NEWSLETTER ON ATMOSPHERIC ELECTRICITY

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INTERNATIONAL COMMISSION ON ATMOSPHERIC ELECTRICITY
(IAMAS/IUGG)

AMS COMMITTEE ON ATMOSPHERIC ELECTRICITY

AGU COMMITTEE ON ATMOSPHERIC AND SPACE ELECTRICITY

EUROPEAN GEOPHYSICAL SOCIETY

SOCIETY OF ATMOSPHERIC ELECTRICITY OF JAPAN

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

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

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

http://ae.atmos.uah.edu

thanks to Monte Bateman's help.

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

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

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

ANNOUNCEMENTS

IN MEMORIAM LESLIE C. HALE

Leslie, at the 11th ICAE in Guntersville, 1999.

Professor Leslie C. Hale died on December 26, 2003, in Las Cruces, NM. He earned his B.S., M.S. and Ph.D. degrees in Electrical Engineering at The Carnegie Institute of Technology. In 1962 he joined the Ionosphere Research Laboratory at The Pennsylvania State University and spent over 30 years of his career there until retirement. He was principal investigator on over 100 sounding rockets. His research in atmospheric electrification was widely published and presented internationally. A summary of much of his work may be found in his *Encyclopedia of Physical Science and Technology* entry of Terrestrial Atmospheric Electricity (most recent revision in 2000).

AWARDS

ATMOSPHERIC AND SPACE ELECTRICITY FOCUS GROUP ANNOUNCEMENT
Call for nominations for AGU Fellows (Due : October 1, 2004) and AGU John Adam Fleming Medal (Due: October 15, 2004).

The Atmospheric and Space Electricity (ASE) Focus Group of the American Geophysical Union (AGU) has formed the Awards and Fellows committee, which is responsible for advancing ASE-affiliated fellows nominations and Fleming Award nominations, as well as coordinating selection of outstanding ASE student paper awards at the AGU Fall Meeting. Membership is composed of ASE-affiliated Fellows and Fleming Award recipients, rotating at-large members, and the Focus Group Executive Committee. The committee is NOT INVOLVED IN THE SELECTION PROCESS. Rather, it offers the expertise and experience of its members to anyone in the community who wants to nominate a colleague. For more information on nominations, please visit:
AGU Fellows: http://www.agu.org/inside/fellnom.html
AGU Medals: http://www.agu.org/inside/awardnom.html
- Fleming: http://www.agu.org/inside/honors.html#Fleming
Please contact one or more members of the committee if you wish to pursue nominating someone for an AGU Fellow or AGU John Adam Fleming Medal.
The ASE Awards and Fellows committee:
Mark Stanley, Chair (505)667-8353 stanleym@lanl.gov
Phil Krider, AGU Fellow (520)621-6836 krider@atmo.arizona.edu
Martin Uman, AGU Fellow/Fleming Medalist (352)392-4038 uman@ece.ufl.edu

Richard Dowden, AGU Fellow 64-3-4730521 dowden@physicist.net
Don MacGorman (405)325-5667 don.macgorman@noaa.gov
Dennis Boccippio (256)961-7909 dennis.boccippio@nasa.gov
Tom Marshall (662)915-5325 marshall@olemiss.edu
Victor Pasko (814)865-3467 vpasko@psu.edu

NEW BOOK

The Lightning Flash, edited by Vernon Cooray,
published by the Institution of Electrical Engineers, London, 2003
(ISBN 0 85296 780 2).

CONFERENCES

18th ILDC (INTERNATIONAL LIGHTNING DETECTION CONFERENCE)

The 18th ILDC will be held in Helsinki, Finland from 7 to 9 June 2004. The conference is sponsored by Vaisala, and will be held for the first time outside Tucson, Arizona. The conference topic is "New understanding of the relationships and impacts of lightning: Improving real-world applications through advances in detection, research and data integration" The deadline for abstracts has passed. More than 70 presentations are scheduled to be presented by attendees from 2725 countries, and a CD with the papers will be distributed at the meeting. Session topics include:

1. Data Integration
2. Property Protection, Forestry, and Aviation
2. Meteorology
3. Warning and Safety
4. Lightning Detection Network Observations
5. Climatology
6. Lightning Detection Network Performance
7. Utilities and Telecommunications
8. Atmospheric Physics.

In addition, discussion forums will be held on such topics as lightning detection, safety, attachments, integration, applications, and meteorology.
All are invited to attend this meeting by registering at www.vaisala.com/ILDC2004.

2004 COSPAR

The 35th COSPAR SCIENTIFIC ASSEMBLY will be held in Paris, France, *(18 - 25 JULY 2004)*, (http://www.copernicus.org/COSPAR/COSPAR.html), with a Symposium (C2.4) on *Atmospheric Electrodynamics and Climate Change* probably on 22 and 23 July 2004. Professor Michael J Rycroft is MSO of this Symposium.
ICAE is one sponsor of 2004 COSPAR.
For the program of this symposium, oral session :
http://www.cosis.net/members/meetings/sessions/oral_programme.php?p_id=65&s_id=1141
Poster session :
http://www.cosis.net/members/meetings/sessions/poster_programme.php?p_id=65&s_id=1141

ICLP'2004

The 27th International Conference on Lightning Protection will be held in Avignon (France) on 13-16 September, 2004. This Conference is organized by Société de l'Electricité, de

l'Electronique et des Technologies de l'Information et de la Communication (SEE) and Ecole Centrale de Lyon (CEGELY).

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

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

CONFERENCE ON SEVERE LOCAL STORMS

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

GROUND' 2004

4 joint events will take place in Belo Horizonte, Brazil, from November 7th to 11th, 2004:
(i) International Conference on Lightning Physics and Effects - 1st LPE
(ii) International Conference on Grounding and Earthing - GROUND' 2004
(iii) Brazilian Workshop on Atmospheric Electricity - 3rd WAE
(iv) Workshop of the Brazilian Lightning Detection Network - 4th RINDAT

The event homepage is available in the site:
http://www.ground2004.com

ABSTRACT deadline is June 18th.

3rd EUROPEAN CONFERENCE ON SEVERE STORMS

The University of León (**ULE**), the Spanish National Meteorological Institute (**INM**) and the European Meteorological Society (**EMS**) are organizing the **Third European Conference on Severe Storms 2004**.
This Conference will be held in **León** (Spain) from 9th to 12th November, 2004.
Information are available in : http://www3.unileon.es/congresos/ecss2004/ENG_principal.htm
The topics of this conference are :
1. Conceptual model of severe convective storms.
2. Tornadoes and tornado genesis
3. European climatology of severe storms and related phenomena
4. Mesoscale structure of severe storms
5. Numerical modelling of the convective systems
6. Severe Storms nowcasting
7. Short-term forecasting
8. Lightning and severe convection
9. Could microphysics in severe convective systems
10. Meteorological radars and weather satellites for observing, forecasting and researching severe convective systems
11. Hail and hailstorms
12. Ground and airborne surveys of damage caused by severe convective weather

2004 AGU FALL MEETING

The 2003 AGU Fall Meeting, sponsored by the American Geophysical Union, will be held from 13–17 December 2004 in San Francisco, California, U.S.A..
For information, see : www.agu.org/meetings
Some deadlines for this Assembly :
11 June 2004 : Session Proposal deadline.
15 July 2004 : Abstract Submission Form available.
1 September 2004 : Abstracts by postal mail deadline.
9 September 2004 : Abstracts by web deadline.

Dennis Boccippio, Chair of AGU Focus Group on Atmospheric and Space Electricity, announces this reminder :
AGU Fall Meeting Session Proposals are due by 11 June.
To keep Fall Meeting organization seamless, please let the ASE Program Committee representative (currently, Dennis) know if you are proposing a session or thinking of doing so. Dennis Boccippio can be reached by cell at any time at 256-468-3801. ASE FG would like to continue and sustain the significant growth in ASE Fall Meeting participation seen last year; feel free to be creative with session topics (e.g., last year' s "Advances in ASE Technology and Algorithms" sessions). It' s been a while since we' ve had a significant atmospheric chemistry presence at the FM, so perhaps that' s a good idea for someone to run with Sessions can be proposed online at: http://www.agu.org/meetings/fm04/ (follow the "Quick Links" link at right, and be sure to propose under the "Atmospheric and Space Electricity" focus

group entry in the pulldown menu on the following page ... it is about halfway down the pulldown list).

2005 EMC ZURICH

Special Session on Lightning and Its Effects at 2005 EMC ZURICH.

Following successful presentations in Montreux (1975, 1977), Rotterdam (1979), and the last twelve years in Zurich from 1981 to 2003, the **16th International Zurich Symposium on Electromagnetic Compatibility** is planned for **February 14-18, 2005** at the Swiss Federal Institute of Technology (ETZ) in Zurich, Switzerland.

Vlad Rakov is Chair of the EMC Zurich Technical Program Committee on Lightning. He has been invited to organize a Special Session on Lightning and Its Effects at EMC Zurich '05. Papers for this Special Session may be submitted on the following topics.

1. Properties of the lightning discharge important for EMC
2. Lightning return-stroke models
3. Lightning EMP
4. Coupling of lightning electromagnetic fields to overhead and buried conductors
5. Lightning locating systems
6. Atmospherics
7. Lightning effects in the middle and upper atmosphere
8. Lightning protection
9. Lightning testing standards

Original, not previously published or elsewhere submitted **preliminary manuscript** (not exceeding four pages) shall be submitted electronically (in PDF format only) via the EMC Zurich website http://www.emc-zurich.ch. The submission deadline is **July 2, 2004**.

All contributions will be reviewed by the Technical Program Committee. Authors will be notified by **September 17, 2004**. Final paper (not to exceed four pages) submission deadline is **November 26, 2004**. If you decide to contribute, please send a copy of your paper to rakov@ece.ufl.edu.

9TH SCIENTIFIC ASSEMBLY OF IAMAS

The 2005 IAMAS General Assembly will be held from 2-11 August 2005 in Beijing, China. As part of this assembly, IAMAS and its Commissions (http://www.iamas.org/) organize a wide range of scientific meetings that are open to all scientists. Based on discussions following the meetings in Sapporo (2003), "The Fascinating Atmosphere: Changeable and Changing" has been agreed to as the scientific theme for IAMAS 2005. ICAE participates to the organization of 4 symposia :

- One symposium in the session A: GASES, AEROSOLS TO CLOUDS (NO RAIN)
"NOx from Lightning and Anthropogenic production with its transport and chemical transformation by deep convection" (ICAE, ICACGP, IOC).
Conveners:

James E. Dye, National Center for Atmospheric Research, PO Box 3000;
Boulder CO 80307, USA; Phone: 303-497-8944; FAX: 303-497-8171; dye@ucar.edu
Pierre Laroche, Atmospheric Environment Research Unit,
ONERA, 92322 Chatillon Cedex France;
Tel +33 1 46734723; Fax +33 1 46734148; laroche@onera.fr
Prof. Xiaoyan Tang at Peking University
Hajime Akimoto, President ICCl 1998-2002, Institute for Global Change Research,
Frontier Research System for Global Change, 3173-25 Showa-machi, Kanazawa-ku,
Yokohama 236-0001, Japan;
TEL: +81-45-778-5710; FAX: +81-45-778-2292; akimoto@jamstec.go.jp

- Three symposia in the session J: ELECTRICAL
"Precipitation and Electrification in Convective Clouds" (ICAE-ICCP)
Conveners:

Clive Saunders UMIST Physics Department, Sackville Street M60 1QD Manchester, UK.
Tel +441 612 003 909 Fax +441 612 003 941 e-mail: clive.saunders@umist.ac.uk
Tsutomu Takahashi, Obirin University, Core-Education Center, Obirin Univ. 3758 Tokiwa-cho,
Machida-shi, Tokyo 194-0294, Japan
tel +81-427-97-0017 fax +81-427-97-0017 e-mail: t2@obirin.ac.jp

"Middle Atmosphere Electrical Events Associated With Tropospheric Storms"
(IAMAS/ICAE, ICMA, IOC-IAGA).
Conveners:

Colin Price Department of Geophysics and Planetary Science, Tel Aviv University
Ramat Aviv, 69978 Israel tel: 972-3-6406029 fax: 972-3-6409282 e-mail: cprice@flash.tau.ac.il
Yoav Yair The Open University of Israel 16, Klauzner Street Ramat-Aviv 61392 Tel-aviv
Tel: 972-3-6465579 fax: 972-3-6465410 e-mail: yoavya@openu.ac.il

"Global Lightning and Climate" (ICAE-ICCL).
Convenors:

E.(Earle) R. Williams, MIT 48-21118, Parsens Laboratory Cambridge, Ma 02181, USA
Tel: (+1) 617 253 2459, Fax: (+1) 617 253 6208, earlew@juliet.ll.mit.edu
Xiushu QIE, Cold and Arid Regions Environmental and Engineering Research Institute,
Chinese Academy of Sciences, W. 260 Donggang Road, Lanzhou, Gansu 730000,
P. R. China, Tel: +86-931-4967686, Fax: +86-931-8274863, Email:qiex@ns.lzb.ac.cn

RESEARCH ACTIVITY BY INSTITUTION

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

During the last semester several activities were conducted by the Atmospheric Electricity Group (ELAT) of INPE in Brazil, including:

- creation in collaboration with other institutions of a web site with real time lightning data of the Brazilian Lightning Detection network;
- beginning of the expansion of the lightning network from 25 to 50 sensors, which should cover about 60% of the country and should be the largest network in the tropics;
- additional observations of significant enhancements of the CG lightning activity in the metropolitan areas of São Paulo and other cities in the Southeastern Brazil. No changes were observed in the peak current and multiplicity values. The percentage of positive CG flashes decreased proportional to the CG flash rate increased;
- simultaneous observations of continuing current with a VLF antenna, optical observations with a high speed camera and electric field observations;
- additional evidences of the influence of smokes of fires on the characteristics of flashes in the North region of the country;
- development of a relative detection efficiency model to correct the data obtained by the Brazilian lightning network, using as the input the lightning data. When applied to the data, the resulting density map in the Southeastern showed a reasonable agreement with that obtained from the OTD/LIS in the last 8 years.
- analysis of the sprite and related observations made during 2003 in the Southeastern region of the country indicated that the phenomenon should be common during the summer season in this region.

From 07 to 11 November 2004, it will be held in Belo Horizonte the 1st International Conference on Lightning Physics and Effects, simultaneously with the 4th Brazilian Workshop on Atmospheric Electricity, the 2004 International Conference on Grounding and Earthing, and the 2nd Workshop of the Brazilian Lightning Detection Network. More details can be found in www.ground2004.com.

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

Overview of Initial Performance of BOLTEK Storm Tracker : A Lightning Detector
S.S. Kandalgaonkar, M.I.R. Tinmaker, M.K. Kulkarni, Asha Nath and H.K. Trimbake

The observations of electrical parameters during disturbed weather electricity specially lightning are of immense importance. Each year lightning is responsible for the deaths of a hundred or so people and millions of dollars in property damage. The investigation of lightning has been hindered by the absence of adequate measurement methods. In the past, observations could only

be locally, and obtaining a global picture was difficult; indeed, until recently, the most accessible global lightning data set was based upon the record of 'thunderdays'. Techniques for studying lightning underwent somewhat of a revolution with the development of sensors that could be deployed in space to view lightning on a large scale by the Ionospheric Sounding Satellite – b (ISS-b) and Defense Meteorological Satellite Program (DMSP) (Mackerras et al., 1998). The DMSP greatly improved the coverage but could only observe the lightning during the night time (Orville and Henderson 1986). Thereafter in April 1995, the OTD was successfully deployed in space and it is the first lightning sensor to have the capability of viewing lightning activity, day and night across the globe while the LIS was launched on the TRMM in Nov 1997 (Christian, 1999 and Boccippio et al 2000 a,b,c). Considerable work has been carried out over the tropics as well as extra tropical regions on lightning by collecting the flash data through different techniques (Orville et al, 1997; Hodanish et al. 1997; Yair et al., 1998; Pinto et al (1999); Boccippio et al., 2000a,b,c; Nesbitt et al., 2000; Williams et al., 2000; Petersen and Rutledge, 2001; Toracinta et al., 2002; Kandalgaonkar et al, 2003).

Recently diurnal variations of lightning activity over the Indian region have been examined by the authors using LIS data. Although the results of their study are encouraging and in good agreement with the earlier studies, it was noticed that the data recorded through satellites have got their own limitations. One of them is: coincidence of passing of satellite and occurrence of thunderstorm. To overcome this difficulty, a new equipment, Boltek Storm Tracker has been installed recently at the Indian Institute of Tropical Meteorology (IITM), Pune and the thunderstorm and lightning activity is being recorded online round the clock.

The Boltek Storm Tracker is a device for measuring the lightning discharges. It is supported by the latest software Lightning 2000. The Storm Tracker is installed at the terrace of the Institute building at Pashan, Pune (18°32′N, 73°51′E, 559 ASL), India nearly about 30 m above the ground and being operated round the clock with minimum resolution time as one minute since from April 6, 2004. It detects the lightning discharges within the preset distance and plots them in a real time on map. It detects the lightning strikes by sensing signals produced by lightning. It has two built in alarms. The close storm alarm will activate if a thunderstorm is detected closer than the preset distance. The severe thunderstorm alarm activates if the number of lightning strikes per minute exceed the preset limit. A low level frequency radio signals produced by lightning's electric discharges travels over hundreds of miles. These signals are traced by the antenna of the storm tracker. The storm tracker uses a direction finding antenna to determine the direction of the lightning signals comes from. The tracker receiver looks at the signal strength to calculate an approximate distance for the lightning strike. Once it knows the distance and direction, it plots on the real time map of specific location. Thus the tracker detects where the lightning is, receives the early warning of the developing and approaching thunderstorms, signals about the near and severe storm alarms, determines the direction of the thunderstorm, follows developing and decaying storms and records all the data to the hard disk of the computer for further analysis.

With this instrument the authors have recorded the lightning data during the latest and the first thunderstorms occurred on 4 and 7 May 2004 at Pune and the observation are still in continuation. From these records it is seen that the instrument is capable of detecting the lightning strokes along with their differential count and percentage distribution. On each day the duration of thunderstorm is nearly 2 hours. During this period the storm tracker could record

nearly 8000 and 15000 flashes up to 300 km from the center of location (Pune). Looking at the capability of the instrument it is quite possible to secure the information of the lightning and thunderstorms at any hour over the interested region. The data collected on thunderstorm days over Pune up to 300 km and more than that 2000 km from Pune location showed the potential of the instrument which is quite exciting. We are the first to install and archive the observations through such a highly sensitive instrument, Boltek Storm Tracker, over this region. The present contribution is mainly to highlight the technical performance of the instrument, Boltek Storm Tracker.

LABORATOIRE D'AEROLOGIE, UNIVERSITE PAUL SABATIER, TOULOUSE, FRANCE

The Laboratoire d'Aérologie is associated with the Working Program "Cloud Electrification and Meteorology" (WP5) of the Research Training Network "Coupling of Atmospheric Layers" project (http://www.dsri.dk/cal/). This project is funded by the European Commission' s Improving Human PotentialProgramme. The network will study the newly discovered electrical discharges in the stratosphere and mesosphere above severe thunderstorms, the so-called "red sprites" and "blue jets". Studies will focus on aspects of sprites and jets that are important for understanding the impact of these high-altitude discharges on the atmosphere. The objective in WP5 is to analyse under which conditions sprites and jets are generated by thunderstorms. Most data for this analysis are provided by networks covering the areas considered in the CAL project. For the lightning activity, these data consist of Cloud-to-Ground lightning flash characteristics : ground strike location, time, polarity, number of stroke by flash, and peak current of the strokes. For the description of the convective systems, radar reflectivity fields detected by the operational radar networks and temperature of the cloud tops provided by the satellite Meteosat are used. Oscar Van der Velde (vdvo@aero.obs-mip.fr), from the Netherlands has started a PhD work in this project with Serge Soula (sous@aero.obs-mip.fr). A campaign took place during the summer of 2003 in France. Another campaign will take place in France again during the summer of 2004.

The Laboratory of Aérologie is involved in studies of correlation between microphysics and lightning activity (Sylvain Coquillat (coqs@aero.obs-mip.fr) and Serge Soula). This topic was specially developed during the MAP project with a campaign in Northern Italy for 1999 Fall and in the PhD work of Yann Seity. A systematic study of the total lightning activity of hail-bearing thundercells is now lead by Marie-Pierre Boussaton (boum@aero.obs-mip.fr) as part of her PhD work. This study contains two aspects, a detailed analysis of some cases of cells producing large hail and a statistical study of several hailstorms observed by meteorological radar facilities.

In order to follow the studies of the charge transport by the convective precipitation, a network of stations in electricity measurements will be installed in the Centre de Recherches Atmosphériques (CRA) in Hautes-Pyrénées (65). These stations consist in an electric field-mill, a precipitation current sensor and an acquisition system, and they will work in permanent mode. This experiment is linked to other observation means about convective clouds, especially local radar and the French lightning flash detection network. The goal is to study the relation between several parameters of the electrical activity of the cell during its lifetime.

A new videosonde designed for microphysical soundings inside thunderclouds has been developed in our group. This sensor makes use of a CCD camera and can provide the phase (liquid or ice), the shape, the size, and the electric charge of each precipitating particle detected singly, the size of which ranges from 0.5 mm to 2 cm and the electric charge from ±1 to ±400 pC. The accuracy on the size measurement varies between about 13 % for the smaller sizes and less than 2.6 % for the larger sizes meanwhile the average accuracy on the charge measurement is 3.2 %. The determination of several large scale parameters deduced from the videosonde data and comparable with radar observations and electrical soundings is possible. This sensor has been tested at the ground during an intercomparison experiment with a disdrometer. It is planned to be launched from the Centre de Recherches Atmosphériques (CRA) where we are still waiting for thunderstorms events...

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

The lightning activities on Tibetan Plateau are continuously studied by using the ground-based observation and LIS/OTD data. Ground-based measurement shows that the thunderstorm is usually accompanied with hail fall on the ground. The charge structure is usually tripolar with a large positive charge region at the base of the cloud. The CG discharge takes about 18.8% of all lightning discharges with a +CG ratio of 18.9%. LIS/OTD observations show a maximum flash density in July over the Tibetan Plateau. Thermodynamic parameters and rainfall obtained from meteorological reanalysis are broadly consistent with the observed seasonal cycle. However, there is more lightning in Spring than one may expect from a simple relationship with rainfall, temperature or cloud buoyancy. The surface sensible heat flux plays an important role in modifying the efficiency of generating lightning from cloud buoyancy, at least on the Tibetan Plateau.

The spectra in the range of 400~700nm for first return strokes of CG lightning flashes have been obtained in Qinghai-Tibetan plateau using a slit-less spectrograph. and new spectra lines of 604.6nm and 619.4nm are found, for the first time. Applying the Large-scale multi-configuration Dirac-Fock wave functions, the parameters such as wavelength, oscillator strengths and excited energy for the transitions related to lightning spectra, were calculated. Comparison of the calculated results with experimental spectra shows that the spectra in plateau area have a distinctive characteristic. Beside the lines of lower excited state with n = 3 in NII ions, transitions of NI and OI are increased, their excited energy is around 13 similar to 14eV, and there are rarely lines from OII ion.

Using a 3D dynamics-electrification coupled model, the effect of electric activity on hail growth and shooting on the surface during thunderstorms has been simulated. The results indicate that the hail with charge and strong electric field make precipitation and diameter of hail particles on the ground increase 50 % and 0.7mm, respectively, and the time of hail shooting lag 3 minutes. Electric action mainly influences collection and melting process of hail. Source and sink of hail decrease, and sink decrease more. So, the total amount of precipitation of hail will increase, and the number of hail particles decreases due to electrical effects. It means that hail particles become bigger and easier to fall.

The artificial triggering lightning experiment will be conducted both in Tibetan Plateau and the coast of South China Sea in the summer of 2004. In the meantime, the observation on natural lightning and environment control on lightning rate will be continuously conducted on Tibetan Plateau.

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

Earle Williams attended a workshop in Osaka, Japan hosted by Zen Kawasaki, and focused on a new climate-related observatory in Darwin, Australia. Thermodynamic and electrical conditions in the Maritime Continent, where Darwin is the main observational center, were contrasted with the same conditions in the other two tropical chimneys, Africa and the Americas.

Following the meeting in Japan, Williams and his son Gregory flew to Vladivostok to pick up the trans-Siberian railway to Moscow, via Ulan-Ude and Irkutsk, on Lake Baikal. The purpose of this trip was to meet with Dr. Yuri Bashkuev and his group at the Buryat Academy of Sciences on possible collaborative work on Schumann resonances. Bashkuev had earlier demonstrated the acquisition of high quality Schumann resonance spectra on the frozen surface of Lake Baikal. Some time was invested in searching for permanent observation sites near the Lake.

Continuing on to Moscow, Williams met Sasha Nickolaenko for further discussions on their joint Twinning Project. This work is concerned with the comparison of theoretical parameters for electromagnetic models of the Earth-ionosphere cavity with like parameters extracted from measured power spectra (by Lorentzian fitting).

An extensive set of referenced notes has been prepared for the Sprites Summer School in Corsica, organized for July 2004 by Martin Fullekrug. These notes are concerned with the microphysical and electrical properties of clouds known to produce sprites. Additional notes were prepared pertaining to the use of laboratory glow discharge tube measurements to infer information on the current density in sprites.

In early May, Williams participated in the International Workshop on the Physics of Lightning in St. Anne, Guadeloupe. Two papers were presented on (1) the evidence for an ice-based electrification process in volcanic eruptions, and (2) the thermodynamic origin of thunderclouds with inverted electrical polarity.

Three abstracts have been submitted to the third international LBA Conference in Brasilia, Brazil, including (1) a comparison of thermodynamic, aerosol, and lightning characteristics in the Amazon and Congo river basins, (2) an examination of cloud top ascent speeds during the SMOCC campaign in Brazil in 2002, and their dependence on cloud base height, and (3) a critique of a recent paper in Science by Andreae, Rosenfeld and collaborators that argues in favor of a positive impact of aerosol on convective cloud development.

Kunal Surana continues work on his Master's thesis toward interpreting multiple modes of the cutoff frequency of the Earth-ionosphere waveguide. These observations are undertaken with a wide bandwidth (2 Hz- 24 kHz) Ez antenna in West Greenwich, Rhode Island. Theoretical calculations by Porrat et al (2000) are the principal model result for comparisons with observations. Wavelet methods are being used to measure the cutoff frequencies, and follow the evolution of ionospheric height from daytime to nighttime.

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

Earle Williams has recently received support from NASA's ASAP (Advance Satellite Aviation Products) program to investigate signals in DoD satellite assets associated with volcanic eruptions. The main goal of these studies is the mitigation of hazard to commercial aviation from volcanic ash.

Toward further understanding of the physical nature of volcanic eruptions, Steve McNutt (University of Alaska) and Earle Williams have been exploring the hypothesis that lightning in eruption clouds has its origin in ice microphysics, as in ordinary thunderclouds. Observations of water contents in explosive magma (of order 5-10 weight percent of the magma) have been incorporated in calculations to show that the total cloud water concentrations in volcanic eruptions can easily exceed the saturation condition of the Clausius-Clapeyron condition. In this case, liquid water and ice are both abundant atmospheric ingredients of volcanic eruptions. Numerous pieces of observational evidence from the volcanology literature have been collected in support of this prediction. The abundance of supercooled water will encourage the coating of ash and tephra particles in the cold part of the eruption cloud, and thereby discourage the action of tribo-electric charging expected for dry silicate minerals. The inferred abundance of ice in the upper parts of deep eruption clouds also explains the problems with the so-called split window technique in distinguishing eruption clouds from thunderstorms, for early post-eruption times.

These ideas were presented at the recent International Workshop on Lightning Physics in Guadeloupe, and are intended for presentation at the upcoming Volcanic Ash Conference in Alexandria, Virginia in June, 2004.

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

1. NLSI's two day workshop *Lightning Safety for Critical High Value Facilities* has been accepted by the US Air Force Space Command for engineering training purposes. The course content can be viewed at:
   www.lightningsafety.com/nlsi_bus/nlsi_program4.htm
   Some 5-6 sessions are conducted annually for Dept. Defense and Dept. of Energy engineering and safety personnel. Contact NLSI for the 2004 schedule.

2. The Sri Lanka International Development Agency (SLIDA) is sponsoring a two day *Lightning Protection for Engineers* workshop in Colombo. NLSI Founder & CEO Richard Kithil is the seminar instructor. The meeting is hosted by Prof. Chandima Gomes at the Univ. of Colombo Dept. of Physics. Attendees from Sri Lanka and the surrounding countries have registered for the May 22-23, 2004 meeting.

3. NLSI is engaged in a USA-wide study of lightning insults to a system of 911 Emergency Radio networks, insured by a major carrier. Losses in the high five figure$ are reported for single lightning incidents. With the project about one-half completed, preliminary results point to causes from: a) Multiple Grounds; b) Lack of detail to SPD issues; and, c) Violation

of National Electrical Code requirements. For more information, see the NLSI paper *Lightning Safety to Dispatch Centers* at:
www.lightningsafety.com/nlsi_lhm/dispatch_cente_safety/html

4. The 209 page book *Lightning Protection for Engineers* has been published by NLSI. It is an illustrated guide in accord with recognized Codes and Standards. It is now available as a guidance and reference handbook. The Table of Contents and other information can be viewed at:
www.lightningsafety.com/nlsi_bus/lp_for_eng_book.html

5. NLSI recently completed a lightning hazard mitigation study for NASA Wallops Island Flight Facility Pad 0B. In 1987, lightning triggered the unintended self-launch of two small test rockets and a 16-foot-long Orion sounding rocket. The ignition mechanism for all three rockets is thought to be premature activation of a small heating coil, used for initiating a pre-launch chain of events.

NATIONAL SEVERE STORMS LABORATORY – NOAA (Norman, Oklahoma, USA)

In May and June of 2004, we will conduct year two of the field phase of the Thunderstorm Electrification and Lightning Experiment (TELEX) in central Oklahoma. The scientific purpose of TELEX is to test and revise hypotheses concerning the inter-relationships among the wind field, microphysical characteristics, electrical structure, and lightning of isolated severe storms and of mesoscale convective systems. Observing systems that we will operate in central Oklahoma include a 10-cm wavelength polarimetric WSR-88 Doppler radar, the Oklahoma lightning mapping array, two mobile Doppler radars, electric field and x-ray sensors, and a mobile laboratory for storm intercept coordination and data acquisition. Again this year, our electric field meter has been substantially upgraded (both mechanically and electronically) to provide higher resolution data that allow more accurate determination of the electric field vector along the flight path. Institutions (principal investigators) involved in the TELEX 2004 field program are the NOAA/National Severe Storms Laboratory (Don MacGorman and Dave Rust), New Mexico Institute of Mining and Technology (Ken Eack, Paul Krehbiel, Bill Rison), the University of Oklahoma (Mike Biggerstaff, Terry Schuur, Jerry Straka), Texas A&M University (Larry Carey), and the University of Washington (Bob Holzworth).

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

Space Science and Technology Department, Rutherford Appleton Laboratory (RAL)
Karen Aplin (k.l.aplin@rl.ac.uk)

Laboratory spectroscopy to investigate the infra-red absorption properties of atmospheric ions is ongoing at the UK Natural Environment Research Council (NERC) Molecular Spectroscopy Facility, located at RAL. A corona source has been used to enhance background ion

concentrations, measured with the Programmable Ion Mobility Spectrometer (PIMS) instrument. Dr Robert McPheat's Fourier transform spectrometer measurements indicate the presence of infra-red absorption bands from ions. Instrumentation has recently been installed at the Snowdon Summit Weather Station in Wales to investigate the longwave absorption properties of ions in the atmosphere. We welcome Helen Brown from Imperial College London, who has recently started work on this project at RAL.

Work continues on the electrical properties of urban air. Atmospheric electrical measurements were some of the first quantitative measurements in atmospheric science, and high quality measurements exist for many European cities in the nineteenth century. Smoke and particles frequently dominate the variations observed in urban air, and the atmospheric electrical data can be used to infer the historical smoke variations. An electrical proxy approach for air pollution has been developed with Dr Giles Harrison (University of Reading) and used to infer the smoke variations near London in the 1860s (Harrison R.G. and Aplin K.L. (2002), *Atmospheric Environment*, **36**, 25, 4037-4043), and for metropolitan Paris in the 1890s.

The Victorian measurements made near London show a smoke variation with two daily maxima. Although this is commonly found in modern cities, the modern source of the variation, the motorcar, had not then been invented. The Paris measurements were made at the top of the Eiffel Tower, a prime research facility of its time, and have allowed a vertical variation of the smoke concentrations to be reconstructed. These findings are useful in understanding composition changes in the urban atmosphere, as well as providing information on pollution and human activity. From this work, the first quantitative comparison between nineteenth century pollution in Paris and London has been made, reported in *Nature* (The veil of two cities, *Nature* **427**, 6969, p25) and the French newspaper *Le Figaro.*

For further information and a translation of the Figaro article see:
http://www.met.rdg.ac.uk/~swshargi/WebStuff/Aerosols/Kew&Paris.html

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

Yoav Yair (OU), **Zev Levin and Colin Price** (TAU) have started a three-year ground-based observation program to study the occurrence and properties of sprites in winter thunderstorms in the eastern Mediterranean. The plan is to use an array of cameras, supported by lightning location systems and weather radar, and observe winter storms as they drift from the west toward the coast of Israel. The first season will be conducted from Tel-Aviv, with possible campaigns from the Wise observatory in the Negev desert, to observe southern storms. A mesoscale numerical model of storm systems in the eastern Mediterranean, used by **Orit Altaratz** (TAU) as part of her Ph.D work, will be used to evaluate the electrical properties of sprite producing clouds.

The data from the MEIDEX-sprite campaign, conducted during the STS-107 mission of space shuttle Columbia in January 2003, are being analyzed by **Yoav Yair** (OU) and **Peter Israelevich** (TAU). A total of ~6.5 hours of data were saved from 21 different orbits. We have positively identified 17 TLEs in the 4:14 hours of accumulated thunderstorm data analyzed thus far (7

sprites, 10 elves together with 20 suspected events). TLE images were obtained over the Pacific and Indian oceans, in the central-south Atlantic and over Argentina, Brazil, north Australia, Tasmania, Congo, Togo, Nigeria and the Borneo and Fiji peninsula. The results of Elves observations have already been published in *GRL* (Israelevich et al., 2004), and those of sprites observations have been accepted to *JGR* (Yair et al., 2004). The forecast method of storms with a potential to produce TLEs, which was used during the mission, had been published in *JAM* (Ziv et al., 2004). **Colin Price** and **Eran Greenberg** (TAU) used ground-based ELF stations (in cooperation with **Gabriella Satori** and **Josef Bor** from GGRI in Hungary, and **Mitsu Sato** and **Hiroshi Fukunishu** of Tohuko University, Japan) to geolocate the MEIDEX TLEs using four ground stations. Paradoxically, all ELVES were successfully geolocated using the ELF transients, while none of the 7 sprites were found to produce ELF transients. **Eran Greenberg** (TAU) has developed as part of his MSc degree an algorithm to automatically geolocate intense global lightning from a single ELF station.

Research continues into the Schumann resonance. **Colin Price** and **Alexander Melnikov** (TAU) have analysed five years of SR data from our Negev site, investigating the characteristics of the SR parameters on daily and seasonal time scales (Price and Melnikov, JASTP, 2004) as well as the effect of the terminator crossing on the SR parameters (Melnikov et al., JASTP, 2004). **Mustafa Asfur** (TAU) is completing his PhD relating lightning variability over Africa to important climate parameters such as surface temperature, upper tropospheric humidity and water vapor. He has developed an empirical model to look at long term variability of African lightning activity since 1950 using NCEP data. **Olga Pechony** (TAU), as part of her PhD, is modeling the SR using a Partially-Uniform Knee (PUK) model. The model takes into account both the day-night asymmetry and the "knee"-like atmospheric conductivity profile. The PUK model was used to calculate SR propagation parameters on Venus, Mars and Titan. The results and the short description of the PUK model are presented in the paper submitted to Radio Science.

Finally, **Colin Price**, **Adi Zomer** and **Michael Finkelstein** (TAU) have established an ultra low frequency (ULF) monitoring station near Eilat along the Dead Sea Rift Valley. The station is to monitor possible ULF precursor activity related to seismic events. We started recording data (3 magnetic components) in June 2003.

UNIVERSITY OF FLORIDA (Gainesville, Florida, USA)

Triggered-lightning experiments will continue in Summer 2004 (for the 12th year) at the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida. These include (1) continued studies of the properties of both natural and triggered lightning using multiple-station measurements of electric and magnetic fields in conjunction with optical and thunder observations, (2) continued studies of the interaction of lightning with power distribution lines, (3) coordinated streak-camera, photoelectric, and image-converter-camera observations of the various lightning processes with emphasis on the attachment process and early stages of the return-stroke process, and (4) continued studies of the energetic radiation (X-rays, gamma-rays) during triggered-lightning discharges, in collaboration with the Florida Institute of Technology (Joe Dwyer).

Jason Jerauld, Martin A. Uman, Vladimir A. Rakov, Keith J. Rambo, and Douglas M. Jordan authored a paper titled “A triggered lightning flash containing both negative and positive strokes”. They present measured current, luminosity, and electric and magnetic fields for a rocket-triggered two-stroke flash, in which the first stroke lowered negative charge to ground and the second stroke lowered positive charge via the same channel. A triggered positive stroke is a very rare event. The measured negative return stroke peak current was –11 kA and the positive +5 kA, with the total charge transfers being -1 C and +24 C, respectively. The paper is published in the GRL.

Mirela Bejleri, Vladimir A. Rakov, Martin A. Uman, Keith J. Rambo, Carlos T. Mata, and Mark I. Fernandez authored a paper titled “Triggered Lightning Testing of an Airport Runway Lighting System“. The lighting system included a buried counterpoise with attached vertical ground rods for protection of the series lighting cable from lightning. Experimental data for voltages and currents at various locations in the runway lighting system due to direct lightning strikes are presented along with the causative lightning current. The data include the first measurements of the responses of an underground bare conductor (counterpoise) to direct lightning strikes. The paper is published in the IEEE Transactions on Electromagnetic Compatibility.

Yoshihiro Baba (on leave from Doshisha University, Japan) and Vlad Rakov authored a paper titled “On the transmission line model for lightning return stroke representation”. The widely used transmission-line model of lightning return stroke in a vertical channel is most rigorously represented by a vertical phased array of current sources that produce a spherical transverse electromagnetic (TEM) wave in the case of return-stroke speed equal to the speed of light. It is shown that a non-zero-radius vertical wire above ground excited by a practical source at its bottom end cannot support unattenuated current waves, and the associated electromagnetic field structure is non-TEM. The paper is published in the GRL.

Jens Schoene, Martin A. Uman, Vladimir A. Rakov, Keith J. Rambo, Jason Jerauld, and George H. Schnetzer authored a paper titled “Test of the transmission line model and the traveling current source model with triggered lightning return strokes at very close range”. The transmission line model (TLM) and the traveling current source model (TCSM) were tested by comparing the first microsecond of model-predicted electric and magnetic field wave forms and field derivative wave forms at 15 m and 30 m with the corresponding measured wave forms from triggered lightning return strokes. In general, the TLM works better in predicting the measured field derivatives than in predicting the measured fields. The TCSM does not adequately predict either the measured electric fields or the measured electric and magnetic field. The paper is published in the JGR – Atmospheres.

Vlad Rakov, Dave Crawford, Venkateswararao Kodali, Vince Idone (SUNYA), Martin Uman, George Schnetzer, and Keith Rambo authored a paper titled “Cutoff and Re-Establishment of Current in Rocket-Triggered Lightning”. A total of three negative rocket-triggered lightning flashes without return strokes are analyzed in order to study the processes associated with the disintegration of the triggering wire and its replacement by an air-plasma channel. It appears that the gap resulting from the vaporization of the triggering wire by the upward-positive leader current is bridged by a leader/return-stroke type process. The paper is published in the JGR – Atmospheres.

UNIVERSITY OF MISSISSIPPI

Maribeth Stolzenburg and Tom Marshall are studying many aspects of the 1999 electric field, lightning, and radar data collected at Langmuir Laboratory in central New Mexico, USA. Studies of electrical evolution, precipitation characteristics, and lightning physics in mountain thunderstorms are underway, in collaboration with colleagues (Paul Krehbiel, Ron Thomas, Bill Rison, Tim Hamlin, Bill Winn, Steve Hunyady, Graydon Aulich, Nicole Ramig) at New Mexico Tech. New investigations of ice microphysics and the role of ice in the electrification of storms will soon begin, in collaboration with John Latham and Alan Blyth.

Studies of the role of thunderstorms in the global circuit and the role of turbulence in electrification are continuing, in association with Eugene Mareev, Stanislav Davydenko, and Andrei Sorokin at the Institute for Applied Physics in Nizhny Novgorod. Modeling results concerning the effect of mesoscale convective systems, particularly the stratiform precipitation region, on the ionospheric potential were presented at the ICAE last year and will soon appear in the Journal of Geophysical Research.

Graduate student Chris Maggio has begun his dissertation research, the first part of which involves a comparison of the timing of initial sources detected by the NM Tech Lightning Mapping Array to the timing of deflections detected by slow and fast antenna instrumentation. Initial results were presented at the Fall 2003 Meeting of the AGU and will be submitted for publication soon.

Lee Coleman successfully defended his dissertation entitled "Effects of Electric Potential on Horizontal Lightning Propagation" and received his Ph.D. Degree in Physics on 7 May. Lee is presently employed here in a temporary postdoctoral position that will allow him to submit several additional pieces of his dissertation work for publication.

THE UNIVERSITY OF READING (Reading, UK)

Giles Harrison (r.g.harrison@reading.ac.uk)

Experimental studies of surface ion-aerosol physics are currently being undertaken as part of the Natural Environment Research Council's Polluted Troposphere project, with Anna Willson and Dr Richard Wilding. The University of Reading Programmable Ion Mobility Spectrometers (PIMS) instruments are being used at field sites in the UK, alongside apparatus from aerosol and chemistry research groups. Measurements of background ion production, small ion concentration and cosmic ray air showers have been made in urban air. Variations in ionisation rates have been associated with both the prevailing meteorological conditions and changes in cosmic ray fluxes, and future work will incorporate the aerosol measurements in assessing the significance of ion-induced ultra-fine particle production.

Analysis of the long data series of UK surface atmospheric electricity measurements continues, investigating links between atmospheric electricity and climate. Measurements exist of the Potential Gradient, air-earth current and air conductivity from three UK sites between 1898 and 1984, although not all the quantities are available from all the sites. Some of this data shows

evidence of global circuit variations and a discussion of the data from Eskdalemuir in Scotland has recently been published; work continues on data from the other sites. The atmospheric electrical measurements also provide information on changes in atmospheric composition during the past century. From the urban air perspective, work with Dr Karen Aplin (Rutherford Appleton Laboratory) has provided a new quantitative comparison of nineteenth century smoke pollution in London and Paris.

THE UNIVERSITY OF TEXAS (Dallas)

At the University of Texas at Dallas Prof. Tinsley and associates have been studying both the very small scale and the very large scale effects of atmospheric electricity.

On the scale of the global electric circuit they are finding further evidence that changes in the downward current density (Jz) in the return path of the circuit affect cloud processes. A paper in press with D. Kniveton of the University of Sussex is on an analysis of satellite data on global cloud cover, showing clear decreases at high latitudes and increases at low latitudes, with a response time of less than a day, to corresponding Jz changes induced by changes in relativistic electron precipitation. This effect is for years when the resistivity of the stratosphere is greatly increased by the presence of volcanic aerosols in it. It is noteworthy that there are no significant galactic cosmic ray (GCR) flux changes during these events (at times of heliospheric current sheet crossings) and the relativistic electrons do not penetrate to the troposphere, thus the cloud effects can only be due to the Jz changes.

Because similar Jz changes can be caused by GCR changes, it is possible that Jz is the proximate cause of many of the observed cloud cover changes associated with GCR changes. Thus GCR changes appear to be just one of several intermediate links between solar activity and cloud changes.

On the smallest scale Prof. Tinsley and associates continue to model the effects of electroscavenging of condensation nuclei and of ice-forming nuclei, that can result in the indirect aerosol effect for cloud cover, including low clouds, and contact ice nucleation leading to enhanced ice precipitation for cold clouds.

Paper published:
Atmospheric Ionization and Clouds as Links Between Solar Activity and Climate, in Solar Variability and its Effects on Climate, AGU Monograph 141, pp. 321-340, ed J. Pap et al., AGU Press, Washington.

VAISALA, THUNDERSTORM BUSINESS UNIT (Tucson, AZ USA and Aix en Provence, FRANCE):

Numerous research and product/services activities are underway or have been completed in 2003-2004. Most of these activities are described in detail in papers to be presented at the 18th International Lightning Detection Conference to be held in Helsinki on June 7-9, 2004. See the conference notice on this newsletter issue. Abstracts can be found under ILDC at www.vaisala.com/ILDC2004.

The U.S. National Lightning Detection Network (NLDN) has undergone a complete upgrade in 2002-2003, replacing all sensors with IMPACT ESP sensors. This upgrade has resulted in (typically) 20-40% improvement in stroke detection efficiency (DE), and 5-15% improvement in flash DE. Independent evaluations in Tucson (Kehoe and Krider, ILDC), and Camp Blanding, Florida (Jerauld et al., ILDC) confirm the performance of the upgraded NLDN.

Vaisala, together with selected Weather Forecast Offices of the National Weather Service, and other research organizations have joined a government, university, and industry alliance to provide total lightning information to improve the operational short range prediction of severe weather. This interest builds on the activity initiated through the NASA Short-term Prediction Research and Transition (SPoRT) Center in Huntsville, AL. A kick-off national workshop was held in Huntsville April 1-2 to identify the common goals and objectives of the research and operational community, and to assign roles and responsibilities within the alliance. The workshop agenda, presentations, and summary are available at the SPoRT Center Web site (http://www.ghcc.msfc.nasa.gov/sport) under the "Meetings" tab.

Four Vaisala VLF sensors, in combination with a subset of NLDN and Canadian sensors are now providing real-time lightning information in the North-Pacific. The goal of the new Pacific Lightning Detection Network (PacNet) is to provide long-range lightning detection over the central and northern Pacific Ocean for research and operational applications. This work has been done in collaboration with Steven Businger (PI) (University of Hawaii), Steve Goodman (NASA MSFC), and other NWS and NASA researchers. Early results will be presented at the ILDC (Pessi et al.).

The Vaisala R&D team has completed the development of a unified sensor architecture and platform that supports all existing Vaisala detection technologies (VHF, LF, and VLF). Product information about this new sensor family (LSx000) and the related central processing systems can be obtained from Vaisala (www.lightningstorm.com). A technical description and validation test results are provided in Soulage et al. (ILDC).

For additional information about Vaisala's lightning research activities, contact Ken.Cummins@vaisala.com

RECENT PUBLICATIONS

Adachi, T.; Fukunishi, H.; Takahashi, Y.; Sato, M., 2004, Roles of the EMP and QE field in the generation of columniform sprites, Geophys. Res. Lett., Vol. 31, No. 4, L04107, 10.1029/2003GL019081.

Aplin K.L. (2004), Atmospheric ion spectra and the rate of voltage decay of an aspirated cylindrical capacitor, *Institute of Physics Conference Series*, in press.

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

Baba, Y. and V.A. Rakov, 2003, "On the Transmission Line Model for Lightning Return Stroke Representation", Geophys. Res. Lett., 30(24), 2294, doi: 10.1029/2003GL018407.

Beasley, William H.; Edgar, Bruce C., 2004, Early coincident satellite optical and ground-based RF observations of lightning, Geophys. Res. Lett., Vol. 31, No. 7, L07107, 10.1029/2003GL018991.

Bejleri, M., V.A. Rakov, M.A. Uman, K.J. Rambo, C.T. Mata, M.I. Fernandez, 2004, "Triggered Lightning Testing of an Airport Runway Lighting System", IEEE Trans. on EMC, vol. 46, No. 1, 96-101.

Bering, E. A., III; Benbrook, J. R.; Bhusal, L.; Garrett, J. A.; Paredes, A. M.; Wescott, E. M.; Moudry, D. R.; Sentman, D. D.; Stenbaek-Nielsen, H. C.; Lyons, W. A., 2004, Observations of transient luminous events (TLEs) associated with negative, cloud to ground (• CG) lightning strokes, Geophys. Res. Lett., Vol. 31, No. 5, L05104, 10.1029/2003GL018659.

Boussaton, M. P., S. Coquillat, S. Chauzy, and F. Gangneron, 2004, A new videosonde with particle charge measurement device for in situ observation of precipitation particles, to be published in the /Journal of Atmospheric and Oceanic Technology/.

Chronis, Themis G.; Anagnostou, Emmanouil N., 2003, Error analysis for a long range lightning monitoring network of ground-based receivers in Europe, J. Geophys. Res., Vol. 108, No. D24, 4779, 10.1029/2003JD003776.

Coleman, L. M., T. C. Marshall, M. Stolzenburg, T. Hamlin, P. R. Krehbiel, W. Rison, and R. J. Thomas, Effects of charge and electrostatic potential on lightning propagation, *J. Geophys. Res.*, *108*, 4298, doi:10.1029/2002JD002718, 2003.

Cooray, V., R. Montano, and V. Rakov, 2004, "A Model to Represent Negative and Positive Lightning First Return Strokes with Connecting Leaders", J. Electrostatics, 60, 97-109.

Cummer, Steven A.; Lyons, Walter A., 2004, Lightning charge moment changes in U.S. High Plains thunderstorms, Geophys. Res. Lett., Vol. 31, No. 5, L05114, 10.1029/2003GL019043.

Davydenko, S. S., E. A. Mareev, T. C. Marshall, and M. Stolzenburg, On the calculation of electric fields and currents of mesoscale convective systems, J. Geophys. Res., 109, doi:10.1029/2003JD003832, 2004.

Dwyer, J.R. H.K. Rassoul, M. Al Dayeh, L. Caraway, B. Wright, A. Chrest, M.A. Uman, V.A. Rakov, K.J. Rambo, D.M. Jordan, J. Jerauld, and C. Smyth, 2004, "A ground level gamma-ray burst observed in association with rocket-triggered lightning", Geophys. Res. Lett., 31, L05119, doi:10.1029/2003GL018770.

Dwyer, J.R., H.K. Rassoul, M. Al Dayeh, L. Caraway, B. Wright, A. Chrest, M.A. Uman, V.A. Rakov, K.J. Rambo, D.M. Jordan, J. Jerauld, and C. Smyth, 2004, "Measurements of x-ray emission from rocket-triggered lightning", Geophys. Res. Lett., 31, L05118, doi:10.1029/2003GL018771.

Fehr, Thorsten; Höller, Hartmut; Huntrieser, Heidi, 2004, Model study on production and transport of lightning-produced NOx in a EULINOX supercell storm, J. Geophys. Res., Vol. 109, No. D9, D09102, 10.1029/2003JD003935.

Gerken, E. A.; Inan, U. S., 2004, Comparison of photometric measurements and charge moment estimations in two sprite-producing storms, Geophys. Res. Lett., Vol. 31, No. 3, L03107, 10.1029/2003GL018751.

Harrison R.G. Long term measurements of the global atmospheric electric circuit at Eskdalemuir, Scotland, 1911-1981 *Atmospheric Research* **70** (1), 1-19, doi 10.1016/j.atmosres.2003.09.007.

Harrison R.G., and Aplin K.L. (2003), Nineteenth century Parisian smoke variations inferred from atmospheric electrical observations, *Atmospheric Environment*, **37**, 38, 5319-5324, doi 10.1016/j.atmosenv.2003.09.042.

Israelevich, P. L.; Yair, Y.; Devir, A. D.; Joseph, J. H.; Levin, Z.; Mayo, I.; Moalem, M.; Price, C.; Ziv, B.; Sternlieb, A., 2004, Transient airglow enhancements observed from the space shuttle Columbia during the MEIDEX sprite campaign, Geophys. Res. Lett., Vol. 31, No. 6, L06124, 10.1029/2003GL019110.

Jacobson, Abram R., 2003, How do the strongest radio pulses from thunderstorms relate to lightning flashes?, J. Geophys. Res., Vol. 108, No. D24, 4778, 10.1029/2003JD003936.

Jerauld, J., M.A. Uman, V.A. Rakov, K.J. Rambo, and D.M. Jordan, 2004, "A triggered lightning flash containing both negative and positive strokes", Geophys. Res. Lett., 31, L08104, doi:10.1029/2004GL019457.

Labrador, Lorenzo J., von Kuhlmann, Rolf, Lawrence, Mark G., 2004, Strong sensitivity of the global mean OH concentration and the tropospheric oxidizing efficiency to the source of NOx from lightning, Geophys. Res. Lett., Vol. 31, No. 6, L06102, 10.1029/2003GL019229.

Lay, Erin H.; Holzworth, Robert H.; Rodger, Craig J.; Thomas, Jeremy N.; Pinto, Osmar, Jr.; Dowden, Richard L., 2004, WWLL global lightning detection system: Regional validation study in Brazil, Geophys. Res. Lett., Vol. 31, No. 3, L03102, 10.1029/2003GL018882.

Miki, M., T. Shindo, V.A. Rakov, M.A. Uman, K.J. Rambo, G.H. Schnetzer, G. Diendorfer, M. Mair, F. Heidler, W. Zischank, R. Thottappillil, and D. Wang, 2003, "Die Anfangsphase von Aufwaertsblitzen", ETZ Elektrotech. Autom., 124(3-4), 50-55.

Noble, Cynthia M. M.; Beasley, William H.; Postawko, Susan E.; Light, T. E. L., 2004, Coincident observations of lightning by the FORTE photodiode detector, the New Mexico Tech Lightning Mapping Array and the NLDN during STEPS, Geophys. Res. Lett., Vol. 31, No. 7, L07106, 10.1029/2003GL018989.

Otsuyama, T.; Manabe, J.; Hayakawa, M.; Nishimura, M., 2004, Characteristic of subionospheric VLF perturbations associated with winter lightning around Japan, Geophys. Res. Lett., Vol. 31, No. 4, L04117, 10.1029/2003GL019064.

Pavanello, D.; Rachidi, F.; Rubinstein, M.; Bermudez, J. L.; Nucci, C. A., 2004, Electromagnetic field radiated by lightning to tall towers: Treatment of the discontinuity at the return stroke wave front, J. Geophys. Res., Vol. 109, No. D6, D06114, 10.1029/2003JD004185.

Pawar, S. D.; Kamra, A. K., 2004, Evolution of lightning and the possible initiation/triggering of lightning discharges by the lower positive charge center in an isolated thundercloud in the tropics, J. Geophys. Res., Vol. 109, No. D2, D02205, 10.1029/2003JD003735.

Rachidi, F., J.L. Bermudez, M. Rubinstein, and V.A. Rakov, 2004, "On the Estimation of Lightning Peak Currents from Measured Fields Using Lightning Location Systems", J. Electrostatics, 60, 121-129.

Rakov, V.A, 2003, "M-Component Mode of Charge Transfer to Ground in Lightning Discharges", ETZ Elektrotech. Autom., Heft 3-4, 53.

Rakov, V.A., R. Thottappillil, and J. Schoene, 2003, "Comments on "On the Concepts Used in Return Stroke Models Applied in Engineering Practice" (Cooray, 2003)", IEEE Trans. on EMC, vol. 45, No. 3, p. 567.

Rakov, V.A., D.E. Crawford, V. Kodali, V.P. Idone, M.A. Uman, G.H. Schnetzer, and K.J. Rambo, 2003, "Cutoff and Reestablishment of Current in Rocket-Triggered Lightning", J. Geophys. Res., 108(D23), 4747, doi: 10.1029/2003JD003694.

Sato, Mitsuteru; Fukunishi, Hiroshi, 2003, Global sprite occurrence locations and rates derived from triangulation of transient Schumann resonance events, Geophys. Res. Lett.Vol. 30, No. 16, 1859, 10.1029/2003GL017291.

Schoene, J., M.A. Uman, V.A. Rakov, K.J. Rambo, J. Jerauld, and G.H. Schnetzer, 2003, "Test of the Transmission Line Model and the Traveling Current Source Model with Triggered

Lightning Return Strokes at Very Close Range", J. Geophys. Res., 108(D23), 4737, doi: 10.1029/2003JD003683.

Soula, Serge; Seity, Yann; Feral, Laurent; Sauvageot, Henri, 2004, Cloud-to-ground lightning activity in hail-bearing storms, J. Geophys. Res., Vol. 109, No. D2, D02101, 10.1029/2003JD003669.

Torii, Tatsuo; Nishijima, Takeshi; Kawasaki, Zen-Ichiro; Sugita, Takeshi, 2004, Downward emission of runaway electrons and bremsstrahlung photons in thunderstorm electric fields, *Geophys. Res. Lett.*, Vol. 31, No. 5, L05113, 0.1029/2003GL019067.

Toumi R, Qie XS , 2004, Seasonal variation of lightning on the Tibetan plateau: A spring anomaly?, Geophys. Res. Lett., 31 (4): art. no. L04115 FEB 27.

Visacro, S., 2004, A representative curve for lightning current waveshape of first negative stroke, Geophys. Res. Lett., Vol. 31, No. 7, L07112, 10.1029/2004GL019642.

Visacro, Silvério; Soares, Amilton, Jr.; Schroeder, Marco Aurélio O.; Cherchiglia, Luiz C. L.; de Sousa, Vander José, 2004, Statistical analysis of lightning current parameters: Measurements at Morro do Cachimbo Station, J. Geophys. Res., Vol. 109, No. D1, D01105, 10.1029/2003JD003662.

Yuan P, Liu XS, Zhang YJ, et al., 2004, Spectral study on lightning return stroke in plateau area, Chinese J. Geophys.-Ch., 47 (1): 42-+ Jan. 2004.

Zhang YJ, Sun AP, Yan MH, et al., 2004, Numerical modeling for effects of electric activity during thunderstorms upon the growth of hail particles, Chinese J. Geophys.-Ch. 47 (1): 25-32, Jan 2004.