

Intergovernmental Panel on Climate Change (IPCC) Report is Released



Image Credit:
<http://www.ipcc.ch/report/ar5/>

The Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) was released in September 2013.

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Welcome to the Environmental Physics Group Winter newsletter...

Welcome to the winter edition of the Environmental Physics Groups newsletter. The newsletter is an opportunity to let all our members know about all of the environmental physics news and events that are going on around the UK, advertising the forthcoming events and reporting on the highlights from the events that have happened. We hope that you will continue to support the EPG though attending these events and suggesting topics that you would like to see included in the future.

This year began with severe storms and flooding that affected the whole of the UK, emphasising the importance of the environmental physics used to study, model and predict such events. Satellite and remote sensing data played a large role during these storms: providing information directly into the numerical weather models used to forecast these weather systems, as well as assessing the impact. This edition of the newsletter pays tribute to the satellite data by reporting on a remote sensing event (page 12) and satellite applications (page 8). Along with news from many more events, we hope that you enjoy the newsletter.



Jarlath Molloy
jarlathmolloy@gmail.com



Hugh Mortimer
Hugh.mortimer@stfc.ac.uk

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

Dear members of the Environmental Physics Group, As you may or may not know, the Institute of Physics is moving from its current location, 76 Portland Place, to a new dedicated building complex in Kings Cross. The relocation of the Institutes headquarters is an exciting milestone for the organisation as it will hopefully secure the future by locating itself in a purpose built building that will meet the needs of the Institute for many years to come. The new premises will provide a greater opportunity to engage with the public while providing us (the members) with a building dedicated for our needs. The new site has been purchased and the IOP, along with their architects are in the process of finalising the design of the new building. The move will take place over the next two years and will be staged process so that we minimise the disruption to the working life of the IOP.



Also the EPG is making some changes of its own. We have always been one of the most active groups within the IOP and as such have used our budget wisely to maximise the number of events that we host. However, last year saw a budget cut to all of the groups and so in an attempt to maintain the quality and the number of events that we organise, we have decided that in some meetings we will charge a small fee to cover meeting costs that are incurred. In doing this we will endeavour to always minimise this fee but for the events that we do charge for we will ensure that quality is exceptional and well worth the small fee. If this is a difficulty for anyone, please let me or the event organiser know, and we will try to help.

I hope that you enjoy the newsletter

Hugh Mortimer - Chair EPG

P.S. For those keen writers, our annual essay competition is still open. All entries need to be received by February 28th (just after the half-term holidays!). See page 18 for more details.

Reports from Previous EPG Events

Higher education and environmental physics Run jointly with the IOP Higher Education Group *Institute of Physics, Portland Place, London* *Wednesday 4th December 2013*

Run jointly with the IOP Higher Education Group and the Higher Education Academy (HEA), this event was aimed at experienced and new practitioners who teach environmental physics. The aim of the day was to help to give participants exemplars showing how environmental physics is currently incorporated into undergraduate physics degrees. Five speakers led to day, with topics ranging from environmental physics degrees and modules to choosing the right words to explain physics to students.

The day was started by Paul Yates who gave an overview of the HEA and the opportunities for UK PI's within the Physical Science remit. He reminded participants of funding opportunities and prizes that support STEM issues and encouraged the audience to consider applying for small grants to facilitate new collaborations and develop new teaching paradigms. This talk was followed by *Mathew Owens (Reading)* who discussed the rationale behind the new BSc course in environmental physics (Oct. 2014). Although there are no core physics modules within the degree programme; fundamental physics concepts are to be taught through environmental applications and examples. Other elements include a strong laboratories and data analysis component and an emphasis of example based learning. The emphasis on environment applications, however, limits the opportunities to cover all the components of an accredited physics degree, but the audience was impressed with the physics examples highlighted.

A stimulating presentation *from Gordon Aubrecht (Ohio State)* highlighted how the information gap fed into public misunderstanding and entrenched views on a wide range of environmental topics. He discussed how we, as physicists, interact with the wider environmental debate. Filling the information deficit with scientific information is not sufficient to engage with the wider public and the choice of language used by scientist when talking with other scientists can actually confuse the wider discussion. The issues of framing, confirmation bias, plausibility and proximity matters all resonate with the public and are key concepts to the delivering a strong and coherent message. The importance of incorporating these ideas within the UG teaching environment was a key point that sparked a lively debate during the lunch break.

After lunch the afternoon session, began with a talk by *Peter Hughes, (Westminster Kingsway College)* who described the role of the

environmental physics group and the history of environmental physics research and teaching in the UK. He described how environmental physics had been in the A-level syllabi for several exam boards in the 1990s but this seemed have drifted out of the curriculum. He stressed the enthusiasm of students when tackling these issues and their engagement with physics more widely when appropriately framed and serves as an excellent tool in helping students transit across the secondary-tertiary boundary.

The meeting continued with two talks describing how environmental physics could be incorporated into a physics programme through individual modules. *Tony Arber (Warwick)* teaches power generation to physicists as a 2nd year optional module taken by ca. 100 students. The module covers standard physics content and explains the physics behind power generation using physics they have already learnt and applying it other areas. This forms the basis of the examined content. Wider discussion on the ethical and moral issues are discussed in class, but are not examined. The wider aim of the course is to enable students to make informed decisions on power technologies. *Stefan Hild (Glasgow)* covers similar areas and is taken in year 4 or 5 as an elective module. The course is split 70% final exam; 30% case study. The latter is based on relevant examples and is expected to include moral and ethical issues. Both these elective courses make use of topical issues in the news and online to motivate the lectures and wider discussions.

The meeting finished with all the speakers engaging with the audience in a panel discussion. A key point highlighted in the discussion is that the nature of science and how we train our undergraduates is an important area and one we don't teach enough. A wide ranging discussion on where environmental physics fits into a usual physics degree programme ensued. The discussion included how environmental physics could be a mechanism for incorporating broader discussions on the scientific method and scientific communication in general. It was recognised that a contextual basis of learning allows for the nature of science to be achieved, but can be slower in teaching physics when applied; but does get students engaged. No clear strategy emerged as to the best route for teaching environmental physics, but the suitability of the topic for forming stimulating examples and as a tool to tackle wider issues was recognised by all the ~40 attendees.

Thomas Hase and Antje Kohnle

The Earth's Climate Past, Present and Future – REMS AT HOME

Institute of Physics, Portland Place, London

Thursday 9th January 2014

Twice a year the retired members of the London and South East Branch of the IOP (REMS) hold a one day meeting in London. These meetings provide an opportunity for REMS to listen to talks of general interest or on specific themes as well as providing a convivial social event. The topic for January was the Earth's Climate Past, Present and Future. Help in choosing speakers was obtained from our sponsors the RMetSoc History Group and the IOP Environmental Physics Group.

The meeting welcomed by Paul Hardaker CE IOP, attracted an audience of about 80 members. There were six 40 minutes talks including question time.

Chris Folland gave the first presentation. The talk drew on recent results of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The main radiative component driving climate variability is the atmospheric absorption by carbon dioxide distributed uniformly throughout the atmosphere. He explained from a variety of sources that a graph of CO₂ and temperature could be derived covering the Eocene period (circa 50 million years ago) to the present and that the global surface temperature was 10o C warmer than today and CO₂ was around 1000pm (cf ~400 ppm today).

The second speaker John Mitchell explained how the IPCC was set up and how it achieved its object of “assessing on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation”. The scientific reports were reduced to an “executive summary” in discussion with politicians.

Tim Palmer explained that forecasting weather and climate was a chaotic process, which leads to loss of predictability and a better approach is to use ensemble techniques because small changes in the initial conditions can lead to radically different forecasts and the best forecast was to express the outcome in terms of probability.

After lunch Ian Strangeways explained the various observational techniques used to monitor the basic climate parameters of temperature, precipitation and wind. The audience proved that it was alert by the number of questions and comments his talk generated.

Simon Buckle tackled the questions of response to the findings of the IPCC and the drawn out process of using the executive summaries as a basis for ongoing Intergovernmental Protocols . The 1997 Kyoto Protocol established legally binding obligations for developed countries to reduce their greenhouse gas emissions. In 2010 the Cancún agreements stated that future global warming should be limited

to below 2.0 °C relative to the pre-industrial level. How this will be met is work in progress!

The last speaker Shanti Majithia discussed the impact of climate parameters on resilience of the infrastructure used by the power distribution industry and on upgrades planned over a rolling 70y timeframe. This includes overhead transmission lines, buried cables, design of sub stations and siting of generating facilities.

David Pick

Photonex13 - The Space Applications

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

Wednesday, 16th October 2013



The Photonex conference is aimed at bringing together all aspects of industry and research. Based at the Ricoh Arena in Coventry, the event provides an opportunity for researchers and industrial

companies meet and to discuss the new research and news from the area of photonics.

The Space Applications meeting at Photonex13 was supported by the IOP Environmental Physics Group and the Satellite Applications Catapult and the enabled this meeting to be free to attend. The funds also enabled us to extend an invitation to present a key note talk from speaker by Sam Adlen from the Satellite Applications Catapult which was very well received by the audience. The selection of other papers was also particularly good, which ensured delegate attendance and both useful, topical content.

Overall the Photonex visitor numbers were up by 25% and we had an amazing response to the Satellite Applications meeting. We had 112 attendees register to attend this meeting, and numbers varied from 30 to 39 for each presentation over the course of the day. To put this in context, this was the third largest attendee rate of all the Conference meetings in 2013.

We are planning to run this meeting again in 2015, and will endeavour to again bring together leaders in industry, research institutes and universities to discuss the latest technology developments and new applications in optical metrology.

Brenda Hargreaves and Hugh Mortimer

The science behind our cultural heritage

Wednesday 23rd October 2013

Institute of Physics, 76 Portland Place, London

Run jointly with the London and South-East branch and the Royal Society of Chemistry's Environmental Group

Dr Nigel Blades, National Trust, and Joseph Padfield, National Gallery

When we visit a historic house or art gallery we often take for granted the objects on display, without thinking about how they are preserved or how they change throughout the centuries. These twin talks provided a fascinating evening of interdisciplinary science in trying to understand these issues. A joint event with the Royal Society of Chemistry's Environmental Group, and the IOP London and South East / REMS branches, this successful evening was attended by 50 people.



Dr Nigel Blades started off the evening describing the challenge the National Trust faces. With over 1 million objects to display and 150 museums, controlling the temperature and humidity of their surrounding environment, whilst making houses accessible to visitors is sometimes difficult. Nigel explained how important relative humidity is: This is the relationship between the moisture content of the air and the content of the

material they are trying to protect. Get it wrong, you could end up with a mouldy painting, cracked lacquer, or warped wood. Get it right, and the visitors won't even notice. Ideally a relative humidity is needed between 40% and 65% to keep artefacts in tip-top condition.

One fun aspect of this presentation was learning about the National Trust properties I had had visited, and the numerous little boxes seen inside various houses taking environmental measurements. Nigel explained how sensors around the property record temperature and relative humidity, and how these can be seen to vary throughout the year. Staff at the properties can vary the temperature to change relative humidity to help to preserve artefacts. Dr Blades took the example of Knole, Sevenoaks in Kent. Knole is a lovely, large property (well worth a visit, especially to see the surrounding deer park!) with 14 purpose-built panelled rooms designed to display painting and furniture. Built in an era of no central heating, Knole is a typical well ventilated property accustomed to cool temperatures. In a cool, gallery environment, some environmental problems can be kept at bay, but when moved to a warmer, more humid environment issues can emerge. This happened with one artefact, where larvae, which had remained

dormant in wood for many years, suddenly emerged as adults and the artefact was infested with small beetles, as with the warmer temperatures the larvae hatched thinking it was spring.

It is not just the houses' artefacts that require preserving, but the buildings themselves. In Dunham Massey, Cheshire (another lovely house with a deer park), Victorian-designed radiators kept parts of the house warm. Now because the Victorians believed in fresh air, as at the bottom of a radiator mounted on an exterior wall, there was a vent directly connected to the outside. Cold air would come through the vent, which then was warmed by the radiators, providing heat to the room. The problem is that if it is very cold outside, the incoming air could be rather chilly, and this became a problem at Dunham Massey. Unknown to staff, a radiator of this type existed, and in the very, very cold winter a few years ago, where temperatures reached -19°C , the cold incoming air made the radiator so cold, the water inside it froze, and burst the radiator. Buildings such as this, keep National Trust staff busy as they try to preserve them and the cultural heritage they contain, within a changing environment.



Joe Padfield on the other hand works in a much more controlled environment, but he is a man with a problem. How do you display paintings in an efficient, well-lit environment so they can be seen, when light can potentially cause much damage, such as fading, to them? Fortunately, unlike the National Trust, the National Gallery only

has to consider a few thousand masterpieces, yet these paintings are irreplaceable and of international importance. How paintings are illuminated is a complex problem, and this was a major news item in early 2013. Newspaper headlines stated that the sunflowers in van Gogh's famous painting were browner than first painted due to damage from LED lighting, but was this claim really true? Joe went onto explain how by taking tiny samples, a few tens of microns across, and viewing them under a microscope, conservationists can see how paint changes and fades. In the case of case of van Gogh's 'chrome yellow' sunflowers, the coating had indeed become browner with time. But were LED lights really to blame? Throughout the lecture, the audience learnt about the different parts of the visible spectrum, and how lighting from parts of the spectrum can cause damage. In the case of the LEDs, they were not convicted of wrong-doing, rather it was ambient light throughout the years that caused the sunflowers to fade. Indeed, in a study at the National Gallery, LEDs were seen in a positive light and are more energy efficient compared with other forms of illumination. You can find out more about spectral power distribution of light and Joe's research at the National Gallery web pages: <http://research.ng-london.org.uk/scientific/spd/>

Apart from the problems of yellow in paintings, Joe explained about how a whole rainbow of colours in pigments used in paintings can be affected by light. For example, in one painting several hundred years old, there was a lady looking into

a dull grey sky. Yet when samples and chemical analysis was undertaken, they found the sky in fact started off bright blue. So, if light can change the colour of the painting, it may portray a whole different meaning. They say a picture is worth one thousand words, but over the years it may take over one thousand words to describe what has happened to the picture! So next time you visit a gallery or historical property, take a careful look at the ambient environment to see how it could influence the artefacts you see – there may be more science going on than what you think.

With thanks to EPG member Brian Davies for organising this event.

Sally Brown

Charged Aerosols

Institute of Physics, 79 Portland Place, London

Thursday, 14 November 2013

The second Focus Meeting of the Aerosol Society was co-organised and supported by the electrostatics and environmental physics groups of the Institute of Physics and held at the IOP building in London, UK, in October 2013. The meeting was attended by 25 delegates, including two invited speakers and six proffered talks.

The morning session began with an invited talk by Professor Wamadeva

Balachandran from Brunel University titled *The effect of electrostatic charge in the pharmaceutical industry*. The talk covered a variety of topics including the numerical deposition of particles in the human lung and the charging of particles emitted from inhalers. The following talk by Ari Ukkonen of Dekati continued the theme by presenting measurements of charge from a dry powder inhaler using the Dekati ELPI and their new instrument, the Dekati Bipolar Charge Analyzer (BOLAR).

Mr Sarda-Estève (CEA/LSCE France) demonstrated a new light portable device, the BIODOSI, that has been developed to detect particulates using electrostatic precipitation. Results from environmental testings, and analysis of collected substances were presented. Dr Charlie Mahoney from the University of Ulster spoke about the detection of airborne micro-organisms by injection into a plasma. Results from experiments detecting pollen grains were presented.

The afternoon session was more focussed on environmental topics, beginning with the second invited talk of the day from Professor Ken Carslaw from the University of Leeds, titled *Ion-induced particle nucleation and the CERN CLOUD experiment*. Professor Carslaw's talk presented results from a controlled



environmental chamber that made use of a proton synchrotron beam at CERN to control the level of ionisation. The talk further discussed the implications for ion induced nucleation on climate. Before a final tea break, Dr Keri Nicoll from the University of Reading discussed possible mechanisms of self-charging within the plume of the Grimsvöten eruption in Iceland. Laboratory experiments on ash samples from the plume demonstrated possible charging of aerosol through triboelectrification.

The final two talks of the day discussed some fundamentals of aerosol charging. Mr James Davies from the University of Bristol spoke about the fundamental properties of aerosols from experiments on single particles, and the implications of charge. Dr Adam Boies of Cambridge University presented measurements of the mobility distribution of various bipolar aerosol chargers (radioactive, x-ray and electrical) and showed that the mobility distributions differed in each method of charging.

The intention of the meeting was to bring together researchers from disparate fields of aerosol science who had worked with electrostatic charge, and the day attracted delegates who worked in areas including environmental sciences, medical sciences, and instrumental development. Each talk was well received and generated good discussion.

The Role of Remote Sensing in Assessing Environmental Impact.

Grantham Institute, Imperial College

Wednesday, 30th October 2013

The Key Note Talk was given by John P. Burrows from Bremen entitled "Remote Sensing of trace gases from Space." He discussed the Global Ozone Monitoring Experiment (GOME) aboard the European ERS-2 satellite which has been taking measurements to observe the changing behaviour of the stratospheric ozone layer, important for the absorption of biologically damaging UV radiation. In addition, GOME is probing the troposphere and making measurements of relevance for pollution and air quality. GOME is the forerunner and smaller version of SCIAMACHY (SCanning Imaging Absorption Spectrometer for Atmospheric CHartography). Both instruments are spectrometers designed to measure sunlight, transmitted, reflected and scattered by the Earth's atmosphere or surface in the ultraviolet, visible and near infrared wavelength region and these



were discussed. Numerical inversion of these spectra yields the amounts and height distributions of atmospheric constituents. GOME has now made over seven years of successful measurements, whereas SCIAMACHY was launched aboard the ESA ENVISAT earth observation satellite on February 28, 2002.

Roland Leigh (University of Leicester) gave a talk entitled "Climate Change Adaptation." The field of Climate Change Adaptation Technologies draws upon a wide range of academic and industrial disciplines to identify and create solutions to challenges created by climate change. Roland discussed many of the current challenges, include implications of changes in temperature and rainfall patterns, with consequent knock-on effects on key systems including agriculture, hydrology and atmospheric chemistry. Roland's current research is predominantly focused on urban management systems, with particular reference to transport and air quality in the Leicester area, and he gave several examples of this in his talk besides introducing the use of thermal imaging in his latest project.

John Remedios (Leicester) gave a talk on the topic of "Satellite remote sensing of surface temperature change in recent decades". John explained that characterisation of surface temperature change remains one of the hot topics of climate change, especially given the observations of the last decade. His talk explained how satellite observations are contributing to our understanding of surface temperatures and provide recent results demonstrating the accuracy of these data sets for climate studies. Global means of satellite data compare well to determinations of sea surface temperature change from in situ data, giving us increased confidence in current historical analyses.

Helen Brindley (Imperial College London) spoke on "Climate monitoring from space: a new perspective? "

Her talk led on thematically from the previous speaker's content and provided a short insight into the way measurements from passive space-based sensors can provide a basis for the understanding and analysis of climate change. She provided examples of climate questions that have been addressed through the use of these data but also highlighted difficulties that are inherent in constructing climate quality space-based records. Helen also discussed proposed initiatives that may help to resolve some of these difficulties in the future.

Obinna Anejionu from Lancaster University provided an interesting talk on the use of satellite imagery in his talk

"Satellite Mapping of Gas Flares in the Niger Delta". His presentation looked at the use of remote sensing to evaluate the environmental impact of gas flaring in the Niger Delta Region of Nigeria, He is especially interested in environmental application of remote sensing and spatial analysis in developing regions. As the only PhD student presenting at the Grantham Institute's event he was not at all daunted by the high calibre and experience of the other speakers, and gave an equally stimulating talk of his own!

Aviation and turbulence in the free atmosphere.
Imperial College London, South Kensington Campus, London,
Wednesday, 15th January 2014

The Royal Meteorological Society special interest group on Aviation Meteorology held a meeting on the topic of turbulence in the free atmosphere on 15 January 2014 which was supported by the Environmental Physics Group. The organiser, Bob Lunnon, introduced the importance of being able to forecast turbulence for both safety reasons and to reduce the operational delays and the costs incurred. Six speakers presented their work on the state of turbulence research highlighting where advances have been made and where further work is required in the future. The Royal Meteorological Society special interest group on Aviation Meteorology originated this meeting at Imperial College, on the topic of turbulence in the free atmosphere. The organiser, Bob Lunnon, introduced the importance of being able to forecast turbulence for both safety reasons and to reduce the operational delays and the costs incurred. He highlighted the existing aviation forecasts produced by the Met Office's World Area Forecast Centre and the SIGMETs which are provided on a regional basis by the local meteorological organisations. The afternoon's first talk was from Bob Sharman of NCAR. He identified three main areas for improvement in future turbulence forecasting; the provision of observations on an aircraft scale; better nowcasting and forecasting capabilities; and finally enhanced understanding of the underlying mechanisms for turbulence in all its forms.

This led on to his work on the GTG (Graphical Turbulence Guidance), which combines an ensemble for clear air turbulence (CAT) predictors into a single product and has been used over the USA and more recently globally.

The diagnostics used are converted to eddy dissipation rate (EDR), an ICAO standard for turbulence monitoring which is aircraft independent. Verification using PIREPS and aircraft automatic observations shows that the GTG consistently performs better than any individual diagnostic.

In understanding the nature of CAT, parametrisation is used because we do not yet have the capability of sub aircraft scale modelling. As a consequence, EDR is not calculated directly from a model but instead from the parametrised diagnostics.

Paul Williams from the University of Reading referred back to classical fluid dynamics in the first part of his talk to describe turbulence and how it manifests itself. In laboratory testing it was shown that even in a neutrally stratified atmosphere (where the Richardson number is $>1/4$) it is possible for Kelvin–Helmholtz instability to form in a region and cause turbulence where it may not have otherwise formed. The source of turbulent events often is many hundreds of miles from where turbulence is experienced, demonstrating that gravity wave propagation is a feature requires further research.

In the second part of his talk Dr Williams explored the theory that the change in our climate resulting from a doubled CO₂ atmosphere may have altered the number and severity of CAT cases, particularly in relation to North Atlantic air traffic. He noted that historical data sets may indicate that there has already been an increase in turbulence, other factors such as the way the observations are made and how the data is reanalysed could have an impact. He has used the CMIP3 model data which is known to represent upper air winds well. His analysis of a range of different CAT diagnostics showed that, in every case, there was an increase of the median turbulence value by 10-40% and the extremes by 40-170%. This increase in turbulent events in a doubled CO₂ world was featured heavily in the world's media.

From modelling and laboratory testing the talks moved to the European funded project DELICAT which is due to finish in April 2014. Patrick Vrancken from the German Aerospace Centre (DLR) described the project and its aim of using an aircraft mounted LIDAR to identify CAT 15-30km ahead of the aircraft.

Jacek Kopeć from the University of Warsaw, was part of the meteorological component working on generating a climatology of CAT over Europe which found that the winter months show a greater likelihood of encountering CAT than during the summer. They also used forecaster and model forecasts of CAT to determine where to fly during the flight trails in summer 2013. Due to the timing of the trials, very little turbulence was forecast and what was experienced was predominantly classified as light.

The results of the project are still being finalised but the major conclusions show that there is some correlation with the RMS LIDAR data and that of the direct observations. During the talk the many obstacles that needed to be overcome were highlighted, such as getting approval for a forward facing LIDAR on the aircraft, the cooling system requirements and the complexity of taking observations from an aircraft. Research has come a long way since LIDAR was first considered for turbulence identification and DELICAT is helping further the potential of this type of warning system.

Moving on to the future of forecasting in the UK, the Met Office's Piers Buchanan presented Phil Gill's presentation on verification of turbulence and the use of ensembles. The Met Office has access to observations from some 747-400s aircraft. From these observations, turbulence climatologies are formed. The Met Office Ensemble Prediction System has been used in a trial and is expected to be used by WAFC forecasters to forecast turbulence in the near future. Similar to the GTG, a number of CAT diagnostics are used along with an ensemble of models with slightly different initial conditions. The output offers uncertainty estimates of the CAT likelihood rather than categorisation of CAT strength.

The combination of the predictors, ensembles and climatology for CAT forecasting generated better statistical skill and relative economic scores than individual predictors.

Finally identifying turbulence through satellite monitoring was investigated in a talk by Peter Francis of the Met Office. His work primarily looked at overshooting tops

in deep convective storms and the associated gravity waves and wind shear associated with such events which can propagate many hundreds of miles from the source. The satellite used for the identification of the convective tops was Meteosat Second Generation which was able to make use of all available wavelengths to identify the physical shape and structure of the convection but also the temperature at the top of the cloud mass.

In the future, Meteosat Third Generation will have a significantly higher refresh rate and resolution that will enable the transient nature of overshooting tops to be tracked by the satellite technology. An animation clearly demonstrated the benefits of the new generation where the gravity waves propagated out from a storm cell over several hundred miles which indicated the impact gravity waves can have on aviation.

The closing remarks concluded that there is a wide range of research investigating all types of turbulence which affect airline operations. Ensembles and multi use predictors pave the way to future turbulent predicting methods for forecasting a few minutes ahead out to several days which will benefit all of aviation.

Lauren Reid

Forthcoming Environmental Physics Group Events

Climate Change 2013. The physical science basis

Institute of Physics, Portland Place, London

Wednesday 5th February 2013

The Summary for Policy Makers of the Working Group 1 contribution to the fifth Assessment Report of the Intergovernmental Panel on Climate Change (AR5) was published in September 2013 and the full report will be published for the first time in January 2014. To mark this event, and to celebrate the large UK contribution to the report, a one day science meeting will be held on Wednesday 5th February 2014 at the Institute of Physics, Portland Place, London. Lead Authors of the report will present key new findings of the AR5, and the associated evidence base, also highlighting outstanding research challenges. The target audience is the UK climate science community and other interested scientists. The meeting is being organised by the National Centre for Atmospheric Science, the Met Office, the Royal Meteorological Society and the Environmental Physics Group of the Institute of Physics

Stefan Thor Smith s.t.smith@reading.ac.uk

The Environment - REMS CEH Wallingford visit ***Centre for Ecology & Hydrology, Wallingford, Oxon. OX10 8BB.*** ***Thursday, 10th April 2014***

This meeting has been organised by Val Woods (CEH), Sally Brown (EPG) and George Freeman (REMS). REMS (Retired Members Section) had a very interesting visit to CEH a few years ago and this meeting will enable us to discover more about their research, together with aspects of the work undertaken by physicists associated with the Environmental Physics Group.

This meeting is open to visitors – it isn't just for the retired! There will be a charge of £17 to cover basic costs and refreshments. Lunch is a hot buffet locally sourced and ecologically produced where possible.

Please check the calendar on the EPG website where there are further details. These will be updated nearer the meeting. For more information, and initial registration, please contact George Freeman by email, georgefreeman@georgefreeman.force9.net. George will be able to send you an application form, menu and further information about the day / speakers.

The Climate, the Environment and the Press

Royal Astronomical Society, Burlington House, Piccadilly, London,
Thursday, 27th March 2014

The aim of the event will be to bring together environmental scientists, journalists and science communicators to discuss the ways in which climate science can be communicated more effectively in the press and what the scientists can do to present their work more effectively and how they work together with public engagement officers, journalists in order to ensure that they are conveying the correct message

Hugh Mortimer hugh.mortimer@stfc.ac.uk or
Dawn Stewart dawn.stewart@iop.org

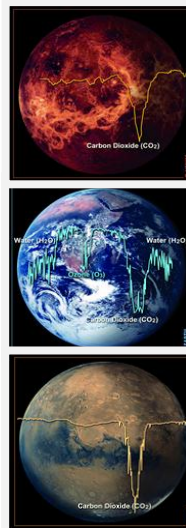


Environmental Physics Day – The role of physics in understanding atmospheres

**Royal Institute of British Architects, 66 Portland Place
Wednesday, 21st May 2014 – details to be confirmed**

We have decided to have a change from our annual group day this year, so will be trying a different format, mixing talks from invited speakers with that of members. Due to the new room arrangements at IOP, we are taking a little longer to organise than normal as we are getting to grips with the new system (apologies!). There will be a small charge to cover catering for this meeting (but not for the evening lecture or AGM).

For those who love to add a date and time in the diary early on, we are presently aiming to start at lunchtime, and end in the evening with a joint evening lecture with the London and South East branch, but we will confirm all by email. We also hope to have talks from our essay winners and have our AGM. Due to timing of this newsletter, we will distribute the AGM notice via email. If you do not have email access at all, please contact group secretary Sally Brown who will post you out a copy.

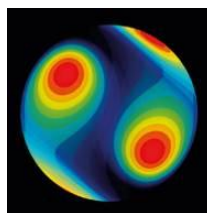


Forthcoming IOP Events

Photon14

**Imperial College London, London, SW7 2AZ, UK
Monday, 1st – 4th September 2014**

Photon14 is the largest optics conference in the UK and the seventh in the series; following Photon02 (Cardiff), Photon04 (Glasgow), Photon06 (Manchester), Photon08 (Edinburgh), Photon10 (Southampton) and Photon14 (Durham). Photon14 will be held at Imperial College London.



Photon is an umbrella conference series embracing a number of important and interconnected constituent conferences with fascinating overlaps and a common social programme

Other Activities

The 8th Annual Environmental Physics Group Essay Competition.

Closing date: 28 February 2014

The annual Institute of Physics Environmental Physics Group essay competition is now open for entries. Entries can cover any aspect of environmental physics. The competition is open to all with prizes in two categories for Years 7-13 and undergrads, postgrads and beyond.

Prizes

Cash prizes of up to £200, plus a certificate and consideration for publication. All entrants will receive free IOP membership for three months. Entries must be original and will be judged on writing quality and content.

Entries and enquiries should be e-mailed to **env.essay@physics.org**. Further details can be found at **<http://env.iop.org>**.

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



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.

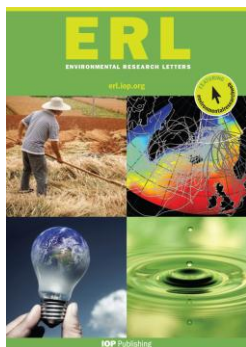
Apply for up to £250 during the course of your PhD.

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

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Environmental Research Letters and *environmentalresearchweb* News



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Julia Pongratz,
Max Planck Institute for
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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 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 you short stories/news items to me [**hugh.mortimer@stfc.ac.uk**](mailto:hugh.mortimer@stfc.ac.uk) and I will choose one lucky article that will be printed in the newsletter.

EPG Committee

Chair: Dr. Hugh Mortimer		RAL Space, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon, OX11 0QX. Tel: 01235 446746 e-mail: hugh.mortimer@stfc.ac.uk
Treasurer: Dr Mhairi Coyle		CEH Edinburgh, Bush Estate, Penicuik, Midlothian, EH26 0QB. Tel: +44(0) 131 445 8574. Fax: +44(0) 131 445 3943 e-mail: mcoy@ceh.ac.uk
Communication (Secretary): Dr Sally Brown		Faculty of Engineering & the Environment, University of Southampton, Highfield, Southampton, SO17 1BJ. Tel: 02380 594796, Fax: 02380 677519 e-mail: sb20@soton.ac.uk
Dr Chris Lavers		University of Plymouth at Britannia Royal Naval College, College Way, Dartmouth, Devon, TQ6 OHJ. Tel: 01803 677218 Fax: 01803 677015 e-mail: brnc-radarcomms1@nrta.mod.uk
Dr Alec Bennett		Biral, PO Box 2, Portishead, Bristol. BS20 7JB Tel: 01275 847787, Fax: 01275 847303 e-mail: alec.bennett@biral.com
Dr Hugh Deighton		Space , CGI Keats House, Springfield Drive, Leatherhead, Surrey, KT22 7LP Tel. 07767 233723 e-mail. hugh.deighton@cgi.com
Dr Simon Buckle		Grantham Institute for Climate Change, Imperial College London, South Kensington Campus, London SW7 2AZ Tel: 020 7594 2620 email: simon.buckle@imperial.ac.uk

Dr Jarlath Molloy		Climate Disclosure Standards Board 40 Bowling Green Lane, London, EC1R 0NE, Tel: 02074157185, e-mail: jarlathmolloy@gmail.com
Dr Paul Green		National physical laboratory, Hampton road, Teddington, Middlesex, TW11 0LW e-mail: paul.green@npl.co.uk
Dr Claire Ryder		Department of Meteorology, University of Reading, Earley Gate, PO Box 243, Reading, RG6 6BB Tel: 0118 3788344 e-mail: c.l.ryder@reading.ac.uk
Dr Stefan Smith		School of Construction Management and Engineering, Whiteknights, PO Box 219 Reading. RG6 6AW. Tel: 0118 3788569 e-mail: s.t.smith@reading.ac.uk

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.

The Institute of Physics, 76 Portland Place, W1B 1NT, UK.

Tel: 020 7470 4800

Fax: 020 7470 4848