www.Atmospheric-Electricity.org

NEWSLETTER ON ATMOSPHERIC ELECTRICITY

Vol. 19· No 2· November 2008

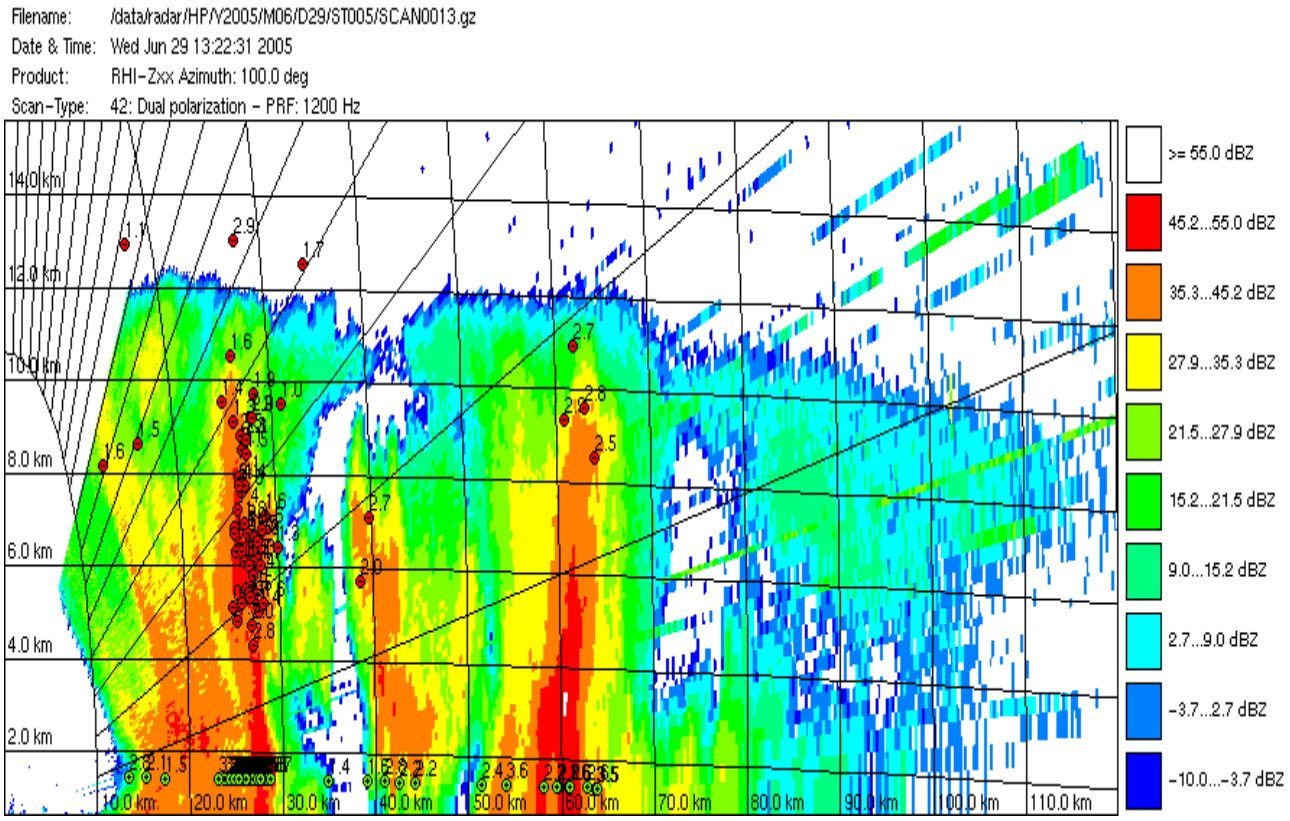
INTERNATIONAL COMMISSION ON ATMOSPHERIC ELECTRICITY (IAMAS/IUGG)

AMS COMMITTEE ON ATMOSPHERIC ELECTRICITY

AGU COMMITTEE ON ATMOSPHERIC AND SPACE ELECTRICITY

EUROPEAN GEOSCIENCES UNION

SOCIETY OF ATMOSPHERIC ELECTRICITY OF JAPAN



At what level the correlation between 4D radar echo and 4D lightning-caused EM emissions could be visualized in the next 10 or 20 years?! This viewgraph shows a comparison between radar echo and LINET locations of lightning-caused VLF/LF (5-200 kHz) EM emission during a 2 min time period centered around the radar scan for a hailstorm observed in Southern Germany on 29 June 2005 at 13:22 UTC. The radar echo is a vertical section through the center of the hailstorm, recorded with POLDIRAD (DLR-Institut fuer Physik der Atmosphaere, Oberpfaffenhofen, D-82234 Wessling, Germany).

LINET intra-cloud strokes (IC, red dots) and cloud-to-ground strokes (CG, green dots) are discriminated (for LINET see group research report, University of Munich, page 9). This viewgraph was provided by Hans D. Betz, taken from a recent publication (H.-D. Betz, K. Schmidt, B. Fuchs, P. Oettinger and H. Hoeller, JOLR, Vol.2, p.1.17, 2007).

ICAE

ANNOUNCEMENTS

A special issue on "Streamers, sprites and lightning"

A special issue on "Streamers, sprites and lightning" (eds.: Ute Ebert and Davis D. Sentman) will appear in Journal of Physics D: Applied Physics, Vol 41, Number 23, Year 2008. It contains 19 extended articles and an editorial review. Online publication is scheduled for the week of Nov. 17, 2008. The articles will be free to download for three months after online publication. Journal homepage: http://www.iop.org/EJ/0022-3727 .

The issue collects original work presented at the workshop "Streamers, sprites, leaders, lightning: from micro- to macroscales" in October 2007 in Leiden, The Netherlands; it brought researchers from plasma physics, electrical engineering and industry, geophysics and space physics, computational science and nonlinear dynamics together around the common topic of generation, structure and products of streamer-like electric breakdown.

Conference aims, program and presentations can be found on
http://www.lorentzcenter.nl/lc/web/2007/265/info.php3?wsid=265 .

Content of the special issue:

Ebert U, Sentman D D,
Streamers, sprites, leaders, lightning: from micro- to macroscales, an editorial introduction
J Phys D: Appl Phys 41 (2008) 230301

Winands G J J, Liu Z, Pemen A J M, van Heesch E J M, Yan K,
Analysis of streamer properties in air as function of pulse and reactor parameters by ICCD photography
J Phys D: Appl Phys 41 (2008) 234001

Eichwald O, Ducasse O, Dubois D, Abahazem A, Merhabi N, Benhenni M,
Yousfi M,
Experimental analysis and modeling of streamer dynamics in air positive corona discharges at atmospheric pressure: Towards an estimation of O and N radical production
J Phys D: Appl Phys 41 (2008) 234002

Nudnova M M, Starikovskii A Yu,
Streamer head structure: role of ionization and photoionization
J Phys D: Appl Phys 41 (2008) 234003

Briels T M P, Kos J, Winands G J J, van Veldhuizen E M, Ebert U,
Positive and negative streamers in ambient air: measuring diameter, velocity and dissipated energy
J Phys D: Appl Phys 41 (2008) 234004

Luque A, Ratushnaya V, Ebert U,
Positive and negative streamers in ambient air: modeling evolution and velocities
J Phys D: Appl Phys 41 (2008) 234005

Manders F, Christianen P C M, Maan J C,
Propagation of a streamer discharge in a magnetic field
J Phys D: Appl Phys 41 (2008) 234006

Kolb J F, Joshi R P, Xiao S, Schoenbach K H,
Streamers in water and other dielectric liquids
J Phys D: Appl Phys 41 (2008) 234007

Briels T M P, van Veldhuizen E M, Ebert U,
Positive streamers in air and nitrogen of varying density: experiments on similarity laws
J Phys D: Appl Phys 41 (2008) 234008

Stenbaek-Nielsen H C, McHarg M G,
High time-resolution sprite imaging: observations and implications
J Phys D: Appl Phys 41 (2008) 234009

Adachi T, Hiraki Y, Yamamoto K, Takahashi Y, Fukunishi H, Hsu R R, Su H T,
Chen B, Mende S B, Frey H U, Lee L C,
Electric fields and electron energies in sprites and temporal evolutions of lightning charge moment
J Phys D: Appl Phys 41 (2008) 234010

Sato M, Takahashi Y, Yoshida A, Adachi T,
Global distribution of intense lightning discharges and their seasonal variations
J Phys D: Appl Phys 41 (2008) 234011

Nguyen C V, van Deursen A P J, Ebert U,
Multiple gamma bursts from long discharges in air
J Phys D: Appl Phys 41 (2008) 234012

Milikh G M, Shneider M N,
Model of UV flashes due to gigantic blue jets
J Phys D: Appl Phys 41 (2008) 234013

Kuo C L, Chen A B, Chou R K, Tsai L Y, Hsu R R, Su H T, Frey H U, Mende S B, Takahashi Y, Lee L C,
Radiative emission and energy precipitation in transient luminous events
J Phys D: Appl Phys 41 (2008) 234014

van Heesch E J M, Winands G J J, and Pemen A J M,
Evaluation of pulsed streamer corona experiments to determine the O* radical yield
J Phys D: Appl Phys 41 (2008) 234015

Gordillo-Vazquez F J,
Air plasma kinetics under the influence of sprites
J Phys D: Appl Phys 41 (2008) 234016

Naidis G V,
Simulation of spark discharges in high-pressure air sustained by repetitive high-voltage nanosecond pulses
J Phys D: Appl Phys 41 (2008) 234017

Capeillere J, Segur P, Bourdon A, Celestin S, Pancheshnyi S,
The finite volume method solution of the radiative transfer equation for photon transport in non-thermal gas discharges: application to the calculation of photoionization in streamer discharges
J Phys D: Appl Phys 41 (2008) 234018

Papadakis A P, Georghiou G E, Metaxas A C,
New high quality adaptive mesh generator utilized in modeling plasma streamer propagation at atmospheric pressures
J Phys D: Appl Phys 41 (2008) 234019

New Books

1. A book titled "Seismo Electromagnetics and Related Phenomena: History and Latest Results" and authored by Profs. O. A. Molchanov and M. Hayakawa has been published recently from TERRAPUB, Tokyo. This book deals with the electromagnetic and plasma phenomena associated with earthquakes (but some of them being closely related with atmospheric electricity field).

2. A book titled "Planetary Atmospheric Electricity" and edited by F. Leblanc, K.L. Aplin, Y. Yair, R.G. Harrison, J.P. Lebreton, M. Blanc has been published recently (Space Science Series of ISSI: SSSI 30, http://www.issibern.ch/publications/sssi.html, Space Science Reviews, Volume 137, Nos 1-4, 2008). This book contains the following topics:

Introductory overviews
- Investigating Earth's atmospheric electricity: a role model for planetary studies, Aplin K. et al.
- Updated review of planetary atmospheric electricity, Yair Y. et al.
- Physical processes related to discharges in planetary atmospheres, Roussel-Dupre R. et al.
- An Overview of Earth's Global Electric Circuit and Atmospheric Conductivity, Michael J Rycroft et al.
- Ions in the Terrestrial Atmosphere and Other Solar System Atmospheres, Harrison G. and Tammet H.
- Charge Generation and Separation Processes, Yair Y.
- Physics of electric discharges in Atmospheric Gases: an informal introduction, Treumann R. et al.

Ionisation processes in planetary atmospheres
- Cosmic Ray Induced Ion Production in the Atmosphere, Bazilvskaya G.A., et al.
- Meteoritic ions in planetary atmospheres, Molina-Cuberos G., et al.
- Profiles of Ion and Aerosol Interactions in Planetary Atmospheres, Tripathi S. et al.

- Composition and measurement of charged atmospheric clusters, Aplin K.
- Atmospheric ions and aerosol formation, Arnold F.
- Tropospheric New Particle Formation and the Role of Ions, J. Kazil, et al.

Measurements, effects and Hazards of thunderstorms and lightning

- Ground-based and space-based radio observations of planetary lightning, P. Zarka, et al.
- Atmospheric electricity at Saturn, Fischer G. D.A. et al.
- Atmospheric Electricity Hazards, Lorenz R.
- Electricity effects on Atmospheric chemistry, Lorenz R.

New missions

- Taranis – a satellite project dedicated to the physics of TLEs and TGFs, Lefeuvre F. E. et al.
- Lightning detection by LAC onboard the Japanese Venus Climate Orbiter Planet-C, Takahashi Y. et al.

Charge generation and separation

- Charge separation mechanisms in clouds, Saunders C.
- Charge structure and dynamics in Thunderstorms, Stoltzenburg M., and T.C. Marshall
- Formation of charge layers in the Planetary atmospheres, Mareev E.
- Electrical charging of volcanic plumes, James, M.R. et al.
- Electrical activity and dust lifting on Earth, Mars and beyond, Renno N. and Jasper Kok
- The charging of planetary rings, Graps A., G. et al.

Electromagnetic signatures of discharges in the atmosphere

- Schumann resonances as a means of investigating the electromagnetic environment in the solar system, Simoes F. et al.
- Blue Jets: Upward lightning, Mishin E. and Gennady Milikh
- VLF studies during TLE occurrences in Europe: A summary of new findings, Mika A and Christos Haldoupis
- DEMETER Observations of EM Emissions related to Thunderstorms, Parrot M. et al.
- On ULF signatures of lightning discharges, Bösinger T. and Shalimov S.

CONFERENCES

2009 EGU GENERAL ASSEMBLY

The General Assembly 2009 of the European Geosciences Union (EGU) will be held in Vienna, Austria, on 19 – 24 April 2009.

The EGU General Assembly covers all disciplines of the Earth, Planetary and Space Sciences. Especially for young scientists the EGU appeals to provide a forum to present their work and discuss their ideas with experts in all fields of geosciences.

The website address of the assembly is: http://meetings.copernicus.org/egu2009/index.html. This assembly has a session on Lightning and its Atmospheric Effects. The deadline for abstract submission is January 14th, 2009.

AGU Chapman Conference on Effects of Thunderstorms and Lightning in the Upper Atmosphere

May 10-14, 2009, the Pennsylvania State University, University Park, Pennsylvania.

The conference web site: http://www.agu.org/meetings/chapman/2009/bcall/ has the most up to date information about conference logistics and deadlines, including a full resolution version of the conference poster.

Conference Objectives: This Chapman Conference will cover topics in a new area involving recent discoveries in geophysical research that link lightning and thunderstorms to the upper atmosphere. The goals of the Chapman conference are to bring together active researchers in the field to assess and review the current state of both experimental and theoretical research, to encourage exchange of ideas, to identify key theoretical problems and coupling processes of possible relevance to the larger geophysical system, and to discuss ideas on possible new types of measurements that could help elucidate key aspects of underlying physical processes. The Conference will cover topics across the full spectrum of disciplines relevant to the subject of effects of thunderstorms and lightning in the upper atmosphere, including the underlying meteorology of sprite-associated lightning, gas breakdown and discharge processes, electromagnetic effects, energetic processes, and photochemical, kinetic and transport mechanisms.

Conveners: Davis D. Sentman, Geophysical Institute, University of Alaska, Fairbanks, AK (dsentman@gi.alaska.edu). Victor P. Pasko, The Pennsylvania State University, University Park, PA (vpasko@psu.edu). Jeff S. Morrill, Naval Research Laboratory, Washington, DC (jeff.morrill@nrl.navy.mil).

Program Committee: Elisabeth Blanc (CEA, France), Steven Cummer (Duke University), Martin Fullekrug (Bath University, United Kingdom), Umran Inan (Stanford University), Elizabeth Kendall (Stanford Research Institute), Walter Lyons (FMA Research), Stephen Mende (UC,

Berkeley), Gennady Milikh (University of Maryland), Torsten Neubert (Danish Nat. Space Center, Denmark), Colin Price (Tel Aviv University, Israel), Craig Rodger (Otago University, New Zealand), Robert Roussel-Dupre (Los Alamos National Laboratory), Fernanda Sao Sabbas (IPNE, Brazil), David Smith (University of California, Santa Cruz), Han-Tzong Su (National Chen Kung Univ., Taiwan), Yukihiro Takahashi (Tohoku University of Japan), Michael Taylor (Utah State University), and Earle Williams (MIT).

IAMAS ASSEMBLY 2009 (Montreal, CANADA)

IAMAS (The International Association of Meteorology and Atmospheric Sciences) assembly 2009 will be held in Montreal, Canada 19-29, July 2009. This is also a big meeting for ICAE colleagues. As one of the 10 commissions of IAMAS, ICAE is organizing the following two symposia (supposed to be held on July 27th and 28th, 2009):

M16: Thunderstorms and their Manifestation on Local, Regional and Global Scales
Convenors: Earle Williams, Serge Soula, Colin Price

Invited speakers:
1. Dr. Joseph R. Dwyer (Florida Institute of Technology, USA), " an update on runaway electrons and high energy particles from thunderstorms".
2. Dr. Zen Kawasaki (Osaka University, Japan), "VHF broadband interferometer and broadband radar".

M17: Lightning: Characteristics, Physics, and Hazard Mitigation
Convenors: Vladimir Rakov, Christian Bouquegneau, Daohong Wang

Invited speakers:
1. Dr. Osmar Pinto (INPE, Brazil), "Geographical Variations in Lightning Parameters".
2. Dr. Mary Ann Cooper (Univ. of Illinois @ Chicago), "Lightning Risks to Humans".
3. Dr. Nick Demetriades (Vaisala, Tucson, Arizona), "An evaluation of cloud-to-ground (CG) lightning warnings based on LF/VLF cloud-to-ground and VHF total lightning mapping network data".

Authors are invited to submit an abstract in English to be considered for oral or poster presentation at these two symposia. **The deadline for submission of abstracts is January 23, 2009**. Authors are asked to submit abstracts using the online abstract submission link. **For detailed information, please visit http://www.moca-09.org/index.asp**.

RESEARCH ACTIVITY BY INSTITUTION

Atmospheric and Space Physics Group at Bard High School Early College II (BHSEC II) Elmhurst, Queens, NY, USA

Natalia N. Solorzano (nataliansolo@gmail.com)
Jeremy N. Thomas (jnt@u.washington.edu; http://earthweb.ess.washington.edu/lnk/jnt/)

Solorzano and Thomas joined the Bard College faculty in September of 2008 and have formed an atmospheric and space physics research group at Bard's new early college program (BHSEC II) in Queens, NY. Additionally, Solorzano and Thomas are Research Scientists through Northwest Research Associates (NWRA) in Redmond, WA.

Current projects at BHSEC II include the following:

Lightning in tropical cyclones globally: (http://wwlln.net/publications/Solorzano_AMS_29FEB2008.pdf)

Solorzano and Thomas are investigating whether lightning activity can be used to better-forecast tropical cyclone intensity change in all global regions using the World Wide Lightning Location Network (WWLLN; http://wwlln.net/). The analysis of hundreds of tropical cyclones will allow statistics to be established that relate lightning activity and tropical storm evolution. Solorzano will present a talk on lightning activity and intensity change in Cyclone Nargis (see Fig. 1) at the Fourth Conference on the Meteorological Applications of Lightning Data at the 2009 AMS Meeting in Phoenix, AZ.

Urban effects on lightning activity in Queens, NY:

Thomas and Solorzano will include their students in a study of how human activities that cause pollution and temperature changes in Queens might be affecting the local weather and lightning activity. A weather station, a video camera, and lightning sensors (including a WWLLN station) will be installed at BHSEC II.

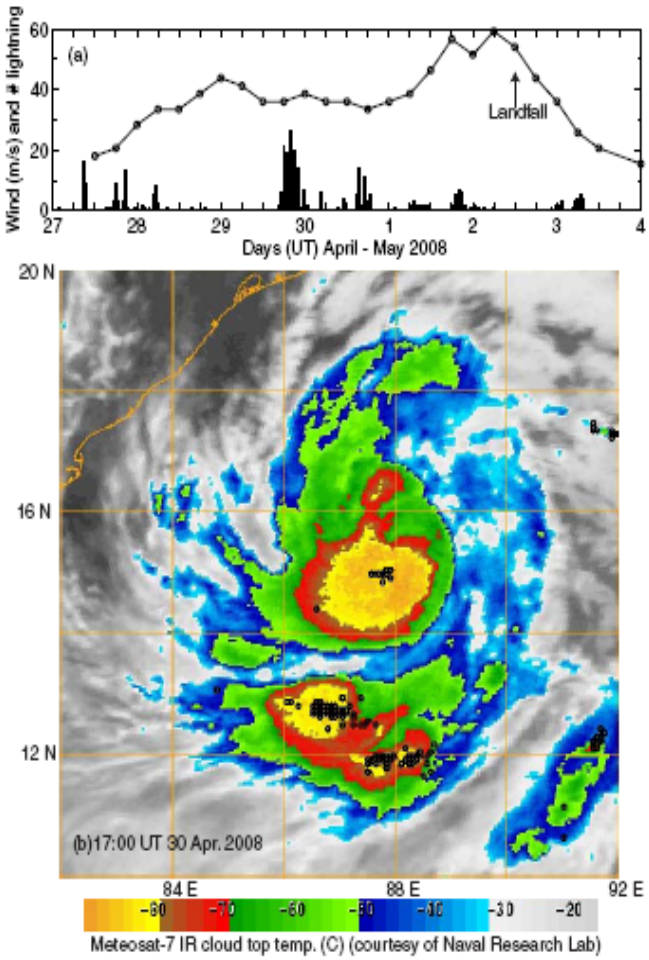


Figure 1: (top) Time histogram of Cylcone Nargis eyewall lightning (within 100 km of the storm center) observed by WWLLN for April 27 – May 4, 2008 along with maximum sustained wind. (bottom) Meteosat-7 infrared image for 17:00 UT April 30 with WWLLN lightning (black circles) from 16:30 – 17:30. The lightning activity clearly shows the active eyewall and rainband regions.

(Recommended for funding by Toshiba America Foundation Nov. 2008 and pending final approval).

Lightning and thunderstorm effects in the middle and upper atmosphere:
(http://earthweb.ess.washington.edu/lnk/jnt/)

Recently accepted by JGR (Thomas et al. 2008) is an analysis of some rare examples of lightning-driven electric field changes obtained at 75-130 km altitude during a sounding rocket flight from Wallops Island, VA in 1995. Also, observations of sprites-halos driven by negative lightning in Argentina during the 2006 Brazil Campaign have been published in GRL (Taylor et al. 2008). Additionally, a study of thunderstorm contributions to the global electrical circuit was published in Atmos. Res. (Thomas et al. 2008).

Reexamination of magnetic precursors to earthquakes:

The magnetic precursors to the Loma Prieta and Guam earthquakes have been carefully reexamined. This work has been submitted to PEPI (Thomas et al. 2008) and will soon be submitted to GRL. Thomas will give a talk on this work at the Fall AGU Meeting in Dec. 2008.

Atmospheric Electricity Group, Physics Department at the University of Munich (Garching, Germany)

Garching, Germany (Hans-dieter.betz@physik.uni-muenchen.de)

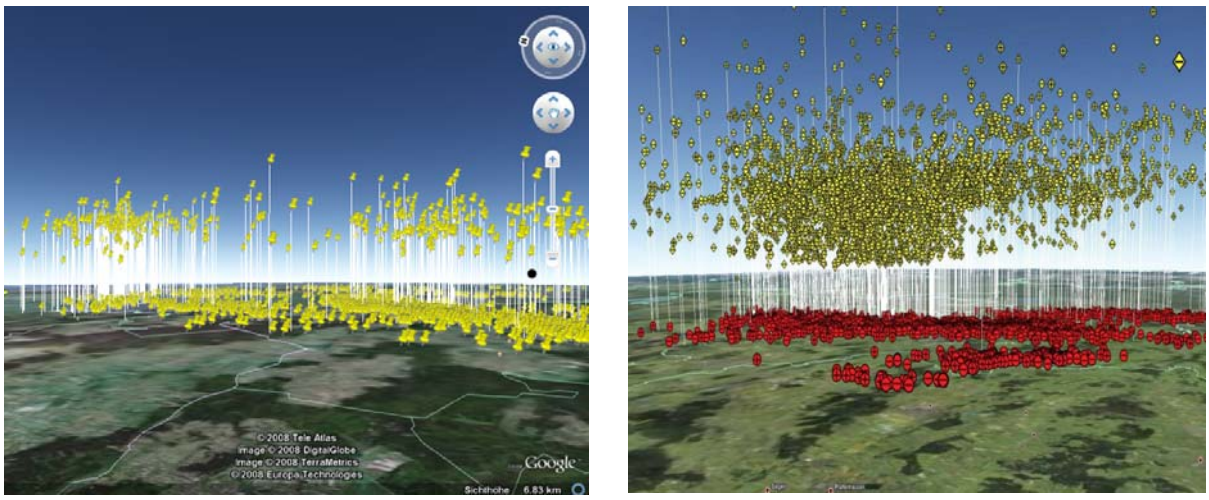
Highlights of the Munich work in atmospheric electricity during the past months concern the edition of a new book on Lightning, a paper on detection of cloud lightning by means of VLF/LF techniques, and progress with the 3D-visualization of severe weather.

A special monograph was edited by Hans D. Betz and co-editors U. Schumann and P. Laroche, entitled "Lightning: Principles, Instrument and Applications", available from Springer (see Springer website with index "Lightning"). It contains 27 chapters by 60 authors, leading experts in the field of lightning research, and covers fundamental lightning processes, measuring and observation techniques, meteorological implications, climate, chemistry and protection. Both experts and non-experts in the field are addressed.

Intricate time coincidences between initial breakdown signals located by VHF and VLF/LF techniques are the topic of a GRL-paper by Betz et al. (2008b); it is shown that the initial discharge phase produces copious pulses in both the VHF and VLF/LF regime. The present understanding of this surprising effect is discussed. The findings complement previous descriptions of cloud lightning.

The possibility to locate pulses from cloud lightning in the VLF/LF range (signals that show up as "IC-strokes") facilitates an automatic procedure to visualize thunderstorms as 3D images with very little time delay. In particular, severe weather conditions become directly visible in terms of dominating numbers of cloud pulses. As an example we show lightning strokes, accumulated within 10-minute slots, for a normal and a severe thunderstorm in southern Germany, exhibiting relatively small and large IC fractions, respectively. The observations are from LINET, the European lightning detection network designed by the University of Munich and operated by nowcast GmbH.

Cloud lightning continues to be investigated because many questions about the production mechanisms remain open and observation techniques can be further optimised for practical applications.



LINET stroke observation of a normal (left, some cloud lightning) and a severe thunderstorm (right, abundant cloud lightning)

Atmospheric Electricity Research Group at the Institute of Geophysics, Pol. Acad. Sci. (Warsaw, Poland)

The results of our investigations obtained in the field of thunderstorm and lightning research were presented by participants of our research group during several international conferences devoted to this issue. During the 3-rd International Symposium on Lightning Physics and its Effects in the frame of European COST Action P18 which took place in Vienna, Austria (14-15 April, 2008), Grzegorz Maslowski (maslowski@prz.esu.pl) and Piotr Baranski (baranski@igf.edu.pl) presented the examination of slow front and fast transition in electric field waveforms produced by first and subsequent lightning strokes detected during summer thunderstorms near Warsaw in years 2005-2007. On the other hand, Marek Loboda from the Warsaw University of Technology (marek.loboda@ien.pw.edu.pl) told about the status and stage of preparation of the Local Lightning Detection Network (LLDN) in the region of Warsaw to start its field measurement campaign in 2009. More details of the two presentations are available on www site: www.costp18-lightning.org.

Jerzy Konarski (jerzy.konarski@imgw.pl) from the Institute of Meteorology and Water Management in Warsaw attended the 2-nd International Lightning Meteorology Conference in Tucson, Arizona, USA (24-25 April, 2008) and gave the presentation showing meteorological background and special type of lightning activity behavior connected with severe winter thunderstorms observed recently in Poland. Abstract and details of that contribution are available on www site: www.vaisala.com.

The new possibility of more exact CG lightning flash detection by evaluation of its important parameters (ΔQ, i.e. the amount of electric charge neutralized by different strokes of such a discharge, and z, i.e. the height above the ground of the ΔQ which is involved in particular lightning stroke) may be obtained from the LLDN electric field change measurements, as reported by Marek Loboda et al. on the 29-th ICLP in Uppsala, Sweden (23-26 June, 2008). The extended version of that contribution was included to the 29-th ICLP Proceedings. The preliminary assessment of lightning flash detection reliability by the LINET and PERUN/SAFIR systems in Poland was given by Jerzy Konarski et al. as the contribution to the ELDW meeting in Ljubljana, Slovenia (13-14 October, 2008). The pdf version

of that presentation can be found on the www site: www.scalar.si/eldw.

The atmospheric electric field variations observed at the ground level as the response to solar wind changes are farther examined by using the geophysical data from two measuring stations at Hornsund and Swider Observatory (S.Michnowski, N. Kleimenova, M. Kubicki, O. Kozyreva).

The data obtained from the VLF/ELF AWESOME system at Swider Geophysical Observatory and the Schumann resonance records from the Hylaty station (Poland-Bieszczady mountains) have been used for studying of the global lightning storm activity (M. Golkowski: mag41@stanford.edu, M. Kubicki, A. Kulak, Z. Nieckarz: nieckarz@if.uj.edu.pl).

At Swider Geophysical Observatory the electric field and electrical conductivity recordings are continued with simultaneous observations of meteorology, radioactivity and air pollutions background (M. Kubicki: swider@igf.edu.pl, B. Laurikainen). These data are analyzed to have a deeper insight into the global electric circuit behaviour.

Our recent paper prepared by Kleimenova N.G., O.V. Kozyreva, S. Michnowski and M. Kubicki and dealing with the effect of magnetic storms on variations in the atmospheric electric field at midlatitudes was published in *Geomagnetizm and Aeronomy*, 2008, Vol. 48 , No 5, pp. 622-630.

CWI Amsterdam and Eindhoven Univ. Technol., The Netherlands

Ute Ebert, http://homepages.cwi.nl/~ebert

The research in The Netherlands focuses on theory (mostly in Amsterdam) and experiments (mostly in Eindhoven) of streamer discharges, as they appear in industrial corona reactors, in an upscaled version in atmospheric sprite discharges, and as an ingredient of lightning leaders.

The results of the streamer-experimental PhD thesis of Tanja Briels (Eindhoven, Dec. 2007) have appeared in 4 journal publications [Briels et al., 2008]. Topics: 1. Similarity laws of streamers at different air densities that extrapolate well to sprites. 2. Large variation of diameters and velocities of streamers with applied pulsed voltage (5 to 100 kV), dependence on voltage rise time, comparison of positive and negative streamers. 3. Dependence of streamers on the oxygen:nitrogen ratio. 4. Imaging streamer inception near a needle electrode. The work is continued by PhD student Sander Nijdam. His first result is stereo-photography and three-dimensional reconstruction of branched streamer trees. Method and branching angle distribution are published in Appl. Phys. Lett. 2008, a preprint discussing reconnection and merging of streamer channels can be found on the preprint server http://arxiv.org/abs/0810.4443. Experiments in 1 p.p.m. pure nitrogen and argon are presently being evaluated; experiments in the gas composition of planetary atmospheres are presently planned.

On the theoretical side, postdoc Alejandro Luque et al. have made major contributions to streamer simulations in fluid approximation in 5 journal papers in 2008. Based on an efficient algorithm for including photoionization [Luque et al., Appl. Phys. Lett. 2007], models of single positive and negative streamers in air now show the same characteristic differences as the experiments of Briels et al. [Luque, Ratushnaya, Ebert, J. Phys. D, 2008]. In a Phys. Rev. Lett. 2008 that was also covered by a research

highlight in Nature, Luque et al. have studied the interaction of two streamers next to each other and found that photoionization can mediate an interaction (this effect is also seen experimentally by Nijdam et al.). Other work concerns a regular array of streamers ("Saffman-Taylor streamers") and their electrodynamics that substantially differs from that of a single streamer. This work is now being continued by postdoc Valeria Ratushnaya and the new PhD student Gideon Wormeester. Mathematical reductions of generic streamer features are covered in journal papers of Fabian Brau et al. and of Gianne Derks et al. in 2008 and continued in recent preprints. Sergey Pancheshnyi (guest in Amsterdam from Toulouse) presently refines the microscopic streamer modeling.

X-ray bursts from lab discharges driven by MV-pulses are studied experimentally by Nguyen et al. [J. Phys. D, 2008]. They achieve a much better statistics and temporal resolution than previous authors [Dwyer et al, Cooray, Rakov et al.] and attribute the gamma-ray bursts to the streamer-leader phase of the discharge.

A theoretical counterpart to these measurements is being built up by Li Chao et al., who just has submitted his PhD thesis and will continue as a postdoc next year in Amsterdam. Li has shown that following individual electrons and their energies in the discharge is desirable for streamer start, chemistry and X-ray production, but in general computationally inefficient or even impossible [IEEE TPS 2008]. The solution lies in a hybrid particle-fluid model [J Phys D 2008] that he now has also implemented in full three spatial dimensions.

More experimental work concerns efficient O-radical production by corona streamer reactors with optimized electrical circuits in the electrical engineering department of TU Eindhoven in journal publications by Winands, van Heesch, Pemen, Liu and Yan.

Work by Manders et al. in the High Magnetic Field Lab in Nijmegen on streamers in high magnetic fields has finally been published in J. Phys. D, it should allow comparison with sprite discharges at high altitudes.

The special issue on Streamers, Sprites and Lightning in J. Phys. D was already mentioned in the announcements. Ute Ebert and Davis D. Sentman have written an editorial review for it.

Geodetic and Geophysical Research Institute

Sopron, Hungary

Different aspects of background and transient Schumann resonances (SR) have been studied mainly based on SR observations at Nagycenk Observatory, Hungary. Gabriella Sátori, Earle Williams and István Lemperger published a paper titled „Variablity of global lightning on the ENSO time scale" in the Special Issue of Atmospheric Research, 2008, available on line as ATMOS-0187.

József Bór and Slovakian colleagues analysed peculiar SR transient events and published their results in the paper: „Adriena Ondrášková, József Bór, Sebastián Sěvčík, Pavel Kostecký, Ladislav Rosenberg, Peculiar transient events in the Schumann resonance band and their possible explanation Journal of Atmospheric and Solar-Terrestrial Physics, Volume 70, Issue 6, April 2008, Pages 937-946.

A new optical observation system was set up in Sopron (47.68°N, 16.58°E), Hungary. József Bór, Veronika Barta and Gabriella Sátori managed to observe over 100 TLEs (sprites, sprite halos and one blue jet) in Central Europe in 2007 and about 70 of such in 2008. The system was improved in 2008 to be fully remotely controllable (Figure 1).

Springer will issue soon a book entitled "Lightning: Principles, Instruments and Applications" edited by Hans-Dieter Betz and co-edited by Ulrich Schumann and Pierre Laroche. Gabriella Sátori, Vadim Mushtak and Earle Williams wrote the Chapter 16 on the utilization of Schumann resonances in studying global lightning activity.

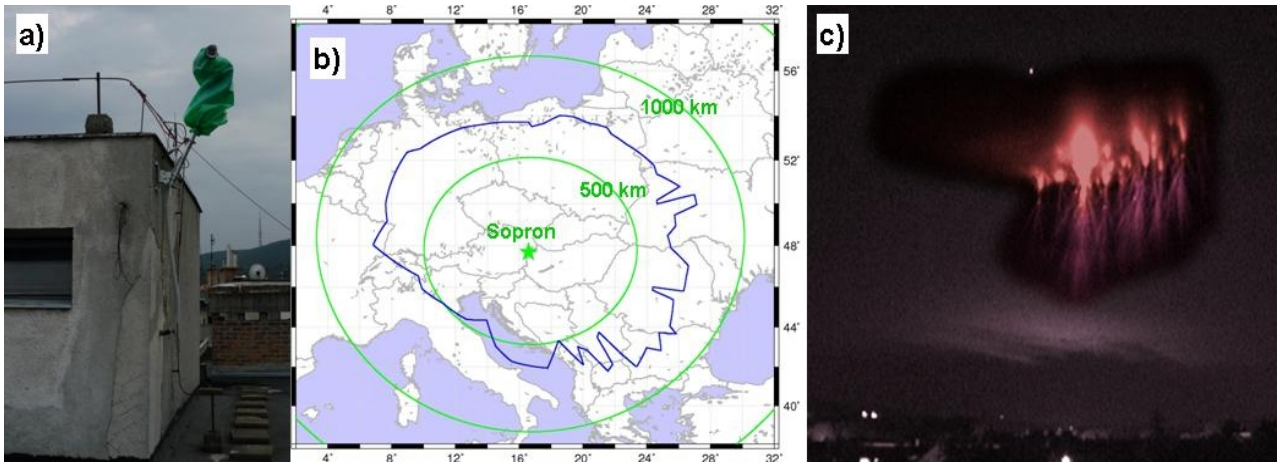


Figure 1. a) remotely controlled camera on top of the Geodetic and Geophysical Research Institute, Sopron Hungary, b) observation range for TLEs from Sopron (blue curve), c) sprites above Northern Italy on 7th August, 2008. 21:23:30.868 UTC (false colors added later), observed with the remotely controlled system.

Holle Meteorology & Photography Oro Valley, Arizona 85737, USA

Lightning casualties in the vicinity of vehicles:

A total of 212 events was analyzed where lightning caused 42 deaths and 288 injuries in the vicinity of vehicles.

The most frequent vehicle impact was a strike to a fully-enclosed metal-topped vehicle with people inside. Vehicles most often had the antenna as a point of entry. There were no injuries in more than half of these events, and few of the other events involved major injuries. The rare significant events occurred when people were startled, made unconscious, or blinded by a nearby strike. It is concluded that being inside a fully-enclosed metal-topped vehicle is safe from the danger of lightning, as stated in safety recommendations, compared to remaining outside at the same time and place.

The next most frequent category occurred when people were in direct contact with a vehicle at the time of lightning. In this situation, there was a high rate of deaths and serious injuries that occurred most often when a person was entering or exiting a vehicle (step voltage).Another group involved people working on a vehicle during a thunderstorm. Additional cases included cranes, golf carts, tractors, and other non-enclosed vehicles, as well as people in parking lots and waiting for buses. Some incidents involved law enforcement and other people near disabled vehicles, and people running or walking to or from a vehicle. In these situations, no safety was provided since they were outside a fully-enclosed metal-topped vehicles.

Reference Holle, R.L., 2008: Lightning-caused deaths and injuries in the vicinity of vehicles. Preprints, 3rd Conference on Meteorological Applications of Lightning Data, January 20-24, New Orleans, Louisiana, American Meteorological Society, 10 pp.

Annual rates of lightning casualties by country

The annual population-weighted lightning fatality rate in Australia, Canada, Europe, Japan,

and the U.S. has been well documented to have decreased by an order of magnitude from around 3 deaths per million people per year to around 0.3 at present. This reduction coincides with a major population shift from rural to urban areas away from labor-intensive agriculture, the frequent occupancy of substantial buildings, better forecasts and awareness of weather and lightning, improved medical care and emergency communications, the widespread availability of fully enclosed metal-topped vehicles, and other unknown factors.

These middle-latitude regions do not have as high a lightning frequency as many other regions of the world. It was estimated by Holle and López in 2003 that an annual rate of 6 deaths per million was appropriate for tropical and subtropical rural agriculturally-dominated areas with few substantial buildings or fully-enclosed metal-topped vehicles nearby. However, lightning casualty data for lesser developed countries are very incomplete in time and space. If the annual rate of 6 deaths per million applies to 4 billion people as suggested in 2003, the resulting annual worldwide estimate is 24,000 deaths and 240,000 injuries from lightning. The collection of lightning fatality totals over long periods is encouraged on a national basis in order to investigate the validity of these estimates.

Reference Holle, R.L., 2008: Annual rates of lightning fatalities by country. Preprints, International Lightning Detection Conference, April 21-23, Tucson, Arizona, Vaisala, 14 pp.

Laboratory of Lightning Physics and Protection Engineering, Chinese Academy of Meteorological Sciences (Beijing, China)

The recent works of Laboratory of Lightning Physics and Protection Engineering (LiP&P) mainly include the following two aspects:

Natural Lightning Observation and Artificially Trigged Lightning Experiment: Collaborated with Guangzhou Meteorological Bureau and Conghua Meteorological Bureau, LiP&P conducted field lightning observation and artificially triggered lightning experiment at Guangzhou Field Experiment Site for Lightning Research and Testing in the summer of 2008. Synthetic measurements of audio, optic, electric and magnetic signal of artificially triggered lightning and natural lightning were performed. The induced current and induced voltage were also measured for studying the characteristics of over-voltage and over-current on power cables and signal cables of automatic weather station in real lightning discharge environment. Data were obtained including the stroke current of artificially triggered lightning, the earth potential lifting at the stroke point, the current dissipation of grounded network. The preliminary analysis indicates that the current peak values of ten return strokes measured in two artificially triggered lightning flashes are between -6.6 kA and -26.4 kA, the charges transferred by them are between -0.52 C and -1.78 C, the half peak width values are between 2.9 μs and 43.5 μs, the 10%～90% rise time values are between 0.3 μs and 0.6 μs. The induced voltage on signal cables of

automatic weather station can reach thousands of volts, the overvoltage on the power cable caused by nearby natural lightning can reach 8～10 kV and the residual voltage of SPD can reach hundreds of volts. The experiment results show that Conghua is an ideal area for lightning observation because of its plentiful lightning activities. As a special technical support platform for lightning research and protection, Guangzhou Field Experiment Site for Lightning Research and Testing will play a more and more important role.

Lightning nowcasting service for the 2008 Beijing Olympic Games: Convective weathers are frequent in Beijing and its circumjacent region during the 2008 Olympic Games. To ensure the success of the Olympic Games, LiP&P developed CAMS_LNWS (Lightning Nowcasting and Warning System), which can produce the 0～1h lightning nowcasting, track the lightning activity region and predict its moving trend. CAMS_LNWS worked all day to produce lightning warning products timely. Through the evaluation and analysis for the products of CAMS_LNWS in several severe synoptic processes during the 2008 Beijing Olympic Games, CAMS_LNWS showed its ability for nowcasting thunderstorm activities in Beijing and its circumjacent region. CAMS_LNWS can give a fine prediction of the lightning activity region about an hour earlier.

The lightning warming products could match well with the observation results and it indicated that CAMS_LNWS could meet the needs of the current operation works. CAMS_LNWS has high degree of automation, good stability, and various and practical products. It can reduce the manpower demand and improve the efficiency for the weather services during the Olympic Games. CAMS_LNWS completes its task successfully to serve the 2008 Beijing Olympic Games, and its effect on the lightning nowcasting and warning services is positive and important. Additionally, CAMS_LNWS will provide an important basic platform for the operation work of lightning forecast in China.

Laboratory of Middle Atmosphere and Global Environment Observation (LAGEO), Institute of Atmospheric Physics, Chinese Academy of Sciences (CAS)

Beijing 100029, China

Shandong artificially triggering lightning experiment (SHATLE), cooperated with Lanzhou group in Cold and Arid Regions Environmental and Engineering Research Institute and Shandong Meteorological Bureau, was continuously conducted in Binzhou, Shandong in the summer of 2008. Thirteen negative lightning flashes including 58 return strokes have been triggered, and 23 current waveforms of return strokes have been documented at the base of the discharge channel since its start in 2005. In SHATLE 2008, a new developed optical control igniting system (OCIS), instead of air pressure ignition, was used to short the time delay of rocket ignition, and five lightning flashes were successfully

triggered in the same thunderstorm event with a triggering efficiency of 100%. The channel base current for an altitude triggered flash were documented. The discharge processes of the altitude triggered flash in SHATLE 2008 were also captured by a high speed camera with a resolution of 1024×512 and a time resolution of 9000 frame/s. Three altitude triggered flashes struck the cotton plant about 50 m away from the triggering facilities, and the plants in an area of about 25 m^2 were perished (Refer the picture below), the corresponding maximum peak current of return stroke was estimated to be about 40-56 kA.

Chinese Red Sprites Observation Campaign (CRSOC) continued in the eastern China in 2008. Five transient luminous events (TLEs) were obtained above two thunderstorms. The appearances were a little different from that in CRSOC 2007. Based on data obtained in CRSOC 2007, Jing Yang and Xiushu Qie recently submitted a paper with a title of "Red sprites and their relationships with the thunderstorms and the lightning activities in Chinese mainland" to Geophys. Res. Lett. They found that all of the parental +CGs were positive and located in large stratiform regions with radar echo of 20-40 dBZ in the rear of the thunderstorms. Meanwhile, the average values of discharge strength of positive CGs in the two red sprites-producing thunderstorms were larger than that of the non-red sprites-producing thunderstorms. The Doppler radar images indicated that comparatively large stratiform regions occurred in the two red sprite-producing thunderstorms, while no large stratiform regions were observed in the non-red sprites-producing thunderstorm.

Beijing Lightning electric field and its change NETwork (BLNET), consisted of 10 substations and time synchronized by GPS, has been installed in the summer of 2008. The field mill, slow antenna and fast antenna were integrated at each substation to monitor the thunderstorm and lightning activities in Beijing area. The data from each substation is transferred automatically to the central station located in LAGEO through internet. The **BLNET** was run during the 2008 Beijing Olympics and the Paralympics, and the data analyzing is just started.

A **Tibetan Plateau lightning automatic observation system,** similar to the BLNET substation, was installed at YangBaJing (4300m asl, about 90 km northwest of Lhasa) since the summer of 2008, cooperated with YBJ International Cosmic Ray Observatory (30°6′7″N, 90°31′25″E). The data is expected to be used in the correlation study between high energy radiation and atmospheric electricity. The system would continue its measurements all around the year.

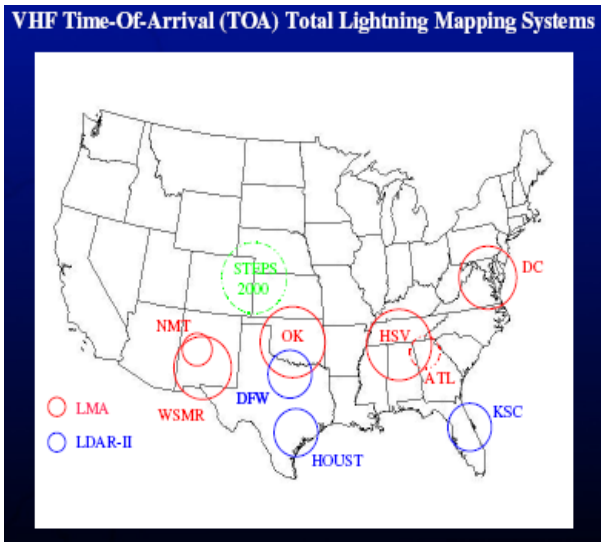
Lightning activities in seven super typhoons over Western Pacific have been investigated by Lunxiang Pan, Xiushu Qie and et al., based on the data from WWLLN and NMC (National Meteorological Center, China). The results indicate three distinct flash density regions in mature typhoon: a weak maximum in the eyewall regions (20~60 km from the center), a minimum 80~200 km outside the eyewall, and a strong maximum in the outer rainbands (>200 km radius). Few lightning occurs near the centre after landfall. In addition, collaborated with Prof. Robert H. Holzworth in University of Washington, two additional WWLLN sensors are being installed in China, one is in Beijing, and another one is in Nanjing near Shanghai. They will play their roles very soon.

Langmuir Laboratory for Atmospheric Research, New Mexico Tech, Socorro, New Mexico

Paul Krehbiel, William Rison, Ronald Thomas
krehbiel@ibis.nmt.edu

The lightning mapping group at New Mexico Tech is involved in several ongoing, parallel research efforts. We have been continuing our studies of volcanic lightning and electrical activity, most recently with the deployment of a four-station network on a coastal island in Chile to study the eruption of the Chaiten volcano during June and July of 2008. The volcano studies are being conducted in collaboration with Stephen McNutt of the Alaska Volcano Observatory. The Chaiten measurements were made with our portable Lightning Mapping Array (LMA) stations similar to those used to study the Augustine volcanic eruptions in January and February 2006. The portable mapping stations are also being used in the Washington DC Metropolitan Area LMA, being jointly operated by NASA and NM Tech for the U.S. National Weather Service. A portable LMA network was operated this past summer in West Virginia as part of a study of lightning transients in coal mines, and we are in the process of providing the University of Oklahoma with a set of portable stations to expand the Oklahoma LMA in preparation for the upcoming VORTEX II and proposed DC3 Atmospheric Chemistry studies. William Rison is developing a low-power version of the portable stations that can be more readily deployed and operated in remote locations, as well as for use in conventional networks.

A collaborative study with Jeremy Riousset and Victor Pasko of The Penn State University was published in the April 2008 issue of the new journal Nature Geoscience. The letter described the ways in which upward discharges (blue jets and gigantic jets) are produced by thunderstorms, based on a combination of observational data and modelling results both of the storm electrodynamics and of lightning discharges within the storms. The study resulted in part by the discovery of three upward jets in the LMA data from the STEPS 2000 field campaign - the first such observations obtained so far with the VHF mapping system, and by the development of a new lightning simulation model by Riousset and Pasko. The April issue featured a cover photograph by Ph.D. student Harald Edens of an attempted upward discharge and bolt-from-the-blue lightning flash in a New Mexico thunderstorm, and an introductory news article on the results by Earle Williams of MIT.



Harald Edens has been continuing his detailed studies of individual lightning discharges at Tech's Langmuir Laboratory in the Magdalena Mountains west of central New Mexico. The studies combine high speed digital electric field and VHF radiation measurements with LMA, photographic, and high-speed video observations, with particular attention on lightning initiation processes, bolt-from-the-blue discharges, and triggered lightning. Edens and Krehbiel have begun a collaborative study with the Cosmic Ray Group at the Research Center of Karlsruhe (FZK),

looking for possible time correlations between lightning and energetic cosmic rays detected by FZK's Kascade and Kascade-Grande arrays (http://www-ik.fzk.de/KASCADE_home.html).

Complete LMA data from the STEPS 2000 field campaign is being reprocessed using our current, improved processing code and will soon be made available online to the atmospheric electricity community and to interested researchers for downloading. Also newly available online is Krehbiel's (1981) Ph.D. dissertation concerning lightning charge centers from multi-station electric field change measurements during the TRIP 76-78 thunderstorm programs at Kennedy Space Center, Florida (available at NMT's Dspace archive at http://hdl.handle.net/10136/92).

Lightning and plasma research group at ONERA

The French Aerospace Lab

Pierre Laroche

The Group had achieved in 2007 the development of a lightning mapper based on the three main methods applied now days: the VHF DTOA, the VHF interferometer and the Low Frequency DTOA (few hundred kHz) (patrice.blanchet@onera.fr, philippe.lalande@onera.fr). The main objective is to get high temporal resolution (10µs), 3D description of all components of a lightning flash including the Recoil Streamer (K change) process.

Modelling of lightning channel behaviour has been realized based on SaturneTM magneto-hydrodynamic code. Specific lightning modules developed by PhD student Laurent Chemartin laurent.chemartin@onera.fr, provide a 3D description of the behaviour of the arc submitted to airflow, and of its interaction with the material on which it is sweeping. Modelling had been successfully compared with laboratory arc experiment performed at Toulouse Aeronautical Test Laboratory (CEAT). Next steps consist in improving the modelling of the material response and taking into account the response of the channel to a return stroke process.

Massachusetts Institute of Technology

Parsons Laboratory, USA

Earle Williams

China devoted considerable effort to reducing pollution levels in Beijing in preparation for the summer Olympic Games in 2008. Xiushu Qie, Guangyang Fang and Earle Williams are collaborating on the behavior of the fair weather electric field in Beijing, before, during and after the Games. For a uniform current density from the global electrical circuit, a reduced (enhanced) electric field is expected in air of high (low) conductivity, according to Ohm's law. Pollution reduces the conductivity by the capture of small ions, the main contributor to air conductivity. Consistent with this prediction, preliminary results on a record extending from early May 2008 to present show a minimum field around the time of the event, and larger fields prior to (in May and June) and following (in September and October) the Games. The overall variation is about a factor-of-two, similar to contrasts in fair weather fields between polluted land stations and oceans. Present efforts are focused on evaluating the contributions from automobile traffic and from coal-fired power

plants to the changing aerosol population. These results are to be presented at the upcoming AGU meeting in San Francisco.

Earle Williams visited the highly electrified premonsoon regime in northern Zambia in early November with a team from Pioneer Productions for the Discovery Channel, in a segment focused on "extreme weather". Optical flash counters loaned by Ralph Markson and a novel cylindrical field mill provided by Nilton Renno were used to document the storm electrification. Total flash rates reaching 1 fps were documented on consecutive days, and centimeter-sized hail was noted in one of these storms (only the second occasion Williams has seen hail on the ground in the tropics, and both times in Africa). Though this sample on the lightning is small, the observations are consistent with the superlative lightning activity in Africa in comparison with that in the 'Green Ocean' of the Amazon basin in South America.

NASA-supported work has been underway with Walt Petersen (U. of Alabama, Huntsville), Carlos Morales (U. of Sao Paulo, Brazil), and Vasso Kotroni (National Observatory of Athens, Greece) to merge VLF lightning observations from STARNET sensors in Africa and the Americas with ZEUS sensors in Europe. The goal is to investigate the behavior of squall lines in Africa during AMMA (African Monsoon and Multidisciplinary Analysis) and NAMMA (the overlapping NASA campaign), and during the 2007 wet season when the MIT radar continued operation in Niamey, Niger, following AMMA. Observations for the August 18, 2006 squall line (that subsequently produced a tropical cyclone off the west coast of Africa) demonstrate that this merging of results is highly successful. These collaborative methods have also led to the location of lightning flashes that also produced video camera-detected sprites in West Africa during the AMMA campaign there (see below).

A host of international collaborators (W. Lyons, Y. Hobara, V. Mushtak, N. Asencio, R. Boldi, J. Bór, S. Cummer, E. Greenberg, M. Hayakawa, R. Holzworth, V. Kotroni, J. Li, C. Morales, T. Nelson, C. Price, B. Russell, G. Sátori, K. Shirahata, Y. Takahashi, and K. Yamashita) have assembled a variety of independent observations (video, ELF, VLF, MeteoSat) to document sprites and their parent lightning flashes over West Africa during the AMMA. These events in August and September of 2006 were detected by as many as six ELF receivers worldwide, and by two VLF networks (WWLLN and ZEUS/STARNET). The analysis of individual bright point sources at ELF enables analysis of the propagation model for the waveguide. The overall results are soon to be submitted to the Special Issue on AMMA in the Quarterly Journal of the Royal Meteorological Society.

Vadim Mushtak, Bob Boldi (U. Alabama, Huntsville) and Earle Williams are engaged in the formal inversion of Schumann resonance background observations to quantify evolving global lightning activity. Simulations with a full day-night model of the Earth-ionosphere cavity and with linearized iterative inversions show promise for workability with real data. Key inputs from multiple stations will be peak intensity, peak frequency, and Q-factors from Lorentzian fits of Schumann resonance power spectra on the four lowest resonant modes.

National Lightning Safety Institute (NLSI), Denver Colorado USA

A ten day Australian lightning safety speaking tour was conducted during September 2008. The lecture series was directed at the Australian natural resources industries. Outdoor workers at large scale facilities (mines, refineries, airports, etc.) often

are threatened by lightning, with injuries and fatalities resulting. A matrix of defenses for lightning safety was presented, as described in outline form below:

Matrix for Lightning Safety for Outdoor Workers

1. Threat Recognition via Detection Instruments and Human Awareness
2. Notification to Affected Persons (sirens, radios, etc.)
3. Evacuation to Pre-Designated Safe Shelters
4. Threat Re-Assessment
5. Resumption of Activities
6. Education and Training, New Employees and Annually

A more detailed treatment of this topic can be found at: www.lightningsafety.com/nlsi_pls/outdoor_workers.html. This website document has been submitted for consideration and inclusion in the next revision of the USA NFPA-780 "Standard for the Installation of Lightning Protection Systems".

NLSI's attention to lightning safety at military explosives storage facilities continued during 2008. Assessments of existing lightning protection systems were conducted at Picatinny Army Depot - Picatinny New Jersey, Langley Air Force Base - Langley VA and McAlester Army Ammunition Deport - McAlester Oklahoma. US Air Force AFI 32-1065, USAF AFI 91-201 and US Army PAM 385-64 were the applicable explosives safety standards where structures were examined for conformity. NLSI's two day class "Lightning Protection for Engineers" also was conducted at these bases for military personnel.

Practical applications of codified lightning protection (IEC 62305) have been applied with success at large scale international mining operations. People safety issues, mentioned above, have incorporated safe shelters in the form of inexpensive and portable used steel shipping containers. The "quasi-Faraday Cage Principle" considers that high frequency current flowing through a conductor generates an electromagnetic field resulting in confining currents towards the outside of the conductor ("Skin Effect" and "Skin Depth"). Since skin depth is proportional to the inverse of the frequency, penetration is surface-limited. Thus metal vehicles and shipping containers can be considered safe refuges from lightning. A paper on NLSI's website gives further details with illustrations: www.lightningsafety.com/nlsi_pls/outdoor_worker_shelters.html. Other lightning protection sub-systems to be considered include low impedance earthing - here, in high resistance rocky conditions, a variety of man-made artificial earth electrode backfills typically is a solution. Suitable surge protection devices also must be employed in two or three stage layers according to IEC Standards. Finally, bonding of all adjacent conductors is essential to avoid the possibilities of voltage rise mis-matches.

National Severe Storms Laboratory (NSSL), Norman, Oklahoma, USA

The following are recent graduates focusing on aspects of storm electricity at the University of Oklahoma and NSSL:

Eric Bruning, 2008, Ph.D. dissertation "Charging regions, regions of charge, and storm structure in a partially inverted polarity supercell thunderstorm. Now employed at NOAA / Earth System Science Interdisciplinary Center / Cooperative Institute for Climate Studies in Maryland, USA.

Nicole Lund, 2008, M.S. thesis, "Relationships between lightning location and polarimetric radar signatures in a small mesoscale convective system." Now employed by Raytheon in Massachusetts, USA.

Clark Payne, 2008, M.S. thesis, "The

evolution of a lightning hole during the 29-30 May 2004 HP supercell during TELEX." Now employed at National Weather Service/Warning Decision Training Branch in Oklahoma, USA.

Ariel Cohen, Ariel Cohen, 2008, M.S. thesis, "Flash rate, electrical, microphysical and dynamical relationships across a simulated storm spectrum." Now a forecaster at NOAA's National Hurricane Center in Florida, USA.

Field program:

NSSL researchers collaborated with colleagues from New Mexico Tech (Socorro, NM) to conduct a field project at the Langmuir Laboratory for Atmospheric Research in New Mexico during the summer of 2008. The small focused effort was to understand better the direct production of ozone within electrically active storms. Five (of five attempted) balloon flights successfully ascended through thunderstorms carrying ozonesondes. In situ measurements from the balloon-borne instruments included ozone mixing ratio, electric field, meteorological variables, and GPS location and timing. Lightning discharges were identified within each storm using the NMT lightning mapping array surrounding Langmuir Lab. The data show that the instruments ascended through regions of high electric fields within the storms, and sometimes the balloon was in close proximity to lightning. Relationships between electric field, lightning, and ozone are being examined.

In addition to the scientific data gathering flights, we tested several improvements to the balloon-borne electric field meter (originally developed by Winn and Byerly). The changes improved the data acquisition process and the quality of the data, which are transmitted to ground and recorded on board.

Rutherford Appleton Laboratory, UK

Karen Aplin, Chris Davis

The group at RAL continues to work on a broad range of atmospheric electrical topics, covering the lower and upper terrestrial atmosphere, and planetary atmospheres. Karen Aplin is editor of a new book on Planetary Atmospheric Electricity, the subject of an article elsewhere in this Newsletter. She is Principal Investigator (PI) of the Asteroid Charge Experiment (ACE) for the Marco Polo asteroid mission. Asteroid charging is thought to be significant for particle motion across, and even away from, the asteroid surface. ACE will make the first measurements of the electric field and charged particle environment at the surface of a near-earth asteroid. Karen is also Deputy PI of a French-led instrument, Atmospheric Relaxation and Electric field Sensor (ARES) to measure the Martian atmospheric electric field, which will be launched on the ExoMars mission in 2016.

Moving back to the terrestrial atmosphere, Karen Aplin and Robert McPheat have developed a radiometer for infra-red optical detection of cluster-ions, recently published in *Reviews of Scientific Instruments*. Chris Davis is developing his work on enhancement of the ionospheric sporadic-E layer in response to lightning, initially published in *Nature* (2005). Since the initial discovery, further work has revealed that there are several mechanisms operating, and that the effect is dominated by negative polarity cloud-to-ground lightning strokes. While the effect is now understood in more detail, the exact mechanisms involved remain unclear. In order to obtain evidence for, or indeed discount some mechanisms, we have now set up a sprite-detection camera at the Laboratory. Sprites remain elusive over the UK but even if they are not associated with the sporadic-E enhancements, we need to make observations in order to discount them as a contributing factor in our lightning studies. The camera set-up is very similar to those used in the Euro-sprite campaigns, with a sensitive

CCD camera and fast lens (f1.2). Recording is triggered by UFO Capture software that detects unexpected differences in intensity between adjacent frames of the movie footage. Although we have yet to detect any unusual optical phenomena associated with lightning, our camera has captured a bright meteor and, in the first weekend of November, many firework displays. Enjoyment of the latter was only restricted by the monochrome nature of the camera.

Space Science and Technology Department (SSTD) Rutherford Appleton Laboratory, UK

Karen Aplin, Chris Davis

Research at SSTD now covers both the disturbed and fair weather aspects of the global electric circuit. Karen Aplin continues to work on atmospheric ionisation, and in particular the infra-red absorption of atmospheric cluster ions, towards the application of this technique to remote sensing of the properties of terrestrial and planetary atmospheres. There is new work underway in comparative planetary atmospheric electricity as well as space instrumentation for atmospheric electricity measurements, for example the Atmospheric Relaxation and Electric Field Sensor (ARES) on the European Exomars mission, in collaboration with French and Hungarian colleagues. For the Europlanet workshop on planetary atmospheric electricity, a new analysis of the development of terrestrial atmospheric electricity has been undertaken, to inform the design of planetary missions.

Chris Davis has been developing mechanisms to explain the enhancements observed in the UK of the ionosphere's E-layer (sporadic E) in response to lightning. This enhancement results from both local and remote lightning sources, indicating that multiple processes are involved. After isolating the gravity wave contribution (which acts at a distance), the enhancement of the Es layer resulting from lightning directly below was shown to be generated by negative cloud-to-ground lightning. This evidence helps rule out certain mechanisms (such as infrasonic waves) while providing insight into other potential initiating mechanisms such as sprites. Further work will include simultaneous optical, field strength, lightning location and ionospheric measurements to isolate the relevant mechanisms. In particular, we plan to identify the relative importance of lightning in generating ionospheric electrons and enhancing mesospheric wind shear, which concentrates existing ionisation.

Tel Aviv University (TAU) and the Open University of Israel (OUI)

Yoav Yair (OUI), Colin Price (TAU) and students Roy Yaniv, Na'ama Reicher, Netta Tzur and Daria Dubrovin have started the 5th winter sprite campaign in Israel. Early success in autumn storms: the first events ever detected over land in Israel were imaged above a desert thunderstorm using a calibrated camera, enabling calculations of absolute sprite brightness. Simultaneous observations from the Hebrew University of Jerusalem are conducted by Caryn Ehrlich and students Elyakom Vadislavski and Shalem Cohen,

targeting storms in the Mediterranean Sea near Cyprus and Turkey. Continuous ELF and VLF data are recorded in the Negev stations to support the optical data. Student Roy Yaniv had joined the Brazilian sprite campaign conducted in early October from Florianópolis, Santa Catarina State, led by Fernanda São-Sabbas (INPE). The 16-day campaign yielded few events due to poor viewing conditions.

Yoav Yair and Barry Lynn (OUI) are continuing the development of the Lightning Power Index (LPI). The numerical experiments with the WRF model were used to investigate the relationship between the model-derived LPI and the observed cloud-to-ground lightning activity. The superiority of the LPI against thermodynamic indices for lightning prediction such as the KI and CPTP was clearly demonstrated for case studies in Spain, Italy, Israel and Greece. Further work on a Coarse-LPI is being pursued for operational forecasting of lightning activity.

Reuven Aviv (Tel-Hai Academic College), Yoav Yair (OUI) and Gilad Ravid (Ben-Gurion University of the Negev) are continuing the work on the network behavior of lightning flashes in adjacent thunderstorm cells. Analysis of flash data from a storm near the coast of Israel showed that it is highly improbable that the lightning events were generated by an independent Poisson process, hinting at a possible inter-connectivity and synchronicity of lighting discharges. Data from the LINET system of several European summer storms was received courtesy of Prof. Hans Betz (U. of Munich) and will be used for further analysis of the properties of the lightning sequence.

Colin Price, Mustafa Asfur and Yoav Yair completed the analysis of the relationship between lightning activity and the increase in wind-speeds within intense hurricanes and typhoons. The analysis shows that in 39 out of the 41 storms of the 2005-2007 seasons, there exists a clear positive correlation between lightning activity and wind speed, with a time lag of about 24h between the maximum lightning activity and the maximum sustained winds in the hurricanes.

Colin Price and graduate student Yuval Reuveni have been analyzing VLF noise data related to the Perseid meteor shower in 2007. Although it is difficult to separate the lightning sferics from the meteor sferics, we are confident that meteors do result in the production of VLF sferics, which can explain the idea of electrophonics (sounds heard simultaneously with the optical observation of meteors).

Colin Price and Tony Merzer, together with graduate students Adi Zomer and Alex Abromov, are continuing to study ULF anomalies related to seismic activity. We have established our second ground ULF observatory close to the Dead Sea Rift Valley, and are continuously monitoring the ULF and ELF fields. In addition, we have started looking at the DEMETER satellite data over our region to try to understand the ULF variations detected by the satellite.

Terrestrial Electromagnetic Environmental Studies Group, University of Electro-Communications

M. Hayakawa (hayakawa@whistler.ee.uec.ac.jp)

The study of winter lightning in the Hokuriku area of Japan and its associated sprites is still going on by means of coordinated measurements (optical measurement, ELF observation in Moshiri, VHF lightning observation (radar) and LF/HF/VHF radio noise measurement). In order to explain the unsolved sprite problems, we have performed

the computer simulations based on the EM code [Asano et al., JGR, 2008]. Furthermore, we have developed a cellular automation modeling to explain the fine structure of sprites [Hayakawa et al., Phys. Plasma, 2007]. Also, the direct effect of lightning discharges onto the ionosphere (so-called Trimpi effects) has been studied by means of subionospheric VLF/LF data from the Japanese network (for the study of sesmo-ionospheric perturbations).

The ELF observations is still continued at Moshiri (Hokkaido) with the measurements of two horizontal magnetic field components and one vertical electric field. The sampling frequency is 4 kHz. We study the Schumann reconances and ELF transients. The diurnal and seasonal variations of Schumann resonance parameters have been studied [Sekiguchi et al., J. Atmos. Electr., 2008], which will be compared with the theoretical modeling. The Schumann resonance data at multiple stations are used to obtain the snapshot distribution of global lightning activity by means of inversion problem. The objective estimation of inverse problem has been nearly established [Ando and Hayakawa, Radio Sci., 2007], so that we will apply this method to a huge amount of data (e.g., one year long) to study the diurnal and seasonal variations of lightning activities for different chimneys. ELF transients observed at Moshiri are used to obtain the global mapping of intense lightning discharges [Yamashita et al., 2008].

The study of electromagnetic phenomena associated with earthquakes, is still going on. The seismogenic ULF emissions have been observed in the Tokyo area by means of Tokyo ULF network. The subionospheric VLF/LF perturbations associated with earthquakes (this can be called, seismo-Trimpis) have been measured by Japanese VLF/LF network. Seismo-atmospheric perturbations are being studied by means of VHF observation (detection of over-horizon VHF noise) (especially we have developed an interferometric observation). Some of these seismogenic effects are found to be closely related with atmospheric electricity studies.

Texas A&M University, USA

Joe Jurecka and Chris McKinney both completed their master's thesis research over the summer and are now employed by the National Weather Service offices at Lubbock and Houston, Texas. Joseph Jurecka (MS) 2008 made “An evaluation of lightning flash characteristics using LDAR and NLDN networks with warm season southeast Texas thunderstorms.” Christopher McKinney (MS) 2008 studied “Total lightning observations of severe convection over North Texas.” Gregory Seroka (BS, Penn State) and Matt Mosier (BS, Texas A&M), new grad students will continue the Jurecka and McKinney lightning research using primarily the NLDN and LDAR II data.

Nathan Clements (MS) 2008 completed his master's research on "The warning time for cloud-to-ground lightning in isolated, ordinary thunderstorms over Houston, Texas." Nathan found that the warning time for the first cloud-to-ground lightning averaged 3 minutes when compared to the first intracloud flash using the Houston LDAR II network. Using the criterion, however, of when the 30-dBZ contour reached the environmental -10 degree isotherm proved to be the best method in forewarning the first CG flash. The average CG warning was 16 minutes, similar to previous studies.

Professors Richard Orville, Courtney Schumacher, and Larry Carey (adjunct professor) are cooperating on National Oceanic and Atmospheric Administration/National Weather Service projects to better integrate the NLDN and LDAR II data into the operational environment of the NWS.

A university-wide annual Sigma Xi Distinguished Lecture will be given in

November by Richard Orville on the subject of "Lightning through a Lens" that will summarize the last few decades of lightning research and provide a view of optical studies to be made over the next decade or so.

One paper was published in February tracing the "Development of the National Lightning Detection Network" over a period of 25 years beginning in the early 1980's (Orville, R. E., Bull. Amer. Meteor. Soc., 89, No. 2, 180-190). It is a credit to our research community that so many colleagues cooperated over the years to produce this national research and operational facility that is now owned and operated by Vaisala, Inc. of Tucson, Arizona.

The Atmospheric Electricity Group, University Of Reading

The atmospheric electricity group at the University of Reading continues to investigate fair weather atmospheric electricity. Recently this has included further recovery of historic atmospheric electricity datasets, and new measurements of charge effects in fair weather clouds.

At Lerwick Observatory in the Shetland Isles, the UK Met Office measured the Potential Gradient from the early 1920s until 1984, but, from 1978-1984 the air-earth current density was also measured. The method used has now been described together with the first analysis of the dataset (Harrison R.G. and K.A. Nicoll, Atm. Res., 89, 181-193, 2008). The columnar resistance at Lerwick is relatively small compared with the polluted site at Kew Observatory, also operated for atmospheric electricity by the Met Office.

A lightweight air conductivity sensor has been developed for use in non-thunderstorm clouds (Nicoll K.A. and R.G. Harrison, Rev. Sci. Instrum., 79, 084502, 2008). The sensor comprises two identical sampling systems to measure bipolar ions simultaneously, with measurements made using a voltage decay mode for economy and thermal stability. The sensor has been flown using a tethered balloon, and work is underway to test it on a variety of aerial platforms.

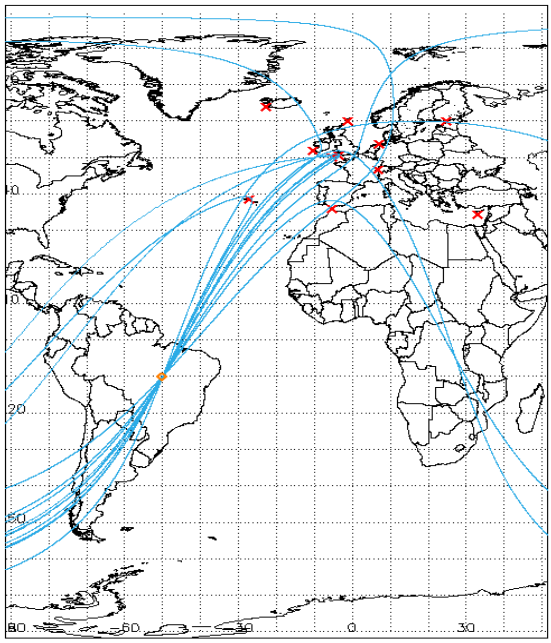
Harrison and Ambaum, (Proc. Roy. Soc. Lond. A, 464, 2561-2573, 2008) have investigated cloud properties observed simultaneously with air earth current density measurements, Jc. A mechanism was proposed which links cloud properties with Jc, through effects of charge on droplet condensation.

A new method has been proposed to distinguish between solar ultraviolet and cosmic ray effects on clouds (Harrison R.G., Proc. Roy. Soc. Lond. A., 464, 2575-2590). This uses a periodicity present in galactic cosmic rays which is absent in solar UV data.

The UK Met Office, Observation R&D Group – VLF Arrival Time Difference lightning location network (ATDnet)

Alec Bennett (alec.bennett@metoffice.gov.uk)

Investigation continues into optimisation of the UK Met Office long range lightning location network (ATDnet) quality control algorithms. The investigation focuses on an adaptive algorithm which considers the effect of diurnal variation in waveform correlation due to the influence of modal interference at the network's frequency (13.7kHz), produced by the Earth-ionosphere waveguide. The spatial distribution of lightning location error has been calculated theoretically and is currently being compared to observations. Several lightning strikes from a volcanic plume following the Chaiten eruption in Chile on 2 May 2008 were



successfully located by ATDnet, despite being over 12,000km away from the network centre. Analysis of the waveforms received over Europe from this volcanic lightning is planned in collaboration with the University of Reading. Studies comparing ATDnet lightning detection with localised (but high detection efficiency) networks covering regions near the limit of the ATDnet coverage (such as Brazil) are expected to be of particular interest to the group. At long distances from the centre of the network the spatial error is most sensitive to variations in waveform correlation due to shallow hyperbolic intersection angles (figure1).

Figure 1: Map of theoretical hyperbolic curves of arrival time difference for the operational ATDnet outstations, intersecting over a Brazilian lightning strike.

The Upper Atmosphere Research Group– National Space Institute–Technical University of Denmark

Copenhagen, Denmark

The group conducts research into studies of sprites, jets, eves, and the terrestrial gamma-ray flashes and has proposed "The Atmosphere-Space Interactions Monitor" (ASIM) to the Human Spaceflight, Microgravity and Exploration Directorate within ESA. ASIM is an instrument suite to be mounted on an external platform on the International Space Station (ISS). ASIM is currently at the end of Phase B. The mission is supported by an international science team. Scientists interested in joining the mission preparations, for instance by planning for co-ordinated ground, aircraft or balloon campaigns during the mission, are welcome to join the science team and should contact Torsten Neubert, neubert@space.dtu.dk.

The group supported the EuroSprite2008 campaign with one optical camera system at the Observatoire Midi Pyrénées and a second system on Monte Corona, Corsica. The camera on Corsica is semi-autonomous, powered by solar cells and controlled over the Internet via a satellite link. The camera at Observatoire Midi Pyrenées was taken down in early November due to heavy snowfall at Pic du Midi. The camera on Monte Corona remains in operation. During the campaign several hundreds of sprites were recorded, with many from the Corsica system. For access to data contact Olivier Chanrion, chanrion@space.dtu.dk.

University of Florida (Gainesville, Florida, USA)

Eleven negative lightning flashes were triggered in 2008 at the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida, operated jointly by the University of Florida and the Florida Institute of Technology. Seven of them contained

leader/return stroke sequences and the other four were composed of the initial stage only. Additionally, two natural negative lightning discharges that terminated on site or in its immediate vicinity were recorded by the multiple-station electric and magnetic field measuring network and/or by the Thunderstorm Energetic Radiation Array (TERA). Two natural lightning flashes and five triggered-lightning flashes were recorded both at Camp Blanding and in Gainesville (separated by a distance of about 45 km).

J. Howard, M.A. Uman, D. Hill, C. Biagi, and J. Jerauld, in collaboration with J.R. Dwyer, Z. Saleh, and H.K. Rassoul of the Florida Institute of Technology, authored a paper titled "Co-location of lightning leader x-ray and electric field change sources". Using an eight-station time of arrival (TOA) network composed of NaI(Tl) scintillation detectors and wideband electric field derivative (dE/dt) antennas covering approximately 1 km2 on the ground, the authors have located both the sources of X-ray emissions and electric field changes produced during the leader phase of both downward negative natural and rocket-triggered lightning strokes. It has been shown that the sources of X rays and leader step electric field changes are co-located in space within 50 m and that the located X rays are emitted 0.1 to 1.3 microseconds after the origin of the leader step electric field changes. The paper is published in GRL.

A. Nag, V.A. Rakov, and C.J. Biagi, in collaboration with W. Schulz of ALDIS (Austria), M.M.F. Saba and A. Oliveira Filho of INPE (Brazil), R. Thottappillil, A. Kafri, N. Theethayi, and T. Gotschl of Uppsala University (Sweden) authored a paper titled "First versus subsequent return-stroke current and field peaks in negative cloud-to-ground lightning discharges". The authors examined relative magnitudes of electric field peaks of first and subsequent return strokes in negative cloud-to-ground lightning flashes recorded in Florida, Austria, Brazil, and Sweden. On average, the electric field peak of the first stroke is appreciably, 1.7 to 2.4 times, larger than the field peak of the subsequent stroke (except for studies in Austria where the ratio varies from 1.0 to 2.3, depending on methodology and instrumentation). Similar results were previously reported from electric field studies in Florida, Sweden, and Sri Lanka. For comparison, directly measured peak currents for first strokes are, on average, a factor of 2.3 to 2.5 larger than those for subsequent strokes. There are some discrepancies between first versus subsequent stroke intensities reported from different studies based on data reported by lightning locating systems (LLS). The ratio of LLS-reported peak currents for first and subsequent strokes confirmed by video records is 1.7 to 2.1 in Brazil, while in the United States (Arizona, Texas, Oklahoma, and the Great Plains) it varies from 1.1 to 1.6, depending on methodology used. The smaller ratios derived from the LLS studies are likely to be due to poor detection of relatively small subsequent strokes. The smaller values in Austria are possibly related (at least in part) to the higher percentage (about 50% versus 24–38% in other studies) of flashes with at least one subsequent stroke greater than the first. The effects of excluding single-stroke flashes or subsequent strokes in newly formed channels appear to be relatively small. The paper is published in JGR.

University of Maryland, USA

Dr. Ken Pickering (NASA/Goddard and Adjunct Professor in the Atmospheric and Oceanic Sciences Department (AOSC) at the University of Maryland) is leading research and applications on three projects related to lightning NOx production. Working in conjunction with Dr. Pickering are Dr. Dale Allen and Dr. Tim Canty (Research Faculty in

AOSC) and two graduate students. This work centers on providing better estimates of lightning NO production and its vertical and geographic distribution for use in regional and global chemical transport models.

Cloud-resolved simulations with chemistry have been conducted for several storms from the STERAO, EULINOX, CRYSTAL-FACE, and SCOUT-O3/ACTIVE field campaigns with the objective of estimating NO production per flash, under support from the National Science Foundation and NASA. Time series of observed flash rates from local or regional lightning networks are input to the model along with several scenarios of NO production per flash which are tested by comparing resulting anvil-level NOx mixing ratios against aircraft observations. Results to date show that on average an intracloud flash produces an amount of NO roughly equivalent to that from a cloud-to-ground flash with a mean value of ~500 moles NO/flash. This work has also led to development of vertical profiles of effective lightning NO emissions which are now being applied in global chemical models. Current activities include simulation of storms from NASA's Tropical Composition, Cloud, and Climate Coupling (TC4) field experiment using data from the Costa Rica Lightning Detection Network. Simulated NO2 tropospheric column amounts from TC4 including the effects of lightning will be compared with those retrieved from the Ozone Monitoring Instrument on NASA's Aura satellite.

Algorithms are being developed to specify flash rates and lightning NO production in NASA's Global Modeling Initiative (GMI) chemical transport model and EPA's Community Multiscale Air Quality (CMAQ) model under support from NASA's Modeling, Analysis, and Prediction (MAP) program and the NASA Applied Sciences Air Quality program, respectively. In the GMI scheme flash rates are estimated using the upward cloud mass flux from the convective parameterization, such that the lightning NO emissions are placed in the same grid cells as where deep convection occurs. Resulting flash rates for individual grid cells are scaled on a monthly basis using the OTD/LIS climatology. In CMAQ over the continental United States the flash rates are estimated using the convective precipitation rate as the predictor variable with monthly scaling using NLDN along with gridded climatological IC/CG ratios. LMA data will be used in better defining the IC/CG ratio for those regions available.

Drs. Rachel Albrecht and Eric Bruning recently joined NOAA's Cooperative Institute for Climate Studies, part of the Earth System Science Interdisciplinary Center at the University of Maryland. They will work on science and algorithm development for the GOES-R Geostationary Lightning Mapper (GLM). This instrument will, for the first time, provide regular and frequent depictions of lightning occurrence from geostationary orbit, offering a significant advance in the ability of scientists to observe and understand the role of lightning in severe weather, tropical storms and climate.

During the coming year, Dr. Albrecht will collaborate with Dr. Robert Kuligowski (NOAA/NESDIS) and Dr. Walt Petersen (NASA/MSFC) on the use of GLM lightning data for rainfall estimation in SCaMPR (Self-Calibrating Multivariate Precipitation Retrieval) algorithm. SCaMPR was chosen as the official rainfall rate algorithm for GOES-R and will use images taken by the onboard Advanced Baseline Imager (ABI) to retrieve rainfall. Dr. Albrecht will generate lightning proxy data of the South-African Lightning Network to be used in conjunction with SEVERI data, which is proxy data for GOES-R ABI. Lightning data is expected to improve instantaneous rainfall rates, specially over convective rain, and future quantitative precipitation estimation methods. Data from the Lightning Image Sensor (LIS) onboard of TRMM satellite will also be used as proxy data for climatological research of maximum lighting rates and total diurnal cycle over GOES-R field

of view.

During the coming year, Dr. Bruning will contribute to algorithm development for GLM. A primary goal for the coming year is development of a physically sound proxy simulation of optical events from the VHF LMAs, which entials better understanding of the physical connection between optical and VHF emissions. Proxy dataset development will be conducted in collaboration with Dr. Bateman (USRA/MSFC). Interaction with the operational community will take place under the umbrella of the GOES-R Proving Ground (http://cimss.ssec.wisc.edu/goes_r/proving-ground.html). Continued oversight of LMA data delivery to the Sterling, VA forecast office and new data delivery to the Storm Prediction Center is planned. He also plans continued collaborative work with Drs. Carey and Petersen (UAH, MSFC) on the topic of thunderstorm charging and storm polarity, focusing on comparison of normal and inverted polarity supercells.

University of Mississippi, Oxford, MS, USA

T. Marshall, M. Stolzenburg

Our continuing investigations, in collaboration with E. Mareev and S. Davydenko (Institute of Applied Physics, Russian Academy of Science) into the Earth's global electric circuit have led to two papers on the role of lightning transients [Mareev et al., 2008; Maggio et al., 2008]. The Mareev et al. study has shown that only a portion of the charge neutralized by a lightning flash contributes to the global circuit, with the efficiency dependent on the altitudes of the lightning charges. Typical CG flashes have efficiencies of 55-75%, and typical IC flashes have 5-15%. For five individual CG flashes studied by Maggio et al., the transient currents moved +1 to +5 C of charge upward from cloud-top toward the ionosphere, with the average transient charge transfer about 35% of the charge transferred to ground. In five IC flashes, the transient currents moved -0.7 to -3 C upward, with the average transient charge transfer only 12% of the lightning charge. Estimates for three storms indicate that the transient currents made only a small global circuit contribution compared to the quasi-stationary Wilson currents because of the offsetting effects of IC and CG flashes in those storms.

Another paper from this collaboration describes the Wilson current contribution of two storms within the global circuit [Davydenko et. al., 2008]. This modeling study estimates the current to the ionosphere for a long-lived severe storm over the U.S. Great Plains and for a New Mexico mountain storm as 0.53 A and 0.16 A, while the electrical energies of these storms were 2.3 × 1010 J and 2.8 × 109 J, respectively. The more vigorous storm transferred ~16,000 C in the global circuit during 8.5 hrs of its lifetime, while the weaker mountain storm transferred ~1200 C in its 2-hr lifetime. Differences in the current and energy of the two storms are primarily due to differences in their internal dynamical and electrical structures, along with their different topographical locations.

Graduate student Baishali Ray continues her progress in estimating the conductivity above thunderstorms and the internal generator current; these are also parts of our global circuit studies funded by the National Science Foundation.

Two studies into the initial stage of lightning have been completed [Coleman et al., 2008; Betz et al., 2008]. Using simultaneous information about the electric field at different altitudes at the time of flashes, Coleman et al. has shown that horizontal lightning channels travel at the altitudes of potential extrema. The simultaneous data are also used to verify the breakdown polarity indicated by the New

Mexico Tech Lightning Mapping Array and to investigate the reason that some CG flashes have a long period of preliminary breakdown before the first return stroke. For 14 CG flashes that initiated when there was a low-level potential extremum, preliminary breakdown lasted an average of 117 ms. For 15 CG flashes initiating when there was no low-level potential extremum, the time between initiation and first return stroke averaged 15 ms. A separate collaborative effort led by H.-D. Betz (University of Munich) compares data from LINET (VLF/LF network) and SAFIR-type (VHF) systems for 12 storms. Betz et al. find that up to 50% of the first in-cloud events detected with the VHF networks are nearly coincident with the first VLF/LF signal. Apparently, without measured preparatory VHF activity, initial breakdown in these time-coincident events begins with a long, strong discharge step producing signatures in the VLF/LF records. These data are consistent with lightning initiation via a runaway breakdown mechanism that extended over hundreds of meters.

Our continuing studies of thunderstorm evolution have resulted in two additional papers, one discussing sequential profiles of electrostatic potential [Stolzenburg et al., 2008] and the other describing findings about the decay stage and end-of-storm oscillation [Marshall et al., manuscript accepted 3 Nov. 2008, J. Geophys. Res.]. Two other studies within this topic, on the initial stage of storms and on the duration of charge in anvil clouds, are nearing completion.

University of Washington

C/NOFS Satellite launched, all instruments working. The Communications/Navigation Outage Forecast System satellite of the AirForce and NASA was launched this year, and all instruments are working well. Shortly a public website will be avaliable for data requests and quick look plots. The satellite includes an experiment focused on diagnosing lightning effects on the ionosphere, by using instruments which measure the vector electric field, optical lightning power, density, and other plasma parameters. Profs. Holzworth and Michael McCarthy both of E&SS, Univ. of Washington, designed the LD (lightning detector) which is part of the VEFI (vector electric field instrument - PI: Dr. Robert Pfaff, NASA GSFC).

WWLLN (the World Wide Lightning Location Network) is rapidly growing. Eight new stations, on several continents have recently been delivered, and should be operating by the end of 2008. As of this writing there are 30 active WWLLN stations, producing over 5 million accurate stroke locations world wide per month (should be 38 sites by end of 2008). For access to the data please see WWLLN.net where you can download a Google Earth kml file (produced by our partner GUIweather) with the global data during the last 30 minutes, or email Prof. Holzworth <bobholz@washington.edu>. The Earth and Space Sciences (E&SS)Department at the University of Washington is looking for well prepared grad students with a strong background in Physics and Math, for positions as Graduate Research Assistants interested in obtaining a PhD in upper atmospheric electrodynamics and plasma physics. Contact Prof. Robert Holzworth for immediate openings <bobholz@washington.edu>. Dr. Holzworth is also appointed in the Physics Department, so you can apply to either E&SS or Physics at the Univ. of Washington, and still work on these interesting problems with Prof. Holzworth.

RECENT PUBLICATIONS

This list of references is not exhaustive. It includes only papers published during the last six months provided by the authors or found from an on-line research in journal websites. Some references of papers very soon published have been provided by their authors and included in the list. The papers in review process, the papers from Proceedings of Conference are not included.

A. Ezcurra, J. Saenz, G. Ibarra-Berastegi, J. Areitio. 2008. Rainfall yield characteristics of electrical storm observed in the Spanish Basque Country area during the period 1992–1996. Atmospheric Research, 89: 233-242.

Abdenbi Mimouni, Farhad Rachidi, Zin-eddine Azzouz. 2008. A finite-difference time-domain approach for the evaluation of electromagnetic fields radiated by lightning strikes to tall structures. Journal of Electrostatics, 66(9-10): 504-513.

Akihiro Ametani, Kae Matsuoka, Hiroshi Omura, Yoshiyuki Nagai. 2008. Surge voltages and currents into a customer due to nearby lightning. Electric Power Systems Research, In Press, Corrected Proof, Available online 18 October 2008.

Alexander G.B., Robyn H.W., Aimee Buhr, Andrew R.B., Zaid Afawi, et al. 2008. A Homozygous Mutation in Human PRICKLE1 Causes an Autosomal-Recessive Progressive Myoclonus Epilepsy-Ataxia Syndrome. The American Journal of Human Genetics, 83(5): 572-581.

Amitabh Nag, Brian A. DeCarlo, Vladimir A. Rakov. 2008. Analysis of microsecond- and submicrosecond-scale electric field pulses produced by cloud and ground lightning discharges. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Aplin K.L. 2008. Composition and measurement of charged atmospheric clusters. Space Science Reviews, 137(1-4): 213-224, doi: 10.1007/s11214-008-9397-1.

Aplin K.L. and McPheat R.A. 2008. An infrared filter radiometer for atmospheric cluster-ion detection. Rev. Sci. Instrument, 79, 106107, doi:10.1063/1.3002428.

Aplin K.L., Harrison R.G., Rycroft M.J. 2008. Investigating Earth's atmospheric electricity: a role model for planetary studies. Space Science Reviews, 137(1-4): 11-27.

Arlene Laing, Mark LaJoie, Steven Reader, Karl Pfeiffer. 2008. The Influence of the El Niño–Southern Oscillation on Cloud-to-Ground Lightning Activity along the Gulf Coast. Part II: Monthly Correlations. Monthly Weather Review, 136(7): 2544–2556.

Assink J. D., L. G. Evers, I. Holleman, H. Paulssen. 2008. Characterization of infrasound from lightning. Geophys. Res. Lett., 35, L15802, doi:10.1029/2008GL034193.

B. A. DeCarlo, V.A. Rakov, J. Jerauld, G.H. Schnetzer, J. Schoene, M.A. Uman, K.J. Rambo, V. Kodali, D.M. Jordan, G. Maxwell, S. Humeniuk, M. Morgan. 2008. Distribution of currents in the lightning protective system of a residential building – Part I: Triggered-lightning experiments. IEEE Trans. on Power Delivery, 23(4): 2439-2446.

Baba Y., V. A. Rakov. 2008. Influence of strike object grounding on close lightning electric fields. J. Geophys. Res., 113, D12109, doi:10.1029/2008JD009811.

Betz H.D., K. Schmidt, P. Laroche, P. Blanchet, W.P. Oettinger, E. Defer. 2008c. LINET – An International Lightning Detection Network in Europe. Atmos. Res., doi:10.1016/J.AtmosRes.2008.06.012.

Betz H.D., K. Schmidt, W.P. Oettinger, B. Montag. 2008d. Cell Tracking with Lightning Data from LINET. Ann. Geophys, 26: 1-7.

Betz H.D., K. Schmidt, W.P. Oettinger. LINET – An International VLF/LF Lightning Detection Network in Europe, in "Lightning: Principles, Instruments and Applications". Eds. H.-D. Betz, U. Schumann, and P. Laroche, ch. 5, Dordrecht (NL), Springer, 2008a.

Betz H.D., T.C. Marshall, M. Stolzenburg, K. Schmidt, W.P. Oettinger, E. Defer, J. Konarski, P. Laroche, F. Dombai. 2008. Detection of in-cloud lightning with VLF/LF and VHF networks for studies of the initial discharge phase. Geophys. Res. Lett., doi:10.1029/2008GL035820 (in press).

Beyza Caliskan Aslan, William W. Hager, Shari Moskow. 2008. A generalized eigenproblem for the Laplacian which arises in lightning. Journal of Mathematical Analysis and Applications, 341(2): 1028-1041.

Brau F, Luque A, Meulenbroek B, Ebert U, Schäfer L. 2008. Construction and test of a moving boundary model for negative streamer discharges. Phys. Rev. E, 77: 026219.

Briels T M P, Kos J, Winands G J J, van Veldhuizen E M, Ebert U. 2008. Positive and negative streamers in ambient air: measuring diameter, velocity and dissipated energy. J. Phys. D: Appl. Phys., 41: 234004.

Briels T M P, van Veldhuizen E M, Ebert U. 2008. Positive streamers in ambient air and in a nitrogen-oxygen-mixture (99.8:0.2). IEEE Trans. Plasma Sci., 36: 906-907.

Briels T M P, van Veldhuizen E M, Ebert U. 2008. Positive streamers in air and nitrogen of varying density: experiments on similarity laws. J. Phys. D: Appl. Phys., 41: 234008.

Briels T M P, van Veldhuizen E M, Ebert U. 2008. Time resolved measurements of streamer inception in air. IEEE Trans. Plasma Sci., 36: 908-909.

Carlson B. E., N. G. Lehtinen, U. S. Inan. 2008. Runaway relativistic electron avalanche seeding in the Earth's atmosphere. J. Geophys. Res., 113, A10307, doi:10.1029/2008JA013210.

Charles L. Hodapp, Lawrence D. Carey, Richard E. Orville. 2008. Evolution of radar reflectivity and total lightning characteristics of the 21 April 2006 mesoscale convective system over Texas. Atmospheric Research, 89(1-2): 113-137.

Charlotte Kounda-Kiki, Jean-François Ponge, Philippe Mora, Corinne Sarthou. 2008. Humus profiles and successional development in a rock savanna (Nouragues inselberg, French Guiana): A micro-morphological approach infers fire as a disturbance event. Pedobiologia, 52(2): 85-95.

Chen A.B., et al. 2008. Global distributions and occurrence rates of transient luminous events. J. Geophys. Res., 113, A08306, doi:10.1029/2008JA013101.

Chronis T.G., S. J. Goodman, D. Cecil, D. Buechler, F.J. Robertson, J. Pittman, R.J. Blakeslee. 2008. Global lightning activity from the ENSO perspective. Geophys. Res. Lett., 35, L19804, doi:10.1029/2008GL034321.

Coleman L.M., M. Stolzenburg, T.C. Marshall, M. Stanley. 2008. Horizontal lightning propagation, preliminary breakdown, and electric potential in New Mexico thunderstorms. J. Geophys. Res., 113, D09208, doi:10.1029/2007JD009459.

Colin Price. 2008. Will a drier climate result in more lightning? Atmospheric Research, In Press, Corrected Proof, Available online 11 September 2008.

Comiso J.C., F. Nishio. 2008. Trends in the sea ice cover using enhanced and compatible AMSR-E, SSM/I, and SMMR data. J. Geophys. Res., 113, C02S07, doi:10.1029/2007JC004257.

D. Matsui, A. Hazmi, T. Watanabe, N. Takagi, D. Wang. 2008. Discharge characteristics obtained with an impulse voltage simulating the lightning stepped leader. J. Atmos. Electr., 28(2): 63-69.

D. Wang, V. Rakov, N. Takagi, T. Watanabe. 2008. A discussion of traveling waves

involved in the lightning return stroke process. J. Atmos. Electr., 28(2): 71-77.

Davydenko S.S., T.C. Marshall, M. Stolzenburg. 2008. Modeling the electric structures of two thunderstorms and their contributions to the global circuit. Atmos. Res., doi:10.1016/j.atmosres.2008.08.006 (in press).

De Conti A., S. Visacro, N. Theethayi, V. Cooray. 2008. A comparison of different approaches to simulate a nonlinear channel resistance in lightning return stroke models. J. Geophys. Res., 113, D14129, doi:10.1029/2007JD009395.

Deierling W., W. A. Petersen, J. Latham, S. Ellis, H.J. Christian. 2008. The relationship between lightning activity and ice fluxes in thunderstorms. J. Geophys. Res., 113, D15210, doi:10.1029/2007JD009700.

Deierling W., W. A. Petersen. 2008. Total lightning activity as an indicator of updraft characteristics. J. Geophys. Res., 113, D16210, doi:10.1029/2007JD009598.

Derks G, Ebert U, Meulenbroek B. 2008. Laplacian instability of planar streamer ionization fronts - an example of pulled front analysis. J. Nonlinear Sci., 18: 551.

Dongxia Liu, Guili Feng, Shujun Wu. 2008. Temporal and spatial characteristics of cloud-to-ground lightning of hailstorms over north China. Atmospheric Research, doi:10.1016/j.atmosres.2008.06.016.

Dongxia Liu, Guili Feng, Shujun Wu. 2008. The characteristics of cloud-to-ground lightning activity in hailstorms over northern China. Atmospheric Research, In Press, Corrected Proof, Available online 13 September 2008.

Dwyer J. R. 2008. Source mechanisms of terrestrial gamma-ray flashes. J. Geophys. Res., 113, D10103, doi:10.1029/2007JD009248.

E.A. Mareev, S.V. Anisimov. 2008. Lifetime of the thunderstorm electric energy in the global atmospheric circuit and thunderstorm energy characteristics. Atmospheric Research, In Press, Corrected Proof, Available online 3 September 2008.

Earle R. Williams. 2008. C.T.R. Wilson versus G.C. Simpson: Fifty years of controversy in atmospheric electricity. Atmospheric Research, In Press, Corrected Proof, Available online 3 September 2008.

Earle R. Williams. 2008. The global electrical circuit: A review. Atmospheric Research, In Press, Corrected Proof, Available online 13 September 2008.

Ebert U, Sentman D D. 2008. Streamers, sprites, leaders, lightning: from micro- to macroscales, an editorial introduction. J. Phys. D: Appl. Phys., 41: 230301.

Edlira Bendo, Molly Gilbert, Rod Foroozan. 2008. Can Lightning Strike Twice? Survey of Ophthalmology, 53(3): 296-300.

Flache D., V. A. Rakov, F. Heidler, W. Zischank, R. Thottappillil. 2008. Initial-stage pulses in upward lightning: Leader/return stroke versus M-component mode of charge transfer to ground. Geophys. Res. Lett., 35, L13812, doi:10.1029/2008GL034148.

Francis J. Merceret, Jennifer G. Ward, Douglas M. Mach, Monte G. Bateman, James E. Dye. 2008. On the Magnitude of the Electric Field near Thunderstorm-Associated Clouds. Journal of Applied Meteorology and Climatology, 47(1): 240–248.

G. Sátori, E. Williams, I. Lemperger. 2008. Variability of global lightning activity on the ENSO time scale. Atmospheric Research, In Press, Corrected Proof, Available online 11 September 2008.

Garipov G. K., B. A. Khrenov, M. I. Panasyuk. 2008. Correlation of atmospheric UV transient events with lunar phase. Geophys. Res. Lett., 35, L10807, doi:10.1029/2007GL032679.

Guili Feng, Xiushu Qie, Jun Wang, Dianli Gong. 2008. Lightning and Doppler radar observations of a squall line system. Atmospheric Research, doi:10.1016/j.atmosres.2008.05.015.

H. Cui, X. Qie, Q. Zhang, T. Zhang, G. Zhang, J. Yang. 2008. Intracloud discharge and the

correlated basic charge structure of a thunderstorm in Zhongchuan, a Chinese Inland Plateau region. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008, doi:10.1016/j.atmosres.2008.06.007.

H. Ren, B. Zhou, V.A. Rakov, L. Shi, C. Gao, J. Yang. 2008. Analysis of Lightning-Induced Voltages on Overhead Lines Using 2D-FDTD Method and Agrawal Coupling Model. IEEE Trans. on EMC, 50(3): 651-659.

Howard J., M. A. Uman, J. R. Dwyer, D. Hill, C. Biagi, Z. Saleh, J. Jerauld, H. K. Rassoul. 2008. Co-location of lightning leader x-ray and electric field change sources. Geophys. Res. Lett., 35, L13817, doi:10.1029/2008GL034134.

Iida K., M. R. Stolzenburg, P. H. McMurry, J. N. Smith. 2008. Estimating nanoparticle growth rates from size-dependent charged fractions: Analysis of new particle formation events in Mexico City. J. Geophys. Res., 113, D05207, doi:10.1029/2007JD009260.

J. Yang, X. Qie, Q. Zhang, Y. Zhao, G. Feng, T. Zhang, G. Zhang. 2008. Comparative analysis of the initial stage in two artificially-triggered lightning flashes. Atmospheric Research, doi:10.1016/j.atmosres.2008.04.010.

Jakke S. Mäkelä, Niko Porjo, Antti Mäkelä, Tapio Tuomi, Vernon Cooray. 2008. Properties of preliminary breakdown processes in Scandinavian lightning. Journal of Atmospheric and Solar-Terrestrial Physics, In Press, Corrected Proof, Available online 12 September 2008.

Jan Laštovička. 2008. Lower ionosphere response to external forcing: A brief review. Advances in Space Research, In Press, Corrected Proof, Available online 10 October 2008.

Jenkins G. S., A. Pratt. 2008. Saharan dust, lightning and tropical cyclones in the eastern tropical Atlantic during NAMMA-06. Geophys. Res. Lett., 35, L12804, doi:10.1029/2008GL033979.

Jenkins G. S., M. Camara, S. A. Ndiaye. 2008. Observational evidence of enhanced middle/upper tropospheric ozone via convective processes over the equatorial tropical Atlantic during the summer of 2006. Geophys. Res. Lett., 35, L12806, doi:10.1029/2008GL033954.

Jerauld J., M. A. Uman, V. A. Rakov, K. J. Rambo, D. M. Jordan, G. H. Schnetzer. 2008. Electric and magnetic fields and field derivatives from lightning stepped leaders and first return strokes measured at distances from 100 to 1000 m. J. Geophys. Res., 113, D17111, doi:10.1029/2008JD010171.

Jeremy N. Thomas, Robert H. Holzworth, Michael P. McCarthy. 2008. In situ measurements of contributions to the global electrical circuit by a thunderstorm in southeastern Brazil. Atmospheric Research, In Press, Corrected Proof, Available online 16 September 2008, doi:10.1016/j.atmosres.2008.03.026.

Jianhua Dai, Yuan Wang, Lei Chen, Lan Tao, Jianfeng Gu, Jianchu Wang, Xiaodong Xu, Hong Lin, Yudan Gu. 2008. A comparison of lightning activity and convective indices over some monsoon-prone areas of China. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Joan Montanyà, Serge Soula, Nicolau Pineda, Oscar van der Velde, Pere Clapers, Glòria Solà, Joan Bech, D. Romero. 2008. Study of the total lightning activity in a hailstorm. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Juan A. Morente, Jorge A. Portí, Alfonso Salinas, Enrique A. Navarro. 2008. Evidence of electrical activity on Titan drawn from the Schumann resonances sent by Huygens probe. Icarus, 195(2): 802-811.

K. P. Naccarato, O. Pinto Jr. 2008. Improvements in the detection efficiency model for the Brazilian lightning detection network (BrasilDAT). Atmospheric Research, In Press, Corrected Proof, Available online

14 September 2008.

K. Squires and S. Businger. 2008. The morphology of eyewall lightning outbreaks in two category 5 hurricanes. Monthly Weather Review, 136(5): 1706–1726.

K. Yamamoto, T. Noda, S. Yokoyama, A. Ametani. 2008. Experimental and analytical studies of lightning overvoltages in wind turbine generator systems. Electric Power Systems Research, In Press, Corrected Proof, Available online 22 October 2008.

Karl D. Stephan, Nathan Massey. 2008. Burning molten metallic spheres: One class of ball lightning? Journal of Atmospheric and Solar-Terrestrial Physics, 70(11-12): 1589-1596.

Keeler J., S. Steiger, R. Hamilton, R. Orville. 2008. Lake-effect thunderstorms in the lower great lakes. J. Applied Meteorology (in press).

Kotroni V., K. Lagouvardos. 2008. Lightning occurrence in relation with elevation, terrain slope, and vegetation cover in the Mediterranean. J. Geophys. Res., 113, D21118, doi:10.1029/2008JD010605.

L. Chemartin, P. Lalande, E. Montreuil, C. Delalondre, B.G. Chéron, F. Lago. 2008. Three dimensional simulation of a DC free burning arc. Application to lightning physics. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

L. Li, V.A. Rakov. 2008. Distribution of currents in the lightning protective system of a residential building – Part II: Numerical modeling. IEEE Trans. on Power Delivery, 23(4): 2447-2455.

L. S. Rose, J. A. Stallins, M. L. Bentley. 2008. Concurrent Cloud-to-Ground Lightning and Precipitation Enhancement in the Atlanta, Georgia (United States), Urban Region. Earth Interactions, 12(11): 11–30.

Leandro Z.S. Campos, Marcelo M.F. Saba, Osmar Pinto Jr., Maurício G. Ballarotti. 2008. Waveshapes of continuing currents and properties of M-components in natural positive cloud-to-ground lightning. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Li C, Ebert U, Brok W J M, Hundsdorfer W. 2008. Spatial coupling of particle and fluid models for streamers: where nonlocality matters. J. Phys. D: Appl. Phys., 41: 032005.

Li C, Ebert U, Brok W J M. 2008. Avalanche to streamer transition in particle simulations. IEEE Trans. Plasma Sci., 36: 910-911.

Li J., S. A. Cummer, W. A. Lyons, T. E. Nelson. 2008. Coordinated analysis of delayed sprites with high-speed images and remote electromagnetic fields. J. Geophys. Res., 113, D20206, doi:10.1029/2008JD010008.

Lu W., D. Wang, N. Takagi, V. Rakov, M. Uman, M. Miki. 2008. Characteristics of the optical pulses associated with a downward branched stepped leader. J. Geophys. Res., 113, D21206, doi:10.1029/2008JD010231.

Luque A, Brau F, Ebert U. 2008. Saffman-Taylor streamers: Mutual finger interaction in spark formation. Phys. Rev., E 78: 016206.

Luque A, Ebert U, and Hundsdorfer W. 2008. Interaction of streamers in air and other oxygen-nitrogen mixtures. Phys. Rev. Lett., 101: 075005.

Luque A, Ebert U. 2008. Interacting streamers in air: The evolution of the space-charge layer in their heads. IEEE Trans. Plasma Sci., 36:914-915.

Luque A, Ratushnaya V, Ebert U. 2008. Positive and negative streamers in ambient air: modeling evolution and velocities. J. Phys. D: Appl. Phys., 41:234005.

M. A. Ferro, M.M.F. Saba, O. Pinto Jr. 2008. Continuing current in multiple channel cloud-to-ground lightning. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

M. Hayakawa, D.I. Iudin, V.Y. Trakhtengerts. 2008. Modeling of thundercloud VHF/UHF radiation on the lightning preliminary breakdown stage. Journal of Atmospheric and Solar-Terrestrial Physics, 70(13): 1660-1668.

M. Marzinotto, G. Mazzanti, C. Mazzetti. 2008.

Crossing quantities: How to compare electrical strength performances of insulation compounds for power cables. Energy, In Press, Corrected Proof, Available online 19 September 2008.

M. R. Bank Tavakoli, B. Vahidi, S.H. Hosseinian. 2008. Discrete-event simulation of the shielding failure of the arrester protected overhead-lines to evaluate risk of flashover. International J. of Electrical Power & Energy Systems, In Press, Corrected Proof, Available online 6 November 2008.

Maggio C.R., T.C. Marshall, and M. Stolzenburg. 2008. Transient currents in the global electric circuit due to cloud-to-ground and intracloud lightning. Atmos. Res., doi:10.1016/j.atmosres.2008.07.008 (in press).

Manders F, Christianen P C M, Maan J C. 2008. Propagation of a streamer discharge in a magnetic field. J. Phys. D: Appl. Phys., 41:234006.

Mareev E. A., S. A. Yashunin, S. S. Davydenko, T. C. Marshall, M. Stolzenburg, C. R. Maggio. 2008. On the role of transient currents in the global electric circuit. Geophys. Res. Lett., 35, L15810, doi:10.1029/2008GL034554.

Mária Putsay, Ildikó Szenyán, André Simon. 2008. Case Study of Mesoscale Convective Systems over Hungary on 29 June 2006 with Satellite, Radar and Lightning Data. Atmospheric Research, In Press, Accepted Manuscript, Available online 31 October 2008.

Mark LaJoie and Arlene Laing. 2008. The influence of the El Niño–Southern Oscillation on Cloud-to-Ground lightning activity along the Gulf coast. Part I: lightning climatology. Monthly Weather Review, 136(7): 2523–2542.

Marshall R. A., U. S. Inan, T. W. Chevalier. 2008. Early VLF perturbations caused by lightning EMP-driven dissociative attachment. Geophys. Res. Lett., 35, L21807, doi:10.1029/2008GL035358.

Matthew E. Ojelede, Harold J. Annegarn, Colin Price, Melanie A. Kneen, Philip Goyns. 2008. Lightning-produced NOx budget over the Highveld region of South Africa. Atmospheric Environment, 42(22): 5706-5714.

Mauricio Vargas, Horacio Torres. 2008. On the development of a lightning leader model for tortuous or branched channels – Part I: Model description. Journal of Electrostatics, 66(9-10): 482-488.

Mauricio Vargas, Horacio Torres. 2008. On the development of a lightning leader model for tortuous or branched channels – Part II: Model results. Journal of Electrostatics, 66(9-10): 489-495.

Melick C. J., P. S. Market, L. L. Smith, B. P. Pettegrew, A. E. Becker, A. R. Lupo. 2008. Investigation of stability characteristics of cold-season convective precipitation events by utilizing the growth rate parameter. J. Geophys. Res., 113, D08108, doi:10.1029/2007JD009063.

Michael F. Donovan, Earle R. Williams, Cathy Kessinger, Gary Blackburn, Paul H. Herzegh, Richard L. Bankert, Steve Miller, Frederick R. Mosher. 2008. The identification and verification of hazardous convective cells over oceans using visible and infrared satellite observations. Journal of Applied Meteorology and Climatology, 47(1): 164–184.

Michael M., S. N. Tripathi, S. K. Mishra. 2008. Dust charging and electrical conductivity in the day and nighttime atmosphere of Mars. J. Geophys. Res., 113, E07010, doi:10.1029/2007JE003047.

Minschwaner K., L. E. Kalnajs, M. K. Dubey, L. M. Avallone, P. C. Sawaengphokai, H. E. Edens, W. P. Winn. 2008. Observation of enhanced ozone in an electrically active storm over Socorro, NM: Implications for ozone production from corona discharges. J. Geophys. Res., 113, D17208, doi:10.1029/2007JD009500.

N. Theethayi, V. Rakov, R. Thottappillil. 2008.

Responses of airport runway lighting system to direct lightning strikes: comparisons of TLM predictions with experimental data. IEEE Trans. on EMC, 50(3): 660-668.

Nag A., V. A. Rakov, W. Schulz, M. M. F. Saba, R. Thottappillil, C. J. Biagi, A. Oliveira Filho, A. Kafri, N. Theethayi, T. Gotschl. 2008. First versus subsequent return-stroke current and field peaks in negative cloud-to-ground lightning discharges. J. Geophys. Res., 113, D19112, doi:10.1029/2007JD009729.

Neubert, T.,M. Rycroft, T. Forges, E. Blanc, O. Chanrion, E. Arnone, A. Odzimek, A. Odzimek, N. Arnold, C.F. Enell, E. Turunen, A. Mika, C. Haldoupis, R. Steiner, T. Bösinger, O. van der Velde, S. Soula, P. Berg, F. Boberg, P. Thejll, B. Christiansen, M. Ignaccolo, P.T. Veronen, M. Füllekrug, J. Montanya, N. Crosby. 2008. Recent results from studies of electrical discharges in the mesosphere. Surveys in Geophysics, DOI 10.1007/s10712-008-9043-1.

Nguyen C V, van Deursen A P J, Ebert U. 2008. Multiple gamma bursts from long discharges in air. J. Phys. D: Appl. Phys., 41:234012.

Nickolaenko A. P., M. Hayakawa. 2008. Comment on "Sprite lightning heard round the world by Schumann resonance methods" by E. R. Williams, V. C. Mushtak, R. Boldi, R. L. Dowden, and Z.-I. Kawasaki. Radio Sci., 43, RS3007, doi:10.1029/2007RS003737.

Nickolaenko A.P., M. Hayakawa, T. Ogawa, M. Komatsu. 2008. Q-bursts: A comparison of experimental and computed ELF waveforms. Radio Sci., 43, RS4014, doi:10.1029/2008RS003838.

Nijdam S, Moerman J S, Briels T M P, van Veldhuizen E M, Ebert U. 2008. Stereo-photography of streamers in air. Appl. Phys. Lett., 92:101502.

O. Chanrion, T. Neubert. 2008. A PIC-MCC code for simulation of streamer propagation in air. Journal of Computational Physics, 227(15): 7222-7245.

O.P. Murty. 2008. Lightning fatality with blast, flame, heat and current effects: A macroscopic and microscopic view. J. of Forensic and Legal Medicine, In Press, Corrected Proof, Available online 6 November 2008.

P.E. de Souza, O. Pinto Jr., I.R.C.A. Pinto, N.J. Ferreira, A.F. dos Santos. 2008. The intracloud/cloud-to-ground lightning ratio in Southeastern Brazil. Atmospheric Research, In Press, Accepted Manuscript, Available online 9 September 2008.

P.I.Y. Velinov, P.T. Tonev. 2008. Electric currents from thunderstorms to the ionosphere during a solar cycle: Quasi-static modeling of the coupling mechanism. Advances in Space Research, 42(9): 1569-1575.

Panagiotis Theodorou, Volker Limmroth, Walter Perbix, Mark Gerbershagen, Friedrich Knam, Gerald Spilker. 2008. Guillain-Barré syndrome after lightning strike. Burns, 34(5): 722-726.

Parrot M., U.S. Inan, N.G. Lehtinen. 2008. V-shaped VLF streaks recorded on DEMETER above powerful thunderstorms. J. Geophys. Res., 113, A10310, doi:10.1029/2008JA013336.

Pereyra R.G., R.E. Bürgesser, E.E. Ávila. 2008. Charge separation in thunderstorm conditions. J. Geophys. Res., 113, D17203, doi:10.1029/2007JD009720.

Petersen D., M. Bailey, W. H. Beasley, J. Hallett. 2008. A brief review of the problem of lightning initiation and a hypothesis of initial lightning leader formation. J. Geophys. Res., 113, D17205, doi:10.1029/2007JD009036.

Phillip E. Shafer and Henry E. Fuelberg. 2008. A perfect prognosis scheme for forecasting warm-season lightning over Florida. Monthly Weather Review, 136(6): 1817–1846.

Pinto O. Jr., I. R. C. A. Pinto. 2008. On the sensitivity of cloud-to-ground lightning activity to surface air temperature changes at different timescales in São Paulo, Brazil. J.

Geophys. Res., 113, D20123, doi:10.1029/2008JD009841.

Q. Zhang, X. Qie, Y. Zhao, X. Kong, J.Yang. 2008. Characteristics and simulation of lightning current waveforms during one artificially triggered lightning. Atmospheric Research, doi:10.1016/j.atmosres.2008.04.015.

R.G. Harrison, K.A. Nicoll. 2008. Air-earth current density measurements at Lerwick; implications for seasonality in the global electric circuit. Atmospheric Research, 89(1-2): 181-193.

Rand R. Evett, Charlene R. Mohrle, Beth L. Hall, Timothy J. Brown, Scott L. Stephens. 2008. The effect of monsoonal atmospheric moisture on lightning fire ignitions in southwestern North America. Agricultural and Forest Meteorology, 148(10): 1478-1487.

Roja Raman M., V. V. M. Jagannadha Rao, M. Venkat Ratnam, G. Kishore Kumar, A. Narendra Babu, S. Vijaya Bhaskara Rao, N. Prabhakara Rao, D. Narayana Rao. 2008. Atmospheric circulation during active and break phases of Indian summer monsoon: A study using MST radar at Gadanki (13.5°N, 79.2°E). J. Geophys. Res., 113, D20124, doi:10.1029/2008JD010341.

Ross M., S.A. Cummer, T.K. Nielsen, Y. Zhang. 2008. Simultaneous remote electric and magnetic field measurements of lightning continuing currents. J. Geophys. Res., 113, D20125, doi:10.1029/2008JD010294.

Rumjana Mitzeva, Boryana Tsenova, Rachel Albrecht, Walt Petersen. 2008. A study of charge structure sensitivity in simulated thunderstorms. Atmospheric Research, In Press, Corrected Proof, Available online 14 September 2008.

Russell C.T., T.L. Zhang, H.Y. Wei. 2008. Whistler mode waves from lightning on Venus: Magnetic control of ionospheric access. J. Geophys. Res., 113, E00B05, doi:10.1029/2008JE003137.

S. Petrova, R. Mitzeva, V. Kotroni, J. Latham, E. Peneva. 2008. Analyses of summer lightning activity and precipitation in the Central and Eastern Mediterranean. Atmospheric Research, In Press, Corrected Proof, Available online 13 September 2008.

S.K. Kar, Y.A. Liou, K.J. Ha. 2008. Aerosol effects on the enhancement of cloud-to-ground lightning over major urban areas of South Korea. Atmospheric Research, In Press, Accepted Manuscript, Available online 19 September 2008.

S.R. Sharma, M. Fernando, Vernon Cooray. 2008. Narrow positive bipolar radiation from lightning observed in Sri Lanka. Journal of Atmospheric and Solar-Terrestrial Physics, 70(10): 1251-1260.

S.R. Sharma, V. Cooray, M. Fernando. 2008. Isolated breakdown activity in Swedish lightning. Journal of Atmospheric and Solar-Terrestrial Physics, 70(8-9): 1213-1221.

Saunois M., C. Mari, V. Thouret, J. P. Cammas, P. Peyrillé, J. P. Lafore, B. Sauvage, A. Volz-Thomas, P. Nédélec, J. P. Pinty. 2008. An idealized two-dimensional approach to study the impact of the West African monsoon on the meridional gradient of tropospheric ozone. J. Geophys. Res., 113, D07306, doi:10.1029/2007JD008707.

Sekiguchi M., Y. Hobara, M. Hayakawa. 2008. Diurnal and seasonal variations in the Schumann resonance parameters at Moshiri, Japan. J. Atmos. Electr., 28: 1-10.

Sentman D.D., H.C. Stenbaek-Nielsen, M.G. McHarg, J.S. Morrill. 2008. Plasma chemistry of sprite streamers. J. Geophys. Res., 113, D11112, doi:10.1029/2007JD008941.

Sentman D.D., H.C. Stenbaek-Nielsen, M.G. McHarg, J.S. Morrill. 2008. Correction to "Plasma chemistry of sprite streamers". J. Geophys. Res., 113, D14399, doi:10.1029/2008JD010634.

Serge Soula, Oscar van der Velde, Joan Montanyà, Torsten Neubert, Olivier Chanrion, Michal Ganot. 2008. Analysis of

thunderstorm and lightning activity associated with sprites observed during the EuroSprite campaigns: Two case studies. Atmospheric Research, In Press, Accepted Manuscript, Available online 13 September 2008.

Shanchang Tao, Yongbo Tan, Baoyou Zhu, Ming Ma, Weitao Lu. 2008. Fine-resolution simulation of cloud-to-ground lightning and thundercloud charge transfer. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Sowmya Lakshminarayanan, Sudhanshu Chokroverty, Noam Eshkar, Raji Grewal. 2008. The spinal cord in lightning injury: A report of two cases. J. of the Neurological Sciences, In Press, Corrected Proof, Available online 23 October 2008.

Stacy A. Fleenor, Christopher J. Biagi, Kenneth L. Cummins, E. Philip Krider, XuanMin Shao. 2008. Characteristics of cloud-to-ground lightning in warm-season thunderstorms in the Central Great Plains. Atmospheric Research, In Press, Corrected Proof, Available online 13 September 2008.

Stolzenburg M., T.C. Marshall. 2008. Charge structure and dynamics in thunderstorms. Space Sci. Rev., 137: 355–372.

Stolzenburg M., T.C. Marshall. 2008. Serial profiles of electrostatic potential in five New Mexico thunderstorms. J. Geophys. Res., 113, D13207, doi:10.1029/2007JD009495.

T.C. Foster, J. Hallett. 2008. Enhanced alignment of plate ice crystals in a non-uniform electric field. Atmospheric Research, 90(1): 41-53.

T.D. Kaladze, O.A. Pokhotelov, H.A. Shah, M.I. Khan, L. Stenflo. 2008. Acoustic-gravity waves in the Earth's ionosphere. Journal of Atmospheric and Solar-Terrestrial Physics, 70(13): 1607-1616.

T.E. Girish, P.E. Eapen. 2008. Geomagnetic and sunspot activity associations and ionospheric effects of lightning phenomena at Trivandrum near dip equator. J. of Atm. and Solar-Terrestrial Physics, In Press, Corrected Proof, Available online 1 October 2008.

Taylor M.J., et al. 2008. Rare measurements of a sprite with halo event driven by a negative lightning discharge over Argentina. Geophys. Res. Lett., 35, L14812, doi:10.1029/2008GL033984.

Thomas, J.N., B.H. Barnum, E. Lay, R.H. Holzworth, M. Cho, M.C. Kelley. 2008. Lightning-driven electric fields measured in the lower ionosphere: implications for transient luminous events. J. of Geophys. Res., in press, October 2008.

Toshio Ogawa, Masayuki Komatsu. 2008. Q-bursts from various distances on the Earth. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

V. Bourscheidt, O. Pinto Junior, K.P. Naccarato, I.R.C.A. Pinto. 2008. The influence of topography on the cloud-to-ground lightning density in South Brazil. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

W.R.G. Farias, O. Pinto Jr., K.P. Naccarato, I.R.C.A Pinto. 2008. Anomalous lightning activity over the Metropolitan Region of São Paulo due to urban effects. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Walt Klenner, Russ Walton, André Arsenault, Laurie Kremsater. 2008. Dry forests in the Southern Interior of British Columbia: Historic disturbances and implications for restoration and management. Forest Ecology and Management, 256(10): 1711-1722.

Van der A R. J., H. J. Eskes, K. F. Boersma, T. P. C. van Noije, M. Van Roozendael, I. De Smedt, D. H. M. U. Peters, E.W. Meijer. 2008. Trends, seasonal variability and dominant NOx source derived from a ten year record of NO2 measured from space. J. Geophys. Res., 113, D04302, doi:10.1029/2007JD009021.

van Heesch E J M, Winands G J J, and Pemen A J M. 2008. Evaluation of pulsed streamer corona experiments to determine the O* radical yield. J. Phys. D: Appl. Phys., 41:234015.

Weitao Lu, Yijun Zhang, Xiuji Zhou, Xiushu Qie, Dong Zheng, Qing Meng, Ming Ma, Shaodong Chen, Fei Wang, Xiangzhen Kong. 2008. Simultaneous optical and electrical observations on the initial processes of altitude-triggered negative lightning. Atmospheric Research, In Press, Corrected Proof, Available online 4 September 2008.

Wendy Rash. 2008. Cardiac injury and death by lightning strike. J. of Emergency Nursing, 34(5): 470-471.

Williams E. R., V. C. Mushtak, R. Boldi, R. L. Dowden, Z.-I. Kawasaki. 2008. Reply to comment by A. P. Nickolaenko and M. Hayakawa on "Sprite lightning heard round the world by Schumann resonance methods". Radio Sci., 43, RS3009, doi:10.1029/2007RS003778.

Winands G J J, Liu Z, Pemen A J M, van Heesch E J M, Yan K. 2008. Analysis of streamer properties in air as function of pulse and reactor parameters by ICCD photography. J. Phys. D: Appl. Phys., 41:234001.

Xiangzhen Kong, Xiushu Qie, Yang Zhao, Tong Zhang. Characteristics of negative lightning flashes presenting multiple-ground terminations on a millisecond-scale. Atmospheric Research, doi:10.1016/j.atmosres.2008.03.025.

Xiushu Qie, Tinglong Zhang, Guangshu Zhang, Tong Zhang, Xiangzhen Kong. 2008. Electrical characteristics of thunderstorms in different plateau regions of China. Atmospheric Research, In Press, Corrected Proof, Available online 9 September 2008, doi:10.1016/j.atmosres.2008.04.014.

Xiushu Qie, Yang Zhao, Qinlin Zhang, Jing Yang, Guili Feng, Xixnagzhen Kong, Yunjun Zhou, Tinglong Zhang, Guangshu Zhang, Tong Zhang, Dongfang Wang, Haihua Cui, Zhongkuo Zhao, Shujun Wu. 2008. Characteristics of artificially triggered lightning during Shandong artificial triggering lightning experiment (SHATLE). Atmos. Res., doi:10.1016/j.atmosres.2008.08.007.

Xueqiang Gou, Mingli Chen, Yijun Zhang, Wansheng Dong, Xiushu Qie. 2008. Wavelet multiresolution based multifractal analysis of electric fields by lightning return strokes. Atmospheric Research, In Press, Accepted Manuscript, Available online 5 September 2008.

Y. Du, Mingli Chen, Qibin Zhou. 2008. Lightning-induced magnetic fields in a building with large metallic plates. Atmospheric Research, In Press, Corrected Proof, Available online 4 September 2008.

Y. Matsudo, T. Suzuki, K. Michimoto, K. Myokei, M. Hayakawa. 2008. Comparison of time delays of sprites induced by winter lightning flashes in the Japan Sea with those in the Pacific Ocean. J. of Atm. and Solar-Terrestrial Physics, In Press, Accepted Manuscript, Available online 25 October 2008.

Yijun Zhang, Weitao Lu, Jun Li, Wansheng Dong, Dong Zheng, Shaodong Chen. 2008. Luminosity characteristics of leaders in natural cloud-to-ground lightning flashes. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Yoshida S., T. Morimoto, T. Ushio, Z.-I Kawasaki, T. Torii, D. Wang, N. Takagi, T. Watanabe. 2008. High energy photon and electron bursts associated with upward lightning strokes. Geophys. Res. Lett., 35, L10804, doi:10.1029/2007GL032438.

Yoshiki Sugawara, Hironori Sahara, Shinichi Nakasuka, Stephen Greenland, Takeshi Morimoto, Kanichi Koyama, Chisato Kobayashi, Hideaki Kikuchi, Takanori Okada, Hidenori Tanaka. 2008. A satellite for demonstration of Panel Extension Satellite (PETSAT). Acta Astronautica, 63(1-4): 228-237.

YoungM.K., Ju Hwan Jeong, Yeon Young Kyong,

Han Joon Kim et al. 2008. Use of cold intravenous fluid to induce hypothermia in a comatose child after cardiac arrest due to a lightning strike. Resuscitation, 79(2): 336-338.

Zafer Kilbas, Murat Akin, Semih Gorgulu, Oner Mentes, Erkan Ozturk, Orhan Kozak, Turgut Tufan. 2008. Lightning strike: an unusual etiology of gastric perforation. The American Journal of Emergency Medicine, 26(8): 966.e5-966.e7.

Zenon Nieckarz, Andrzej Kułak, Stanisław Zięba, Marek Kubicki, Stanisław Michnowski, Piotr Barański. 2008. Comparison of global storm activity rate calculated from Schumann resonance background components to electric field intensity E0Z. Atmospheric Research, In Press, Corrected Proof, Available online 5 September 2008.

Zhongkuo Zhao, Qilin Zhang. 2008. Influence of lightning channel tortuosity on the associated electromagnetic field in time domain. Atmospheric Research, doi:10.1016/j.atmosres.2008.05.013.

Reminder

Newsletter on Atmospheric Electricity presents twice a year (May and November) to the members of our community with the following information:

- ✧ announcements concerning people from atmospheric electricity community, especially awards, new books...,
- ✧ announcements about conferences, meetings, symposia, workshops in our field of interest,
- ✧ brief synthetic reports about the research activities conducted by the various organizations working in atmospheric electricity throughout the world, and presented by the groups where this research is performed, and
- ✧ a list of recent publications. In this last item will be listed the references of the papers published in our field of interest during the past six months by the research groups, or to be published very soon, that wish to release this information, but we do not include the contributions in the proceedings of the Conferences.

No publication of scientific paper is done in this Newsletter. We urge all the groups interested to submit a short text (one page maximum with photos eventually) on their research, their results or their projects, along with a list of references of their papers published during the past six months. This list will appear in the last item. Any information about meetings, conferences or others which we would not be aware of will be welcome.

Newsletter on Atmospheric Electricity is now routinely provided on the web site of ICAE (http://www.Atmospheric-Electricity.org), and on the web site maintained by Monte Bateman http://ae.nsstc.uah.edu/.

In order to make our news letter more attractive and informative, it will be appreciated if you could include up to two photos or figures in your contribution!

Call for contributions to the newsletter

All issues of this newsletter are open for general contributions. If you would like to contribute any science highlight or workshop report, please contact Daohong Wang (wang@gifu-u.ac.jp) preferably by e-mail as an attached word document.

The deadline for 2009 spring issue of the newsletter is **May 15, 2009**.

Editor:
Daohong Wang
Secretary of ICAE
E-mail:wang@gifu-u.ac.jp
Tel: 81-58-293-2702
Fax:81-58-232-1894

Compiler:
Wenjuan Zhang
Chinese Academy of Meteorological Sciences
Beijing, China
zhangwj@cams.cma.gov.cn

Newsletters on Atmospheric Electricity are supported by International Commission on Atmospheric Electricity, IUGG/IAMAS.