

The Effect of Charged Aerosols on Earth's Climate.



Image Credit: Augustine Volcano in Alaska: US Geological Survey

An IOP meeting in November will bring together researchers to discuss the effect of charged aerosols on our climate.

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Welcome to the Environmental Physics Group Summer 2013 newsletter...

Welcome to the late summer edition of the Environmental Physics Groups newsletter. I am writing this as the new chairman of the group and as such, I would like to thank Pat Goodman on behalf of all of us in the Environment Physics Group, for all of his hard work and leadership over the past 9 years.

In this edition we have reports from the very successful EPG Members' Day (page 10), and other events this year. There are also announcements for forthcoming EPG events including the "Charged Aerosol" Meeting (front cover and page 14) and an evening lecture on the "Science behind cultural heritage". On page 5, are the winners of our essay competition. We will also be holding our annual environmental physics essay competition this year. Further details to be announced in due course.

Finally, we would like to start a new section within the newsletter that is based around you. The "**members news**" section will include interesting stories and activities that you have been up to (preferably based around environmental physics!). If you have anything that you think would be suitable, please send it to me.

We hope that you enjoy the newsletter.



Hugh Mortimer

Hugh.mortimer@stfc.ac.uk

EPG News: A message from Hugh Mortimer, new Chair of the EPG

Dear Members of the Environmental Physics Group,

It's my great honour to write this having just been elected as chairperson of the Environmental Physics Group. First of all I would like to recognise all of the hard work that Pat Goodman has done for the group over the long time that he served on the committee. His experience, enthusiasm and humour will be a great loss. I hope to continue the good work that Pat started, especially in his efforts to forge stronger links between the groups within the IOP. I will be looking to continue our great record of organising joint meetings and events with other groups, both within the IOP and further afield, in order to encourage collaboration across the diverse disciplines of physics. As a group we will also be looking at ensuring that events and meetings are held with the IOP branches across the whole of the UK to ensure that all of our members are included and feel connected. I would very much like to encourage members who have an idea for an event or would like to help organise an event in their own discipline – either stand alone or with another society – who would like some help from the EPG to contact any one on the committee, as we love to help you.

I am particularly passionate about communication and outreach and feel that environmental physics can be used as a tool to inspire the next generation of scientist. As such we will look to continue our very successful newsletter and essay competition which attracts entries from members as young as 15 and covers topics from ocean currents through to pollution in our cities.

I am delighted to have the chance to work on your behalf and look forward to the next few years.

Hugh Mortimer - Chair EPG



Congratulations to our essay winners!



Thank you for everybody who entered our group essay competition. We had a very high standard of entries, and were delighted to award prizes to:

- Sian Williams, Imperial College “Communicating climate change: Should we sell environmentally friendly behaviour?”
- Heidi Burgess, Glasgow University “The smell of the sea: Sulphur production by marine algae”
- Toby Harris, The Leys School “Nuclear fusion: When will it come together?”

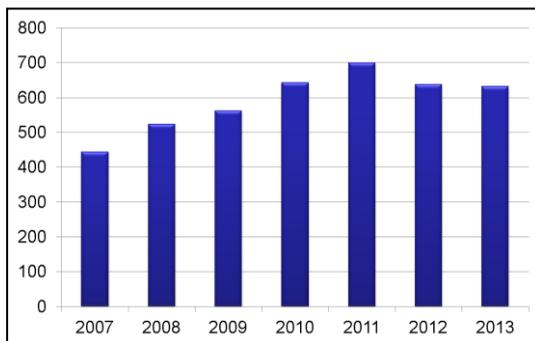
Sian was our overall winner and won £200 with our runners up, Heidi and Toby, each winning £100. Congratulations to all three.

We encourage all members and non-members to consider entering next years essay competition. Further details will be released via email and posters to shortly. We welcome entries from anybody who has an interest in the subject – please feel free to send the email advert on to anyone who you may think is interested.

Secretary’s report 2012-2013

This is my first report as Honorary Secretary, and summarises the AGM, held on Wednesday 22nd May 2013 at IOP, Portland Place, London. It was attended by 17 group members, plus two co-opted committee members and a few additional delegates at Members’ Day.

Group membership is still healthy at 632 people.



The minutes of the 2012 AGM were read and approved. Reports from the Chair and Treasurer were presented.

The committee met four times during 2012-13 (September – 8 attendees, December – 8 attendees, March – 7 attendees and May – 10 attendees)

Prior to the AGM, the committee comprised three officers, seven ordinary members and two co-opted members.

<i>Name</i>	<i>Status</i>	<i>Elected</i>
Pat Goodman (Chair)	officer	2010
Mhairi Coyle (Vice Chair & Hon Treasurer)	officer	2011
Sally Brown (Hon Secretary)	officer	2012
Jarlath Molloy	ordinary	2011
Simon Buckle	ordinary	2011
Claire Ryder	ordinary	2012
Paul Green	ordinary	2012
Alec Bennett	ordinary	2009
Hugh Mortimer	ordinary	2009
Christopher Lavers	ordinary	2011
Liz Kalaugher (<i>environmentalresearchweb</i>)	co-opted	n/a
Gui Wright (ERL)	co-opted	n/a

Following the AGM, Pat Goodman (Chair) has had to step down from the committee due to reaching the maximum time served according to IOP regulations. Claire Ryder remains on the committee, but is taking a short break due to maternity leave. Following the AGM, Hugh Mortimer was elected as Group Chair and Alec Bennett re-elected. Hugh Deighton and Stefán Thor Smith have been elected to the group.

As part of AOB, Pat Goodman made members aware of the change in location on the Institute of Physics. This was very likely to be the last Members' Day and AGM in Portland Place as the lease expires on the property. A new venue is to be confirmed!

Thank you to Pat Goodman for his many years of hard work within the committee in a number of roles, particularly as Chair. Congratulations to those newly elected. I look forward to working with you all in the coming year.

Sally Brown
Honorary Secretary
May 2013

Reports from Previous EPG Events

Environmental Electrostatics 4

Institute of Physics, London

Wednesday 24th April 2013

Run jointly with the IOP Electrostatics Group

The IOP environmental physics and electrostatics groups co-organised a half day meeting to look at various aspects of Environmental Electrostatics. This is the fourth such meeting and there were 24 registered attendees. After a brief introduction from Dr Alec Bennett, the first session began with Professor Giles Harrison, University of Reading, giving a historical perspective of the Carnegie Curve, the background diurnal cycle of the Earth's natural potential gradient. The talk described some of the processes involved in measuring the atmospheric electric field on the Carnegie cruise ship. The talk was concluded by noting a relationship between the Carnegie curve, and the diurnal cycle of cloud height, a topic that would be revisited later in the day.

Ian Pavey, from Chilworth Technology, described a series of measurements using electric field mills – a common device used to measure the atmospheric electric field. The applications of these measurements included a lightning detection system. Also introducing measurements and techniques of lightning detection was Dr. Alec Bennett who introduced the Biral Thunderstorm Detector, an instrument currently in development. His talk discussed the processes involved in lightning detection and charges in clouds and precipitation.

After a short break for refreshments, Dr Isobel Houghton of Bristol University presented measurements of potential gradient, cloud base height, temperature,

relative humidity and visibility taken at the MET office, Exeter, using several collocated instruments. Two case studies were presented, an instance showing changes to the convective boundary layer and an instance of fog. Moving vertically upwards in the atmosphere, Dr Martin Füllekrug of Bath University revisited the theme of lighting by discussing atmospheric phenomena above the cloud layer, in his talk *lightning into space*. He presented images of sprites, jets and other phenomena and discussed ground level detection techniques.

Dr Keri Nicoll from Reading University continued where Professor Harrison's talk left off by describing measurements of cloud base height, which showed a diurnal variation related to that of global potential gradient. Her talk further discussed the distribution and movement of charges within clouds. Dr Karen Aplin described the detection of cluster ions from their infra-red absorption spectrum. Cosmic rays cause ionisation in the atmosphere and events were detected using a cosmic ray telescope, after an event, a filter radiometer was used to measure changes in the absorption of infra red in order to detect cluster ions. Results were presented from a measurement campaign over one year.

There were 7 posters presented during the day, two from Dr Aplin (Oxford) the first entitled *Lord Kelvin's atmospheric electricity measurements* an analysis of some of Lord Kelvin's atmospheric electricity measurements on the isle of Arran in 1859, and the second *infra-red absorption in cluster ions* elaborated on her talk. Dr Houghton of Bristol University presented a poster entitled *Triboelectric charging of volcanic ash from the 2011 Grimsvötn eruption*. Dr James Matthews, also of Bristol University presented *The effect of wind on ion concentrations found downwind of high voltage power lines in corona*. Four posters were presented by researchers from Reading University; Prof. Harrison presented a poster entitled *Monitoring of space weather and radioactivity using small airborne platforms*, Dr Chris Davies presented *Solar wind modulation of UK lightning rates*, Dr Nicoll presented *Phase locking of lower atmosphere phenomena with space weather changes* and Graeme Marlon presented *Atmospheric point discharge currents measured with a bi-polar logarithmic current amplifier*.

The day finished with a discussion of some of the issues brought up during the day, including the mechanisms by which a falling raindrop could gain or lose charge, and the possibility of co-ordinating potential gradient measurements throughout the UK.

James Matthews, meeting co-organiser

Weather and Climate Modelling

Imperial College, London

Wednesday 17th April 2013.

Run jointly with the Royal Meteorological Society and the Grantham Institute for Climate Change

A half-day meeting on the topic of 'Should weather and climate prediction models be deterministic or stochastic?' was held at Imperial College London on the afternoon of Wednesday 17 April 2013. The meeting was co-sponsored by the Grantham Institute for Climate Change and the IOP Environmental Physics Group, and was part of the Royal Meteorological Society's National Meetings programme. Around 150 people attended.



The subject of the meeting was a topical one. It is becoming increasingly common to represent subgrid-scale features in weather and climate models by including random noise. But is this really the best approach to the parameterisation problem? With Brian Hoskins (Imperial College) as chairman, the meeting set out to examine the pros and cons of these stochastic approaches, compared to the traditional deterministic approach.

Kerry Emanuel (Massachusetts Institute of Technology) spoke first, on why deterministic weather prediction remains important. Next came Tim Palmer (University of Oxford, ECMWF), who argued that weather and climate models should be stochastic. Then, Anders Persson (Swedish Meteorological Society) spoke about uncertainty, specifically how to turn a 'bad' thing into a 'good' thing. After a coffee break, Terry Davies (Met Office) discussed predictability, model errors and scale. Finally, Dan Cornford (Aston University) spoke about pragmatic treatment of belief and inference in modelling.

The speakers' slides, together with mp3 audio recordings of their talks, can be downloaded from this website:

<http://www.rmets.org/events/should-weather-and-climate-prediction-models-be-deterministic-or-stochastic>

Paul Williams, Meeting Organiser

Environmental Physics Group Members' Day

Institute of Physics, London

Wednesday 22nd May 2013.



The annual Environmental Physics Group Members' Day was held again this year in May. This successful event hosted a range of talks from prize winning essays given by A-level physics students through to the way in which communication effects how we perceive scientific results. The day attracted 33 people and culminated with the joint London and South East branch key note lecture by Michael Rycroft

Gui Wright and Liz Kalaugher are co-opted committee members, and both spoke about their involvement in Environmental Research Letters (ERL) and environmentalresearchweb.org. They spoke about the benefits in publishing in ERL (particularly given the shift towards open access), including exclusive on-line facilities of both websites. IOP members are even offered discounts on publication costs, which now includes the opportunity to include a video abstract alongside the traditional paper publication, for further details see page 18.

Dr Sirinath Jamieson is interested in how scientists communicate with each other across disciplines. In her talk, she challenged the audience to think in different ways and explained differences in language used in communication. Part of this involved understanding the bigger picture and trying to take account of all factors influencing a problem, as



failure to do so may lead to costly mistakes. Sirinath is particularly interested in applying these principles to biosustainability and the environment, and creating technologies that can assist in a more sustainable built environment. For more information, see: www.biosustainabledesign.org

Angus Ferraro is a PhD student at the University of Reading who is researching the effect of geoengineering aerosols and their effect of climate and circulation. Geoengineering is a controversial topic that one government or organisation could undertake to change the weather, but one that can have global consequences. Angus explained the different types of aerosols, how they grow and interact, and

through model simulations how they effect weather patterns. He concluded that geoengineering can change circulation patterns, and the more geoengineering is used, that potentially worse conditions could be generated.

Finally, you may have felt that the weather has been a little cold and unseasonal lately, but for Royal Holloway/NPL PhD student Chris Ball, these temperatures are warm! Chris has recently returned from fieldwork in Ny-Ålesund, Svalbard. He and a team of scientists were measuring bidirectional reflectance – which defines how light is reflected on a surface (think about how light changes in photographs between neighbouring scenes). These measurements are important to understand as scientists can better understand the mechanisms of energy transfer around the world, from cold and snowy environments that only absorb 10% of surface radiation, to oceans, which absorb 90% of incoming radiation. After an enjoyable afternoon, we had our AGM and joint evening lecture.

Hugh Mortimer and Sally Brown

**Environmental Physics Group Members' Day – evening lecture
by Michael J Rycroft 'The global atmospheric electric circuit'
Institute of Physics, London
Wednesday 22nd May 2013.
Run jointly with the London and South-East Branch**



How many times does lightning flash around the globe in a single second? The eminent professor, Michael Rycroft was our speaker for the evening, and this is just one of the many interesting facts explained during his lecture. Professor Rycroft has spent his life researching

atmospheric physics, in particular atmospheric electricity. In this talk, Michael started with some inspirational quotes, such as 'one man's noise, is another man's signal', and it is the small, and sometimes difficult to measure signal of atmospheric ions that allow current flow in the global atmospheric circuit that was at the centre of his talk.

The global atmospheric circuit is a picture describing how charge manifests itself and moves around the atmosphere – from the surface to the ionosphere. The atmosphere is slightly electrified due to ionisation by galactic cosmic rays and

natural radioactivity. Some of the ions formed attach to atmospheric aerosols, some which also become cloud condensation nuclei. Michael explained how electrical conductivity varies with altitude: for a vertical column, 95% of its resistance is in the lowest 10km of the atmosphere.

Professor Rycroft explained the two types of atmospheric circuits – DC and AC. In the DC circuit, currents flow between the generator regions (such as thunderstorms or electrified rainclouds), and the load regions, which are in fair weather regions. The current flow has a diurnal pattern that depends on universal time (GMT) - known as the Carnegie Curve after the ship on which the original measurements were made– associated with successive local time maxima in thunderstorms globally. In the AC electric circuit, charge sources include the magnetosphere and geomagnetic pulsations. There are also lightning discharges – either from cloud to ground, between clouds, or through unusual meteorological phenomena occurring above thunderstorms called sprites. These of course vary on different temporal and spatial scales, and link the different parts of the circuit together. Interestingly, although the general public may perceive the lightning as very powerful, lightning itself is not a very significant contributor to the global electric circuit due to the cancelling of negative discharges by fewer, but more substantial, positive discharges.

So, what was the answer to the number of lightning flashes occurring around the globe each second? It's 44 – and by following the Carnegie Curve, we can predict that these peak in the early evening Greenwich time.

Sally Brown and Giles Harrison

Forthcoming Environmental Physics Group Events

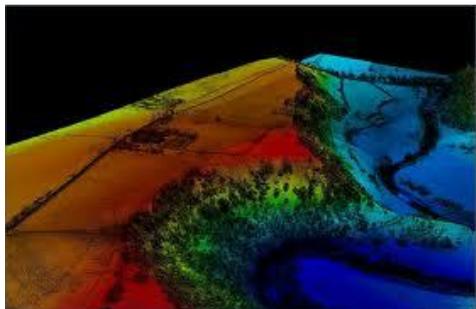
The science behind cultural heritage

Institute of Physics, 76 Portland Place, London

Run jointly with the London and South-East Branch and Royal Society of Chemistry Environmental Group

Wednesday, 23 October 2013.

Tea and coffee from 6pm. Event starts 6.30pm.



This joint meeting between the London and South East Branch, Environmental Physics Group and the RSC Environmental Group will give a fascinating insight of the science behind cultural heritage.

There will be two speakers, chemist Joe Padfield of the National Gallery speaking on the effect of light on old masterpieces, and Nigel Blades from

National Trust speaking about heat, moisture and the preservation of art collections in historic houses. Registration is required, please contact Sally Brown, sb20@soton.ac.uk stating which organisation you are a member of.

Remote Sensing Applications in Environment, Climate Change and Human Impact Assessment

Grantham Institute, Imperial College London

Run jointly with the Grantham Institute

30th October 2013 PM

This event is co-sponsored by the Grantham Institute and the Institute of Physics Environmental Physics Group. For further details contact the Conservation and Indigenous Communities SIG Convenor and EPG Committee member Chris Lavers, on:

brnc-radarcomms1@nrta.mod.uk

<http://www.rspoc.org.uk/index.php/special-interest-groups/conicom-sig-menu.html>



Charged Aerosols

Institute of Physics, 76 Portland Place, London

Run jointly with the IOP Electrostatics Group and Aerosol Society

Thursday, 14 November 2013

Charged Aerosols is a joint meeting organised by the Institute of Physics Electrostatics Group and the Aerosol Society, which aims to bring together researchers in different fields united in their study and utilisation of electrical charge on aerosols. Topics covered include: medical and pharmaceutical applications and health implications for charged aerosol; natural and anthropogenic generation of charged aerosol in the atmosphere, laboratory and in industry; ion-aerosol interaction fundamentals; and aerosol charge measurement techniques.



Registration is required, and may be done so here: <https://www.iopconferences.org/iop/448/home>. Please contact Lisa Cornwell, for further details. Tel: +44 (0)20 7470 4800, E-mail: lisa.cornwell@iop.org.

Photonex13

The Ricoh Arena, Phoenix Way, Foleshill, Coventry CV6 6GE

Wednesday 16th October 2013

This meeting will bring together industry, research institutes and universities to discuss the technological developments and new applications in space based Earth Observation. Subjects to be covered include how the current Earth observation challenges will be met by future technology, the advancement of optical technology in telescopes as well as space strategy and funding for Earth Observation projects from agencies such as the TSB and STFC.

Please go to <http://www.onlineregistration.co.uk/cgi-bin/reg.pl?showdir=photonex/13&formname=regphotonex> to register for this event.

The teaching of environmental physics
Institute of Physics, 76 Portland Place, London
Run jointly with the IOP Higher Education Group
Wednesday 4th December 2013

Climate change and alternatives to fossil fuels are major societal challenges, and physics graduates should be equipped to tackle these issues. This one-day event with the IOP Higher Education Group will give participants exemplars showing how to incorporate environmental physics into a wider degree programme and as stand-alone modules at different levels. The event will highlight the societal benefits of including environmental physics into the curriculum. The event will aim to disseminate tried and tested examples of good practice in the teaching of environmental physics with a view to more widespread adoption across UK institutions.

Confirmed speakers include:

- Mathew Owens, Department of Meteorology, University of Reading
- Tony Arber, Department of Physics, University of Warwick
- Stefan Hild, Department of Physics, University of Glasgow
- Gordon Aubrecht, Department of Physics, Ohio State University

As the programme is still being finalised, firm details and timings of the day are not available yet, but we will send around an email in due course. Alternatively, you can keep an eye on the IOP calendar.

At home – The earth's climate past, present and future
Institute of Physics, 76 Portland Place, London
Thursday 9th January, 10.30am – 4pm.

Meeting organised by David Pick of the Retired Members Section, part of the London and South East Branch, plus the Royal Met Soc (History of Meteorology and Physical Oceanography Special Interest Group)

The Retired Members Section (REMS) have regular get-togethers, and in January their topic of interest is relevant to environmental physicists. REMS have an excellent website, and further details of the day and speakers are noted here (with a summary below):

http://www.johnabelling.webspace.virginmedia.com/html/rem_s_events_to_book.html

10:30 Arrival, coffee

11:00 Welcome, notices

11:10 Past Climate; Chris Folland

11:45 The Intergovernmental Panel on Climate Change; John Mitchell

12:20 Forecasting the Future Climate; Tim Palmer

13:00 Lunch (chargeable)

14:15 Observing the Climate; Ian Strangeways

14:50 Policy Considerations; Simon Buckle

15:25 Developments on the National Grid; Shanti Majithia

16:00 Tea and dispersal

There is a charge for this event. Please contact John Belling of REMS, john.a.belling.secrems@gmail.com, 07986 379935, 42 Cunningham Park, Harrow, Middlesex, HA1 4QJ, if you wish to attend. This meeting is open to visitors.

Aviation and turbulence in the free atmosphere

Imperial College, London

Run with the Royal Met Soc and Grantham Institute

15th January 2014, 2pm start

Addressing naturally occurring turbulence outside the planetary boundary layer such as caused by convection and mountain waves, this meeting will involve a series of lectures on the effects of aviation. Topics include theories of turbulence and their practical application, forecasts and measurements.

For more information, please see the notice on the Royal Met Soc website:

<http://www.rmets.org/events/aviation-and-turbulence-free-atmosphere>

Ideas for forthcoming events

We are always on look out for events that the EPG can help organise or fund, including those with other organisations that would appeal to our group. The group is run by members for members, so we appreciate ideas from anyone! Over the next year, we will be working with REMS, aiming to organise a visit to CEH Wallingford and run a series of events linked to the release of the Intergovernmental Panel on Climate Change's reports. If you have any ideas or would like to assist, please let Hugh Mortimer know (details at back of newsletter).

Forthcoming IOP Events

Advances in Photovoltaics

Institute of Physics, 76 Portland Place, London

24 September 2013

This one day meeting provides a forum to help assess the current state of the art in solar cells. It brings together a list of distinguished invited speakers whose expertise covers the range of photovoltaic technologies.

An exhibition will be held alongside this meeting in the catering and poster area. The exhibition is open to companies interested in promoting their products and services to a specialised audience. This event is organised by IOP Ion and Plasma Surface Interactions Group and co-sponsored by IOP Energy Group and Environmental Physics Group. This event requires registration. Please contact Claire Garland, Tel: +44 (0)20 7470 4800, E-mail: claire.garland@iop.org for further details, or see the conference website: <https://www.eventsforce.net/iop/362/home>

Photon14

Imperial College, London

1st – 4th September 2014

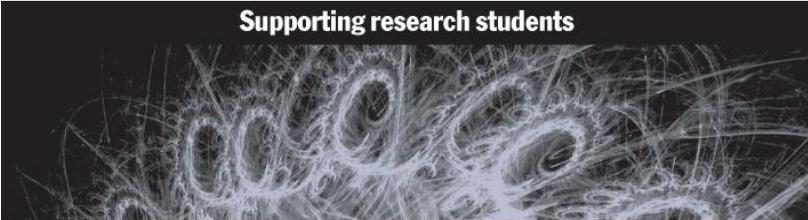
A date for your diaries! Photon14 promises to follow a series of successful conferences over the past decade. Registration is not open yet, but do keep an idea on the website for further details: <http://physicsworld.com/cws/event/2014/sep/01/photon14>

Other Activities

Research Student Conference Fund

Each year the group is allocated funds for students to apply for financial assistance to attend environmental-physics related international conferences and major national meetings. Some students have really benefited from the fund, such as Audrey Roy-Poirier who attended the 9th International Symposium on Analytical and Applied Pyrolysis (or Pyrolysis 2012) in Austria. We are pleased to sponsor students at events such as these, and still have funds available. All PhD students are welcome to apply for up to £250 during the course of their studies. Please see the advert below for further details.

Supporting research students



Research Student Conference Fund

Providing financial support to research student members, to attend international conferences and major national meetings.

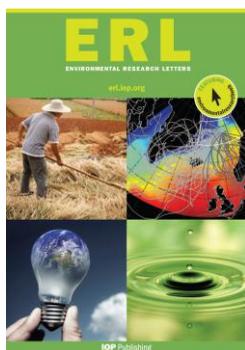
Apply for up to £250 during the course of your PhD.

Applications are considered on a quarterly basis and should reach the Institute by: 1 March, 1 June, 1 September or 1 December

For further information see www.iop.org or contact supportandgrants@iop.org

IOP Institute of Physics

Environmental Research Letters and *environmentalresearchweb* News



Environmental Research Letters, ERL (erl.iop.org), is a broad scope, open access journal published by IOP Publishing, covering all areas of environmental science. The journal provides a coherent and integrated approach, publishing high quality, high impact original research articles, editorials, and commissioned Perspective articles which highlight the impact and wider implications of research appearing in ERL. With a current Impact Factor of 3.582, ERL receives over 85,000 article downloads each month and with rapid peer review accepts articles for publication within 80 days of submission, on average.

Research in the journal regularly appears in high-profile media outlets such as the New York Times, The Guardian and BBC, as well as guaranteed coverage in *environmentalresearchweb* (see below). As a gold open access journal, all articles are free to readers, and funded by an article publication charge. To find out more and read the latest open issue (No. 2: Apr-Jun 2013), go to erl.iop.org.



The sister publication to ERL, environmentalresearchweb, offers news and views about the latest research in environmental science. Members of environmentalresearchweb (free to join) receive a 25% discount on the open access article charge for their first publication in ERL, as well as the option of a weekly email newswire. The site currently features a blog about fieldwork on vegetation and climate change in Lapland - see <http://blog.environmentalresearchweb.org/category/kilpisjarvi/> for more

ERL is evolving

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with others in new and innovative ways.



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ENVIRONMENTAL RESEARCH LETTERS

The less formal format of the video abstracts allows the authors to phrase their message in a clear and personal way. Together with the additional audio-visual dimension, the videos bridge the gap between the technical article and a broad audience.

Julia Pongratz,
Max Planck Institute for
Meteorology

WITH AN ERL VIDEO ABSTRACT YOU CAN:

- showcase your research
- engage with your community
- raise your visibility
- make an impact

In this paper, Harrison et al investigate how the global fair weather atmospheric electricity current, which is affected by space weather, cosmic rays and the El Niño Southern Oscillation, is linked with layer cloud properties. Read the paper for free, and watch the video abstract at

<http://iopscience.iop.org/1748-9326/8/1/015027/article>



To see the latest video abstracts and for more information visit erl.iop.org and select video abstracts.

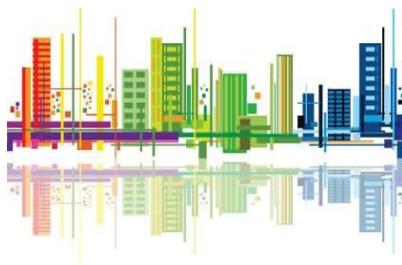


IOP Publishing

Careers in Physics

IoP Careers Website and Bursaries

The IoP offers an up-to-date careers resource that is aimed at providing students and career scientists alike a place to explore new opportunities. The IoP would like to promote this service which can be found at <http://www.iop.org/careers/index.html>



Members News

...I would like to place a request for interesting members news stories that we can start to include in this “...**And finally**” section. If you have any interesting news stories that relate to Environmental Physics and that you would like to see appear here please forward your short stories/news items to me hugh.mortimer@stfc.ac.uk and I will choose one lucky article that will be printed in the newsletter.

EPG Committee

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