Integrated Land Ecosystem - Atmosphere Processes Study

iLEAPS Newsletter

Issue No. 1 – November 2005

http://www.atm.helsinki.fi/ILEAPS

iLEAPS is a core project of IGBP GLOBAL CHANGE

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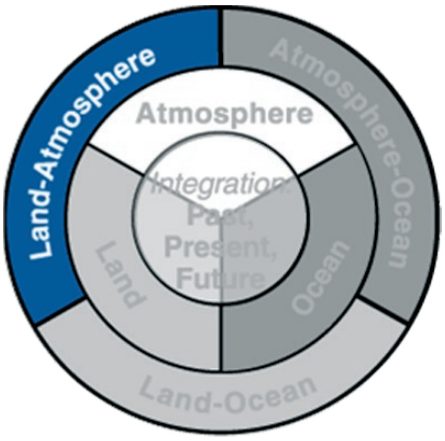
Editorial

A Welcome from the iLEAPS co-Chairs Meinrat O. Andreae and Pavel Kabat

IGBP, the International Geosphere-Biosphere Programme, completed its first phase of activities in 2003. This has provided a welcome opportunity to take stock of successes and failures over the first decade, and to make plans for the future, building on the lessons learned over a decade of IGBP research. The most impressive success of IGBP, in our view, was that it created a community of researchers from previously disconnected scientific disciplines, who now share a common vision of the Earth as an integral system. The concept of an "Earth System", which was a fairly abstract idea to most of us in the early days of the IGBP, is now the fundamental paradigm shaping our science.

This shift is also reflected in the "organization chart" of IGBP II.The "Bretherton Diagram", showing components of the Earth System as separate boxes connected by arrows, was commonly used to illustrate research activities on these components (oceans, atmosphere, biota, etc.) and their interactions. In the "IGBP Onion", the major Earth System compartments, atmosphere, land, and ocean, are merged into one symbol, with each segment representing one core project of the new IGBP II. Surrounding them are three "interface" projects that have been set up to investigate the interactions between compartments.



iLEAPS, the Integrated Land Ecosystem Atmospheric Processes Study, is the land-atmosphere project in IGBP II. Its objective is to investigate the complex and numerous interactions and feedbacks at the interface between land and atmosphere. iLEAPS is building on key findings of previous IGBP projects, most notably BAHC (Biospheric Aspects of the Hydrological Cycle) and IGAC (International Global Atmospheric Chemistry).

One example of interactions addressed in iLEAPS is the massive perturbation of the tropical atmosphere by the combination of land use change (deforestation) and the emission of atmospheric pollutants, especially aerosols from industrial combustion and biomass burning. Since the tropics are the "heat engine" that drives the large-scale atmospheric circulation, the perturbation of tropical cloud and rainfall processes is expected to affect climate dynamics worldwide. Anthropogenic emissions of aerosols and their precursors, occurring mainly on the land surface, affect the properties of clouds and thereby the intensity and location of rainfall, as well as the vertical redistribution of pollutants in the atmosphere. These effects feed back on the land surface by affecting the terrestrial water cycle, which in turn has consequences for water availability, agricultural productivity and the emission of trace gases from land ecosystems.

iLEAPS, as a land – atmosphere interface project, will naturally work in close collaboration with the corresponding atmosphere and land projects of IGBP-II, i.e., IGAC II and the Global Land Project (GLP). It must be also tightly linked with the programs that address the next higher levels of integration in Earth System, and with Integrated Regional Studies (IRS) planned within the Earth System Science Partnership (ESSP). iLEAPS will also closely interact with the World Climate Research Programme (WCRP), particularly with the project of the Global Energy and Water Cycle Experiment (GEWEX) such as Global Land/Atmosphere System Study (GLASS) and Global Atmospheric Boundary Layer Study (GABLS) and with GEWEX Radiation Panel (GRP).

In this Newsletter, you will find an overview of the science and implementation plan for iLEAPS, describing the exciting new directions this project is embarking on. Like all of IGBP, iLEAPS is driven "bottom-up" to a great extent – it lives through the activities that members of the scientific community design to implement land-atmosphere research. We hope that this newsletter and the iLEAPS science plan motivate you to become part of iLEAPS community by joining some of the ongoing projects, or even by initiating one of your own! We are planning to have articles in future editions of the newsletter to introduce the first iLEAPS projects to you. As results are coming in from the projects, we expect to have articles summarizing highlights from ongoing iLEAPS research.

In this, the first issue of the iLEAPS Newsletter, we also want to introduce ourselves. iLEAPS has two co-chairs, M. O. "Andi" Andreae and Pavel Kabat, and an international Scientific Steering Committee with 18 members, who cover a wide range of scientific backgrounds and geographic origins. We are giving you some background in the newsletter about who they are, what their scientific expertise is, and how to contact them. If you are interested to become involved in iLEAPS, they would be happy to serve as contact points for you! Another way to get in touch with iLEAPS is through our International Project Office in Helsinki, where Anni Reissell, our Project Officer, and her team manage iLEAPS' affairs. And, last not least, let us invite you to iLEAPS' first Science Conference, to be held in Boulder, Colorado, in January 2006! This will be a great opportunity to hear about the results of the first iLEAPS projects and to draw up plans for future ones.

1st iLEAPS Science Conference Boulder, Colorado, USA 21 – 26 January 2006

Registration open

iLEAPS

THEMES

1. Land-atmosphere exchange of reactive and long-lived compounds: Key interactions and feedbacks in the Earth System
2. Feedbacks between land biota, aerosols, and atmospheric composition in the climate system
3. Feedbacks and teleconnections in the land surface, vegetation, water, and atmosphere system
4. Measurement and modelling of material and energy transfer in the soil, canopy, and boundary-layer system
5. Modelling of land-atmosphere interactions: Towards the Earth System approach

IMPORTANT DATES

May 2005	2nd Announcement and call for papers
30 September CLOSED	Deadline for submitting papers
22 October 2005	Confirmation of papers
7 November 2005	Closing date for early bird registration
21 - 26 January 2006	Conference
26 - 28 January 2006	Post-conference workshop

INVITED SPEAKERS

Dennis Baldocchi, USA
Richard Betts, UK
Guy Brasseur, Germany
Martin Claussen, Germany
Graham Feingold, USA
Robert C. Harriss, USA
Elisabeth A. Holland, USA
Bert Holtslag, Netherlands
Carlos Nobre, Brazil
Maria Kanakidou, Greece
Franz X. Meixner, Germany
Roger A. Pielke Sr., USA
Phil Rasch, USA
Michael Raupach, Australia
Piers J. Sellers, USA
Soroosh Sorooshian, USA
Timo Vesala, Finland

SCIENTIFIC COMMITTEE

Meinrat O. Andreae, Germany
Pavel Kabat, Netherlands
Almut Arneth, Sweden
Paulo Artaxo, Brazil
Roni Avissar, USA
Mary Anne Carroll, USA
Torben R. Christensen, Sweden
Nathalie de Noblet-Ducoudré, France
Paul Dirmeyer, USA
John Finnigan, Australia
Laurens Ganzeveld, Germany
Sandy Harrison, UK
Michael Keller, USA
Markku Kulmala, Finland
Luanne Otter, South Africa
Daniel Rosenfeld, Israel
Kazuyuki Yagi, Japan
Xiaodong Yan, China
Anni Reissell, Finland

LOCAL ORGANIZERS

Michael Boy
Alex Guenther
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SUPPORT

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NCAR Atmospheric Chemistry Division
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NRF National Research Foundation South Africa
climate changes spatial planning

OFFICIAL WEBSITE
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The IPO is sponsored by University of Helsinki, Finnish Meteorological Institute, and Ministry of Education, Finland

iLEAPS is a core project of IGBP
GLOBAL CHANGE IGBP

Fotos © University Corporation for Atmospheric Research

People

iLEAPS Scientific Steering Committee

Meinrat O. Andreae, Prof. Dr., iLEAPS co-Chair

Director of the Biogeochemistry Department at the Max Planck Institute, Mainz (Germany) and adjunct professor at the Faculty of Graduate Studies, York University, Ontario (Canada). He has received several awards: World Meteorological Organization Gerbier-Mumm Award (1988), Fairchild Distinguished Scholar Award, California Institute of Technology (1993), Member of Academia Europaea (1995), Most Highly Cited Researchers (2003). He is member of the Scientific Steering Committee for the International Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) and the European Commission Science Panel on Atmospheric Composition Change. He has led the IGBP-IGAC project on biomass burning (BIBEX) and served in Scientific Steering Committees (IGBP) and European Commission Science Panel. His background is in geochemistry and oceanography. His scientific expertise is in oceanography, tropical aerosols, terrestrial, oceanic, and atmospheric chemistry.
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Pavel Kabat, Prof. Dr., iLEAPS co-Chair

Professor in climate hydrology at Wageningen University and Research Centre, Wageningen (Netherlands), science director of a national research programme on Climate and Spatial Planning, scientific director of International Dialogue on Water and Climate, chair of International Science Panel of Global Energy and Water Experiment-International Satellite Land Surface Climatology Project of the World Climate Research Programme (GEWEX-ISLSCP / WCRP), research programme overall co-ordinator of European contribution to the LBA. He served as chair of the International Scientific Steering Committee of IGBP, core project Biospheric Aspects of the Hydrological Cycle (BAHC). His research focuses on hydrology, regional and global water cycles, hydrometeorology, water and carbon cycles, measurements and modelling of land –atmosphere exchange processes, climate interactions, and environmental monitoring in relation to climate change.
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Almut Arneth, Dr.

Leader of MCT-ELSA, a Marie Curie Excellence Team on Exchange Processes in the Land Surface - Atmosphere System, Lund University (Sweden). Her background is in ecophysiology and environmental physics. Her research interests include the long-term responses of plants and ecosystems to climate change and atmospheric CO_2 concentration, constraints on, and feedbacks of, biogenic trace gas emissions in the land-atmosphere system and the process-based modelling of soil, plant and ecosystem biogeochemistry. She has led projects on ecosystem-atmosphere exchange in Botswana, New Zealand, Siberia and Northern Sweden, and participated in Carbonsink-LBA in Amazonia.
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Paulo Artaxo, Prof. Dr.

Professor of environmental physics at the University of São Paulo (Brazil). Participant in several major international research efforts, such as IGAC, CACGP, IPCC, WMO and others. He has acted as member of several scientific steering committees, such as at the International Global Atmospheric Chemistry Program IGAC/IGBP, Deposition of Biologically Important Trace Species (DEBITS) project, Biomass Burning Experiment (BIBEX) project, Polar Atmospheric Snow Chemistry Committee (PASC), and the IPCC Panel on Global Aviation Effects. He is one of the coordinators and member of the Scientific Steering Committee of the LBA Experiment and member of the IPCC working group on climate change impacts. He was general secretary of the CACGP, the IAMAS Commission on atmospheric chemistry and global pollution. His scientific experience is in radiative effects of aerosols, focusing on tropical aerosols, biogeochemical cycling in the Amazon basin, dry and wet deposition, biogenic and biomass burning aerosols. He also works with urban air pollution in megacities.
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Mary Anne Carroll, Prof. Dr.

Professor of Atmospheric, Oceanic and Space Sciences and Chemistry at the University of Michigan (USA). Director of the Program for Research on Oxidants: Photochemistry, Emissions, and Transport (PROPHET), Executive Director of the Biosphere-Atmosphere Research and Training (BART) Program, and member of the National Academy of Sciences Board on Atmospheric Sciences and Climate. She has focused on instrument development and field studies of the role of reactive nitrogen oxides in oxidant photochemistry in the troposphere and stratosphere. She has coordinated and taken part in ground-based and airborne measurements of NO_x, NO_y, O_3, and CO in North America, South America, Antarctica, Norway, Tahiti, Christmas Island, and Easter Island. She is also interested in atmosphere-biosphere interactions, especially atmosphere-forest exchange of reactive nitrogen. She coordinates the iLEAPS recognized project LEARN (Land Ecosystem-Atmosphere Reactive Nitrogen).

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Roni Avissar, Prof. Dr.

Dr. Avissar is W.H. Gardner Professor and Chair of the Department of Civil and Environmental Engineering at Duke University, North Carolina (USA). He is a member of the Global Water Cycle Steering Committee of the US Global Climate Research Program and of the Science Steering Committee of the Large-Scale Biosphere Atmosphere Experiment in Amazonia (LBA). He also serves as a member of various committees for the AGU. His background is in soil and water sciences, micrometeorology, and mesoscale meteorology. His expertise is in environmental fluid dynamics: measuring and modelling land-atmosphere and ocean-atmosphere interactions at micro- to global scales; including dynamics of the atmosphere, lakes and oceans, regional and global weather and climate, hydrometeorology, soil-plant-atmosphere relationships, material dispersion and diffusion, impact of tropical deforestation on local, regional and global hydroclimatology.

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Paul Alan Dirmeyer, Dr. (2004-2005)

Associate research scientist at the Center for Ocean-Land-Atmosphere Studies, Calverton (USA). He is chair of Global Soil Wetness Project (GSWP/GEWEX) and Global Land Atmosphere System Study (GLASS/GEWEX), as well as member of Modelling and Prediction Panel (GMPP/GEWEX) and Global Water Cycling Program (GWCP). Principal investigator for the following projects: Collaborative Research on Characterizing Land Surface Memory to Advance Climate Prediction (NSF), Multi-model Investigations of Climate in the Global Land-Atmosphere System (NASA) and co-investigator for Predictability and Variability of the Present Climate (NASA, NOAA, NSF), Land Information Systems (NASA). His background is in meteorology. His research area is surface hydrology, biogeochemistry, hydrometeorology, hydroclimatology, climate simulation, modelling land-atmosphere and ocean-atmosphere interactions, land surface in climate predictability, forecasting, effect of vegetation on historic climate, water cycle, atmosphere-biosphere general circulation modelling. From January 2006, Associate Program Director at the National Science Foundation (USA).

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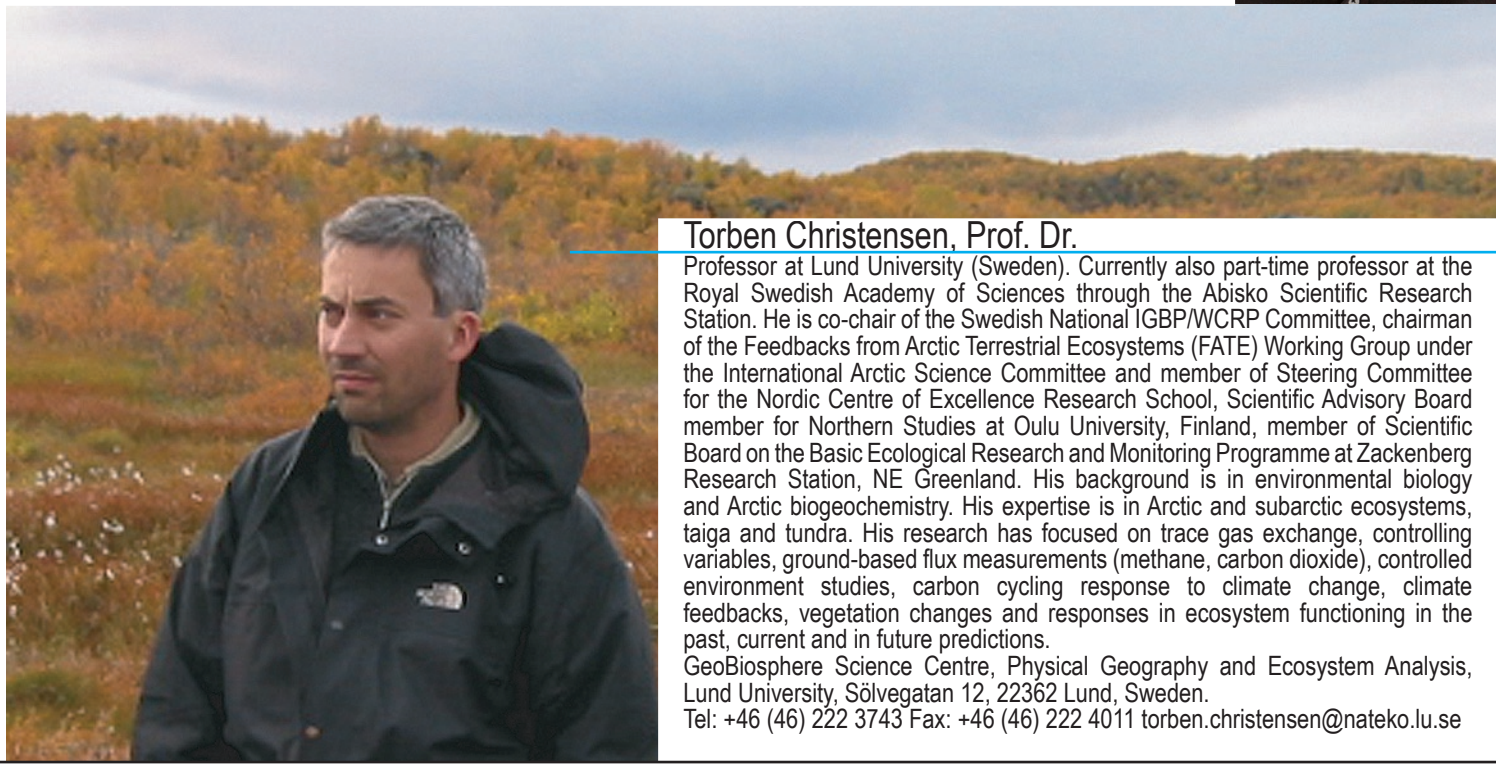

Torben Christensen, Prof. Dr.

Professor at Lund University (Sweden). Currently also part-time professor at the Royal Swedish Academy of Sciences through the Abisko Scientific Research Station. He is co-chair of the Swedish National IGBP/WCRP Committee, chairman of the Feedbacks from Arctic Terrestrial Ecosystems (FATE) Working Group under the International Arctic Science Committee and member of Steering Committee for the Nordic Centre of Excellence Research School, Scientific Advisory Board member for Northern Studies at Oulu University, Finland, member of Scientific Board on the Basic Ecological Research and Monitoring Programme at Zackenberg Research Station, NE Greenland. His background is in environmental biology and Arctic biogeochemistry. His expertise is in Arctic and subarctic ecosystems, taiga and tundra. His research has focused on trace gas exchange, controlling variables, ground-based flux measurements (methane, carbon dioxide), controlled environment studies, carbon cycling response to climate change, climate feedbacks, vegetation changes and responses in ecosystem functioning in the past, current and in future predictions.

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John Finnigan, Dr.

Director of CSIRO Centre for Complex System Science and chief research scientist at CSIRO Atmospheric Research, F.C. Pye Laboratory (Australia). He has served as co-chair of the International Review Committee of the CarboEurope Program supported by the European Union, chair of CSIRO Science Investment Focus Group on Complex System Science, member of CSIRO Science Forum, as well as member of several scientific and practical committees within CSIRO. He has worked at University of Colorado/NOAA/ERL/NCAR in Boulder, Colorado (USA) and Georgia Tech in Atlanta, Virginia (USA). His research interests are Complex Systems Science, network theory and agent based modelling, application of dynamical systems theory and low dimensional models to atmospheric surface layer flow, atmospheric boundary layer flow over vegetation canopies and complex topography, wind tunnel and theoretical models of atmospheric flows and their combination with field experiment, the theoretical and philosophical basis of surface-atmosphere exchange measurement.

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Laurens Ganzeveld, Dr.

Dr. Ganzeveld is research scientist at Max Planck Institute for Chemistry, Mainz (Germany). He is member of the Global Emission Inventory Activity (GEIA) and co-chair of the workgroup land within the Community Earth Systems Models (COSMOS) project. His background is in atmospheric physics and environmental sciences. His research interests are atmospheric chemistry, atmospheric chemistry-climate interactions, surface trace gas and aerosol exchanges, micro- and planetary boundary layer meteorology, and modelling BVOC transport and dry deposition in canopies.

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Sandra Harrison, Prof. Dr.

Professor at the University of Bristol (United Kingdom). She has served as member in several international project committees, such as Co-operative Holocene Mapping Project (COHMAP), Global Palaeohydrology Project, Palaeohydrological changes in the temperate zone during the last 15 000 years: lake and mire environments (IGBP Project 158B), Coordinating Panel on Biospheric Aspects of the Hydrological Cycle (BAHC/IGBP), and Study of the Last InterGlacial in the Arctic and subarctic (LIGA). She is currently coordinator for Circum-Mediterranean Biomes (CiMBIO) project, Indian Subcontinent Biomes (INDSUBIO) project and member of several scientific steering committees, such as Paleoclimate Modelling Intercomparison Project (PMIP), Pan-Arctic Iniative (PAIN), and initiative for an Earth System Atlas (AIMES/IGBP). Her background is in geology. Her areas of expertise are palaeoclimate, general circulation modelling, global hydrological modelling, global biome models, dust sources and deposition, role of dust in climate changes at present, in the past and future, palaeo perspective.

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Markku Kulmala, Prof. Dr.

Professor in physics at the Department of Physical Sciences and Director of the Division of Atmospheric Sciences at the University of Helsinki (Finland). Principal investigator of several large scientific projects supported by the European Commission and related to climate change (BOND, CASOMIO, PARTS, QUEST), health effects of air pollution (HEAPPS), origin and formation of secondary organic aerosol (OSOA), interhemispheric differences in cirrus properties from anthropogenic emissions (INCA), North Atlantic Aerosol Characterization (ACE), for example. He leads the Nordic Centre of Excellence on Biosphere-Aerosol-Cloud-Climate Interactions (BACCI) and the Academy of Finland Centre of Excellence on physics, chemistry and biology of atmospheric composition and climate change. Expertise in atmospheric aerosols, modelling of aerosol processes, atmospheric ions and electricity, microphysics of clouds, boreal forest.

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Nathalie de Noblet-Ducoudré, Dr.

Dr. de Noblet-Ducoudré is research scientist at Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Gif-sur-Yvette cedex (France). She is a member of several scientific committees: national program on climate dynamics, national program developed to understand past climate changes in tropical areas (ECOFIT), committee for evaluation of the Climate and Land Surface Systems Interaction Centre (CLASSIC, Earth Observation Centre of Excellence) program launched by the Natural Environment Research Council (NERC) in the United Kingdom. She is involved in several projects for the Natural Environmental Research Council in the United Kingdom and the National Science Foundation. She was a National Research Council post-doctoral fellow at NASA/JPL in Pasadena, California (USA). Her background is in meteorology. Her areas of expertise are climate dynamics, modelling of global terrestrial surface-atmosphere interactions focusing on hydrology, energy balance, and land cover impacts, also in terms of past climate changes.

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Senior research officer at the University of Witwatersrand, Johannesburg (South Africa). She is a regional coordinator of the international Southern African Research Initiative (SAFARI 2000), co-convenor of the Biosphere-Atmosphere Trace Gas Exchange (BATREX/IGBP) program. She is member of an international project investigating air pollution in South Africa (Brown Haze II) and member of the Steering Committee for the international group supporting global change research in developing countries (Pan African START). She has worked at NCAR in Boulder, Colorado (USA), Max Planck Institute for Chemistry in Mainz (Germany) and at the University of Montana (USA). Her background is in ecophysiology, but she has more recently worked in the field of biogeochemistry. Her areas of expertise are terrestrial ecology and tropospheric chemistry, measurements and modelling of VOCs and interaction with aerosol products, ecology of South-African (savanna) ecosystems, particularly soil water deficit aspects.

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Director and professor of Key Laboratory of East Asia Climate – Environmental Research at the Chinese Academy of Science, Beijing (China). Dr. Yan has implemented a number of research projects as principal investigator and he is currently chief scientist of CAS project on Northern China Water Resources Study. For his scientific work, Dr. Yan was rewarded International START Young Scientist Award in 2001. He is also active in international exchange and cooperation in global change study participating in a number of international projects. He has organized several international conferences and edited international scientific journal special issues. His background is in mathematics and ecology and he has been a visiting scientist at the University of Virginia, Charlottesville, Virginia, USA. His areas of expertise are global change impacts, ecosystem productivity, climate-vegetation interaction modelling, land-surface biological processes modelling and terrestrial carbon cycle modelling, tree layer dynamics, Gap model.

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Michael Keller, Dr.

Dr. Keller is NASA project scientist for the LBA-ECO component of the Brazilian led Large Scale Biosphere Atmosphere Experiment in Amazonia (LBA), affiliate professor at the University of New Hampshire (USA), and Research Scientist at the International Institute of Tropical Forestry, US Forest Service. He served as co-convenor of the Biosphere-Atmosphere Trace Gas Exchange in the Tropics (BATGE) activity under IGBP/IGAC. He is co-chair of the International Scientific Steering Committee for LBA. His background is in geological and geophysical sciences. Dr. Keller studies the function of tropical forests ecosystems and the control of atmospheric chemistry and composition. This work covers a broad range of scales from forest plots to regional modelling studies of carbon and trace gases. Use of remote sensing techniques for understanding ecosystem structure and function has become a prominent theme recently. Coordinator of the starting iLEAPS project FLARES (Fire-Land-Atmosphere Regional Ecosystem Studies).

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Daniel Rosenfeld, Prof. Dr.

Dr. Rosenfeld is a professor at the Institute of Earth Sciences, The Hebrew University of Jerusalem (Israel). He has received several honours including the Verner Suomi Medal (American Meteorological Society, 2001) "for key contributions to remote measurement and interpretation of rainfall, cloud optical properties, and cloud microphysical properties" and the Thunderbird Award (Weather Modification Association, 2001). He has also received an award for popular writing in sciences. He is a Fellow of the American Meteorological Society (2003). His background is in meteorology and areas of expertise are physics of clouds and precipitation, aerosol-cloud-climate relationships, remote sensing from radars and satellites of these interactions. His research is related to the ways by which a variety of aerosols affect in very different ways clouds and precipitation around the world. These aerosol sources include urban pollution, smoke from burning forests and from burning oil fields, volcanic emissions, deserts mineral and salt dusts, pristine rain forests, and marine salt particles.

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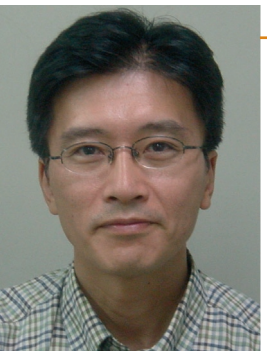

Kazuyuki Yagi, Dr.

Head of the Greenhouse Gas Team, the Department of Global Resources at the National Institute for Agro-Environmental Sciences (NIAES), Tsukuba, Ibaraki (Japan) and a member of several Japanese and American scientific societies. His background is in biogeochemistry and soil science. His areas of expertise are agricultural sources of trace gases (methane, nitrous oxide, ammonia, halocarbons) particularly in Asian agroecosystems, material cycling in agricultural ecosystems, isotopic measurements, as well as biogeochemistry and global environmental change. His current research activities focus on emissions of these environmentally important trace gases in association with different land uses and agricultural management. In particular, his research group focuses on methane from rice paddies and nitrous oxide from fertilized agricultural fields, aiming at quantifying and modelling the processes of these greenhouse gas emissions and developing their mitigation technologies. He is also interested in human induced changes of nitrogen cycling in ecosystems and its environmental impacts through leaching, runoff and volatilization.

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People

iLEAPS International Project Office

The IPO staff in front of the University of Helsinki buildings that host the IPO office. From left: Michael, Hanna, Asbjørn, Jari, Anni, and Nuria. The staff is combining iLEAPS office tasks with research work.

Executive Officer Anni Reissell. PhD in analytical chemistry on chamber and ambient air measurements of BVOC. Her background includes radiopharmaceuticals, natural radioactivity, air quality measurements of inorganic compounds, research scientist at the Finnish Meteorological Institute, research chemist at the Air Pollution Research Center, University of California, Riverside (USA). She has lectured in accreditation and validation of analytical methods, atmospheric chemistry and experimental methods used in atmospheric chemistry and also supervised MSc and PhD students. Research interests: integrated land ecosystem atmosphere processes.

Project Officer Michael Boy. PhD in atmospheric physics with expertise in secondary organic aerosols. Currently he is doing a post-doc to develop a model for the prediction of new particle formation inside the PBL in the Atmospheric Chemistry Division at NCAR (National Center for Atmospheric Research) in Boulder (Colorado, USA) and taking care of the local arrangements for the first iLEAPS Science Conference.

Project Officer Nuria Altimir. PhD student at the Department of Forest Ecology, University of Helsinki. Background in biology from University of Barcelona, Spain. Current research on forest-atmosphere interactions, ozone fluxes in particular.

Project Officer Hanna Lappalainen. PhLic and PhD student at the Faculty of Biosciences, University of Helsinki. Research interest in phenology and climate change. Also working at the Finnish Meteorological Institute. Background in project management e.g. research finance, contracts, communications and public outreach.

Project Officer Jari Holopainen. PhD student at the Department of Geology, University of Helsinki. Current research on paleoclimatology, on the areas of human - environment interactions; historical climatology; effects of climate variations on culture; interactions between ecological and atmospheric processes.

Project Secretary Asbjørn Aarflot. MSc in physical chemistry combined with a degree in pedagogy, both from the University of Bergen. In addition to iLEAPS assignments, he is working on training and education for the Nordic Graduate School CBACCI and the EU network ACCENT.

The iLEAPS International Project Office is located at the Department of Physical Sciences of the University of Helsinki, Finland. The office is sponsored by the University of Helsinki, the Finnish Meteorological Institute and the Finnish Ministry of Education.

UNIVERSITY OF HELSINKI

FINNISH METEOROLOGICAL INSTITUTE

OPETUSMINISTERIÖ

Landscape photos
p.4, plains above the tropical rainforest on the Huanchaca tabletop mountain in Noel Kempff National Park, Bolivia
p.5, skydiving over Perris Valley in California, USA (photo by Perris Valley Sky Diving Company)
p.5, mixed mire partly underlain by permafrost at the Stordalen mire, 10 km East of Abisko, subarctic Sweden
p.6-7, rice fields of the Yuanyang county in Yunnan Province of Southwestern China
p.8, holding an andiroba plant (Carapa guianensis) in the Brazilian Amazon.
Next to these lines: aerial photo over Botswana (courtesy Almut Arneth).

Science

iLEAPS Science Plan and Implementation Strategy

iLEAPS, Integrated Land Ecosystem-Atmosphere Processes Study, is the research initiative of IGBP, International Geosphere-Biosphere Programme, focusing on land-atmosphere interactions. The overall goal of iLEAPS research is:

To enhance understanding of how interacting physical, chemical, and biological processes transport and transform energy and matter through the land-atmosphere interface, from past to future and from local to global.

The iLEAPS Science Plan and Implementation Strategy presents several key research issues that should be addressed during the 10-year research project. The document gives guidelines for iLEAPS research initiated and implemented by researchers all over the world. Since theories, methods used in the experimental work, data handling and modelling progress with time, the research issues and the implementation will evolve. This is illustrated in the iLEAPS website where recognized activities present their research plan, implementation, development and results. The iLEAPS Science Plan and Implementation Strategy will be published in the IGBP Report Series and is also available on the iLEAPS website.

Research questions

Similar to other IGBP core projects and international research programmes, the iLEAPS Science Plan poses several research questions. Important questions are: (i) how the terrestrial ecosystem-atmosphere system functioned under pre-industrial conditions? (ii) how are human activities influencing it? (iii) to what extent does terrestrial vegetation determine its physical and chemical environment on various temporal and spatial scales? (iv) what are the implications for the dynamics of the Earth System?

The iLEAPS research questions gather multiple disciplines to work in an integrated fashion around four foci: 1) Land-atmosphere exchange of reactive and conservative compounds: Key interactions and feedbacks in the Earth System 2) Feedback between land biota, aerosols, and atmospheric composition in the climate system 3) Feedbacks and teleconnections in the land surface-vegetation-water-atmosphere system 4) Transfer of material and energy in the soil/canopy/boundary-layer system: Measurements and modelling. Some interesting examples of iLEAPS research are given in this issue (p12-13) for each focus.

Regional examples

The scientific goals of iLEAPS have been chosen to reflect topics and regions where, based on previous research, interactions, feedbacks, and teleconnections play prominent roles and are essential to scientific understanding. On the other hand, the issues and regions selected are also likely to represent some of the critical switches or choke-points in the Earth System, where local and regional changes may have the strongest influence on the overall Earth System. One example is the tropical region mentioned in the editorial of this issue. Vast areas and millions of people in Africa and Asia rely heavily on the rainfall during monsoon season. For example, in Eastern China the intensive changes in land-use with heavy anthropogenic emissions have an effect on climate. Long-term field campaigns integrated with modelling are needed to fully understand the reasons for the high variability of the monsoon climate. Possible anthropogenic modifications in the monsoon systems will impact the global climate system. Also the artic and boreal regions, where temperatures and precipitation have risen rapidly and snow and ice cover are decreasing are focal points for iLEAPS research. This is a region that demands the study of the changing interactions between physical climate, ecosystems, the water and carbon cycles, and human society.

Action

You can get involved with iLEAPS in many ways. The facing page summarises how to participate in iLEAPS activities and follow iLEAPS events.

Capacity building and knowledge transfer is an essential component of iLEAPS. Knowledge transfer is essential in iLEAPS and includes interdisciplinary training, capacity building and student outreach (initial contact and regional involvement, on-site training, follow-up workshops, databases), and communication.

iLEAPS articles are published in the IGBP newsletter and various international journals. A brochure, website, newsletter and press releases for meetings and large regional integrative projects are part of outreach and communication. iLEAPS will also encourage community and policy related outreach activities associated with the regional integrative projects.

iLEAPS is lead by a Scientific Steering Committee (SSC) of 18 scientists from around the world (featured in this issue p 4-8). The SSC guides the overall scientific direction and development, the planning and implementation of the project. iLEAPS activities are coordinated through the International Project Office (p 9).

Get involved with iLEAPS

iLEAPS invites all research efforts to contribute to the research and implementation strategy outlined in the iLEAPS Science Plan and Implementation Strategy. Research activities that aim to solve iLEAPS related scientific questions, within approaches agreeable with iLEAPS Implementation Strategy, are eligible as iLEAPS recognized tasks. Such tasks should have clearly defined goals and a finite lifetime. A task can consist of networks of process studies to elucidate specific iLEAPS scientific questions, field campaigns, modelling for tool development, validations and intercomparisons, long-term integrated field studies, international interdisciplinary mega-campaigns, synthesis studies, databases, conferences on specific scientific questions, synthesis meetings. Integrated multi- and cross-disciplinary tasks are considered iLEAPS recognized projects and otherwise iLEAPS recognized supporting activities.

The fundamental guidelines forming the basis for iLEAPS research:

- Consider multiple scalars and their interactions and feedbacks in the land-atmosphere system.
- Foster process-based understanding of the land-atmosphere system on a broad variety of temporal and spatial scales.
- Incorporate measurements together with modelling and integration.
- Include scientific questions of regional and global importance.
- Operate across traditional scientific and organisational boundaries.
- International and open to all participants based on scientific contributions.
- Contain a capacity building component.

Task proposals may be submitted to the iLEAPS SSC (via the IPO) at any time. Detailed guidelines for proposal submission must be obtained by contacting the iLEAPS office or visiting www.atm.helsinki.fi/ILEAPS. iLEAPS cannot provide direct funding for research activities but official recognition of an activity can be of help to obtain funding. iLEAPS will provide promotion to the international scientific community, links to other relevant activities, and venues for scientific exchange.

Web pages

Visit our web site at http://www.atm.helsinki.fi/ILEAPS to obtain more information about iLEAPS. The web pages offer updates on iLEAPS activities, science highlights, events.

e-mailing list

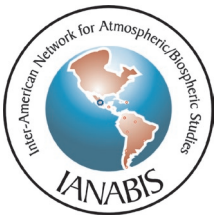
Join our e-mail list by following the “e-mail list” link from our web site to register on-line. We use the list to distribute information about iLEAPS and related activities. You will receive updates in our quarterly e-mail bulletin as well as timely information as short e-mail alerts.

Newsletter

The Newsletter is published twice a year and can also be accessed as an electronic version at our web site. To receive the printed version by post, please join our e-mail list. If you wish to receive several copies, please contact the IPO. We welcome contributions, for instructions see http://www.atm.helsinki.fi/ILEAPS/index.php?page=bulletins or the back cover of this issue.

Current recognized activities

African Monsoon Multidisciplinary Analyses



Inter-American Network for Atmospheric/ Biospheric Studies

Fire-Land-Atmosphere Regional Ecosystem Studies

International Network Measuring Terrestrial Carbon, Water and Energy Fluxes Across Daily to Inter-Annual Time Scales

Land Ecosystem-Atmosphere Reactive Nitrogen

Volatile Organic Compounds in the Biosphere-Atmosphere System

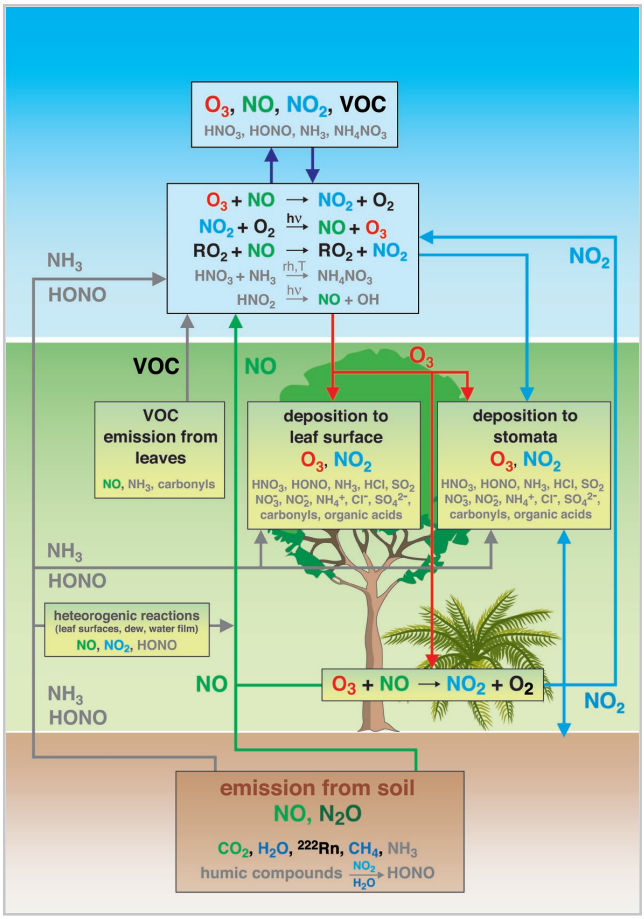
More information about the current iLEAPS recognized projects and activities is available on our web pages. Upcoming issues of the iLEAPS Newsletter will provide more insight into each of the current and future recognized activities.

Focus 1

Land-atmosphere exchange of reactive and conservative compounds: Key interactions and feedbacks in the Earth System.

The land-atmosphere exchange processes of a variety of substances are tightly coupled, highly sensitive to climate change, and contribute to climate forcing through their effects on tropospheric chemistry and radiative flux. Long-lived gaseous compounds, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) as well as reactive volatile organic compounds (VOC) and nitrogen oxides (NO_x) are linked in the geochemical cycles of carbon and nitrogen. This research focus integrates the various processes of production, transport, transformation, and deposition. This approach requires the tools of several disciplines, including biology, physics, and chemistry.

Example: Abundance and behaviour of reactive trace gases at the land-atmosphere interface. The components of the interface include the soil, the plant canopy and the within and above-canopy atmosphere. Processes to be considered are those that define the state of the interface, e.g. boundary layer dynamics, turbulence, photosynthesis, precipitation, radiation, as well as those that describe the interaction with and between the trace gases such as emission, deposition, heterogeneous chemistry and photochemistry, nitrification, ammonization, or evaporation (Figure courtesy of Franz X. Meixner, Max Planck Institute for Chemistry).

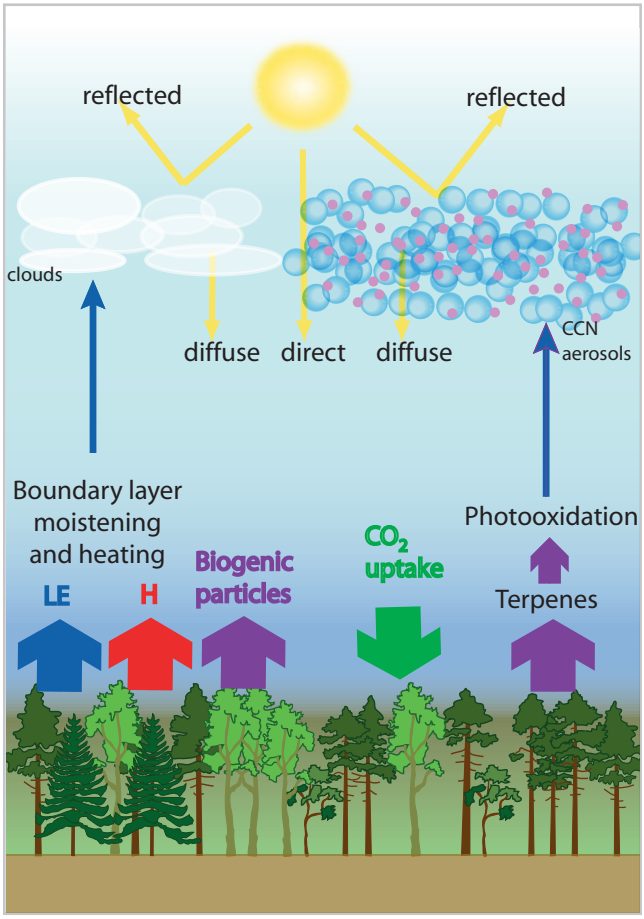


Focus 2

Feedbacks between land biota, aerosols, and atmospheric composition in the climate system.

This focus comprises the interaction of biogenic and anthropogenic aerosol particles with the climate system and also the coupling of biological and hydrological processes with atmospheric reactions to control the self-cleansing mechanism of the atmosphere. Primary and secondary, biogenic and anthropogenic aerosol particles have an effect on radiative flux and on cloud-precipitation processes. These affect climate and feed back to the land surface. Surface-atmosphere exchange processes are important in determining the concentration of hydroxyl radical, the main oxidant determining the rate of chemical removal of compounds in the atmosphere. Changes in land-use and -cover directly or indirectly affect the oxidizing capacity of the atmosphere and surface removal processes. Hence, surface-atmosphere exchanges as well as mixing and transport play a key role in regulating chemical transformations. Changes in gas-phase chemistry also affect aerosol formation and growth processes.

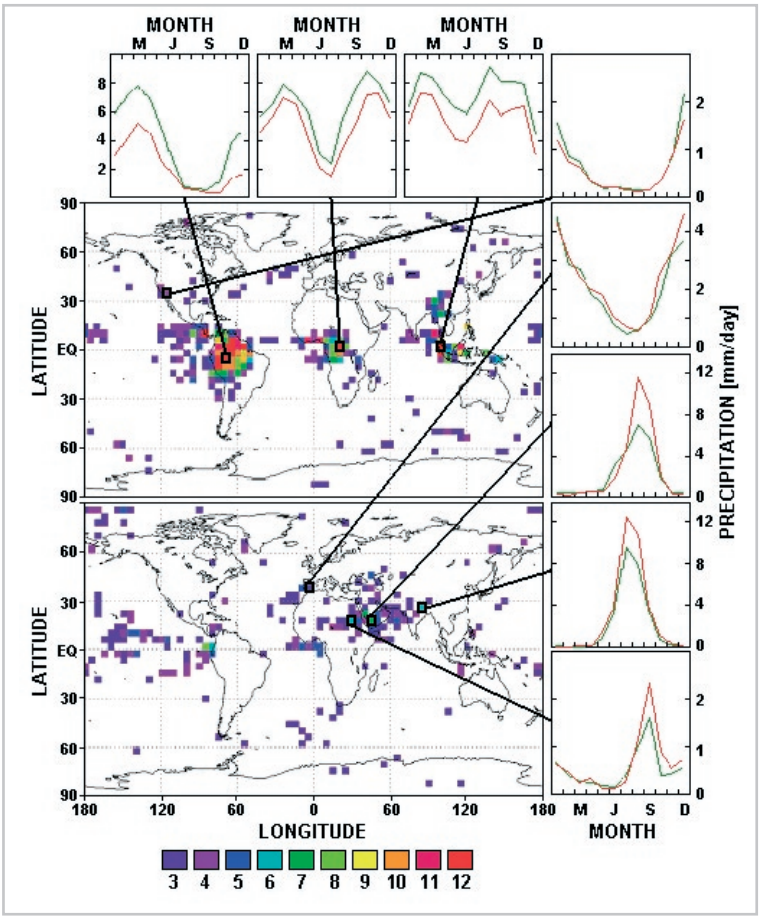
Example: Aerosol-mediated feedback loop on forest carbon uptake. Vegetation promotes the formation of aerosols by oxidation of emitted volatiles organic compounds and also the formation of clouds through the combined control it exerts on evaporation. In turn, the light regime received by the vegetation is affected by aerosols and clouds.



Focus 3 *Feedbacks and teleconnections in the land surface-vegetation-water-atmosphere-system.*

To examine the magnitude and the control exerted by land-atmosphere interactions on the exchange of various compounds, both hydrological and biogeochemical cycles have to be studied from the scale of small streams to global scale. High-latitude ecosystems are particularly important due to likely climate sensitivity and potentially strong feedback on atmospheric methane and carbon dioxide concentrations. Landscape changes as a result of human influence can lead to large changes in the spatial redistribution of heat, moisture, and energy. Multiple equilibria, thresholds, and surprises in the climate system are also discussed.

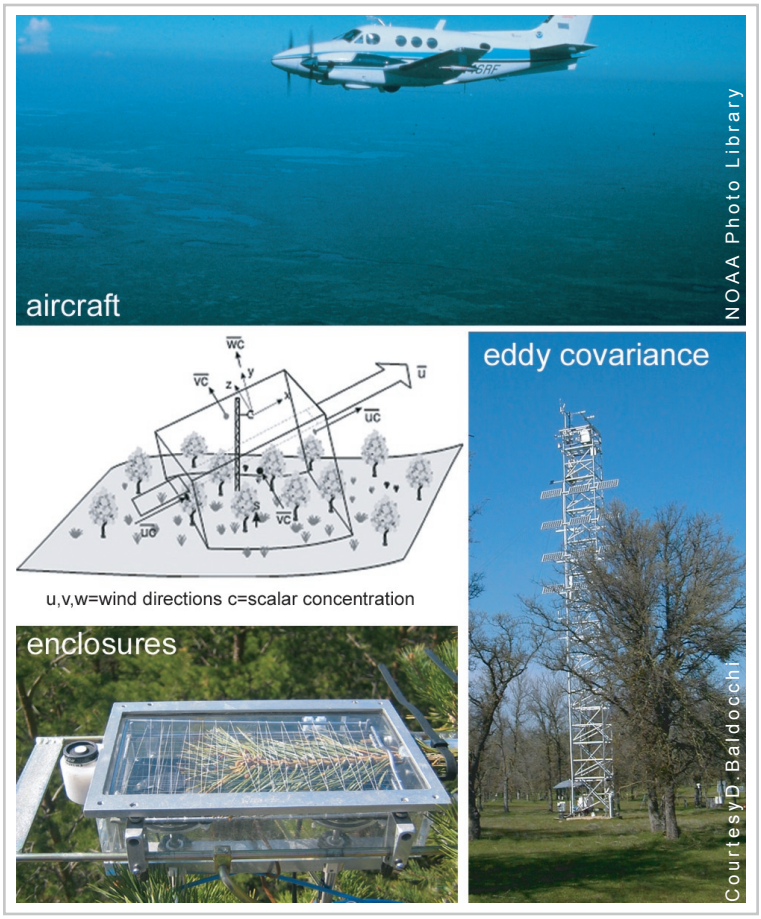
Example: Worldwide locations where precipitation has either significantly decreased (top) or increased (bottom) during a period of at least three months of the year, as a result of simultaneous deforestation of Amazonia, Central Africa and South-East Asia simulated with the NASA-GISS GCM II. The ensemble-mean annual cycle of precipitation (mm/day) for the control (green line) and deforested (red line) cases at continental locations most severely affected by the deforestation is also represented. The colour scale indicates the number of months registering a statistically significant change (95% level of confidence) during the annual cycle (Figure from Avissar and Werth 2005, J. Hydromet. 6, 134-145 © American Meteorological Society (AMS)).



Focus 4 *Transfer of material and energy in the soil, canopy, boundary-layer system: Measurements and modelling.*

Focus 4 describes the type of measurements needed to study the various processes, interactions, and feedbacks presented in Foci 1-3. Because of the complexity of the interactions between the numerous processes, measurements and modelling activities need to be explicitly linked. The measurement methods include surface flux measurements, boundary-layer budgets, aircraft measurements, and remote sensing techniques. The integration of measurements and modelling include, for example, scaling from local observations to estimates of regional exchange and sensitivity studies with fully coupled surface-atmosphere models.

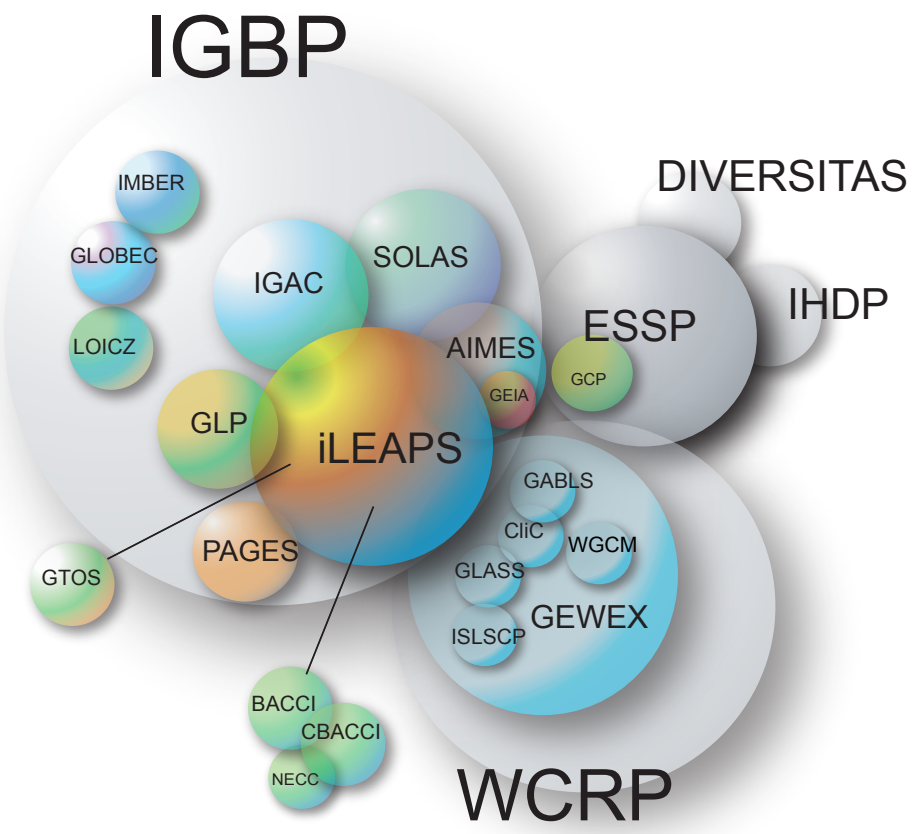
Example: The aerodynamic method erects a notional control volume over a representative patch of surface, measures the flows in and out of its aerial faces and the concentration changes within it to deduce the surface exchange by difference. The figure shows a control volume over complex terrain. The same mass balance philosophy lies behind enclosure, aircraft, and boundary-layer budget techniques. Enclosures provide detailed information on local processes, aircrafts record the flux along long flight lines, and boundary layer budgets employ the entire planetary boundary layer as the control volume. Aerodynamic methods often work best when more than one of these approaches can be combined.



Partners in Earth System Science

iLEAPS research covers the basic processes that link land-atmosphere exchange, climate, the water cycle, and tropospheric chemistry. In order to achieve the extensive goals set for this integrated project, cooperation with various research programs, both at the national and international level, is a vital aspect in iLEAPS. This is in full agreement with the collaborative and integrative approach of IGBP II; global change research will be driven by the Earth System Science Partnership -ESSP- that links the research programmes IGBP, WCRP (World Climate Research Programme), IHDP (International Human Dimension Programme), and DIVERSITAS, an international programme of biodiversity science

The most apparent connections are to IGAC in several projects studying atmospheric processes. iLEAPS and IGAC already share activities in AMMA, the African Monsoon Multidisciplinary Analysis, and also ongoing cooperation on aerosol particles, formation and growth as well as indirect effects on



Integrative research requires cooperation between a variety of disciplines, experimentalists and modellers. The figure above shows some iLEAPS links with other projects and programmes.

First Circular

Earth System Science Partnership

DIVERSITAS GLOBAL CHANGE IGBP IHDP WCRP

Global Environmental Change: Regional Challenges

An Earth System Science Partnership Global Environmental Change Open Science Conference

Beijing, China
9-12 November 2006

www.essp.org/essp/ESSP2006/

ESSP OPEN SCIENCE CONFERENCE

The Partnership

The first Global Change Open Science Conference, held in Amsterdam in 2001, was a milestone in the scientific, political and public understanding of this far-reaching topic. One outcome of that Conference was the formation of the **Earth System Science Partnership (ESSP)**, a collaboration between

- **DIVERSITAS** - an international programme of biodiversity science
- **IGBP** - the International Geosphere-Biosphere Programme
- **IHDP** - the International Human Dimensions Programme on Global Environmental Change
- **WCRP** - the World Climate Research Programme

Since then the ESSP has created four major interdisciplinary Joint Projects on carbon, food, health and water in the Earth System, and has initiated the first of a series of Integrated Regional Studies.

CONFERENCE OBJECTIVES

This Conference provides the opportunity for the presentation of advances since the Amsterdam Conference in our understanding of the natural and social systems of global environmental change and to highlight the ESSP approach to study of the Earth System.

Conference Themes

- *The Conference will highlight advances in our understanding of the physical, biogeochemical, biodiversity and human dimensions aspects of global environmental change.*
- *Science in support of sustainability will be featured, with special sessions on global environmental change research relating to food, water, carbon and human health, as reflected in the ESSP Joint Projects.*
- *Special attention will be given to dynamics, impacts and consequences of the interactions between natural and social systems at regional scales, including extreme events, and how they connect with global-scale phenomena.*
- *Research concerning global environmental change in monsoon Asia will also be a particular focus.*

We invite scientists, policy makers, practitioners, scholars, members of the private sector and journalists to participate in this Conference and to submit proposals for sessions and abstracts. Prior to the main Conference, the 2nd International Young Scientists' Global Change Conference (7-8 November 2006) will provide an opportunity for selected young scientists to present and discuss their work.

- **Proposals for sessions may be submitted online October – November 2005 at**

www.essp.org/essp/ESSP2006/

- **Abstracts for presentations and posters may be submitted online February – May 2006.**

global climate. The collaboration will be intensified with future activities on the aerosol-cloud-climate connection. In addition, the self-cleansing capacity of the atmosphere is tightly linked with the Earth's surface, deposition and emissions, both anthropogenic and natural.

iLEAPS and IGAC share mutual interests in the new IGBP core project AIMES (Analysis, Integration and Modelling of the Earth System) and GEIA/AIMES (Global Emission Inventory Activity). GEIA supports models with quantitative descriptions of anthropogenic emissions and natural exchanges of trace gases and aerosols; all iLEAPS modelling activities will benefit significantly by close interaction with AIMES. On palaeoperspective aspects of land-atmosphere interactions, iLEAPS will work in collaboration with IGBP core project PAGES (Past Global Changes).

Tight connections are also with the starting IGBP core project Global Land Project (GLP), which addresses issues related to terrestrial ecology, land-use and land-cover, and has a strong human dimension component. With SOLAS (Surface Ocean Lower Atmosphere Study), iLEAPS shares the strong need for the development of sound theory to describe the behaviour of the atmospheric boundary layer and its interactions with the underlying surface, as well as the requirement for improvements in flux measurement technology. Both projects are interested in emissions, transport and effect of dust and other land emissions (Fe, N, P, etc) as well as marine emissions, for example DMS, DMSe, Organo-I, NH_3.

iLEAPS will develop a very close partnership with WCRP and the core project GEWEX (Global Energy and Water Cycle Experiment) which will supply the connections to physical climate, meteorology, and surface hydrology. It is of interest to both projects to improve climate and global climate models to coupled models that include the terrestrial carbon cycle, atmospheric chemistry and hydrological processes, as well as vegetation, emissions of aerosol particles and aerosol precursors. GEWEX has already initiated essential research in important collaborative areas of research: land surface processes and atmospheric coupling (GLASS), satellite remote sensing and land surface climatology (ISLSCP), physics of boundary layer development (GABLS), on processes in the arctic environment (CliC), and on coupled modelling (WGCM).

Specific iLEAPS projects will work with the satellite remote sensing community such as GOFC/GOLD of GTOS (Global Terrestrial Observing System) which is developing a number of burned-area products and vegetation products, and GCSS/GEWEX, which is aimed at improving cloud parameterisations in climate models. Fluxes of reactive carbon compounds cannot be treated separately from CO_2 fluxes, requiring collaboration with the ESSP joint integrative carbon program, Global Carbon Project (GCP).

iLEAPS is also tightly linked with the Centers of Excellence of the Nordic countries Research Unit on Biosphere-Aerosol-Cloud-Climate Interactions (BACCI), Nordic Centre for Studies of Ecosystem Carbon Exchange and its Interactions with the Climate System (NECC), Nordic Graduate School Biosphere-Carbon-Aerosol-Cloud-Climate Interactions (CBACCI), and the Academy of Finland Research Unit on Physics, Chemistry and Biology of Atmospheric Composition and Climate Change.

ESSP OPEN SCIENCE CONFERENCE

INTERNATIONAL ORGANISING COMMITTEE

Co-chairs: Qin Dahe, Gordon McBean

Zhisheng An, Guy Brasseur, Pep Canadell, David Carson, John Church, Eric Craswell, Congbin Fu, Roland Fuchs, Barbara Göbel, John Ingram, Christian Körner, Anne Larigauderie, Peter Lemke, Michel Loreau, Michael Manton, Tony McMichael, Kevin Noone, Roberto Sanchez-Rodriguez, Robert Scholes, Will Steffen, Coleen Vogel

CONFERENCE ORGANISER

China National Climate Committee

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If you are unable to access the website, please contact the Conference Secretariat.

General Information

IMPORTANT DATES

- **Call for Sessions: October – November 2005**
- **Registration opens: October 2005**
- **Call for Papers: February – May 2006**
- **Young Scientists' Conference: 7-8 November 2006**
- **Open Science Conference: 9-12 November 2006**

VENUE

Beijing International Convention Centre (BICC) is located about 20 kilometres west of Beijing Airport. Many hotels are to be found within easy walking distance of the BICC. Further information about hotels, obtaining visas and local arrangements will be provided in the second circular and on the web-site.

WORKING LANGUAGE

English will be the working language of the Conference.
Simultaneous interpretation will not be provided.

Design & Layout: C. Michaut (CNRS), Editing: V. Detemmerman (WCRP), Photo: MoCo - France

www.essp.org/essp/ESSP2006/

2nd International Young Scientists' Global Change Conference

Beijing, China
7-8 November 2006

Organised by START – a programme for regional capacity building

START
IHDP • IGBP • WCRP

Global environmental change is a challenge that will require the attention of generations of scientists. ESSP's SysTem for Analysis Research and Training (START) is organising a two-day Young Scientists' Conference just prior to the ESSP Open Science Conference designed to recognize the achievements of outstanding Young Scientists, to assist in their career development, and to encourage them in networking among themselves and with the senior community of international scientists.

Participants will be invited on the basis of a competitive peer-review process.

Further information will be posted as it becomes available at **www.START.org** and at **www.essp.org/essp/ESSP2006/**.

Chemistry at the Interface

Sarah Doherty
IGAC International Project Office

IGAC is the International Global Atmospheric Chemistry Project, and like iLEAPS, is also a core project of IGBP. IGAC focuses on forwarding atmospheric chemistry research, in particular where multidisciplinary and multi-national efforts are required. More information on IGAC can be accessed at http://www.igac.noaa.gov

The International Global Atmospheric Chemistry (IGAC) Project, under joint sponsorship of the Commission on Atmospheric Chemistry and Global Pollution (CACGP) and the International Geosphere-Biosphere Programme (IGBP), was created in the late 1980s to address growing international concerns over rapid changes observed in Earth's atmosphere. A decade of research under IGAC has revealed how human activities have perturbed the chemical composition of the atmosphere on local, regional, and global scales. Further, critical feedbacks exist between the atmospheric chemical composition, climate, and the human activities that drive these emissions. Based on this, IGAC's goals have been recently updated to focus on two overarching questions: What is the role of atmospheric chemistry in amplifying or damping climate change? Within the Earth System, what effects do changing regional emissions and depositions, long-range transport, and chemical transformations have on air quality and the chemical composition of the planetary boundary layer?[1]

Addressing these global research questions requires coordination and collaboration across both geographic and disciplinary boundaries. The new IGBP Core Projects iLEAPS and SOLAS (Surface Ocean Lower Atmosphere Study) provide essential links between IGAC's work in the atmosphere and the processes at the land and ocean interfaces which both drive and are affected by atmospheric chemical composition and climate. Here we describe just two of the many areas where iLEAPS research will provide critically needed input to IGAC science:

Organic aerosols

It has recently become clear that organic constituents comprise a significant fraction of atmospheric aerosol, over both the land and ocean. Organics influence the physical and chemical properties of aerosol particles and thus have effects on the atmosphere and climate through interaction with reactive trace gases, water vapour, clouds, precipitation, and radiation. Biota, biomass burning, and forest fires account for a large fraction of organic emissions over land, and the source strengths of these emissions remain highly uncertain[2]. The processes controlling the emissions of organics in both gas and aerosol phases and the sensitivity of these processes to

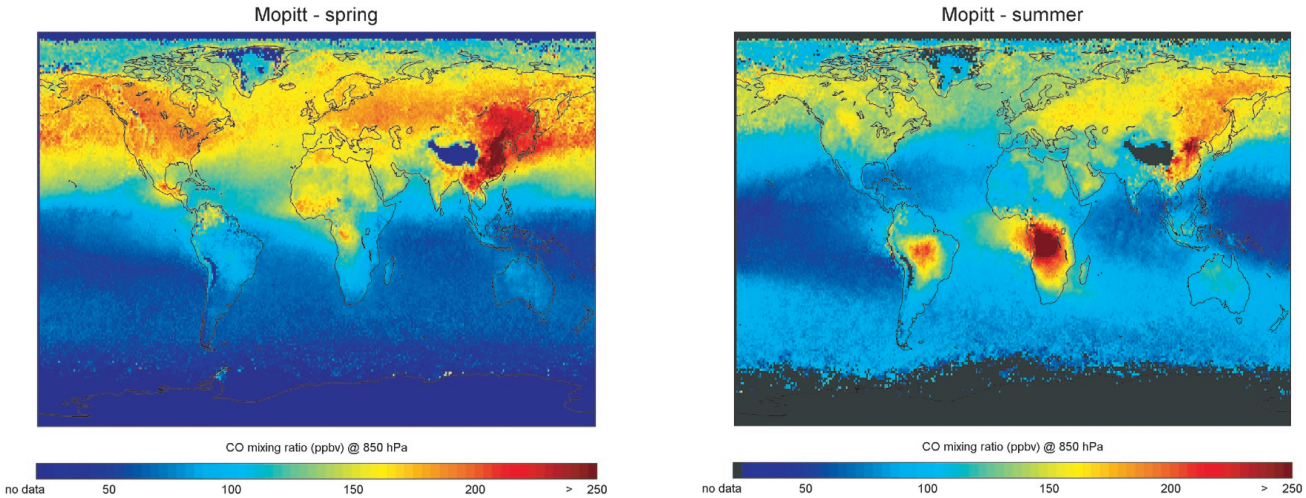

Figure 1. Spring and summer seasonal global record of the amounts and geographic sources of CO as measured from the MOPITT sensor (Measurements of Pollution in the Troposphere) on NASA's Terra satellite. In spring, sources in highly populated areas dominate, whereas in summer forest fires and biomass burning constitute a much higher fraction of CO emissions. (Courtesy Cathy Clerbaux, NCAR Atmospheric Chemistry Division)

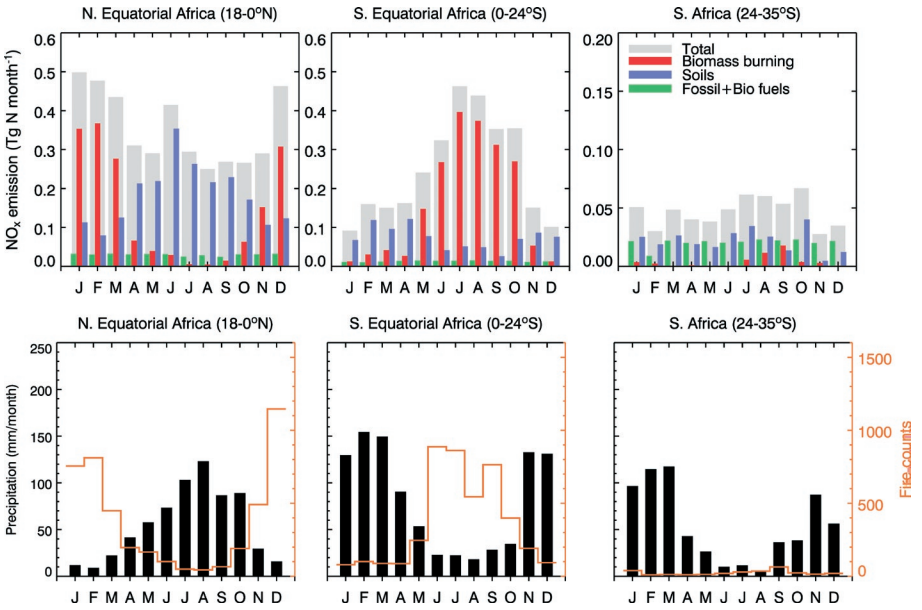

Figure 2. [top] Monthly top-down GOME O_x emissions averaged over three regions in Africa (grey bars). Note the different scale on the right-most panel. Bottom-up estimates of biofuel and fossil fuel NO_x emission inventories are combined with the spatial location of fires to partition emissions between biomass burning (red bars), soil (blue bars), and fossil+biofuel (green bars) sources. [bottom] Seasonal variations in number of total active fires (solid orange line) and mean precipitation (black bars) observed by the Tropical Rainfall Measuring Mission (TRMM). (From Jaeglé et al., 2004).

changes in climate and land use, for example, must be better understood. iLEAPS research (such as through the VOCBAS & FLARES projects) will be critical to being able to both better constrain current sources of organic constituents as well as to predicting how these may change with time.

Processes controlling natural emissions of gas species

While the concentrations of many atmospheric trace gas species have become dominated by anthropogenic activities natural source remain important for many radiatively and chemically active species such as carbon monoxide (CO), methane (CH_4), and nitrous oxide (NO_2). For example, while CO emissions in many areas are dominated by fossil fuel burning, in other regions/seasons both natural and man-made fires are the primary source of CO emissions (Fig 1). Similarly, soil emissions have a large or dominant influence on atmospheric NO_2 concentrations in some seasons and locations. Fertilizer use clearly has a strong influence on soil emissions of NO_2 in agricultural regions. In some areas, however, it is also controlled by precipitation rates (Fig 2)[3,4], which themselves are likely to change with climate. Given the complex feedbacks between the emission of these species, climate, and human activities, progress will only be made in better constraining controlling processes and future emissions rates through the integrated approach being undertaken by iLEAPS.

Sarah.Doherty@noaa.gov

[1] IGAC Science Plan and Implementation Strategy; see http://www.igac.noaa.gov for downloadable pdf.
[2] Kanakidou J. H. Seinfeld, S. N. Pandis, I. Barnes, F. J. Dentener, M. C. Facchini, R. van Dingenen, B. Ervens, A. Nenes, C. J. Nielsen, E. Swietlicki, J.P. Putaud, Y. Balkanski, S. Fuzzi, J. Horth, G. K. Moortgat R. Winterhalter, C. E. L. Myhre, K. Tsigaridis, E. Vignati, E. G. Stephanou, J. Wilson, 2004. Organic aerosol and global climate modelling: A review, Atmos. Chem. Phys. Discus., 4, 5855-6024.
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JOINT IGAC/CACGP/WMO SYMPOSIUM

ATMOSPHERIC CHEMISTRY AT THE INTERFACES 2006

17-23 SEPTEMBER 2006 | CAPE TOWN | SOUTH AFRICA

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Email: enquiries@atmosphericinterfaces2006.co.za
www.Atmosphericinterfaces2006.co.za

Announcing a joint conference of the IGAC Project (International Global Atmospheric Chemistry), CACGP (the Commission on Atmospheric Chemistry and Global Pollution) and WMO (the World Meteorological Organization).

"Atmospheric Chemistry at the Interfaces", is the theme for the conference, which will highlight the current state of knowledge of the interaction between various components of the Global System. This theme represents the common interests of the three sponsors, and focuses on the great challenges of interdisciplinary research and effective cross-disciplinary communication in times of ever increasing specialization.

Stable boundary layers and land surface climate

Results from the GEWEX Atmospheric Boundary Layer Study

Prof. Dr. Bert Holtslag
Wageningen University, The Netherlands

GABLS refers to the GEWEX Atmospheric Boundary Layer Study. The project aims to improve the understanding and the representation of the atmospheric boundary layer in regional and large-scale climate models[1]. Results of a recent GABLS model intercomparison highlighted large model errors due to an inadequate representation of small-scale and near surface processes. These errors affect prediction of local and regional representations of land-atmosphere exchange and may impact on global scale climate change studies as well.

The warming predicted by climate models seems to occur mostly during stable atmospheric conditions[2]. During stable conditions the potential temperature increases with height which means that the surface is colder than the atmosphere above. Such conditions prevail in the atmospheric boundary layer over the continental land and ice regions during night, and may occur during the whole day in wintertime. Thus, proper modelling of regional and global climate needs a valid representation of the stable atmospheric boundary layer

However, the current parameterisation of the stable boundary layer (SBL) is still rather poor, and progress is slow[3,4,5]. Unfortunately regional and global climate models are very sensitive to the model formulation of mixing processes in stratified conditions. This is shown, for example, in a study with the ECMWF (European Center for Medium-Range Weather Forecasting) model of vertical mixing in stable conditions[6]. From two model runs with the same forcing conditions, but with (slightly) different stability functions in the mixing scheme, it was seen that differences in the mean winter temperatures at a height of 2 meters between the two model runs can be as large as 10ºK over the land areas! Similar results appear between model runs with different boundary layer mixing schemes for winter climate over Antarctica[7].

Climate models and weather forecast models need to incorporate an overall representation of the small-scale boundary-layer and near surface processes. The relevant small-scale processes in the stable boundary layer are: clear air radiation, drainage flow, generation of gravity waves and shear instabilities, fog and dew formation, the occurrence of a low-level jet and generation of discontinuous or intermittent turbulence[8]. In addition, the phenomenology of stable atmospheric boundary layers is quite diverse, e.g. shallow and deep boundary layers with continuous turbulence through most of their depth, and boundary layers with intermittent turbulence or even laminar flow. The small-scale processes influence the vertical and horizontal exchange of quantities between the surface and the atmosphere as well as the mixing in the atmosphere on a variety of scales. In addition, turbulent mixing in stratified flow has an inherent non-linear character and may, as such, trigger positive feedbacks. These positive feedbacks, in turn, may cause unexpected transitions between totally different SBL regimes[8].

The overall representation of the small-scale boundary-layer and near surface processes and the related 'spatial averaging' is highly non-trivial due to the existence of many non-linear processes and the heterogeneity of the environment at a variety of scales. This normally is a motivation to allow for some

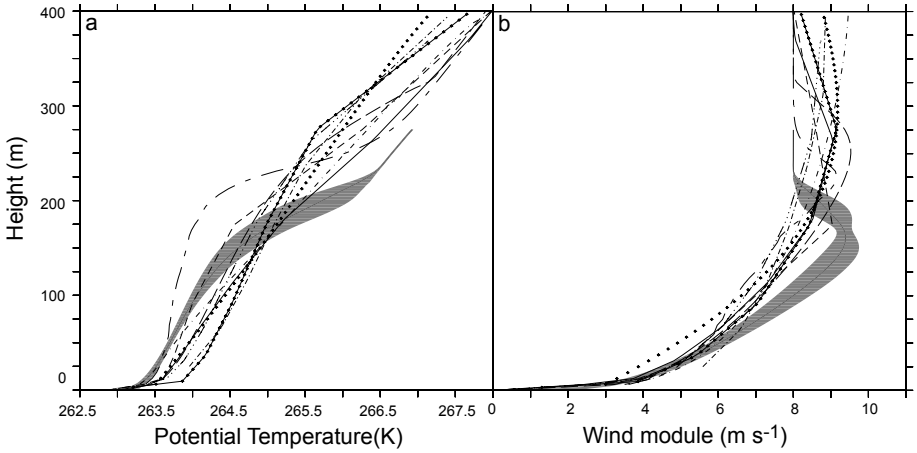

Figure 1. Mean profiles for a) potential temperature and b) wind magnitude for different 1D models (lines with different symbols) in comparison with the average results from Large Eddy Simulation (grey band). The 1D model results correspond mostly to the output of operational models achieved after nine hours of surface cooling which is sufficient to achieve a quasi-steady state (after Cuxart et al, 2005).

'enhanced-mixing' in models as compared with tower observations[3]. Another reason for allowing enhanced mixing is to prevent the models to go to a decoupled mode, which in turn may lead to run-away characteristics close to the ground[9].

Within GABLS, an intercomparison of boundary-layer schemes for stable conditions was organised with the aim to review the state of the art and to compare the skills of single column (1D) models[10] and Large-Eddy Simulation models[11]. A rather simple case was selected in which the stable boundary layer is driven by an imposed, uniform geostrophic wind, with a specified surface-cooling rate over (homogeneous) ice.

The results of the intercomparison show that with the same initial conditions and model forcings, the models yield a large range of results for the mean temperature and wind profiles (Fig 1) as well as for their corresponding heat and momentum flux profiles (Fig 2). The variation in the results is strongly related to the details of the boundary-layer mixing schemes[10]. Note that the models in use at operational weather forecast and climate centres typically allow for enhanced mixing resulting in too deep boundary layers, while the typical research models produce less mixing more in agreement with the 'Large Eddy Simulation' results for this case.

Because of the enhanced mixing in operational weather and climate models, they results in an over prediction of the surface drag and deepness of the boundary layer, and an underestimation of the wind turning in the lower atmosphere[12]. When the models with enhanced mixing are coupled to a surface energy balance, they also produce too high surface temperatures[9]. However, by decreasing the mixing and surface drag, a direct impact on the atmospheric dynamics ('Ekman pumping') is noted[6] and too active cyclones are forecasted.

Given the arguments above and the GABLS findings, there is a clear need for better understanding and a more general description of the atmospheric boundary layer under stably stratified conditions in atmospheric models for weather and climate. This is also directly relevant for air quality and Earth System studies, since the exchange of trace gases and pollutants is directly impacted by the boundary layer mixing. As such, there is a direct link between the GABLS and iLEAPS programs. To get involved in future GABLS activities, please contact the author and for more information follow the updates at the GABLS website (http:// www.met.wau.nl/projects/Gabls/index.html/).

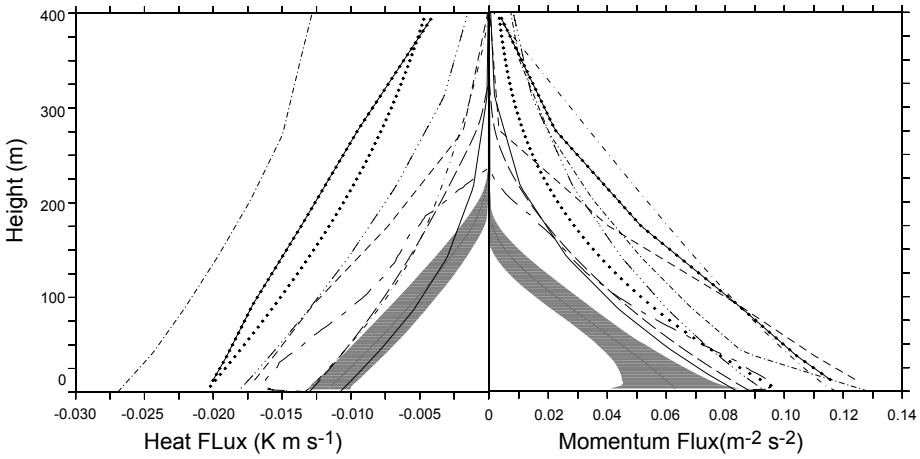

Figure 2. As Figure 1 but for a) the corresponding heat and b) momentum fluxes (after Cuxart et al, 2005).

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Activities

iLEAPS sessions at EGU

European Geophysical Union 2nd General Assembly 24-29 April 2005 Vienna

The EGU meeting gathers yearly thousands of researchers in the general fields of Geophysics. iLEAPS was present at the meeting convening a session of its own as well as co-sponsoring sessions in the areas of Atmospheric Sciences (AS), Biogeosciences (BG) and Hydrological Sciences (HS). The adjoining table lists the iLEAPS co-sponsored sessions at this 2005 assembly. The abstracts of all presentations can be consulted from the EGU meeting pages at http://meetings.copernicus.org/egu2005/. A special issue with some of the presentations will be published in the EGU journal Biogeosciences.

iLEAPS will again participate in the next EGU General Assembly, in Vienna, 2—7April 2006 as well as in the next American Geophysical Union Fall Meeting 2006.

iLEAPS session at the 2005 EGU General Assembly

AS2.05 Interactions and Feedbacks between Land Ecosystems and Atmospheric Processes. Andreae, A., Kabat, P., Reissell, A.

iLEAPS co-sponsored sessions

AS1.11 African Monsoon Multidisciplinary Analysis global scale using field experiments, remote sensing. Mari, C., Parker, D., Lloyd, C., Fink, A.

AS1.13 Aerosol-precipitation interactions. Andreae, M., Lohmann, U., Rosenfeld, D.

AS 2.04 Biosphere-atmosphere exchange of reactive trace gases. Rinne, J., Koppmann, R., Karl, T.

BG1.03 Biological processes related to trace gas emissions. Kesselmeier, J., Schnitzler, J.

BG1.04 Biosphere-atmosphere exchange of inorganic nitrogen compounds - influence on atmospheric chemistry and climate forcing. Pilegaard, K., Meixner, F.

BG1.11 CARBOEUROPE: Approaches to assess the European carbon budget. Schulze, E., Valentini, R.

HS2 Estimation of soil moisture at the regional and global scale using field experiments, remote sensing and land surface modeling. de Rosnay, P., Wigneron, J., van den Hurk, B., Schwank, M.

HS9 Modelling water and energy budgets from catchment to global scales. Rosbjerg, D., Doell, P., Jacob, D., Kunstmann, H., Roads, J.

iLEAPS SSC meeting 29 April-1 May 2005 Vienna

The iLEAPS Scientific Steering Committee gathers annually to discuss the basis of iLEAPS science and its implementation. In 2005 the meeting took place in Vienna in connection with the EGU General Assembly. In addition to iLEAPS SSC members and IPO staff, participants were ex-officios, representatives from other IGBP core projects and iLEAPS recognized activities (see photo and accompanying list). iLEAPS SSC recognized two activities: LEARN, Land Ecosystem-Atmosphere Reactive Nitrogen, and FLUXNET, an International Network Measuring Terrestrial Carbon, Water and Energy Fluxes Across Daily to Inter-Annual Time Scales. The next SSC meeting takes place in Boulder (CO, USA) on 20 to 21 January 2006, in front of the 1st iLEAPS Science Conference.

Science at the top of the National Libray in Vienna. Photo by Anni Reissell

1. Bert Holtslag, GABLS/GEWEX 2. Elisabeth Huber-Sannwald, IANABIS 3. José Luis Morán-López, IANABIS 4. Kevin Noone, IGBP 5.Alex Guenther, GEIA/AIMES 6. Kim Pilegaard, ACCENT 7. Céline Mari, AMMA France 8. Dennis Ojima, GLP 9. Francesco Loreto, VOCBAS 10. Kathy Hibbard, AIMES 11 Sandro Fuzzi, IGAC. Missing from the photo: Rick Lawford, IGPO/GEWEX; Peter van Oevelen, IGPO/GEWEX; Jan Polcher, GMPP/GEWEX, AMMA International; Patricia de Rosnay, EGU Convener. Photo by Asbjørn Aarflot

Summer School iLEAPS-CBACCI

Formation and Growth of Secondary Atmospheric Aerosols 1-10 August 2005

The joint CBACCI (the Nordic Graduate School Biosphere-Carbon-Aerosol-Cloud-Climate Interactions) and iLEAPS Summer School 2005 gathered 35 students from 11 countries and 5 continents to Finland to study aerosol science. The location was set in remote and beautiful Hyytiälä forestry field station about 200 km North of Helsinki.

The 10 days were packed with lectures covering theory and experimental data on formation and growth of atmospheric aerosols, instrumentation and theories on how to measure these aerosols as well as aerosols' role in meteorology, biosphere-atmosphere interaction and global models. Each lecture was followed by a set of exercises that the students had to discuss and solve in groups and then later present. The course required an advanced level in physics including basic knowledge in classical physics and mathematics and introductory knowledge in aerosol physics and/or thermodynamics/ physical chemistry.

A special focus was given to the SMEAR II (Station for Measuring Forest Ecosystem - Atmosphere Relations), located at the same forestry field station and home to almost 10 years of continuous field measurements relevant to soil, vegetation, micrometeorological and aerosol sciences and particularly to the study of their interrelations. The students were on the first day guided through the station to get acquainted with the measurement techniques and set-up for measurements of aerosols size and distribution, plant respiration and photosynthesis, and meteorological variables. The final question in the oral group exam given by Markku Kulmala was to use the knowledge acquired during the course to suggest improvements for SMEAR II development. Now that is of course a very challenging question but also very inspiring. It will not be a surprise if some of the ideas harvested from the students will be incorporated into SMEAR II.

Although the lectures and exercises were held from 9 am to 8 pm almost every day there was also time for recreational events. With bags packed with coffee, tea and rolls the students, assistants and teachers went during the weekend to Siikaneva wetland conservation area, and to Helvetinkolu in Helvetinjärvi National Park. Nearly every evening the two saunas were heated and even non-Finnish participants found pleasure in the relaxation of a hot steamy sauna followed by a cool swim in the lake.

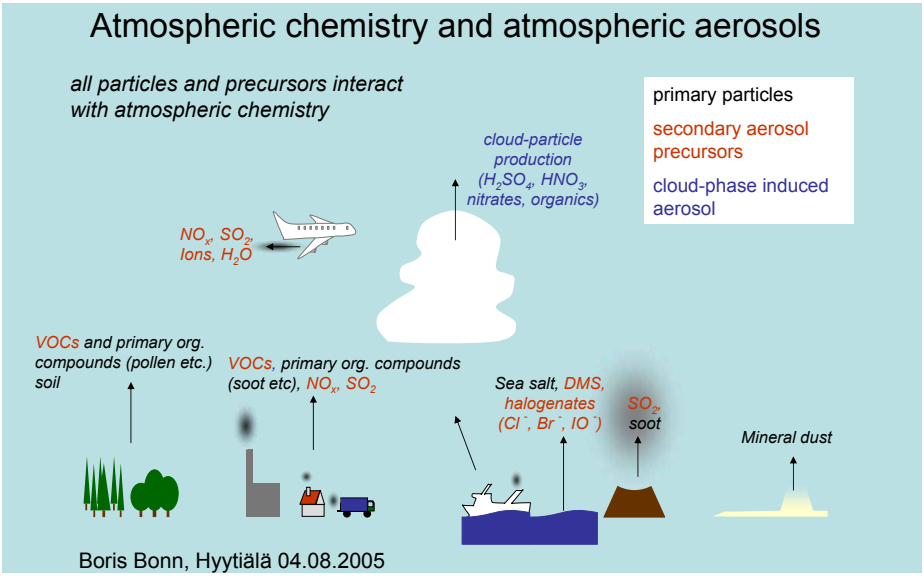
Students and teachers of the summer school on the visit to Siikaneva mire.

The next summer school on formation and growth of atmospheric aerosols will be held in late summer/early fall 2007 at the same location and jointly organized by the Nordic graduate school CBACCI and iLEAPS. Visit our website or join our e-mail list to keep informed! More information on CBACCI from http://www.atm.helsinki.fi/CBACCI/

Asbjørn Aarflot, asbjorn.aarflot@helsinki.fi

Teachers

Dr. Annica Ekmann, Department of Meteorology, Stockholm University; Prof. Ken Carslaw, School of Earth and Environment, University of Leeds; Prof. Spyros Pandis, Carnegie Mellon University USA and University of Patras, Greece; Prof. Madis Noppel, Institute of Environmental Physics, University of Tartu; Prof. Perti Hari, Department of Forest Ecology, University of Helsinki; Prof. Markku Kulmala, Prof. Kaarle Hämeri Dr., Lauri Laakso, Dr. Boris Bonn, Ilona Riipinen, Department of Physical Sciences, University of Helsinki; Prof. Veli-Matti Kerminen, Prof. Kari Lehtinen Dr. Hannele Korhonen, Dr. Heikki Lihavainen; Finnish Meteorological Institute, Finland



One slide from the lecture "Atmospheric chemistry behind aerosol formation".

Formation and Growth of Secondary Atmospheric Aerosols

Joint Workshop iLEAPS-SOLAS-IGAC-ACCENT-BACCI
15-17 August 2005 Hyytiälä, Finland

Aerosol particles in the Earth's atmosphere affect the global energy balance directly by scattering and to a lesser extent by absorbing incoming solar radiation. They also have an influence on the climate indirectly as they act as a cloud condensation nuclei (CCN) onto which cloud droplets are formed[1].

The aerosol particle population is in constant turmoil. The particles are colliding with each other, gaseous compounds are condensing onto them altering their composition, chemical reactions are occurring on the surface and within the particles, particles are lost due to deposition to the various surfaces in the Earth-atmosphere interface, and the population is renewed as new particles are formed either directly or via diverse gas-to-particle conversion mechanisms. Formation of new atmospheric aerosol particles has been observed worldwide[2], but the exact mechanism by which this formation occurs is scientifically still an open question.

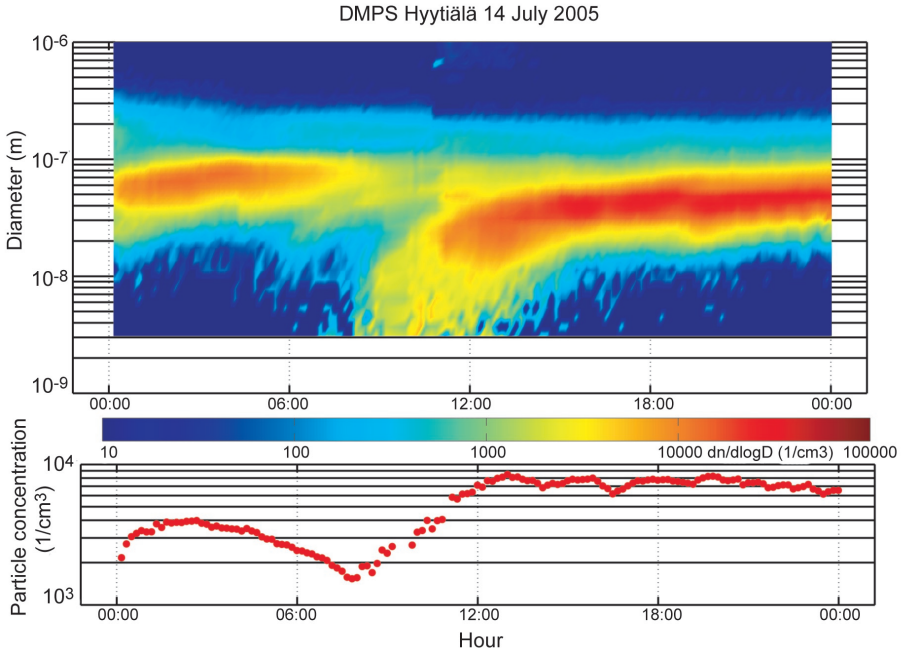


Figure 1. Ambient aerosol size distribution as a contour plot during one day at SMEAR II field station (upper panel) and total number concentration (lower panel). In the morning hours, new particles are formed and appear at the lower detection limit of the sizing instrument (3 nm in diameter). Concurrently, the total number concentration increases. During the day, the particles grow by condensation of various vapours reaching a modal average size of 50 nm.

This question was the central point during an intensive 3-day workshop held last summer, an event chaired by Professor Markku Kulmala from the University of Helsinki. Some 50 researchers from Europe, US, Africa and China joined forces to discuss the current state and future of aerosol research from the atmospheric perspective. The workshop location, Hyytiälä, is home to the SMEAR II field station[3], where almost 10 years of continuous measurements have revealed that formation and subsequent growth of aerosols occurs on 60 to 120 days a year, on average[4]. At the same time the workshop participants were discussing possible formation mechanisms, measurements at SMEAR II continued as usual (Fig 1).

During the workshop, the participants presented recent developments in the field of atmospheric aerosol particle physics and chemistry in oral and poster sessions. Special attention was given to new techniques of observations, theoretical interpretation and understanding of the processes governing new particle formation in atmospheric conditions. In addition, implementation of the observations and theories to models of various scales was discussed. The oral and poster presentations were followed by intensive discussion, which continued in three working groups (atmospheric observations, atmospheric models, and basic nucleation). The working groups discussed and reported on current status of research and also future plans in detail, and the outcome will be published as a progress report. The Hyytiälä forestry field station provided a relaxing setting for the workshop. This enabled active and lively discussions amongst the researchers at their early stage of academic career and the more experienced scholars.

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iLEAPS hosted the IGBP IPO Meeting

14-16 September 2005 Helsinki and Hyytiälä, Finland.

The IPO meeting participants got the famous grand tour at the Hyytiälä SMEAR II station. The guides were professors Markku Kulmala (far left) and Pertti Hari (front center) from the University of Helsinki, Departments of Physical Sciences and Forest Ecology.

Executive officers from IGBP core projects and ESSP joint projects get together yearly for a 3-day meeting with reps from the IGBP Secretariat to share experiences on "nuts and bolts", discuss scientific issues, plan future collaboration within IGBP and ESSP as well as outreach to other programs. While IGBP is consolidating into its second phase, the projects find their offices at different stages of maturity. GLOBEC and PAGES are very established. LOICZ, joint core project of IGBP and IHDP, is in the beginning of its second phase and the IPO is facing a change in location in the near future. The second phase of IGAC started with a new executive officer, and iLEAPS is developing rapidly since its creation from scratch in 2004. SOLAS and IMBER recently recruited executive officers, AIMES as well. This means different degrees of familiarity on the IGBP and Earth System Science projects and therefore time to prepare a guide how to start, run and close down an international project office. In addition to the iLEAPS staff Participants were the Executive Officers of: GLOBEC Global Ocean Ecosystem Dynamics, Manuel Barange; LOICZ Land-Ocean Interactions in the Coastal Zone, Hartwig Kremer; SOLAS Surface Ocean-Lower Atmosphere Study, Jeff Hare; IGAC International Global Atmospheric Chemistry, Sarah Doherty; IMBER Integrated Marine Biogeochemistry and Ecosystem Research, Sylvie Roy; PAGES Past Global Changes Thorsten Kiefer; AIMES Analysis, Integration and Modeling of the Earth System, Kathy Hibbard. From the IGBP Secretariat: Bill Young, Joao Morais, and Kevin Noone. Also GWSP, Lara Wever, was present as invited partner project.

The post conference workshop to the 1st iLEAPS Science Conference, Boulder 21-26 January 2006

Flux Measurements in Difficult Conditions, a specialist Workshop
Boulder, Colorado, USA, 26 – 28 of January 2006

iLEAPS

Surface exchange measurements are motivated by important questions in biology, ecology and biogeochemical cycling. Measurement sites often do not conform to the ideal conditions of homogeneity and stationarity that allow simple application of the eddy flux approach. Difficulties arise in connection to advective flows caused by topography and/or heterogeneity, spatial and temporal intermittency in exchange processes , contribution and origins of low frequency eddies, nighttime stably stratified flows.

This workshop aims to:
–Define the conditions where flux measurements are likely to be compromised by departures from ideal flow behaviour
–Develop methods to identify these departures and their causes
–Assess the significance of the resulting measurement errors to meteorology and biogeochemistry

The workshop will discuss:
–Recent field experiments
–Physical modelling
–Theoretical models and data assimilation for correction
–Footprint analysis in difficult conditions

Registration open

WEBSITE and registration:
http//:www.atm.helsinki.fi/ILEAPS/fluxworkshop2006
Contact and organizers:
iLEAPS International Project Office ileaps-ipo@helsinki.fi
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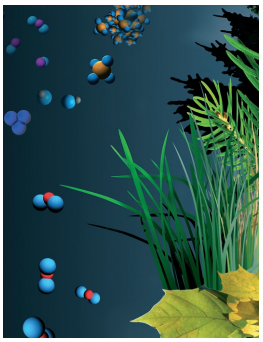

Cover: Glynn Gorick illustration of iLEAPS related research. The illustration shows different spatial scales, from molecular to global. The main elements in the land-atmosphere relationships find their place in this figure, which will be used as the graphical base to communicate iLEAPS related research. This is part of the Earth System illustration that Glynn is creating for IGBP. glynn@gorick.co.uk

INSTRUCTIONS TO CONTRIBUTORS

The iLEAPS Newsletter informs on iLEAPS-related scientific activities. The theme of contributions should be relevant to iLEAPS and integrated land-atmosphere research.
The Newsletter is published twice a year and it is released both in printed and on-line versions. For the paper version the specified word length given in these instructions is enforced. The author may provide additional material to be used on the iLEAPS web pages.

EDITORIAL.

Editorials are around 500 words with or without one accompanying figure. Editorials are by invitation and feature a personal interpretation and evaluation on the theme of the issue.

SCIENTIFIC ARTICLES.

Articles are 700-1000 words and cover 1-2 pages with accompanying 2-3 pictures or figures. Articles can contain the following:
RESULTS of scientific research
SUMMARIES presenting synthesis of recent scientific development in land-atmosphere research
POSITION PAPERS stating views and directions in scientific research
REPORTS presenting key scientific outcomes of programmes, workshops, or meetings.

NEWS

Other than strictly scientific contents will be max 200 words and can be for
PEOPLE presentation
ACTIVITIES report and commentaries
ANNOUNCEMENTS of coming events, job vacancies or short news.

Text and graphs should be provided in separate files. Text should be in .doc or .txt. Photographs should be in .tiff format, minimum 300dpi. Graphs and figures should be in its original format or as high resolution .tiff. or .eps images. The contributors are kindly requested to handle potential copyright issues of the material.
Contributions should be e-mailed to the Executive Editor at the iLEAPS IPO.

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