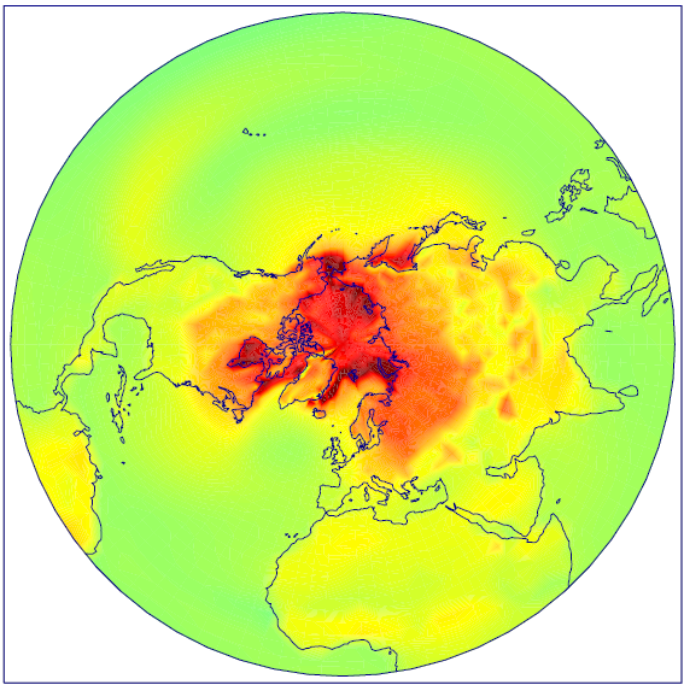
IOP Institute of Physics
Environmental Physics Group

NEWSLETTER October 2009



Predicted Northern-Hemisphere temperature rise due to the doubling of CO_2

A simulation of climate change on a regional scale
by Sarah Keeley, Department of Meteorology, University of Reading.

Contents

Hello and welcome to the October 2009 newsletter!

We hope you had a great summer and for many of you, a fulfilling start to the new University year.

Firstly we have said goodbye to Karen Aplin as editor of this newsletter (although she remains a keen member of the committee). The committee would like to say a big thank you to Karen for her hard work in compiling the newsletter over the past six years. Thanks also to Paul Williams who also stepped down as web editor when he became Secretary of the Group in the Spring. The role of newsletter editor has now been merged with web editor, and as Communication Editors, we have high standards to live up to!

Environmental physics issues have been much in the news recently and will continue to be so in the forthcoming months, particularly the COP Climate Change Conference in Copenhagen in December. After an excellent two issues of Physics World on geoengineering and energy problems (in September and October), we would like to know your views on the climate and energy problem (see page 13) - please write or email us (details on the end of the newsletter) and we hope to publish a selection next time.

There are plenty of other ways to get involved in the group, from entering the essay competition (see page 4) to presenting at the Group's Environmental Physics Day on 26th May 2010, when we are celebrating our 20th anniversary (see separate flyer). We hope you can join us!

Sally Brown and Hugh Mortimer

EPG News

The 5th Annual Environmental Physics Group Essay Competition.

Closing date – 31st December 2009

Entries are now open for this year's EPG Essay Competition, the aim of which is to encourage and recognise excellence in communicating the significance, value and rewarding nature of engaging with environmental physics. Essay topics should cover aspects that are encompassed by the Group's interests in environmental physics, which include, but are not limited to: atmosphere and climate; hydrology; plant physics; glaciology; waste; energy; the built environment.

- Prize money totals £500;
- A certificate will also be awarded to the winning author(s);
- The winning entry will be considered for publication (previous winners have been published in Physics Education);
- All entrants will be offered 3 months free membership of the Group and of the IOP;
- The competition is open to all, but entries from students are particularly welcome;
- Essays must be no more than 2,000 words long;

Entries must be original and will be judged on writing quality and content. It is anticipated that presentations will be made to and by the winning author(s) at the Group's Environmental Physics meeting on Wednesday 26th May 2010.
Entries should be sent to: env.essay@physics.org, preferably as a pdf file, along with full contact details and student status if appropriate. Entries may also be submitted by post to:

Environmental Physics Group Chair (essay competition),
c/o Science Support Officer,
The Institute of Physics,
76 Portland Place,
London. W1B 1NT

Further details are available on the Group's web site or from env.essay@physics.org.

Reports from previous events

Environmental Electrostatics III, "Measurement and modelling of charges in the environment"

Karin Aplin reports on this half day event that took place on 24th June 2009 at the Institute of Physics.

This event was attended by around 35 people and continued the triennial series of meetings investigating modelling and measuring electrostatics in the environment organised by Giles Harrison (Reading University). The emphasis was on modelling the effects of charged particles and ions, but methods for monitoring changes in the atmospheric electrical environment were also discussed.

With Alec Bennett (Met Office, Exeter) in the chair, Ian Pavey from Chilworth Technology, Southampton, opened the meeting with a presentation entitled "Instrumentation for long term continuous measurement of ground level atmospheric electric fields." Ian gave an enlightening talk which discussed the electrostatic field mills developed by John Chubb. Many years of development have led to robust, commercially available instruments that are suitable for monitoring the atmospheric electric field in both fine and stormy weather. Ian described some of the more subtle techniques that are required to ensure reliable operation, such as the use of charge sensitive amplifiers to minimise the effect of water over insulation surfaces and avoidance of the need for earthing of the rotating chopper.

Next, Alison Buckley (University of Bristol), presented research into the effects of high voltage power lines on the charge distribution of aerosols. Power lines in poor working condition generate corona ions, which are subsequently carried downstream by the wind. Alison's research used sophisticated measurements of corona ion mobility spectra and aerosol charge distributions to show that the ambient aerosol charge distribution is modulated by the presence of corona ions. These results have relevance to the "corona ion hypothesis", that the increased prevalence of childhood leukaemia near power lines could be related to charge-enhanced aerosol deposition in the lung.

An increase in spatial scale followed for the next talk in which Anna Odzimek (University of Leicester) described an innovative application of the PSPICE electrical engineering software to model the atmospheric global electric circuit. Using a sophisticated electrical engineering model to describe the effect of lightning discharges, cosmic ray ionization and upper atmosphere discharges, the model allows currents flowing in the global circuit to be derived. The charging effect of fair weather clouds can also be included.

After coffee and posters, the meeting resumed, chaired by Giles Harrison, with Joseph Ulanowski (University of Hertfordshire) talking about “Radiative properties of charged dust clouds”. This project began as a novel “spin-off’ provoked from unexpected polarization effects found in astronomical data. The polarization is consistent with alignment of atmospheric dust particles, for which dust electrification provides a compelling possible explanation. In a collaborative project with scientists from Reading University, optical particle sensors have been combined with sensitive electrical sensors for flights on meteorological sounding balloons in dusty areas. Flights are now underway during the dust season in Saudi Arabia, to investigate natural charging of atmospheric dust clouds.

Michael Rycroft (CAESAR Consultancy, Cambridge and Bath University) then presented joint work with Anna Odzimek where the engineering model discussed in the earlier part of the meeting was used to quantify the effects of lightning on the ionosphere, the upper conductive layer in the global atmospheric electric circuit. In addition to the cloud-to-ground lightning that we are all familiar with, Michael included the effects of the many types of upper atmosphere discharges which have only been identified in the last 10-15 years, and for which classification is effectively still ongoing. These discharges move upwards on a gigantic scale from clouds to the ionosphere, a distance of many tens of kilometres. Despite this, individual sprites, for example, which occur above large positive cloud-to-ground lightning bolts, were found to reduce the potential of the ionosphere by only ~1V.

The final talk of the meeting was, “Do cosmic rays have any significant effect on climate?”, which was a lively and provocative presentation from Arnold Wolfendale (University of Durham), who summarized several of the well-known mechanisms proposed for cosmic rays to affect clouds, as well as introducing some novel suggestions by which cosmic rays could have affected climate in the past. His overall conclusion was that there is, as yet, no firm evidence for cosmic rays affecting climate.

Three posters were also presented, by James Matthews et al (Bristol University), Keri Nicoll et al (Reading University), and Karen Aplin et al (Rutherford Appleton Laboratory, now at Oxford University). These posters covered a wide range of topics, respectively: measurement of electric fields near power lines, balloon soundings of the charge on a cloud, and modelling the electrical environment at an asteroid. With scientific discussions continuing into the evening at the nearby Mason’s Arms, there was lots of positive feedback and we look forward to EE4 in 2012!

Computer Simulation and the Environment

This meeting was held on 10th September 2009 at the Institute of Physics and was co-organised and reported on by Paul Williams.

Around 30 delegates attend the Computer Simulation and the Environment one day meeting. One delegate had even travelled all the way from Illinois especially to attend! The meeting focussed on state-of-the-art computer simulations of all aspects of the physical environment. The key aim was to bring together two communities which perhaps interact less than they should, namely experts in software development for high-performance and distributed computing, and developers and vendors of the next generation of hardware. Concomitantly, the meeting was co-organised by the Environmental Physics Group and the Computational Physics Group.

In the morning session, Carl Christensen (Stanford University) talked about volunteer computing projects in the earth sciences. These projects aim to use the spare capacity of volunteers' personal computers, which is otherwise wasted. The cost is a fraction of that of a supercomputer, although the need for interaction with participants can scare the more socially awkward academics! One example was the quake-catcher network (QCN) volunteer computing project, the accelerometers contained within most laptops (ostensibly to park the hard drive if dropped!) are used as a network of earthquake detectors.

Hiro Yamazaki (Oxford University) noted that a recent world modelling summit had called for $1bn to revolutionise climate modelling, with most of the funds to be spent on supercomputing. But how will we know when the revolution is over and success has been achieved? When models can simulate scales of 25 km? Or 1 km?! As an alternative to the expensive super-computing route, ClimatePrediction.net is a high-profile volunteer computing project in which enthusiasts run a version of the Met Office's climate model on their personal computers, to investigate uncertainty in future climate change. The project has received widespread media coverage.

Matt Piggott (Imperial College London) noted that the oceans play a central role in climate, through highly non-linear coupling to the atmosphere and cryosphere. Ocean models traditionally employ uniform structured meshes (e.g. fixed rectangular grids) as their numerical strategy. But modern techniques help to ensure the "genetic diversity" of models by proposing adaptive unstructured meshes (e.g. evolving triangular grids) as an alternative numerical strategy. Typically, around 10% of the computational effort is spent adapting the mesh. The efficiency of models can be increased 10-100 times through these innovative techniques.

After lunch, Lois Steenman-Clark (Computational Modelling Service, National Centre for Atmospheric Science) talked about running sophisticated atmospheric model experiments on super-computers. For climate simulations, the current goal is for models to run around 1000 times faster than reality. But this goal is impeded by the drives towards increased resolution, increased complexity, and longer integration times. For now, existing models can be adapted easily to run on bigger computers, but there will come a time when the source codes must be re-written from scratch. This task might be difficult, because academics do not get Brownie Points for writing and documenting codes!

Moving onto the second half of the meeting on hardware aspects, Akira Asato (Fujitsu) discussed Fujitsu's range of processors, including a forthcoming new processor for peta-scale super-computers. The new processor delivers higher performance and lower power consumption. New algorithms for trigonometric functions and reciprocal calculations are, respectively, seven times and five times faster than with the previous processor. Conditional loops are improved, also. On average, the new processor uses half the power of its predecessor and delivers three times the performance.

Finally, Eng Lim Goh (SGI) talked about the many various applications of high-performance computing. Generally, improvements at the extreme length scales of simulation (e.g., galactic scales, the planetary scale, and the femto scale) are academic-driven. In contrast, improvements at the intermediate scales (e.g. the fluid flow around aeroplanes and swimmers' bodies) are commerce-driven. Simulating 100 years of climate at 100 km resolution is possible on present computers, and so is simulating 1 minute at 1 metre resolution. The drive is towards simulating 100 years at 1 metre resolution, however. SGI accelerators, for which existing code just needs to be re-compiled rather than re-written, could help achieve this goal.

Overall, a very enjoyable and informative meeting was had. Both of the communities that were present – modellers and hardware developers – benefited from the all-too-rare chance to interact, to take stock of the current state of computer modelling of the physical environment, and to discuss possible future directions.

Forthcoming Environmental Physics Group Events

Extreme Weather Events, Surface Science Centre, Physics Department, Liverpool University

Ross Reynolds, Reading University.
Thursday 12th November 2009. Coffee from 6pm, for 6.30pm start.

In collaboration with the Merseyside Branch, Ross's presentation will look at the origin, nature and prediction of severe weather in both the USA and UK, focusing on tornadic storms, hurricanes and explosive depressions. These phenomena have been and are still studied intensively, offering a significant challenge to researchers and operational meteorologists alike. For further information, contact Prof Mike Poole at mike.poole@stfc.ac.uk

Low NOx Combustion, East Midlands Conference Centre, University of Nottingham

Wednesday 21st April 2010.

This meeting will be of interest to academics and industrialists alike and will bring together experts in combustion processes and the impacts of combustion products on human health and in the environment. The focus will be on nitrogen oxides (NOx), delivered through a series of invited talks, providing high quality reviews on topics including:

- Impacts & regulation
- Transport and urban air pollution
- NOx from industrial sources, including power generation
- NOx and aviation

There will also be an opportunity for a series of shorter presentations, *e.g.* by research students.

Registration will be required for this meeting, and further information will be available from the Institute of Physics. Further details will appear shortly on the Environmental Physics Group web site:
http://www.iop.org/activity/groups/subject/env/

Optical Environmental Sensing VII – First Announcement, University of Southampton.

Monday 23rd – Friday 27th August 2010.

This meeting will be a session of the Photon10 conference, which will also include a plenary session on 'Green Photonics'. The meeting is intended as a forum for presentation and discussion of current developments in optical environmental sensing and is organised jointly by the IOP Optical and Environmental Physics Groups. The meeting will encompass a wide scope including new developments in optical measurement techniques and applications in monitoring the atmosphere, clouds and the terrestrial environment.

Photon10 will be held between 23rd - 27th August 2010 at the University of Southampton and a call for papers will be issued in Autumn 2009.

Further details are also available at: http://www.photon.org.uk/activity/index.html

Registration will required for this meeting. Further details will appear on the Environmental Physics Group web site http://www.iop.org/activity/groups/subject/env/

Forthcoming IOP Events

Early Career Research in Electrostatics and Dielectrics, Institute of Physics, London.

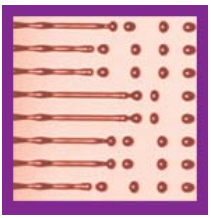
Tuesday 15th December 2009

This one-day meeting seeks to bring together PhD students and early career researchers in both academia and industry who are active in any area related to electrostatics and dielectrics, to present their work and discuss advances in the fields with their peers. The abstract deadline for poster and oral presentations is Friday 13th November, Further details available at: http://www.iop.org/Conferences/Forthcoming_Institute_Conferences/2009/ECRED/page_36871.html

Novel Aspects of Surfaces and Materials (NASM3), Chancellors Hotel and Conference Centre, Manchester.

Sunday 11th – Thursday 15th April 2010

Organised by the Applied Physics Technology Division of the Institute of Physics



This conference is the third in the series and will include presentations on current applied physics challenges, developments and approaches to surfaces and materials. Speakers will share their vision and knowledge on contemporary research and technology. Interdisciplinary and interactive, the conference will highlight new developments in the field and promote opportunities for new collaborations on funding applications and networking. For further details, see http://nasm.iop.org/

Other Forthcoming Events

Water Catchments: New Instrumentation Technologies for Research and Regulation Needs.

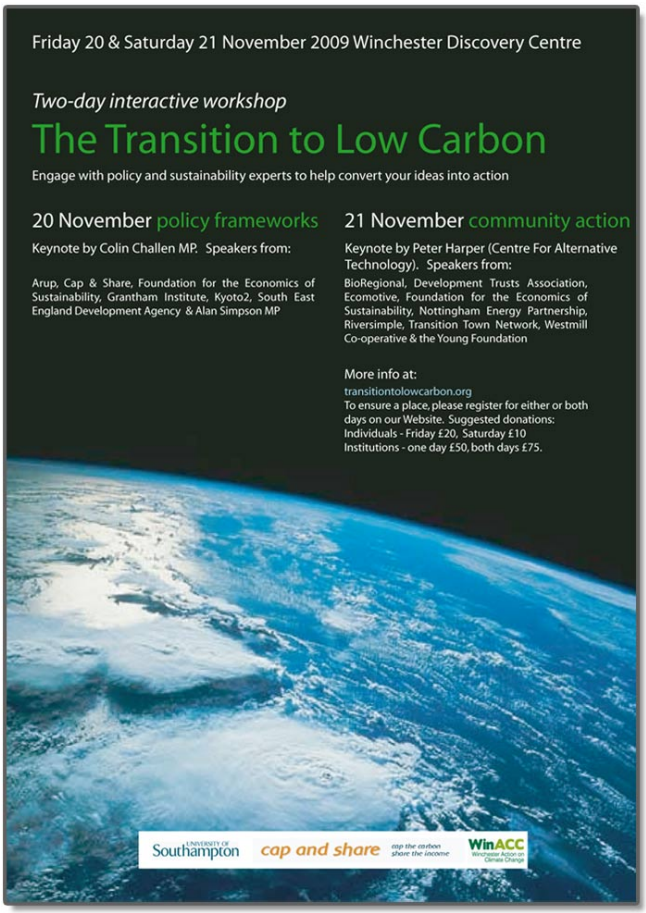
Institute of Physics, 76 Portland Place, London.

Tuesday 27th October 2009.

This event, hosted by the SIKTN Environmental Measurement Special Interest Group (EMSIG), will focus on providing important enabling technologies for both academics and industrialist to solve the problems around freshwater supply. Further information, including registration and the provisional programme can be found online at:

http://sensors.globalwatchonline.com/epicentric_portal/site/sensors/menuitem.51ce3d3b0b5c1165af71b5308380e1a0/?mode=0

The Transition to Low Carbon, Winchester Discovery Centre.
Friday 20th- Saturday 21st November 2009.



October's Physics World discussed the energy problem and with many of us within the Environmental Physics Group researching climate change, there are possibly less of us do something about it at a community or local level. This two day interactive workshop allows participants to engage with key policy and sustainability experts and explore how to convert ideas to reduce carbon emissions into action. This workshop examines the implications for both policy and independent initiatives.

For full programme details and to register please visit http://transitiontolowcarbon.org

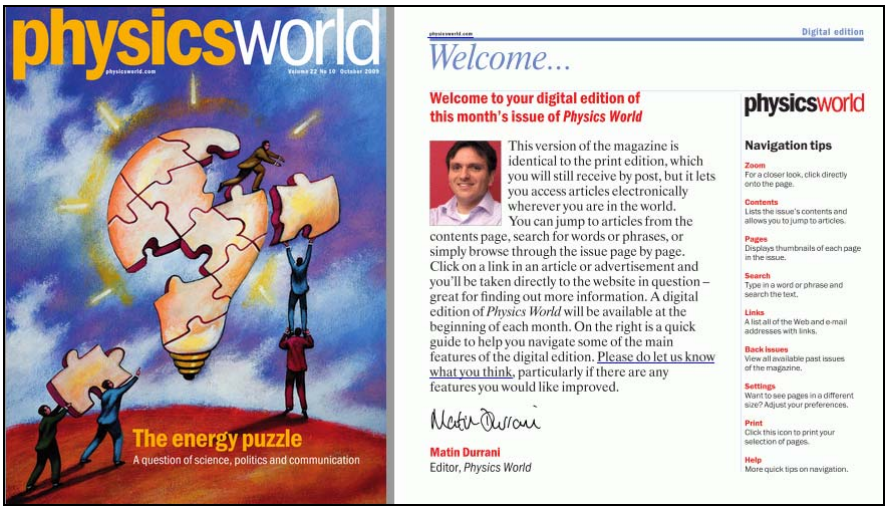
Other Activities

Environmental matters in Physics World

Missed an issue of Physics World? Trying to remember an article that you read some time ago?

No need to worry as Physics World is now on the web. Log on to MyIOP at http://my.iop.org and select Physics World from the 'Useful Links' masthead menu and then follow the link to 'Physics World Digital'. If you have forgotten your password, click the 'Forgotten your login details' link or contact member.services@iop.org

The format is really straightforward to use as you can easily navigate to any section of Physics World just be clicking on the links or a relevant part of the page.



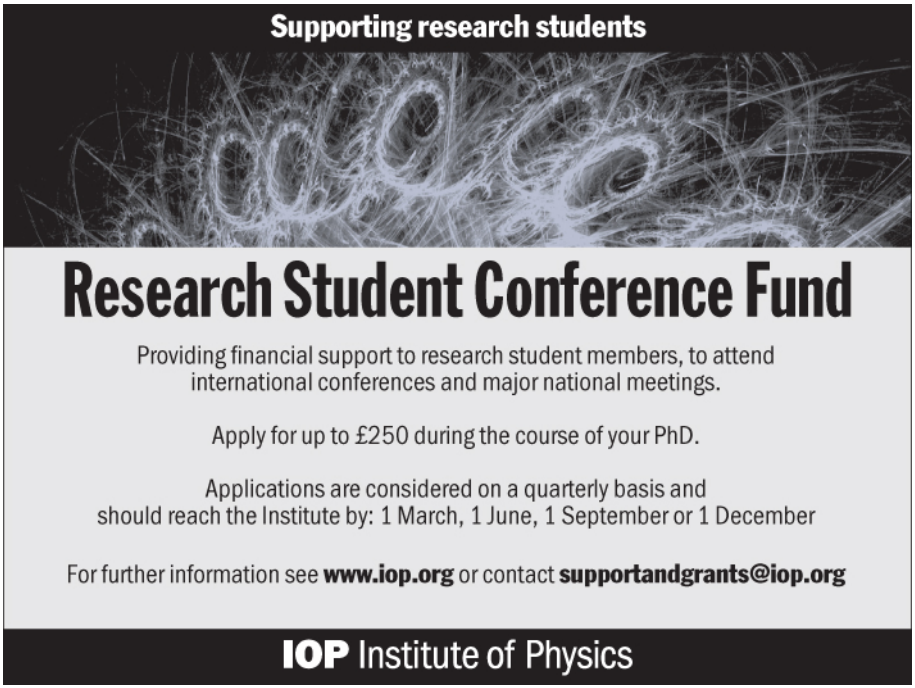
Physics World – Viewpoint

September's and October's issues are very relevant to our group – tackling the issues of energy, climate and geoengineering. What do you think the remaining pieces of the puzzle are to solve the energy problem? Are you doing something at a local level? Or do we have an energy problem? What about geoengineering? Do you agree that it is the best way to solve the climate change problem, or is it ethically wrong? Send your views into Sally or Hugh (email addresses at the back of the newsletter), and we'll publish a selection in our next newsletter.

Physics World – Webinar series

On another note, keep an eye on the IOP webinar series. September's webinar introduced IDL - software which specialises in data analysis and data visualization, which is often used in environmental research. You can register in advance and view past webinars at http://www.physicsworld.com/cws/go/webinarX where X represents the webinar number (September's webinar was number 4).

Research Student Conference Fund



EPG Committee

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This newsletter is also available on the web and in larger print sizes

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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