NEWSLETTER ON ATMOSPHERIC ELECTRICITY

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INTERNATIONAL COMMISSION ON ATMOSPHERIC ELECTRICITY (IAMAS/IUGG)

AMS COMMITTEE ON ATMOSPHERIC ELECTRICITY

AGU COMMITTEE ON ATMOSPHERIC AND SPACE ELECTRICITY

EUROPEAN GEOPHYSICAL SOCIETY

SOCIETY OF ATMOSPHERIC ELECTRICITY OF JAPAN

The Newsletter on Atmospheric Electricity being sent by e-mail, those colleagues needing a paper version should contact Serge Soula: (serge.soula@aero.obs-mip.fr) or Pierre Laroche: (Pierre.Laroche@onera.fr). They will receive the Newsletter by regular mail. Those knowing anybody who needs such a paper version are also welcome to contact us. On the other hand, the easiest way to communicate being electronic mail, we would be grateful to all of those who can help us complete the "atmospheric electricity" list of email addresses already available. All issues of this Newsletter are available on the website of the International Commission on Atmospheric Electricity:

http://www.atmospheric-electricity.org/

This site includes information on the new International Commission of Atmospheric Electricity and on the next ICAE Conference. During the 2003 conference in Versailles several Commission meetings were held to choose the venue of the next conference and to elect new members and new Officers. The next Conference will be held in 2007 in Beijing, China.

We remind all our colleagues that the Newsletter remains also available on the website:

http://ae.atmos.uah.edu

thanks to Monte Bateman's help.

Futhermore our publication will be included in the online library of the SAEJ website :

http://lightning.pwr.eng.osaka-u.ac.jp/saej .

Contributions to the next issue of this Newsletter (May 2004) will be welcome and should be submitted to Serge Soula or Pierre Laroche before April 30, 2004, preferably under word attached documents. A reminder will be sent to all colleagues whose e-mail addresses are presently listed.

ANNOUNCEMENTS

NEWS FROM THE COMMISSION

The 12th Conference on Atmospheric Electricity was held on 9-13 June in Versailles, France. 150 scientists from 27 countries participated in this Conference. The photo of the Conference is available on the Website: http://www.atmospheric-electricity.org/
The proceedings edited by ONERA (Paris) gathered 240 selected papers.

During the conference in Versailles several Commission meetings were held to choose the venue of the next conference and to elect new members and new officers.
The next ICAE Conference, will be held in **2007 in Beijing, China**.

Several members of the Commission stepped down:

Lothar H. Runhke, USA, former Commission President,
Hannes Tammet, Estonia
R. Jayaratne, Botswana
Serge Chauzy, France, Secretary of the Commission

Many thanks to all of them for their participation to the commission and a special thank to Serge Chauzy who just achieved a tremendous work as Secretary of the Commission.

New members were elected:

James E. Dye, USA
Xiushu Qie, China,
Serge Soula, France
Osmar Pinto, Brazil

New Honorary members:

Lothar H. Runhke, USA
Hannes Tammet, Estonia
Toshio Ogawa, Japan

New Officers:

Serge Soula, France, has been elected as Secretary of ICAE

Pierre Laroche, France, has been re-elected for a second, and last term, as President of ICAE

For more information about ICAE see the website: http://www.atmospheric-electricity.org/

AWARDS

The National Lightning Safety Institute (NLSI), Louisville CO announces the 2003 recipients of the Annual Lightning Safety Recognition Awards. Recognized are those groups and individuals who provide leadership for lightning safety issues and who serve as role models for others. This year's Awards are in several categories:

US Government Service (Organization) Award
The NOAA Lightning Safety Awareness Week (LSAW) Team.
For three years of initiative in developing effective campaigns which have achieved heightened awareness about lightning safety throughout the USA. See*: www.lightningsafety.noaa.gov*

US Government Service (Individual) Award
Steve Hodanish, NOAA Warning Coordination Meteorologist Pueblo Colorado. For accomplishments in promulgating lightning safety information through the Pueblo NOAA website *www.crh.noaa.gov/pub/LTG.html* and for personal volunteer efforts with local, state and federal groups.

Individual (International) Award
Hartono Zainal Abidin, Lightning Research Sdn Bhd, Kuala
Lumpur Malaysia. For conclusive studies into conventional and unconventional engineering practices for lightning protection as they apply to the Malaysian infrastructure and for leadership within the local, national and regional IEEE organizations. See more information at: *http://202.186.86.35/special/online/hartono/default.html*

Individual (International) Award
Chandima Gomes PhD, Dept. Physics, University of Colombo Sri Lanka. For leadership in hosting educational conferences about lightning safety issues in Sri Lanka and the South Asia regional area and for teaching excellence at the University of Colombo Department of Physics. Further details may be read at: *www.sundayobserver.lk/2005/05/18/new25.html*

FELLOWSHIP

V.A. Rakov has been elected Fellow of AMS "for outstanding contributions to the atmospheric or related oceanic or hydrologic sciences, or their applications, during a substantial period of years" and Fellow of IEEE "for contributions to the understanding of lightning discharge phenomena"

NEW BOOK

New Monograph: "Lightning: Physics and Effects", Cambridge University Press, 687 p., 2003, V.A. Rakov and M.A. Uman. Available at :
http://titles.cambridge.org/catalogue.asp?isbn=0521583276

CONFERENCES

2003 AGU FALL MEETING

The 2003 AGU Fall Meeting, sponsored by the American Geophysical Union, is held 8 – 12 December 2003 in San Francisco, California, U.S.A. For detailed information, contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC, 20009 USA; Phone: +1-202-462-6900; Fax: +1-202-328-0566; E-mail: meetinginfo@agu.org; Web Site: www.agu.org/meetings.
For the session in *Atmospheric and Space Electricity* : Dennis J. Boccippio, NASA MSFC, 804 Wells Ave., Huntsville, AL 35801, USA; Tel: +1-256-539-8406, E-mail: Dennis.Boccippio@nasa.gov
For the program of the of the session *Atmospheric and Space Electricity* see on the Web site www.agu.org/meetings.

EUROPEAN GEOSCIENCES UNION (EGU) 1ST GENERAL ASSEMBLY

The first general assembly of the EGU will be held in Nice (France) from 26 to 30 April 2004. The Sponsors are EGU and AGU.
Contact: EGU Office, Max-Planck-Str. 13, 37191 Katlenburg-Lindau, GERMANY ; **Phone:** +49-5556-1440; **Fax:** +49-5556-4709; **E-mail:** egu@copernicus.org; **Web Site:** www.copernicus.org/EGU/EGU.html;
Abstract Deadline**:** 11 January 2004
A session in Solar and Terrestrial Sciences : ST6 Solar and heliospheric influence on the Earth's weather and climate (co-sponsored by CL). Convener: Füllekrug, M.

6th IWPL (INTERNATIONAL WORKSHOP on PHYSICS of LIGHTNING)

The 6th IWPL will be held in Saint-Anne, Guadeloupe, France on 3-9 May, 2004. The deadline for reception of abstracts is January 15, 2004.
The sessions of this workshop will be:
1- Atmospheric Electricity and Thunderstorm Electrification
2- Lightning Phenomenology and Meteorology
3- Lightning Discharge
4- Lightning Detection and Protection
5- Lightning and Human beings (this session will be held at Pointe à Pitre University)

For Information :
APERI, Att. Gérard Berger,
28, Résidence La Vallée, 91120 PALAISEAU, France.

By Fax & e-mail :
Gérard BERGER : +33.1.69.85 17 99 e-mail : gerard.berger@lpgp.u-psud.fr
Nicolas FLORET : +33.1.47.78.45.95 e-mail : nicolasfloret@wanadoo.fr

2004 COSPAR

The 35th COSPAR SCIENTIFIC ASSEMBLY will be held in Paris, France, *(18 - 25 JULY 2004),* with a Symposium (C2.4) on *Atmospheric Electrodynamics and Climate Change* probably on either 19 or 20 July 2004. Professor Michael J Rycroft is MSO of this Symposium.
Some details of the theme of the meeting are given on page 25 of the August 2003 COSPAR Information Bulletin, Number 157, or on http://www.copernicus.org/COSPAR/COSPAR.html
The deadline for abstracts is 15 February 2004.

ICLP'2004

The 27th International Conference on Lightning Protection will be held in Avignon (France) on 13-16 September, 2004. This Conference is organized by Société de l'Electricité, de l'Electronique et des Technologies de l'Information et de la Communication (SEE) and Ecole Centrale de Lyon (CEGELY).

Conference Office Address :
ICLP'2004, SEE, 17 rue Hamelin, F 75783 PARIS Cédex 16.
Tel: 33(0) 1 56 90 37 05
Fax: 33(0) 1 56 90 37 08
E-mail: iclp2004@see.asso.fr
Wel site: http://www.iclp2004.org

Abstract submission deadline: 1st September 2003.

Topics of the Conference:
- Lightning discharge
- Lightning occurrence characteristics
- Lightning electromagnetic impulse (LEMP) and lightning-induced effects
- Lightning attachment
- Lightning downconductors and earthing
- Lightning protection of power systems
- Lightning protection and electronic systems
- Lightning deleterious effects
- Practical and specific lightning protection problems

- Lightning protection and lightning testing standards

CONFERENCE ON SEVERE LOCAL STORMS

The 22nd Conference on Severe Local Storms will be held on 4-8 October 2004 in Hyannis, Massachussets.
The deadline for Abstract submission is on 17 May 2004.
The deadline for manuscript submission is on 9 August 2004.
The Preregistration deadline is on 5 September 2004.

RESEARCH ACTIVITY BY INSTITUTION

ATMOSPHERIC ELECTRICITY GROUP (ELAT) – BRAZILIAN INSTITUTE OF SPACE RESEARCH (Sao José dos Campos – Brazil)

In last summer season (Jan-March - 2003) we continued our campaign initiated at the end of 2002 to observe sprites and stratospheric electric fields in the southeast Brazil in collaboration with the Universities of Washington and Utah State. The results showed larger (over 140 V/m at 34 km altitude) electric fields in the stratosphere (although not necessarily related to sprites) and that the phenomenon is common at this region. For the next year, similar observations are planned to the South of Brazil. Also, we continued our triggered lightning campaign recording peak current values of strokes of an altitude triggered flash with peak currents up to 45 kA. For the next summer season, we are planning to begin X-ray observations associated with triggered flashes. In the next year, it will be held in November the IV Brazilian Workshop on Atmospheric Electricity, probably in Rio.

ATMOSPHERIC ENVIRONMENT RESEARCH GROUP AT ONERA

Alain Delannoy and Alain Broc investigate the atmospheric conditions which lead to the lightning strike to aircraft over Atlantic Ocean. Two cases have been studied. The first case is associated with lightning flashes in winter over the North sea where helicopters are often struck. In this region, due to the high latitude, the vertical structure of thunderclouds is strongly different from that of summer cells of warmer countries. The second case is associated with spring thunderclouds which develop near the west coast of Portugal. For these two cases, the 3D description of the convective cell has been performed by using the French meso-scale non hydrostatic model for atmospheric simulation Méso-NH. The results compared with NOAA satellite observations are used in a microphysical dynamical and electrical 1.5 D model from University of Washington, adapted by Bob Salomon during a post-doc in the Group. This model is used to simulate the vertical electrification within the cell.

Philipe Lalande and Patrice Blanchet are currently developing a set of instruments for the observation of lightning flashes :

- PROFEO is a new 3D VHF ground lightning imaging system. The system based around Paris (France) will be in operation at the end of 2005. The system could also be moved to be included into international scientific campaigns.
- ALISDAR is an automatic lightning sensor detection and recording to be installed onboard airliners. A prototype has been successfully tested on an airbus A340-600. From this instrument, the intra-cloud lightning can be characterised.

- New more compact antennae have been designed for the ORAGES project which objective is to observe the lightning activity from space.

A PhD student, Isabelle L'Helgoualc'h, is developing a physical model of lightning flash propagation. This model is intended in a near future to deliver a simulation of the VHF radiation of lightning.

DANISH SPACE RESEARCH INSTITUTE, COPENHAGEN DENMARK

During the summer of 2003 an observational campaign was conducted over Southern Europe to observe Sprites, Jets and Elves. Instrumentation included remote-controlled, semi-automatic video cameras at the Observatoire Midi-Pyrénées, VLF receivers in France and on the island of Crete, HF receivers at 4 locations in France, and more. Simultaneously, teams in South Africa looked for optical signatures of relativistic electrons injected in Sprites, precipitating in the magnetically conjugate hemisphere. More than 130 Sprites were recorded along with some Elves and one Jet. The data are still under analysis. Some first results will be presented at the AGU Fall meeting in session AE41-B and AE42-B. The Sprite2003 team and some sample images are shown on www.dsri.dk/~neubert/sprite2003.

The EU FP5 Research Training Network "Coupling of Atmospheric Layers" was launched last November. The network is a collaboration with 11 institutions across Europe for the study of Sprites and their effects on the atmosphere and ionosphere. During the past year, 8 young scientists have been hired. The work proper will commence in November of this year. More information on the network is found on www.dsri.dk/cal.

HOLLE METEOROLOGY AND PHOTOGRAPHY (Arizona, USA)

Ron Holle (ron.holle@vaisala.com) presented several papers on lightning safety and related demographics at the International Conference on Lightning and Static Electricity (ICOLSE) in September 2003. They were presented in the Keraunomedicine sessions during the meeting.

Over 100 cases of lightning deaths and injuries that occurred during the recreation activities of soccer, baseball, golf, and camping activities around the world were summarized in Holle (2003). One recurring conclusion is that casualties occurred not only during the game or at the camping site, but also during other phases of these activities, such as practice and seeking inadequate shelter. A second general conclusion is that advanced planning was typically lacking when the lightning casualties occurred.

Holle and López (2003) identified a major shift away from agricultural and rural settings of lightning casualties 100 years ago, to urban and recreation events in recent years. Also identified were the types of shelter taken, transportation, and gender in these comparisons between centuries. Such information are useful in identifying the most appropriate audience and approaches for lightning safety efforts.

Systematic collection of lightning death information exists in only a few countries. The third presentation (Holle et al., 2003) estimated an annual worldwide total of 24,000 lightning deaths

and 240,000 injuries. These rates were found by estimating the population living in countries with lightning rates equaling or exceeding the average US flash rate. Regions were also identified that continue to have labor-intensive agriculture and mostly ungrounded housing. Factors that will increase or decrease these first simple estimates were also provided to make it possible to adjust the rates in the future with more precise information.

Recent communications:

Holle, R.L., 2003: Activities and locations of recreation deaths and injuries from lightning. Preprints, ICOLSE, 16-18 September, Blackpool, England, paper 103-77 KMI, 6 pp.

Holle, R.L., R.E. López, and B. Navarro, 2003: U.S. lightning deaths, injuries, and damages over the last century. Preprints, ICOLSE, 16-18 September, Blackpool, England, paper 103-36 KMS, 11 pp.

Holle, R.L., and R.E. López, 2003: A comparison of current lightning death rates in the U.S. with other locations and times. Preprints, ICOLSE, 16-18 September, Blackpool, England, paper 103-34 KMS, 7 pp.

INDIAN INSTITUTE OF TROPICAL METEOROLOGY – PHYSICAL METEOROLOGY AND AEROLOGY DIVISION (Pune, India)

Lightning activity over the Indian region from Satellite-based (LIS and OTD) Observations by S.S. Kandalgaonkar**,** M.I.R. Tinmaker, M.K. Kulkarni, Asha Nath and H.K. Trimbake. Indian Institute of Tropical Meteorology (IITM) is a research institute and has significant contributions in the challenging areas such as Meteorology and Atmospheric Sciences. Atmospheric Electricity is the branch of atmospheric physics, which comes under the domain of atmospheric sciences. The topic atmospheric electricity is divided into two categories of weather conditions : fair and disturbed weather. The present contribution is an outcome from the disturbed weather atmospheric electrical parameter namely, lightning. Since lightning plays an important role in the global electric circuit, it is essential to examine its distribution on annual as well as seasonal scale. With this view, the authors have taken up this study where the lighting data from the satellite (LIS and OTD) is used.

Information concerning the lightning activity in different geographical regions is of much interest both in the engineering applications and in the analysis of interaction between lightning and the earth's atmosphere. Different techniques for studying lightning activity brought somewhat a revolution with the development of sensor consisting of lightning detection and mapping systems that have been developed in past decades. Thereafter the Optical Transient Detector (OTD) mounted on Micro Lab-I Satellite was orbiting the earth since April 1995, while the lightning imaging sensor (LIS) was launched on Tropical Rainfall Measuring Mission (TRMM) in November 1997. In the present study, the authors have utilized the monthly LIS / OTD lightning flash grid ($5^o \times 5^o$) data for the period 1995-1999 / 1998-2002 over the Indian land mass region between 8-30^{o}N, and 73-86^{o}E. An attempt has also been made to examine the activity from the both satellite during the overlapping period i.e. 1998 and 1999. These data have been analyzed to obtain their total, seasonal and differential flash count variation. The results obtained from the 5 year / overlapping period suggests that there is a significant difference in the total flash

count by LIS / OTD satellite. Total flash count measured by LIS / OTD satellites is 1.76×10^5 / 8.5×10^4 (5 year period) and 6.7×10^4 / 3.1×10^4 (overlapping period) and the corresponding flash density values by LIS / OTD are 5.64 km^2 y^{-1}/ 2.6 km^2 yr^{-1} (5 year period) and 5.1 km^2 yr^1 / 2.35 km^2 yr^{-1} (overlapping period) respectively. Seasonal analysis of the flash count suggests that for all seasons during the 5 year and the overlapping period the density values obtained by LIS are observed to be higher than the OTD sensor. The analysis of differential count suggests that though the OTD satellite recorded less number of flashes during the entire as well as for the overlapping period than the LIS, the intra cloud (IC) flash count obtained from both the satellite is observed to be higher than the cloud to ground (CG) flash count. This result suggests that the region under study receives more number of IC flashes. Thus, the net results of the above studies suggest that the detection efficiency of the LIS sensor is higher as compared to OTD sensor. This result is in partial agreement with the studies made by (Bond et al., 2002).

INDOOROOPILLY MEDICAL CENTRE (AUSTRALIA)

The study of human and medical interaction with lightning is continuing happily. It is a great pleasure to report that Keraunomedicine (KM) has at last found a "conference home" as part of ICOLSE. A successful meeting of ICOLSE was held in Blackpool in September, and a significant KM stream was part of that, to the benefit of all. This stream will develop, and is set to become the focus of the KM community. I urge interested people to watch advertising and calls for ICOLSE 2005, and to attend and contribute to it. I have indicated willingness to coordinate this aspect of the meeting – c.andrews@pobox.com. Watch this space for ongoing advice of the developing major meeting in Keraunomedicine.

Part of the conference was the great pleasure of presenting a Medal of Honour to one who has contributed greatly to Keraunomedicine over many years. This was the inaugural presentation, and the first recipient has graciously given his name to the medal. It was entirely fitting that the first recipient was Dr Nobu Kitagawa, and the ongoing honour will become The Nobu Kitagawa Medal in Keraunomedicine.

In the area there is a significant crossover with the study of electrical injuries, and my activities are spread between both. At present I am working on projects like – a Handbook for applying IEC479 principles; Analysing currents flowing via the Fifth Mechansim (Streamer Current) proposed by Mary Ann Cooper and Ralph Andersen; Neural Pathways and Central Pathways including the place of the NMDA receptor in Injuries; Home Lightning Location Systems using GPS technology; and Cohort Analysis of an Electrically Injured Population.

LABORATORY OF LIGHTNING AND SEVERE STORM, COLD AND ARID REGIONS ENVIRONMENTAL AND ENGINEERING RESEARCH INSTITUTE, CHINESE ACADEMY OF SCIENCES, LANZHOU, GANSU 730000, P. R. CHINA

Observations on spectra of natural lightning have been carried out in Qinghai-Tibetan plateau and coastal area of Guangdong province in China by using a slit-less spectrograph. There are notable differences between the spectra features in the coastal area and the plateau region. Parameters like wavelength, oscillator strengths, transition probabilities, and excited energies have been calculated for the transitions related to lightning spectra. It is deduced from spectra structure and transition properties that the peak temperature of lightning discharge channel for intense stroke may be higher than the estimated value in the past and the peak channel temperature in plateau area should be lower than the value in other regions.

Radio frequency observations of CG lightning have been made using broadband interferometer. During the preliminary breakdown and step leaders process, a sequence of fast negative streamers were observed to start continually from far or farther away the start region of the flash and progress down the developing leader channel and supply negative charge that assists the leader's development. The bi-directional propagations of the lightning channel within clouds have been observed for both CG and IC discharges. Radiation field spectra of the two concurrent breakdown processes at the channel extremities are quite similar, indicating that the both may be negative breakdown and caused by the same mechanisms. The spectra shapes for different discharge processes are obvious dissimilar in the interval from 25 to 100 MHz. Radiation from the CG lightning is stronger in the lower frequency range than IC lightning.

Lightning activity on the Tibetan Plateau has been being studied by using the satellite data provided by GHCC in Huntsville and the in-situ observation data. The Satellite observations of lightning show a clear seasonal and diurnal variation in this high- altitude region. A non-linear relationship between lightning activity and monthly averaged convective available potential energy (CAPE) is found. The flash number per CAPE on the Tibetan Plateau is much larger than for other prominent lightning activity (but low-altitude) regions. The ground-based observation shows the special characteristics of both thunderstorm charge structure and the lightning activity.

Ground-based observation of NO_x generated by lightning has been carried out, and a very good correlation has been found between the E-field change and concentration of NOx. The impacts of NO_x generated by lightning on chemical field in East Asia has been simulated. It has been found that lightning directly controls the average mixing ratio of NO_x in the air during the thunderstorm process.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (Parsons Laboratory, Cambridge, Massachusetts 02139, USA)

Harrison (GRL, 2000) has recently published evidence for a secular decline in the strength of the DC global circuit, attributed to variation in cosmic radiation. Williams (GRL, 2003) offers an alternative interpretation for the observations: declining pollution concentrations in England over the course of the 20th century are associated with increases in electrical conductivity and hence

decreases in the electric field (with no change in global circuit current) at surface stations used by Harrison.

Following the ICAE meeting in Versailles, Earle Williams made visits to Gabriella Satori in Hungary and to Sasha Nickolaenko and Sasha Shvets in the Ukraine. In Hungary, work was initiated on a paper comparing lightning activity, Schumann resonance intensity and thermodynamics for the Amazon and Congo basins. This paper was recently submitted to the SPECIAL issue for JASTP. In the Ukraine, collaboration resumed on a Twinning Foundation grant, aimed at distinguishing different ionospheric models for their effect on Schumann cavity quality factor (Q) and resonance frequencies.

Graduate student Kunal Surana is using the expanded bandwidth (2 Hz- 25 kHz) of the new electric field antenna in West Greenwich, Rhode Island to monitor tweek sferics and the cutoff frequency (~1.8 kHz) of the global waveguide. Changes in the cavity due to changes in incoming ionizing radiation from day to night, changes due to solar X-rays, and changes due to lightning from within the cavity are all targets of interest.

Measurements continue with Mike Valente and Bob Golka on a large (6 ft. long and 2 ft diameter) air-filled glow discharge tube. This work is aimed at quantifying the relationship between the absolute radiance (watts/m^2/sr/nm) associated with N21P red light and the electrical power dissipation and current density in sprites. This interest has led to tube operation in a range of current density several orders of magnitude lower than in previous laboratory glow discharge work. Consistent with work on other gases, the luminous efficiency of the discharge is remarkably stable over a large parameter space.

The computation of summertime climatologies for wet bulb potential temperature and cloud base height for the continental U.S. provide a mechanism for the origin of inverted polarity thunderstorms. All laboratory workers agree that in the limit of large cloud water content, the rimer charges positively. Observations from STEPS (Rust and MacGorman, 2002) have shown the presence of inverted polarity clouds in the presence of both large instability and high cloud base height. Large liquid water content is favored under these conditions because cumulonimbus updraft widths increase with cloud base height (Williams and Stanfill, 2002) and because the water-removing coalescence zone is shortened with high cloud bases (Rosenfeld and Woodley, 2003). These results have been submitted to the Special Issue of Atmospheric Research following the ICAE Conference in Versailles.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (Lincoln Laboratory, Lexington, Massachusetts, USA)

In March 2003, a global intercomparison of different geostationary satellite methods for identifying oceanic thunderstorms was carried out, under the auspices of the FAA-supported Oceanic Weather program. Participants in this study were NCAR (Cathy Kessinger and Dave Johnson), NRL (Rick Bankert and Jeff Hawkins), AWC (Fred Mosher), and MIT LL (Mike Donovan and Earle Williams). NASA's Precipitation Radar and Lightning Imaging Sensor on board the TRMM satellite were used to validate the oceanic thunderstorms. The results show that it is difficult to distinguish oceanic thunderstorms on the basis of satellite visible and infrared methods alone.

Interest continues in the use of DoD satellite assets for the study of volcanic eruptions and ash cloud production, also in the Oceanic Weather context. Some opportunity for future work here may be realized in NASA's ASAP (Advanced Satellite Aviation Products) program.

NATIONAL LIGHTNING SAFETY INSTITUTE (NLSI) (Louisville, Colorado, USA)

NLSI has published a new 65 page booklet "Bonding for Lightning Protection." More than 100 illustrations
describe correct bonding methods for fences, building exteriors and interiors, radio towers, I.T. room equipment, cable shields, etc. All recommendations are compliant with NFPA-780 and IEC 61024-1-2. The Table of Contents is viewable the NLSI website page:
www.lightningsafety.com/nlsi_bus/bonding_book.html

POLISH ACADEMY OF SCIENCES (Warsaw, Poland)

The atmospheric electricity research group at the Institute of Geophysics P. A. Sci. is continuing its investigations in the field of thunderstorms and fair weather electricity.

We cooperate with the Institute of Meteorology and Water Management in Warsaw using its nine SAFIR stations network for lightning monitoring and the recently installed new Doppler radar for thunderclouds and lightning discharges observation in Poland. Now we collect the further data about the occurrence of multi-stroke lightning flashes and the complex discharge lightning events (CDLE) in different stages of a thundercloud life. A part of obtained results about the CDLE's observed in thunderstorms near Warsaw and their characteristic features was presented by Piotr Barański (baranski@igf.edu.pl) during the 12-th ICAE in Versailles, France, in this year. The validation of the SAFIR detections, especially these concerning the multiple cloud-to-ground flashes with bipolar strokes, is still thoroughly examined (P. Barański, P. Bodzak).

At the polar station Hornsund, Spitsbergen, the electric field and vertical air- earth current recordings are continued with simultaneous magnetometer, riometer as well as meteorological and radioactivity pollution measurements (M.Kubicki, S.Michnowski, B. Laurikainen). The influences of solar wind on the electrical element variations at the ground in Hornsund are being examined with the use of geophysical data from Hornsund, satellite data on interplanetary magnetic field of solar wind as well as the IMAGE net of magnetometer and riometer stations (S.Michnowski, M.Kubicki, N.Kleimonova, S.Israelsson, N.Nikiforova).

Examination of the atmosphere response to solar cosmic ray events is continued (Z. Kobyliński, S. Michnowski).

At Świder Geophysical Observatory the atmospheric electricity recordings have been continued on the background of simultaneous observations of meteorology, aerosol and radioactivity, and pollution parameters (M. Kubicki: swider@igf.edu.pl, W. Kozłowski, B. Laurikainen).

New sensors for air-earth current density, electric field and space charge recordings are designed (J.Drzewiecki, J.Berlinski, M.Kubicki).

SPACE SCIENCE AND TECHNOLOGY DEPARTMENT – RUTHERFORD APPLETON LABORATORY (Oxfordshire, UK)

Karen Aplin (k.l.aplin@rl.ac.uk) at the Rutherford Appleton Laboratory (RAL) is continuing her research into atmospheric ions: both their measurement and their effects on climate. She continues to improve the Programmable Ion Mobility Spectrometer (PIMS), originally developed with Dr Giles Harrison at The University of Reading and now a mainstay of several experimental campaigns. A recent discovery is a new algorithm for retrieval of ion mobility spectra[1], which permits inversion of spectra from historic ion measurements in addition to a novel approach for modern spectral measurements. Dr Aplin is also leading a project funded by the UK Natural Environment Research Council (NERC) to investigate the infra-red absorption properties of ions in the atmosphere[2]. This experiment comprises laboratory measurements carried out at the NERC Molecular Spectroscopy Facility, located at RAL, which will measure the absorption properties of artificially-generated ion concentrations. Atmospheric measurements of downwelling infra-red radiation will be compared to background cosmic ray ionisation measurements at a Welsh mountain weather station, to complement the laboratory experiments. Detailed ionisation profiles will be obtained in the summer of 2004 using radioactivity-sonde measurements.

Short term placement available
A six month position (approx May-October 2004) is available at the Rutherford Appleton Laboratory, near Oxford, for a postgraduate student or recent graduate to assist with the molecular cluster-ion absorption experiment above. The student should ideally have some experience of experimental work in atmospheric electricity, and the position is likely to involve regular travel to Wales for field measurements. Please contact Karen Aplin for further details.

TEL AVIV UNIVERSITY, DEPARTMENT OF GEOPHYSICS AND PLANETARY SCIENCES (Tel Aviv, Israël)

The analysis of the sprite data obtained during the MEIDEX space shuttle mission in January 2003 is continuing. The video retrieved contains information from 21 different orbits (out of 24 performed) and a total of 392 minutes (out of 458 recorded). **Yoav Yair** (The Open University) and **Peter Israelevitch** (Tel Aviv University) are searching each frame of the video data for sprites and elves. The number of positively identified events from 7 orbits is 15. The results were reported at the ICAE and IUGG meetings. The operational procedure for predicting the location of major storms with a high probability of producing TLEs, developed by **Baruch Ziv** and **Yoav Yair** (The Open University), which was used during the mission, will be published in the Journal of Applied Meteorology. **Eran Greenberg** and **Colin Price** are developing a new

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[1] **Aplin K.L. (2003), A novel technique to determine atmospheric ion mobility spectra In: Chauzy S. and Laroche P. (ed.),** ***Proceedings of 12th International Conference on Atmospheric Electricity*****, Versailles, Paris 9th-13th June 2003 (ISBN 2-7257-0008-6), 1, 357-360**

[2] Aplin K.L. (2003), Direct radiative effects of tropospheric ionisation, *Atmospheric Chemistry and Physics Discussions*, **3**, 3205-3222

improved ELF geolocation procedure, by which Schumann resonance (SR) data from single and multiple stations are used to locate the space-observed TLEs. This work is being done in collaboration with **Gabriella Satori** (Hungary) and **Mitsutero Sato** (University of Sendai, Japan). **Yoav Yair**, **Zev Levin** and **Colin Price** have received a 3-year grant from the Israeli Science Foundation for conducting sprite research in winter thunderstorms. Observations will be conducted initially from the Tel-Aviv University campus, with possible future campaigns conducted from Mt. Carmel and Mitzpe-Ramon.

Olga Pechony, Zev Levin and **Colin Price** have recently completed a study of a severe weather event in southern Israel that produced flash floods, large hail, and large amounts of positive lightning. **Bella Federmesser** and **Colin Price** have completed an analysis of 6-years of TRMM precipitation and lightning data over the Mediterranean Sea. Interesting relationships between the precipitation and lightning have been found. **Olga Pechony** and **Colin Price** are developing a theoretical model of the SR, to simulate the SR observations we collect at our Negev station. We hope to use the theoretical model to help us interpret the physical meaning of what we observe experimentally at our field site. Long-term statistics of the SR parameters at our station have been analysed by **Alexander Melnikov** and **Colin Price**. Two papers have been submitted to JASTP related to our observational data. **Mustafa Asfur** and **Colin Price** have been analyzing the experimental SR data related to African lightning activity, together with the NOAA NCEP reanalysis data from Africa. We find remarkable correlations between the SR data and climate parameters such as surface temperature, vertical mass flux, upper tropospheric humidity, and total precipitable water.

Colin Price, **Michael Finkelstein** and **Adi Zomer** have started a new project to monitor ULF radiation in the atmosphere. The ULF radiation (f<1Hz) may show anomalous activity in seismic zones prior to earthquakes. A new field station has been constructed along the Dead Sea rift valley near the town of Eilat.

Orit Altaratz has completed her PhD work under **Zev Levin** and with the assistance of **Tamir Reisin**. Her research included the development of a 3D RAMS model with electrical development in a cloud field. This is the first time that such a model has been used to test various electrical processes in a realistic cloud field. As part of her research she was able to explain the reasons for the high lightning rate over the sea near the Haifa coast and the higher lightning frequency near Haifa than near Tel Aviv, just 80 km to the south. Two papers on this work have been submitted for publication in Atmospheric Research.

TEXAS A&M UNIVERSITY, DEPARTMENT OF ATMOSPHERIC SCIENCES

Our Texas A&M University lightning research efforts received a big boost with the awarding of the recent NSF-MRI to install an LDAR II Vaisala-GAI network around Houston, Texas. This network will be comprised of twelve sensors centered on Houston, the most polluted city in the United States. The network will be the foundation of the HEAT project, i.e. the Houston Environmental Aerosol Thunderstorm project scheduled for the summer of 2005. Interested readers can learn more about this project from the web page:
http://www.met.tamu.edu/ciams/heat/index.html

The idea for the HEAT project developed from the research reported by Orville et al. Orville et al., 2001: Enhancement of cloud-to-ground lightning over Houston, Texas. Geophys. Res. Ltr., 28, 2597-2600.
and by Steiger et al.
Steiger et al., 2002: Cloud-to-ground lightning characteristics over Houston, Texas: 1989-2000. J. Geophys. Res., 107, D11, 10.1029/2001JD001142.
A more recent paper published in October provides further evidence of enhanced ground strike lightning activity associated with human activities, this time over southern Louisiana:
Steiger, Scott M.; Orville, Richard E., Cloud-to-ground lightning enhancement over Southern Louisiana, Geophys. Res. Lett., *Vol. 30, No. 19, 1975 10.1029/2003GL017923. October 2003.*

We anticipate that the 12-station LDAR II network will be operational in the first half of 2004. The development of the HEAT project is a large program whose success to-date has been the result of assistance from many colleagues, including Paul Krehbiel, John Helsdon, Charlie Knight, Ken Cummins, Rod Rogers, Don MacGorman, and Dave Rust to name just a few. Graduate students Scott Steiger, Brandon Ely, and Jamie Smith will be using LDAR II data for their thesis and dissertation research in the next few years. It should be noted that the HEAT project is just a small part of an overall 18-month program supported by the EPA, NOAA, and the TCEQ (Texas Center on Environmental Quality) beginning in May 2004 and covering the pollution episodes of two summers.

In addition to the good news of the NSF-MRI award, an equally important event occurred when Dr. Larry Carey joined our faculty as an assistant professor in September. Larry Carey comes to us from North Carolina University. Before that, he was at Colorado State University working and studying under Professor Steve Rutledge where he received his PhD in 1999. His most recent paper is:
Carey, Lawrence D.; Rutledge, Steven A., Characteristics of cloud-to-ground lightning in severe and nonsevere storms over the central United States from 1989–1998, *J. Geophys. Res.,* Vol. 108, No. D15, 4483, 10.1029/2002JD002951, August 2003.

UNIVERSITY OF FLORIDA (Gainesville, Florida, USA)

A total of 24 lightning flashes were initiated from June 30 to August 15, 2003 at the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida. Of these 24, 12 contained leader/return stroke sequences and 12 were composed of the initial stage only. All triggered flashes effectively transported negative charge to ground, except for one flash that lowered both positive and negative charge to ground. This flash consisted of an initial stage followed by two return strokes, with the initial stage and first stroke lowering negative charge and the second stroke lowering positive charge. Five flashes with return strokes were triggered using the tower launcher and seven flashes were triggered using a mobile launcher mounted on the extendable arm of a utility truck. Additionally, two natural lightning discharges that terminated on site were recorded by the multiple-station electric and magnetic field measuring network.

Jason Jerauld defended his Masters thesis titled “A Multiple-Station Experiment to Examine the Close Electromagnetic Environment of Natural and Triggered Lightning”, and

Venkateswararao Kodali defended his Masters thesis titled "Characterization and Analysis of Close Lightning Electromagnetic Fields". Jason continues his research toward a Ph.D. degree. Also, Angel Mata defended his Masters thesis titled "Interaction of Lightning with Power Distribution Lines: 2001 and 2002 Experiments at the International Center for Lightning Research and Testing (ICLRT)", and Robert Olsen defended his Masters thesis titled "Optical Characterization of Rocket-Triggered Lightning at Camp Blanding, Florida".

Vladimir A. Rakov, Martin A. Uman, and Keith J. Rambo reviewed ten years of triggered-lightning experiments at Camp Blanding, Florida, in a paper presented at the 12th Int. Conf. on Atmospheric Electricity, Versailles, France, June 9-13, 2003. The lightning-triggering facility at Camp Blanding, Florida was established in 1993 by the Electric Power Research Institute (EPRI) and Power Technologies, Inc. (PTI). Since September 1994, the facility has been operated by the University of Florida (UF). During the last eight years (1995-2002) over 40 researchers (excluding UF faculty, students, and staff) from 14 countries representing 4 continents have performed experiments at Camp Blanding concerned with various aspects of atmospheric electricity, lightning, and lightning protection. These countries include Australia, Austria, Canada, France, Germany, Iran, Italy, Japan, Norway, Poland, Russia, Sweden, Switzerland, and USA. Since 1995, the Camp Blanding facility has been referred to as the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida. A summary of the lightning triggering operations conducted for various experiments at the ICLRT from 1997 to 2002 is presented in Table 1.

Table 1. 1997-2002 Triggered-Lightning Experiments at the ICLRT at Camp Blanding, Florida

Year(s)	Rocket Launchers Used	Total Flashes Triggered	Flashes with Return Strokes	Positive or Bipolar Flashes	Time Period
1997	4	48	28	1	May 24 – Sept. 26
1998	3	34	27	-	May 15, July 24 – Sept. 30
1999	2	30	22	1	Jan. 23, June 26 – Sept. 27
2000	2	30	27	-	June 12 – Sept. 6
2001	2	23	11	-	July 13 – Sept. 5
2002	2	19	14	-	July 9 – Sept. 13
1997 – 2002		**184**	**129**	**2**	

The results of triggered-lightning studies at the ICLRT serve (1) to understand better the physics of the lightning discharge, (2) to improve lightning protection schemes, (3) to evaluate the performance characteristics of the U.S. National Lightning Detection Network (NLDN) (e.g., Cramer et al. 2001), and (4) to test the validity of lightning return-stroke models (e.g., Rakov and Uman 1998; Uman et al. 2002; Schoene et al. 2003).

The principal results obtained from 1993 through 2002 at the ICLRT include

(1) characterization of the close lightning electromagnetic environment (Rakov et al. 1998, 2001; Uman et al. 2000, 2002; Crawford et al. 2001; Schoene et al. 2003);

(2) first lightning return-stroke speed profiles within 400 m of ground (Wang et al. 1999c);
(3) new insights into the mechanism of the dart-stepped (and by inference stepped) leader (Rakov et al. 1998; Wang et al. 1999c);
(4) identification of the M-component mode of charge transfer to ground (Rakov et al. 1995, 1998, 2001);
(5) first optical image of upward connecting leader in triggered-lightning strokes (Wang et al. 1999a);
(6) electric fields at distances from the lightning channel attachment point ranging from 0.1 to 1.6 m (Miki et al. 2002);
(7) inferences on the interaction of lightning with ground and with grounding electrodes (Rakov et al 1998, 2002);
(8) discovery of X-rays produced by triggered-lightning strokes (Dwyer et al. 2002, 2003; Al-Dayeh et al. 2002);
(9) new insights into the mechanism of cutoff and re-establishment of current in rocket-triggered lightning (Rakov et al. 2003).

In 2002, the University of Florida acquired an image converter camera K004M, manufactured by BIFO, Moscow, Russia, for studying the lightning attachment process at the ICLRT. The camera can be operated in either streak or framing mode. In the streak mode, record length can be selected in the range from 0.3 to 1000 us, and the limiting temporal resolution is about 1 ns. In the framing mode, the number of frames is up to nine, the exposure time is from 0.1 to 10 us, and the interframe interval is from 0.5 to 100 us. The results of testing of this and other image converter cameras using laboratory sparks up to 6 m in length are presented by Shcherbakov et al. (2003).

THE UNIVERSITY OF READING (Reading, UK)

Giles Harrison (r.g.harrison@reading.ac.uk) reports:
Work continues at Reading investigating the physical links between atmospheric electricity, aerosols, clouds and climate. A review paper on this subject, written jointly with Ken Carslaw (School of the Environment, University of Leeds, UK), has now appeared in *Reviews of Geophysics*. It follows the publication of a paper in *Science*, on *Cosmic rays, Clouds and Climate*.

In a new experimental project funded by Natural Environment Research Council, ion-aerosol interactions in urban air are being studied. Deployment of several Programmable Ion Mobility Spectrometers (PIMS) developed at Reading will be central to this work. Richard Wilding and Anna Wilson have joined Giles Harrison on this topic.

At the ICAE in Versailles, conference papers were presented on long-term measurements, the link between solar variability, clouds and climate (with Jasper Kirkby from CERN, Switzerland), radioactive aerosol in the environment (with Sachchida Tripathi, Oxford) and perhaps appropriately to the conference's venue, potential measurement made on the Eiffel Tower in the 1890s (with Karen Aplin, Rutherford-Appleton Lab, Oxon). Work on recovering more of the

long series of UK Potential Gradient, air conductivity and air-earth current measurements continues. A comparison of the UK results with those obtained at Nagycenk, Hungary, has been published in *Annales Geophysicae*, and an overview of the UK data was presented earlier this year in *Weather*.

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