the eggs

E.G.U. NEWSLETTER

ISSUE 21, SEPTEMBER 2007
AVAILABLE ON-LINE AT www.the-eggs.org

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  Impacts on Environment, Society and Economy
- **Global satellite observations of greenhouse gas emissions**
- **Short Report on the 3rd Alexander von Humboldt International Conference**
  on East Asian Monsoon, Past, Present and Future, held in Beijing, China, 9-11 August 2007

Paper: ISSN 1027-6343
Online: ISSN 1607-7954

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Cover photo: An image of the Birksdal Glacier in Norway. Credit: Jorge Mataix-Solera, Universidad Miguel Hernandez, Elche - Alicante, Spain. Distributed by EGU via www.imaggeo.net.

Coverage of the EGU 2007 Assembly in the media

Dozens of contributions have appeared in the printed media, tv and radio

The last EGU Assembly in Wien has received large coverage by the media. Journalists were attending the Assembly and have been busy interviewing scientists and attending sessions and press conferences. As a result, many presentations made by scientists during the Assembly received wide media coverage.

You can have a look at some of the radio and printed media reports at
http://www.egu-media.net/content/view/113/7/

EGU Vladimir Vernadsky Medal 2007 to Jaap Sinninghe Damsté

for his scientific work on the development of molecular biomarkers

The section Biogeosciences of the European Geosciences Union (EGU) has awarded the prestigious Vernadsky Medal 2007 to Jaap Sinninghe Damsté of the Royal Netherlands Institute for Sea Research NIOZ. Damsté receives the medal for the extraordinary quality of his scientific work in the field of biogeochemistry. The Vernadsky Medal is the second international award for Sinninghe Damsté. Last year he already received the Treibs Medal in organic geochemistry from the American Geochemical Society.

Professor Jaap Smede Sinnighe Damsté was born on January 1, 1959 in Baarn, The Netherlands. He studied analytical environmental chemistry at the Technical University of Delft (1984, Cum Laude) and obtained a Ph. D. in organic geochemistry from the same university (1988, Cum Laude). In 1993 he moved to the Royal Netherlands Institute for Sea Research, where he now heads the Marine Biogeochemistry and Toxicology Department. He is professor of molecular paleontology at the Utrecht University (since 2003) and member of the Royal Netherlands Academy of Arts and Sciences (since 2005).

His Ph.D. work on organic sulfur was truly ground-breaking and resulted in a revision of global geochemical carbon and sulfur cycling. Sinninghe Damsté and colleagues have developed numerous paleoceanographic proxies and molecular indices that have opened new avenues for tracing past ecosystem functioning and linking microbial identity with biogeochemical activity. Examples include ladderane lipids for bacteria involved in Anammox and isorenieretene, a molecular proxy for photic zone anoxia. His study of rise of the rhizosolenid diatoms via the occurrence of highly branched isoprenoid alkenes in sediments provided not only unprecedented detail on evolution of diatoms, but also an independent calibration of the molecular clock. Recently, his research group has discovered that archaea are widely distributed in the ocean and that some members are chemoautotrophs fixing carbon dioxide via oxidation of ammonium. Moreover, they have used archaeal membrane lipids to develop a novel paleothermometer (TEX86), and its application has already generated a number of new, perplexing insights.

Jaap Sinninghe Damsté gets the Vernadsky Medal for his scientific work on the development of molecular biomarkers. These can be used to decipher the interactions between the biosphere and the geosphere of our planet. Biomarkers are organic molecules from (remnants of) micro-organisms like bacteria and unicellular algae. The occurrence of certain species is often characteristic for the environment in which they flourished, because that environment had to meet the specific demands from these organisms. Sinninghe Damsté and his research group investigate current processes in our seas and oceans as well as processes that occurred in the past, sometimes more than a hundred million years ago. The characteristics of these ancient environments are usually reconstructed from the biomarker molecules occurring in sediment cores from the sea-bottom.

The Vernadsky Medal is named after the Russian-Oekraïnian geologist Vladimir Ivanovich Vernadsky (1863-1945), who is regarded as the founding father of the modern biogeosciences. Sinninghe Damsté is the fourth scientist to receive this honorary award. He received the medal during the fourth general meeting of the European Geosciences Union in Vienna from 15 - 20 April 2007.

Liu Tungsheng EGU Alexander von Humboldt Medallist 2007

This medal is reserved for scientists from Developing Countries who have achieved exceptional international standing in geosciences and planetary and space sciences

The Alexander von Humboldt Medal is reserved for scientists from Developing Countries (with emphasis on Latin America and Africa) who have achieved exceptional international standing in geosciences and planetary and space sciences, defined in their widest senses.

Liu Tungsheng was this year's awardee, for his exceptional contributions to Earth and Environmental Sciences, particularly in advancing our understanding of paleoclimatic change using Chinese loess-paleosoil sequence. The medal is normally awarded during the yearly EGU Assembly, but Prof. Liu Tungsheng was not able to attend the Wien meeting. So the medal was presented to Prof. Liu Tungsheng during EGU's 3rd Alexander von Humboldt Conference held in Beijing, China, 9-11 August 2007 (see Conference Report in this issue, http://www.the-eggs.org/articles.php?id=110) by André Berger, EGU Honorary President.

André Berger's address:

Professor Liu Tungsheng's career has been highlighted with outstanding environmental achievements, particularly in advancing the understanding of paleoclimatic change and in promoting Chinese contributions to environmental science. By half a century of tireless and energetic endeavor, Liu established the Chinese loess-paleosoil sequence as a first-rank terrestrial record of paleoclimatic history for the past 2.5 million years, an achievement dreamed by a broad range of scientists for generations. It parallels the records of deep-sea sediments and polar ice sheets, and even combines the advantages of both records in completeness and high-resolution. This work was accomplished by convincingly demonstrating, from numerous publications, the following crucial points:

(1) loess-paleosol sequence in China results from a continuous aeolian dust accumulation;

(2) the accumulation rates closely relate to the atmospheric conditions,

(3) the regional climate is linked to global climatic forcing;

(4) the chronological framework of the entire loess sequence is possible; and

(5) loess sequences allow the reconstruction of climatic variations at time scales going from the astronomical one of the glacial-interglacial cycles (as observed in deep-sea sediments) to the thousand years time scale.

Liu has also greatly promoted and was -and still is- actively involved in recent studies that extend the lower boundary of Cenozoic eolian deposits in northern China, first to about 8 Ma BP based on the aeolian Red Clay, and then to about 22 Ma BP based on the Qinan eolian sequences, both being among the best Cenozoic climate records of the Euro-Asian continents.

Liu also extended and made tremendous contributions to applied environmental science. A geochemical approach conducted by Liu's team on the endemic disease, the Keshan Disease, led to a great advance in solving this half-a-century mystery. His finding of the relationship between loess collapse property and its composition proved effective in engineering prevention of water-soil erosion in the vast loess region.

Liu has proved to be extremely influential in both national and

The Medal presented to Prof Liu Tungsheng. From left to right : Peter Fabian (Founding President oif EGU and initiator of the von Humbldt Conference series), Tungsheng Liu, André Berger (Honourary President of EGU and co-chair of the meeting), Zhongli Ding (Director of Institute of Geology and Geophysics of the Chinese Academy of Sciences and co-chair of the meeting).

international geological and geoenvironmental circles. He played a key role in the establishment of the most effective state laboratories and institutions for environmental research, and in the development of environmental science in China. He devoted full emotion and enthusiasm, promoted international cooperation and communication involving a broad range of scientists who have interest in some way in loess, and collaborated fruitfully with scholars worldwide. These efforts were extremely effective in boosting Chinese contributions to the advances of environmental science, and led to the blooming of Chinese loess research in international scientific forums over past decades.

In summary, Liu Tungsheng has demonstrated an impressive excellence both in scientific research and leadership, a combination rarely seen. Just because of such a combination maintained through his long lasting career, Liu has made an outstanding environmental achievement in the modern world.

Claude Jaupart receives EGU Arthur Holmes Medal & Honorary Membership 2007

for his fundamental research concerning the fluxes of energy in the Earth with specific reference to volcanic systems

The Arthur Holmes Medal & Honorary Membership of the EGU, form one of the three equally-ranked most prestigious awards made by the Union, and they are reserved for scientists who have achieved exceptional international standing in Solid Earth Geosciences, defined in their widest senses, for their merit and their scientific achievements.

Claude Jaupart received the EGU Arthur Holmes Medal & Honorary Membership 2007 during the last Assembly in Wien for his fundamental research concerning the fluxes of energy in the Earth with specific reference to volcanic systems.

Claude Jaupart has made major and highly original contributions to physical volcanology, igneous processes, geodynamics and heat flow in the Earth. Claude has applied his deep knowledge of physics and fluid dynamics to make major advances in understanding dynamic processes and heat transfer. He is an able mathematician and outstanding experimentalist with an intuitive feel of how nature works. He has combined these skills with an encyclopaedic knowledge of earth sciences and an appreciation of the importance of collecting high quality field data. In volcanology his contributions include: understanding how the dynamics of bubbly magmas in conduits leads to episodic degassing behaviour at basaltic volcanoes, the role of magma permeability in controlling transitions between explosive and effusive eruptions, the non-linear dynamics of conduit flows from magma chambers, the role of compressibility in bubbly magmas and lavas, convection in lava lakes, the influence of volcanic edifices on the propagation of dykes and formation of magma chambers, and magma chamber control of eruption dynamics. He has also made important contributions to igneous processes and the origin of igneous layering, in particular in his work on the kinetics of crystallization and compositional convection. His research papers are characterized by mathematical and physical rigour, elegant and insightful experiments, and close links between the models and observations of geological, geophysical, petrological and geochemical data. In geodynamics Claude has made highly original and important contributions on heat transfer in the Earth through his field measurements of heat flow, laboratory measurements of thermal conductivities, and modeling studies of mantle convection. He is the World leading figure in heat flow studies and his work in Canada has set a new standard; combined with his theoretical knowledge he has constrained the heat flow in continents and related these measurements to Earth history. His ideas on the geotherm in ancient cratons have been vindicated from mantle nodule data. He has made important contributions to understanding mantle convection, in his pioneering work on convection in fluids with strongly temperature-dependent viscosity and models of lateral convection in the mantle below continents. Claude is a polymath in the true tradition of Arthur Holmes and is one of the outstanding European earth scientists of the last several decades.

Claude Jaupart has received several awards: from the French academy of sciences; the Geological Society of London; the International Association for Volcanology and Chemistry of the Earth's Interior. He is a Fellow of the American Geophysical Union, Honorary Fellow of the European Union of Geosciences and member of the Institut Universitaire de France.

The medal is named after Arthur Holmes. In 1913, Arthur Holmes, before he even earned his doctoral degree, he proposed the first geological time scale, based on the fairly recently discovered phenomenon of radioactivity. Using his quantitative time scale and other factors, he made an estimate of Earth's age that was far older than anyone had suggested until then - 4 billion years. His initial estimates of Earth's eras have held up remarkably well over time: For example, he placed the beginning of the Cambrian period at around 600 million years ago; today 590 million years is the time frame largely accepted.

Around 1930, Holmes suggested a mechanism that could explain Alfred Wegener's theory of continental drift: the power of convection. Currents of heat and thermal expansion in the Earth's mantle, he suggested, could force the continents toward or away from one another, creating new ocean floor

and building mountain ranges (a theory later clarified by Harry Hess). Holmes was a widely respected geologist by then, but he was a few years too late to support Wegener (who died in 1930), and about 30 years too early to have hard data to back up his theory. He warned that his ideas were purely speculative and could have no scientific value until they acquire support from independent evidence. Yet he had come very close to describing the modern view of Earth's plates and the dynamics between them.

Claude F. Boutron receives the EGU Alfred Wegener Medal and Honorary Membership 2007

for his impressive contributions to improving our scientific knowledge of atmospheric geochemical cycles of heavy metals and their alteration by human activities

Professor Claude Boutron is one of the top leaders in the research of glaciology and atmospheric chemistry. In an impressive scientific career, he has developed critically important scientific knowledge concerning atmospheric geochemical cycles of heavy metals and their alteration by human activities. This knowledge was obtained by analyzing a large variety of snow and ice cores from Greenland, Antarctica, Latin America and the Alps for a wide range of heavy metals (especially Pb, Hg, Cd, Cu, Pt, Pd, Rh and U).

One of Professor Boutron's major achievement was to develop sophisticated techniques suitable for the reliable determination of heavy metals at the incredibly low concentration levels of less than 0.1 picogram per gram at which these metals are found in Greenland and Antarctic snow and ice cores. Also, he initiated a network of international collaborators with leading research institutes in Australia, Russia, the United States, Belgium and Italy for the development of innovative ultra sensitive analytical techniques.

Among the most spectacular results, which were obtained by Prof Boutron, is the evidence of an early large-scale atmospheric pollution for Pb and Cu two millennia ago during the peak of the Roman civilization, long before the Industrial Revolution This history was a crucial factor in the development and fall of the successive civilizations and is of considerable interest to archeologists.

Extremely interesting results were also obtained about the history of atmospheric pollution for Pb since the Industrial Revolution in both hemispheres. They clearly showed a dramatic increase in Pb concentration in Greenland snow from the 1930s to the late 1960s because of the massive rise in the use of lead alkyl additives in gasoline, and the subsequent decrease after the early 1970s as a consequence of the decrease in the use of these additives. This and similar results for Antarctica show that atmospheric pollution for heavy metals has reached the most remote areas of our planet.

Other investigations conducted by Prof. Boutron deal with observed changes in Hg concentrations in Antarctic ice during the past 40000 years showing that a large fraction of this metal originated from the emissions of gaseous Hg from productive ocean regions.

Most recently Prof. Boutron presented the first time series of uranium in snow and ice cores from the Mont Blanc. It shows a pronounced enhancement after World War 2, in particular due to the atmospheric transport of dust particles emanating from intensive mining and smelting activities in the former German Democratic Republic.

Professor Boutron is an investigator of exceptional capability using sophisticated techniques whose sensitivities and accuracies are presently without peer within the world's scientific community. He has made outstanding contributions to the scientific understanding of the pollution history of the Earth from the Antiquity to present times. Moreover, his European Research Course on Atmosphere has now a very high reputation gathering each year more than 50 students from many different nations and backgrounds.

For his impressive contributions to improving our scientific knowledge of atmospheric geochemical cycles of heavy metals and their alteration by human activities, Claude F. Boutron received the EGU Alfred Wegener Medal and Honorary Membership 2007 during the last EGU Assembly in Wien.

The Alfred Wegener Medal & Honorary Membership of the EGU, form one of the three equally-ranked most prestigious awards made by the Union, and they are reserved for scientists who have achieved exceptional international standing in atmospheric, hydrological or ocean sciences, defined in their widest senses, for their merit and their scientific achievements. Alfred Wegener was a German climatologist and geophysicist who, in 1915, published as expanded version of his 1912 book The Origin of Continents and Oceans. This work was one of the first to suggest continental drift and plate tectonics. He suggested that a supercontinent he called Pangaea had existed in the past, broke up starting 200 million years ago, and that the pieces "drifted" to their present positions. He cited the fit of South America and Africa, ancient climate similarities, fossil evidence (such as the fern Glossopteris and mesosaurus), and similarity of rock structures.

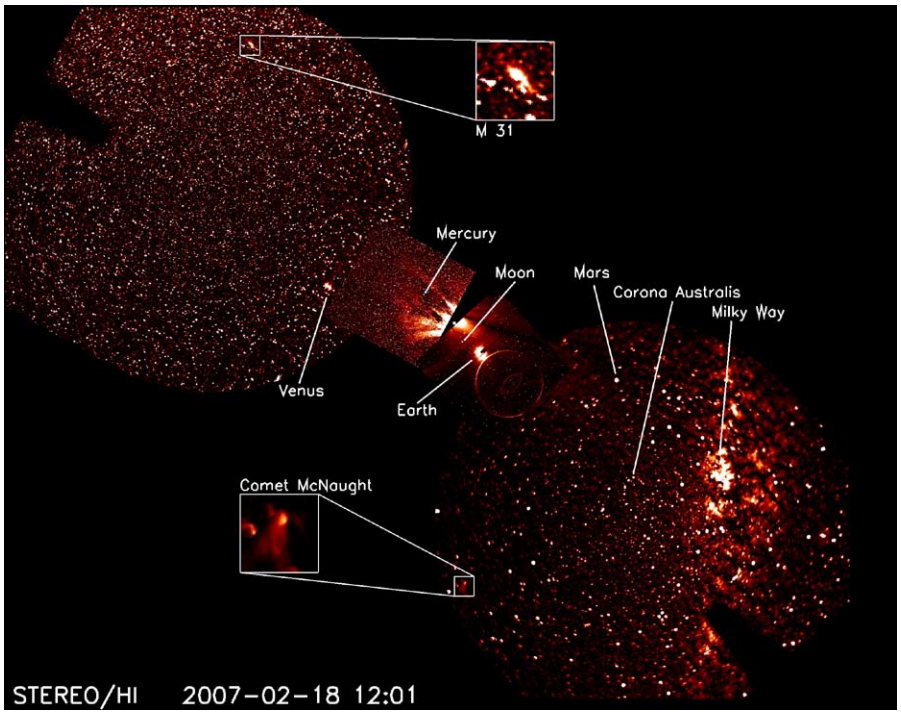
First 3D images of the Sun

NASA announced the release of first 3D images from the STEREO twin spacecraft

April 23, 2007.- NASA's twin Solar Terrestrial Relations Observatory (STEREO) spacecraft orbiting the sun have made the first three-dimensional images of our star.

STEREO (Solar TErrestrial RElations Observatory) is a mission in NASA's Solar Terrestrial Probes program (STP). The two-year mission, launched October 25, 2006, will provide a unique view of the Sun-Earth System. Two nearly identical observatories - one ahead of Earth in its orbit, the other trailing behind - trace the flow of energy and matter from the Sun to Earth. The separation of the spacecraft allows 3-D images of the sun.

STEREO is a key addition to the fleet of space weather detection satellites with its unique side-viewing perspective. Violent solar weather originates in the sun's atmosphere, or corona, and can disrupt satellites, radio communication, and power grids on Earth. Dr. Russell Howard of the Naval Research Laboratory, Washington is the Principal Investigator for the SECCHI (Sun Earth Connection Coronal and Heliospheric Investigation) suite of telescopes on the spacecraft. Part of SECCHI is also the Heliospheric Imager (HI) is a wide-angle imaging system for the detection of coronal mass ejection (CME) events in interplanetary space and, in particular, of events directed towards the Earth. The HI instrument has been developed by a UK-led consortium which includes the Centre Spatial de Liege, Belgium, and the Naval Research Laboratory, USA. Principal Investigator is Prof. Richard A. Harrison from Rutherford Appleton Laboratory.



The complete field of view of the HI cameras. The Sun, on this scale, is represented by a white dot in the middle of the image. Credit: Rutherford Appleton Laboratory, Centre Spatial de Liege and University of Birmingham.

STEREO's depth perception will help improve space weather forecasts. Of particular concern are Coronal Mass Ejections (CMEs). CMEs are eruptions of plasma from the sun's atmosphere. A CME cloud can contain billions of tons of plasma and move at a million miles per hour. Knowing where the front of the CME cloud is can help improve estimates of the arrival time from within a day or so to just a few hours.

STEREO's first 3-D images are being provided by NASA's Jet Propulsion Laboratory, Pasadena, USA. The Johns Hopkins University Applied Physics Laboratory, Laurel, Md., USA, designed and built the spacecraft. The STEREO imaging and particle detecting instruments were designed and built by scientific institutions in the U.S., UK, France, Germany, Belgium, Netherlands, and Switzerland.

STEREO images, including 3-D ones, can be found at

http://www.nasa.gov/mission_pages/stereo/news/stereo3D_press.html

The World Meteorological Organization reports on extreme weather and climate events

Weather and climate are marked by record extremes in many regions across the world since January 2007 according to a press release by WMO

WMO, Geneva, 7 August 2007.- Weather and climate are marked by record extremes in many regions across the world since January 2007. In January and April 2007 it is likely that global land surface temperatures ranked warmest since records began in 1880, 1.89°C warmer than average for January and 1.37°C warmer than average for April. Several regions have experienced extremely heavy precipitation, leading to severe floods. The Fourth Assessment Report of the WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) notes an increasing trend in extreme events observed during the last 50 years. IPCC further projects it to be very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent.

WMO and the National Meteorological and Hydrological Services of its 188 Members are working with other UN Agencies and partners towards the establishment of a multi-hazard early warning system. Furthermore, they are putting in place sustainable observation systems needed for monitoring and assessing the impacts of climate change and determining the adaptation priorities for the most vulnerable countries.

Heavy rainfall, cyclones and wind storms

During the first half (June-July) of the Indian summer monsoon season, four monsoon depressions (double the normal frequency) caused heavy rainfall and floods in India, Pakistan and Bangladesh. Many stations reported 24h rainfall exceeding 350 mm. These monsoon extremes and incessant rains caused large-scale flooding all over South Asia, a situation that continues even now, resulting in more than 500 deaths, displacement of more than 10 million people and destruction of vast areas of croplands, livestock and property.

Cyclone Gonu, the first documented cyclone in the Arabian Sea, made landfall in Oman on 6 June with maximum sustained winds near 148 km/h. Gonu moved through the Persian Gulf making a second landfall in the Islamic Republic of Iran. In Oman, the cyclone affected more than 20,000 people and was responsible for more than 50 fatalities.

Heavy rains during 6-10 June ravaged areas across southern China. Flooding affected over 13.5 million people with more than 120 fatalities due to floods and landslides.

In England and Wales the period May to July in 2007 was the wettest (406 mm) since records began in 1766, breaking the previous record of 349 mm in 1789. The extreme rainfall in June, with 103.1 mm of rain recorded in 24 hours during 24-25 June in northeast England, was followed by a similar event with 120.8 mm of rain on 20 July in central England. Both events resulted in extensive flooding across parts of England and Wales. At least nine people have died and damage is estimated at more than US$6.00 billion.

With 126 mm (normal for 1961-1990: 71 mm], Germany experienced its wettest May since country-wide observations started in 1901. In sharp contrast, the previous month was the driest April since 1901 with an average of 4 mm (7% of the 1961-1990 normal).

A powerful storm system affected much of northern Europe during 17-18 January 2007 with torrential rains and winds gusting up to 170 km/h. There were at least 47 deaths across the region, with disruptions in electric supply affecting tens of thousands during the storm. Initial estimates of losses were reported as 3-5 billion Euros.

The worst flooding event in 6 years hit Mozambique in February. An estimated 30 people were killed and 120,000 evacuated from the central Zambezi basin. Additional flooding and loss of life was attributed to the landfall of tropical cyclone Favio on 22nd February.

Abnormally heavy and early rainfall in Sudan since the end of June has caused the Nile River and other seasonal rivers to overflow, resulting in extensive flooding and damaging more than 16,000 houses.

In May a series of large swell waves (estimated at 3-4.5 meters) swamped some 68 islands in 16 atolls in the Maldives causing serious flooding and extensive damages.

In early May, Uruguay was hit by the worst flooding since 1959. Heavy rainfall in portions of Uruguay produced floods that affected more than 110,000 people and severely damaged crops and buildings.

Heat Waves

Two extreme heat waves affected south-eastern Europe in June and July, breaking the previous records with temperatures exceeding 40 °C. Dozens of people died and fire-fighters worked around the clock fighting blazes devastating thousands of hectares of land. On 23 July, temperatures hit 45°C in Bulgaria, setting a new record.

In May a heat wave affected areas across western and central Russia breaking several temperature records. In Moscow, temperatures on 28 May reached 32.9°C, the highest temperature recorded in May since 1891.

In many European countries, April was the warmest ever recorded with the temperatures reaching more than 4°C over and above the long-term mean in some areas.

Recognizing the severe health impacts of heat waves, the WMO and the World Health Organization (WHO), are at an advanced stage of preparing Guidance on the implementation of Heat Health early Warning Systems (HHWS).

Climate Change and Extremes

According to the most recent climate change scientific assessment reports of the joint WMO/UNEP Intergovernmental Panel on Climate Change (IPCC), the warming of the climate system is unequivocal. Eleven of the last twelve years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature. The 100-year trend (1906-2005) is 0.74°C. The linear warming trend over the last 50 years (0.13°C per decade) is nearly twice that for the last 100 years. Paleoclimatic studies suggest that the average Northern Hemisphere temperatures during the second half of

the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in the past 1,300 years.

IPCC further notes that there has been an increasing trend in the extreme events observed during the last 50 years, particularly heavy precipitation events, hot days, hot nights and heat waves.

Climate change projections indicate it to be very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent.

Additional facts:

An unusual cold winter season brought winds, blizzards and rare snowfall to various provinces in South America with temperatures reaching as low as -22°C in Argentina and -18°C in Chile in the beginning of July.

On 27 June a winter weather front moved across South Africa bringing the country's first significant snowfall since 1981 (25 cm of snow in parts of the country).

In India, a heat wave during mid-May produced temperatures as high as 45-50°C.

Many European countries had their warmest January on record. January temperatures in The Netherlands were the highest since measurements were first taken in 1706, averaging about 7.1°C (2.8°C above 1961-1990 average) while in Germany the temperatures were 4.6°C above the 1961-1990 average.

An increase in intense tropical cyclone activities in the North Atlantic since about 1970 has been observed.

This information is based on inputs received from several WMO Members and with the collaboration of the NOAA National Climatic Data Centre (NCDC), USA, Germany's National Meteorological Service, the Deutscher Wetterdienst (DWD) and the Met Office, UK. It includes an indicative but not exhaustive coverage of the observed weather and climate extremes. More comprehensive information on weather and climate anomalies observed in 2007 will be provided towards the end of the year.

WMO Press Release No. 791

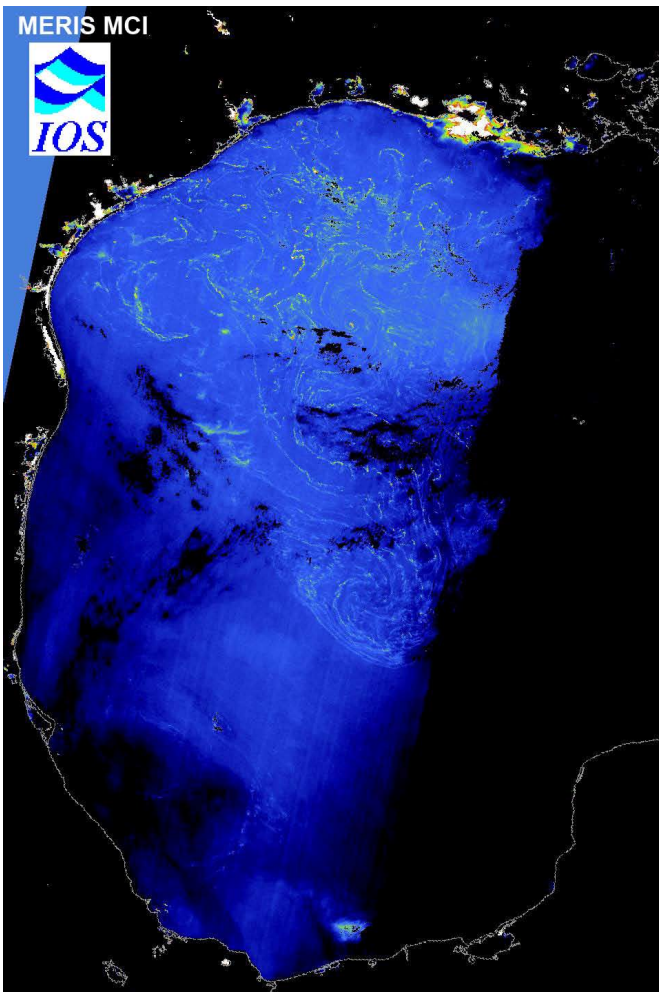
First detection of Sargassum from space

Using optical radiance data from MERIS extensive lines of floating Sargassum seaweed in the western Gulf of Mexico were identified

Using optical radiance data from MERIS, Drs. Jim Gower and Stephanie King (Institute of Ocean Sciences, Canada) and Chuanmin Hu (University of South Florida, US) were able to identify extensive lines of floating Sargassum seaweed in the western Gulf of Mexico. This is the first time that Sargassum has been identified from space.

The discovery was made using the MERIS Maximum Chlorophyll Index (MCI) which provides an assessment of the amount of chlorophyll in vegetation to produce detailed images of chlorophyll per unit area. MERIS is uniquely suited for this because it provides images of above-atmosphere spectral radiance in 15 bands, including three bands at wavelengths of 665, 681 and 709 nm, in order to measure the fluorescence emission from chlorophyll-a. The 709 nm band of MERIS is not present on other ocean-colour sensors, and was essential for the detection of Sargassum. The MCI index was also used to find intense phytoplankton blooms in the Antarctic.

Reference: Gower, J.; King, S., Intense Plankton Blooms and Sargassum Detected by MERIS, Proceedings of the MERIS (A)ATSR Workshop 2005 (ESA SP-597). 26 - 30 September 2005 ESRIN, Frascati, Italy. Editor: H. Lacoste. Published on CDROM., p.20.1.



MERIS MCI image of the western Gulf of Mexico for 2 June 2005, showing extensive lines of floating Sargassum in the open waters. Credit: Institute of Ocean Sciences, Canada.

2007 Call for ESF Research Networking Programme proposals

ESF Research Networking Programmes are networking activities bringing together nationally funded research activities for four to five yearshaven, has been awarded this year's "Communicator Award - Science Award of the Donors' Association".

ESF Research Networking Programmes are networking activities bringing together nationally funded research activities for four to five years, to address major scientific issues or science-driven topics of research infrastructure at the European level with the aim of advancing the frontiers of science.

Key objectives include:

creating interdisciplinary fora;
sharing knowledge and expertise;
developing new techniques;
training young scientists.

A successful Programme proposal must show high scientific quality and also demonstrate added value by being carried out at a European level rather than by individual research groups at the national level.

Proposals

Proposals may be submitted in any or across several of the following broad scientific fields:

Biomedical Sciences
Life, Earth and Environmental
Physical and Engineering Sciences
Humanities
Social Sciences
Science driven issues of Research Infrastructures in any of the above fields

Format and activities

A Programme can include the following activities:

Science meetings (workshops, conferences or schools) organised either by Programme participants or following an open call for proposals;

Grants for short and exchange visits awarded following an open call for applications;

Publication of information brochures and leaflets, DVDs and CD Roms, scientific books and meeting proceedings etc; creation of websites;

Creation of scientific databases at the European level.

The Call and the submission form are available at: http://www.esf.org/activities/research-networking-programmes/2007-call-for-proposals.html

The deadline for submission is 30 October 2007, 16:00hrs CET.

ESF

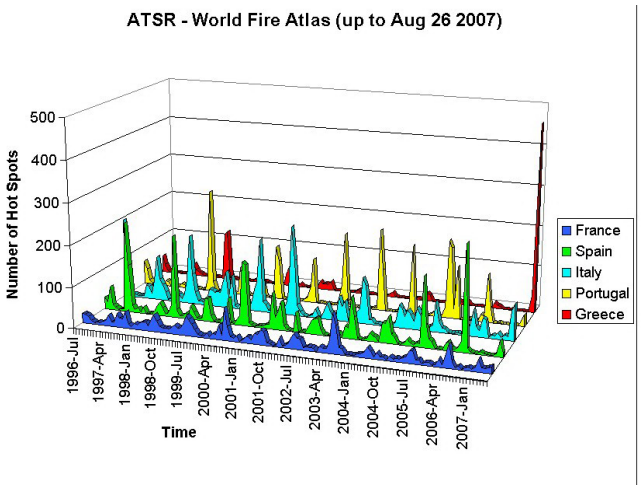
Greece suffers more fires in August 2007

Greece has experienced more wildfire activity this August than other European countries have over the last decade, according to data from ESA satellites

29 August 2007.- Greece has experienced more wildfire activity this August than other European countries have over the last decade, according to data from ESA satellites. The country is currently battling an outbreak of blazes, which began last Thursday, that have spread across the country killing more than 60 people.

ESA's ERS-2 and Envisat satellites continuously survey fires burning across the Earth's surface with onboard sensors – the Along Track Scanning Radiometer (ATSR) and the Advanced Along Track Scanning Radiometer (AATSR) respectively, known as the ATSR Word Fire Atlas, which is available to users online in near-real time.

The ATSR World Fire Atlas is the longest worldwide fire atlas available. Even if the atlas is not supposed to pick up all fires due to satellite overpass constraints and cloud coverage, it is statistically representative from one month to the other and from one year to the other.



Number of monthly hotspots from ESA's World Fire Atlas. Credit: ESA

Temperatures exceeding 308ºK at night are classed as burning fires. Data gathered from July 1996 to 28 August 2007 was used to plot the number of fires occurring monthly and show Greece has had four times the number of fires this August compared to its July and August 1998 records.

Weather conditions, including record summer temperatures and hot dry winds, in 2007 made parts of the Mediterranean – including Greece and southern Italy – a tinderbox, the United Nations Food and Agriculture Organization said.

ESA

ESA seeks candidates for simulated Missions to Mars in 2008/2009

ESA is looking for 12 volunteers to take part in a 520-day simulated Mars mission

19 June 2007.- ESA is preparing for future human exploration missions to Mars and is looking for 12 volunteers to take part in a 520-day simulated Mars mission.

Men and women on a journey to Mars will have to take care of themselves for almost two years during the roundtrip. Their survival is in their own hands, relying on the work of thousands of engineers and scientists back on Earth, who made such a mission possible. The crew will experience extreme isolation and confinement. They will lose sight of planet Earth. A radio contact will take 40 minutes to travel to us and then back to the space explorers.

Simulation

In order to investigate the human factors of such a mission, ESA has teamed up with the Russian Institute of Biomedical Problems (IBMP) and will send a joint crew of six on a 520-day simulated mission to Mars.

The simulation follows the mission profile of a real Mars mission, including an exploration phase on the surface of Mars. Nutrition will be identical to that provided on board the International Space Station. The simulations will take place here on Earth inside a special facility in Moscow. A precursor 105-day study is scheduled to start by mid-2008, possibly followed by another 105-day study, before the full 520-day study begins in late 2008 or early 2009.

ESA is looking for 12 volunteers who are ready to participate in the simulations and thereby help to support the preparations of the real thing: a mission to Mars. Four volunteers will be needed for each of the three simulations. The selection procedure is similar to that of ESA astronauts, although there will be more emphasis on psychological factors and stress resistance than on physical fitness.

For detailed information on this Call for Candidates and for the application form please refer to:

http://www.spaceflight.esa.int/callforcandidates

Alongside such dedicated space mission simulations, a complementary approach to understand the complexities of human health and behaviour is to look at analogue environments. These are operational environments, which, through their natural situation produce some similar constraints as for example a mission to Mars.

ESA has already been active for some years in the Antarctic Concordia research station. In support of the scientific and technical projects there, ESA is looking for one person (each year) with a medical background. The details of that Call for Candidates can also be found at the web address indicated above.

ESA

Hinode's solar data access

Opening of the Hinode Science Data Centre in Norway

30 May 2007.- Since 27 May, Europe's scientists have free access to spectacular data and images from Hinode, a Japan-led mission with ESA participation that studies the mechanisms that power the Sun's atmosphere and cause violent eruptions.

This free access is now possible thanks to the opening of the Hinode Science Data Centre in Norway, developed and run by the Institute of Theoretical Astrophysics at the University of Oslo on behalf of ESA and the Norwegian Space Centre. It is part of ESA and Norway's joint contribution to this solar mission.

In exchange for ESA's and Norway's contribution to the mission, European scientists have been guaranteed free access to the Hinode data by the Japan Aerospace Exploration Agency (JAXA).

The website of Hinode Science Data Centre: http://sdc.uio.no/

A Hinode movie archive is located at http://www.nasa.gov/mission_pages/solar-b/hinode_videos_archive_1.html

Climate change impact on cultural heritage

Last results of Noah's Ark project, a research project addressing the impact of global change in cultural heritage buildings

On 30 May 2007 in Roma, Italy, representatives of Noah's Ark project consortium, including partners from Italy, Spain, UK, Czech Republic, Sweden, Poland and Norway, and coordinated by Prof. C. Sabbioni of the Institute for Sciences of the Atmosphere and Climate (ISAC) CNR, Bologna (Italy), presented the first Vulnerability Atlas that maps the climate likely to affect European cultural heritage through the 21 st century. The Atlas provides climate data relevant to cultural heritage as well as meteorological information in terms of potential risks to heritage and changes due to damage.

For its impact on policy, Noah's Ark has also produced Guidelines that scope "adaptation strategies" for cultural heritage under conditions of a changing climate. These adaptation strategies should enable heritage stakeholders, public policy-makers and national heritage organizations to prepare for future climate change pressures.

One of Noah's Ark conclusions is that water appears to be the most important danger for cultural heritage. Intense rain, flood, or simply increased rainfall can overload roofing and gutters or penetrate into materials and deliver pollutants to building surfaces. Water is also involved in humidity change which affects the growth of micro-organisms on stone and wood, the formation of salts that degrade surfaces and influences corrosion. Furthermore, drier seasons increase salt weathering of stone and the desiccation of soils that protect archaeological remains and lend support to the foundations of buildings.

Noah's Ark has benefited from a broad partnership of academic researchers with particular expertise in physical, chemical and biological impacts on cultural materials, as well as cultural heritagestakeholders and representatives of the insurance industry, who are confronting the costs of climate change impacts in a direct way.

Web site of Noah's Ark: http://noahsark.isac.cnr.it/

Editor's note: *more on Noah's Ark project was reported in Issue 12 of this Newsletter. http://www.the-eggs.org/articles.php?id=70*

German TerraSAR-X radar satellite sends first data

Just four days after the launch of the satellite from Baikonur, brilliant first satellite images have been received

June 21, 2007.- Just four days after the launch of the German radar satellite TerraSAR-X from Baikonur on Friday, 15 June 2007, the first satellite images have been received.

The first pictures appeared on the monitors of the DLR Space Operations Center in Oberpfaffenhofen, near Munich. Although the satellite will only achieve its final orbit after ten days in space, the first data, actually sent simply for testing purposes, is already of a very high quality and sharp detail (see images at http://www.dlr.de/en/desktopdefault.aspx/tabid-15/138_read-9519/).

TerraSAR-X is the first German Public-Private Partnership (PPP) satellite - jointly realised by DLR and EADS Astrium (see The Eggs -EGU Newsletter report earlier this year at http://www.the-eggs.org/news.php?typeid=0&id=318).

ESF-LESC Travel Grants

ESF-LESC Travel Grants to support participation in the 2nd International AMMA (African Monsoon Multidisciplinary Analyses) Conference

A number of ESF-LESC travel grants are available, principally aimed at European young researchers, to support their active participation in the following event:

2nd International AMMA (African Monsoon Multidisciplinary Analyses) Conference in Karlsruhe, Germany, on 26-30 November 2007: http://science.amma-international.org.

Applications should be sent electronically with all documents in one single attachment (word or pdf format) to amma07@esf.org.

Deadline for application: 30 September 2007

For more information, please go to http://www.esf.org/lesc/grants.

Radio signals from the Sun precede radiation storms

CMEs which generate a radio signal also produce radiation storms

31 May 2007.- SOHO has helped uncover radio signals that foretell dangerous Coronal Mass Ejections, or CMEs, which produce radiation storms harming infrastructure on ground, in space as well as humans in space. Scientists made the connection by analysing observations of CMEs from ESA/NASA's SOHO (Solar and Heliospheric Observatory) and NASA's Wind spacecraft. The team includes researchers from Goddard, the Catholic University of America, Washington, the Naval Research Laboratory, Washington, and the Observatory of Paris.

"Some CMEs produce radiation storms, and some don't, or at least the level of radiation is significantly lower," said Dr. Natchimuthuk Gopalswamy of NASA's Goddard Space Flight Center in Greenbelt, Maryland, lead author of the results.

SOHO's Large Angle and Spectrometric Coronagraph (LASCO) can see CMEs and the Energetic and Relativistic Nucleon and Electron experiment (ERNE) detects their radiation. Wind has an instrument that can pick up a CME's radio signal (The Radio and Plasma Wave experiment).

The team compared observations from both SOHO and Wind and looked at 472 CMEs between 1996 and 2005 that were fast and covered a large area of the sky. They discovered that those CMEs which generated a radio signal also produced radiation storms, but CMEs without a radio signal did not.

Strong CME shocks accelerate electrons in the solar wind, which in turn produce the radio signal. The same strong shock must also accelerate atomic nuclei in the solar wind, which produce the radiation storm, according to the team.

The research, funded by NASA, was presented at the American Astronomical Society's 210th Meeting during 27-31 May 2007 in Honolulu, Hawaii.

Ozone hole similar to recent years

According to the first WMO Antarctic Ozone Bulletin of 2007

WMO, Geneva, 28 August 2007.- The first WMO Antarctic Ozone Bulletin of 2007 was published today, 28 August. It reports that the size and depth of the ozone hole are similar to recent years at this time. Although it emerged earlier this year, it is still too early to tell how it will compare with the record large ozone hole of 2006. Ozone depletion usually continues until early October, so it will be a further five weeks or so before a clear statement can be made.

Below the executive summary of the report. The whole repost can be found at http://www.wmo.int/pages/prog/arep/documents/ant-bulletin-1-2007.pdf

During the April-late June 2007 time period, 50 hPa temperatures averaged over the 60-90°S region have been close to, or somewhat below, the 1979-2006 average. From late June until late July this mean temperature was above the average. Since late July, the mean temperature has been oscillating around the 1979-2006 mean. During the last few weeks, the 50 hPa temperature in the 60-90°S region has been approx. 2 K warmer than at the same time last year.

Minimum temperatures in the vortex at 50 hPa are quite similar to those of 2006, but at 10 hPa the August minimum temperatures are lower this year than last year.

Since mid-June, temperatures low enough for nitric acid trihydrate (NAT or PSC type I) formation have covered about 70-75% of the vortex area. This is less than in 2006, when the NAT area in late July corresponded to 90% of the vortex area. Since the onset of NAT temperatures in mid-May, the NAT area was larger than the 1979-2006 average until late June. From early July to mid-July the NAT area was lower than the 1979-2006 average, but after that, the NAT area has again been somewhat above the long-term mean. Compared to the four most recent winters, the NAT area so far in 2007 is relatively small. Until early July, the NAT area behaved quite similarly to these recent winters, but after that the NAT area has been lower than for any of the winters in the 2003-2006 time period.

The size of the vortex at the 460 K isentropic level has been higher than the 1979-2006 average since early May. On certain days in July and August the vortex has been larger than the maximum for the 1979-2006 period. It should be pointed out, however, that vortex size gives no direct indication of the degree of ozone loss that might occur later in the season.

The longitudinally averaged heat flux between 45°S and 75°S is an indication of a disturbed stratosphere. From April to the end of June 2007, the heat flux was close to or below the 1979-2006 average. In July, the heat flux increased a lot and was, on some days, larger than the 1979-2006 maximum. This is a sign of an unstable vortex. During August the heat flux has become smaller and is now approaching the average for the season.

At the altitude of ~18 km the vortex is now almost entirely depleted of HCl, one of the reservoir gases that can be transformed to active chlorine. In the sunlit collar along the vortex edge there is 1.0 - 1.8 ppb of active chlorine (ClO), and some first signs of ozone depletion is visible. The south polar vortex is less concentric in 2007 than in 2006, and this has led to a relatively early onset of ozone depletion.

As the sun returns to Antarctica after the polar night, it is expected that ozone destruction will speed up. It is still too early to give a definitive statement about the development of this year's ozone hole and the degree of ozone loss that will occur. This will, to a large extent, depend on the meteorological conditions. The small NAT area observed so far could indicate that the 2007 ozone hole will be relatively small.

WMO and the scientific community will use ozone observations from the ground, from balloons and from satellites together with meteorological data to keep a close eye on the development during the coming weeks and months.

WMO

Pierre Auger Observatory shares cosmic-ray data with public and students

Scientists of the Pierre Auger Collaboration (July 3rd) began the public release of one percent of the cosmic-ray events

04 July 2007.- Scientists of the Pierre Auger Collaboration (July 3rd) began the public release of one percent of the cosmic-ray events recorded by the Pierre Auger Observatory in Argentina. New cosmic-ray data—about 70 events per day—will be posted on a daily basis. The data and their visualizations are available at www.auger.org and www.auger.org.ar.

The international Pierre Auger Collaboration, which includes scientists from 17 countries, explores the origins of extremely rare ultra-high-energy cosmic rays. These are the highest-energy particles ever recorded in nature. When such a particle hits the atmosphere it creates an air shower that can contain 200 billion particles by the time it reaches the ground.

The one-percent release is part of the worldwide Pierre Auger education and outreach program. It will allow teachers to expose students to real scientific data and the breathtaking processes that take place in the cosmos. The two Web sites provide the data both as graphical displays and in tabular form. For each cosmic-ray air shower, the Web sites show the energy and direction of the incoming cosmic-ray particle. The public data provides information on cosmic-rays with extremely high energy, up to 5 x 10^19 electron volts (eV).

When construction is complete near the end of the year, the Pierre Auger Observatory will extend over 3000 square kilometres in Argentina's Mendoza Province, east of the Andes Mountains. The full observatory will consist of an array of 1,600 detectors that record the arrival of air showers on the ground. Information gathered by the detectors is transmitted to a central data acquisition system using solar-powered cellular phone technology. Surrounding the detector array and looking toward its centre is a set of 24 telescopes that—on clear moonless nights—observe the ultraviolet fluorescence light produced as shower particles travel through the atmosphere.

Two more active moons around Saturn

Saturn's moons Tethys and Dione are flinging great streams of particles into space

13 June 2007.- Saturn's moons Tethys and Dione are flinging great streams of particles into space, according to data from the NASA/ESA/ASI Cassini mission to Saturn. The discovery suggests the possibility of some sort of geological activity.

The particles were traced to the two moons because of the movement of electrically charged gas (plasma) in the magnetic environs of Saturn. Saturn rotates around itself in 10 hours and 46 minutes. This sweeps the magnetic field and the trapped plasma through space.

Soon after Cassini reached Saturn, in June 2004, it revealed that the planet's rotation squashes the plasma into a disc and that great fingers of gas are being thrown out into space from the disc's outer edges. Hotter, more tenuous plasma then rushes in to fill the gaps.

Now, Jim Burch of the Southwest Research Institute, USA, and colleagues have made a careful study of these events using the Cassini Plasma Spectrometer (CAPS). They have shown that the direction of the ejected electrons points back towards Tethys and Dione.

Until this result, among Saturn's inner moons only Enceladus was known to be an active world, with huge geysers spraying gases hundreds of kilometres above the moon's surface. "This new result seems to be a strong indication that there is activity on Tethys and Dione as well," says Andrew Coates from the Mullard Space Science Laboratory, University College London, and a collaborator on this latest work.

The findings appeared in the 14 June 2007 issue of the Nature. The article, 'Tethys and Dione as sources of outward-flowing plasma in Saturn's magnetosphere', is by J. Burch, J. Goldstein, W. Lewis, D. Young, A. Coates, M Dougherty and N. André.

RAS President condemns NASA chief's comments on global warming

Professor Rowan-Robinson issued a statement on Dr. Griffin's views on global warming

6 June, 2007.- Head of NASA, Dr. Michael Griffin, speaking on National Public Radio (U.S.A.) on the 1st of June, 2007, commended on global warming. His comments created various reactions, as he stated he is not sure whether we should take action on global warming or not. The transcript of the interview follows below:

Q: It has been mentioned that NASA is not spending as much money as it could to study climate change - global warming - from space. Are you concerned about global warming?

GRIFFIN: I'm aware that global warming exists. I understand that the bulk of scientific evidence accumulated supports the claim that we've had about a one degree centigrade rise in temperature over the last century to within an accuracy of 20 percent. I'm also aware of recent findings that appear to have nailed down — pretty well nailed down the conclusion that much of that is manmade. Whether that is a longterm concern or not, I can't say.

Q: Do you have any doubt that this is a problem that mankind has to wrestle with?

GRIFFIN: I have no doubt that … a trend of global warming exists. I am not sure that it is fair to say that it is a problem we must wrestle with. To assume that it is a problem is to assume that the state of Earth's climate today is the optimal climate, the best climate that we could have or ever have had and that we need to take steps to make sure that it doesn't change. First of all, I don't think it's within the power of human beings to assure that the climate does not change, as millions of years of history have shown. And second of all, I guess I would ask which human beings — where and when — are to be accorded the privilege of deciding that this particular climate that we have right here today, right now is the best climate for all other human beings. I think that's a rather arrogant position for people to take.

Q: Is that thinking that informs you as you put together the budget? That something is happening, that it's worth studying, but you're not sure that you want to be battling it as an army might battle an enemy?

GRIFFIN: Nowhere in NASA's authorization, which of course governs what we do, is there anything at all telling us that we should take actions to affect climate change in either one way or another. We study global climate change, that is in our authorization, we think we do it rather well. I'm proud of that, but NASA is not an agency chartered to, quote, battle climate change.

Professor Rowan-Robinson, who is currently serving as president of the Royal Astronomical Society (UK), which represents more than 3000 astronomers worldwide, issued the following statement:

I was disturbed to read the comments by the Head of NASA, Michael Griffin, on global warming and climate change. While accepting that a trend of global warming exists, he questions whether this is a problem we must wrestle with.

This is counter to the strong advice of the world's climate scientists, expressed through the UN Intergovernmental Panel on Climate Change, who have urged the world's leaders to act swiftly to limit the rise in warming to no more than 2 degrees Centigrade. It is also counter to the Stern Report, which demonstrated that limiting global warming is both do-able and affordable.

Europe's space scientists, astronomers and Solar System scientists, will be dismayed by Michael Griffin's position and it will undermine their confidence in his leadership of NASA, an organisation with which the UK has a strong shared purpose.

I call on Michael Griffin to withdraw these comments.

A catastrophic flood separated Britain from France hundreds of thousands of years ago

according to research published in the journal Nature

19 July 2007.- A study, led by Sanjeev Gupta and Jenny Collier from Imperial College London, has revealed images of a valley tens of kilometres wide and up to 50 metres deep carved into chalk bedrock on the floor of the English Channel (Sanjeev Gupta, Jenny S. Collier, Andy Palmer-Felgate and Graeme Potter, Catastrophic flooding origin of shelf valley systems in the English Channel, Nature, 19 July 2007). The submerged valley was imaged using high-resolution sonar waves. The maps highlight deep scour marks and landforms which were created by torrents of water rushing over the exposed channel basin. The preservation of the landscape on the floor of the English Channel, which is now 30-50 m below sea level, is far better than anyone would have expected.

To the north of the channel basin was a lake which formed in the area now known as the southern North Sea. It was fed by the Rhine and Thames, impounded to the north by glaciers and dammed to the south by the Weald-Artois chalk ridge which spanned the Dover Straits. It is believed that a rise in the lake level eventually led to a breach in the Weald-Artois ridge, carving a massive valley along the English Channel, which was exposed during a glacial period.

At its peak, it is believed that the flood could have lasted several months, discharging an estimated one million cubic metres of water per second. This flow was one of the largest recorded megafloods in history and could have occurred 450,000 to 200,000 years ago.

The breach and permanent separation of the UK also affected patterns of early human occupation in Britain. Researchers speculate that the flooding induced changes in topography creating barriers to migration which led to a complete absence of humans in Britain 100,000 years ago.

Southern Ocean taking up less CO2

The research shows that an increase in winds above the Southern has led to the release of stored CO2 into the atmosphere

One of our planet's most important absorbers of carbon dioxide is failing to take up as much of the greenhouse gas as had been expected, according to an article published by European researchers this week in the journal Science. A decline in the ability of Antarctica's Southern Ocean to act as a carbon 'sink' could mean higher levels of atmospheric CO2 in future than previously predicted. Carbon sinks are important because they soak up excess CO2 from the atmosphere, helping temper the effects elevated greenhouse gas levels have on the environment. The four-year study was carried out by scientists from the University of East Anglia (UEA), British Antarctic Survey (BAS) and the Max-Planck Institute for Biogeochemistry.

The report's lead author Dr Corinne Le Quéré of UEA and BAS stated "This is the first time that we've been able to say that climate change itself is responsible for the saturation of the Southern Ocean sink. This is serious. All climate models predict that this kind of 'feedback' will continue and intensify during this century. The Earth's carbon sinks – of which the Southern Ocean accounts for 15% – absorb about half of all human carbon emissions. With the Southern Ocean reaching its saturation point more CO2 will stay in our atmosphere".

The research shows that an increase in winds above the Southern has led to the release of stored CO2 into the atmosphere, preventing further absorption of the green house gas. Oceans store much of their CO2 in deep waters but as the winds increase, the water mixes more. This effect was predicted by scientists and to a certain extent has been taken into account by climate models, but it is occurring 40 years earlier than expected.

Increasing winds in the Southern Ocean have been ascribed to two factors, the first being the depletion of ozone in the upper atmosphere which alters regional temperatures. The second factor is that recent climate change warms the tropics more than the Southern Ocean, which changes atmospheric circulation above the Southern Ocean causing stronger winds.

EC Research Website

Atmospheric effects of volcanic eruptions as seen by paintings of famous artists

Red-to-green ratios in paintings have been used with model to compile time series of aerosol optical depth at Northern Hemisphere middle latitudes during 1500–1900

Paintings created by famous artists, representing sunsets throughout the period 1500–1900, provide proxy information on the aerosol optical depth following major volcanic eruptions. This is supported by a statistically significant correlation coefficient (0.8) between the measured red-to-green ratios of a few hundred paintings and the dust veil index. A radiative transfer model was used to compile an independent time series of aerosol optical depth at 550 nm corresponding to Northern Hemisphere middle latitudes during the period 1500–1900. The estimated aerosol optical depths range from 0.05 for background aerosol conditions, to about 0.6 following the Tambora and Krakatau eruptions and cover a period practically outside of the instrumentation era.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/4027/2007/acp-7-4027-2007.html

C. S. Zerefos, V. T. Gerogiannis, D. Balis, S. C. Zerefos, and A. Kazantzidis, Atmospheric effects of volcanic eruptions as seen by famous artists and depicted in their paintings, Atmos. Chem. Phys., 7, 4027-4042, 2007

Agricultural sustainability in the semi-arid Near East

In much of the region today, agricultural land use is not sustainable given existing technology and national priorities

Agriculture began in the eastern Mediterranean Levantine Corridor about 11000 years ago toward the end of the Younger Dryas when aridity had diminished wild food resources. During the subsequent Climatic Optimum, agricultural villages spread rapidly but subsequent climatic changes on centennial to millennial scales resulted in striking oscillations in settlement, especially in marginal areas. Natural climate change thus alternately enhanced and diminished the agricultural potential of the land. Growing populations and more intensive land us, both for agriculture and livestock, have led to changes in the structure of vegetation, hydrology, and land quality. Over the millennia, political and economic interventions, warfare and incursions by nomadic herding tribes all impacted sustainability of agriculture and the ability of the land to supports its populations. In much of the region today, agricultural land use is not sustainable given existing technology and national priorities. The Near Eastern case is instructive because of the quality of information, the length of the record, and the pace of modern change.

The article is available free of charge at:
http://www.clim-past.net/special_issue5.html

F. Hole, Agricultural sustainability in the semi-arid Near East, Clim. Past, 3, 193-203, 2007

Solar, heliospheric and external geophysical effects on the Earth's environment

Special issue of Advances in Geosciences devoted to scientific and educational issues

This special issue is devoted to scientific and educational issues concerning Solar, heliospheric and external geophysical effects on the Earth's environment. Traditionally there has been a divide between scientific papers and those papers dedicated to educational aspects regarding a scientific subject. As a consequence, papers are in general published in journals dedicated to one or the other type – scientific or educational.

The aim of this special issue is to show that scientific and educational papers can complement each other well when published together, offering the reader an interdisciplinary approach to the subject matter being covered. The papers collected in this special issue are based both on presentations given at the EGU06 session ST5.8 "Solar, heliospheric and external geophysical effects on ecosystems", as well as on work performed under the umbrella of the four year Coupling of Atmospheric Layers (CAL) research training network project. CAL was funded by the European Commission within the Marie Curie Actions to study unanswered questions relating to transient luminous events (TLEs), such as sprites, and their effects on the atmosphere. More specifically, CAL concerned thunderstorms, electrical and space radiation effects in the stratosphere, mesosphere and lower thermosphere. The research was also aimed at studying therelation of TLEs to various aspects of the atmospheric system,and thus the Earth's climate.

The Special issue can be assessed online free of charge at
http://www.adv-geosci.net/13/index.html

Editor(s): N. B. Crosby and M. J. Rycroft, Solar, heliospheric and external geophysical effects on the Earth's environment: scientific and educational initiatives, ADGEO, Volume 13, 2007

Multiple steady-states in the terrestrial atmosphere-biosphere system

representation of vegetation in terms of a few, discrete vegetation classes can result in an artificial emergence of multiple steady states and an underestimation of vegetation productivity

Multiple steady states in the atmosphere-biosphere system can arise as a consequence of interactions and positive feedbacks. While atmospheric conditions affect vegetation productivity in terms of available light, water, and heat, different levels of vegetation productivity can result in differing energy- and water partitioning at the land surface, thereby leading to different atmospheric conditions. Here the authors investigate the emergence of multiple steady states in the terrestrial atmosphere-biosphere system and focus on the role of how vegetation is represented in the model: (i) in terms of a few, discrete vegetation classes, or (ii) a continuous representation. They then conduct sensitivity simulations with respect to initial conditions and to the number of discrete vegetation classes in order to investigate the emergence of multiple steady states. They find that multiple steady states occur in their model only if vegetation is represented by a few vegetation classes. With an increased number of classes, the difference between the number of multiple steady states diminishes, and disappears completely in our model when vegetation is represented by 8 classes or more. Despite the convergence of the multiple steady states into a single one, the resulting climate-vegetation state is nevertheless less productive when compared to the emerging state associated with the continuous vegetation parameterization. The authors conclude from these results that the representation of vegetation in terms of a few, discrete vegetation classes can result (a) in an artificial emergence of multiple steady states and (b) in a underestimation of vegetation productivity. Both of these aspects are important limitations to be considered when global vegetation-atmosphere models are to be applied to topics of global change.

The article is available free of charge at:
http://www.biogeosciences.net/4/707/2007/bg-4-707-2007.html

A. Kleidon, K. Fraedrich, and C. Low, Multiple steady-states in the terrestrial atmosphere-biosphere system: a result of a discrete vegetation classification?, Biogeosciences, 4, 707-714, 2007

Effects of iron on the elemental stoichiometry during EIFEX

Iron limitation does not always increase silicification in diatoms

The interaction between iron availability and the phytoplankton elemental composition was investigated during the in situ iron fertilization experiment EIFEX and in laboratory experiments with the Southern Ocean diatom species Fragilariopsis kerguelensis and Chaetoceros dichaeta.

Contrary to other in situ iron fertilization experiments the authors observed an increase in the BSi:POC, BSi:PON, and BSi:POP ratios within the iron fertilized patch during EIFEX. This is possibly caused by a relatively stronger increase in diatom abundance compared to other phytoplankton groups and does not necessarily represent the amount of silicification of single diatom cells. In laboratory experiments with F. kerguelensis and C. dichaeta no changes in the POC:PON, PON:POP, and POC:POP ratios were found with changing iron availability in both species. BSi:POC, BSi:PON, and BSi:POP ratios were significantly lower in the high iron treatments compared to the controls. In F. kerguelensis this was caused by a decrease in cellular BSi concentrations and therefore possibly less silicification. In C. dichaeta no change in cellular BSi concentration was found. Here lower BSi:POC, BSi:PON, and BSi:POP ratios were caused by an increase in cellular C, N, and P under high iron conditions.

These results indicate that iron limitation does not always increase silicification in diatoms and that changes in the BSi:POC, BSi:PON, and BSi:POP ratios under iron fertilization in the field are caused by a variety of different mechanisms. The results therefore imply that simple cause-and-effect relationships are not always applicable for modeling of elemental ratios.

The article is available free of charge at:
http://www.biogeosciences.net/4/569/2007/bg-4-569-2007.html

L. J. Hoffmann, I. Peeken, and K. Lochte, Effects of iron on the elemental stoichiometry during EIFEX and in the diatoms Fragilariopsis kerguelensis and Chaetoceros dichaeta, Biogeosciences, 4, 569-579, 2007

Satellite measurements of the global mesospheric sodium layer

offer explanation for the dramatic removal of Na below 85 km at latitudes above 50° during summer by the uptake of sodium species on the ice surfaces of polar mesospheric clouds

Optimal estimation theory is used to retrieve the absolute Na density profiles in the mesosphere/lower thermosphere from limb-scanning measurements of the Na radiance at 589 nm in the dayglow.

Two years of observations (2003 and 2004), recorded by the OSIRIS spectrometer on the Odin satellite, have been analysed to yield the seasonal and latitudinal variation of the Na layer column abundance, peak height, and peak width. The layer shows little seasonal variation at low latitudes, but the winter/summer ratio increases from a factor of ~3 at mid-latitudes to ~10 in the polar regions. Comparison of the measurements made at about 06:00 and 18:00 LT shows little diurnal variation in the layer, apart from the equatorial region where, during the equinoxes, there is a two-fold increase in Na density below 94 km between morning and evening. This is most likely caused by the strong downward wind produced by the diurnal tide between ~02:00 and 10:00 LT. The dramatic removal of Na below 85 km at latitudes above 50° during summer is explained by the uptake of sodium species on the ice surfaces of polar mesospheric clouds, which were simultaneously observed by the Odin satellite.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/4107/2007/acp-7-4107-2007.html

Z. Y. Fan, J. M. C. Plane, J. Gumbel, J. Stegman, and E. J. Llewellyn,Satellite measurements of the global mesospheric sodium layer, Atmos. Chem. Phys., 7, 4107-4115, 2007

Decrease in the electric intensity of VLF/LF radio signals and possible connections

The geomagnetic activity, the meteorological conditions in the receiver area and the regional seismic activity were investigated on the time of occurrence of these decreases

In February 2002, a receiver was put into operation at the Department of Physics of Bari University (Southern Italy) to record VLF-LF radio signals. The intensity and the phase of the signals transmitted by GB (f=16 kHz, United Kingdom), FR (f=20.9 kHz, France), GE (f=23.4 kHz, Germany), IC (f=37.5 kHz, Island) and IT (f=54 kHz, Sicily, Italy) has been monitored with a 5 s sampling rate. The intensity raw data averaged over 10 min, from February 2002 to April 2006, have been analysed.

Several decreases of the electric field intensity of the radio signals with a duration of some days were revealed, generally occurring in not concomitant periods. The GE signal decreases systematically in winter and summer each year and so, it could be supposed that such decreases are related to the transmitter. On the contrary, all the other decreases pointed out are sporadic and the previous justification does not seem realistic. On the time occurrence of these decreases, the geomagnetic activity, the meteorological conditions in the receiver area and the regional seismic activity were investigated. The main result is that, generally, a pre or post seismic effect seems to give the most convincing justification. The effect seems to appear for earthquakes with magnitude M≥4.3, when the epicentres are within the third Fresnel zone of the radio signals or near enough to some radio path.

The article is available free of charge at:
http://www.nat-hazards-earth-syst-sci.net/7/423/2007/nhess-7-423-2007.html

P. F. Biagi, L. Castellana, T. Maggipinto, G. Maggipinto, A. Minafra, A. Ermini, V. Capozzi, G. Perna, M. Solovieva, A. Rozhnoi, O. A. Molchanov, and M. Hayakawa, Decrease in the electric intensity of VLF/LF radio signals and possible connections, Nat. Hazards Earth Syst. Sci., 7, 423-430, 2007

First direct observation of the atmospheric CO2 year-to-year increase from space

Satellite measurements of the CO2 total column to retrieve information on the atmospheric CO2 on the level of a few ppm

The reliable prediction of future atmospheric CO2 concentrations and associated global climate change requires an adequate understanding of the CO2 sources and sinks. The sparseness of the existing surface measurement network limits its current knowledge about the global distribution of CO2 surface fluxes. The retrieval of CO2 total vertical columns from satellite observations is predicted to improve this situation. Such an application however requires very high accuracy and precision. The authors report on retrievals of the column-averaged CO2 dry air mole fraction, denoted XCO2, from the near-infrared nadir spectral radiance and solar irradiance measurements of the SCIAMACHY satellite instrument between 2003 and 2005. They focus on northern hemispheric large scale CO2 features such as the CO2 seasonal cycle and show - for the first time - that the atmospheric annual increase of CO2 can be directly observed using satellite measurements of the CO2 total column. The satellite retrievals are compared with global XCO2 obtained from NOAA's CO2 assimilation system CarbonTracker taking into account the spatio-temporal sampling and altitude sensitivity of the satellite data. They show that the measured CO2 year-to-year increase agrees within about 1 ppm/year with CarbonTracker. They also show that the latitude dependent amplitude of the northern hemispheric CO2 seasonal cycle agrees with CarbonTracker within about 2 ppm with the retrieved amplitude being systematically larger. The analysis demonstrates that it is possible using satellite measurements of the CO2 total column to retrieve information on the atmospheric CO2 on the level of a few parts per million.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/4249/2007/acp-7-4249-2007.html

M. Buchwitz, O. Schneising, J. P. Burrows, H. Bovensmann, M. Reuter, and J. Notholt, First direct observation of the atmospheric CO2 year-to-year increase from space, Atmos. Chem. Phys., 7, 4249-4256, 2007

An overview of snow photochemistry: evidence, mechanisms and impacts

The nature of snow at a fundamental, physical level and current understanding of nitrogen, oxidant, halogen and organic photochemistry within snow

It has been shown that sunlit snow and ice plays an important role in processing atmospheric species. Photochemical production of a variety of chemicals has recently been reported to occur in snow/ice and the release of these photochemically generated species may significantly impact the chemistry of the overlying atmosphere.

Nitrogen oxide and oxidant precursor fluxes have been measured in a number of snow covered environments, where in some cases the emissions significantly impact the overlying boundary layer. For example, photochemical ozone production (such as that occurring in polluted mid-latitudes) of 3–4 ppbv/day has been observed at South Pole, due to high OH and NO levels present in a relatively shallow boundary layer. Field and laboratory experiments have determined that the origin of the observed NOx flux is the photochemistry of nitrate within the snowpack, however some details of the mechanism have not yet been elucidated.

A variety of low molecular weight organic compounds have been shown to be emitted from sunlit snowpacks, the source of which has been proposed to be either direct or indirect photo-oxidation of natural organic materials present in the snow. Although myriad studies have observed active processing of species within irradiated snowpacks, the fundamental chemistry occurring remains poorly understood. Here the authors consider the nature of snow at a fundamental, physical level; photochemical processes within snow and the caveats needed for comparison to atmospheric photochemistry; their current understanding of nitrogen, oxidant, halogen and organic photochemistry within snow; the current limitations faced by the field and implications for the future.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/4329/2007/acp-7-4329-2007.html

A. M. Grannas, A. E. Jones, J. Dibb, M. Ammann, C. Anastasio, H. J. Beine, M. Bergin, J. Bottenheim, C. S. Boxe, G. Carver, G. Chen, J. H. Crawford, F. Dominé, M. M. Frey, M. I. Guzmán, D. E. Heard, D. Helmig, M. R. Hoffmann, R. E. Honrath, L. G. Huey, M. Hutterli, H. W. Jacobi, P. Klán, B. Lefer, J. McConnell, J. Plane, R. Sander, J. Savarino, P. B. Shepson, W. R. Simpson, J. R. Sodeau, R. von Glasow, R. Weller, E. W. Wolff, and T. Zhu, An overview of snow photochemistry: evidence, mechanisms and impacts, Atmos. Chem. Phys., 7, 4329-4373, 2007

NW Adriatic Sea biogeochemical variability in the last 20 years (1986–2005)

Annual climatologies, links between the concentrations of chlorophyll-a and the variability in the environment, trophic differences between two areas and chlorophyll-a trends over time

This paper presents a long-term time series (1986–2005) of hydrological and biogeochemical data, both published and unpublished. Data were collected in the north-western area of the Adriatic Sea, at two stations that are considered hydrodynamically and trophically different. The time series have been statistically and graphically analysed on a monthly scale in order to study the annual climatologies, links between the concentrations of chlorophyll-a and the variability in the environment, trophic differences between the two areas and chlorophyll-a trends over time.

Basically, the two areas have similar hydrological features, yet they present significant differences in the amount of nutrient inputs: these are in fact higher at the coastal site, which is characterized by a prevalence of surface blooms, while they are lower at the offshore station, which is mainly affected by blooms at intermediate depths. Nonetheless, throughout the whole water column, chlorophyll-a concentrations are only slightly different. Both areas are affected by riverine discharge, though chlorophyll-a concentrations are also driven strongly by the seasonal cycle at the station closer to the coast. Results show that the two stations are not trophically different, although some controlling factors, such as zooplankton grazing in one case and light attenuation in the other, may further regulate the growth of phytoplankton. In both cases no significant trends are detected in either the average chlorophyll-a values or in dispersion of the data, in contrast with significant trends in temperature and salinity.

The article is available free of charge at:
http://www.biogeosciences.net/4/673/2007/bg-4-673-2007.html

L. Tedesco, G. Socal, F. Bianchi, F. Acri, D. Veneri, and M. Vichi, NW Adriatic Sea biogeochemical variability in the last 20 years (1986–2005), Biogeosciences, 4, 673-687, 2007

Global impact of road traffic emissions on tropospheric ozone

Assessment of the impact of non methane hydrocarbons emissions from road traffic

Road traffic is one of the major anthropogenic emission sectors for NOx, CO and NMHCs (non-methane hydrocarbons). The authors applied ECHAM4/CBM, a general circulation model coupled to a chemistry module, which includes higher hydrocarbons, to investigate the global impact of 1990 road traffic emissions on the atmosphere.

Improving over previous global modelling studies, which concentrated on road traffic NOx and CO emissions only, the authors assess the impact of NMHC emissions from road traffic. It is revealed that NMHC emissions from road traffic play a key role for the impact on ozone. They are responsible for (indirect) long-range transport of NOx from road traffic via the formation of PAN, which is not found in a simulation without NMHC emissions from road traffic. Long-range transport of NMHC-induced PAN impacts on the ozone distribution in Northern Hemisphere regions far away from the sources, especially in arctic and remote maritime regions. In July, total road traffic emissions (NOx, CO and NMHCs) contribute to the zonally averaged ozone distribution by more than 12% near the surface in the Northern Hemisphere midlatitudes and arctic latitudes. In January, road traffic emissions contribute near the surface in northern and southern extratropics more than 8%.

Sensitivity studies for regional emission show that effective transport of road traffic emissions occurs mainly in the free troposphere. In tropical latitudes of America up to an altitude of 200 hPa, global road traffic emissions contribute about 8% to the ozone concentration. In arctic latitudes NMHC emissions from road transport are responsible for about 90% of PAN increase from road transport, leading to a contribution to ozone concentrations of up to 15%.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/1707/2007/acp-7-1707-2007.html

S. Matthes, V. Grewe, R. Sausen, and G.-J. Roelofs, Global impact of road traffic emissions on tropospheric ozone, Atmos. Chem. Phys., 7, 1707-1718, 2007

Halogens and their role in polar boundary-layer ozone depletion

Review of the history, chemistry, dependence on environmental conditions, and impacts of ozone depletion events

During springtime in the polar regions, unique photochemistry converts inert halide salt ions (e.g. Br−) into reactive halogen species (e.g. Br atoms and BrO) that deplete ozone in the boundary layer to near zero levels. Since their discovery in the late 1980s, research on ozone depletion events (ODEs) has made great advances; however many key processes remain poorly understood.

In this article the authors review the history, chemistry, dependence on environmental conditions, and impacts of ODEs. Research has shown the central role of bromine photochemistry, but how salts are transported from the ocean and are oxidized to become reactive halogen species in the air is still not fully understood. Halogens other than bromine (chlorine and iodine) are also activated through incompletely understood mechanisms that are probably coupled to bromine chemistry. The main consequence of halogen activation is chemical destruction of ozone, which removes the primary precursor of atmospheric oxidation, and generation of reactive halogen atoms/oxides that become the primary oxidizing species.

The different reactivity of halogens as compared to OH and ozone has broad impacts on atmospheric chemistry, including near complete removal and deposition of mercury, alteration of oxidation fates for organic gases, and export of bromine into the free troposphere. Recent changes in the climate of the Arctic and state of the Arctic sea ice cover are likely to have strong effects on halogen activation and ODEs; however, more research is needed to make meaningful predictions of these changes.

The article is available free of charge at:
http://www.atmos-chem-phys.net/7/4375/2007/acp-7-4375-2007.html

W. R. Simpson, R. von Glasow, K. Riedel, P. Anderson, P. Ariya, J. Bottenheim, J. Burrows, L. J. Carpenter, U. Frieß, M. E. Goodsite, D. Heard, M. Hutterli, H.-W. Jacobi, L. Kaleschke, B. Neff, J. Plane, U. Platt, A. Richter, H. Roscoe, R. Sander, P. Shepson, J. Sodeau, A. Steffen, T. Wagner and E. Wolff, Halogens and their role in polar boundary-layer ozone depletion, Atmos. Chem. Phys., 7, 4375-4418, 2007

The EDC3 chronology for the EPICA Dome C ice core

EDC3 gives accurate event durations within 20% back to MIS11 and accurate absolute ages with a maximum uncertainty of 6 kyr back to 800 kyr

The EPICA (European Project for Ice Coring in Antarctica) Dome C drilling in East Antarctica has now been completed to a depth of 3260 m, at only a few meters above bedrock.

Here the authors present the new EDC3 chronology, which is based on the use of 1) a snow accumulation and mechanical flow model, and 2) a set of independent age markers along the core. These are obtained by pattern matching of recorded parameters to either absolutely dated paleoclimatic records, or to insolation variations. The authors show that this new time scale is in excellent agreement with the Dome Fuji and Vostok ice core time scales back to 100 kyr within 1 kyr. Discrepancies larger than 3 kyr arise during MIS 5.4, 5.5 and 6, which points to anomalies in either snow accumulation or mechanical flow during these time periods. They estimate that EDC3 gives accurate event durations within 20% (2ó) back to MIS11 and accurate absolute ages with a maximum uncertainty of 6 kyr back to 800 kyr.

The article is available free of charge at:
http://www.clim-past.net/3/485/2007/cp-3-485-2007.html

F. Parrenin, J.-M. Barnola, J. Beer, T. Blunier, E. Castellano, J. Chappellaz, G. Dreyfus, H. Fischer, S. Fujita, J. Jouzel, K. Kawamura, B. Lemieux-Dudon, L. Loulergue, V. Masson-Delmotte, B. Narcisi, J.-R. Petit, G. Raisbeck, D. Raynaud, U. Ruth, J. Schwander, M. Severi, R. Spahni, J. P. Steffensen, A. Svensson, R. Udisti, C. Waelbroeck, and E. Wolff, The EDC3 chronology for the EPICA Dome C ice core, Clim. Past, 3, 485-497, 2007

Climate Change and Switzerland in 2050

Impacts on Environment, Society and Economy

by Gabriele Mueller-Ferch and Esther Thalmann

The report describes mean vulnerabilities of the environment, the economy and the society in Switzerland with regard to climate change until the year 2050. Based on a regional climate model potential impacts on water supply, agriculture, terrestrial ecosystems, the energy sector, tourism and health are presented. Different measures and adaptation strategies are discussed

The report describes mean vulnerabilities of the environment, the economy and the society in Switzerland with regard to climate change until the year 2050. Based on a regional climate model, potential impacts on various subject areas like for example water supply, agriculture or tourism are presented. Different measures and adaptation strategies are discussed. All projections for the future are based on assessments of today's knowledge.

Climate change scenarios for 2050

The report assumes a warming of approximately 2 °C in autumn, winter and spring (with a range of uncertainty between 1 and 5 °C) as well as just under 3 °C in summer (with a range of uncertainty between 2 and 7 °C) as you can see in Fig 1 showing the results of the regional climate model.

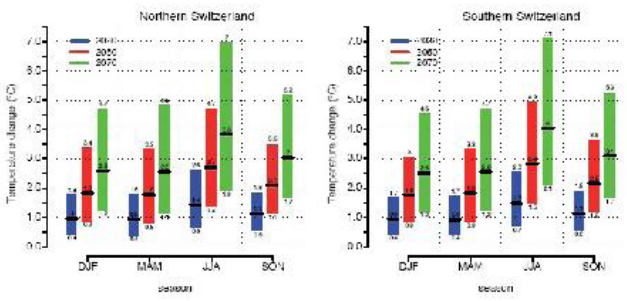


Fig. 1: Temperature change for Northern and Southern Switzerland in 2050 compared with 1990 in winter (DJF: December-February), spring (MAM: March-May), summer (JJA: June-August) and autumn (SON: September-November). The horizontal lines show the mean estimate (median). The warming will be within the range of the colored bars with a probability of 95 % (confidence interval 95 %). Source: C.Frei, MeteoSchweiz, Zurich

With regard to precipitation in winter an increase of about 10% is expected. In summer a decrease of about 20% can be assumed (see Fig. 2). The number of extreme precipitation events is very likely to increase and therefore also the number of floods and mudslides. They will occur particularly in winter, but possibly despite smaller total precipitation amounts also in summer. In summer heat waves will generally increase, and probably droughts as well. In contrast, in winter cold spells will decrease.

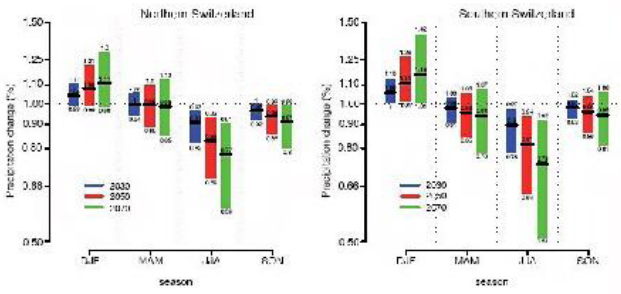


Fig. 2: Relative change of the mean seasonal precipitation for Northern and Southern Switzerland in 2050 compared with 1990 (logarithmic scale; definition of seasons see fig. 1). A value of 0.50 indicates a decrease by 50 %, a value of 1.25 an increase by 25 % compared with today's conditions. Source: C.Frei, MeteoSchweiz, Zurich

Contention for water supply

In comparison to other countries Switzerland disposes of substantial water reserves. Climate change will affect these reserves: Less water will be available in summer and autumn, more pronounced during drought periods. At the same time the demand for irrigation in agriculture will increase causing contention between ecosystems, different users and regions.

This may lead to losses in agriculture and electricity production, mainly in river power plants. Water supply can probably be ensured by an optimized water management.

As precipitation increasingly falls as rain instead of snow, floods become more frequent and more severe, particularly in winter. Possible measures include sustainable flood protection by renaturing and broadening rivers and the limitation of damage potential. An adequate cultivation of lakes and the use of storage reservoirs as backing mean a reduction and shift of fluctuation.

Agriculture can adapt to moderate warming

A moderate warming of less than 2 to 3 °C may overall have a positive effect on Swiss agriculture. The production of meadows and the potential crop yield of many cultivated plants will increase as a result of the longer vegetation period, provided that the supply of water and nutrients is sufficient. On the other hand, water supply will decrease in summer, weeds and insect attacks will occur more often. By means of an adequate choice of cultivated plants, cultivation methods and management, agriculture will be able to adapt to a moderate rise of the mean temperature by 2 to 3 °C until 2050.

If temperature rises by more than 2 to 3 °C until 2050 the disadvantages will outweigh the advantages of the warming: During the vegetation period water scarcity will become more frequent, and the faster plant development will result in harvest losses for crop and grain legumes. The damage caused by extreme events like extreme drought periods or heavy precipitation will increase.

Changes in terrestrial ecosystems

In Switzerland flora and fauna will continue to approach those at lower elevations and in more southern areas. Temperature-sensitive species will move to cooler areas at higher elevations if possible. Less mobile species will be reduced or will disappear. Most of all the combination of effects, for example high temperatures and little precipitation, may reduce the productivity of forests and permanent grassland. The disposability of water will be of increasing importance to ecosystems in the future, in particular to those situated in valleys and hilly areas.

Shifts in the energy sector

Less heating energy will be required in winter and more cooling energy in summer (see Fig.3). This means a shift in the energy demand from fuel to electricity. Newer buildings normally dispose of a good heat insulation that reduces the heating demand during the cold season. However, dissipation of waste heat (produced by equipment, people etc.) is limited and requires cooling, in particular with increasing temperatures and heat waves in summer. Energy-efficient devices, air-conditioning and sunscreen may provide relief amongst others. Construction standards should be adjusted to the future climate. Measures are also possible in urban development, for instance by the creation of aeration corridors.

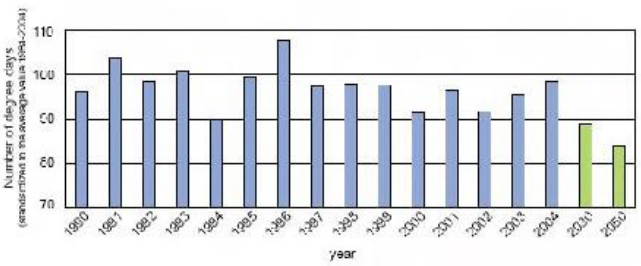


Fig. 3: Annual heating degree days from 1990 to 2004 standardized to the average value of the period 1984 to 2004. For the years 2030 and 2040 the bars represent the expected values according to a scenario of the Swiss Federal Office of Energy SFOE.

The small runoff and the decreasing cooling effect on rivers, in particular in summer, will have an adverse effect on hydropower and nuclear energy. Annual production is expected to decline by a few per cent until 2050.

New Renewable energy will become more competitive due to higher energy demand, the demand for CO2-free energy and increasing energy prices. The focus is primarily on energy gained from windmills and timber. In consideration of long-term trends and the development of forestry and timber industry the potential of timber may triple.

Impact on tourism

In winter the rising snow line means that ski resorts in the foothills of the Alps may not operate profitably anymore. Ski resorts situated at high elevations may benefit. With the increasing threat of traffic routes by extreme events the accessibility of tourist resorts in the Alps becomes more difficult. The attractiveness of alpine tourist areas will also be influenced by the decreasing snow reliability and the expected changes in the natural scenery, in particular the retreat of glaciers (see Fig. 4).

Fig. 4: The glacier decrease had already started in the 19th century due to natural reasons. The human caused warming has been dominating the continuous ice decrease of the alpine glaciers in the 20th century. Left: Lower Grindelwald glacier in 1858 (picture: F. Martens, Alpine Club Library London, H.J. Zumbühl). Right: Lower Grindelwald glacier in 1974 (picture: H.J. Zumbühl). The little picture shows the glacier in 2006 (picture: S. U. Nussbaumer).

Melting permafrost means a costly risk for a number of mountain railways, as at higher elevations the foundations of masts and stations are often anchored in the frozen loose stone. The risk of rock slides increases as well. In order to maintain the attractiveness of tourist destinations, the offer needs to be adjusted to new conditions.

Health effects

In Switzerland the increase in heat waves, in combination with an elevated ozone concentration, represents the most important sanitary consequence of climate change. It is possible, though, to counter the increase in mortality caused by heat with adequate measures. Heat waves also impair the efficiency of the working population and thereby have economic effects.

The development of various vector-borne illnesses is rather uncertain. In Switzerland the dissemination of malaria or dengue is quite unlikely. On the other hand, West Nile fever is on the advance. Higher temperatures could also generate new vectors or cause a vector to change its host. Regarding illnesses transmitted by ticks, there may be changes in the range of vectors, infection rates and period of activity.

Conclusions

From today's perspective the consequences of climate change until 2050 seem to be manageable in Switzerland without severe societal problems, provided that the warming does not exceed the expected magnitude. To this day, however, there are no precise estimates of the costs for the adaptations and measures mentioned, which, for some fields, may be of economic relevance. In particular, the tourism sector will have to face drastic changes.

Having said that, there are many countries in the world, in particular developing countries which, on the one hand, are hit by more serious consequences and, on the other hand, do not dispose of the financial resources to adapt. The emerging geopolitical developments may well have consequences on Switzerland.

The report "Climate Change and Switzerland in 2050 - Impacts on Environment, Society and Economy" is published by the Swiss Advisory Body on Climate Change (OcCC) and ProClim- (Forum for Climate and Global Change, Swiss Academy of Sciences). The full report (170 p.) can be downloaded as pdf in German and French on www.occc.ch or www.proclim.ch. The Summary is translated in English and Italian. You can order a printed version at proclim@scnat.ch.

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Global satellite observations of greenhouse gas emissions

by A.P.H. Goede and co-workers

The EVERGREEN project, funded by the European Commission's 5th Framework Environmental Programme for better exploitation of Earth Observation data, has demonstrated the benefits of new methods for the exploitation of satellite data in climate and air pollution research and application. In particular, the SCIAMACHY instrument on board the European Earth Observation satellite ENVISAT has produced the first retrievals of greenhouse gas emissions from space, generates ozone measurements that improve the weather forecast and delivers an operational service for air pollution monitoring and predictions

In this paper the results of the EVERGREEN project are summarised and focussed on the SCIAMACHY measurements of methane (CH4), carbon dioxide (CO2) and carbon monoxide (CO) in the troposphere. But also the measurements by MIPAS of the vertical distribution of these gases in the upper troposphere and lower stratosphere are analysed. Both SCIAMACHY and MIPAS are spectrometers on board the ESA environmental satellite ENVISAT, which was launched March 1st, 2002 with a scheduled operational life time of 5 years. The measurements by MOPITT, a Canadian instrument on the NASA EOS Terra satellite launched in December 1999, provide additional information on tropospheric carbon monoxide. Global, regional, yearly and seasonal variations of CH4, CO2 and CO over the years 2003-2005 are analysed and compared with theoretical models and ground based measurements. Inverse modelling studies based on satellite data have revealed for the first time a number of significant discrepancies in the CH4 and CO emissions compared with existing emission estimates.

CLIMATE CHANGE

A useful parameter in climate research is radiative forcing, the change in net irradiance (W/m2) at tropopause height (between 8 and 18 km) exerted by a change in greenhouse gas concentrations. For small changes this provides a measure for the change in temperature at the earth surface. Greenhouse gas radiative forcing can be determined from measurement of their concentration distribution.

The underlying parameters for greenhouse gas concentrations are the sources and sinks. Emissions may be estimated from measured emission factors in combination with statistical data, the so-called bottom-up approach used by countries reporting under the United Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Emissions can also be derived from measurement of the concentration distribution and inverse modelling, the so-called top-down approach. Discrepancies exist between the two approaches whilst uncertainties are considerable. This limits our understanding of climate change and adversely affects verification of greenhouse gas emission inventories.

Inverse modelling has been carried out from ground based observations, but results are limited by the scarce and unbalanced distribution of ground stations [Bergamaschi, 2005]. From their vantage points in space satellite measurements have the benefit of global coverage, but measurement accuracy is a challenge. This challenge was met by EVERGREEN (EnVisat for Environmental Regulation of GREENhouse gases), a European Commission RTD project carried out by a consortium of 12 European partners [Goede, 2006].

Methane

Methane is, after carbon dioxide, the second most important anthropogenic greenhouse gas, contributing directly 0.48 Wm−2 to the total anthropogenic radiative forcing of 2.63 Wm−2 by well-mixed greenhouse gases (IPCC, 2007). In addition, there is an indirect radiative forcing of about 0.3 Wm−2 through the formation of other greenhouse gases, notably tropospheric ozone and stratospheric water vapor. Although the

global annual source strength of methane (550 ± 50 Tg yr−1) is relatively well constrained, considerable uncertainties exist in the partitioning of sources and their spatial and temporal distribution.

Vibrations in the methane molecule produce characteristic absorption lines in the near-infrared at around 1.6 and 2.3 µm. This part of the spectrum is covered by the SCIAMACHY channels 6 and 8. From the ratio of the earthshine radiance and the solar irradiance, total column abundances of methane can be retrieved by means of differential optical absorption spectroscopy (DOAS). Since these are the first ever attempts to retrieve methane information from a space-based instrument operating in this part of the spectrum, the EVERGREEN project engaged three independent retrieval algorithms' developments: IUP Bremen (WFM-DOAS), SRON (IMLM) and IUP Heidelberg (IMAP-DOAS). SRON focussed on methane retrieval from channel 8 [Gloudemans, 2005], IUP Heidelberg on channel 6 [Frankenberg, 2006] and IUP Bremen did both [Buchwitz 2005a/b, 2006].

In addition to algorithm challenges, there are a number of instrument challenges to be met. The near-infrared detectors of SCIAMACHY suffer from an increasing amount of dead and bad pixels, high dark currents leading to a low signal to noise ratio, and an ice-layer building up on the cooled detector surfaces (150 K), altering the instrument slit function. These complications are not foreseen in the official ESA data products and had to be resolved by the project.

In the EVERGREEN proposal, total column measurements of O2 were proposed as a proxy for the light path in the conversion of methane columns into column averaged mixing ratios. However, as it turned out, O2 was not very suitable because the photon scattering at 0.76 µm, the O2-A absorption band, differed significantly from the scattering at 1.65 µm, the methane absorption band. To overcome this problem, CO2 retrievals in a nearby retrieval window at 1.55 µm were used as a proxy for the light path of the CH4 retrieval in channel 6 [Frankenberg, 2005]. For channel 8 scattering is less dominant. Here, surface pressure has been employed as a scaling factor.

The methane product developed under the EVERGREEN project has achieved the high precision (1-2%) required to deduce emissions from inverse modelling. Systematic errors (biases) that determine accuracy are still subject to further investigation. Precision and accuracy have been validated by ground based FTIR measurements performed under the Network for the Detection of Atmospheric Composition Change (NDACC).

In some cases, important information over the oceans has been retrieved. This has been made possible by the normalized DOAS retrieval approach, in which the normalization of methane by carbon dioxide allows clouded pixels to be taken into account. Clouded pixels provide for high reflectivity over the ocean, which is needed to obtain sufficient signal strength of the reflected radiation measured by SCIAMACHY. Ocean information proves essential for successful inverse modelling of global methane emissions.

Higher methane emissions in the tropics

The first SCIAMACHY retrievals of methane obtained with the IMAP-DOAS algorithm over the time period August to November 2003 were presented by Frankenberg (2005). This time period coincides with peak emissions of rice paddies in Asia. The result shows that the North-South gradient is well reproduced. An important new finding is that regions with enhanced methane abundances are observed, most notably over Asia, central Africa, northern South America and eastern USA. The observations have been averaged over the period August to November 2003 on a 1˚x1˚ horizontal grid [Frankenberg, 2005].

The most likely cause for high abundances observed in Africa and the USA are wetlands and coal mining, respectively. Methane abundances modelled by the TM3 global atmospheric model (forward model) based on current bottom-up emission inventories for the same time period are in general agreement with measurements. However, large differences between SCIAMACHY measurements and TM3 model results (of the order of 40-90 ppbv) are observed in the tropical belt especially over the broad-leafed forest areas of South and Central America, West Africa, Indonesia and New Guinea [Frankenberg, 2005]. The conclusion is that tropical methane emissions are significantly underestimated in current bottom-up inventories.

The EVERGREEN project has developed inverse modelling tools that have been applied to the methane measurements from SCIAMACHY. Two different inverse modelling approaches have been pursued: four-dimensional variational (4D-Var) assimilation by KNMI [Meirink, 2006] and synthesis inversion by JRC-IES [Bergamaschi, 2007]. Both approaches are complementary; the former allows the optimization of surface fluxes at high spatial resolution, while the latter is more straightforward and robust.

Data assimilation is a statistical method based on Bayes' theorem that adjusts modelled parameters (such as emissions) to fit observations (such as concentration distributions) and thereby improve the model simulations over the time period of interest. It is shown that 4D-var is an efficient method to deal with large quantities of satellite data and to retrieve emissions at high resolution. Observing System Simulation Experiments (OSSEs) have been performed to demonstrate the feasibility of the method and to investigate the usefulness of SCIAMACHY observations for methane source estimation.

On the basis of OSSE's, the impact of a number of parameters on the error in the retrieved methane emission field has been analysed. These parameters include the measurement error, the error introduced by the presence of clouds and the spatial resolution of the emission field. Some important conclusions regarding the SCIAMACHY measurements have been drawn: (i) The observations at their estimated precision of 1.5 to 2% can contribute considerably to uncertainty reduction in monthly, sub continental (~500 km) methane source strengths, (ii) Systematic measurement errors well below 1% have a dramatic impact on the quality of the derived emission fields. Hence, every effort should be made to identify and remove/correct such systematic errors, (iii) It is essential to incorporate partly clouded pixels in order to sufficiently constrain the inverse modelling, (iv) The uncertainty in measured cloud parameters will at some point become the limiting factor for methane emission retrieval, rather than the uncertainty in measured methane itself.

An initial inversion for the year 2004 of real SCIAMACHY observations has been performed. The 4D-Var system succeeds in producing an analysis that very closely matches the satellite observations over the entire globe. However, particularly at high latitudes, the satellite data suggest much more seasonal variability than can be accommodated by the combination of surface observations and models. This indicates considerable biases in the satellite data and/or in the model.

A work-around strategy is to fit a latitudinal bias directly in the inversion. This strategy has been followed for the synthesis inversion.

The synthesis inversion simultaneously uses the NOAA surface observations of CH4 and the IMAP SCIAMACHY retrievals and includes a polynomial correction to compensate for the systematic bias [Bergamaschi, 2007]. The results suggest significantly larger tropical emissions as compared with both a priori estimates and with inversion based on the surface measurements alone, see Figure 1. The large tropical CH4 emissions derived from the SCIAMACHY observations are attributed to larger emissions mainly from tropical wetlands, but also an increase of CH4 emissions from termites and a decrease of the soil sink. The recent finding of CH4 emissions from plants under aerobic conditions [Keppler, 2006] could help to explain these larger emissions, but this suggestion is subject of the current scientific debate [Dueck, 2007].

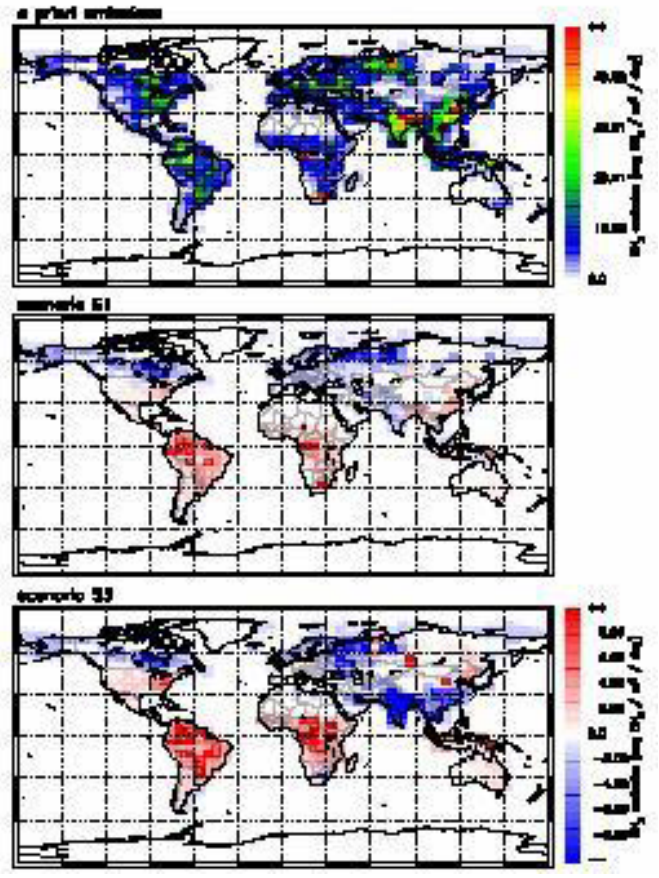

Figure 1. A priori emissions (top) and inversion increment for 2 different inversion scenarios: S1 includes surface measurements only; S3 includes both satellite and surface observations. Total emissions for the year 2003 are shown [Bergamaschi, 2007]. Copyright 2007 American Geophysical Union. Reproduced by permission of American Geophysical Union.

Methane radiative forcing

Results above refer to total column measurements. To assess the effect on the radiation balance and radiative forcing, the vertical distribution of methane must be known. Measurements by MIPAS could provide this information.

In order to assess the sensitivity of radiation budget modelling to stratospheric methane measurements, the average and twice the standard deviation profile measured by MIPAS have been fed into the model. The resulting change in radiation budget is very small (< 0.01 W/m2). A similar conclusion was reached for radiative forcing. First, troposphere mixing ratios were assumed over the entire stratosphere. This increased the forcing by 0.1%. Next, methane was removed from the stratosphere altogether yielding a decrease of 3.4%. It can be concluded that the satellite measurements of stratospheric methane do not lead to a significant improvement of the global radiation budget and radiative forcing [Frieß, 2004].

Therefore, there is a large premium on extending the vertical profile measurement information from the stratosphere down into the troposphere. The altitude range of the operational MIPAS methane product is typically 8 to 50 km with an error budget of the order of 10%. Not included in this figure is the impact of clouds which generally leads to a systematic positive bias in the upper troposphere range. Based on cloud-filtered MIPAS measurements, the increase in radiative forcing since pre-industrial time due to methane has been calculated, assuming a surface mixing ratio of 0.7 ppm in the unperturbed pre-industrial case. The relative spatial methane distribution has been assumed unchanged, but stratospheric adjustment of temperatures has been taken into account. The calculated direct radiative forcing of methane is 0.443 Wm-2, in agreement with IPCC figures. For consistency, the radiative forcing by CO2 and N2O has also been calculated. Results are 1.46 Wm-2 for CO2 and 0.15 Wm-2 for N2O, also in agreement with IPCC figures [Myhre, 2006].

The geographical distribution of the radiative forcing is shown in Figure 2 [Myhre, 2006]. Generally, a large latitudinal gradient in the forcing is observed, with the highest values in the tropics, reflecting the large temperature gradient between the surface and the upper troposphere. The imprint of clouds can clearly be seen, with reduced radiative forcing in regions with clouds, which also absorb infrared radiation, leaving less energy to be absorbed by methane. The cloud effects can clearly be seen in the zones of convection in the tropics as well as in the belts of low pressure systems at mid latitudes in both hemispheres.

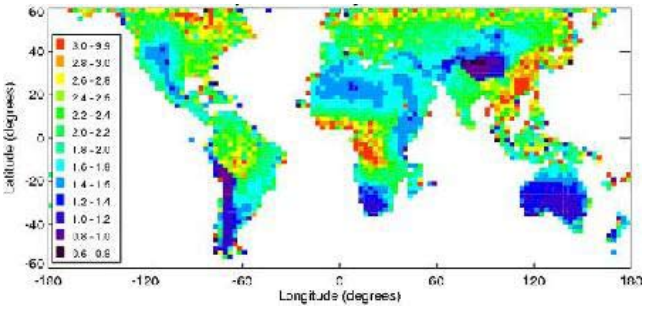

Figure 3. Annual mean CO total columns for the period September 2003 to August 2004 are retrieved from SCIAMACHY by the IMLM retrieval algorithm [Laat, 2006]. Copyright 2006 American Geophysical Union. Reproduced by permission of American Geophysical Union.

Carbon monoxide emissions

CO emissions have been retrieved by Bayesian inverse modelling, determining the optimum between a priori emissions, chemical observations and the predictions of a global

chemical-transport model [Muller, 2005]. Surface measurements and space based monthly averaged CO columns of the MOPITT instrument serve as observations, whilst the model is IMAGES. The bottom-up emission inventory of the EC 4th framework RTD project POET is used as a priori data.

Compared with methane, the relation between emissions and abundances is more non-linear, as CO is a more reactive gas. Therefore, inverse modelling was performed with an adjoint model taking into account the chemical feedbacks. The adjoint technique allows performing grid-based inversions, where the emissions of every model pixel, month and category are optimised. The adjoint model of IMAGES (transport and chemistry, 59 chemical compounds) has been built and verified under the EVERGREEN project. The cost function and its derivatives are calculated in the forward and adjoint models respectively, and are used as input to the minimisation subroutine. This provides new estimates of the emissions, until the cost function minimum is found. The number of iterations needed ranges typically between 30 and 50.

The results show an increase in global anthropogenic and biogenic emissions and a decrease in biomass burning emissions over Africa. Chinese anthropogenic emissions show an increase. Top-down anthropogenic emissions are now estimated to be 760 Tg/yr, i.e. about 100 Tg/yr more than bottom-up estimates.

Carbon dioxide

Carbon dioxide is the most important anthropogenic greenhouse gas. Information on CO2 sources and sinks on the global scale is currently derived from a highly precise but rather sparse network of about 100 ground stations (e.g., NOAA/ESRL). Satellite measurements provide the global coverage needed to better constrain the inverse models in the derivation of CO2 sources and sinks.

The retrieval of a long-lived and therefore well-mixed gas such as CO2 is extremely challenging, because only small variations in the concentration distribution contain the necessary information on surface sources. Due to its near-infrared nadir observation capability SCIAMACHY is the first satellite instrument that is highly sensitive to CO2 in the boundary layer where most variation occurs [Buchwitz, 2005a]. Therefore, SCIAMACHY CO2 retrievals attempting to retrieve the small concentration differences play a pioneering role which requires the development of a dedicated retrieval algorithm, Weighting Function Modified Differential Optical Absorption Spectroscopy (WFM-DOAS) [Buchwitz, 2000]. WFM-DOAS is a linear least-square method based on scaling (or shifting) pre-selected vertical CO2 profiles.

The CO2 columns are retrieved from the spectral fitting window 1.558-1.594 µm of SCIAMACHY channel 6 [Buchwitz, 2005a/b, 2006, 2007b]. Dry air column averaged mixing ratios XCO2 are determined by normalisation with the simultaneously measured oxygen columns retrieved from the O2 A-band. Because of the large spectral distance between the CO2 band and the O2 band, the light path error does not fully cancel in the CO2 to O2 column ratio XCO2 calculated. The resulting XCO2 error contains both random and systematic components. Under high and variable aerosol load this error can become as large as several percent. This problem is overcome by identifying the aerosol contaminated scenes. A similar situation occurs with cloud contaminated scenes. Cloud contaminated ground pixels are identified by a threshold algorithm based on the sub-pixel information contained in the SCIAMACHY Polarization Measurement Devices.

Figure 4a shows bi-monthly averages of XCO2 retrieved over the northern hemisphere by WFM-DOAS version 0.4 [Buchwitz, 2005b]. Figure 4b shows TM3 model simulations. Both model and measurements have been (re-)sampled on the same grid allowing meaningful comparison. Qualitatively, there is a reasonable agreement between the SCIAMACHY measurements and the model simulations. Quantitatively, there are significant differences with respect to the spatial details and the amplitude of the CO2 spatial and temporal variability.

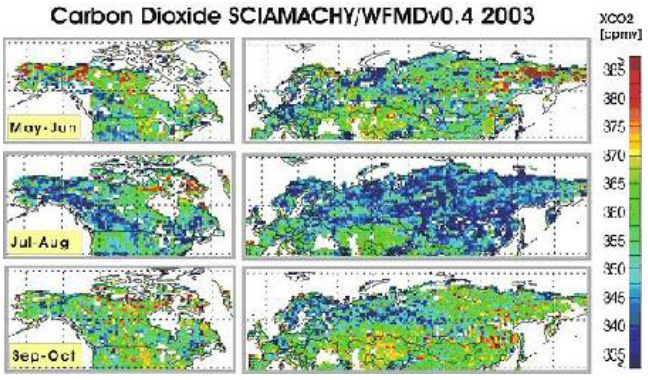

Figure 4a. Carbon dioxide column averaged mixing ratios over the northern hemisphere for the year 2003 as retrieved from SCIAMACHY near-infrared nadir spectra using the initial version 0.4 of the WFM-DOAS retrieval algorithm [Buchwitz, 2005b].

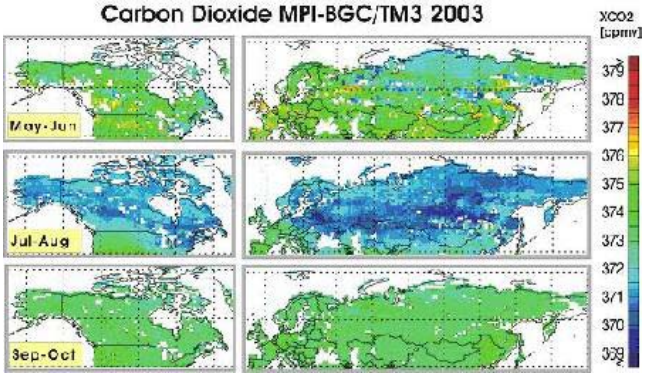

Figure 4b. Carbon dioxide column averaged mixing ratios over the northern hemisphere for year 2003 obtained from TM3 model of MPG-BGC-Jena [Buchwitz, 2005b].

Recently, three years of SCIAMACHY data (2003-2005) have been reprocessed using the improved WFM-DOAS version 1.0 with improved spectral calibration and updated spectroscopic line parameters. This data is currently being analysed and first results are published [Buchwitz, 2007b]. The focus is on large scale Northern Hemispheric features such as the seasonal cycle of CO2 and the year-to-year increase, mainly caused by the burning of fossil fuel. Results show excellent synchronisation of the seasonal cycle, but the amplitude is larger compared with models. In July/August during the growing season the CO2 amplitude measured is 10% to 20% lower, whilst in November/December when rotting sets in, the CO2 amplitude is 10% to 20% higher. These results may be explained by a larger land surface exchange flux of CO2 than

is currently derived in modelled vertical transport (see model comparison). However, it could also be due to problems with the accuracy of the satellite data. Clearly, these interesting results warrant further investigation.

VALIDATION

The EVERGREEN data products for CH4, CO and CO2 retrieved from the SCIAMACHY near infrared channels have been validated by an independent team by comparing these data with data from the ground-based FTIR spectrometer network of the NDACC (http://www.ndacc.org).

Due to inherent limitations of the FTIR and SCIAMACHY measurements, validation is not straightforward and several issues had to be resolved. These issues are (i) how to deal with varying ground station altitude (ii) sparse data availability and (iii) difference in observed air masses. The first item was dealt with by normalising all data to ECMWF pressure data and introducing an altitude correction factor. The second item is addressed by temporal interpolation among FTIR data. However, spatial representation remains limited by the high northern latitude locations of some FTIR stations, where SCIAMACHY data quality is known to be poor. The third issue represents an inherent limitation in comparing data above a single ground station with data covering a finite ground pixel size and requires a case by case inspection [Dils, 2007].

The results of the validation exercise with FTIR stations for methane, carbon monoxide, and carbon dioxide are summarised in Table 1. A large number of data have been compared (order 104 for all individual data products). Seasonality is captured relatively well as indicated by the correlation coefficients, except for CO2. Part of this CO2 error is reduced in the new WFM-DOAS version 1.0, not considered in this Table. Scatter for XCH4 has reduced to acceptable level for inverse modelling of emissions to be carried out, whilst scatter for SCIAMACHY CO and for CO2 remains on the high side. However, results are unfavourably biased by the high Northern latitude locations of FTIR stations where CO and CO2 data quality is known to be low.

	CO				CH_4		CO_2
	WFMD CO v0.5	IMLM CO v6.3	IMAP XCO v0.9	WFMD XCH_4 v0.5cor	IMLM CH_4 v6.3	IMAP XCH_4 v1.1	WFMD XCO_2 v0.4
Bias	1.00 + 0.87	-14.7 + 0.93	-4.59 + 0.63	-3.28 + 0.25	-2.33 + 0.10	-0.62 − 0.24	-6.93 + 0.14
N	22362	12232	14418	42072	5323	22954	7704
σ_{scat}	25.1	22.4	23.5	1.73	3.14	[illegible]	3.72
R	0.82	0.83	0.53	0.90	0.7[illegible]	0.70	0.45
σ_{FTIR}		9.47			1.15		[illegible]
TP		5(?)			[illegible]		1

Table 1. SCIAMACHY validation results based on FTIR of the NDSC [Dils, 2006].

*The errors represent the weighted standard errors (3*std/sqrt(N)) of the ensemble of individual weighted biases. Bias is the calculated weighted bias (in %) of the SCIAMACHY data relative to the 3rd order polynomial fit through the ground based FTIR data using the large grid (LG = ± 2.5° LAT, ± 10° LON) spatial collocation criteria (the weight w =1/(err)2, in which err is the error on the individual measurement as given by the data providers). The bias is calculated for all stations. For individual stations bias can differ significantly. N is the number of correlative individual SCIAMACHY data. sigmascat is the percentage 1sigma weighted standard deviation of the daily averaged SCIAMACHY measurements with respect to the polynomial interpolation of the daily FTIR data, corrected for the daily bias. R is the correlation coefficient between the weighted monthly mean SCIAMACHY and FTIR data. Also given are the scatter of the daily averaged FTIR data points relative to their corresponding polynomial fit values (sigmaFTIR) and the target precisions (TP) needed for inverse modelling on a regional scale.*

MODEL COMPARISON

A comprehensive comparison of 5 atmospheric chemistry transport models TM5, TM4, TM3, IMAGES, and LMDZ has been carried out by the EVERGREEN project [Bergamaschi, 2006] with the objective to analyze differences in model transport, in particular vertical mixing in the boundary layer and in convective transport, synoptic variations, and large scale global circulation, including inter-hemispheric exchange and stratosphere troposphere exchange (STE). Simulations employ tracers with different atmospheric lifetimes: 222Rn (3.8 days), CH4 (~9 years), SF6 (~3000 years). Furthermore, the chemistry has been tested through OH fields derived from full chemistry model simulations.

222Rn simulations show significant differences in vertical transport between models, leading to differences in simulated 222Rn concentrations near the surface of up to a factor 3. The TM4/5 models show the highest 222Rn concentrations near the surface, while the other models display stronger vertical mixing. Simulations with SF6 show significant differences in inter-hemispheric transport between the models, ranging from 6 to 12 months. STE is weaker and probably more realistic (15–16 months) in TM4/5 and LMDZ than in TM3 and IMAGES (7-8 months). CH4 tracer simulations with prescribed OH fields are consistent with the 222Rn and SF6 simulations. Results are also consistent with previous model comparisons such as TransCom2.

Simulated OH fields show significant differences between models near the earth surface, probably due to different emission inventories of CO, NMHC and NOx. In the free troposphere the spatial OH distribution is similar for all models. Also, the seasonal OH variation is consistent for all model runs.

CONCLUSION AND FUTURE OUTLOOK

The EVERGREEN project has produced:

- Improved global data products for CH4, CO and CO2 based on SCIAMACHY satellite measurements.
- Validation of these data against the ground-based NDACC FTIR measurements showing good precision of CH4 and adequate precisions of CO and CO2
- Inverse modelling of these data showing higher CH4 emission in the tropics and higher anthropogenic CO emission in South East Asia compared with bottom-up estimates.
- Total column distributions of CO2 over the Northern Hemisphere showing a larger amplitude of the CO2 seasonal cycle measured by SCIAMACHY compared with models.
- Radiation budget and forcing calculations, including MIPAS satellite measurements for CH4, that are consistent with IPCC figures.
- Data assimilation tools and Observing System Simulation Experiments for inverse modelling of sources and sinks defining criteria for successful inversion.
- Model comparisons identifying weaknesses in modelled vertical transport.

EVERGREEN results have found application in the ECESA GMES operational service for atmosphere PROMOTE. Data users may consult the ESA PROMOTE web-site for access to the data [Goede, 2004].

EVERGREEN has provided information for the specification of future space-based climate gas sensors [Barrie, 2004]. Crucial is the understanding and reduction of systematic errors encountered in instrument calibration and data retrieval. Higher detector sensitivity in combination with higher spectral resolution, feasible with today's technology, marks an obvious road to improved data accuracy. Improved accuracy in underlying spectroscopic data remains an important priority, as errors propagate directly into volume mixing ratios. Future satellite sensors should aim at higher temporal and spatial resolution, in particular vertical profile information in the troposphere is necessary in order to understand errors in vertical transport modelled.

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Short Report on the 3rd Alexander von Humboldt International Conference

on East Asian Monsoon, Past, Present and Future, held in Beijing, China, 9-11 August 2007

by André Berger and Peter Fabian

The EGU Humboldt Conference series was initiated for holding international and interdisciplinary conferences on geosciences topics of great importance to regions outside Europe, with global impact as well, to be jointly organized by EGU and a host institution of that particular region.

Beijing, August 31, 2007.- The Third European Geosciences Union (EGU) Alexander von Humboldt International Conference (AvH) was devoted to East Asian Monsoon, Past, Present and future. It was held in Beijing from 27 to 30 August 2007, in the Meeting Hall of The Institute of Geology and Geophysics, Chinese Academy of Sciences (19 Beitucheng West Road, Chaoyang District, 100029 Beijing, P.R. China).

The First EGU Humboldt Conference on The El Niño Phenomenon and its global impact was held 16–20 May 2005 in Guayaquil/Ecuador. Attended by over 150 scientists from 42 countries worldwide it turned out to be highly successful. The proceedings of this conference are published in a special volume of Advances in Geosciences (www.advances-ingeosciences.net). The Second EGU Humboldt Conference on The role of Geophysics in Natural Disaster Prevention took place 5–9 March 2007 in Lima/Peru. We had almost 200 participants from 53 countries worldwide who experienced an exciting interdisciplinary meeting with stimulating discussions. Manuscripts of papers presented in Lima are in review at present, a proceedings volume of Advances in Geosciences is under preparation.

The Local Organizing Committee of this 3rd AvH Conference was chaired by Professors Ding Zhongli and Guo Zhengtang from the Institute of Geology and Geophysics of the Chinese Academy of Sciences (CAS) in Beijing. The conference was sponsored by European Geosciences Union, the Chinese Academy of Sciences, the PAGES International Geospere Biosphere Programme, the Foreign Affairs Bureau of CAS and the Institute of Geology and Geophysics of CAS.

This Third von Humboldt conference was attended by 87 registred participants and roughly 30 Ph. D. students. 52 papers were delivered among 10 sessions, each being introduced by invited Keynote Speakers :

I. Introduction: History of paleo-EAM (chair: A. Berger)

II. Data and data analysis (chairs: J. Guiot/ D.D. Rousseau)

III. Reconstruction and modeling paleo-EAM

--Tectonic timescale (chairs: R. Tada / Z. Guo)

--Orbital time scal (chairs: A. Berger / Z. Ding)

--Millenium to century time scale (chair: P. Braconnot)

IV. Paleo EAM teleconnections (chairs: P. Wang / G. Ganssen)

V. Recent Past, Present, Future and Impacts of EAM

--Last hundreds of years (chair: T. Yao)

--Present-day EAM (chair: P. Fabian)

--Impacts of EAM (chair: C. Fu)

--Future EAM

VI. Conclusions by Peter Fabian and André Berger.

A Townhall Meeting *PAGES new Working Group on Global Monsoon* also took place during the Conference. Six monsoon systems are recognised in the modern world, the African, South Asian, East Asian, Australian, North American

and South American, and future changes have the potential to affect billions of people. The regional monsoon systems are driven by the same annual cycle of solar heating, yet differ from each other in their geographic position and orographic features, and changes of the global monsoon are now studied as well as regional and local-scale monsoon climate. This new PAGES working group focuses on the large-scale regional to global changes in monsoons across recent and past timescales and on their underlying forcings and teleconnections, by combining evidence from paleo reconstructions, instrumental records and model simulations.

Also, the EGU's prestigious A. von Humboldt Medal was presented to Prof. Liu Tunsheng during the Conference (see EGU News in this issue, http://www.the-eggs.org/news.php?id=437&typeid=1).

Keynote speakers

--Tung Sheng LIU: Loess and paleomonsoon in China, an historical overview

--Bin WANG: Modeling the present-day Asian monsoon, the large scale dynamics problem

--Tetsuzo YASUNARI: Asian monsoon and the uplift of the Tibetan Plateau

--Pinxian WANG: Paleo EASM and teleconnections

--Steven CLEMENS : Variability of the East Asian monsoon at the orbital scale

--Jean JOUZEL: Climate of the last 800000 years in ice cores

--Sulochana GADGIL: The interannual variation of the Indian Monsoon:prediction and impacts.

--Pascale BRACONNOT: Modeling the response of the East Asian Monsoon to the astronomical forcing.

--Tandong YAO: East Asian Monsoon in Tibetan continental glaciers.

--Joel GUIOT: Paleoclimate data analysis

Aim of the Conference

Meteorological data are too short to capture the whole variability of the climate system and in particular to visualize the type of climate that is predicted to occur over the next decades and centuries. This is why it is important to reconstruct past climates and understand past climatic variations. Marine deep sea cores and ice cores have contributed and continue to contribute a lot to this aim, but land records contribute also significantly mainly to understand better climate and climate variations at the regional scales.

The meeting aimed at discussing East Asian Monsoon (EAM) (using modelling and proxy records) in aspects related to ocean, atmosphere, land surface, climate and biosphere, its human impacts and teleconnections worldwide. Both records of the past and present-day observations were reviewed to better understand the mechanisms driving its behaviour and so, to better predict it and its impacts.

Conclusions

The 3rd AvH conference was a great promotion of international collaboration on the East Asian monsoon between China and the communities of scientists related to EGU and PAGES. The set of invited lectures was a successful overview of monsoon studies, apparently occurring for the first time. It is to be expected that, due to our effort, meteorologists dealing with present-day monsoon will become more deeply involved in our future discussions and reviews. Our meeting is a first step towards more cross-disciplinary exchanges in China and worldwide on monsoon and its impacts on Society. It is also, without any doubt, definitely promoting EGU and its journal Climates of the Past.

The abstracts of the presentations can be found at http://www.conferencenet.org/conference/3rdAVH/html/AvH3_absolute_final.pdf

André Berger and Peter Fabian

A simple atmospheric electrical instrument for educational use

Electricity in the atmosphere provides an ideal topic for educational outreach in environmental science; to support this objective, a simple instrument to measure real atmospheric electrical parameters is presented

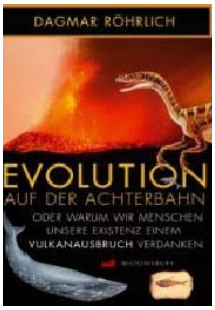
Electricity in the atmosphere provides an ideal topic for educational outreach in environmental science. To support this objective, a simple instrument to measure real atmospheric electrical parameters has been developed and its performance evaluated.

The instrument is inexpensive to construct and simple to operate, readily allowing it to be used in schools as well as at the undergraduate University level. It is suited to students at a variety of different educational levels. Students can make measurements of the fair weather electric field and current density, thereby gaining an understanding of the electrical nature of the atmosphere.

The instrument is described in detail by Bennett and Harrison in a new paper in EGU's Advances in Geosciences, http://www.adv-geosci.net/ (A simple atmospheric electrical instrument for educational use, Adv. Geosci., 13, 11–15, 2007. The full article is available online free of charge at http://www.adv-geosci.net/13/index.html).

The authors state that their work was stimulated by the centenary of the 1906 paper in which C. T. R. Wilson described a new apparatus to measure the electric field and conduction current density. Measurements using instruments based on the same principles continued regularly in the UK until 1979. The instrument proposed is based on the same physical principles as C. T. R. Wilson's 1906 instrument.

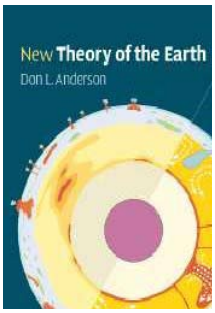
Evolution auf der Achterbahn Oder Warum Wir Mensdhen Unsere Existenz Einem Vulkanausbruch Verdanken



Authors: Dagmar Röhrlich
Publisher: Berlin Verlag GmbH
ISBN: 3-8270-5143-6
YEAR : 2006
EDITION : 1st (language: German)
PAGES : 237
PRICE : 14.90 €
hardback

Wie sich das Leben entwickelt hat, ist eine der spannendsten Fragen der Wissenschaft. Der Geologin und Wissenschaftsjournalistin Dagmar Röhrlich haben es vor allem die Zeiten gewaltiger Umbrüche angetan. Mehrmals in der Erdgeschichte starb ein Großteil der Arten aus und hinterließ ökologische Nischen, sodass die Karten des Lebens neu gemischt wurden. So profitierten die Dinosaurier vom Massenaussterben am Ende des Perm und die Säugetiere von dem am Ende der Kreidezeit. Ausgehend von den Katastrophen schlägt Röhrlich einen weiten Bogen: Es geht ihr um die gesamte Geschichte des Lebens, von den ersten Lebensspuren, die in Grönland ans Licht kamen, über die ersten Fossilien in der Ediacara-Fauna von Australien und den Werdegang der Saurier bis zur Entwicklung des Menschen, der selbst tief in seine Umwelt eingreift.

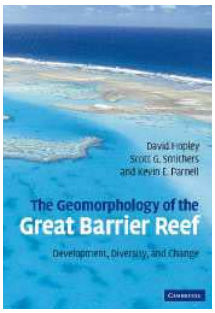
New Theory of the Earth



Authors: Don L. Anderson
Publisher: Cambridge University Press
ISBN: 0521849594
YEAR : 2007
EDITION : 1st
PAGES : 384
PRICE : 52.00 €
hardback

New Theory of the Earth is an interdisciplinary advanced textbook on the origin, composition, and evolution of the Earth's interior: geophysics, geochemistry, dynamics, convection, mineralogy, volcanism, energetics and thermal history. This is the only book on the whole landscape of deep Earth processes which ties together all the strands of the subdisciplines. It is a complete update of Anderson's Theory of the Earth (1989). It includes many new sections and dozens of new figures and tables. As with the original book, this new edition will prove to be a stimulating textbook on advanced courses in geophysics, geochemistry, and planetary science, and supplementary textbook on a wide range of other advanced Earth science courses. It will also be an essential reference and resource for all researchers in the solid Earth sciences.

The Geomorphology of the Great Barrier Reef: Development, Diversity and Change



Authors: Scott G. Smithers, Kevin E. Parnell, David Hopley
Publisher: Cambridge University Press
ISBN: 0521853028
YEAR : 2007
EDITION : 1st
PAGES : 532
PRICE : 119.00 €
hardback

Over the last 25 years considerable information on the geomorphological evolution of the world's largest coral reef system, the Great Barrier Reef, has become available. This book reviews the history of geomorphological studies of the Great Barrier Reef and assesses the influences of sea-level change and oceanographic processes on the development of reefs over the last 10,000 years. It presents analyses of recently attained data from the Great Barrier Reef and reconstructions of the sequence of events which have led to its current geomorphology. The authors emphasise the importance of the geomorphological time span and its applications for present management applications. This is a valuable reference for academic researchers in geomorphology and oceanography, and will also appeal to graduate students in related fields.

2nd Annual Arctic Frontiers conference (Meeting)

20/01/2008 - 25/01/2008 - Tromso, Norway

Sunday 20- Opening Event

Monday 21- Tuesday 22- Policy Making Conference: Challenges for oil and gas development in the Arctic

Wednesday 23- Friday 25- Scientific Conference: Assessment of oil and gas activities in the Arctic

The 2nd annual Arctic Frontiers conference will take place in Tromsø, Norway, 20-25 January 2008. It is hosted by the University of Tromsø, and organized and financed by stakeholders from the private and public sector. Arctic Frontiers 2008 has entered cooperation with Arctic Monitoring and Assessment Program (AMAP), a permanent working group of the Arctic Council. AMAP will launch the results from its 3 year circumpolar study: "Assessment of Oil and Gas Activities in the Arctic". Arctic Frontiers Tromsø 2008 will discuss the associations between Arctic oil and gas activities and environmental challenges, society and indigenous peoples.

Policy Making Conference: Challenges for oil and gas development in the Arctic

Invited keynote speakers will provide a review of the current development of oil and gas in the Arctic, introduce urgent socio-economic, environmental and political issues, and identify challenges in the coming years.

Session 1: Social, economic and cultural perspectives of Arctic oil and gas development.

Session 2: Environmental challenges of Arctic oil and gas development – risk management and technological solutions.

Session 3: Dynamics of permafrost and the consequences of climate change.

Scientific conference: Oil and Gas Activities in the Arctic, the scientific frontier

The AMAP report on: Assessment of Oil and Gas Activities in the Arctic has been prepared in response to a request from the Ministers of the Arctic Council and will be presented at the Arctic Frontiers 2008 in Tromsø. The report builds on and expands the AMAP assessment completed in 1997.

The assessment have been subjected to both peer and national review to ensure the highest quality and to avoid statements that may have unintended consequences at national or local levels.

Session 1: Oil and Gas Activities in the Arctic. Past, Present and Future

Session 2: Social Economic Aspects of Arctic Oil and Gas Development, and Indigenous Peoples' Perspectives

Session 3: Sources, Inputs, Concentrations and Fate of Petroleum Hydrocarbons and PAHs in the Arctic Environment

Session 4: Effects of Petroleum Hydrocarbons on Arctic Biota and Humans

Session 5: Status and Vulnerability of Arctic Ecosystems and Effectiveness of Regulations and Emergency, Preparedness and Response

Session 6: Arctic Environmental Technologies

Deadline for submission of abstracts for oral and poster presentations: 30 september 2007. The abstract format can be downloaded from the Arctic Frontiers web site using the "Call for paper" button.

Please forward your abstract to amap@amap.no attention Inger Utne.

Conference website: http://www.arctic-frontiers.com

18th International Congress of Biometeorology (Meeting)

22/09/2008 - 26/09/2008 - Tokyo, Japan

The Scientific Committee invites authors to submit abstracts for oral presentations or posters for consideration and inclusion in the program. All submitted abstracts will be reviewed by the Scientific Committee. The Scientific Committee will award the best presentation to three young scientists (under 40 years old).

Deadline: 15 November 2007

Acceptance notification: 29 February 2008

Organizer:

ISB

http://www.icb2008.com/

Stratospheric Processes and their Role in Climate (SPARC)- 4th General Assembly 2008 - (Meeting)

31/08/2008 - 05/09/2008 - Bologna, Italy

Scientific topics will include:

Stratosphere-Troposphere Dynamical Coupling

Stratospheric Variability and Climate Change

Extra-tropical Upper Troposphere/Lower Stratosphere

Detection, Attribution and Prediction of Stratospheric Change

Tropical Tropopause Layer

Atmospheric Chemistry and Climate

Scientific organising committee co-chairs:

Peter Haynes (phh@damtp.cam.ac.uk)

Thomas Peter (thomas.peter@env.ethz.ch)

Local Organizing Committee Chair:

Elisa Manzini (manzini@bo.ingv.it)

http://www.cmcc.it/sparc-ga2008

International Conference in Studying, Modeling and Sense Making of Planet Earth- 2nd Call for Papers (Meeting)

01/06/2008 - 06/06/2008 - Mytilene, Lesvos, Greece

On the occasion of the celebration of the International Year of Planet Earth in 2008, the Department of Geography of the University of the Aegean in Lesvos, Greece, is organizing the international conference "Studying, Modeling and Sense Making of Planet Earth". The UNESCO Natural Sciences Sector has granted support to the conference. The Scientific and the Organizing Committee invite papers for presentation as well as posters.

The conference will consist of three parallel streams as follows:

a. Studying the earth system – it will be devoted to the natural sciences, the links within their fields and subfields as well as their links to the social sciences

b. Modeling the earth system – it will be devoted to selected modeling fields with an emphasis on integrated modeling of the various components of the earth system at various spatial and temporal scales

c. Sense making of the earth system – it will be devoted to the social and the policy sciences and the humanities (economics, sociology, psychology, political sciences, policy sciences, spatial planning, history) that try to make sense of the ways people perceive, function, modify and, in general, interact with the earth system, at the same time being a part of it.

Extended Deadline for abstract submission: September 30th, 2007. The Conference language is English.

Detailed information on paper submission, registration, fees, important dates and accommodation will be posted on the conference website:
http://www.aegean.gr/geography/earth-conference2008/en/main_fr.htm

All abstracts should be submitted via the abstract submission e-form found on the conference website. You will be asked to fill in the registration form before submitting an abstract and you will be notified for the registration and abstract submission via e-mail.

For more information about the conference please contact:

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http://www.aegean.gr/geography/earth-conference2008/en/main_fr.htm

ISU's 12th Annual International Symposium- Space Solutions to Earth's Global Challenges (Meeting)

20/02/2008 - 22/02/2008 - Strasbourg, France

During each academic year, the International Space University (ISU) organizes a three-day symposium as an interdisciplinary, international forum to help both the users and the providers of space-related systems to move forward from the discussion of problems to the formulation of innovative solutions. As an independent organization, ISU has developed a winning formula for a "different kind of symposium":

· Addressing all aspects of the subject: - policy, business, legal, scientific, technical, etc.
· Creating ample time for discussion, in the sessions and during interactive events
· Fostering constructive dialogue among different sectors of the space community, or between different communities, that do not interact in more narrowly focused symposia.

The 12th Symposium will emphasize the benefits of the space program for society.

Sessions

1. Where Are We Now?
2. Looking Earthward
3. Moving Outward
4. Using Space Technology 'Back Home' on our Toughest Challenges
5. Cleaning Up Our Own Act - 'Green Space'
6. Where Do We Go from Here?

Participants will include members of agencies, industry and academia, plus enthusiasts and students with interests in space activities, in global problems of Earth's environment, energy and resources, and especially the links among them.

The program will include invited contributions from leading experts plus presentations and posters selected on the basis of abstracts submitted in response to the Call for Papers by the deadline date of 5th October 2007.

More information at: http://www.isunet.edu

Organizer:
ISU
http://www.isunet.edu

International Society for Photogrammetry and Remote Sensing (ISPRS) 2008 Congress (Meeting)

03/07/2008 - 11/07/2008 - Beijing, China

The International Society for Photogrammetry and Remote Sensing (ISPRS) cordially invites you to submit an abstract to the ISPRS 2008 Congress that will be held in Beijing, China 3-11 July 2008. The theme of the Congress is the "Silk Road For Information From Imagery." ISPRS Commission VIII, Working Group 2 focuses on Hazards, Disasters, and Public Health and is particularly interested in abstracts relevant to public health and geospatial technologies. The deadline for submitting abstracts is 20 October 2007. Authors will be notified by 20 January 2008 as to whether or not the paper is accepted. The deadline for submitting full papers is 30 April 2008.

Online Abstract Submission:
http://www.isprs2008-beijing.org/PDF/ISPRS2008_OnLineAbstractSubmisstionSystem_UserManual.pdf
(preffered method)

Abstract Submission Form:
http://www.isprs.org/documents/orangebook/app5.html
The abstract submission form should be sent to the Congress Secretariat before 20 October 2007.

For more information on the abstract submission please visit:
http://www.isprs2008-beijing.org/abstracts.htm

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http://www.isprs2008-beijing.org/