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Cirrus Clouds and their Supersaturated Environment

International Heliophysical Year U.N. Basic Space Science Workshops

New "SPICE" Website Available to the International Solar System Exploration Community

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Flying start for HESS

The new web-based Hydrology and Earth System Science (HESS), and particularly HESS Discussions (HESSD) have made a flying start, with many papers in the pipeline.

We are glad to say that the new web-based HESS, and particularly HESSD has made a flying start. There are many papers in the pipeline and already there are quite a number of papers in discussion in HESSD. We strongly recommend taking a look at:

http://www.cosis.net/members/journals/df/recent.php?j_id=12

If a paper is in your field of competence, please contribute to the discussion or give a review. This is really the strength of HESSD: that it is a journal reviewed by the hydrological community.

Also have a look at the first volume of HESSD:

http://www.cosis.net/members/journals/df/issue.php?j_id=12&i_id=117

containing the papers by Malin Falkenmark and Jim Dooge (the first Dalton and Darcy medalists) with referee comments. It also contains our editorial that gives all the details about the new journal.

During the EGU meeting in Vienna we'll have an opportunity to discuss HESS and receive your feedback.

In closing, we would like to invite you to consider HESSD/HESS as an outlet for the prime results of your research. If you are convening a session at the upcoming annual EGU meeting, or at any other conference for that matter, and you identify a selection of outstanding contributions that would benefit from being published in a special section, we would certainly be very open to your suggestion.

Hubert Savenije,
Murugesu Sivapalan,
Kurt Roth
Executive editors of HESS

Young Scientist Outstanding Poster Paper Award

Young colleagues have the possibility to apply for the Young Scientist Outstanding Poster Paper Award at EGU 2005.

More information on the possibility to apply for the Young Scientist Outstanding Poster Paper Award can be found on our web page http://www.copernicus.org/EGU/ga/egu05/ysoopp_award.htm

The general aim of the Young Scientists' Outstanding Poster Paper (YSOPP) Award is to help to increase the general interest in the poster sessions at the EGU General Assemblies and to enhance their visibility, to further improve the overall quality of poster presentations and most importantly, to foster the excitement of younger colleagues in presenting their work in form of a poster.

The awards are presented by the Divisions and Sections of the Union, but not all Divisions and Sections are presently making this award. The Divisions and Sections presenting this award for the EGU 2005 Assembly are:

Division on Hydrological Sciences
Division on Atmospheric Sciences
Division on Ocean Sciences
Division on Seismology
Section on Nonlinear Processes in Geophysics

Procedure for Application

Eligible for this award are MS and PhD students as well as recent graduates (conferral of degree after 1 January of the year preceding the conference, i.e. 2004 for the meeting in 2005) presenting their thesis work provided they are the first author and personally present their poster at the conference.

With the "Notice of Schedule" authors will be informed about the final status of the presentation of their paper: oral or poster. Young scientists meeting the criteria above and having been selected to present a poster may register to participate in the YSOPP Award contest of their respective Division or Section by using the link indicated. Thereby, registration with COSIS and the abstract ID-Nr. of the respective presentation are required. The students name will then be forwarded to coordinators of the respective Division or Section together with the e-mail address, poster title, abstract, abstract ID-Nr., session nr., poster board nr. and 'on-display' time.

The following link can be used for applying:

http://www.cosis.net/members/meetings/abstract_ysopp.php?m_id=20

Huygens lands successfully on Titan

After a 4 billion kilometre journey through the Solar System that lasted almost 7 years, the Huygens probe plunged into the hazy atmosphere of Titan at 11h13 CET on January 14 and landed safely on its ground at 13h45 CET.

Paris, January 2005.- The first scientific data arrived at the European Space Operations Centre (ESOC) in Darmstadt, Germany, on the 14th of January afternoon at 17:19 CET. Huygens is the first successful attempt to land a probe on another world in the outer Solar System. “This is a great achievement for Europe and its US partners in this ambitious international endeavour to explore Saturn system”, said Jean-Jacques Dordain, ESA’s Director General.

Following its release from the Cassini mothership on 25 December, Huygens reached Titan’s outer atmosphere after 20 days and a 4 million km cruise. The probe started its descent through Titan’s hazy cloud layers from an altitude of about 1270 km at 11:13 CET. During the following three minutes Huygens had to decelerate from 18,000 to 1,400 km per hour.

A sequence of parachutes then slowed it down to less than 300 km per hour. At a height of about 160 km the probe’s scientific instruments were exposed to Titan’s atmosphere. At about 120 km, the main parachute was replaced by a smaller one to complete the descent, with a touchdown at 13:34 CET. The probe landed safely, likely on a solid surface.

The probe began transmitting data to Cassini four minutes into its descent and continued to transmit data after landing at least as long as Cassini was above Titan’s horizon. The certainty that Huygens was alive came at 11:25 CET of the 14th of January, when the Green Bank radio telescope in West Virginia, USA, picked up a faint but unmistakable radio signal from the probe. Radio telescopes on Earth continued to receive this signal well past the expected lifetime of Huygens.

Huygens data, relayed by Cassini, were picked up by NASA’s Deep Space Network and delivered immediately to ESA’s European Space Operation Centre in Darmstadt, Germany, where the scientific analysis is currently taking place.

Huygens provided the first direct and detailed sampling of Titan’s atmospheric chemistry and the first photographs of its hidden surface, and will supply a detailed ‘weather report’.

One of the main reasons for sending Huygens to Titan is that its nitrogen atmosphere, rich in methane, and its surface may contain many chemicals of the kind that existed on the young Earth. Combined with the Cassini observations, Huygens will afford an unprecedented view of Saturn’s mysterious moon.

One week after the successful completion of Huygens’ mission to the atmosphere and surface of Titan, the largest moon of Saturn, ESA brought together some of the probe’s scientists to present and discuss the first results obtained from the data collected by the instruments.

More than 474 megabits of data were received in 3 hours 44 minutes from Huygens, including some 350 pictures collected during the descent and on the ground, which revealed a landscape apparently modelled by erosion with drain channels, shoreline-like features and even pebble-shaped objects on the surface.

The atmosphere was probed and sampled for analysis at altitudes from 160 km to the ground, revealing a uniform mix of methane with nitrogen in the stratosphere. Methane concentration increased steadily in the troposphere down to the surface. Clouds of methane at about 20 km altitude and methane or ethane fog near the surface were detected.

The probe’s signal, monitored by a global network of radio telescopes on Earth, will help reconstruct its actual trajectory with an accuracy of 1 km and will provide data on Titan’s winds. Huygens was still transmitting after 3 hours on the surface. Later recordings are being analysed to see how long Huygens kept transmitting from the surface.

Samples of aerosols were also collected at altitudes between 125 and 20 km and analysed onboard. During the descent, sounds were recorded in order to detect possible distant thunder from lightning, providing an exciting acoustic backdrop to Huygens’s descent (sounds from the winds during the probe’s descent can be heard at

http://www.esa.int/export/SPECIALS/Cassini-Huygens/SEM85Q71Y3E_0.html

As the probe touched down at about 4.5 m/s, a series of instruments provided a large amount of data on the texture of the surface, which resembles wet sand or clay with a thin solid crust, and its composition, mainly a mix of dirty water ice and hydrocarbon ice, resulting in a darker soil than expected. The temperature measured at ground level was about -180 degrees Celsius. Deceleration and penetration data provided by the SSP indicate that the material beneath the surface’s crust has consistency of loose sand, possibly the result of methane rain falling on the surface over eons, or the wicking of liquids from towards the surface. Heat generated by Huygens warmed the soil beneath the probe and both the GCMS and SSP detected bursts of methane gas boiled out of the surface material, reinforcing methane’s principal role in Titan’s geology and atmospheric meteorology - forming clouds and precipitation that erodes and abrades the surface.

In addition, DISR surface images show small rounded pebbles in a dry riverbed. Spectra measurements (colour) are consistent with a composition of dirty water ice rather than silicate rocks. However, these are rock-like solid at Titan’s temperatures. Titan’s soil appears to consist at least in part of precipitated deposits of the organic haze that shrouds the planet. This dark material settles out of the atmosphere. When washed off high elevations by methane rain, it concentrates at the bottom of the drainage channels and riverbeds contributing to the dark areas seen in DISR images.

“We now have the key to understanding what shapes Titan’s landscape,” said Dr Martin Tomasko, Principal Investigator for the Descent Imager-Spectral Radiometer (DISR), adding: “Geological evidence for precipitation, erosion, mechanical abrasion and other fluvial activity says that the physical processes shaping Titan are much the same as those shaping Earth.”

Spectacular images captured by the DISR reveal that Titan has extraordinarily Earth-like meteorology and geology. Imag-

es have shown a complex network of narrow drainage channels merge into river systems running into lakebeds featuring offshore 'islands' and 'shoals' remarkably similar to those on Earth (images of Titan including a composite of Titan's surface seen during the descent of the Huygens probe can be seen at http://www.esa.int/export/SPECIALS/Cassini-Huygens/SEMC8Q71Y3E_0.html

Data provided in part by the Gas Chromatograph and Mass Spectrometer (GCMS) and Surface Science Package (SSP) support Dr Tomasko's conclusions. Huygens' data provide strong evidence for liquids flowing on Titan. However, the fluid involved is methane, a single organic compound that can exist as a liquid or gas at Titan's sub-170oC temperatures, rather than water as on Earth.

Titan's rivers and lakes appear dry at the moment, but rain may have occurred not long ago.

New, stunning evidence based on finding atmospheric argon-40 indicates that Titan has experienced volcanic activity generating not lava, as on Earth, but water ice and ammonia.

Thus, while many of Earth's familiar geophysical processes occur on Titan, the chemistry involved is quite different. Instead of liquid water, Titan has liquid methane. Instead of silicate rocks, Titan has frozen water ice. Instead of dirt, Titan has hydrocarbon particles settling out of the atmosphere, and instead of lava, Titanian volcanoes spew very cold ice.

"We are really extremely excited about these results. The scientists have worked tirelessly for the whole week because the data they received from Huygens are so thrilling. This is only the begging, these data will live for many years to come and they will keep the scientists very very busy", said Jean-Pierre Lebreton, ESA's Huygens Project Scientist and Mission manager.

The Cassini-Huygens mission is a cooperation between NASA, ESA and ASI, the Italian space agency. The jet Propulsion Laboratory (JPL), a division of the California Institute of Technology in Pasadena, is managing the mission for NASA's Office of Space Science, Washington DC. JPL designed, developed and assembled the Cassini orbiter while ESA operated the Huygens atmospheric probe.

ESA PR No 03-2005, 04-2005 and 05-2005

ESF call: Soils & Carbon

RSTCB - Call for Workshop Proposals, Call for Grant Applications

The ESF Programme RSTCB (The Role of Soils in the Terrestrial Carbon Balance) announces a Call for Proposals for Workshops in 2005 and 2006 and a Call for Applications for Short Visit and Exchange Grants, deadlines 31 March 2005. Further information and access to the online application forms at http://www.esf.org/rstcb

Joanne Goetz
Life, Earth and Environmental Sciences (LESC)
European Science Foundation (ESF)

Mediterranean SST map

The most detailed ever heat map of all 2 965 500 square kilometres of the Mediterranean sea is being updated on a daily basis as part of ESA's Medspiration project.

15 December 2004.- The most detailed ever heat map of all 2 965 500 square kilometres of the Mediterranean, the world's largest inland sea is being updated on a daily basis as part of ESA's Medspiration project.

With sea surface temperature (SST) an important variable for weather forecasting and increasingly seen as a key indicator of climate change, the idea behind Medspiration is to combine data from multiple satellite systems to produce a robust set of sea surface data for assimilation into ocean forecasting models of the waters around Europe and also the whole of the Atlantic Ocean.

For the Mediterranean Sea, the Medspiration product is being created to an unprecedented spatial resolution of two square kilometres, as Ian Robinson of the Southampton Oceanography Centre, managing the Medspiration Project explains: "The surface temperature distribution in the Mediterranean contains many finely detailed features that reveal eddies, fronts and plumes associated with the dynamics of water circulation. A resolution as fine as this is needed to allow these features to be properly tracked."

The remaining ocean products are intended to have a impressive spatial resolution of ten square kilometres. Overall results from the Medspiration project also feed into an ambitious scheme to combine all available SST data into a worldwide high-resolution product, known as the Global Ocean Data Assimilation Experiment (GODAE) High-Resolution Sea Surface Temperature Pilot Project (GHRSST-PP).

Its aim is to deliver to the user community a new generation of highly accurate worldwide SST products with a space resolution of less than ten kilometres every six hours.

As an important step towards achieving this goal, ESA has initiated Medspiration as the European contribution to the overall GHRSST-PP effort. The Agency also funded a GHRSST International Project Office, located at the Hadley Centre for Climate Prediction and Research, a part of the UK Met Office located in Exeter.

"Medspiration is at the forefront of the GHRSST-PP effort and is driving the operational demonstration of GHRSST-PP as an international system," says Craig Donlon, head of the GHRSST Office. "GHRSST has developed with a 'system of systems' approach, demanding stable interfaces and comprehensive data handling and processing systems.

"Medspiration is ready to deliver the European component of GHRSST-PP. Over the next 12 months Medspiration will play a fundamental role in partnership with other operational groups in the USA, Australia and Japan as the GHRSST-PP system begins the operational delivery of a new generation of SST data products to European and international user communities in near real time."

A number of different satellites measure SST on an ongoing basis. For example, the Advanced Along-Track Scanning Radiometer (AATSR) aboard ESA's Envisat uses infrared wavelengths to acquire SST for a square kilometre of ocean to an accuracy of 0.2 °C. Thanks to its high accuracy, AATSR is helping to calibrate other sensors employed by the Medspiration project.

Other satellites may have decreased accuracy or resolution, but potentially make up for it with cloud-piercing microwave abilities or much larger measuring 'footprints'. Combine all available satellite data together – along with localised measurements from buoys and research ships - and you can achieve daily monitoring of the temperature of all the oceans covering 71% of the Earth's surface. This information is then prepared for input into the relevant 'virtual ocean' – a sophisticated computer model of the genuine article.

The combination of satellite and also available in-situ observations with numerical modelling – a technique known as 'data assimilation' – is an extremely powerful one. It has revolutionised atmospheric weather forecasting and is now being applied to the oceans.

Near real time observational inputs keep an ocean model from diverting too much from reality, while the outputs from the model make up for any gaps in coverage. With maximised coupling between actual observations and the numerical model, output data can be credibly used for operational tasks such as sea state and algal bloom forecasting, and predicting the path of oil spills. And these models can also be used to look deeper than just the ocean surface.

"The time is coming for operational monitoring and forecasting of three-dimensional global ocean structure," comments Jean-Louis Fellous, Director for Ocean Research at France's IFREMER, the French Research Institute for Exploitation of the Sea, a Medspiration project partner. "A project like Medspiration is a key contribution to this endeavour.

"With the capabilities offered by spaceborne SST sensors, by satellite altimeters and by the 1,500 profiling floats measuring temperature and salinity in the deep ocean – and all this data being fed in near-real time to global ocean models, this vision is becoming a reality."

Although the new map of the Mediterranean represents an important step forward, both Medspiration and GODAE GHRSST-PP remain works in progress at this point.

The main problem with monitoring high-resolution SST of the Mediterranean is cloud cover. To compensate the team has available a near real time data stream from four separate satellites – two European, one American and one Japanese. Also applied is a technique called 'objective analysis' that minimises cloud effects by interpolating values from just outside the obscured area or from that area measured at times before or after cloud covered it.

Mixing satellite data together on a routine basis is fraught with difficulty because the thermal structure of the upper ocean is actually extremely complex, and different sensors may be measuring different values. There is also considerable day-to-night variability, with daytime temperatures varying with depth much more than those during the night.

Part of the aim of Medspiration is to fully account for this diurnal cycle, in order to improve the overall effectiveness of its data assimilation into ocean forecasting models.

Related links

- Medspiration (http://www.soc.soton.ac.uk/lso/medspiration/)
- GODAE (http://www.bom.gov.au/bmrc/ocean/GODAE/)
- GHRSST-PP (http://www.ghrsst-pp.org/)

ESA

43 million Euro for European Scholarships to 3,000 Indian students

The EU and India recently concluded a partnership agreement that will improve scientific ties between the 25-member bloc and the world's largest democracy.

The strategic partnership was sealed during the eighth EU-India summit which was held in the Hague (NL) last month. Dutch premier Jan Peter Balkenende, whose country holds the rotating EU presidency, signed on behalf of the Union, and his Indian counterpart Manmohan Singh represented India at a special ceremony in the Dutch administrative capital.

The Union already has comparable accords with the United States, Canada, China and Japan, and is negotiating a similar one with Russia.

Scientific exchange

The two sides also signed an accord worth 43 million euro to extend European scholarships to 3 000 Indian masters degree students over the next three years – the largest EU programme of its kind.

Following the agreement, India indicated its desire to participate in the EU's Galileo satellite navigation system. China has already approved a 230-million participation commitment. India has still to negotiate its contribution with the Union.

Survey of users buying SeaWIFS data from ORBIMAGE

Last week, IOCCG held its 10th annual Committee meeting. One of the items discussed at length was the continued demand for SeaWiFS data by the ocean-colour user community following the cessation of NASA's SeaWiFS data buy from ORBIMAGE

January 27, 2005.- Last week, the International Ocean Colour Coordinating Group (IOCCG) held its 10th annual Committee meeting on Margarita Island, Venezuela, (19-21 January 2005). One of the items discussed at length was the continued demand for SeaWiFS data by the ocean-colour user community following the cessation of NASA's SeaWiFS data buy from ORBIMAGE (23 December 2004). The current ORBIMAGE policy and associated user agreement for SeaWiFS data were reviewed. A number of concerns were expressed by participants regarding the high cost of the data and the limitations imposed by ORBIMAGE on the use of the data. The IOCCG felt that to address some of these concerns, the first step would be to survey the community to determine how many research groups are currently buying SeaWiFS data from ORBIMAGE, and the annual cost of the data-buy.

If you, or your group, are currently purchasing SeaWiFS data from ORBIMAGE, please write to IOCCG@mar.dfo-mpo.gc.ca and provide us with the following information:

i) How many people in your group are using SeaWiFS data purchased from ORBIMAGE

ii) The total cost of the data-buy from ORBIMAGE, in US$

The Committee will collate this information and use the result in preparation of a position paper concerning the SeaWiFS data stream. We look forward to your cooperation in this unfortunate matter.

IOCCG

Sea Surface Reflectance instead Ocean Colour

IOCCG proposes tentatively that from now on what we have been calling "ocean colour" be called Sea Spectral Reflectance (SSR).

February 1, 2005.- For some time, the International Ocean-Colour Coordinating Group (IOCCG) has been debating the advantages and disadvantages of the term "ocean colour" as a descriptor for our area of science. It differs from the terms applied in other areas of ocean remote sensing (such as SST, SSH) in that it is rather vague and is not immediately recognisable as a quantitative entity. Some people on the outside perceive it as nothing but pretty pictures from which no quantitative information can be extracted. For example, "ocean colour" as stated has no obvious scientific units. When remote sensing missions contributing to climate studies are listed, ocean colour stands out from the rest in this respect. In the worst case, the result is that ocean-colour work might be taken less seriously than the rest by the earth-observation community, clearly an undesirable outcome.

Against this background, the IOCCG proposes tentatively that from now on what we have been calling "ocean colour" be called Sea Spectral Reflectance (SSR). It would subsume all the principal derived products we are accustomed to using. It has the advantage of being brief (SSR), a description of what we use (spectral reflectance) and is known to be dimensionless. SSR is clearly quantifiable.

The purpose of this communication is to solicit comments from the SSR community. If the comments are generally favourable, the committee will work aggressively to establish this new terminology at the international level. The IOCCG considers that this would represent a beneficial change for our community.

Please send your comments to: IOCCG@mar.dfo-mpo.gc.ca, with the subject line "Ocean-Colour Name?"

IOCCG

10th IOCCG Committee Meeting

The 10th annual IOCCG Committee meeting took place on Margarita Island, Venezuela from 19-21 January 2005.

The 10th annual IOCCG Committee meeting took place on Margarita Island, Venezuela from 19-21 January 2005 and was attended by 25 participants, representing various Space Agencies and Research Institutes. The final minutes of the meeting will be posted on the IOCCG website in due course.

Activities of the six current IOCCG working groups (see http://www.ioccg.org/groups_ioccg.html) were reviewed, and the Committee was pleased to learn that most of these groups intended to submit a draft report this year, which would lead to the publication of several new titles in the IOCCG series of reports.

A proposal for a new IOCCG working group, to examine requirements for an ocean-colour sensor in the coastal zone, was also accepted. This group would be co-chaired by Drs. Curtiss Davis (NRL) and Christopher Brown (NOAA). The status of current and planned ocean-colour sensors was also reviewed, which

lead to extensive discussions about the expiry of NASA's contract with Orbimage for SeaWiFS data. The Committee agreed to survey the ocean-colour community to ascertain the number of users buying SeaWiFS data from Orbimage world-wide.

Presentations from the meeting are available on the IOCCG website at http://www.ioccg.org/ioccg10.html.

IOCCG

Earth and Space Week

Third Earth Observation Summit agrees ten-year GEOSS action plan

17 February 2005.- Around 60 nations and more than 40 international organisations joined ESA and host the European Community at the Third Earth Observation summit on Wednesday. At the Palais d'Egmont in Brussels as assembled delegates formally agreed a ten-year plan to implement a Global Earth Observation System of Systems.

The plan summarises the steps that need to be taken to put a Global Earth Observation System of Systems (GEOSS) in place. GEOSS will build on existing Earth Observation systems by coordinating efforts, addressing data gaps and supporting interoperability and information sharing. It aims to increase responsiveness to user needs and improve information delivery to users.

The creation of a single, comprehensive and sustained system for Earth Observation should help countries to identify and address global environmental and economic challenges, including climate change and natural disasters – the agreement coming on the same day that the Kyoto Protocol entered into force, and just under two months after the Indian Ocean tsunami disaster.

Delivering the opening address, European Commission (EC) Environmental Commissioner Stavros Dimas said that a combination of different Earth Observation systems is needed to study the kind of complex phenomena found within the Earth system: "Good policy needs good science – we need to understand the environment in order to protect it.

"It is very fitting that we are today, on the date of entry into force of the Kyoto Protocol, launching a system that will greatly enhance our understanding of the environment and will hopefully help us to do what we can to improve it."

Kusmayanto Kadiman, Indonesian State Minister for Research and Technology, described his 220-million person nation as "both threatened and blessed by nature", with the vast archipelago both rich in resources but also subject to a variety of hazards including earthquakes and volcanoes, forest fires, hurricanes and floods as well as the recent tsunami that struck Sumatra and Banda Aceh on 26 December 2004.

Kadiman said he was overwhelmed by the response of the world community, including near-real time satellite imagery provided through the Charter on Space and Major Disasters, which enabled the government to swiftly grasp the full scope of the tragedy.

"The effectiveness of Earth Observation has been demonstrated," Kadiman said. He added that Indonesia is setting up a Regional Centre for Disaster Mitigation, planned as part of a global network of such centres. "Early-warning systems are required to guard against future disasters, so GEOSS could not be more timely."

US Commerce Secretary Carlos Gutierrez reminded the Summit that it had been just 19 months since the First Earth Observation Summit in Washington DC. A lot of work had been done to reach this stage, but the benefits would be worth it: "Hurricane prediction has already saved the lives of many people, keeping our citizens out of harm's way. A third of the US economy is weather or climate-related – a figure amounting to 3 trillion dollars".

GEO Co-chair Rob Adam, Director-General of the South African Department of Science and Technology, welcomed the GEOSS implementation plan, stating that its emphasis on capacity-building will particularly help sustain and extend the observational capacities of developing countries.

Colonel Benjamin Ndala, Secretary-General of the International Commission of the Congo-Oubangi-Sangha Basin (CICOS) gave an example of how capacity-building works in practice. Starting in 1996, a project called PUMA ensured that 53 African national meteorology services would be capable of making use of the enhanced data and services provided by the new Meteosat Second Generation (MSG) family of European weather satellites.

Supported by 11 million from the European Commission, as well as bilateral contributions from the Belgium, France and the UK, PUMA has set up a total of 59 receiving stations across the African continent – one for each participating country and six regional centres – and 350 technicians will have been trained by September of this year.

He added that the PUMA Task Team is now working on a follow-up project called African Monitoring of the Environment for Sustainable Development (AMESD), that extends beyond meteorology to cover Earth Observation capacity-building, with the intention of providing support for African policy makers. AMESD will serve as the African link to GEOSS.

Stephen Briggs of ESA's Earth Observation Science and Applications Department gave details of a programme called TIGER which is focused on applying Earth Observation to Africa, with a particular focus on water management issues – some 95 research proposals have been received across the continent. Satellite radar images are being used to calculate rates of water extraction from underground aquifers, for example, based on millimetre-scale measurements of ground motion.

Alan Belward of the EC's Joint Research Centre in Italy stated that the JRC's Africa Observatory project aims to supply Earth Observation data to African users. Belward had a graphic example of how Earth Observation can work in practice – he compared a 1963 declassified military satellite image of Lake Chad to a view from 2000, showing that it is now only a tenth the size it was forty years ago. Shortages of water and other resources are increasing drivers of regional conflicts.

Developing countries are disproportionately threatened by climate change, he said. But Earth Observation can enable wise stewardship of resources such as water, forestry and national parks – valuable in themselves as tourist attractions, but threatened by illegal logging and poaching.

"The environment and poverty reduction fit hand in glove," Belward said. "Natural resources equal income in developing countries. Poor management of natural resources now can limit their value for future generations - decreasing biodiversity limits the value of ecosystem services."

Mosibudi Mangena, South Africa's Minister of Science and Technology said he was very pleased to have GEOSS established, and that the developing world was so well represented: "We will be able to generate data and also get data on a worldwide basis, to use it in our own countries in action against poverty and the other issues that affect humanity.

"For developed countries the GEOSS challenge is to coordinate many existing systems, while we in many cases still have to create our own Earth Observation systems. We welcome GEOSS and hope it will bring future generations a better health than our own."

ESA

The carbon budget of the North Sea

The carbon exchange fluxes with the North Atlantic Ocean dominate the gross carbon budget.

A carbon budget has been established for the North Sea, a shelf sea on the NW European continental shelf. The carbon exchange fluxes with the North Atlantic Ocean dominate the gross carbon budget. The net carbon budget – more relevant to the issue of the contribution of the coastal ocean to the marine carbon cycle – is dominated by the carbon inputs from rivers, the Baltic Sea and the atmosphere. The North Sea acts as a sink for organic carbon and thus can be characterised as a heterotrophic system. The dominant carbon sink is the final export to the North Atlantic Ocean. More than 90% of the CO2 taken up from the atmosphere is exported to the North Atlantic Ocean making the North Sea a highly efficient continental shelf pump for carbon.

Whole paper (open-access) available at http://www.copernicus.org/EGU/bg/bg/2/87/bg-2-87.pdf

The paper is part of a Special BG issue, Coastal Biogeochemistry (http://www.cosis.net/members/journals/df/special_issue.php?j_id=9&i_id=105).

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Global indirect aerosol effects: a review

Review of the indirect aerosol effects on the climate system

Aerosols affect the climate system by changing cloud characteristics in many ways. They act as cloud condensation and ice nuclei, they may inhibit freezing and they could have an influence on the hydrological cycle. While the cloud albedo enhancement (Twomey effect) of warm clouds received most attention so far and traditionally is the only indirect aerosol forcing considered in transient climate simulations, here we discuss the multitude of effects. Different approaches how the climatic implications of these aerosol effects can be estimated globally as well as improvements that are needed in global climate models in order to better represent indirect aerosol effects are discussed in this paper.

Whole paper (open-access) available at http://www.copernicus.org/EGU/acp/acp/5/715/acp-5-715.pdf

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Transfer of organic Br and Cl from the Biosphere to the Atmosphere during the K/T Impact

The K/T impact may have resulted in serious ozone depletion from chlorinated and brominated compounds

Following the Cretaceous/Tertiary (K/T) meteoritic impact some 65Myr ago, large portions of aboveground terrestrial biomass were burned. As a result, large amounts of various trace gases were injected to the atmosphere, inducing a wide range of effects on climate and ecosystems. Here, it is commented on the previously unaccounted for emission to the atmosphere of methyl bromide (CH3Br) and methyl chloride (CH3Cl) from extensive biomass burning that followed the impact. Based on reported biomass burning emission rates of the above organohalogens relative to CO2, it is estimated that their emissions from global fires resulted in tropospheric mixing ratios of around 20-65.8ppbv organic Cl and 110-390pptv organic Br. The above calculated mixing ratios of organic chlorine and bromine are more than an order of magnitude greater than their present, anthropogenically perturbed level and, although the ocean ultimately might absorb them, we argue here that they could still remain in the atmosphere for many years, and a substantial fraction could be transported to the stratosphere, thus substantially affecting the ozone layer. This would have led to very serious increases in short wavelength UV radiation reaching the lowermost atmosphere.

Whole paper (open-access) available at http://www.copernicus.org/EGU/acp/acp/5/207/acp-5-207.pdf

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A probabilistic seismic hazard model based on cellular automata and information theory

A spatio-temporal model of earthquakes occurrence based on Information Theory and Cellular Automata

We try to obtain a spatio-temporal model of earthquakes occurrence based on Information Theory and Cellular Automata (CA). The CA supply useful models for many investigations in natural sciences; here, it have been used to establish temporal relations between the seismic events occurring in neighbouring parts of the crust. The catalogue used is divided into time intervals and the region into cells, which are declared active or inactive by means of a certain energy release criterion (four criteria have been tested). A pattern of active and inactive cells which evolves over time is given. A stochastic CA is constructed with the patterns to simulate their spatio-temporal evolution. The interaction between the cells is represented by the neighbourhood (2-D and 3-D models have been tried). The best model is chosen by maximizing the mutual information between the past and the future states. Finally, a Probabilistic Seismic Hazard Map is drawn up for the different energy releases. The method has been applied to the Iberian Peninsula catalogue from 1970 to 2001. For 2-D, the best neighbourhood has been the Moore's one of radius 1; the von Neumann's 3-D also gives hazard maps and takes into account the depth of the events. Gutenberg-Richter's law and Hurst's analysis have been obtained for the data as a test of the catalogue. Our results are consistent with previous studies both of seismic hazard and stress conditions in the zone, and with the seismicity occurred after 2001.

Whole paper (open-access) available at http://www.copernicus.org/EGU/npg/12/npg-12-381.pdf

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The European Project for Ice Coring in Antarctica

EPICA provides information for eight glacial cycles

by E. Wolff and H. Miller

The European Project for Ice Coring in Antarctica (EPICA) is a consortium of scientists from 10 European countries that has set out to drill two new cores: one giving a record longer than 400 kyrs, the other giving far more detail about the last climatic cycle. In a major publication, the team have presented data extending nearly 800 kyrs in the past, with more to come. Future plans by the international ice coring community include ideas to extend the record in both Antarctica and Greenland yet further into the past, and to understand the spatial variability of polar climate on different timescales.

Ice cores have provided many of the key pieces of evidence about past changes in climate and in forcing factors for climate. In particular, the core from Vostok (Antarctica) shows how climate and greenhouse gases have been intimately linked over the last 400,000 years. The European Project for Ice Coring in Antarctica (EPICA) is a consortium of scientists from 10 European countries that has set out to drill two new cores: one giving an even longer record, the other giving far more detail about the last climatic cycle. In a major publication, the team have presented data extending nearly 800,000 years in the past, with more to come. Future plans by the international ice coring community include ideas to extend the record in both Antarctica and Greenland yet further into the past, and to understand the spatial variability of polar climate on different timescales.

The contribution of ice cores

In debates about the future of the Earth's climate, we rely on our understanding of how the Earth system works, and on ensuring that the correct processes are included in predictive models. One of the most important lines of evidence comes from palaeoclimate - how did the Earth behave in the past, and why? In recognition of this, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), due in 2007, will include a separate chapter on palaeoclimate. There are numerous sources of palaeoclimate information, but ice cores form a particularly powerful resource for periods up to (as we shall see) one million years in the past. The power of ice cores comes from the fact that, not only do they record climatic parameters, but they also document many of the forcing factors for climate. For example, the history of volcanic forcing can be estimated from sulfate deposition to ice sheets, while one resource for determining past solar activity is the concentration of 10Be in ice cores. Most strikingly, and most directly, ice cores contain a unique record of the past composition of the atmosphere. As snow turns to solid ice under the weight of overlying ice, it includes air bubbles, which act as tiny canisters of ancient air, from which past changes in major greenhouse gases (e.g. CO2, CH4, N2O) can be determined.

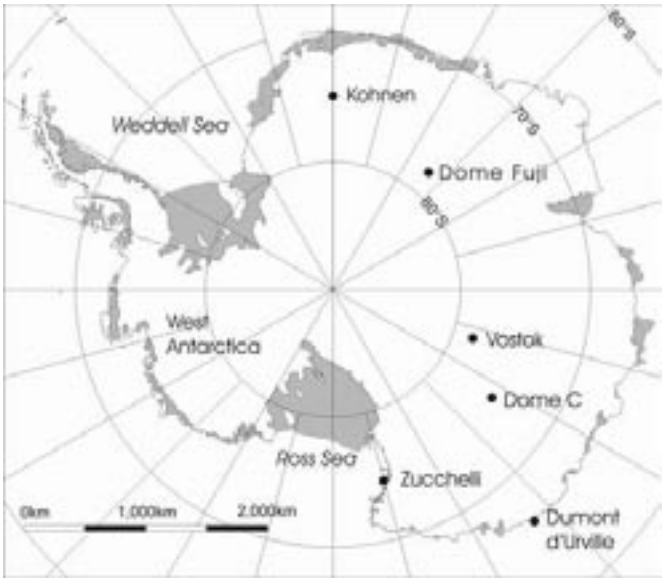

Figure 1. Map of Antarctica showing major ice core drilling sites.

As an example, it is only through ice cores that we know what the natural concentrations of carbon dioxide and methane concentrations in the atmosphere were, and how they have grown dramatically since the middle of the nineteenth century. Ice cores provided the first clear evidence that very abrupt climate changes (Dansgaard-Oeschger events) occurred during the last glacial period. And most famously, the Vostok (Ant-

arctica, Fig. 1) ice core (Petit et al., 1999) showed how climate and greenhouse gases varied (Fig. 2) over the last 420 kyr (420,000 years). During this time, Antarctica experienced four long cold periods (glacials), and four short warm periods (interglacials). Carbon dioxide and methane concentrations varied in a remarkably similar way to Antarctic temperature, with high concentrations during interglacials. The main results from Vostok have been fully confirmed in the 340 kyr record from Dome Fuji.

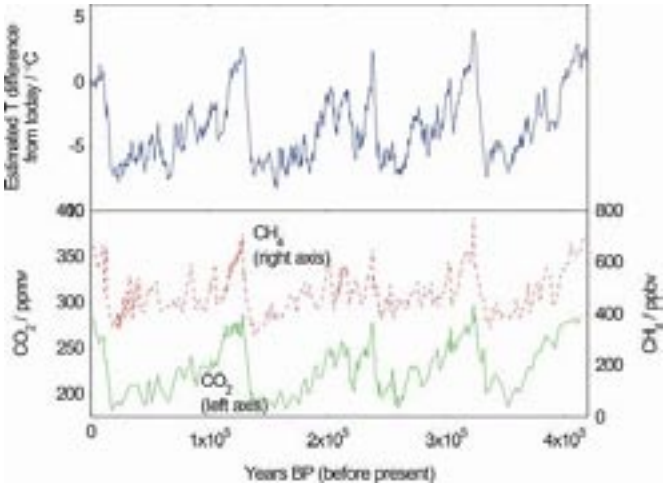

Figure 2. Data from the Vostok (Antarctica) ice core (Petit et al., 1999), with temperature modified as per (Vimeux et al., 2002).

The EPICA project

The Vostok record is a key dataset for palaeoclimate reconstruction. However, ice core scientists recognised that more still could be obtained from other sites. As is well-known, Vostok sits above a large sub-glacial lake, and basal melting occurs at the upstream end of the lake. This is what limits the timespan of the core to 420 kyr. In addition, the low snow accumulation rate at Vostok limits the resolution in the more recent layers. Finally, it is clear that we can expect spatial differences in the pattern of past climate change around Antarctica, and for that reason ice cores from other locations are required.

European scientists have had a long history of working together on ice core projects. In the early 1990s, a team of seven European nations was successful in drilling through the highest part of the Greenland ice sheet in the Greenland Ice Core Project (GRIP). The GRIP core, along with its US counterpart, GISP2, provided an excellent record of climate change in the north over the last 100 kyr (Johnsen et al., 1992). Following this success, European eyes turned to Antarctica, and EPICA was formed. EPICA is a consortium of laboratories from 10 European nations (Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom), organised under the European Science Foundation, and funded by the national agencies and the European Union. It was agreed that two new cores were needed from East Antarctica. The first one, to be drilled at Dome C, would aim for a record of climate covering at least half a million years. The second one, in Dronning Maud Land, would target a high resolution record of at least one climatic cycle from a site in the Atlantic sector of the continent. Only by pooling the financial, technical, logistic and intellectual resources of all the EPICA nations could the two cores be recovered and fully utilised.

The Dome C drilling began with a pilot hole in the austral summer of 1996-97. The work was delayed when the drill became stuck at a depth of 788 m two years later. A new hole was started, and has reached a depth of 3190 m (with just over 100 m remaining to be drilled before the bedrock is reached). It is from this core that the recent spectacular results were obtained (EPICA Community Members, 2004). Dome C is a remarkable location (Fig. 3). The mean annual temperature at the site is -54.5^{o}C, with summer temperatures rarely exceeding -20^{o}C. The site lies 3233 m above sea level, and has a very low snow accumulation rate (equivalent to 2.5 cm of water per year). A positive part of this is that it rarely snows and during the summer bright sunshine is the norm. All the equipment and personnel were taken to the site either by tractor trains from the French coastal station of Dumont d'Urville, or by light aircraft from the Italian coastal station, Zucchelli (at Terra Nova Bay). Both these stations are over 1000 km from Dome C, and the success of the Dome C drilling depended on enormous efforts from the French and Italian Antarctic operators (IPEV and PNRA). Dome C is the site of a new year-round station, Concordia, that will be opened by IPEV and PNRA during the 2004-05 summer season.

Figure 3. Aerial overview of Dome C, Antarctica.

The drilling in Dronning Maud Land (DML) started later, after a four-year pre-site survey. It has now reached a depth of 2565 m, about 230 m above the bedrock. The ice at this depth is believed to be about 200 kyr old. The snow accumulation rate at DML is over double that of Dome C, and it is already clear from preliminary results that the DML core will yield a new record of unprecedented detail for at least the last 100 kyr. Individual annual layers can still be discerned in the ice from the glacial period, and may offer a good prospect of improving the dating of Antarctic ice cores. The site of the drilling has been built up into a new station (Kohnen), and is supplied through the German coastal station of Neumayer, again with a huge logistic effort led by the Alfred Wegener Institute (AWI).

The cores are obtained with two similar electromechanical ice drills, whose design is based on the experience already accumulated with the drill developed by Danish scientists and engineers for the earlier Greenland drillings. The drills produce cores of 10 cm diameter and typically lengths of about 3 m each time the drill is lowered. Every summer, a team of drillers and scientists has descended on Dome C and DML. In a typical season at Dome C, 7 drillers and 14 scientists drilled and

processed over 1000 m of core. Many measurements were made in the field (in a laboratory stabilised at -20ºC), and the ice was cut into sections that were subsequently sent frozen to Europe, and distributed to more than 15 laboratories.

740,000 years of Antarctic climate

The preliminary analysis of the top 3139 m of ice from Dome C allowed EPICA to produce a major paper (authored by the entire EPICA community) in June 2004, discussing climate over the last 740 kyr (EPICA Community Members, 2004). With further ice analysed since the paper was published, EPICA has almost doubled the climate record available in comparison to the Vostok data. The deuterium content of the ice contains (to first order) the signal of Antarctic temperature. It is immediately obvious (Figure 4) that the signal over the "Vostok period" is very similar to what we have already seen in the Vostok core. However, in the earlier period, the behaviour changes dramatically.

Figure 4. Kohnen Station, Antarctica.

The earlier part of the record continues to be dominated by 100 kyr cyclicity. However, the four most recent climate cycles consisted of interglacials (like the present one) that were short, surrounding long cold periods. In contrast the three previous cycles had almost equal periods of warm and cold, but the interglacials were much less warm than the more recent ones. Some kind of similar behaviour is evident in the marine isotope records that already exist; these are often interpreted as records of global ice volume, although they certainly contain a component of water temperature as well. However, the pattern of cool interglacials is much more obvious in the ice core data, which records atmospheric temperature. Many other parameters in the ice change in concert with the temperature: for instance, dust concentrations are high when climate is cold, and low when climate is warm.

One particular feature that has excited interest is the warm period centred on 425 kyr before present (B.P.), known as marine isotope stage 11. This is often considered to be the best analogue we have access to for the present and near future in the absence of anthropogenic influence. That is because the shape of Earth's orbit around the Sun has a pattern then similar to that of the present. All the parameters we measure (including the greenhouse gas concentrations) show a similar pattern in the transition into MIS 11 as they do in the transition into the Holocene (although with subtle differences in timing). MIS 11 was warm for 28000 years, whereas we have had interglacial warmth for only 12000 years so far. If the present

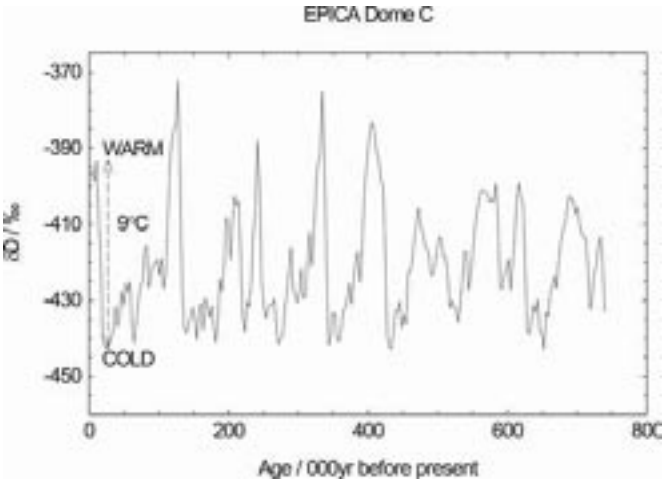

Figure 5. Deuterium (a proxy for atmospheric temperature) from the Dome C ice core.

interglacial was like the three that preceded it, then a new cold period would be imminent (within a few millennia); but if MIS11 is the better analogue, a new ice age is far away.

The future: EPICA and IPICS

The data presented so far are only the start of the story. Within a few months we should know for the first time what were the concentrations of CO2 and CH4 in the atmosphere between 420 and 800 kyr BP. Will they continue to show the same close relationship to Antarctic temperature that we observe in the more recent period (Wolff et al., 2004)? Analysis of other constituents in the ice is continuing, and should reveal information about other forcings and boundary conditions. Meanwhile, the first records from the DML core over a complete cycle are starting to emerge, and they will show us whether the South Atlantic region responds in a different way to the rest of the continent to the rapid northern hemisphere climate changes that we know occurred during the last glacial period.

A small team of drillers and scientists is returning to Dome C in November 2004 to try to retrieve the remaining 120 m of ice above bedrock there. If the chronology of the ice is well-behaved, this will extend the record beyond 900,000 years.

Ice cores have already provided many of the key facts on which our knowledge of past climate, and of the behaviour of the Earth system, rest. Representatives of most of the leading ice core nations and teams met in April 2004 near Washington to consider what more ice cores can offer. What emerged was a consensus for an ambitious plan, taking probably 15 years to fulfil, and requiring the participation of every ice coring nation. The programme has been tentatively titled International Partnerships in Ice Core Sciences (IPICS).

In Antarctica, IPICS recognises that even older ice is available. From marine sediment records, we know that, just before the Dome C record begins, climate was dominated, not by 100 kyr cycles, but by 40 kyr cycles. IPICS would aim to find somewhere in East Antarctica where a record of at least 1.2 million years could be retrieved, thus giving several examples of the 40 kyr cycles to match those we already have for the longer cyclicity. This material will help us to understand why the dominant period of climate is now 100 kyr, which in turn will tell us why we are in a warm period today. For Greenland, a Danish-led team recently presented the longest reliable record of climate available so far from a northern hemisphere

ice core (North Greenland Ice Core Project Members, 2004). This extends to 123 kyr BP, but does not yet include the whole of the last interglacial. A second IPICS target is to find a new site in Greenland where the record of that interglacial can be completed. Over shorter time periods, we know that different mechanisms predict different spatial patterns of change during rapid climate changes at different sites around Antarctica. A number of drillings are already underway that will encompass at least the last 30 kyr at sites around the edge of Antarctica, and a major US initiative is currently targeting a longer, very high resolution, record of climate in West Antarctica. IPICS aims to complete a network of cores, with increasing spatial density for decreasing timescales, around both the Antarctic and Arctic. So far, these plans are only on the drawing board, but it is hoped that the International Polar Year (www.ipy.org) of 2007-08 will provide an impetus for the international effort needed to find the best sites and start the drillings.

The EPICA project has set new standards for international collaboration to produce a spectacular increase in knowledge. When it is complete, we will have a very much clearer view of the functioning of the climate system over something approaching a million years, and, along with other projects in Greenland and West Antarctica, an even more detailed view of the most recent climate cycle. These successes have whetted our appetite for yet more ambitious plans, which we expect to pursue under the IPICS banner in the next decade or more.

Acknowledgments

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Cirrus Clouds and their Supersaturated Environment

Report on the COST 723 Workshop

by Klaus Gierens

On 11/12 October, 2004, about 50 scientists met at DLR Oberpfaffenhofen in order to discuss how to unify the so far distinct research topics of Cirrus Clouds and Ice-Supersaturated Regions. Up to now, no operational weather prediction or climate model could represent the ice-supersaturated air masses that are the parent regions of non-convective cirrus. But the situation is beginning to change. The workshop has clarified the need to represent cirrus formation more correctly and, therefore, to include ice supersaturation in models. The workshop also made suggestions to WMO and satellite data producers.

On 11/12 October, 2004, about 50 scientists met at DLR Oberpfaffenhofen in order to discuss how to unify the so far distinct research topics of Cirrus Clouds and Ice-Supersaturated Regions.

The workshop was organised by Dr. Klaus Gierens as an activity of the European COST Action 723 (Data Exploitation and Modelling for the Upper Troposphere and Lower Stratosphere; http://www.cost723.org/). The workshop saw the presentation of 15 talks and several posters. There was a splinter session with two working groups and, simultaneously, a meeting of the Action's Management Committee.

The workshop was opened by Bernard Legras, who introduced the participants to the goals of the Action.

Klaus Gierens gave an overview of the problems that arise in the relationship between cirrus and climate as a consequence of the fact that cirrus clouds have only a weak relationship with ice saturation, because (1) they form at high supersaturation and (2) their tendency to approach equilibrium (i.e., saturation) after ice formation is not very strong. He pointed out also that it is extremely difficult to correctly predict cirrus cloudiness in a future climate, since changing background conditions affect the probability to surpass the required high nucleation thresholds more strongly than they affect the mean state.

The first session saw talks about recent field measurements by Bob Herman, Andy Heymsfield, and Cornelius Schiller, and about ground radar and lidar measurements by Y Jaya Rao. Bob Herman reported on measurements of relative humidity inside and outside of cirrus clouds and contrails. In a 20 to 40 min old low temperature contrail (-76°C) there was residual supersaturation of about 30%, which could have been D-ice of Gao et al. (2004). Also, in clear air they sometimes measured supersaturation exceeding 80%, where the threshold for homogeneous nucleation was about 60%. Andy Heymsfield discussed measurements and modelling of a wave cloud event during NASA MidCiX. It was impressive to see how such a cloud forms within one second (flight time): the RHi drops down from 140% to saturation while a huge number of ice crystals are formed. Interestingly, this burst of cloud formation took place when the vertical velocity in the wave was still low. The observations gave indications of a strong heterogeneous mode of ice formation (concentration 1/L), while the model results showed that use of the Koop formulation for homogeneous nucleation yielded good agreement between observations and modelling at the temperature of the event, -55°C. Y Jaya Rao presented combined lidar and VHF radar measurements of cirrus and aerosol from Gadanki, India. This is a very useful combination of instruments, since the radar is able to measure vertical velocities in the tropopause region with a velocity resolution of 10 cm/s and range resolution of 150 m. Together, these instruments can be used to estimate diabatic heating rates and ice mass fluxes in tropopause cirrus clouds. Such monitoring is of great value for studies of Stratosphere-Troposphere-Exchange. Cornelius Schiller reported on results of the APE-THESEO campaign over the Indian Ocean. In particular, he showed that the cirrus clouds in the Tropical Tropopause Layer can be divided into two classes: (i) barely visible cirrus, and (ii) sub-visible cirrus. Barely visible cirrus clouds probably originate from convective towers, and are surrounded by subsaturated air, i.e., this air is not the parent region of the embedded clouds. These clouds are in moisture equilibrium, i.e., RHi inside these clouds is 100%. Sub-visible cirrus clouds, however, are always embedded in humid (some-

times supersaturated) air, and the supersaturation within these clouds reaches 70%. They are probably formed in situ, for instance by gravity wave activity.

The sessions about observations were continued by talks from Peter Spichtinger, Claudia Stubenrauch, Johannes Nielsen, and Markus Quante. Peter Spichtinger presented two case studies of Ice-Supersaturated Regions (ISSRs), one formed in a slow synoptic uplift that was accompanied by a warm conveyor belt; in this case the supersaturation were formed by the adiabatic cooling of the air masses, and the ISSR lasted for more than a day, probably without forming a cirrus cloud. The other ISSR was formed by quick upward motion induced by the superposition of two groups of internal gravity waves of different origin (jet stream and mountain overflow); within this ISSR a cirrus cloud formed and grew quickly, and the lifetime of this system was less than 12 hrs. Claudia Stubenrauch presented a study of the evolution of persistent contrails using TOVS data of upper tropospheric humidity and effective high cloud amount. She showed there is a positive trend of contrails in regions with air traffic and that the trend is stronger in winter and spring than in other seasons. She also showed how to extract UTHi information from the TOVS data for the 100-300 hPa layer, and that there is often supersaturation in this layer, both in clear air and in thin cirrus. The supersaturation yields higher values in the thin cirrus than in clear air. Johannes Nielsen discussed whether humidity fluctuations (reaching far into the supersaturated regime even when there is a large crystal surface area density) observed in cirrus clouds could be explained within the current understanding of crystal growth theory. He tested several hypotheses without much success; the only mechanism that worked (i.e., that led to a long relaxation time for supersaturation in presence of large ice crystal surface area density) was to assume a very low deposition coefficient. The values required to reproduce the observations were much lower than what is usually assumed (although not excluded from microphysical theory); hence this issue is still open. Markus Quante then reviewed observations of turbulence in midlatitude cirrus clouds. Turbulence in cirrus is generally weak (with exceptions) and occurs intermittently. It may act as a trigger for nucleation of ice crystals in a supersaturated environment.

In the next session (talks by Andy Gettelman and Bernd Kärcher) the workshop turned to model-related questions. Andy Gettelman investigated the impact of a modification of the bulk nucleation formulation in the NCAR global modelling system, such that supersaturation is allowed. This modification affects the water vapour field, the cirrus fractional coverage, and the radiation flow through the atmosphere and chemistry. The threshold supersaturation also affects the water abundance in the stratosphere. He also showed that the new sensor AIRS measures ice supersaturation in the tropics at 200 hPa about 2% of the time. Bernd Kärcher presented results from domain-filling trajectory calculations of cirrus properties. The process simulations have led to the following conclusions. Synoptic cold pools define the overall thermodynamic conditions in which the formation of ice clouds takes place, but cloud properties are determined by mesoscale processes. The physical processes that determine the frequency of occurrence of cirrus (e.g., cloud cover) and the cloud microphysical properties (i.e., radiative forcing) depend on each other. Changes in upper tropospheric cooling rates and freezing aerosols can lead to changes in global cirrus cover comparable in magnitude to observed decadal trends.

The session about model-related questions was continued after the Tuesday morning break-out sessions with talks by William Lahoz, Adrian Tompkins, Herman Smit, and Johannes Quaas. William Lahoz talked about assimilation of water vapour in the Met Office's Unified Model. He stated that assimilation of water vapour in the UTLS is desirable because of the many important roles water vapour plays in radiation, dynamics, and chemistry; but unfortunately it is difficult for a number of reasons. New approaches are being tested at DARC/MetOffice, ECMWF and perhaps elsewhere. Data assimilation of water vapour can provide added value to the Earth Observation and modelling communities. Adrian Tompkins investigated the effect of simple homogeneous ice nucleation on the ECMWF model, i.e., he used simple extensions of the operational cloud scheme that allow supersaturation and looked at the consequences. He showed that one has either to assume that RHi in clouds relaxes instantaneously to saturation or one has to introduce a new prognostic equation. Herman Smit reported on MOZAIC data for upper tropospheric humidity. He stated that, over the North Atlantic, more than 35% of the MOZAIC data show ice supersaturation, but only less than one percent show liquid supersaturation. Median horizontal sizes of ISSRs are about 70 km, which is consistent with mean pathlengths of about 150 km determined by other work. Vertical thicknesses are mostly smaller than 1 km, consistent with results from radiosonde data. Backward trajectory calculations for tropical humidity data showed how a unimodal humidity distribution centred at saturation near convective outflows develops within a couple of days into a bimodal distribution, with one dry mode at about 25% RHi and one supersaturated mode. At present, it is not clear what keeps the air supersaturated over this period. Johannes Quaas, giving the final talk, showed how he evaluated the microphysical scheme in two GCMs using satellite data. He could, for instance, use satellite data to tune model parameters. Several model deficiencies were identified; hence the use of satellite data was stated useful for improving GCMs.

The two working groups discussed the relation between cirrus and ISSRs from the measurement and observation perspective (Chair: Andy Heymsfield, Rapporteur: Martina Krämer) and from the modelling perspective (Chair: Adrian Tompkins, Rapporteur: Peter Spichtinger). The observation group asked the question: "What can we do to get a good representation between cirrus microphysics/dynamics and ice supersaturation?". The following items were discussed: ice nucleation, measurement issues, ice growth rates and equilibrium (residual) supersaturation, cloud dynamics and radiation, anthropogenic effects, and satellite remote sensing. The group developed ideas for new measurement strategies and campaigns. The modelling group discussed possibilities for a more physically based representation of cirrus clouds and ISSRs in large-scale models. The following items were discussed: Relative roles of heterogeneous and homogeneous nucleation, whether they should be treated differently in different synoptic situations, role of gravity wave induced effects, necessity to describe ice supersaturation within clouds, what kind of pdfs to describe subgrid scale processes, sedimentation schemes, and whether one should describe vertical subgrid variations.

Resume of the Workshop

I believe that this was a successful workshop. In particular, I see that the community is now aware of a problem that seemed to be not so obvious before, namely that cirrus clouds

do not form at ice-saturation. Up to now, no operational weather prediction or climate model could represent the ice-supersaturated air masses that are the parent regions of non-convective cirrus. But the situation is beginning to change. The workshop has clarified the need to represent cirrus formation more correctly and, therefore, to include ice supersaturation in models. Ways to this end have been discussed, and the first numerical experiments in this direction have been presented. Experimenters have widened their view on cirrus clouds: not only should the cirrus itself be in their focus but also their environment and, in particular, the spectra and probability distribution of vertical wind speeds in cirrus altitudes have been seen as an important, but difficult to measure, parameter. On the other hand, there is hope that instruments like the radar antenna array in Gadanki, India, will help to establish the desired databases on vertical wind speeds. The workshop also discussed the relative relevance of heterogeneous vs. homogeneous nucleation mechanisms, and the significance of high residual supersaturation in some cirrus clouds, in particular at very low temperatures (T~200K). Additionally, in situ measurements of clear air with more than 100% supersaturation have been shown; however, their significance is unclear at the moment. Evidently, the solution of the last two issues needs better knowledge of nucleation modes and of possible mechanisms impeding crystal formation and growth. Work on these problems will form a natural bridge between these microphysical effects and the macrophysical properties of the clouds and the humidity inside and outside of them.

The workshop also made two suggestions to WMO and satellite data producers:

1. WMO should abandon the practice to report relative humidities with respect to liquid water at T<-40°C. As there is no bulk liquid water at these temperatures, the reported data are based on uncertain mathematical extrapolations of the saturation curve. Recent measurements by Fukuta and Gramada (2003) place considerable doubt on the accuracy of these formulations, including the standard one by Goff and Gratch. Relative humidities at T<-40°C should be reported with respect to ice.

2. Satellite data products of upper tropospheric humidity are mostly constrained to values up to ice saturation. There may be reasons for this practice, but it is against current knowledge, hence it should be abandoned.

It is hoped that the COST Action and GEWEX will lobby these suggestions in favour of better data in the UTLS.

References

Fukuta, N. and C. M. Gramada, Vapor pressure measurement of supercooled water, J. Atmos. Sci., 60, 1871-1875, 2003.

Gao, R.S., et al., Evidence that nitric acid increases relative humidity in low-temperature cirrus clouds, Science, 303, 516-520, 2004.

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International Heliophysical Year U.N. Basic Space Science Workshops

First joint IHY / Basic Space Science Workshop to be held in November 2005

by Hans J. Haubold and Barbara Thompson

On 11/12 October, 2004, about 50 scientists met at DLR Oberpfaffenhofen in order to discuss how to unify the so far distinct research topics of Cirrus Clouds and Ice-Supersaturated Regions. Up to now, no operational weather prediction or climate model could represent the ice-supersaturated air masses that are the parent regions of non-convective cirrus. But the situation is beginning to change. The workshop has clarified the need to represent cirrus formation more correctly and, therefore, to include ice supersaturation in models. The workshop also made suggestions to WMO and satellite data producers.

What is IHY?

In 1957 a program of international research, inspired by the International Polar Years of 1882-83 and 1932-33, was organized as the International Geophysical Year (IGY) to study global phenomena of the Earth and geospace. The IGY involved about 60,000 scientists from 66 nations, working at thousands of stations, from pole to pole to obtain simultaneous, global observations on Earth and in space. There had never been anything like it before. The fiftieth anniversary of the International Geophysical Year will occur in 2007. We propose to organize an international program of scientific collaboration for this time period called the International Heliophysical Year (IHY). IHY will focus on the problem of solar variability and its connection to terrestrial effects at Earth and space.

What does “Heliophysical” mean? “Heliophysical” is an extension of the word “Geophysical,” extending the connections from the Earth to the Sun & interplanetary space. The 2007 “IHY” activities will build on the success of IGY 1957 by continuing the legacy of system-wide studies.

Basic Space Science Workshops

The United Nations / ESA Basic Science Workshops, since 1991, have worked to stimulate and establish Basic Space Science activities in Developing Nations. The Planning Team for the IHY/Basic Space Science Workshops held its first meeting in October 2004. The team was able to identify several global instrumentation initiatives which can be deployed in developing nations as part of IHY. The workshops in the upcoming years will focus on establishing connections with developing nations and exploring instrumentation opportunities.

What are the goals of IHY?

The objective of the IHY is to discover the physical mechanisms at work which couple the atmosphere of the Earth to events that drive them from the heliosphere. The systematic global study of this connection is to be the central theme of the IHY. In view of these aims, we propose the following objectives for the IHY:

* To obtain a coordinated set of observations to study at the largest scale the solar-generated events which affect life and climate on Earth.

* To document and report the observations and provide a forum for the development of new scientific results utilizing these observations.

* To foster international cooperation in the study of heliophysical phenomena now & in the future.

* To communicate the unique scientific results of the IHY to the interested scientific community and to all peoples of Earth.

Opportunities for Involvement

The first joint IHY / Basic Space Science Workshop will be

held at the United Arab Emirates University, 20-23 November 2005. Although the workshop will be open to address all scientific results, and plans for basic space science in developing nations, special emphasis will be given to the possibilities offered by the preparations for the International Heliophysical Year (IHY). Additional workshops will be held annually. Interested parties who have access to the World Wide Web may register their participation in the IHY "Science Coordination Database." Go to the IHY website at http://ihy.gsfc.nasa.gov and enter the "Get Involved" section. Additional opportunities for participation are also included on this site.

Contact Information

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http://ihy.gsfc.nasa.gov/

New "SPICE" Website Available to the International Solar System Exploration Community

Archiving and providing access to data returned from space science missions

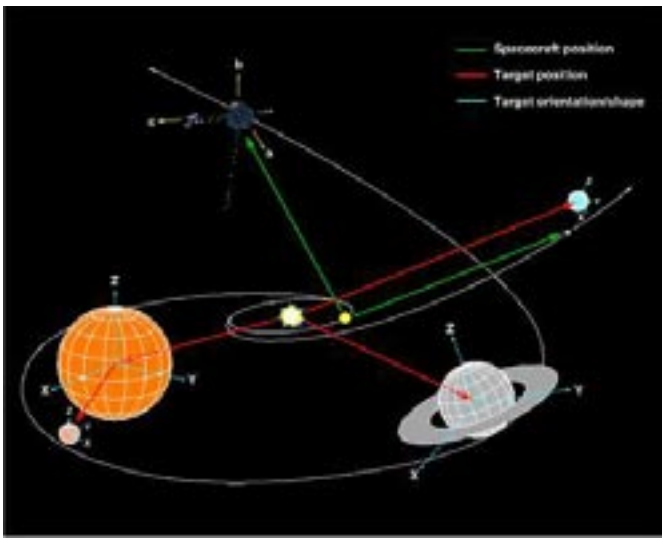
by Charles H. Acton

"SPICE" comes from Spacecraft, Planet, Instrument, C-matrix, and Events. SPICE provides scientists and engineers access to a variety of mostly geometry-related information, such as target body ephemerides, spacecraft trajectory and orientation, instrument pointing and field-of-view specifications, reference frame specifications and time conversion capabilities.

In the early 1980's, NASA—on the advise of the National Academy of Research—embarked on implementing better means for archiving and providing access to the data returned from space science missions. One result of this was the "SPICE" ancillary information system. SPICE provides scientists and engineers access to a variety of mostly geometry-related information, such as target body ephemerides, spacecraft trajectory and orientation, instrument pointing and field-of-view specifications, reference frame specifications and time conversion capabilities.

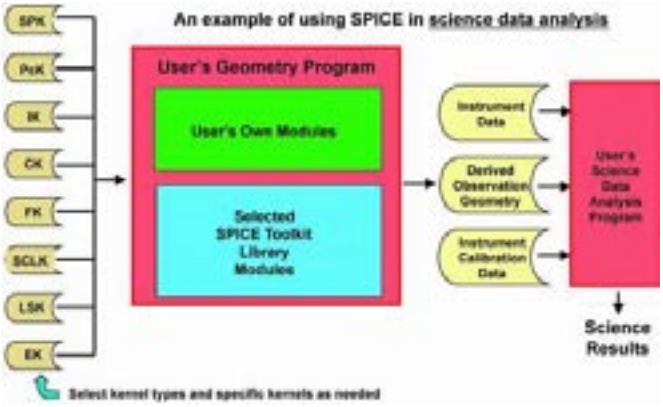
"SPICE" comes from Spacecraft, Planet, Instrument, C-matrix, and Events. This system also includes a collection of software collectively known as the SPICE Toolkit. The principle component of the SPICE Toolkit is a subroutine library. A SPICE customer typically includes a few modules from this library in her/his own application program to access ancillary data from one or more SPICE data files (also known as SPICE "kernels") and to then compute derived geometric quantities of interest such as latitude and longitude, altitude, and lighting angles. The SPICE Toolkit is available for most popular computing environments, and comes ready-built, well tested, and highly documented. The SPICE library is available in ANSI FORTRAN 77 (SPICELIB), ANSI C (CSPICE) and as interfaces for Interactive Data Language (Icy).

Starting with Magellan, SPICE has or will be used on almost every NASA planetary mission (Lunar Prospector was the one exception). It is also used as an alternative (not a project commitment) on ESA's Mars Express mission with implementation on SMART-1, Rosetta and probably Venus Express in progress. At JAXA implementation of SPICE for Muses-C and SELENE is also being implemented by scientists on a best efforts basis. SPICE has also been used on some non-planetary missions such as Genesis, and is used by astronomers at some observatories.



The Solar System from a SPICE Perspective.

SPICE is used extensively by flight project instrument teams to both plan their observations and to help analyze and document their archival data products. Scientists worldwide can obtain SPICE data–and the extensive SPICE Toolkit software that is used to derive quantities from those data–to help further analyze or re-interpret archived space science data. Scientists and engineers may use SPICE to help design a new mission, or to evaluate the chances for obtaining desirable observations from an existing trajectory design.



Using SPICE: use of SPICE data files ("kernels") and SPICE subroutines in a typical science data analysis scenario.

All SPICE data and SPICE Toolkit software are freely distributed worldwide from the NAIF node of NASA's Planetary Data System. A collection of SPICE tutorial packages provides–in viewgraph format–key design and usage descriptions. These are all available at NAIF's new website: http://naif.jpl.nassa.gov.

Some "open book" programming lessons to help get new users well introduced to using SPICE are also available from the NAIF server at: ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Lessons/.

Learning to use SPICE is not a trivial endeavor, but those needing access to the kinds of information available within SPICE will find substantial capability under their control as they learn SPICE interfaces bit-by-bit. The extensive documentation and tutorials provided help newcomers get going with SPICE, as does the consultation offered by the NAIF Team. NAIF's commitments to portability of code and data, and to never changing or removing SPICE library modules, means customers can concentrate on their own work.

Persons interested in keeping up to date with SPICE development and NAIF plans may sign up for SPICE news at: http://naif.jpl.nasa.gov/mailman/listinfo/spice_announce.

Persons interested in discussing SPICE issues with colleagues may sign up with the SPICE Discussion system at: http://naif.jpl.nasa.gov/mailman/listinfo/spice_discussion.

Development of the core SPICE system is carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. Colleagues at other space institutions, most especially the Johns Hopkins Applied Physics Lab (APL), the European Space Research and Technology Centre (ESTEC) and the Japan Aerospace Exploration Agency (JAXA) provide local adaptation, deployment and operation of SPICE for selected missions.

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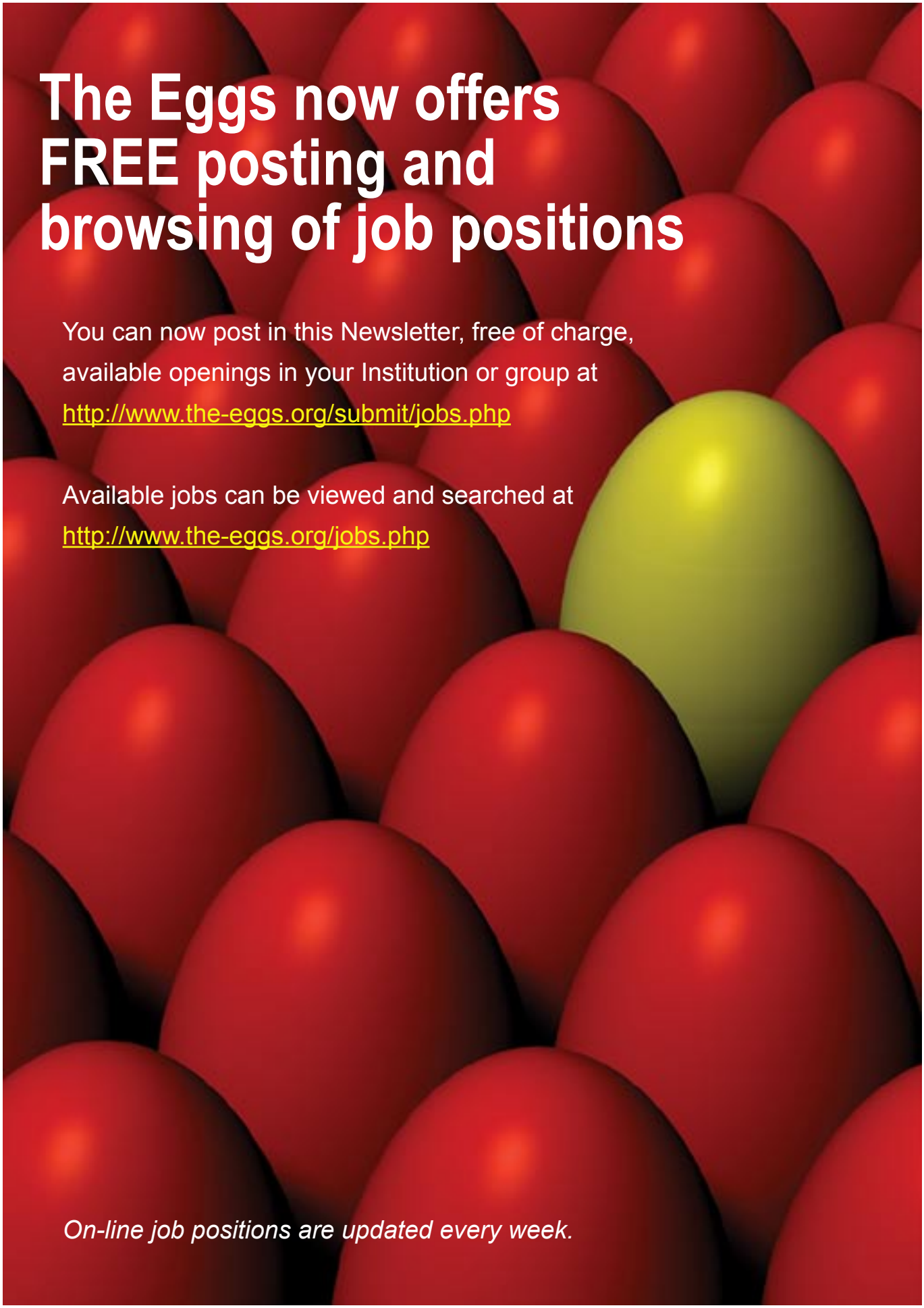

The Eggs now offers FREE posting and browsing of job positions

You can now post in this Newsletter, free of charge, available openings in your Institution or group at http://www.the-eggs.org/submit/jobs.php

Available jobs can be viewed and searched at http://www.the-eggs.org/jobs.php

On-line job positions are updated every week.

Earth science/astronomy teachers: One stop at the web

Lots of ideas for experiments, presentations etc. to students aged 3 to 19 years.

Make a visit to http://www.scienceonestop.com/.

This is a very useful site, with a lots of ideas for experiments, presentations etc. to students aged 3 to 19 years. First click on the age group, then chose your subject. Two of the subjects (perhaps more) are of interest to the readers of this Newsletter; these are the Earth Science and Astronomy subjects. Then, you land on a list of works, organisations, exhibitions and teaching ideas. We have checked some of the material and it can be very useful, some of it perhaps also to introductory University classes (although it takes some passion to find exactly what fits your needs).

A basic understanding of the atmosphere and the climate for non-specialists

Leben im Treibhaus-Unser Klimasystem und was wir daraus machen

Peter Fabian
Published by: Springer-Verlag Berlin Heidelberg New York
ISBN: 3-540-43361-9
YEAR : 2002
EDITION : 1st
#PAGES : 258
PRICE : 24.95 €

Peter Fabian's new book 'Leben im Treibhaus' (Living in the Greenhouse) by Springer presents an introduction to the atmosphere of the earth, the climate and the processes that control it, as well as a number of other themes that influence the atmosphere of the earth and are of current concern.

The book, according to the author, is addressed to all geoscientists, biologists and environmental scientists, landscape and urban planners, as well as interested individuals, politicians and NGO's who wish to understand the complex interactions of the earth's climate system. The author succeeds largely in his goal of addressing this diverse audience and offering it an understanding of basic atmospheric processes.

The book is divided into seven chapters:

1. The evolution of the earth's atmosphere
2. The earth's greenhouse
3. The role of the biosphere in the climate system
4. Natural climatic variations-the changing climatic history of the earth
5. Environmental changes as a consequence of anthropogenic perturbations
6. International treaties for the protection of the environment
7. The future evolution

The chapters are coherently arranged; but can also be read largely independently of the rest of the book, which is of great value for the non-specialist reader.

The first chapter offers in 17 pages a basic introduction to the evolution of the atmosphere. Chapter 2, with more than 50 pages, is one of the two 'core' chapters of the book, presenting the basis for addressing the issue that is set in the book's title. It offers a basic introduction to atmospheric structure, the ozone layer and its chemistry, dynamical processes in the atmosphere, the atmospheric radiation balance, the water cycle, El Nino, and the earth's climatic zones.

The third chapter discusses the role of the forests in the regulation of climate, the carbon, nitrogen and sulfur cycle, and the atmospheric oxidation potential (I found the latter somewhat out of place in this particular chapter; it would probably fit more into place in chapter 5). Chapter 4 discusses methods for reconstructing past climates, climate variations in the last 1000 years and the glacial/interglacial cycling of the climate.

Chapter 5 is the other 'core' chapter of the book. It discusses photochemical smog, biomass burning, acid rain, impacts of air travel, stratospheric ozone depletion, and, in its last 17 pages, the present global climate changes (due to the rising concentrations of greenhouse gases in the atmosphere) and their consequences.

Chapter 6 presents very briefly (in about 9 pages) the Montreal and Kyoto Protocols. The chapter could benefit from the inclusion of some other international conventions, since relevant issues are discussed in the book (e.g. the Convention on the Long-Range Transport of Air Pollutants, or CLRTAP).

The last chapter is the epilogue of the book, presenting briefly some considerations about the future of the climate.

The overall quality of the printing and the text layout are of impressive quality. The text contains numerous black and white figures, diagrams and other graphic material, which are also of superb quality. They succeed in clearly conveying to the non-specialist reader their message. 14 colour plates, annexed at the end of the text, complement these.

One of the great advantages of the book is the style of writing, which is typical of Peter Fabian's non-specialist texts: Clear, easily understandable by the non-specialist, and yet scholarly and accurate.

A few parts of the book (chapter 1 and parts of chapter 5) are the evolution of parts of the second edition of an earlier (also in German) book of Peter Fabian, 'Atmosphaere und Umwelt' – Atmosphere and Environment (Springer, 1987). Starting my Ph.D. in Germany back in October 1987, Peter Fabian's book 'Atmosphaere und Umwelt' was my first German text, which I managed to read from beginning to end, dictionary always at hand to complement my then poor vocabulary. In retrospect, I can say that I greatly profited from that book, regarding understanding of basic concepts in atmospheric chemistry (which was largely the focus of that book as well as of my Ph.D.). This focus is largely expanded in 'Leben im Treibhaus', and I am sure the book will be of great value to undergraduate students in earth sciences, beginning Ph.D.s in atmospheric sciences, and non-specialists, who wish to expand their understanding in atmospheric processes without going very much into the detail of a more specialized text (provided, of course, that they speak German). As mentioned above, both the writing style and the figures aid this title greatly in addressing the non-specialist effectively.

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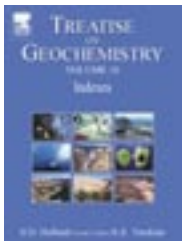
Volumes 8 and 9 for 80 Euro each

Treatise on Geochemistry gets cheaper



Published by: Elsevier
ISBN: 0-08-043751-6
YEAR : 2005
EDITION : 1st

It appears that Elsevier has started to respond to criticism for the somewhat absurd price policy of the 10-volume set of Treatise on Geochemistry (see issue 8 of The Eggs).

The following two volumes will appear mid-2005 in paperback and can be purchased separately for 80 Euros each:

-Treatise on Geochemistry, Volume 8, Biogeochemistry, William H. Schlesinger (Ed.), http://www.elsevier.com/inca/705272

-Treatise on Geochemistry, Volume 9, Environmental Geochemistry, Barbara Sherwood Lollar (Ed.), http://www.elsevier.com/inca/705270

Reviews of these two volumes have appeared at our previous issue (see http://www.the-eggs.org/bookreviews.php?id=26 for volume 8 and http://www.the-eggs.org/bookreviews.php?id=29 for volume 9). Till 1 June 2005 there is an introductory offer: 1 volume for 67 Euros, or volumes 8+9 for 120 Euros. We hope that the other volumes will soon also follow in paperback with similarly reasonable prices as volumes 8 and 9.

Ed.

The following books, and the information about the book provided below, have been received from the publisher.

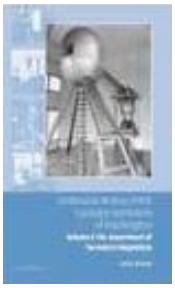
An Introduction to the Environmental Physics of Soil, Water and Watersheds

Authors: Calvin W. Rose
Publisher: Cambridge University Press
ISBN: 0521536790
YEAR : 2004
EDITION : 1st
PAGES : 439
PRICE : 43.50 €

This introductory textbook describes the nature of the Earth's environment and its physical processes so as to highlight environmental concerns arising from human use and misuse of soil and water resources. The author provides a thorough introduction to the basic issues regarding the sustainable, productive use of land resources that is vital in maintaining healthy rivers and good groundwater qualities. He develops a quantitative approach to studying these growing environmental concerns in a way that does not require prior knowledge of the physical sciences or calculus. The straightforward writing style, lack of prerequisite knowledge and copious illustrations make this textbook suitable for introductory university courses, as well as being a useful primer for research and management staff in environmental and resources management organisations. Each chapter ends with a set of student exercises for which solutions are available from solutions@cambridge.org.

paperback

Centennial History of the Carnegie Institution of Washington



Authors: Louis Brown
Publisher: Cambridge University Press
ISBN: 0521830796
YEAR : 2004
EDITION : 1st
PAGES : 314
PRICE : 86.20 €

In 1902, Andrew Carnegie founded the Carnegie Institution of Washington, to support innovative science research. Since its creation two years later, the Department of Terrestrial Magnetism has undertaken a broad range of research from terrestrial magnetism, ionospheric physics and geochemistry to biophysics, radio astronomy and planetary science. This second volume in a series of five histories of the Carnegie Institution describes the people and events, the challenges and successes that the Department has witnessed over the last century. Contemporary photographs illustrate some of the remarkable expeditions and instruments developed in pursuit of scientific understanding, from sailing ships to nuclear particle accelerators and radio telescopes to mass spectrometers. These photographs show an evolution of scientific progress through the century, often done under trying, even exciting circumstances.

Volume 2: The Department of Terrestrial Magnetism hardback

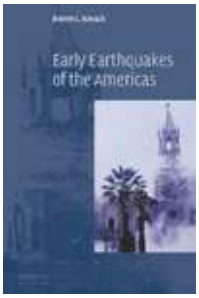
Centennial History of the Carnegie Institution of Washington-3: The Geophysical Laboratory

Authors: Hatten S. Yoder
Publisher: Cambridge University Press
ISBN: 052183080X
YEAR : 2004
EDITION : 1st
PAGES : 284
PRICE : 86.20 €

For over a century, the Geophysical Laboratory of the Carnegie Institution of Washington has witnessed exciting discoveries and ingenious research, made possible by the scientific freedom granted to members of the department. For the most part, this research has involved laboratory experimentation on the physics and chemistry of rock-forming minerals at high temperature and pressure. This third volume in a series of five histories of the Carnegie Institution documents the contribution made by the members of the Geophysical Laboratory to our understanding of the Earth, from mineral formation deep below the surface, to the search for the origins of life, and out into space to study the chemical evolution of the interstellar medium. Field work has taken researchers from active volcanoes to ships collecting ocean sediments, and geological mapping expeditions around the world. Contemporary photographs throughout illustrate the evolution of the department and its research.

hardback

Early Earthquakes of the Americas

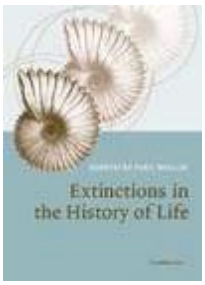


Authors: Robert L. Kovach
Publisher: Cambridge University Press
ISBN: 0521824893
YEAR : 2004
EDITION : 1st
PAGES : 268
PRICE : 87.00 €

There is emerging interest amongst researchers from various subject areas in understanding the interplay of earthquake and volcanic occurrences, archaeology and history. This discipline has become known as archeoseismology. Ancient earthquakes often leave their mark in the myths, legends, and literary accounts of ancient peoples, the stratigraphy of their historical sites, and the structural integrity of their constructions. Such information leads to a better understanding of the irregularities in the time-space patterns of earthquake and volcanic occurrences and whether they could have been a factor contributing to some of the enigmatic catastrophes in ancient times. This book focuses on the historical earthquakes of North and South America, and describes the effects those earthquakes have had with illustrated examples of recent structural damage at archaeological sites. It is written at a level that will appeal to students and researchers in the fields of earth science, archaeology, and history.

hardback

Extinctions in the History of Life

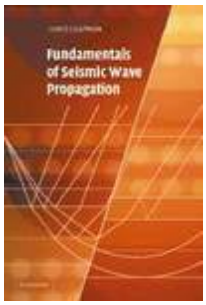


Authors: Paul Taylor (ed.)
Publisher: Cambridge University Press
ISBN: 0521842247
YEAR : 2004
EDITION : 1st
PAGES : 204
PRICE : 57.00 €

Extinction is the ultimate fate of all biological species - over 99% of the species that have ever inhabited the Earth are now extinct. The long fossil record of life provides scientists with crucial information about when species became extinct, which species were most vulnerable to extinction, and what processes may have brought about extinctions in the geological past. Key aspects of extinctions in the history of life are here reviewed by six leading palaeontologists, providing a source text for geology and biology undergraduates as well as more advanced scholars. Topical issues such as the causes of mass extinctions and how animal and plant life has recovered from these cataclysmic events that have shaped biological evolution are dealt with. This helps us to view the current biodiversity crisis in a broader context, and shows how large-scale extinctions have had profound and long-lasting effects on the Earth's biosphere.

hardback

Fundamentals of Seismic Wave Propagation

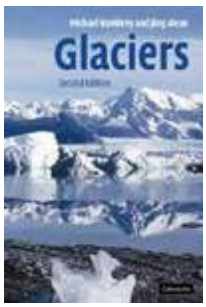


Authors: Chris Chapman
Publisher: Cambridge University Press
ISBN: 052181538X
YEAR : 2004
EDITION : 1st
PAGES : 608
PRICE : 93.00 €

Fundamentals of Seismic Wave Propagation presents a comprehensive introduction to the propagation of high-frequency body-waves in elastodynamics. The theory of seismic wave propagation in acoustic, elastic and anisotropic media is developed to allow seismic waves to be modelled in complex, realistic three-dimensional Earth models. This book provides a consistent and thorough development of modelling methods widely used in elastic wave propagation ranging from the whole Earth, through regional and crustal seismology, exploration seismics to borehole seismics, sonics and ultrasonics. Particular emphasis is placed on developing a consistent notation and approach throughout, which highlights similarities and allows more complicated methods and extensions to be developed without difficulty. This book is intended as a text for graduate courses in theoretical seismology, and as a reference for all academic and industrial seismologists using numerical modelling methods. Exercises and suggestions for further reading are included in each chapter.

hardback

Glaciers

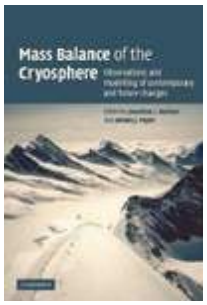


Authors: Michael Hambrey, Juerg Alean (eds.)
Publisher: Cmbridge Univesrity Press
ISBN: 0521828082
YEAR : 2004
EDITION : 2nd
PAGES : 394
PRICE : 50.00 €

Glaciers are among the most beautiful natural wonders on Earth, but for most of us the least known and understood. This book describes how glaciers grow and decay, how they move, and how they influence human civilisation. Today covering a tenth of the Earth's surface, glacier ice has shaped the landscape over millions of years by scouring away rocks, transporting and depositing debris far from its source. Glacier meltwater drives turbines and irrigates deserts, yields mineral-rich soils, and has left us a wealth of valuable sand and gravel. However, glaciers also threaten human property and life. Our future is indirectly bound up with the fate of glaciers and their influence on global climate and sea level. A lively running text develops these themes and is supported by over 200 stunning photographs, taking us from the High-Arctic through North America, Europe, Asia, Africa, New Zealand and South America to the Antarctic.

hardback

Mass Balance of the Cryosphere

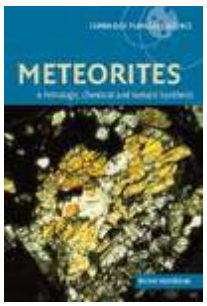


Authors: Jonathan L. Bamber, Antony J. Payne (eds)
Publisher: Cambridge University Press
ISBN: 0521808952
YEAR : 2004
EDITION : 1st
PAGES : 644
PRICE : 123.20 €

The cryosphere comprises all the frozen water and soil on the surface of the Earth. Mass Balance of the Cryosphere focuses on two key components of this environment: land ice (in the form of ice sheets, caps and glaciers) and sea ice. These components have been identified as important indicators of both short and long term climate change. Early chapters cover the theory behind field-based and satellite observations, and modelling of mass balance, providing a thorough grounding in all the concepts and issues presented later in the book. Later chapters review our current understanding of the present and predicted future mass balance of the cryosphere. This is an important reference for all scientists working in the fields of climate change, environmental sciences and glaciology. It is written by leading authors in the field, and is fully integrated to provide a coherent, cross-referenced and consistent exposition on the subject.

hardback

Meteorites: A Petrologic, Chemical and Isotopic Synthesis

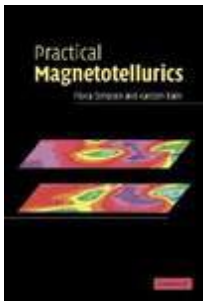


Authors: Robert Hutchison
Publisher: Cambridge University Press
ISBN: 0521470102
YEAR : 2004
EDITION : 1st
PAGES : 505
PRICE : 167.40 €

Meteorite research is fundamental to our understanding of the origin and early history of the Solar System. Some meteorites were produced by melting on asteroids, a few are from the Moon and others are martian. Their study yields a chronology of the first 100 million years of Solar System history, and provides evidence that our Sun went through a highly radiative, T Tauri stage. This book considers the mechanism and timing of core formation and basaltic volcanism on asteroids, and the effects of heating water-rich bodies. Results from meteorite research are placed in a galactic setting, and a theory is proposed for the origin of the planets of our Solar System. This advanced yet succinct introduction provides a classification of meteorites, and discusses their ages and origin. It will be valuable to graduate students and scientists in astrophysics, space research, cosmochemistry, geochemistry, isotope geology, and earth and planetary sciences.

hardback

Practical Magnetotellurics



Authors: Fiona Simpson
Publisher: Cambrgidge University Press
ISBN: 0521817277
YEAR : 2005
EDITION : 1st
PAGES : 270
PRICE : 58.00 €

The magnetotelluric (MT) method, a technique for probing the electrical conductivity structure of the Earth, is increasingly used both in applied geophysics and in basic research. This is the first book on the subject to go into detail on practical aspects of applying the MT technique. Beginning with the basic principles of electromagnetic induction in the Earth, this introduction to magnetotellurics aims to guide students and researchers in geophysics and other areas of earth science through the practical aspects of the MT method: from planning a field campaign, through data processing and modelling, to tectonic and geodynamic interpretation. The book will be of use to graduate-level students and researchers who are embarking on a research project involving MT; to lecturers preparing courses on MT; and to geoscientists involved in multi-disciplinary research projects who wish to incorporate MT results in their interpretations.

hardback

Time Series Analysis and Inverse Theory for Geophysicists

Authors: David Gubbins
Publisher: Cambridge University Press
ISBN: 0521819651
YEAR : 2004
EDITION : 1st
PAGES : 255
PRICE : 40.50 €

This unique textbook provides the foundation for understanding and applying techniques commonly used in geophysics to process and interpret modern digital data. The geophysicist's toolkit contains a range of techniques which may be divided into two main groups: processing, which concerns time series analysis and is used to separate the signal of interest from background noise; and inversion, which involves generating some map or physical model from the data. These two groups of techniques are normally taught separately, but are here presented together as parts I and II of the book. Part III describes some real applications and includes case studies in seismology, geomagnetism, and gravity. This textbook gives students and practitioners the theoretical background and practical experience, through case studies, computer examples and exercises, to understand and apply new processing methods to modern geophysical datasets.

paperback

Atmospheric Convection: Research and Operational Forecasting Aspects (Course)

18/07/2005 - 22/07/2005 - Udine - ITALY

Course Goals

The course has two main goals:

a) review the theory of tropospheric convection and the physics of related meteorological phenomena

b) teach and share the experience on local severe weather operational forecasts

Course Topics

The topics of the course will include the following themes:

* Atmospheric Thermodynamics
* Convective Severe Weather phenomena classification
* Environments prone to severe weather onset and development
* Sea-air interactions and their influence on atmospheric convection
* Orographic effects on Convective Severe Weather phenomena
* Numerical simulations and case studies of Convective Severe Weather phenomena
* Convective Severe Weather phenomena operational forecasts
* Verification of Severe Weather forecasts

Related Activities

During the course there will be the following additional activities:

* Discussions about the possibility to activate collaborations among the people participating to the course, or the institutes they come from, i.e. joint projects and European projects focused on local severe weather research and operational forecast aspects.
* Participants are invited to present their current research and/or forecasting activities.
* Visit at the OSMER, the Regional Meteorological Observatory of ARPA FVG.

Target People

Physics PhD students, post-Doctoral researchers, researchers, meteorologists, forecasters.

Lecturers

* H. Brooks - Mesoscale Applications Group NOAA/National Severe Storms Laboratory, Norman, Oklahoma, USA
* D. Giaiotti - ARPA - Osservatorio Meteorologico Regionale (OSMER), Udine, Italy
* P. Markowski - Pennsylvania State University, University Park, Pennsylvania, USA
* R. Mosetti - Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Trieste, Italy
* R. Steinacker - University of Vienna, AUSTRIA
* F. Stel - ARPA - Osservatorio Meteorologico Regionale (OSMER), Udine, Italy

Organizer:

CISM, International Centre For Mechanical Sciences, coordinated by D.B. Giaiotti (ARPA-OSMER Udine, Italy), F. Stel (ARPA-OSMER Udine, Italy) and R. Steinacker (University of Vienna, Austria)

http://www.fisica.uniud.it/~osmer/CISM_course_2005/cism_main.html

Cargese International School - UPPER TROPOSPHERE AND LOWER STRATOSPHERE (Course)

03/10/2005 - 15/10/2005 - Cargese, Corsica (France)

MAIN TOPICS AND COURSES:

- Observations
- Satellite instruments, in-situ and remote measurements of water vapour and chemical compounds, clouds in the UT/LS, data evaluation.
- Data assimilation
- Theory, assimilation of satellite data, numerical weather prediction, assimilation in global models of atmospheric chemistry
- Modelling and understanding
- Dynamics and global circulation, transport and mixing, ozone chemistry, cirrus clouds, water budget in the UT/LS, tropical dehydration

CONFIRMED SPEAKERS

F. Bouttier (MeteoFrance) , S. Buehler (Univ. Bremen), B. Carli (CNR/IFAC), D. Fonteyn (BIRA/IASB), A. Gettelman (NCAR), K. Gierens (DLR), J. Joiner (NASA-GSFC), H. Kelder(KNMI), W. Lahoz (Univ. Reading), B. Legras (LMD/IPSL), P. Levelt (KNMI), L. Moyer (Harvard Univ.), A. O'Neill (Univ. Reading), R. Swinbank (Met. Office), O. Talagrand (LMD/IPSL), G. Vaughan (Univ. Aberystwyth), H. Wernli (Univ. Mainz)

Organizer:

S. Buelher (Univ. Bremen), W. Lahoz (Univ. Reading), B. Legras (ENS, Paris), L. Moyer (Harvard Univ.)

http://www.cost723.org/school

1st Intn'l Conference: Multifunctionality of Landscapes-Analysis, Evaluation and Decision Support (Meeting)

18/05/2005 - 19/05/2005 - Giessen, Germany

The First International Conference on 'Multifunctionality of Landscapes: Analysis, Evaluation, and Decision Support', will be held on May 18-19, 2005 at the University of Giessen, Germany. This meeting will provide a multidisciplinary platform for environmental scientists and modellers as well as administra-

tion and management professionals to discuss the latest developments in monitoring, modelling and evaluating landscape services.

The conference is organized by the Collaborative Research Centre (SFB) 299 and sponsored by the Deutsche Forschungsgemeinschaft (German Science Foundation).

The deadline for submitting abstracts is February 15, 2005.

Contact: Dr. Martin Bach,
martin.bach@agrar.uni-giessen.de

Organizer:
Collaborative Research Centre (SFB) 299
http://www.sfb299.de/conference/

5th Annual Meeting of the European Meteorological Society (Meeting)

12/09/2005 - 16/09/2005 - Utrecht, The Netherlands

The meeting will be held jointly with the 7th European Conference on Applications of Meteorology (ECAM). It is an open scientific conference with symposia, lecture and poster sessions as well as a scientific exhibition.

You are herewith invited to participate in the conference and submit abstracts.

Programme Overview:

AM - 7th European Conference on Applications of Meteorology (ECAM)
AW - Atmosphere and the water cycle - a real-time look
CL - Climatology
CO - Computing in Atmospheric Sciences
IO - Instruments and methods of observations
IP - Information provision and education
VO - Open VOLTAIRE Conference

More information can be obtained from the conference web page or the EMS Secretariat, ems.sec@met.fu-berlin.de.

Deadline for Call for Contributions (ECAM): 31 January 2005

Deadline for Receipt of Abstracts (EMS): 10 May 2005.

Organizer:
European Meteorological Society
www.copernicus.org/ems/2005

Polar Regions and Quaternary Climate (Meeting)

24/09/2005 - 29/09/2005 - Acquafredda di Maratea (near Naples), Italy

The European Science Foundation is organising next September a conference on:

Polar Regions and Quaternary Climate

EuroConference toward an Integrative View of Climate in Antarctica and Circum-Antarctic Regions

Chair: Jérôme Chappellaz (LGGE CNRS-UJF, Grenoble, F)

Deadline for applications is the 20th of June 2005.

One of the big unknowns regarding the climate dynamics in the course of glacial-interglacial cycles and of abrupt events is the role of the Antarctic and the Southern ocean.

The European Project for Ice Coring in Antarctica (EPICA) has now provided the climate community with two new ice cores covering more than 200,000 years at Dronning Maud Land (facing the south Atlantic) and about 900,000 years at Dome C (Antarctic plateau). The new data can now be presented and synthesized; but it will be of much higher value if it is viewed in context with other climate proxy records, with current observations and with climate and ice sheet models.

The main goal of the conference will thus be the comparison of the two EPICA ice core records with records from other climatic archives in Antarctica and circum-Antarctic regions. In addition, reviews of present-day studies in Antarctica, interactions with climate and ice sheet modelling will stimulate discussions about the most urgent open questions regarding climate and environmental changes in and around Antarctica, leading to a joint strategy for future ice core investigations.

The conference will include six sessions:

(1) Antarctic climate : an ice-core synthesis,

(2) The circum-Antarctic regions and their link with Antarctica,

(3) Atmospheric physics and chemistry in south polar regions: what can we learn from ice-core chemistry and atmospheric modelling?,

(4) Antarctic ice sheet dynamic and its impact on climate,

(5) Dating: what progresses on the Achille heel of temporal archives?,

(6) Present-day observations in Antarctica: hints for future ice-core investigations.

This conference is part of the 2005 ESF Research Conferences Scheme. More info about the conference can be found at the conference web site.

Organizer:
ESF
http://www.esf.org/conferences/lc05115

Magnetospheres of the Outer Planets (Meeting)

07/08/2005 - 12/08/2005 - University of Leicester, UK

FIRST CALL FOR ABSTRACTS / REGISTRATION FOR MOP 2005

The Magnetospheres of the Outer Planets conference is to be hosted by the University of Leicester between the 7th-12th August, 2005. At the conference website you will find instructions for submitting your abstract online (deadline 1st April 2005), and also for registration and payment of fees (deadline 2nd May 2005).

We welcome contributed presentations on any topics relating to the magnetospheres of the outer planets. The main purpose of the conference is to better our understanding of the physical processes which control the magnetospheres of the

four giant planets, often with reference to the Earth's magnetosphere, and perhaps to other astrophysical objects.

We expect that continuing deliberations on the more mature results at Jupiter in the post-Galileo era will play an important rôle at this meeting. In addition, with the arrival of the Cassini-Huygens mission at Saturn, we look forward to discussions based on this new data, as well as comparisons with data from the Voyager and Pioneer spacecraft.

Suggested topics include:

auroral processes

magnetospheric dynamics

magnetosphere-ionosphere-atmosphere coupling

solar wind interaction rings and moons, and their interactions with magnetospheres

sources of magnetospheric plasmas

plasma micro-physics

atmospheric modelling

theoretical modelling

internal field modelling

comparative magnetospheres

future missions

We look forward to welcoming you to Leicester this summer.

Best wishes, Emma Bunce, Stan Cowley, and Jon Nichols.

Organizer:

Dr Emma Bunce Prof Stan Cowley Dr Jon Nichols of the Radio and Space Plasma Physics group, Department of Physics and Astronomy, University of Leicester

http://ion.le.ac.uk/mop

6th International Conference on Urban Climate (ICUC6) (Meeting)

12/06/2006 - 16/06/2006 - Göteborg, Sweden

The International Association for Urban Climate (IAUC, www.urban-climate.org) and Göteborg University, in co-operation with the World Meteorological Organization invite you to the Sixth International Conference on Urban Climate (ICUC-6).

The deadline for submission of abstracts is 10th November, 2005. Abstracts will be submitted via the web.

We welcome papers seeking to understand the nature of the atmosphere in urban environments or to the application of such knowledge to the better design and operation of settlements. Scales of interest range from individual built elements (roofs, walls, roads) through whole buildings, streets, factories, parks, clusters of buildings and neighborhoods, to whole cities and urban regions and their impacts on weather and climate at scales up to those of global change. The focus can be original research into the physical, biological and chemical atmospheric processes operating in built areas; the weather, climates and surface hydrology experienced in built areas; the design and testing of scale, statistical and numerical models of urban climates; or reports on the application of climatic understanding in architectural design or urban planning. Papers may relate to new concepts, methods, instruments, observations, applications, forecasting operations, scenario testing, projections of future climates, etc. Sessions that focus on major field studies or other projects or topics may be proposed.

Appropriate topics include, but are not restricted to: Airflow over cities, including turbulence, urban roughness and drag, changes of wind speed and direction, urban circulation systems, and wind engineering; Anthropogenic Heat; Building climates (interior and exterior) and the climatic performance of built features; Carbon exchanges in urban areas; Cities and global change; Climate-sensitive urban design and planning; Climates of paved surfaces such as roads, streets, highways, runways and parking lots; Climatic performance of urban trees, lawns, gardens, parks, green roofs, irrigation, rivers, lakes and reservoirs; Emergency response planning; Exchanges of heat, mass and momentum between the urban surface and its boundary layer; Forecasting urban weather, comfort, hazards, and air quality; Interactions between urban climate and the emission, dispersion, transport, transformation and removal of air pollutants; Models, and their evaluation, of the urban atmosphere at all scales and urban surface-atmosphere exchanges; Remote sensing of cities and urban climate; Road climatology in cities, including influence from traffic and other city related-objects; Short- and long-wave radiation in polluted air and urban visibility; Topoclimatology of cities, including the effects of coasts, valleys and other landforms; Urban biometeorology relevant to the functioning of plants, wildlife and humans; Urban climates in high latitude settings; Urban heat islands, their nature, genesis and mitigation; and Urban impacts on surface moisture, dew, evaporation, humidity, fog, cloud and precipitation.

For further information, please see http://www.urban-climate.org (links: ICUC, then ICUC6) or email Prof. Sven Lindqvist, chair of the local organizing committee (sven@gvc.gu.se) or Prof. Sue Grimmond (grimmon@indiana.edu), President IAUC. The official language of ICUC-6 is English.

Organizer:

International Association for Urban Climate

http://www.urban-climate.org

CALL FOR PAPERS: IUGG 2005 Session GAIV.01 (Meeting)

18/07/2005 - 29/07/2005 - Toulouse, France

Call for Abstracts for IUGG 2005 General Assembly Session GAIV.01 on "The Sun: its Interior, Atmosphere and Wind" IUGG 2005 General Assembly In Toulouse, France 18-29 July 2005

Continuous ground- and space-based observations of the Sun have provided detailed information on the solar interior, extended corona and solar wind. These observations offer a unique capability to investigate the physical processes responsible for the dynamic nature of the Sun. The combination of these observations with realistic modeling is reshaping our understanding of the solar magnetic field and solar activity, and the mechanisms by which the corona is heated and the solar wind is accelerated.

The symposium invites contributions covering observations, theory and modeling of the different aspects of the Sun, including its interior, dynamo, magnetic field, atmosphere and wind. This broad scope is aimed at stimulating exchange and

promoting discussion on physically connected phenomena which are seldom discussed in a single meeting.

Convener: Mari Paz Miralles, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., MS-50, Cambridge, MA 02138, USA, tel: 1-617-496-7925, fax: 1-617-495-7455, mmiralles@cfa.harvad.edu

Co-conveners: Jorge Sanchez Almeida, Instituto de Astrofisica de Canarias, E-38200 La Laguna, Tenerife, Spain, tel: 34-922-605-200, fax: 34-922-605-210, jos@iac.es

K. Shibata, Kwasan Observatory, Kyoto University, Yamashina, Kyoto 607-8471, Japan, tel: 81-75-581-1235, fax: 81-75-593-9617, shibata@kwasan.kyoto-u.ac.jp

The Preliminary Program indicates that IAGA session GAIV.01 will be held on July 27-29, 2005. Since this session covers a very broad range of topics, we would appreciate hearing from those interested in attending. Please send either a title and/or abstract to the convener, so that we can plan the sessions and invited contributions based on interest and anticipated attendance.

Important dates:

Deadline for paper abstracts submission: 13 March 2005

Deadline for electronic abstracts: 27 March 2005

For abstract submission, registration, and more information see the conference web site.

Organizer:

The international Association of Geomagnetism and Aeronomy (IAGA), International Union of Geodesy and Geophysics (IUGG)

http://www.iugg.org/IAGA/index.htm

Asia Oceania Geosciences Society's 2nd Annual Meeting (Meeting)

20/06/2005 - 24/06/2005 - Singapore

AOGS is pleased to announce AOGS 2005, the Asia Oceania Geosciences Society's 2nd Annual Meeting, taking place in Singapore, 20 to 24 June 2005.

This follows its highly successful inaugural run which attracted high profile projects and scientists of national and international stature. Arising from this, new challenges have come about in creating international exchange, research programs abroad, educational outreach, forging many special ties and relationships that transcend geographical, political and racial boundaries.

AOGS 2005 provides an exciting and continued forum for mind sharing, debate and professional networking. Just as the AGU and EGU conferences and exhibitions serve respectively the North American and European international geosciences communities, AOGS 2005 will serve that of Asia to Oceania - stretching from Kashmir to Wellington.

AOGS will be the catalyst to bring together Asian and international scientists from Europe and the Americas who seek to develop partnership with them and to share their accumulated knowledge and experience.

Organizer:

Asia Oceania Geosciences Society

http://www.asiaoceania-conference.org/

Multifunctionality of Landscapes- Analysis, Evaluation, and Decision Support (Meeting)

18/05/2005 - 19/05/2005 - University of Giessen, Germany

The First International Conference on "Multifunctionality of Landscapes – Analysis, Evaluation, and Decision Support" will provide a multidisciplinary platform for environmental scientists and modellers as well as administration and management professionals to discuss the latest developments in monitoring, modelling and evaluating landscape services. The conference is organized by the Collaborative Research Centre (SFB) 299 and sponsored by the Deutsche Forschungsgemeinschaft (German Science Foundation).

Organizer:

Collaborative Research Centre (SFB) 299, University of Giessen, Germany, sponsored by the Deutsche Forschungsgemeinschaft (German Science Foundation)

http://www.sfb299.de/conference

IAGA 2005 (Meeting)

18/07/2005 - 29/07/2005 - Toulouse, France

The scientific programme of the assembly includes Association Lectures, Joint IAGA and ICMA Symposia, IAGA Division and Interdivisional Commission Symposia, IAGA Business Meetings and Working Group Meetings. The programme with its 61 symposia covers all the scientific fields of the two organisations: electrical and magnetic properties of the Earth's core, mantle and crust, the middle and upper atmosphere, the ionosphere and magnetosphere, the Sun, the solar wind, the planets and interplanetary bodies.

Deadline for pre-registration at the reduced rate: 1st May 2005.

Organizer:

IAGA

http://www.iugg.org/IAGA