

GLOBAL CHANGE NEWSLETTER

No. 44

December
2000

The International Geosphere–Biosphere Programme (IGBP: A Study of Global Change
of the International Council for Science (ICSU))

The
Global Change
Open Science Conference
10–13 July 2001, Amsterdam
Special Edition
See centre pages for Programme pull out!

The Challenge of Amsterdam 2001: Building Towards a New Science for Global Sustainability

by Will Steffen, João Morais and Wendy Broadgate

The Global Change Open Science Conference in Amsterdam next July is one of the biggest challenges that IGBP and our colleagues in the International Human Dimensions Programme (IHDP) and the World Climate Research Programme (WCRP) have faced. But the Conference is just as big a challenge for YOU, our scientific community.

We hope that this special edition of the Global Change NewsLetter shows that the Conference offers much to a wide range of interests in the global change research community. In fact, your active participation can help ensure that it does!!

The OSC structure and content reflect the evolution of the global change research community towards a more integrative Earth System Science aimed at global sustainability issues. If one word could describe this evolution, it would be 'interdisciplinarity'. As Earth System Science moves towards more integration in the next decade, there is a need to have both (i) a sound disciplinary base of science, and (ii) clear scientific questions to guide us towards integrated solutions beyond disciplinary boundaries.

Poster sessions, a central feature of the Conference with six hours of dedicated viewing time,

provide a forum for specialists to show their research in the context of the "bigger picture". The sessions are organised around eight broad, integrative themes, but offer a superb opportunity to present the rich array of detailed science that is essential for understanding the Earth System.

The 'poster cluster' concept described on page 16 of this Newsletter provides the framework for 'self-organising' groups of posters to be presented around more specific themes and topics. The challenge is to you, the scientific community, to identify the themes, round up your colleagues, and put on the show. So if you are still looking for your niche in Amsterdam, why not organise a poster cluster and *make your niche!*

Parallel sessions (see pages 16 and 17) also act as a bridge between the more detailed science of the poster sessions and

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What kind of global change science will get funded in the future?

Doing integrative, interdisciplinary science at the international scale is a huge challenge to the scientific community. It is just as big a challenge to the national and regional science funding agencies. Often organised around more traditional disciplinary lines, many of the world's leading agencies have already recognised the interdisciplinary future of Earth System Science and are developing ways of funding it. Ensuring that this evolving science fully engages the sustainable development community (at all levels, from NGOs to intergovernmental bodies), and *vice versa*, is a related challenge.

Active dialogue between the Global Environmental Change programmes, other national and international science bodies, research funding agencies, user communities, and policy groups is well underway to find creative sources of funding to support Earth System Science. There is also an increasing commitment to relate Global Change research, from its earliest planning phases, to the concerns and needs of those who will use our work.

This novel conference will present Global Change research with an approach that is interdisciplinary – the kind of science that will be funded and supported in the future.

the broad synthesis and context-setting talks of the plenary. There are 3 periods of parallel sessions, offering a total of 21 sessions. The programme has been carefully prepared to minimize the compromises that have to be made when selecting which sessions to attend.

The plenary programme, shown in detail on pages 14-15, places the wealth of excellent science that contributes to global change research into the broader context of Earth System Science and global sustainability. Mini-articles in this Newsletter give a hint of the nature of the individual presentations in the plenary programme.

Some of the big questions that will be addressed directly in Amsterdam are set out below:

- *What does biodiversity have to do with Earth System Science?* Debate the ways in which life itself – the ecological

complexity of Earth – can affect the functioning of the planet

- *Can technology spare the planet?* 'Technological optimists' and 'technological pessimists' will debate the potential for advances in technology to mitigate global environmental change.
- *Is the ice at the North Pole really disappearing?* Consider the latest evidence of rapid climatic changes in the high latitudes, and their implications.
- *Is the Earth well buffered against human forcings or can we drive it into rapid and irreversible changes?* Hear the latest findings from ice core and other records. What do they tell us about the dynamics of the Earth System? What

can simulation tools tell us about the future?

But how effective and useful is this science if we cannot communicate it to a wide range of audiences? The media campaign associated with the Conference, described on page 18, is designed to significantly raise our profile within the policy community, the private sector and the general public.

Another challenge of Amsterdam 2001 is to fully involve the scientific communities of the developing regions of the world. Although much progress has been made over the past decade via START (START is the Global Change System for Analysis Research and Training (co-sponsored by IGBP, IHDP and WCRP) and other groups in building global change research capacity in the developing world, there are still big challenges ahead. See page 12 for more information on support for participants from the developing world.

Above all, the Global Change Open Science Conference has two simple aims: (i) to present the results of the last decade of international global change research, emphasising the implications for global sustainability; and (ii) to point the way towards the next decade of Earth System Science. The latter, in particular, poses fundamental questions about the ways we do our science.

So accept the challenge of interdisciplinarity and contribute to this evolving science – come to Amsterdam!

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The Open Science Conference will offer a smorgasbord of interesting science. Here is a taste of what's to come...

Climate Change Fore and Aft: Where on Earth are We Going?

by Tom Pedersen

Recent results from a variety of paleoarchives show that rapid and profound shifts in Earth's climate occurred repeatedly during the Late Pleistocene. Rapid variations in the concentrations in the atmosphere of the greenhouse gases CO₂, CH₄ and N₂O occurred in lockstep with temperature, implying a causative relationship. Abrupt changes in the character of thermohaline circulation in the sea, particularly in the North Atlantic, generated swings in temperature across the northern hemisphere. Shifts in hydrologic balances in continental interiors were marked, producing in some regions severe drought.

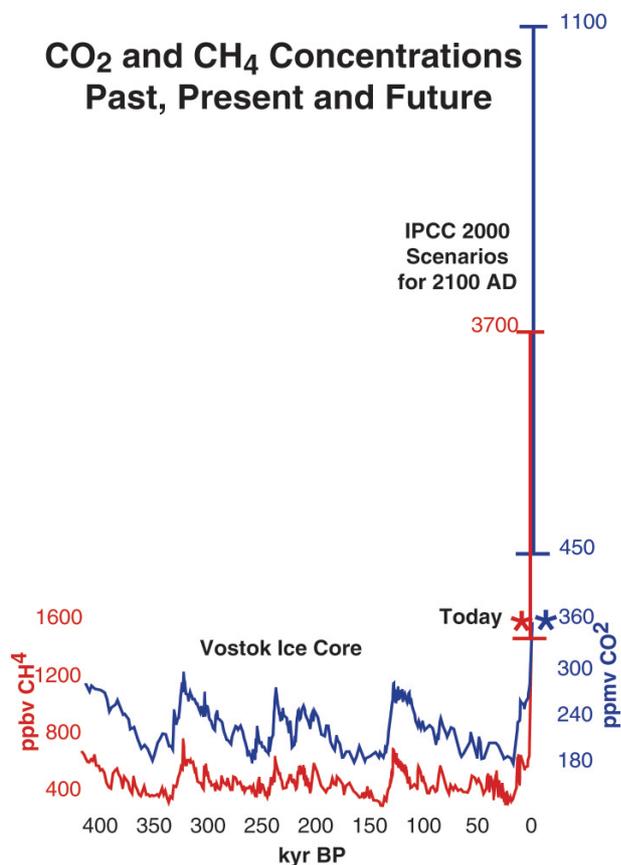
In contrast, the climate of the Holocene has been thought to have been relatively stable and this has probably contributed to the flourishing of human societies. But as we continue to

abrupt changes have occurred within this epoch, albeit with amplitude swings smaller than in the Pleistocene.

The paleodata suggest that the sensitivity of Earth's climate system to forcings is well within the scale of anticipated anthropogenic perturbations. Thus, the historical records offer a warning: should we continue along the climate-modulating trajectory that we have established, we should anticipate sudden

"... the historical records offer a warning: should we continue along the climate-modulating trajectory that we have established, we should anticipate sudden changes."

improve our understanding of the past and struggle to predict the future, the intimate interconnectedness of the climate system is becoming increasingly obvious. Many of the past variations in climate that have recently been discovered can be described as having occurred abruptly, that is within decades or less. The Holocene has not been immune to such swings;



changes. These may (or will?) include: a) potentially major variations in regional precipitation patterns; b) abrupt changes in average regional temperatures; c) sudden increases in the rate of addition of methane to the atmosphere from marine sedimentary (clathrate) sources; and d) rapid increases in the addition of nitrous

“...paleorecords now available show that in geological terms, abrupt, natural changes are common, and we can fully expect them in the future.”

oxide to the atmosphere.

There can be little doubt that the social and economic consequences of such variations will be negative. Furthermore, human societies are constantly making themselves more vulnerable to climate shifts.

Consider episodic drought. In central Africa, borders now prevent the past migrations of

populations that occurred when shifts to drier conditions rendered some regions inhospitable. In northern Texas, groundwater resources have been mined to the point where pumping from wells will soon no longer be able to provide a buffer against the dry spells that have occurred in that area for millennia. In Gujarat, northwestern India, the burgeoning population is increasingly at the mercy of the monsoon, for groundwater has been all but exhausted in the region.

Consider deforestation. The extraordinary floods in the Yangtze River Valley in 1998 displaced more than 200 million people. But the flooding was not the result of record rainfall. Rather, it was the direct consequence of severe deforestation and the associated inability of the soils in the Yangtze watershed to act as a buffer during heavy rains.

The high quality paleorecords now available show that in geological terms, abrupt, natural

“Given additional human-induced forcing of climate, we can reasonably expect enhanced societal distress as climate changes are superimposed on increasingly vulnerable populations.”

changes are common, and we can fully expect them in the future. Given additional human-induced forcing of climate, we can reasonably expect enhanced societal distress as climate changes are superimposed on increasingly vulnerable populations. The case for mitigative actions to limit such forcings is thus highly compelling.

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The Impact of Dams on Fisheries: Case of the Three Gorges Dam

by Chen-Tung Arthur Chen

Rivers are the major conduits for the passage of water, nutrients, organic material and particulate matter from land to sea. It has been well documented that the completion of a large dam, such as the Aswan Dam on the Nile, is central to substantial reductions in fish stocks in the connecting estuaries. Briefly put, dams block the down-stream transport of particulate matter which is an important source of nutrients and food for the aquatic biota. The effects, however, go far beyond the estuaries.

Taking the case of the Three Gorge's Dam as an example, evidence is provided to show that, despite a large riverine input of nutrients to the East China Sea (ECS), it is in fact only a small fraction (7% for P and

33% for N) of the external nutrient supply supporting new production that is actually from that input. It is now clear that the major nutrient supply originates from the on-shore advection of the subsurface Kuroshio waters.

It is argued that the completion of the Three Gorges Dam on the Yangtze River is likely to result in diminished productivity in the ECS, home to the largest fishing grounds in the world. Cutting back the Yangtze River outflow by a mere 10% will reduce the cross-shelf water exchange by about 9% because of a reduced buoyancy effect, and, at the same time, it will cut the onshore nutrient supply by nearly the same amount. It then follows that primary production and fish catch in the ECS can be expected to decrease proportionately.

From a global perspective, approximately 40% of the fresh

water and particulate matter entering the oceans are transported by the ten largest rivers and this is in the form of a buoyant plume on the open shelves.

These shelves also face diminished fish production when damming reduces freshwater outflow.

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1000 Years of Climate Change

by Raymond S. Bradley

We are living in unusual times. Twentieth century climate was dominated by near universal warming. Almost all parts of the globe had temperatures at the end of the 20th century that were significantly higher than when it began. But instrumental data provide only a limited perspective on present climate. How unusual was the last century when placed in the longer-term context of climate in the centuries and millennia leading up to the 20th century?

A wide variety of annually resolved paleoclimate proxies are available to answer this question. These include: historical documentary records, tree rings (width, density); ice cores (isotopes, melt layers, net accumulation, glaciochemistry); corals (isotopes and other geochemistry, growth rate); varved lake sediments (varve thickness, sedimentology, geochemistry,

diatom and pollen content); banded speleothems (isotopes).

Studies of these and other proxies reveal that temperatures declined from A.D. 1000 until the late 19th century, followed by warming at a rate that is unprecedented in the record, leading to temperatures in the late 20th century that were unique in the context of

the entire millennium (Figure 1).

Statistical studies and energy balance models indicate that much of the variability of temperature over the millennium can be accounted for by variations in

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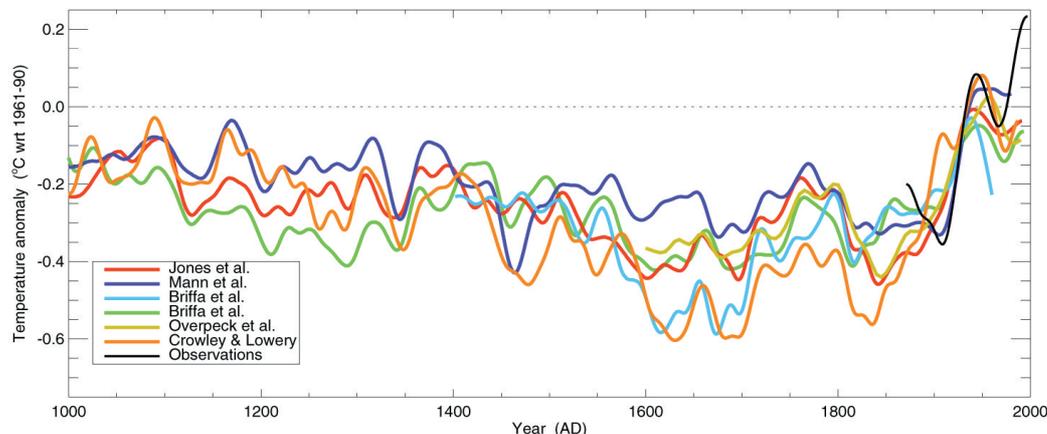


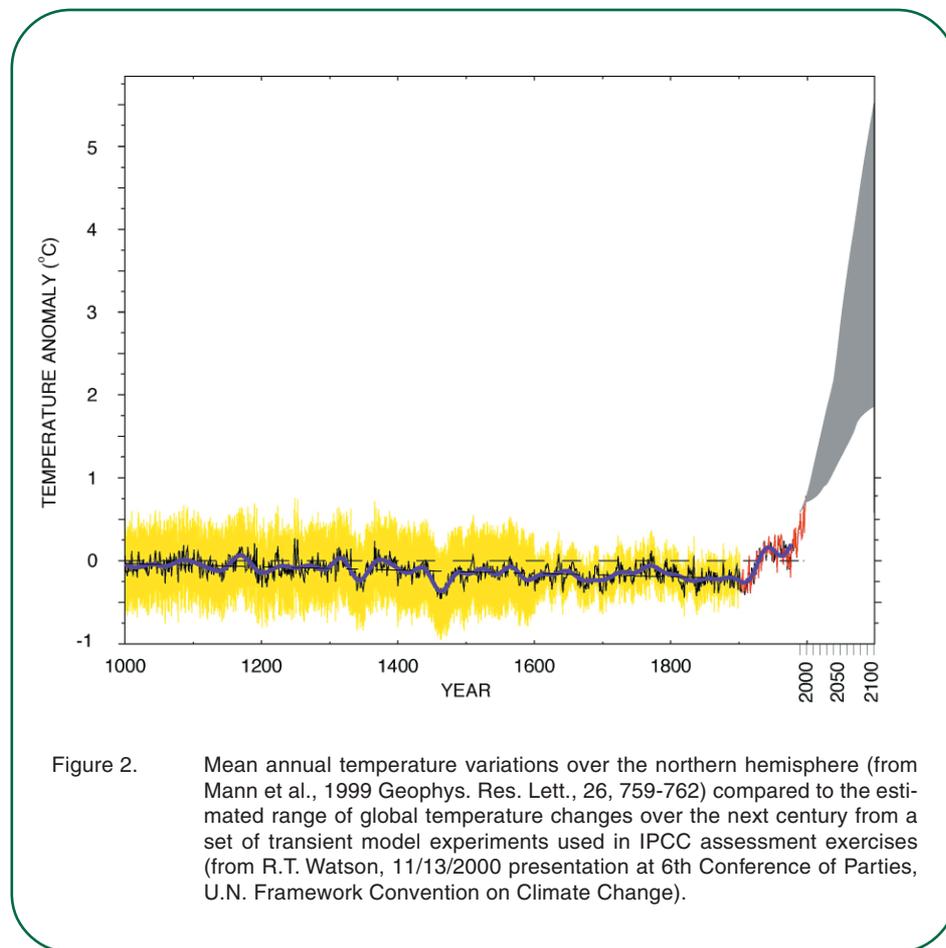
Figure 1. Various estimates of large-scale (northern hemisphere) temperature variations over the last millennium, with reference to the average from 1961-90. The differences relate, in part, to the fact that they do not all represent the same season, or geographical domain (from Briffa et al., 2000. *J. Geophys. Res.*, in press).

the output of energy from the sun, explosive volcanic eruptions and internal variability of the ocean-atmosphere system. The twentieth century warming is inexplicable by these mechanisms. Only increased levels of

greenhouse gases appear to explain the unusual warming in the 20th century. Figure 1 shows that the overall range in temperature over the last 1000 years has been quite small. For example, the range in 50-year means has

only been <1°C (from the coldest period in the 17th and 19th centuries, to the warmest period of the last 50 years). Within that narrow envelope of variability, all of the significant environmental

changes associated with the onset and demise of the "Little Ice Age" (~1450-1850) took place. This puts into sharp perspective the magnitude of projected future changes resulting from greenhouse-gas increases and associated feedbacks (Figure 2). Even the low end of model estimates suggests additional temperature increases on the order of 1-2°C by the end of the 21st century (Intergovernmental Panel on Climate Change, 2001) which would be far beyond the range of temperatures experienced over (at least) the last 1000 years.



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From Friibergh to Amsterdam: On the Road to Sustainability Science

by James J. McCarthy and Nancy M. Dickson

The world's present development path is not sustainable. Efforts to meet the needs of a growing population in a globalizing, unequal and human-dominated world will continue to exert unsustainable pressures on the Earth's essential life-support systems. Worrying interactions among climate change, loss of biological diversity, increasing poverty and disease, and growing inequality combine to increase the vulnerability of humans and nature.

Meeting fundamental human needs while preserving the life-support systems of Earth will require a worldwide acceleration of today's halting progress in a transition toward sustainability. A response as to how this transition might be achieved has begun to emerge in recent reports of national and international scien-

Global
Issues



Local
Issues

old rich millions
affluence
"global people"
resource surpluses
causes of climate change
technological knowledge
theory driven research

Digital divide

poor, young billions
poverty
"local people"
resource shortages
impacts of climate change
traditional knowledge
action driven research

Figure 1. Sustainability Science within a Divided World. A cartoon-like view of the sharp contrast in both perceptions and realities of resource distribution between countries of the 'north' and 'south'. The research of the "north" is global in orientation, theory-driven, and draws upon technological knowledge. The much smaller research effort of the "south" is local in orientation, action-driven, and draws upon traditional knowledge. The socio-economic, environmental, and knowledge dichotomies are exacerbated by the deepening 'digital divide'.

tific organizations, as well as from independent networks of activists and scientists.

To take these ideas further, two

The meeting at Friibergh, Sweden described in this article, helps set the stage for Bill Clark's presentation on day 4 of the OSC: What new "science systems" are needed to achieve global sustainability?

dozen scientists, drawn from the natural and social sciences and from across the world, convened at Sweden's Friibergh Manor in October 2000. Participants concluded that promoting the goal of sustainability requires the emergence and conduct of the new field of sustainability science.

Sustainability science seeks to improve on the substantial but still limited understanding of nature-society interactions gained in recent decades. This has been achieved through work

in the environmental sciences estimating and evaluating human impacts, and evidence from social and development studies that takes into account environmental influences on human well-being. What is urgently needed now is a better general understanding of the complex dynamic interactions between society and nature so that the alarming trend towards increasing vulnerability is reversed. This will require major advances in our ability to analyze and predict the behavior of complex self-organizing systems, characterize the irreversible impacts of interacting stresses, interpret multiple scales of organization, and assess the roles of various social actors with divergent expectations. Much contemporary experience points to the need to address these issues through integrated scientific efforts focused on the social and ecological characteristics of particular places or regions. The workshop formulated an initial set of core questions that exam-

ines the combinational character of nature-society interactions, our ability to guide those interactions along more sustainable trajectories, and ways to promote and implement the social learning that will be essential to the navigation of a transition to sustainability.

By structure, method, and content, sustainability science must differ fundamentally from most science as we know it. Familiar approaches to developing and testing hypotheses are inadequate because of non-linearity, complexity, and long time lags between actions and their consequences. Additional complications arise from the recognition that humans cannot stand outside the nature-society system. The common sequential analytical phases of scientific inquiry such as conceptualizing the problem, collecting data, developing theories and applying the results will become parallel functions of social learning, which incorporate the elements of action, adaptive

management and policy as experiment. Sustainability science will therefore need to employ new methodologies that generate the semi-quantitative models of qualitative data, build upon lessons from case studies, and extract inverse approaches that work backwards from undesirable consequences to identify pathways that can avoid such outcomes. Scientists and practitioners will need to work together with the public at large to produce trustworthy knowledge and judgement that is scientifically sound and rooted in social understanding.

Furthermore sustainability science will learn to work with all manner of social groups to recognize how they come to gain knowledge, establish certainty of outlooks, and adjust their perceptions as they relate to each other's needs. This in turn will require sustainability science to sense better how governments are responding, how democracies are improving and how citizens generally act to play out the sustainability transition.

Meeting the challenge of sustainability science will also require new styles of institutional organization to foster and support inter-disciplinary research over the

long term; to build capacity for such research, especially in developing countries; and to integrate such research in coherent systems of research planning, assessment and decision support. We need to be able to involve scientists, practitioners, and citizens in setting priorities, creating new knowledge, evaluating its possible consequences, and testing it in action. This will require integration of this new active knowledge in particular locations and cultural settings through broader networks of research and monitoring.

In the coming years, the emerging field of sustainability science will need to move forward along several pathways if it is to prove successful. There will be wide discussion within scientific communities, North and South, of the approach, its key questions, methods of inquiry, and institutional needs. There should be an effort to reconnect science to the many political efforts for promoting sustainable development. One benchmark is the forthcoming "Rio + 10" Conference that will review developments in science over the decade since the UN Conference on Environment and Development. And across the continents, in groups small and

large, research relating to sustainability science is under way and accelerating. This research can be connected and enhanced, and it can transform itself into the core of an effective new field.

Note: Participants at the Workshop were B. Bolin, W. Clark, R. Corell, N. Dickson, S. Faucheux, G. Gallopin, A. Gruebler, M. Hall, B. Huntley, J. Jäger, C. Jaeger, N. Jodha, R. Kaspersen, R. Kates, I. Lowe, A. Mabogunje, P. Matson, J. McCarthy, H. Mooney, B. Moore, T. O'Riordan, J. Schellnhuber, U. Svedin. A report on the workshop, together with updates on a larger follow up meeting to be held a year hence in the Southern Hemisphere, will be posted on the following web site:

<http://sustainabilityscience.org>

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Open Meeting of the Human Dimensions of Global Environmental Change Research Community

The 2001 Open Meeting of the Human Dimensions of Global Environmental Change Research Community will take place in Rio de Janeiro, Brazil, October 6 – 8, 2001.

Particular emphasis will be placed on research reports that include a regional or "place-based" perspective and that make a linkage between natural and social sciences, as well as among local, regional and global scales.

Plenary themes of the meeting will address the challenges of integration in human dimensions research – across disciplines, across hemispheres, and across the science/policy interface. They will also address issues of central importance to both the developed and the developing world – "urban sustainability", "vulnerability", and "poverty and the environment". One plenary talk will discuss the climate change issue in the post-Kyoto era and the implications for human dimensions research.

In addition to plenary talks, there will be a large number of parallel sessions. The International Scientific Planning Committee welcomes the submission of abstracts, as well as proposals for sessions.

Information about the meeting, including instructions for the submission of abstracts, will be available on the following websites: <http://sedac.ciesin.org/openmeeting/>

Inquiries can be addressed to: open.meeting@ciesin.org

The deadline for submission of abstracts and session proposals is March 29, 2001.

Hot Spots of Land Use Change and the Climate System: A Regional or Global Concern?

by P Kabat, M Claussen, Congbin Fu, Tetsuzo Yasunari and Carlos Nobre

Traditionally, Earth's vegetation cover has been considered as a more or less passive component of the climate system. Alexander von Humboldt (1849), for example, imagined that somewhere in the "dark past", a strong subtropical Atlantic gyre flooded the Sahara and washed away vegetation and fertile soil and therefore caused the desertification of North Africa. Koppen (1936) described vegetation as "crystallised, visible climate", thereby considering vegetation as being an entirely passive, climate-determined system, which itself had no impact on atmospheric or oceanic processes. Not too long ago (up to the middle of the nineties), coupled atmosphere-ocean models were regarded as state-of-the-art climate models, in which the vegetation patterns were kept as simple as possible and constant in time.

On the other hand, many studies, most of which were carried out during the last 5 to 10 years, point clearly towards a key role which land surface and biospheric processes may play in weather and climate at local, regional and global scales. The role of the land surface ranges from purely physical influences (e.g. the aerodynamic drag on the atmosphere, role of soil characteristics in controlling soil moisture and runoff) to some major biological influences (e.g. leaf stomata response to environmental changes and biogeochemical cycles). Hence, a more general definition of a climate system which encompasses not only the abiotic world (atmosphere, hydrosphere, cryosphere, pedosphere), but also the living world, the biosphere, is put forward.

In this session, we will focus on Earth's most important "hot spots" the past and current land cover and land use changes, and systematically investigate the possible role of these changes for the past, present and future

climate. A significant amount of observational, analytical and modeling evidence has gradually been acquired for these regions, which points towards a significant input which land surface- and biogeochemical processes and feedbacks have in determining our present and future climate. This evidence comes from a whole range of spatial scales, from point and local measurements all the way up to global scale multi-century modeling.

Regional or global concern?

From theoretical considerations about the Earth's climate system, it should be expected that large scale (regional) land cover changes, particularly in the tropics, will have remote climatic effects. Therefore we make an attempt to put our "hot spot" regions into a global Earth System perspective, and try to answer some questions about

possible global feedbacks and implications. Given that the three major tropical convective heating centers are associated with the land surfaces in Africa, Amazonia, and the maritime region of SE Asia, changes in vegetation cover in these regions could effect the structure, the strength and positioning of convective storms. Even small changes in the magnitude and spatial pattern of tropical convection may then alter the magnitude and pattern of upper-level tropical outflow which feeds the higher altitude zonal jet, therefore affecting regions far beyond the actual "hot spots" of land use change. Apart from affecting the

...we believe that [there is] strong evidence ...pointing towards global implications of large scale regional land use changes...

mean zonal flow, alternation in tropical convection may also force anomalous Rossby waves which can propagate to higher latitudes. Therefore, land cover changes which result in changes in tropical convection may affect weather and climate remotely both in the tropics and at high latitudes, analogously to well documented remote effects attributed to the opposing phases of ENSO. In addition, changes in tropical and mid-latitude vegetation cover appear to play a significant role in tropical monsoon circulations, which have global effects and interactions extending far from the tropics.

North Africa: A Green Sahara

In this century, the Sahelian region has experienced the longest drought in its recorded history. Annual rainfall has been persistently below the long term average since the late sixties (figure 1). Land surface degradation resulting from population pressure in excess of the region's carrying capacity has been considered as one of the causes of this prolonged drought.

It is crucial to understand the relative importance of land surface processes for Sahelian climate in a broader perspective of complex interactions within the entire climate system. In prehistoric times, the Sahelian region had seen a much more dramatic desertification episode than persists till present. In the early and mid-Holocene, the climate was humid and there was a high vegetation fractional cover (figure 2). Modeling results by Claussen et al (1999), clearly show that subtle changes in orbital forcing (figure 2 A) triggered changes in North African climate which were then strongly amplified by

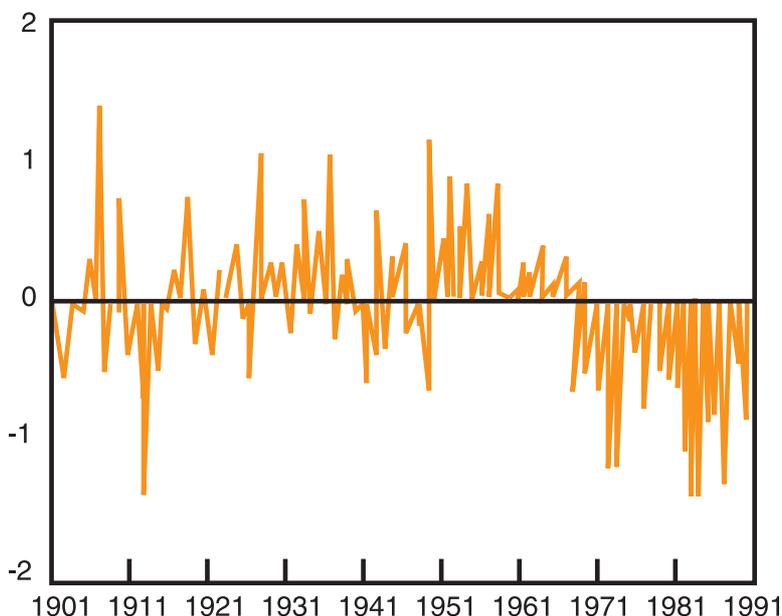


Figure 1. Land Degeneration and Rainfall in the Sahel

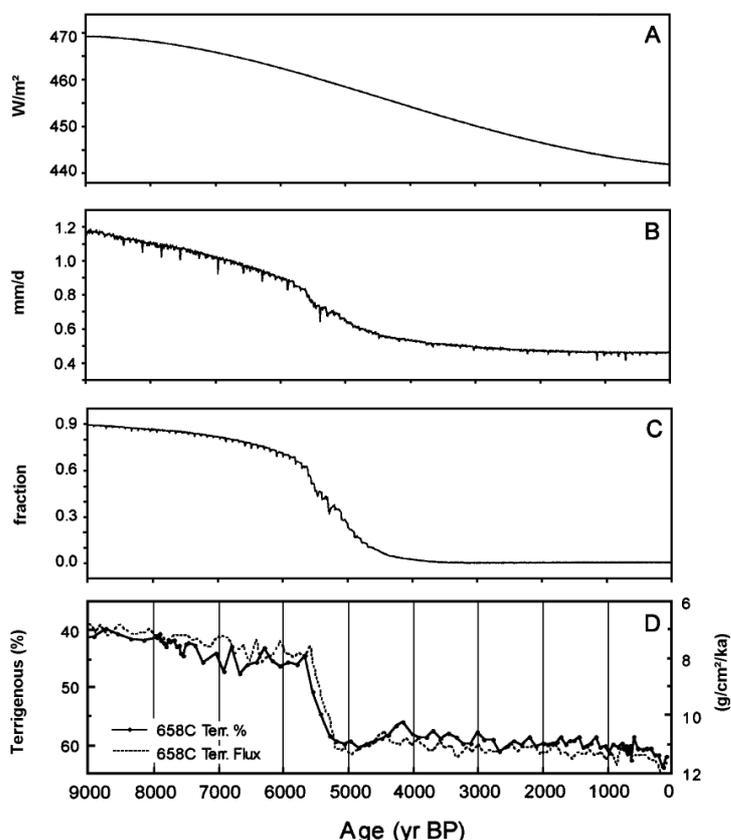


Figure 2. Green Sahara

biogeophysical feedbacks in the region (figure 2 B, C, D). The timing of the transition from the green to deserted Sahara, which started at around 5,5 ka BP in the model, was governed by a global interplay between atmosphere, ocean, sea ice and vegetation. The latter is affected by a change in tropical Sea Surface Temperatures (SSTs) and by the synergism between biospheric and oceanic feedbacks. Hence, the abrupt desertification-abrupt in comparison with the subtle change in orbital forcing- is a regional effect with a clear impact of land surface (biospheric) processes. The timing of this abrupt transition, depends however on global processes. Figure 2 D shows a comparison with data of terrigenous material in cores off the North Atlantic coast (deMenocal et al, 2000).



Even though more complex global implications and feedbacks of regional land use changes are just starting to be explored more systematically (e.g. the links with the terrestrial carbon cycle), we believe that strong evidence is quickly being assembled pointing towards global implications of large scale regional land use changes, as a part of the Earth's "physical and biogeochemical" climate system. Adding the human and socio-economical dimension as a part of an already very advanced globalization process will only exacerbate the importance of regional to global land use change-climate feedbacks.

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The Asian Monsoon and Land Use Changes in South East Asia

More of the half of the world population lives under the Asian monsoon climate. The life, agriculture and economy of the people living in this region depend upon rainfall water provided by the monsoon as a part of a huge water cycle system. Reliable seasonal forecast of monsoon rainfall and associated water scarcity and/or abundance are therefore very essential for this particular region of the world.

The Asian monsoon system has been classically studied and described as a seasonally changing atmospheric circulation, induced simply by the heating contrast between the land mass and the ocean. However, based on recent large scale observations and modelling, the seasonal monsoon cycle, as well its inter-annual variability, are now attributed to highly non-linear processes in an interactive, land surface-atmosphere-ocean system. In addition, these recent studies have shown that the Asian monsoon system is tightly coupled with the ENSO in the Pacific Ocean.

We emphasise that the variability and long-term change of the Asian monsoon are most likely to be very sensitive both to natural forcings (e.g. secular change of insolation), as well as to human induced changes of land use and atmospheric composition (e.g. deforestation and fossil fuel emissions).

During the history of civilisation over the last 3 000 years, the changes in land use over East Asia have been one of the largest in the world. Experiments with global and regional climate models have been performed to examine the most likely response of the Asian monsoon system to human induced land cover change. Results have shown that past and current anthropogenic land cover changes have brought about significant variations of the land surface dynamic parameters, such as surface albedo, surface roughness, vegetation leaf area index and vegetation fractional coverage. These variations resulted in large changes in surface energy and water balance, which in turn impacted upon atmospheric circulation over the region and beyond.

Simulated weakening of the summer monsoon in the study is a result of virtual destruction of the natural vegetation in this part of East Asia. This is fully consistent with the observed monsoon index and the aridity trend in the region. We conclude that the regional to continental land use – atmosphere feedbacks are a strong part of the Asian monsoon system dynamics. The effects of land uses changes in SE Asia are very likely to propagate far beyond the region itself, and therefore become a significant factor in the Earth System dynamics.

GLOBAL Change Requires Scientists, Globally

One of the big challenges ahead for IGBP is to facilitate the *next* generation of global change scientists. IGBP's future is about increasing scientific understanding as well as a broader human capacity to deal with implementing Earth System Science. Disciplinarily as well as geographically comprehensive. Value adding and networking, hand-in-hand.

A special effort is being made to attract and support at least 100 scientists from less developed countries. We are making a concerted effort to obtain funding earmarked for this purpose to allow scientists attending from countries around the world, particularly from regions where there is no local capacity to support their participation.

We are also establishing collaboration with international NGOs, foundations and intergovernmental agencies engaged in promoting research in environmental change and sustainability sciences. There are an increasing number of such institutions indicating their willingness to provide support for a handful of their own grantees to attend the Conference.

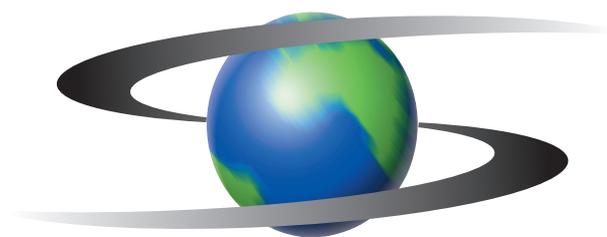
Furthermore, we welcome suggestions from individuals or agencies that wish to promote new contacts and explore further synergism. We are aware that there are many more individuals and institutions out there who we don't know about or with whom we have not yet been able to develop collaboration.

In the meantime, as announced on the Conference website, eligible candidates should send a request for support to: sec@igbp.kva.se with subject "OSC support". They should include (1) a copy of the poster abstract (2) an indication of the amount of support required in EURO, (3) a statement of how the work relates to global change research, and (4) a short curriculum vitae.

Funding is unfortunately limited and not all candidates can be supported. Decisions on the initial round of applications will be announced in February and the final decision will be made by the end of May 2001. The selection criteria will include the originality of the work to be presented and the level of collaboration with existing IGBP, IHDP, WCRP or START projects. However, we do have in mind to be inclusive of scientists already contributing to ongoing global change networks as well as having newcomers joining such groups.

A distinguished philosopher (Bertrand Russell) once declared that 'change' is scientific and 'progress' is ethical - change being indubitable whereas progress is a matter of controversy. Global change science is trying to find the right balance.

João Morais, IGBP Secretariat, E mail: morais@igbp.kva.se



*Challenges of a
Changing
Earth*

Global Change Open Science Conference

The Programme at a glance

10 -13 July 2001, Amsterdam



Day 1		Day 2		Day 3		Day 4	
Achievements and Challenges		Advances in Understanding				Looking to the Future	
Mon 9	Tue 10	Wed 11	Thu 12	Fri 13			
Arrival, Registration and Dutch Science Tours	Opening Challenges of a Changing Earth Food, Land and Oceans Air Quality	Global Biogeochemistry Land-Ocean Interactions	The Climate System Changing Land Cover and the Earth System	Simulating and Observing the Earth System Does the Earth System Need Biodiversity?			
Lunch							
	Global Carbon Cycle Water Resources Poster Session 1 Reception	Parallel Session A Parallel Session B	Parallel Session C Poster Session 2	Can Technology Spare the Planet? Towards Global Sustainability New Era for Earth System Science			

Registration Information

The fastest and most efficient way to register and submit abstracts is online at the Conference website. Hard copies of the registration form and abstract submission form are available from:

Open Science Conference Secretariat, Congrex Holland BV, PO Box 302, 1000 AH Amsterdam, The Netherlands. Phone: +31 20 5040208, Fax: +31 20 5040225, E mail: igbp@congrex.nl

Abstract submission deadline is 31 March 2001

Registration deadline is 30 April 2001

ACCOMMODATION!

Amsterdam is a popular place in the summer and hotels are booking up fast. Make sure you book accommodation as early as possible!

www.sciconf.igbp.kva.se

Global Change Open Science Conference Programme

Day 1 – 10 July: Achievements and Challenges

- 0900-0930 Opening Ceremony:
- 0930-1015 Challenges of a Changing Earth. Towards a Scientific Understanding of Global Change. *Prof Berrien Moore III*, Institute for the Study of Earth, Oceans & Space, University of New Hampshire, USA
- 1015-1045 Break
- 1045-1200 Food, Land and Oceans: Can Productivity AND Ecosystems be Sustained

The Centrality and Complexity of Land Change: Myths and Realities: *Prof B.L. Turner II*, The George Perkins Marsh Institute of Geography, Clark University, USA

Climate Variability and Ocean Ecosystem Dynamics: *Dr Michael J. Fogarty*, National Oceanic Atmospheric Administration, National Marine Fisheries Service, Woods Hole, USA

Environmental Consequences of Feeding a Doubled Population: Optimists v. Pessimists. Industry/policy representative TBA

- 1200-1300 Out of Breath? Air Quality in the 21st Century

Atmospheric Chemistry in the Anthropocene Era. *Prof Paul J. Crutzen*, Max-Planck-Institute for Chemistry, Mainz, Germany

Fires and Haze: The Social and Political Inequality of Air Quality in South East Asia. *Simon S.C. Tay*, Chairman of the Singapore Institute of International Affairs, Singapore

- 1300-1400 Lunch
- 1400-1530 Managing Planetary Metabolism? The Global Carbon Cycle

Ocean and Land Carbon Dynamics. 'Sinks Forever' v. 'Sink Saturation': *Prof Ian R. Noble*, Cooperative Research Centre for Greenhouse Accounting, Canberra, Australia

Carbon and the Science-Policy Nexus: The Kyoto Challenge: *Dr Robert T. Watson*, Chairman, Intergovernmental Panel on Climate Change (IPCC) and Chief Scientist, The World Bank

Industry Response to the CO₂ Challenge: Industry representative TBA

- 1530-1630 Water in a Changing Global Context: The Resource Challenge of the Century?

Will We Have Enough Water of Sufficient Quality? *Prof Hartmut Grassl*, Max-Planck-Institute for Meteorology, Hamburg, Germany

Will Water Get to the People Who Need It? TBA

- 1630-1645 Summary: *Prof Peter D. Tyson*, Climatology Research Group, University of Witwatersrand, South Africa

- 1645-1845 Poster Session I
- 1845- Reception

Day 2 – 11 July: Advances in Understanding

- 0830-1000 Global Biogeochemistry: Understanding the Metabolic System of the Planet

Ocean Biogeochemistry: A Sea of Change: *Prof. David M. Karl*, School of Ocean and Earth Science and Technology, University of Hawaii, USA

The Past, Present and Future of Carbon on Land: *Dr Robert J. Scholes*, Commonwealth Scientific and Industrial Research (CSIRO), Republic of South Africa

Can New Institutions Solve Atmospheric Problems? The Cases of Acid Rain, Ozone Depletion, and Climate Change: *Prof Oran R. Young*, Institute on International Environmental Governance, Dartmouth College, USA

- 1000-1030 Break
- 1030-1200 Land-Ocean Interactions: Regional-Global Linkages

Emissions from and Deposition to the Ocean: Biogeochemical Interactions and Feedbacks: TBA

The Impacts of Dams on Fisheries: The Three Gorges Dam Case Study. *Prof Chen-Tung Arthur Chen*, Institute of Marine Geology and Chemistry, National Sun Yat-Sen University, Taiwan

TBA, *Prof Liana Talaue-McManus*, Marine Science Institute, University of the Philippines

- 1200-1300 Lunch
- 1300-1530 Parallel Session A
- 1530-1600 Break
- 1600-1830 Parallel Session B
- 1830- Drinks and Poster Viewing

Day 3 – 12 July: Advances in Understanding

0830-1030 The Climate System: Prediction, Change and Variability

Climate Change Fore and Aft: Where on Earth are We Going? *Prof Thomas F. Pedersen*, Earth and Ocean Sciences, University of British Columbia, Canada

1000 Years of Climate Change. *Prof Raymond S. Bradley*, Department of Geosciences, University of Massachusetts, USA

The Changing Cryosphere: Impacts of Global Warming in the High Latitudes. *Dr Oleg Anisimov*, State Hydrology Institute, St Petersburg, Russia

The Coupled Climate System: Variability and Predictability: *Prof Antonio J. Busalacchi*, Earth System Science Interdisciplinary Center, University of Maryland, USA

1030-1100 Break

1100-1230 Changing Land Cover and the Earth System: Regional-Global Linkages

Synthesis and Overview: *Dr Pavel Kabat*, Wageningen University and Research Centre, The Netherlands

Africa: Greening of the Sahara: *Dr Victor Brovkin*, *Dr Martin Claussen*, *Dr Andrey Ganopolski*, Potsdam Institute for Climate Impact Research, Germany.

Land-Cover Change and the Asian Monsoon I: *Prof Congbin Fu*, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing

Land-Cover Change and the Asian Monsoon II: *Prof Tetsuo Yasunari*, University of Tsukuba, Japan

The Amazon Basin and Land-Cover Change: A Future in the Balance: *Dr Carlos Nobre*, National Space Research Institute (INPE), São Paulo, Brazil

Summary: Dr Pavel Kabat, Wageningen University and Research Centre, The Netherlands

1230-1330 Lunch

1330-1600 Parallel Session C

1600-1630 Break

1630-1830 Poster Session II

Day 4 – 13 July: Looking to the Future: Earth System Science and Global Sustainability.

0830-1015 Simulating and Observing the Earth System

Virtual Realities of the Past, Present and Future: *Prof John Mitchell*, U.K. Meteorological Office (Hadley Centre), UK

Coping with Earth System Complexity and Irregularity: *Prof H.J. Schellnhuber*, Potsdam Institute for Climate Impact Research, Germany

Earth System Observation: TBA, CNES; France

Summary: Prof Chris Rapley, British Antarctic Survey, UK

1015-1045 Break

1045-1200 Does the Earth System Need Biodiversity?

Why does Earth System Science need Marine Biodiversity?: *Prof Katherine Richardson*, Institute of Biological Sciences, University of Aarhus, Denmark

Does Biodiversity Matter for Terrestrial Ecosystem Processes and Services? *Dr Sandra Diaz*, Universidad Nacional de Cordoba, IMBIV-CONICET, Argentina

Summary: Dr Michel Loreau, Pierre et Marie Curie University, Paris, France

1200-1300 Lunch

1300-1415 Can Technology Spare the Planet?

The Great Restoration of Nature: Why and How: *Mr Jesse H. Ausubel*, Program for the Human Environment, The Rockefeller University, USA

Industrial Transformation: Exploring Systems Change in Production and Consumption: *Prof Pier Vellinga*, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, The Netherlands

Summary: Prof Robert Wasson, Centre for Resource and Environmental Studies, The Australian National University

1415-1530 Towards Global Sustainability

Transition to Sustainability: Developing Country Perspective: *Dr Julia Carabias*, Forum Secretary for the Environment, Mexico

Research System for a Transition toward Sustainability: *Prof William C. Clark*, Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University, USA

Summary: Dr Jill Jäger, Executive Director, International Human Dimensions Programme on Global Environmental Change

1530-1600 Break

1600-1645 Closing Session

A New Era for Earth System Science: *Dr Peter Lemke* (WCRP), *Prof Berrien Moore III* (IGBP), *Prof Jose Sarukhan* (DIVERSITAS), *Prof Arild Underdal* (IHDP)

Poster Sessions

Posters will be a prominent feature of the conference - they will be displayed for the full 4 days in an attractive area within the RAI Conference Centre, where refreshments will be served. There will be two dedicated viewing sessions (when authors are requested to stand by their posters) on Days 1 and 3.

Will my poster will be placed with others from a similar research theme? Yes. When you submit your abstract online you must select one of 8 broad Themes, such as "Oceans and Coasts" or "Sustaining the Land: Food, Biodiversity and Other Services" (full listing below). All posters will be displayed within one of these Themes. Many posters will be further grouped with other posters into more closely defined categories known as clusters, such as "New approaches to monitoring change in the Global Ocean" or "Food Production and Feedbacks to the Earth System". Poster Clusters will be organised by the IGBP core projects (IPO's) and by co-ordinators in IHDP and WCRP. There will be several Poster Clusters associated with Parallel Sessions.

Can I suggest a topic for a Poster Cluster? Yes. The titles of Poster Clusters are evolving and topics will be posted on the web site as they are received. This is the part of the conference where you can really make your niche! If you would like to suggest a Poster Cluster, please contact your International Project Office. For more details see the poster section on the website.

Poster Themes (within each Theme posters will be grouped into Clusters):

- Earth System, Planetary Metabolism and Global Element Cycles
- Looking Back to the Future: Palaeo Studies of the Earth System
- Water Cycle, Water Resources, Water Security
- Climate Variability and Climate Change
- Oceans and Coasts
- Atmosphere and its Interfaces; Air Quality
- Sustaining the Land: Food, Biodiversity and Other Services
- The Human Enterprise and Global Sustainability: Industry, Transport, Institutions, Vulnerability

Parallel Sessions

As far as possible, each session offers bio-physical and socio-economic perspectives. A detailed description of each session and the names of the organisers/chairs can be found on the conference web site: www.sciconf.igbp.kva.se

Session A – Wednesday 11 July, 1300 - 1530

- A1 - The Global Carbon Cycle
- A2 - Megacities and Global Change
- A3 - El Niño-Southern Oscillation in the Context of Past and Future Climate Variability
- A4 - Ground-truthing Earth System Models
- A5 - Biodiversity
- A6 - Global Change and Fire
- A7 - Human Interactions in the Coastal Zone

Session B – Wednesday 11 July, 1600 - 1830

- B1 - Tradeoffs between Food Production and Environment
- B2 - Predicting Land-Use Change
- B3 - The Cryosphere and Global Change - Mechanisms and Indicators

- B4 - Coupled Earth System Modelling
- B5 - The Terrestrial Biosphere and Global Change
- B6 - Transformation Processes in Society
- B7 - The Oceans and Global Change

Session C – Thursday 12 July, 1330 - 1600

- C1 - Vulnerability of Water Resources to Environmental Change
- C2 - Putting People into the Earth System: Victims or Villains, Disturbance or Solution?
- C3 - The Atmosphere and Global Change
- C4 - Non-Linear Responses and Surprises to Global Change
- C5 - Long Term Perspectives on Ecosystem Management for Sustainability
- C6 - Science and the Policy Process: IPCC and Beyond
- C7 - Global Change and Mountain Regions

Parallel Sessions

Three periods of parallel sessions punctuate Days 2 and 3 of the Conference, providing seven and a half hours for discussion and debate. Each period of parallel sessions has 7 topics, carefully selected to minimise overlap. Discussion of major global issues such as the carbon cycle (A1), tradeoffs between food production and environment (B1), vulnerability of water resources (C1) and biodiversity (A5) will cover some of the pressing issues facing us now and in the future. Dedicated sessions will debate the role of the oceans in climate change (B7), and how global change affects and is affected by the atmosphere (C3), the terrestrial biosphere (B5), mountain regions (C7), fire (A6) and the frozen areas of the planet, the cryosphere (B3).

Rapid and unpredicted system responses can result from small environmental changes, but linear thinking is very much entrenched in the management of environmental change – a novel session on non-linear responses and surprises to global change (C4) will consider a variety of biological, climate and socio-economic case studies showing the complexity of this complex issue.

How do we bridge the gulf between biophysical and cultural perspectives on the relations between environment and societal change? Increasingly, it is realised that understanding past variability in climate, hydrological regimes and ecosystem responses is essential for managing ecosystems in a sustainable manner. A session on long term perspectives on ecosystem management for sustainability (C5) will look into the past to help us manage ecosystems in the future.

Most sessions will attempt to cover the topic with an interdisciplinary approach, encompassing physical and biogeochemical issues in tandem with the socio-economic drivers and effects. Are humans the victims of global environmental change or the villains who cause it (C2)? What are the global impacts of mega-cities, which are growing rapidly, particularly in the developing world (A2)? Is the coastal zone earth's most important boundary and what are the economic-ecological challenges in this region (A7)? How can we use the past to predict future El Nino events and what are the socio-economic implications (A3)? How will socio-economic forces affect land use change in the future (B2)? How do changes in cultural, economic, social and political forces shape production and consumption and what are the associated environmental impacts (B6)?

The IPCC process is described through a series of case-studies (C6). How does IPCC feed into the Framework Convention and influence national policy making? How do the Global Change Programmes relate to IPCC and provide input to the process? What does IPCC mean for science in less developed countries?

The Earth System will be considered as a whole in Session B4 where the variety of Earth System models will be discussed along with the challenges of coupling models together– is the whole greater than the sum of the parts? A session on ground-truthing of Earth System models (A4) will review the progress that has been made in combining observations with model results and considers how we can make better use of existing and new techniques for data gathering and assimilation.

Each session will contain invited talks and presentations selected from submitted abstracts. In many cases, a poster cluster (see page 16) will be associated with the parallel session, which will draw attention to those posters and encourage discussion to continue offline. Further details of each session are available online at <http://www.sciconf.igbp.kva.se>

Wendy Broadgate, IGBP Secretariat. E mail: wendy@igbp.kva.se

Global Change Science and the Media

Getting any important environmental message on to the public agenda can be tough. The public has been primed to environmental issues through NGOs and the politics of the Kyoto protocol has been in the public mind for some time. But people are still uncertain about the extent or even the reality of issues such as global warming and are beginning to get tired of hearing about “the problems”. What is lacking is the scientific basis required to understand global change. It is time to help fill the knowledge vacuum and the Global Change Open Science Conference is the perfect opportunity.

Gone are the days when environmental issues were considered trendy in the media world. It seems you need to have an earth shattering (literally!) news angle - something that’s going to affect everyone on the planet tomorrow, not in 50 or 100 years. But often in the push to get these messages out and make them accessible to a wider audience, the science has been lost or boiled down to a single-issue bottom-line such as “the ice caps are melting”. The component parts of the bigger picture become separated and all the public sees is a confused jigsaw of seemingly unrelated information.

The Open Science Conference is surely a terrific opportunity to convey scientific knowledge about global change in the context of the whole Earth System. An advantage often overlooked is that the science of global change is itself fascinating and can be used as a vehicle to transport important messages to the public. When people understand and are inspired by the science, the implications for society are easier to convey.

The Open Science Conference will offer journalists a smorgasbord of interesting multidisciplinary science. What is the current state of the Earth and how does it function? What unseen processes are at work in the oceans and the atmosphere, cleaning up the messes we make? When the Earth can do no more cleaning, can technology come to our aid? Can we predict how much the climate, oceans and landscape will change and how societies will respond to the challenge of a changing Earth?

A team of scientists and science journalists is working behind the scenes from now until the conference, liaising with reporters, writing briefing notes and lining up interviews. During the conference there will be media briefings each day that will take the form of roundtable discussions on overarching themes. There is a very good chance that the Open Science Conference will be a highly significant media event resulting in international coverage of global change research.

Susannah Elliott, IGBP Secretariat, E mail: susannah@igbp.kva.se

HOTELS

July is high tourist season in Amsterdam and hotels, especially budget and low-cost hotels, are booking up fast. We are concerned that prospective Conference participants may have problems securing a hotel room.

PLEASE BOOK YOUR HOTEL ROOM NOW, EITHER WITH THE CONFERENCE ORGANISER VIA THE REGISTRATION PROCESS OR DIRECTLY WITH THE HOTEL.

Many budget and low cost hotels can be booked directly. Please consult the Amsterdam Tourist Bureau website for a comprehensive listing of hotels in the city, including contact information for each:

www.amsterdamtourist.nl

Tel: +31-900-400-4040 For information

Tel: +31-777-000-888 For hotel reservations

'Conference Monday': *Dutch Science Tours*

The Conference's host nation, the Netherlands, has a rich scientific tradition and has made strong contributions to global environmental change research. The Conference week begins on the 9 July with a relaxed day of visits to Dutch scientific institutions. It is a terrific opportunity to meet Dutch colleagues, see global change research 'in action' and view some of the Dutch polder landscape.

Ten science tours will be offered to a number of destinations around the Netherlands. All tours will begin and end at the Amsterdam RAI Congress Centre, the site of the Conference and participants will be able to register onsite and collect the conference materials before the beginning of the Conference. We recommend, however, that you note your preferences for the Dutch Science Tours well before the time of the conference. Instructions on registering for the tours will be posted on the web site shortly. All science tours are offered free-of-charge to participants and will be conducted in English.

Here is a preliminary programme for the day:

(More information and updates will soon be available on the Conference homepage)

Tour 1

Climate Change and Biosphere Research Programme (CCB) Wageningen University and Research Centre (WUR)

The International Soil Reference and Information Centre (ISRIC)

Time: 14.00 - 22.00 p.m.
Place: Wageningen and Kootwijk
Number of guests: max. 100

Wageningen University and Research Centre (Wageningen UR) is the agricultural research centre in the Netherlands. Wageningen UR is a collaboration between the Agricultural University and the Agricultural Research Institutes (such as Alterra and Plant Research International). National and international, Wageningen UR is a major player in the research fields of global change, land-use, climate change and biosphere, water management and sustainable development. Wageningen UR is closely involved with many IGBP programs, such as BAHC, GAIM, GCTE, LUCC and START.

The excursion will include visits to the Climate Change and Biosphere Research Programme (CCB) and the non-WUR organisation, International Soil Reference and Information Centre (ISRIC).

For more information about CCB and ISRIC see their web sites: www.wur.nl, www.alterra.wageningen-ur.nl, www.plant.wageningen-ur.nl, www.dow.wageningen-ur.nl/msa, www.dpw.wageningen-ur.nl/ento and www.agro.wageningen-ur.nl/ssg

Tour 2

Centre for Isotope Research / Centrum voor Isotopen Onderzoek (CIO), University of Groningen

Time: 9.00 a.m. – 22.30 p.m.
(N.B. early departure)
Place: Hornhuizen and Groningen
Number of guests: max. 40

The Centrum voor Isotopen Onderzoek (CIO, Centre for Isotope Research) is the central lab in the Netherlands for measurements of natural stable and radio-active isotopes. These analytical skills are being applied in many fields of science, but the CIO's emphasis is on the subjects: Global carbon cycle (atmospheric greenhouse gas studies), Paleoclimate studies using ice cores (with a laser measurement facility), and sediment archives (carbon-14 related calibration and paleo-climate studies).

Lutjewad is located at the foot of the sea dike of the Wadden sea. This is a remarkable tidal flat estuary, which is mostly dry during low tide. The excursion includes (if weather permits) a short walk on the "sea side" of the dike. The route back to Amsterdam leads through three of the four IJsselmeer polders: The North East polder (1942), Eastern Flevoland (1957) and Southern Flevoland (1968)

More information about CIO can be obtained from the website: www.cio.phys.rug.nl

Tour 3

Netherlands Centre for Climate Research / Centrum voor Klimaat Onderzoek (CKO)

Time:	afternoon
Place:	Lopik
Number of guests:	max. 75

CKO was established to improve co-ordination and co-operation in the field of global-change research of the Institute for Marine and Atmospheric Research (IMAU) of Utrecht University, the National Institute of Public Health and the Environment (RIVM), and the Royal Netherlands Meteorological Institute (KNMI). Currently, CKO has become one of the major expertise centres for atmospheric, oceanic and climatic research in the Netherlands and Europe. CKO not only aims to pursue a state-of-the-art scientific agenda but also bridges scientific insights and policy needs. CKO research will be presented near the Cabauw Mast for Atmospheric Research.

The excursion will offer you an opportunity to climb the mast and, when the weather is clear, overlook the landscape. Around the mast we will organise an information market, where researchers from the CKO, IMAU, RIVM and KNMI present some of their research.

Tour 4

Netherlands Energy Research Foundation / Energieonderzoek Centrum Nederland (ECN)

Time:	14.00 - 16.00 p.m.
Place:	Petten
Number of guests:	max. 45

The Netherlands Energy Research Foundation ECN is the largest independent organisation for energy research in the Netherlands. Over 600 highly qualified professionals carry out research on energy and energy-related topics. ECN is the birthplace of innovative technologies for a safe, efficient and ecologically sound energy supply. ECN research priorities include renewable energy (solar, wind, biomass, renewable energy in the built environment), clean use of fossil fuels, policy studies and energy efficiency.

This excursion will offer the participants an opportunity to visit the institute, where researchers from the ECN present some of their research concerning energy-related topics like solar, wind, biomass, etc .

More information about ECN can be obtained from the website: www.ecn.nl

Tour 5

Institute for Environmental Studies / Instituut voor Milieuvraagstukken (IVM), Free University of Amsterdam

Time:	09.00 a.m.- 18.30 p.m.
Place:	Amsterdam
Number of guests:	max. 50

Being the oldest environmental research institute in the Netherlands, the Institute for Environmental Studies (IVM) has built up considerable experience in dealing with the complexity of environmental issues. Its purpose is to contribute to the sustainability of societies and the rehabilitation and preservation of the environment through academic research. IVM addresses challenging environmental problems and offers both pragmatic and innovative solutions.

The excursion includes a series of lectures (Economics of Global Change, Societal Dimensions of Extreme Weather, Trade and Environment etc) and a scientific boat trip over the famous IJ.

More information about IVM can be obtained from the website: www.vu.nl/ivm

Tour 6

Netherlands Centre for River Research / Nederlands Centrum voor Rivierkunde (NCR) Utrecht University

Time:	11.00 a.m.- 19.00 p.m.
Place:	Utrecht and several places near the river Rhine
Number of guests:	max. 100

NCR promotes collaboration between different organizations involved in river research in order to strengthen the education and the scientific research of the river in Dutch universities.

About 25% per cent of the Dutch territory is below sea level with the lowest spot at 6.7 metres beneath sea level. When the first settlers came to the Netherlands around five thousand years ago, they found a marshy river delta. They raised terps or mounds to keep all their goods dry and they constructed primitive river dikes. Over the centuries since, water management has been perfected, with the development of dikes, overflows, drainage pools, pumping stations and storm flood barriers. Without the coastal dunes and river dikes, two thirds of the country would be inundated at times of flood.

The excursion will take participants to various places along the river with a guided discussion of the various cultural and historic elements and dike-enforcements.

More information about NRC can be obtained from the website: <http://hydr.ct.tudelft.nl/ncr>

Tour 7

Centre for Estuarine and Coastal Ecology / Centrum voor Estuariene en Mariene Oecologie (NIOO-CEMO)

Time:	full day excursion (N.B. early departure)
Place:	Yerseke
Number of guests:	max. 50

The Centre for Estuarine and Coastal Ecology of the Netherlands Institute of Ecology was formerly known as the Delta Institute and was created by the Royal Netherlands Academy of Arts and Sciences in 1957 to study the effects of the Delta Plan on the ecology of the delta area. The Centre has moved in 1997 to a new building in Yerseke on the dyke of the Oosterschelde. Its three departments are devoted to the study of marine microbiology (especially blue-greens and diatoms), meio- and macrobenthos, sediment biogeochemistry and modelling and littoral vegetations (salt marshes and seagrass beds).

The tour involves a visit to this special area, including a tour around the institute. The delta of the rivers Rhine, Meuse and Scheldt in the South-West of the Netherlands presents one of the most striking examples of human interference with coastal systems.

More information about NIOO-CEMO can be obtained from the website: <http://www.nioo.knaw.nl>

Tour 8

Netherlands Institute for Sea Research / Nederlands Instituut voor Onderzoek der Zee (NIOZ)

Time:	full day excursion (N.B. early departure)
Place:	Den Burg
Number of guests:	max. 45

NIOZ is a research institute associated with the Netherlands Organization for Scientific Research (NWO) and is presently one of the major European oceanographic institutes. Its mission is to pursue multidisciplinary marine research related to phenomena and mechanisms in coastal and shelf seas as well as the open ocean and involves close co-operation between physicists, chemists, geologists and biologists. Most of the research is concentrated in four major research themes: 1. Transfer and transport of matter and energy in the sea; 2. Transfer of matter in sediments; 3. Ecology of marine species, community dynamics and biodiversity; 4. Temporal variability in marine systems and climate change.

NIOZ is situated on the island of Texel, the biggest of the Dutch Wadden islands (see www.texel.nl). During the excursion the participants are guided by bus around the

island and visit the institute. NIOZ participates actively in CLIVAR, GLOBEC, JGOFS, LOICZ and SOLAS. The LOICZ IPO is located at the NIOZ and shall be visited during the excursion.

More information about NIOZ can be obtained from the website: www.nioz.nl

Tour 9

Space Research Organization Netherlands / Stichting Ruimteonderzoek Nederland (SRON)

Time:	afternoon
Place:	Utrecht
Number of guests:	max. 20

The Space Research Organization of the Netherlands (SRON) is part of the Netherlands Organization for Scientific Research (NWO) and is the national agency for space research. The SRON programme for Earth System Science is focussed on two main lines of research: Atmospheric Composition and Chemistry, and Gravity Field and Ocean Circulation. SRON laboratories also develop instruments for space-based observation

SRON will provide a tour of their research facilities and discuss their research projects.

More information about SRON can be obtained from the website: www.sron.nl

Tour 10

International Institute for Aerospace Survey and Earth Sciences / Internationaal Instituut voor Lucht- en Ruimte Kaartering en Aardwetenschappen (ITC), Technical University Enschede

Time:	afternoon (departure in the morning)
Place:	Enschede
Number of guests:	max. 50

The International Institute for Aerospace Survey and Earth Sciences (ITC) concentrates on earth observation, the generation of spatial information and on the development of data integration methods and provides knowledge of geoinformation management. ITC also provides education, research and consulting as a means to contribute to capacity building in the developing world.

ITC has offices in Enschede and Delft and invites participants to visit the institute where several demonstrations/workshops will be offered.

More information about ITC can be obtained from the website: www.itc.nl

Student participation

The Global Change Open Science Conference is an outstanding opportunity for young scientists interested in Global Change to meet not only the very best scientists in this field but also each other. The latest scientific results on Global Change will be synthesized and thoroughly discussed with a highly prestigious scientific audience. This conference will provide a terrific overview of the Global Change science that has been done during the past several years. Syntheses of the different core-projects will be made available at the Conference.

The last day will be a particularly important one for young scientists. The program presents visionary and creative new approaches for studying a complex planetary system in which human activities are intimately interwoven with natural processes. It will outline a research programme for our current era of increasing human domination of many global-scale processes.

There will also be an opportunity to meet with Dutch scientists and students involved in Global Change research on July 9 when tours to various scientific institutions in the country will take place (see pages 19-21).

During the Conference there will be dedicated Poster Sessions in which you are encouraged to participate. Students are explicitly invited to present the results of their research in the framework of the following Poster themes:

- Earth System, Planetary Metabolism and Global Element Cycles
- Looking back to the Future: Palaeo Studies of the Earth System
- Water Cycle, Water Resources, Water Security
- Climate Variability and Climate Change
- Oceans and Coasts
- Atmosphere and its Interfaces; Air Quality
- Sustaining the Land: Food, Biodiversity and other Services
- The Human Enterprise and Global Sustainability: Industry, Transport, Institutions, Vulnerability

In each of the 8 categories a prize of USD/ Euro 250,- will be awarded to the first (student) author of the best poster



Cheap accommodation, especially for students participating at the Conference, is available in Amsterdam, Utrecht and Haarlem. In Amsterdam there is the *Casa Academica* and *Arena* where you can get rooms for USD 30.- per night. Reservations will be made by the Conference Secretariat.

Students can make their own reservation for low budget accommodation which will be available in Youth Hostels, e.g. Youth Hostel 'Stadsdoelen' (Kloveniersburgwal 97, 1011 KB Amsterdam, tel: 003120-6246832, e-mail: stadsdoelen@njhc.org) and *Vondelpark* (Zandpad 5, 1054 GA Amsterdam, tel 003120-5898996) who will accommodate you for USD 20,- per night.

In Utrecht is *Strowis Hostel Low Budget Accommodatie* (Boothstraat 8, 3512 BW, Utrecht, tel 003130-2380280) which has rooms for 2 - 8 persons. *Hotel Domstad* (Parkstraat 5, 3581 PA Utrecht, tel. 003130-2310131) has single rooms per night for USD 25,- (incl. breakfast).

Make sure you make early reservations as many young people will visit Amsterdam or Utrecht during the summer.

The Organizing Committee of the Global Change Open Science Conference invites all young scientists from all over the world to come to Amsterdam to present their work, to discuss their research projects and inspire each other to outline a research programme for the future.

Eduard A. Koster, Conference Programme Committee

For more information see the conference website: www.sciconf.igbp.kva.se

IGBP and Related Meetings

All meetings listed below are open for all scientists to attend.

A full list of IGBP and related meetings can be found in our website: www.igbp.kva.se

2001

IGAC Symposium on "Atmospheric Chemistry in the Tropics: From Local to Global, From Air Pollution to Climate Change"

22-23 January, Bangkok, Thailand

Contact: Prof. Jariya Boonjawat, Email: jariya@start.or.th,
Internet: <http://www.start.or.th/IGAC7/>

Land use change and the terrestrial carbon cycle in the Asian-Pacific Region.

29 January-1 February, Kobe, Japan

GCTE/LUCC et al workshop: Contact: Pep Canadell,
Email: pep.canadell@gcte.org

CUBA 2001 - Symposium on Tropical and Subtropical Palynology (America - Africa)

9-14 February, La Habana, Cuba

Contact: Dr. Sonia MACHADO RODRIGUEZ,
Email: ecologia@unepnet.inf.cu

SPACC Meeting: Turning Points in the Benguela System

12-16 February, Cape Town, South Africa

Contact: Robert Crawford crawford@sfri.wcape.gov.za or
GLOBEC IPO, Email: globec@pml.ac.uk

Global Change and Sustainable Development in Southeast Asia: A regional science-policy conference

17-19 February, Chiang Mai, Thailand

Contact: Connie Chiang, Email: connie@start.or.th,
Internet: <http://www.icsea.or.id/sarcs2001/>

2nd Wadati Conference on Global Change and Polar Climate

7-9 March, Tsukuba Science City, Japan

Contact: Hiroshi L. Tanaka

IGBP workshop on "Nonlinear and threshold responses to global change". (pending final confirmation)

19-23 March, Durham, North Carolina, USA

Contact: Pep Canadell, Email: pep.canadell@gcte.org

31st Arctic Workshop

22-24 March, Amherst, USA

Contact: Julie Brigham Grette,
Email: brigham-grette@geo.umass.edu
Contact: Ray Bradley, Email: rbradley@geo.umass.edu

European Geophysical Society XXVI General Assembly

26-30 March, Nice, France

Internet: <http://www.copernicus.org/EGS/egs.html>

International symposium: Snowmelt erosion and related problems.

28-30 March, Oslo, Norway

Contact: Lillian Øygarden,
Email: lillian.oygarden@jordforsk.no
Internet: <http://www.jordforsk.no/Avdmiljo/snowmelt.htm>

Science Conference on terrestrial global change research in China.

29-30 March, Beijing, China

Contact: Pep Canadell, Email: pep.canadell@gcte.org

Neogene Climate of the Indian Ocean and the Indian Subcontinent

29-30 March, Kharagpur, India

Contact: Dr. Anil K. Gupta, Email: anilg@gg.iitkgp.ernet.in
<http://homepages.go.com/~neogeneclimate2001>

Estimating rare long-distance dispersal to predict plant persistence and migration.

9-13 April, Montpellier, France

Contact: Steve Higgins, Email: higgins@nbict.nbi.ac.za

Linking Models to Observations.

21-30 April, The Netherlands

Contact: Peter de Ruiter, Email: p.deruiter@frw.ruu.nl

Plant Functional Types in relation to Disturbance and Land Use: Synthesis and Challenges.

28 April-2 May, Israel (exact location to be announced)

Contact: Sandra Diaz, Email: sdiaz@gtwing.efn.uncor.edu or
Contact: Sue McIntyre, Email: sue.mcintyre@tag.csiro.au or
Local organization: Marcelo Sternberg,
Email: sterenm@popeye.cc.biu.ac.il

GCTE Focus 1 Workshop: Using isotopic traces in elevated CO2 studies

2-4 May, Beaufort NC, USA

Contact: Diane Pataki, Email: pataki@biology.utah.edu

GEOTROP 4th International Conference on Environmental Chemistry and Geochemistry in the tropics

7-11 May, Townsville, Australia

Contact: Greg Brunskill, Email: g.brunskill@aims.gov.au,
Internet: <http://www.tvl.clw.csiro.au/geotrop2001/>

SPACC - Retrospective data analyses meeting

29 May-1 June, Lima, Peru

Contact: Tim Baumgartner tbaumgar@cicese.mx or
GLOBEC IPO, Email: globec@pml.ac.uk

Climate Change and Variability in Northern Europe - Proxy Data, Instrumental Records, Climate Models and Interactions

6-8 June, Turku, Finland

Contact: Mia Rönkä, Programme Secretary,
Email: miaron@utu.fi

Millennial-scale events in the North Atlantic region during Termination 1

13-18 June, TBA

Contact: Dr. Jasper Knight, Email: j.knight@ulst.ac.uk

CoastGIS 2001: 4th International Conference on Computer Mapping and GIS for CZM- Managing the Interfaces

18-20 June, Halifax, Nova Scotia, Canada

More information on <http://agc.bio.ns.ca/coastgis2001>

Workshop on Emissions of Chemical Species and Aerosols into the Atmosphere

19-22 June, Paris, France

Contact: Email: clg@aero.jussieu.fr

Global Change Open Science Conference: Challenges of a Changing Earth

10-13 July, Amsterdam, The Netherlands

Contact: CONGREX Holland BV, The Netherlands.
Phone: +31 20 5040208, Fax: +31 20 5040225,
E mail: igbp@congrex.nl

Detecting Environmental Change: Science and Society

16-20 July, London, UK

Contact: Dr Catherine E. Stickley, Email:
c.stickley@ucl.ac.uk

Change and Sustainability of Pastoral Land Use System in Temperate East Asia: an open symposium

26-30 July, Mongolia

Contact: T. Chuluun, Email: chuluun@nrel.colostate.edu

LUCC Workshop, Linking cover change and household level data

Summer 2001-Winter 2002, Honolulu, Hawaii

Contact: Email: FosJ@EastWestCenter.org,
mishra@hawaii.edu, ron_rindfuss@unc.edu,
walsh@geog.unc.edu

Climate Conference 2001

20-24 August, Utrecht, The Netherlands

Contact: M. van Haersma Buma, Email: m.buma@fbu.uu.nl
Internet: <http://www.phys.uu.nl/~wwwimau/cc2001.html>

PAGES - PEP III Past Climate Variability in Europe and Africa

27-31 August, Les Centre de Congrès, Aix-en-Provence, France

Contact: Dr. Catherine Stickley, Email: c.stickley@ucl.ac.uk
Internet: www.geog.ucl.ac.uk/ecrc/pep3

Paleoceanography Methodology Workshop

August (tbc), Munich, Germany

Contact: Jurgen Alheit,
Email: juergen.alheit@io-warnemuende.de

International Conference on Paleoceanography VII

16-22 September, Sapporo, Japan

Contact: Hisatake Okada,
Email: icp7@cosmos.sci.hokudai.ac.jp
Internet: <http://www.ijnet.or.jp/JTB-CS/icp7/>

Tree Rings and People. An International Conference on the Future of Dendrochronology

22-26 September, Davos, Switzerland

Contact: Paolo Cherubini,
Email: paolo.cherubini@wsl.ch
Internet: <http://www.wsl.ch/forest/dendro2001/>

3rd International Conference on Land Degradation and Meeting of the IUSS SubcommitteeC – Soil and Water Conservation

24-28 September, Rio de Janeiro, Brazil

More information on <http://www.cnps.embrapa.br/ICLD>

SPACC - Spatial dynamics of pelagic fish in upwelling areas

September (tbc), Cape Town, South Africa

Contact: Pierre Freon: pfreon@sfri.wcape.gov.za
Contact GLOBEC IPO, Email: globec@pml.ac.uk

PNEC-LOICZ Workshop on Southwestern European estuaries – biogeochemical fluxes

September, Villefranche, France

Contact: Dr J-P Gattuso, Villefranche.

6th International Carbon Dioxide Conference**1-5 October, Sendai, Japan**

Contact: Dr. Shuji Aoki,
 Email: secre@co2.geophys.tohoku.ac.jp
 Internet: http://co2.geophys.tohoku.ac.jp/

Open Meeting of the Human Dimensions of Global Environmental Change Research**6-8 October, Rio de Janeiro, Brazil**

Contact: Email: open.meeting@ciesin.org
 http://sedac.ciesin.org/openmeeting

2nd Swedish National PAGES meeting**11-14 October, Sigtuna, Sweden**

Contact: Gunhild (Ninis) Rosqvist,
 Email: ninis@natgeo.su.se
 http://www.geo.su.se/naturgeo/klimat

2nd International Nitrogen Conference (N2001),**14-18 October, Potomac Maryland, USA**

Contact: Jim Galloway, Email: jng@virginia.edu
 Contact: Dr. Ellis Colwing, Email: ellis_cowling@ncsu.edu
 Internet: http://eas.sdsc.edu/n2001

Joint IAPSO-IABO Assembly and XII Colloquium: 2001 - An Ocean Odyssey**21-28 October, Mar del Plata, Argentina**

Contact: Paola Rizzoli, Email: rizzoli@MIT.EDU
 Contact: GLOBEC IPO, Email: globec@pml.ac.uk
 Contact: Hugh Ducklow, Email: duck@vims.edu
 Contact: Karin Lochte,
 Email: karin.lochte@io-warnemuende.de
 Contact: Email: gmperill@criba.edu.ar
 Email: iado@criba.edu.ar

VI International Symposium and Field Workshop on Paleopedology (ISFWP)**October, Mexico City, Mexico**

Contact: Dr. Elizabeth Solleiro-Rebolledo
 Email: solleiro@geologia.unam.mx
 Internet: http://inqua.nlh.no/commpl/pedmeet2.htm

Abrupt Climate Change Dynamics**10-15, November, Il Ciocco, Italy**

Contact: Keith Alverson, Email: alverson@pages.unibe.ch

1st Symposium GLOBEC-Spain**28-30 November, Cadiz, Spain**

Contact: Fidel Echevarria, symposium.globec@uca.es_or
 GLOBEC IPO, Email: globec@pml.ac.uk

Oceans and Coasts at Rio+10: assessing progress, addressing continuing and new challenges**3-7 December, UNESCO Paris, France**

Contact: Dr Biliانا Cicin-Sain, Email: bcs@udel.edu

Land use change and crop-associated biodiversity.**TBA, Nairobi, Kenya**

Contact: Valerie Brown,
 Email: ValerieBrown@compuserve.com

Global analysis of base rates and impacts of biotic invasions.**TBA, Santa Barbara, USA**

Contact: Mark Lonsdale
 Email: Mark.Lonsdale@ento.csiro.au
 Contact: Montserrat Villa, Email: vila@cc.uab.es

Note to contributors to the Global Change NewsLetter

Articles should achieve a balance of (i) solid scientific content, and (ii) appeal to the broad global change research community rather than to a narrow discipline. Articles should be between 800 and 1500 words in length, and be accompanied by one to three key graphics or figures (colour or black and white).

Letters in response to an article in this NewsLetter or relating to global change issues generally should be a maximum of 200 words in length and include author and contact details.

Deadlines for 2001:

March issue (special edition on LBA) Deadline for material: February 9

June issue Deadline for material: May 11

September issue Deadline for material: August 10

December issue Deadline for material: November 2

Send contributions by email to the Editor, Susannah Elliott, Email: susannah@igbp.kva.se;
 Phone: +46 8 16 64 48; Fax: +46 8 16 64 05



Letter to the Editor, from Pierre Biscaye:

The article by Schneider, Bard and Mix in NewsLetter 43 (Oct 2000) presents several variables to be used in establishing "...an international consensus on the definition of the 'Ice Age' or 'LGM (Last Glacial Maximum) time slice...". It is not clear to me in the article if, or to what extent, the distribution of continental ice will be used in establishing this "time slice". Because the term "Last Glacial Maximum" was first used in connection with the maximum areal distribution of the great continental glaciers, it would seem that a study of this phenomenon, or at least a compilation of existing maps of dated glacial moraines should logically play a role in this effort. That ice-age maximum in ice distribution has its marine counterpart in data on lowered sea level (a variable that should also be included), but, because of the topography of the continental glaciers, there is not necessarily a linear relationship between the two. Indeed, there is something about the forcing functions of climate change to be learned from the relative timing of all possible variables that reflect "glacialness".

*Pierre E. Biscaye, Lamont-Doherty Earth Observatory of Columbia University, NY.
E-Mail: biscaye@LDEO.columbia.edu*

Response, from Alan Mix, Ralph Schneider, Edouard Bard:

Pierre Biscaye requests clarification on whether the EPILOG initiative (Environmental Processes of the Ice Age, Land, Ocean, Glaciers) considered the distribution of continental ice in establishing a Last Glacial Maximum (LGM) time slice. EPILOG's LGM definition arose as an international consensus view, at the first EPILOG science meeting reported in the IGBP newsletter. The EPILOG LGM is based on "the period of maximum globally integrated ice volume, in accordance with the glacial eustatic sea-level low stand" (Schneider et al., 2000). The primary data are records of ice-equivalent sea level as global integrators of regional ice-volume changes (Lambeck et al., 2000) but the specific LGM definition is chronologic, based on calendar-corrected ^{14}C ages of the sea-level low stand off Northern Australia (Yokoyama et al., 2000). EPILOG's preferred LGM interval is 19-23 ka, but an alternate of 18-24 ka allows for dating uncertainties.

The celebrated LGM horizon of CLIMAP (approximately 18 ka ^{14}C , roughly equal to 21 calendar ka) lies within the EPILOG LGM interval. CLIMAP's LGM was originally defined, for stratigraphic convenience, by a distinct minimum of calcium carbonate percentages in North Atlantic sediments prevalent between 40° and 60°N (McIntyre, et al., 1976), where the first regional reconstruction of sea-surface temperatures was focused. The choice of this event, dated by CLIMAP at approximately 18 ka ^{14}C , was justified as an approximate midpoint of a broad interval of glacial advances dated on land. Independently, Pisias (1976) found that the average age of a maximum in foraminiferal d^{18}O in low-resolution records was 17.9 ± 1.3 ka ^{14}C . This chronologic link allowed CLIMAP to calibrate biostratigraphic and lithostratigraphies in other regions to their North Atlantic LGM level using d^{18}O in a subset of cores, with a precision of a few thousand years (CLIMAP, 1976; Shackleton, 1977). For example, in a later SST reconstruction (CLIMAP, 1981) 24% of the cores used d^{18}O stratigraphy. Ironically, CLIMAP's LGM carbonate minimum in the North Atlantic probably corresponds to either one of the so-called Heinrich ice rafting events (for example HE-1 is now dated at 15.0 ± 0.7 ka, and HE-2 is dated at 22.2 ± 1.1 ka ^{14}C ; Elliot et al., 1998), or to one of the intervening smaller ice rafting events that dilute the concentration of biogenic carbonate. Such events represent anomalously cold transient events within the broader LGM interval (Bard et al., 2000).

We now know, from detailed records generated in the 20 years since the end of CLIMAP, that changes in sea level (or ice volume) and d^{18}O are partially decoupled (Mix and Ruddiman, 1985; Clark and Mix, 2000) and that the chronologically defined LGM interval need not coincide with the maximum areal extent of ice sheets. Certainly not all glaciers reached their maximum, and temperatures were not everywhere at their minimum, at the same time. We agree that much can be learned from the relative timing and amplitude of changes in many variables associated with ice-age climate. Indeed these issues underlie EPILOG's aim to catalyze a rich community synthe-

sis of LGM environments on land and in the sea, including regional reconstructions of the mean state, variability within, and transitions into and out of the LGM state, for the purpose of exploring and understanding these dynamic global-scale changes.

More details on the first EPILOG workshop on environmental reconstruction of the LGM can be found in Mix et al. (2001). Results from a second EPILOG workshop, which focused on ice sheets and sea levels, are summarized by Clark et al. (submitted), and will be documented fully in a forthcoming special issue of *Quaternary Science Reviews*.

Alan C. Mix, Oregon State University, OR. Email: mix@oce.orst.edu

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Correspondence

Letters can be in response to an article in an earlier edition of the Newsletter or about IGBP science/issues in general. Please keep letters as brief as possible (maximum of 200 words) and send to Susannah Elliott at the IGBP Secretariat (Email: Susannah@igbp.kva.se, Fax: 46 8 16 64 05).

GLOBAL CHANGE NEWSLETTER

Edited by Susannah Elliott

Layout by John Bellamy

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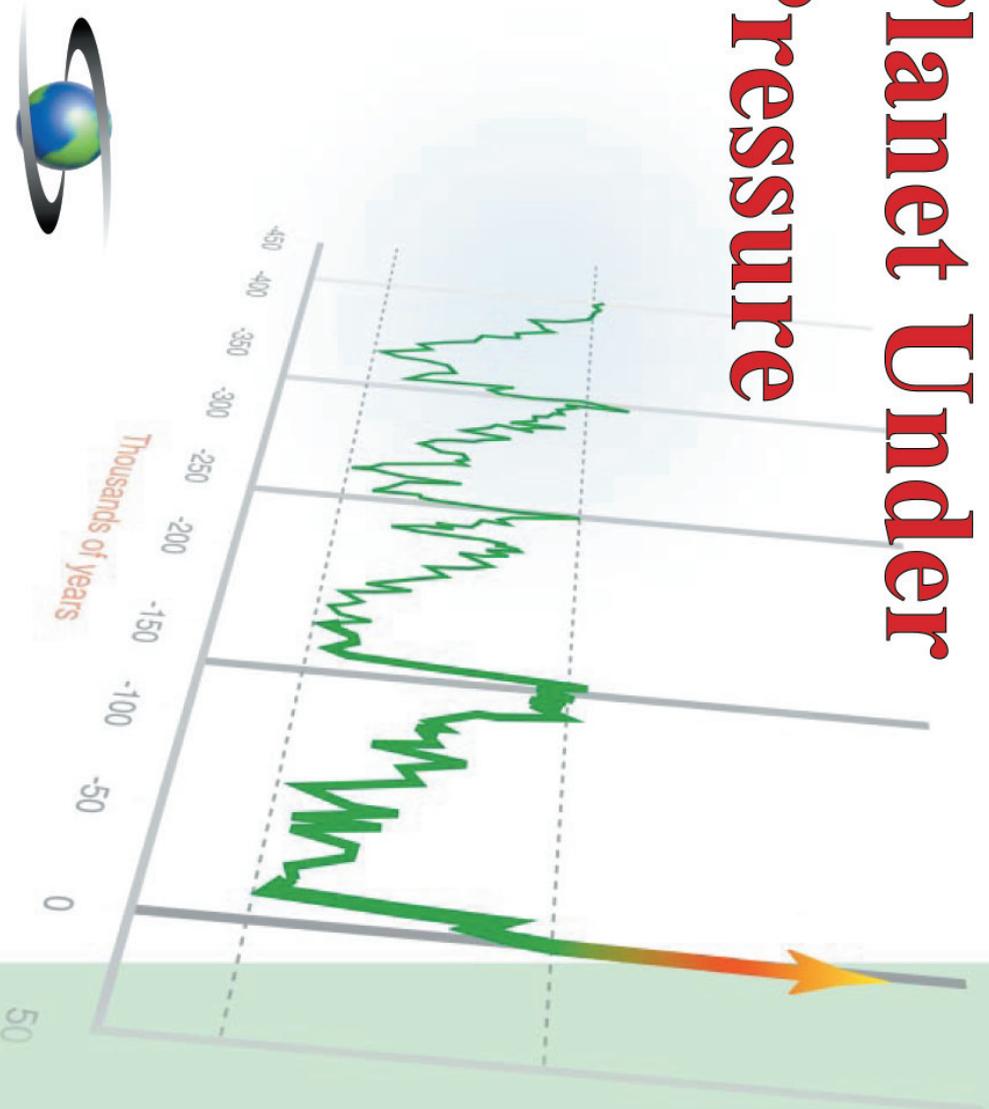
The IGBP Report Series is published in annex to the Global Change Newsletter



ISSN 0284-5865



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