the University of Oslo and author of over 40 books, including *Ecology, Community and Lifestyle*. This course will take place at Schumacher College, an international centre for ecological studies. For more information about this and other courses, please contact: Hilary Nicholson, Schumacher College, The Old Postern, Dartington, Totnes, Devon, TQ9 6EA. Tel.: (+44-1803) 865 934, Fax: (+44-1803) 866 899.

Web Pages

IGBP	http://www.igbp.kva.se/
IHDP	http://heiwwww.unige.ch/hdp/
WCRP	http://www.wmo.ch/web/wcrp/
WMO	http://www.wmo.ch/
TWAS	http://www.ictpc.trieste.it/twas/
SCAR	http://www.antarc.utas.edu.au/scar/

GLOBAL CHANGE NEWSLETTER

Edited by Sheila M. Lunter

Newsletter requests and change of address information should be sent to:

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e-mail: sec@igbp.kva.se

The IGBP Report Series is published in annex to the Global Change Newsletter

Announcement and Call for Papers

Announcement of a Chinese BAHC Workshop 10 - 12 November 1996 in Beijing, China

The IGBP Core Project BAHC and the Chinese Working Group on BAHC, CNG-IGBP are convening a three day workshop to synthesise BAHC relevant science with emphasis on China. This synthesis is intended to be part of the planning process to develop a large scale experiment around the North East China transect.

The workshop will emphasise and encourage presentations and discussions on the following topics:

- ◆ Climate induced land cover change impacts on the hydrological cycle;
- ◆ Human induced land cover change impacts on the hydrological cycle;
- ◆ Issues concerned with the regional sustainable development of agriculture and water resource management in terms of climate change effects.

Specific topics of interest are based on the major questions posed for mid-latitude transects. These questions are:

- ◆ How do precipitation amount and distribution impact on the mixture of plant functional types?
- ◆ What are the key interactions between climate, soil type, plant functional types, and ecosystem processes?
- ◆ How are patterns in soil organic matter and nutrient dynamics influenced by plant functional types and do they change in time in response to changes in vegetation?
- ◆ Are root distribution characteristic of particular plant function types a key determinant of vegetation structure along a spatial gradient of water availability?
- ◆ Is net primary production controlled by precipitation and decomposition controlled by temperature?
- ◆ What are the implications of hydrological regimes on the sustainability of crop production?

Participants of the workshop are invited to present papers or poster on themes related to the topics. Abstracts should be in English and not exceed one page. Deadline is 1 September 1996. Working language of the workshop will be English. There will be no simultaneous interpreting service.

For further details please contact:

In China: Prof. Changming Liu, Department of Hydrology, Institute of Geography, CAS, Building 917, Datun Road, Anwai, Beijing 100101. P.R. China. Tel.: 86-10-64914289, Fax: 86-10-64911844

Others: Dr. Michael Fosberg, BAHC Core Project Office, Potsdam Institute, for Climate Impact Research, P.O. Box 601203, 14412 Potsdam, Germany. Tel: 49-331-2882543, Fax: 49-331-2882547, e-mail: BAHC@pik-potsdam.de

LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE

Core Project of
The International Geosphere-Biosphere Programme (IGBP)

CORE PROJECT OFFICE

CORE PROJECT EXECUTIVE OFFICER

The Land-Ocean Interactions in the Coastal Zone, (LOICZ) Core Project of the International Geosphere-Biosphere Programme (IGBP) is seeking to appoint a highly motivated and independent person as Core Project Executive Officer. The successful applicant will take administrative and scientific responsibility for a small (four person) dynamic, international office that acts as the international secretary for the LOICZ Core Project. LOICZ is a project studying the influence of changing climatic factors and the impact of human activities in the coastal zone from coastal drainage basins to the continental shelf edge. The project attempts to generate global syntheses of information in disciplines ranging from the natural to the socio-economic sciences. The LOICZ Core Project Office is presently in the fourth of the initial five-year period of funding. See the World Wide Web Site: <http://www.nioz.nl/loicz/> for additional background material on the LOICZ Core Project.

Responsibilities will include:

- ◆ management and administration of the LOICZ Core Project on a day-to-day basis;
- ◆ develop, promote and co-ordinate LOICZ scientific research;
- ◆ provide project advocacy, promotion and publicity;
- ◆ maintain routine correspondence with the IGBP Secretariat in Stockholm, Sweden;
- ◆ develop and maintain links with other international and national agencies and initiatives;
- ◆ ensure effective co-ordination with other IGBP Programme Elements;
- ◆ manage the CPO personnel and finances on behalf of the NIOZ Director; and,
- ◆ organise meetings and workshops in support of the Core Project.

Qualifications and Experience

- ◆ a broad interest in the scientific fields related to the LOICZ Core Project;
- ◆ appropriate management, organisational and communication skills in an international field;
- ◆ a PhD (or equivalent research experience) in one of the natural sciences;
- ◆ experience in the organisation of international meetings and workshops;
- ◆ a sound working knowledge of the English language; and,
- ◆ flexibility and willingness to undertake overseas travel.

Conditions:

The contract is for a period of 12-16 months, depending on the starting date, to be completed no later than the end of 1997. The successful applicant would be expected to assume duties as soon as possible. Salary will be commensurate with qualifications. Applications from persons interested in accepting the appointment on a leave of absence from their home institute or university with salary provided by NIOZ are encouraged.

Location: The Netherlands Institute for Sea Research (NIOZ), Texel, The Netherlands.

For further information please contact the LOICZ CPO, phone: (+31-222) 369 404.

Interviews with selected applicants will be held in the English language. Applications in English, together with a curriculum vitae and names of three referees, should be directed to the Personnel Officer, NIOZ, PO Box 59, 1790 AB Den Burg - Texel, The Netherlands. The closing date for applications is 1st September 1996.



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