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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

ANNOUNCEMENTS

The present Newsletter on Atmospheric Electricity has been founded by the International Commission on Atmospheric Electricity (IAMAS/IUGG), with the valuable sponsoring of the American Meteorological Society and the American Geophysical Union. For the present issue, we welcome two new sponsors: the European Geophysical Society (EGS) and the Society of Atmospheric Electricity of Japan (SAEJ). We are sure that they will contribute as well as AGU and AMS to the diffusion of this Newsletter in the scientific community.

The Newsletter on Atmospheric Electricity being now sent by e-mail, those individuals needing a paper version should contact Serge Chauzy: (chas@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 now electronic mail, we would be grateful to all of those who can help us complete the "atmospheric electricity" list of email addresses already available. We remind all our colleagues that the Newsletter is 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 new associated institutions websites. The EGS site is: www.cosis.net, and the SAEJ site: http://lightning.pwr.eng.osaka-u.ac.jp/saej .

Contributions to the next issue of this Newsletter (May 2002) will be welcome and should be submitted to Serge Chauzy or Pierre Laroche before April 30, 2002, preferably under word attached documents. A reminder will be sent to all colleagues whose e-mail addresses are presently listed.

NEWS

GEOPHYSICAL CALENDAR

The Geophysical Calender is issued annually by the International Space Environment Service (ISES/NOAA) to recommend dates for solar and geophysical observations, which cannot be carried out continuously. Paper copies of this Calender used to be sent every year to various institutions and scientists. There will be no more paper release since it is now available on the website of ISES : http://ises-spaceweather.org. The 2001 edition can be presently consulted and the 2002 edition will be available soon.

C. T. R. WILSON NOTEBOOKS

Earle Williams reports:

The Center for the History of Physics of the American Institute of Physics (Spencer Weart) has recently provided funds for the microfilming of the research notebooks of C.T.R. Wilson. Comprising fifty volumes, this material is presently in archive in the library of the Royal Society of London. The microfilming will enable wider access to this valuable resource. Requests to have the material digitized and placed on a website were declined by the Royal Society, owner of the copyright.

NFPA 780

The National Fire Protection Association (NFPA) held a hearing on October 4, 2001, on the status of NFPA 780, their lightning protection standard. On October 11, 2001, NFPA announced it would retain NFPA 780 and issue the 2000 edition of the Standard, which had been held up pending this hearing. The CASE report submitted to the NFPA as substantiation of the scientific basis of conventional lightning protection systems (available at the AGU CASE website at http://CASE.agu.org) was a major factor in helping to retain this valuable standard. The CASE working group, formed as a result of the discussion of the status of NFPA 780 at the annual CASE meeting of December 18, 2000, was chaired by Bill Rison of New Mexico Tech. The CASE report was endorsed by the AGU President Marcia McNutt and by the ICAE President Pierre Laroche.

NEW "EDITOR'S CHOICE – ATMOSPHERIC ELECTRICITY" ALL ELECTRONIC JOURNAL

Richard Orville reports:

The American Geophysical Union is launching a new all electronic journal beginning this January. There will be two issues each month, published on the Web on the 15th and 30th. Richard Orville, Editor (Texas A&M University), will be assisted by an advisory board consisting of Vlad Rakov (University of Florida) and Dave Sentman (University of Alaska). We will select articles in the field of atmospheric electricity from AGU journals in press, primarily from JGR-D (Atmospheres), JGR-A (Space Physics), Radio Science, and Geophysics Research Letters. All articles in AGU journals will be surveyed for their atmospheric electricity content and relevance to our field. I anticipate that approximate 5-10 articles will be published electronically in Editor's Choice-Atmospheric Electricity.

The first two months, January and February 2002, are free to AGU members. Sign up; try it out. Annual subscriptions will be $36. Contact Stephan Cole (scole@agu.org) to subscribe!

Email me at rorville@tamu.edu if you have questions about this new AGU initiative. I will anticipate one frequent question by noting that the AGU does not plan to make articles

published before January 2002 available through Editor's Choice-Atmospheric Electricity. All AGU articles beginning in January 2002 related to atmospheric electricity will be considered for this new electronic journal

CONFERENCES

2001 AGU FALL MEETING

We remind you that the 2001 Fall AGU Meeting will be held on December 10-14, 2001 in San Francisco. Below is the schedule for the Committee on Atmospheric and Space Electricity (CASE) sponsored sessions. A total of 79 papers will be presented, 22 orally and 57 as posters. For more information visit http://www.agu.org/meetings/fm01call.html.

Monday, December 10:

AE11A – Lightning and Storm Electrification I, 0830-1200 (POSTER), MC Hall D

AE12A – Lightning and Storm Electrification II, 1330-1700 (POSTER), MC Hall D

Tuesday, December 11:

AE21A – Lightning and Storm Electrification III, 0830-1200 (ORAL), MC 123

AE22A – Thunderstorm Electrical Effects on the Middle and Upper Atmosphere and Ionosphere I, 1330-1700 (ORAL), MC 123

Wednesday, December 12:

AE31A – Thunderstorm Electrical Effects on the Middle and Upper Atmosphere and Ionosphere II, 0830-1200 (POSTER), MC Hall D

The annual CASE meeting will be held in San Francisco on Monday, December 10, 2001, 6:30-7:30 p.m., Moscone Center, room #125. Please send your suggestions for the CASE meeting agenda to rakov@ufl.edu.

For more information about the 2001 Fall AGU meeting, please visit:
http://www.agu.org/meetings/fm01call.html.

EUROPEAN SCIENCE FOUNDATION "SPECIAL" WORKSHOP

Martin Fullekrug reports :

The European Science Foundation (ESF) will support a workshop on SPECIAL (Space Processes and Electrical Changes Influencing Atmospheric Layers) to be held in Cambridge, UK, on January 3-6, 2002. For more information on the ESF, please check out http://www.esf.org/physical/pn/Special/speciala.htm.

The SPECIAL workshop is entitled: "SPACE WEATHER AND THE EARTH'S WEATHER AND CLIMATE. Links between solar activity, magnetospheric variability, clouds, thunderstorms, and lightning." The workshop hosts three distinct thematic groups which are working on :

(1) Global Atmospheric Electric Circuit

(2) Charged Particle Fluxes, Events, and Statistics and

(3) Sprites and Lightning.

During the workshop, distinct introductory review lectures will be given and an extended poster session will be held for discussion and planning of future research. For more detailed information on the SPECIAL goals, registration forms, and recent announcements, check out the SPECIAL website at http://sgo.fi/SPECIAL.

16th CONFERENCE ON HYDROLOGY

The 16th Conference on Hydrology, sponsored by the American Meteorological Society and organized by the AMS Committee on Hydrology, will be held 13–17 January 2002 as part of

the 82nd AMS Annual Meeting in Orlando, Florida. A preliminary program, registration, hotel and general information are posted on the Web at http://www.ametsoc.org/AMS.
The deadline for abstracts and extended preprint manuscripts has passed.

EUROPEAN GEOPHYSICAL SOCIETY (EGS) XXVII GENERAL ASSEMBLY

The XXVIIth General Assembly of the European Geophysical Assembly, co-sponsored by EGS and American Geophysical Union (AGU), will be held 21 – 26 April 2002 in Nice, France. For complete information, contact: EGS Office, Max-Planck-Str 13, 37191 Katlenburg-Lindau, Germany; Phone: +49-5556-1440; Fax: +49-5556-4709.
E-mail: egs@copernicus.org; Web Site:
http://www.copernicus.org/EGS/egsga/nice02/nice02.htm
The absolute deadline for receipt of abstracts is 11 January 2002.

25th CONFERENCE HURRICANES AND TROPICAL METEOROLOGY

The 25th Conference Hurricanes and Tropical Meteorology, sponsored by the American Meteorological Society and organized by the AMS Committee on the Hurricanes and Tropical Meteorology, will be held 29 April–3 May 2002 at the Holiday Inn—San Diego, in San Diego, California. More information on the website: http://www.ametsoc.org/AMS.
The deadline for abstracts has passed.

2002 AGU SPRING MEETING

The 2002 AGU Spring Meeting, sponsored by the American Geophysical Union, will be held 28 – 31 May 2002 in Washington, DC (Washington Convention Center), U.S.A. For detailed information, contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC, 20009 USA; Phone: +1-202-462-6900; Fax: +1-202-328-0566; E-mail: meetinginfo@agu.org; Web Site: www.agu.org/meetings.
The deadline to propose sessions to the Spring Meeting has passed. The deadline for receipt of application for Berkner Travel Fellowships is 31 January 2002. The deadline for receipt of the Postal/Express Mail Abstracts is 5 March 2002 and for receipt of the Electronic Abstract 12 March 2002 (1400 UTC): 29 April 2002. For more information, visit the site http://earth.agu.org/meetings/meetings.html.

11th CONFERENCE ON CLOUD PHYSICS

The AMS Conference on Cloud Physics, sponsored by the American Meteorological Society and organized by the AMS Committee on Cloud Physics, will be held 3–7 June 2002 at the Ogden Eccles Conference Center located in the Ogden Marriott in Ogden, Utah. This year Cloud Physics will be held in conjunction with the AMS 11th Conference on Atmospheric Radiation, with which there will be several joint sessions.
Preliminary programs, registration, hotel, and general information will be posted on the AMS Web site (http://www.ametsoc.org/AMS) in mid-February 2002.
Please submit your abstract electronically via the Web by 4 January 2002 (refer to the AMS Web page at http://www.ametsoc.org/AMS for instructions). Authors of accepted presentations will be notified by e-mail in early February. A preprint CD-ROM is being prepared and authors of invited and accepted papers will be asked to contribute. Instructions for the electronic submission of extended abstracts will be posted on the AMS Web site. Manuscripts must be submitted by 22 March 2002.

10th CONFERENCE ON MOUNTAIN METEOROLOGY

The 10th Conference on Mountain Meteorology and the Mesoscale Alpine Programme (MAP) Meeting 2002 will be held 17-21 June 2002 in Park City, Utah. The conference is sponsored by the American Meteorological Society, the International Conference on Alpine Meteorology (ICAM), and the European Meteorological Society (EMS) and organized by the AMS Committee on Mountain Meteorology.
The deadline for abstracts is 14 December 2001. Abstracts are now submitted electronically (refer to the AMS home page, http://www.ametsoc.org/AMS, for the instructions on this new electronic procedure).

INTERNATIONAL TROPICAL RAINFALL MEASURING MISSION (TRMM) CONFERENCE

The International Tropical Rainfall Measuring Mission (TRMM) Science Conference will be held 22–26 July 2002 at the Hyatt Regency Waikiki in Honolulu, Hawaii. The conference is sponsored by the National Aeronautics and Space Administration (NASA) and the National Space Development Agency (NASDA) of Japan.
Titles and abstracts (not to exceed 500 words) in English must be received by 1 February 2002. For further information: visit http://trmm.gsfc.nasa.gov.

21st CONFERENCE ON SEVERE LOCAL STORMS

The 21st Conference on Severe Local Storms, sponsored by the American Meteorological Society and organized by the AMS Committee on Severe Local Storms, will be held 12–16 August 2002 at the Henry B. Gonzalez Convention Center in San Antonio, Texas. This conference will be held in conjunction with the 19th Conference on Weather Analysis and Forecasting and the 15th Conference on Numerical Weather Prediction.
A preliminary program, registration, hotel, and general information will be posted on the AMS Web site (http://www.ametsoc.org/AMS) in mid-March 2002. Detailed information on BAMEX can be found at http://www.mmm.ucar.edu/bamex/science.
Please submit your abstract electronically via the Web by 15 March 2002 (refer to the AMS Web page at http://www.ametsoc.org/AMS for instructions).

2002 URSI GENERAL ASSEMBLY

The 2002 URSI General Assembly will be held 17-24 August 2002 in Maastricht, Netherlands. There will be a joint session organized by Commissions H, G, and E, titled: "Lightning effects in the ionosphere and the radiation belts". Session Organizers: Steve Cummer, Craig Rodger, and Yasuhide Hobara. This session will cover all aspects of coupling between lightning and the ionosphere/magnetosphere system. This includes direct interactions, such as those leading to transient optical emissions like sprites and jets, and indirect interactions, such as whistler-induced magnetospheric particle precipitation and its effect on the radiation belts. Papers reporting experimental and theoretical results on these and related topics, such as the local and global effects of these processes and the characteristics of lightning responsible for these phenomena, are solicited. Abstract Deadline: 15 January 2002. Abstracts can only be officially submitted on the web at: http://www.ursi-ga2002.nl. Please also send a copy of your abstract to one of the convenors via email: cummer@ee.duke.edu, crodger@physics.otago.ac.nz, or hobara@cnrs-orleans.fr.

2002 INTERNATIONAL LIGHTNING DETECTION CONFERENCE

The 2002 International Lightning Detection Conference, sponsored by Global Atmospherics, Inc., will be held 16–18 October 2002, in Tucson, Arizona, at the University Park Marriott. Topics will include meteorological correlations, lightning signatures, geographic and

orographic effects on observed lightning parameters, global lightning detection, 3-dimensional lightning mapping, large-scale (regional/continental) lightning network integration, forecasting and nowcasting improvements, forensic analysis and damage investigation, electric power line performance, telecommunications issues, aviation management, and developing safety recommendations.
Presentations will be in both oral and poster form. Please use e-mail to submit your 200-word abstract to gstevens@glatmos.com. Deadline for abstracts is 1 April 2002. Acceptance notification will begin 15 May 2002. Final papers are due 15 August 2002.
For further information please contact: Shelly Denman, 2002 ILDC Coordinator, Global Atmospherics, Inc., 2705 East Medina Road, Tucson, AZ 85706 (tel: 520-806-7498 or 800-283-4557, fax: 520-741-2848, e-mail: sdenman@glatmos.com).

26th INTERNATIONAL CONFERENCE ON LIGHTNING PROTECTION

The 26th International Conference on Lightning Protection, ICLP 2002 will be held at Cracow in Poland 2nd to 6 September 2002. This conference will provide an excellent opportunity for scientists, engineers, designers and users of lightning protection systems, from a wide range of universities and industry, to present and discuss the latest scientific results and share their practical experience in the field of lightning protection technology. http://www.iclp2002.pl.

2002 AGU FALL MEETING

The 2002 AGU Fall Meeting, sponsored by the American Geophysical Union, will be held 6 – 10 December 2002 in San Francisco, California, U.S.A. For detailed information, contact: AGU Meetings Department, 2000 Florida Avenue, NW, Washington, DC, 20009 USA; Phone: +1-202-462-6900; Fax: +1-202-328-0566; E-mail: meetinginfo@agu.org; Web Site: www.agu.org/meetings.

2003 EGS – AGU – EUG JOINT ASSEMBLY

The 2003 European Geophysical Society – American Geophysical Union – European Union of Geosciences Joint Assembly will be held 7 – 11 April 2003 in Nice, France. It will be sponsored by EGS, AGU, and EUG. Contact: EGS office, Max-Planck-Str. 13, 37191 Katlenburg-Lindau, GERMANY; Phone: +49-5556-1440; Fax: +49-5556-4709; E-mail: egs@copernicus.org; Web Site: www.copernicus.org/EGS; Abstract Deadline: 10 January 2003.

12th INTERNATIONAL CONFERENCE IN ATMOSPHERIC ELECTRICITY

As it has been decided by the International Commission on Atmospheric Electricity during the 11th Conference held in Huntsville (Alabama, USA) in 1999, the 12th Conference in Atmospheric Electricity will be hosted in Versailles (France) in 2003. The period chosen is 9-13 June. The scientific committee and the local organizing committee are being set up and the first announcement will be released soon.

XXIIIrd IUGG GENERAL ASSEMBLY

The XXIIIrd General Assembly of the International Union of Geodesy and Geophysics will be held in Sapporo, Japan, June 30 – July 11, 2003. The scientific program intends to highlight the latest developments in the relevant fast-breaking sciences, as well as reviewing progress in the traditional fields. Amongst the various associations depending from IUGG, IAMAS

(International Association of Meteorology and Atmospheric Sciences) will be present. The ICAE is one of the specialized commissions related to IAMAS. More information is available on the website: http://www.jamstec.go.jp/jamstec-e/iugg/index.html.

RESEARCH ACTIVITY BY ORGANISATION

* AGU COMMITTEE ON ATMOSPHERIC AND SPACE ELECTRICITY

1. CASE conducted three meetings, in Guntersville, Alabama (June 1999) and in San Francisco, California (December 1999 and December 2000).
2. In 2001, CASE formed the working group on the National Fire Protection Association Standard for the Installation of Lightning Protection Systems (NFPA 780). The working group, chaired by Dr. Bill Rison, is preparing "an independent literature review and analysis from a reliable source demonstrating the validity of the basic technology and science underlying traditional lightning protection systems" that are being challenged by some manufacturers of "non-conventional" lightning protective systems.
3. CASE organized three Special Sessions at the 1999 Fall AGU Meeting and two Special Sessions at the 2000 Fall AGU Meeting. CASE also proposed two Special Sessions for the 2001 Fall AGU Meeting, Electrical Effects of Thunderstorms on the Middle and Upper Atmosphere (co-conveners D. Sentman and V. Pasko) and Lightning and Storm Electrification (co-conveners V. Rakov and D. MacGorman).
4. In 1999, CASE participated in revising the citation for the John Adam Fleming Medal. The 2001 Fleming Medal was awarded to Dr. Martin A. Uman, a member of our community.
5. In 2001, CASE made a contribution to the Crosscuts topics, as per request of the AGU Publications Committee. Also, CASE chair nominated Dr. John C. Willett for the AGU Index Committee.
6. CASE has continued its participation in the Newsletter on Atmospheric Electricity published jointly by the AMS Committee on Atmospheric Electricity, CASE, and the International Commission on Atmospheric Electricity.

* COLORADO STATE UNIVERSITY (Fort Collins, Colorado, USA)

RADAR METEOROLOGY GROUP

Walt Petersen and Steve Rutledge have recently published two Journal of Climate studies describing TRMM satellite observations of lightning flash density and convective vertical structure in the tropics. The studies are titled "Regional Variability in Tropical Convection: Observations from TRMM" (J. Climate, 14, 3566-3586) and "TRMM Observations of Intraseasonal Variability in Convective Regimes Over the Amazon" (J. Climate, in press). The second study was conducted in collaboration with Richard Blakeslee (NASA-MSFC) and Stephen Nesbitt (U. of Utah).

The first study examines the seasonal variability of convective vertical structure (via the TRMM-PR) and lightning flash density (via TRMM-LIS) across the global tropics. The results suggest that regional seasonal mean differences in tropical convective vertical structure

are ubiquitous, and most pronounced above the freezing level. Not coincidentally, the variability in convective structure is consistently manifested in seasonal mean lightning flash densities, mixed phase region precipitation ice water contents and pixel-based mean rain rate statistics. On a more local scale, and following the results of recent observations collected during TRMM-LBA, the second J. Climate paper uses similar data and analysis techniques (TRMM-PR, TMI, LIS) augmented by Brazilian Lightning Detection Network (BLDN) data to investigate sub-monthly variability in convective regimes over the Amazon and sub-tropical S. America. These results suggest that variability in convective structure and lightning activity (especially obvious in time series of BLDN lightning data) are well correlated to variability in the direction of the low level zonal-wind over the Amazon. This is especially true for the southern Amazon, where despite similar area averaged mean daily rainfall, during periods of easterly (westerly) low level wind, convection exhibits a distinctly more continental (oceanic) structure, exhibiting more (less) robust mixed-phase ice processes and an associated increase (decrease) in lightning activity. Ultimately these variations are related to periodic intrusions of extra tropical frontal systems into the tropics and subtropics.

Lawrence Carey, Walt Petersen and Steve Rutledge have been examining spatial distributions of equivalent potential temperature (θ_e; a measure of tropospheric instability) and severe thunderstorm frequency, partitioned by the occurrence and polarity of CG lightning. The polarity partitions are defined for severe storms possessing either predominately negative or positive CG lightning (PNCG and PPCG respectively) over the mid-western U.S. This study is being conducted on a climatological scale using 10 years of NCEP Reanalysis data (2.5° x 2.5° grid) and NLDN lightning data. The analysis suggests that peaks in PPCG dominated severe thunderstorm frequency generally occur upstream (west and northwest) and along the gradient of θ_e ridges, e.g., along a dry-line or the polar front. Conversely, peaks in PNCG severe storms are located to the southeast of the PPCG maxima, occurring closer to θ_e ridge axes. These results, compiled over climatological temporal and spatial scales, suggest a relationship between near surface θ_e and lightning polarity that is broadly consistent with the conceptual model advanced by Smith et al. (2000), and based on case studies, to describe mesoscale to storm-scale transitions in CG lightning polarity as a function of θ_e.

Walt Petersen, Rob Cifelli and Dennis Boccippio (NASA-MSFC) recently spent five weeks (Sept. 4 – Oct. 6, 2001) in the Mexican warm-pool (10°N 95°W) as part of the EPIC2001 field campaign aboard the NOAA Research Vessel Ronald H. Brown studying the characteristics of convection in the eastern Pacific ITCZ. They were responsible for operating the C-band Doppler radar and collecting radiosonde observations. Post field campaign *impressions* of the convection and its electrification suggest that 1) convection over the near-coastal Mexican warm-pool is more intensely electrified than that observed over more isolated tropical oceanic regions; 2) the diurnal cycle of intense convection as observed by radar, and defined by height of the 30 dBZ reflectivity core, is well correlated to the diurnal cycle of lightning and boundary layer θ_e, all tending to peak in the early morning hours local time; 3) both the intensity (but not necessarily area coverage) of convection and frequency of lightning tend to be largest on the leading edge of westward moving tropical easterly waves, coincident with increases in boundary layer parcel buoyancy; and 4) as in other regions of the world, boundary layer θ_e appears to be well correlated to lightning flash count (using CG data from the GAI NLDN long range product).

Jesse Ryan, in collaboration with Wei-Kuo Tao (GSFC), is running the Goddard Cumulus Ensemble Model (GCE) on TRMM-LBA cases, including 26 January and 25 Febuary 1999. Charging parameterizations are being added to the GCE in an effort to quantify storm electrification.

DEPARTMENT OF ATMOSPHERIC SCIENCE

The M.S. research of Bard Zajac, under the advisement of Steve Rutledge, was published in the May 2001 issue of *Monthly Weather Review*. The article entitled, "Cloud-to-Ground Lightning Activity in the Contiguous United States from 1995–1999" documents the spatial, annual and summertime diurnal distributions. It also identifies relationships between storm morphology and lightning activity over the north-central U.S. and the Gulf coast using radar-lightning case studies.

Several new results are presented with most new results associated with the unique signals observed over the north-central U.S. by the National Lightning Detection Network (i.e., maximum in percentage of positive CG lightning and positive CG mean/median peak current). Results from Zajac and Rutledge (2001) show that intense, and possibly severe, storms are responsible for the unique signals—and not stratiform regions of mesoscale convective systems.

To quote: "positive lightning was produced primarily during summer in the hours around sunset by isolated storms and convective lines in various stages of mesoscale convective system (MCS) development. These convective events usually contained one or more storms that were characterized by predominantly positive lightning, high positive flash rate, and large positive peak currents."

The article can be downloaded in PDF format from:
http://www.cira.colostate.edu/ramm/visit/zajac_rutledge_2001_mwr.pdf

COOPERATIVE INSTITUTE FOR RESEARCH IN THE ATMOSPHERE (CIRA)

The Virtual Institute for Satellite Integration Training (VISIT) continues to provide National Weather Service forecasters, and other interested groups and individuals, with training on lightning and a variety of on-line lightning resources. The following PDF documents are conference papers to be presented at the 2002 AMS Annual Meeting. They describe the VISIT lightning training program and one of the training courses:

"Lightning Training from the Virtual Institute for Satellite Integration Training: 1999–2001"
http://www.cira.colostate.edu/ramm/visit/zajac_et_al_2002_iips.pdf

"Lightning Meteorology I: An Introductory Course on Forecasting with Lightning Data"
http://www.cira.colostate.edu/ramm/visit/zajac_weaver_2002_awips.pdf

The VISIT web site is located at: www.cira.colostate.edu/visit with on-line lightning resources found under Links/Tutorials. The point-of-contact for VISIT lightning training is Bard Zajac at: zajac@cira.colostate.edu .

* INTERNATIONAL COMMISSION ON ATMOSPHERIC ELECTRICITY

ICAE and IOC (International Ozone Commission) co-sponsored with IPCC a symposium on "Thunderstorm-Produced NOx and Implications for Tropospheric Ozone" at the 8th Scientific Assembly of IAMAS (www.IAMAS.org), in Austria last July. Jim dye from NCAR (dye@ucar.edu), Ken Pickering from University of Maryland (pickering@atmos.umd.edu) and Harmut Hoeller (Harmut.Hoeller@dlr.de)from DLR were the convenors of this meeting where 23 papers were gathered and presented and during which fruitful exchange occurred between experimentalists and modelists.

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

The Indian Institute of Tropical Meteorology (IITM) functions as a national centre for basic and applied research in monsoon meteorology of the tropics in general with special reference to monsoon meteorology of India and neighborhood. Its primary functions are to promote guide and conduct research in the field of meteorology in all its aspects. Since its inception, the Institute is engaged in several scientific research programmes of National and International in the area of Meteorology and Atmospheric research. Its goals are to enhance the knowledge of Atmospheric Science by identifying and conducting research programme on problems of National and International importance. Its challenging area of the research is the Monsoon Meteorology. Beside this it also contributes significantly to area of Climate Modeling, Hydro-meteorology, Atmospheric Chemistry etc. Atmospheric Electricity is one of these areas, in which the research work is in progress by conducting field programmes, SERC School etc. These programmes were organized to have interaction of scientists working in different areas of Atmospheric Sciences.

Thunderstorms is an important phenomenon to understand many issues related to Weather and Atmospheric Electricity, it is essential to study the climatology of thunderstorms. In our earlier study the authors have examine the relationship of wet-bulb temperature with thunderstorm activity over the land region. Also, the functioning of (wet-bulb temperature) T_w over the land region and SSTs over the oceanic region incorporates the effect of both i.e. land and sea surface temperature and moisture; and both of them are important for the thermodynamics of moist convection. With this intention the authors have carried out this study, in which they have examined the occurrence of thunderstorms over coastal belts of Indian Peninsula and over two island stations each in Arabian Sea and Bay of Bengal.

Thunderstorm Activity Over the Island Stations and along the East and West Coasts of India

S.S. Kandalgaonkar, M.I.R. Tinmaker, M.K. Kulkarni and Asha Nath

Monthly data of number of thunderstorm days and mean sea surface temperature (SST) for a period of 11 years, over the two island station, each in Bay of Bengal (PBL) and Arabian Sea (Minicoy) and for several stations along the east and west coasts of the Indian Peninsula have been used in the study. In the present study the authors compare the thunderstorm day activity with SST. This comparison has revealed that both the parameters show clear signals of their semi-annual variations which are in phase with each other. This confirms the intuitive feeling about the convection over the oceans. The central focus of this study was the issue of the sensitivity of the occurrence of the thunderstorms to SST variation. This information is an exceedingly important result towards documenting the response of tropical convection to modest changes in the surface thermodynamics over the oceans. Our analysis has shown that the occurrence of thunderstorms over the Bay of Bengal was nearly double than that over the Arabian Sea for every 1^oC change in SST. SST analysis has suggested that the higher activity of thunderstorm over Bay of Bengal may be attributed to the warmer (0.4 to 1.2^oC) temperature conditions. The other result of this analysis has shown that the peak warming of the SST in the two sea regions by the end of April and September-October months precede the onset of the southwest (June-September) and Northeast (October-November) monsoon seasons respectively by about 30-45 days.

*** LABORATOIRE D'AEROLOGIE, UNIVERSITE PAUL SABATIER (Toulouse, France)**

A special study is being conducted by Yann Seity (seiy@aero.obs-mip.fr), Serge Soula (sous@aero.obs-mip.fr), and Serge Chauzy (chas@aero.obs-mip.fr) on the occurrence of large proportion of positive CG lightning flashes during certain stages of strong thunderstorms. A tight correlation has been observed between this proportion (as established from the French Météorage detection system) and the rain yield per flash (deduced from radar measurements). The higher the positive CG proportion, the higher the rain volume per flash. Taking this property into account leads to a reasonable retrieval of the surface precipitation amount of a given thunderstorm event from its flash pattern. The introduction of the amount of radiation sources detected by SAFIR also improves this retrieval. A radar characterization of the events observed during the MAP field experiment shows that the large proportion of positive CG mostly derives from a particular dynamics including strong vertical updrafts.

The same approach of the correlation between rain amount and CG flash activity has been developed by Serge Soula in the framework of a collaboration between our group and the Cold and Arid Regions Environmental and Engineering Research Institute of Lanzhou (China). The results obtained are published in a paper to appear in Annales Geophysicae.

Sylvain Coquillat (coqs@aero.obs-mip.fr), Serge Soula, and Serge Chauzy continue their investigations on the part played by thundercloud precipitation in the electric charge transfer within the cloud and between cloud and ground. In particular, the relationship between size and net charge of raindrops is studied. The detailed observation of size and charge distribution during the transition polarity of the surface precipitation current is associated to the corresponding radar data. This study should lead to better estimate the origin of the rain charge within the cloud.

In collaboration with Henri Sauvageot (sauh@aero.obs-mip.fr), the characteristics of coastal thunderstorms has been studied, using the total lightning activity, and a set of meteorological data including radar and satellite detection, as well as atmospheric sounding data. Although the land/water contrast is weaker in coastal area than at distance from the littoral, flash intensities appear to be higher over water.

The CG activity of hail producing thunderstorms has also been observed. It regularly appears that the CG flash rate (as obtained from the detection networks operating during MAP) drastically decreases during the hail episode of the storm identified by polarimetric radar measurements. In these cases, the proportion of positive CG increases during the hail episode.

On the other hand, since 1999, Gilles Molinié (molg@aero.obs-mip.fr), Jean-Pierre Pinty (pinjp@aero.obs-mip.fr), and Franck Roux (rouf@aero.obs-mip.fr) have been developing an explicit parameterization to study electrical processes inside thunderstorms with the French mesoscale model Meso-NH for real case applications (http://www.aero.obs-mip.fr/mesonh/index2.html). The model can simulate a great variety of 3D atmospheric flows over complex terrains using the grid nesting technique. The code is vectorized and fully parallelized. The bulk microphysical scheme (particle size distribution described by a gamma law) for mixed phase cloud is used to prognose the electric charge attached to each of the five microphysical species. The electric charge on iced hydrometeors is generated only by the non-inductive charge separation mechanism. The electric charge exchanged during particle interactions is explicitly resolved over the whole spectrum of the hydrometeors using look-up tables. The electrical potential is computed with a FFT and Gauss elimination solver. Finally the growth of the electric field is relaxed by the generation of lightning flashes for which several schemes are under test. We have run the model by simulating idealized thunderstorms such as single cell storms without wind shear (Communication at the 4th International Workshop on Physics of Lightning, September 2001, Japan) with a possible estimation of NOx production by lightning flashes (Communication at the 8th Scientific Assembly of IAMAS, July 2001, Austria).

* LF*EM RESEARCH (Dunedin, New Zealand)

(17 Dunedin/Wtt Highway, PINE HILL 9001 Dunedin, NZ)

Richard L Dowden (dowden@physics.otago.ac.nz) reports on world-wide lightning location by VLF:

A lightning stroke can be located to within a few km in real time from the time of group arrival* (TOGA) of the VLF sferics received at 4 or more sites. The receiving sites can be a few thousand km apart so that about 20 sites distributed around the world would be sufficient for full global coverage. All sferic receivers need continuous connection to the internet to enable real time location. As a retired professor of physics, I am setting up a global network without direct funding. I already have lightning receivers in operation at the 6 following sites:

Dunedin	45.9 S	170.5 E
Perth	32.1 S	115.8 E
Brisbane	27.6 S	153.1 E
Darwin	12.4 S	130.9 E
Singapore	1.3 N	103.8 E
Osaka	34.8 N	135.5 E

At each site I provided and set up the lightning receiver with antenna (a simple vertical whip, about 2 m long) and a PC connected to the internet. The host at each site supplies the internet connection and in return gets free access to the lightning position (and other) data world wide. Only the hosts and their immediate colleagues get this free access, just as if they had bought access or software licenses. I have received invitations to set up my lightning receivers at (or near) the following sites:

Durban	29.9 S	31.0 E
Huancayo	12.1 S	75.2 W
Agra	27.2 N	78.0 E
Tucson	32.3 N	111.0 W
Budapest	47.5 N	19.1 E
Poker Flat	65.1 N	147.3 W
Tromsoe	69.6 N	19.2 E

I hope to set up these during the next (northern hemisphere) summer. These 13 sites are not well distributed. Sites in far east Canada, far east Brazil, and on islands in the main oceans would make this distribution more even and allow full global coverage even when one or two sites are out of action due to power outages and the like. If you would like to be a host and get free access to the data, send me an email to the above address.

* LIGHTNING RESEARCH GROUP – OSAKA UNIVERSITY (Osaka, Japan)

Lightning Research Group of Osaka University (hereinafter LRGOU) realized the operational broadband interferometer in two-dimension, and LRGOU operated the system during field campaigns in Darwin, Australia in 2000 and in Hokuriku, Japan in 2001. The broadband interferometer owns two main interesting capabilities. One is the capability to monitor the thunderstorm activity and its movement in a relatively wide range. This capability was confirmed during the Darwin campaign, in which LRGOU took the role of monitoring thunderstorm for Biomass Burning and Lightning Experiment (BIBLE). LRGOU could capture two beautiful thunderstorm activities by the broadband interferometer. The other

capability is to locate the VHF radiation sources with quite high time resolution, and the lightning discharge propagation with branching can be visualized. During the winter campaign this function was realized. These achievements have been reported as scientific papers on IEEE Transaction on Instrumentation and Measurement, Geophysical Research Letters, Journal of Atmospheric and Solar-Terrestrial Physics, and IEICE Transaction on Electronics.

LRGOU is concerned with Tropical Rainfall Measuring Mission (TRMM), which is the cooperation between NASA and NASDA, as one of principal investigators of Lightning Imaging Sensor (LIS). By analyzing LIS and Precipitation Radar, LRGOU discovered two interesting issues. One is the discrepancy of lighting activity over Indonesia during El Nino period and ordinary period. It is well known that during El Nino period there is less precipitation over western Indonesia than normal period. On the contrary the lightning activity during El-Nino period is more than during normal period. That means the less precipitation, the more lightning activity. The interpretation of this issue is not obtained yet. The other issue is the parameterization of thunderstorms from the aspects of the global observations. The first discovery was published as one of the articles of Geophysical Research Letters, and the second is now being prepared to submit to a scientific journal.

LRGOU analyzed the archived data captured during China filed campaign in 1997. LRGOU recognized two possible inverted charged distribution thunderstorms. "Inverted charge distribution" means the lower positive charge and upper negative charge distribution. LRGOU is preparing an article to a scientific journal.

LRGOU intends to conduct a filed campaign for winter thunderstorms from December 2001 through January 2002. One of the objectives is improvement of the broadband interferometer through observations.

Additionally Japan Meteorological Agency (hereinafter JMA) has equipped and been operating a national wide SAFIR network. LRGOU contributed to evaluate the system performance by the comparison SAFIR data with TRMM/LIS data. JMA SAFIR apparently is working well.

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

Work continues with Sharon Stanfill and Mark Weber on the FAA-supported Oceanic Convective Weather project. Collaboration with Erich Stocker at NASA GSFC has enabled the construction and implementation of filters for the TRMM PR and VIRS 3-year satellite archive for appropriate meteorological entities. These include all locations where 30 and 40 dBZ reflectivity thresholds are exceeded at 7 km altitude, the locations of all isolated warm precipitating clouds, and the locations of all mesoscale convective systems. Monthly global maps are now available for all three entities for the three year period 1997-2000. The 40 dBZ locations are almost exclusively continental, whereas 30 dBZ locations predominate both over land and in the oceanic ITCZ. Warm precipitating clouds are primarily an oceanic phenomena, but leave unanswered the underlying explanation: a land-ocean contrast in updraft strength or in the concentration of cloud condensation nuclei. The MCS locations are to be compared with mesoscale lightning locations by Schumann resonance methods from Rhode Island.

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

A new antenna for the measurement of the vertical electric field has been constructed in the woods in Rhode Island, following small scale deforestation by Vadim Mushtak. Consisting of five large ceramic insulator columns donated by the Boston Edison Company, this 7 meter stack will ultimately replace the 10 m antenna mast installed by Charles Polk in the late 1960's and still currently used. Mike Stewart of Thunderstorm Technology designed and constructed the analog electronics. The pie-in-the-sky goal is the implementation of DSP to achieve wide band reception from the Schumann resonance region into the slow tail region at ELF, and beyond the waveguide cutoff to the sferics region at VLF. The DSP is being implemented by graduate student David Lowenfels.

The physical origin of the huge land-ocean lightning contrast has been examined by focussing on island electrification. Islands are miniature continents with a range of areas from <1 km^2 to 10^6 km^2. Predictions for critical island area for substantial thermal perturbation and for aerosol perturbation differ by an order of magnitude. Work is underway by graduate student Twiggy Chan with the Lightning Imaging Sensor data from the NASA TRMM (Tropical Rainfall Measuring Mission) satellite to test these predictions. Preliminary results with thunderday data from about 50 islands (WMO, 1956) suggests a transitional behavior between ocean and continent at an island area of a few hundred square kilometers. This result is more consistent with the thermal hypothesis than the aerosol hypothesis.

The radar/aerosol/lightning study in Brazil concerned with contrasting electrification in different meteorological regimes has been accepted for publication in the LBA Special Issue of the Journal of Geophysical Research. Major improvements in the paper were made possible by regime comparisons of the lightning stroke yield per kilogram of rainfall, made possible by Dave Wolff's TOGA radar analysis at GSFC and Rich Blakeslee's analysis at MSFC with the Brazil lightning detection network.

Earle Williams has completed a review article on sprites for Physics Today to appear in the November issue. Sprite imagery that Physics Today editors chose to include was contributed by Matt Heavner, Walt Lyons, Dana Moudry, Dave Sentman, Mark Stanley, Mike Taylor, and Gene Wescott. Robert Golka provided considerable assistance with the work on glow discharge tubes.

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

(www.lightningsafety.com)

1. On Oct. 4 the Standards Council of the National Fire Protection Assn. (NFPA) voted to retain NFPA-780 (the de factor lightning protection standard in the USA) at a meeting in Santa Fe NM NLSI, the DOE, the US military services, university researchers and Franklin commercial interests unified to advocate retention of 780 despite heavy opposition from Early Streamer Emission air terminal proponents. The version 2000 of NFPA-780 is to be released soon.
2. The ICOLSE meeting was about 40% under-attended due to the World Trade Center crisis. NLSI papers were on Safety for Small Shelters (with Vlad Rakov) and on NFPA-780. Both papers are on the NLSI WWW site at: www.lightningsafety.com
3. Recent NLSI consulting has focused on lightning hazard mitigation for explosives storage facilities. Site recommendations were completed at:
    - 3.1 Hanscomb Air Force Base, MA Police HE Storage facility.
    - 3.2 Hawthorne Army Depot, NV, HE storage facilities.
    - 3.3 Los Alamos Natl Labs, NM, HE storage facilities.

4. NLSI has been appointed to the task force to revise Underwriters Laboratories UL-96, “Standard for Safety, Lightning Protection Components.”
5. The City of Boulder CO recently completed a comprehensive review of athletic fields and swimming pools for lightning safety. Policies and site signage were developed under NLSI guidance.
6. The NLSI High Altitude Lightning Observation Station (HALOS) five year air terminal experiment was re-designed. Initially steel Franklin rods were installed but their high melting temperature made recognition of arcing and pitting difficult. Aluminum rods are now installed with thanks for continuing suggestions and help from Charles Moore, New Mexico Tech. The NLSI WWW site has photos of this modification and other details.

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

Don MacGorman and Dave Rust have continued analyses of data from STEPS. Recently they finished initial documentation of possible inverted-polarity electrical structures in STEPS thunderstorms. Evidence that such structures may exist were found in electric field profiles from seven storms. This was initially reported at the AGU annual fall meeting in December 2000 and is the subject of a paper that Rust and MacGorman recently submitted to Geophysical Research Letters. Other on-going analyses include collaborative studies with several STEPS investigators.

On July 3, 2001, fire destroyed the leased building known as the "Balloon Barn," used by the NSSL Field Observing Facilities and Support Group led by Dave Rust. The fire also destroyed all the equipment inside, valued at $2 million and owned by the National Severe Storms Laboratory, the University of Oklahoma, Texas A&M University, and Texas Tech University. The equipment included vehicles, mobile ballooning facilities, electric field meters for in situ balloon flights, and the components of a lightning mapping array which was to have been installed a few weeks later. Just seven weeks after the fire, NSSL's parent organizations, the Office of Oceanic and Atmospheric Research and the National Oceanic and Atmospheric Administration, provided nearly $1.2 million to replace what was lost by NSSL. The University of Oklahoma will replace its equipment by a combination of funds from insurance, the State of Oklahoma, and the University. All affected organizations are committed to a full replacement of facilities and capabilities. Details about the fire and recovery efforts are available at:
http://www.nssl.noaa.gov/headlines/fire.html.

* NCAR MESOSCALE AND MICROSCALE METEOROLOGY DIVISION (Boulder, Colorado, USA)

Airborne Field Mill Project

James Dye, Eric Defer (USRA), and Wiebke Deierling, a student from the Univ. of Hannover, Germany, have been involved in the Airborne Field Mill (ABFM) project which took place over Kennedy Space Center Florida during June 2000, Feb. 2001, and June 2001. The purpose of the campaigns were to obtain simultaneous in-situ airborne measurements of the electric fields and microphysical content in anvils and thick clouds near Kennedy Space Center using the Univ. of North Dakota Citation jet aircraft. The aircraft was instrumented with 6 field mills designed and built by Nasa Marshall Space Flight Center (MSFC) and an extensive array of microphysical probes to sample from a few microns to several millimeter sized

particles including the new SPEC Cloud Particle Imager and the High Volume Sample Probe. The aircraft measurements were made in coordination with radar measurements from the Patrick Air Force Base 74-C radar and the Melborne NEXRAD radar. Measurements from the KSC LDAR and Cloud-to-Ground Lightning Sensing System, and surface electric field mill network provide information on lightning and surface electric fields. In particular, we want to determine decay rates of electric fields after lightning has occurred in the parent storm within the anvils over KSC. We also want to compare these decay rates with theoretically predicted decay rates. Although there was interest in seeing under what circumstances thick clouds (stratiform-type clouds deeper than 4500 feet thick residing between the 0 and –20 C levels) are electrified, there were too few cases during the February campaign to examine this question. This is a joint effort between NCAR, NASA MSFC, the Univ. of North Dakota, Univ. of Arizona, NOAA ETL, NOAA Hurricane Research Division and Kennedy Space Center.

Penetrations in a given storm initially were flown near to, but at a safe distance from, the convective cores of storms. Then subsequent passes were made in the anvil at different distances downstream to examine the decay of the electric field both with time and distance. As there currently is relatively limited information available on the vertical distribution of electric fields combined with microphysics, spiral ascents and descents were made when Air Traffic Control was able to give clearance.

Analysis of this data set is currently underway. Early results suggest that when the reflectivities in the anvils get low, approximately below 10 to 15 dBZ, the electric fields have decayed to a few kV/m or less. This and other comparisons with vertical reflectivity structure suggest that much of the charge in the anvils may be carried by precipitation-sized particles which can sediment out of the anvil, but this hypothesis needs much more testing. Early results also suggest that a radar based rule might be useful for indicating when there is little hazard from natural or triggered lightning in anvils.

STERAO Lightning Analysis

Eric and Wiebke have also been examining both the 3D and 2D real-time ONERA lightning interferometer measurements collected during the STERAO experiment from NE Colorado in 1996. They are examining the structure of single flashes as well as flash characteristics over the entire lifetime of thunderstorms. The 3D system has 23 microsec time resolution and can store up to 4000 VHF sources per sec, while the 2D system has 100 microsec resolution and can store only 100 sources per sec. A comparison of the two systems shows that the flash detection efficiency of the 2D system is considerably lower than that from the 3D system. Averaged over the 5 hour lifetime of the 10 July 1996 STERAO storm, the 2D system detected about 55% of those detected with the 3D system by a detailed flash by flash analysis. The analysis also showed that determinations of flash duration from the 2D system were highly unreliable and that most flashes < 1 millisec duration as sensed by the 3D system are missed by the 2D system.

* NOAA/AOML/HRD R/E/AO1

Robert Black (Robert.A.Black@noaa.gov) reports :

This season, a fifth field mill was added to the NOAA WP-3D aircraft. This aircraft obtained our first 3-D electric field measurements in 3 Atlantic hurricanes and several cumuli off the SW coast of Florida during flights made in support of the CAMEX-IV experiment. Analysis of these data have not yet begun.

* OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES Atmospheric Environment Research Group (Paris, France)

www.onera.fr

The Atmospheric Environment Research Unit at ONERA (Pierre.Laroche@onera.fr) continues the development of the modeling of the sweeping of a lightning channel on an aircraft fuselage. Alain Delannoy (Alain.Delannoy@onera.fr) and Philippe Lalande (Philippe.Lalande@onera.fr) in collaboration with Anders Larson (andlar@eagle.foi.se, now at F.O.I in Sweden) set up a physical model of this phenomenon which is presently under evaluation on a airliner numerical meshing.
The work on FORTE results, with the help of Abe Jacobson's group at Los Alamos, was used to specify the ORAGES microsatellite project mission which might be decided by the French Space Agency in 2002. ORAGES is a low orbiting mission project dedicated to the detection and localization of VHF emission from lightning. A preliminary prototype of ORAGES payload was tested this fall on a balloon at the CNES'stratospheric balloon facility in South West of France.
ONERA has followed on the collaboration with INRS and Hydro-Quebec from Canada on triggering and guiding long arcs with a plasma channel created by an ultrashort laser pulse (H. Pepin et al, Physics of Plasmas, Vol.8 N°5, May 2001). The Canadian group led by Henri Pépin and Hubert Mercure has demonstrated that the plasma channel created by focusing the laser beam close to a positive electrode in a large air gap (3 to 7 m) can lower the inception voltage by 50% and increase the leader velocity by a factor of 10. A. Bondiou-Clergerie (Anne.Bondiou-Clergerie@onera.fr) and Philippe Lalande have obtained very encouraging results in modeling this effect, with the help of PhD. student Daniel Comtois, and François Vidal, in charge of theoretical aspects at INRS, who has brought new insights in the physics of the leader head.

* POLISH ACADEMY OF SCIENCES (Warsaw, Poland)

The atmospheric electricity research group at the Institute of Geophysics reports:
The thundercloud dynamic structure and its space and time evolution depicted on the radar pictures, and simultaneous monitoring of the thunderstorm electrical activity by using the field mill and the Maxwell current density measurements at the earth's surface are examined for the cases of thunderstorm days in Warsaw (P. Baranski; baranski@igf.edu.pl). It is observed that distinct differences between spring and summer conditions for thundercloud development result in generation of different types of lightning discharge clusters. To obtain more information about lightning discharge characteristics, a flat plate antenna with the charge integrator and the 40 ns sampling A/D PC card with external triggering and 64 MB memory buffer on its board was used for recording the electric field changes of the observed lightning. The collected signatures for close ground flashes (less than 50 km distance from our measuring point) have shown an unusual behavior for some return stroke intervals. To explain those anomalies, extended investigations are planned with the use of data of the SAFIR detection and location network that is now installed in Poland.
The atmospheric electricity recordings are continued to be carried out on the background of meteorological, aerosol, radioactive and chemical pollution, and space charge density (the Obolensky method) observations at Swider Geophysical Observatory (M. Kubicki; swider@igf.edu.pl). The results are being published and exchanged (M. Kubicki). The

airborne radioactivity and electrical properties of ground level air are also studied (B. Laurikainen and M. Kubicki).
At the polar station at Hornsund, Spitsbergen, the electric field and vertical air-earth current recordings accompanied by the meteorological observations and geomagnetic, riometer and other geophysical measurements are continued (M. Kubicki and S. Michnowski).
New designs of electric field, air-earth and space charge density sensors are being developed (J. Berlinski, J. Drzewiecki, M. Kubicki).
The local effects at Hornsund and Swider on the electric field and air-earth current variations are analyzed (M. Kubicki, S. Warzecha). The influences of solar wind on the electrical variation at the ground during magnetic substorms in Hornsund are being examined (S. Michnowski, N. Kleimenova, S. Israelsson, N. Nikiforova, and M. Kubicki).

* SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, INSTITUTE OF ATMOSPHERIC SCIENCES (Rapid City, South Dakota, USA)

Andrew.Detwiler@sdsmt.edu or John.Helsdon@sdsmt.edu

The T-28 armored aircraft group at SDSMT continues to analyze data from the Severe Thunderstorm Electrification and Precipitation Study (STEPS). This effort includes Qixu Mo, Donna Kliche, Tom Warner, and Andy Detwiler. We are focusing so far on storms from two days during STEPS, 11 June and 29 June, and are working with other STEPS groups to analyze observations not only from the aircraft, but from the radars, lightning mapping array, balloon soundings, mobile mesonet, and other STEPS field observing systems. In addition, we are working with our colleagues John Helsdon and Dick Farley to compare observations with model simulations of these storms. We hope to develop analyses of several more interesting cases, as we look at the evolution of precipitation, electric charge distribution, and lightning in High Plains storms.
Graduate student Inna Sus, working with John Helsdon, has completed her Master's Thesis involving the development of a non-grid-point-dependent lightning parameterization scheme for the Institute of Atmospheric Sciences two- and three-dimensional storm electrification models (SEMs). The parameterization creates 50 m channel segments using random free electrons at the tip of each developing segment to determine the direction of each new segment. The scheme uses the electric field from the previous two segments to determine which of an altitude-dependent number of cosmic-ray-generated free electrons can create an avalanche within a minimum time. This electron is selected to determine the direction of the next segment. If two electrons meet the minimum time criterion, a branch segment is also created. Within the main charge regions, the gradient of the charge density is used to determine the next segment and/or branch direction. The parameterization creates realistic branched lightning channels without the restriction that they must propagate between model grid points.
Ph. D. candidate Xingjun Zhang, working with John Helsdon, is completing his dissertation research involving the use of the 3D SEM with a nine component and 18 reaction chemistry module along with the lightning parameterization of Helsdon et al. (1992) to simulate the NO_x production by lightning and its subsequent distribution within the model cloud. The dissertation work has included 2D and 3D test calculations based on the 19 July 1981 CCOPE storm. The final part of the research work involves a simulation of the 10 July multiple cell case from the STERAO project. In the final simulation, three cells develop initially – all electrically active. During the three hours of simulated time, two of the cells die out and the third takes on a supercell character. Overall, 1003 lightning discharges are generated and the

resulting NO_x distribution and its affect on O_3 are being analyzed. The dissertation should be complete in December.

* STANFORD UNIVERSITY: STARLAB (Stanford, California, USA)

The VLF Group at STAR Laboratory of Stanford University is actively involved in experimental and theoretical work targeted at understanding the strong upward electrodynamic coupling of tropospheric thunderstorms to the mesospheric and lower ionospheric regions and associated optical and electromagnetic effects.
This past summer the VLF group, in conjunction with Torsten Neubert and Thomas Allin of the Danish Meteorological Institute, participated in an experiment to detect optical emissions from sprites in regions conjugate to their source locations. Rick Rairden of Lockheed Corporation was situated in France to provide telescopic imagery and sprite locations while Geoff Baimbridge of Stanford took photometer measurements of the night sky in South Africa. Unfortunately, due to weather limitations, no one to one correlations were made between sprites and conjugate flashes.
Elizabeth Gerken conducted telescopic (.72 x .90 degree field of view) optical measurements of heater-induced airglow created by the HAARP HF antenna array in Gakona, AK. Observing either the absence or presence of structure in the airglow would give additional insight into the atmospheric makeup of these heated regions. One might expect fine structure due to ambient electron density variations or small variations in the main lobe of the radiation pattern. In the past year two campaigns were conducted at HAARP, one in October 2000 and the other in March 2001. During the October campaign, the experiment was conducted on three nights and initial studies of the data do not show detectable airglow emissions. During the March campaign, artificial airglow at 630 nm was observed on two nights. On both nights airglow patches were produced above HAARP during O-mode pulses at the foF2 critical frequency.
Robert Moore and Geoff Baimbridge installed two new VLF receivers in Colorado in July to supplement the existing Holographic Array for Ionospheric Lightning research (HAIL). The new receivers will increase the accuracy at which the scattering pattern for early fast and lightning induced electron precipitation events can be resolved.
In August of 2001, Troy Wood of Stanford, in conjunction with Victor Pasko of Penn State University, acquired both broadband (100 Hz – 25 kHz) and narrowband (NAU and NAA VLF transmitters) horizontal magnetic field measurements using two orthogonal loops antennas located in Vieques, Puerto Rico. The experiment obtained unique correlated measurements between the Arecibo Observatory's UHF and co-axial VHF radars, a VHF radio interferometer and the VLF broadband and narrowband data in order to study the atmosphere/ionosphere at unprecedented resolution.

* STATE UNIVERSITY OF NEW YORK AT ALBANY – SUNYA (Albany, New York, USA)

Hurricane studies: we are using lightning locations from the National Lightning Detection Network to gain insight into the thermodynamics and dynamics of hurricanes. Our interest is not in electrification as such, but in the uses of remotely-sensed lightning as an indicator of convective activity. The NLDN has the huge benefit of being continuous in space and time, as long as the hurricanes of interest are over land or within about 400 km of the United States coast over water.

The question we address in our most recently submitted work is what factors determine the azimuthal distribution of convection in tropical cyclones. Convection is measured by ground flash density from the NLDN. All storms within range of the NLDN between 1985 and 1999 were included in the study. We have shown (Corbosiero and Molinari, "The Effects of Vertical Wind Shear on the Distribution of Convection in Tropical Cyclones", *Monthly Weather Review*, submitted) that vertical wind shear is the dominant influence. A downshear left maximum occurs within 100 km of the center of tropical cyclones (i.e., if vertical wind shear is from the west, maximum convection is in the northeast quadrant of the storm). A downshear right maximum occurs in the outer band region (r = 100-300 km). The latter appears to represent the "stationary band complex" of Willoughby et al. (1984).
The downshear maximum was a robust signature: more than 90% of ground flashes occurred downshear in the storm core when vertical wind shear exceeded 5 m s^{-1}. The results were equally valid over water and over land, and for depression, storm, and hurricane stages of the tropical cyclones.
Outgoing longwave radiation is a poor measure of convective intensity. Ground-based or airborne radar is only infrequently in range of hurricanes, and space-based radar (such as from TRMM) exists on polar orbiting satellites that only sporadically observe the tropical cyclone. We believe that lightning data provide a unique and beneficial perspective for this type of work.

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

NASA had delayed the launch of the space shuttle Columbia mission STS107 to late June 2002. Hence, the MEIDEX-Sprite campaign that will be conducted during the flight was pushed back to summer 2002. The campaign, managed by Yoav Yair, Zev Levin and Colin Price, involves observations of TLEs from space together with simultaneous global measurements of ELF/VLF waves from the parent lightning. This international cooperation now includes coordinated ground measurements from stations in Japan, Taiwan, Germany, USA and Israel. The primary science instrument is a Xybion IMC-201 multispectral camera with 6 filters. Data will be recorded digitally on board and as backup on the ground. Additional wide-field coverage by a color camera will be transmitted in real-time. The latest mission time-line allocates 10 shuttle orbits for dedicated sprite observations, with a total time of 250 minutes. Additional observations are being considered, as well as coordinated limb observations with the SOLSE instrument, also on-bord this flight. The MEIDEX payload is being integrated into the shuttle, after completing calibrations at NASA's Laboratory for Atmospheres at GSFC, and will be shipped to the cape in February 2002. The TAU group is developing operational forecast techniques to evaluate the regions of high convective activity, where major thunderstorms occur that will be conducive to sprite occurrence (http://luna.tau.ac.il/~tomer/MEIDEX/home.htm).
During the academic year 2001/2002 Colin Price is spending a sabbatical at the Meteorological Services of Canada in Toronto, Canada. He is working with Bill Burrows and Pat King using lightning data to improve the short-term forecasts of severe weather in Canada. They are using the Canadian Lightning Detection Network (CLDN), in operation since 1998, to investigate a number of case studies involving summer and winter lightning and severe weather. The lightning data will be compared to both satellite cloud data and ground-based radar to investigate the relationships between lightning activity and predictable model parameters.

Colin Price and student Mustafa Asfur continue studying the use of the Schumann Resonances for studying the earth's climate. We have found a striking agreement betweeen lightning activity over Africa and South America and the amount of upper tropospheric water vapor in these regions.

* UNIVERSITY OF MISSISSIPPI (University, Mississippi, USA)

Physics Ph.D. candidate Lee Coleman, under the direction of Tom Marshall, continues the analyses of balloon sounding, radar, and lightning data from SEET (Study of Electrical Evolution in Thunderstorms), a field project at Langmuir Lab in 1999. These analyses are being done in collaboration with Maribeth Stolzenburg and numerous colleagues at New Mexico Tech, including Paul Krehbiel, Bill Winn, Ron Thomas, and Bill Rison.

* UNIVERSITY OF FLORIDA (Gainesville, Florida, USA)

A total of 23 lightning flashes were initiated from July 13 to September 5, 2001, at the International Center for Lightning Research and Testing (ICLRT) at Camp Blanding, Florida. Of these 23, 11 contained downward leader/upward return stroke sequences, and 12 were composed of the initial stage only. All triggered flashes effectively transported negative charge to ground. Fourteen flashes were triggered using an underground rocket-launching facility surrounded by a 70 x 70 m^2 buried metallic grid, and nine flashes were triggered using the tower rocket launcher.

Rafael Sutil defended his Masters thesis titled "EMTP modeling of direct lightning strikes to the lightning protective system of a residential building". His current E-mail address is sutilrr@bv.com.

Megumu Miki (Central Research Institute of Electric Power Industry, Tokyo, Japan), Vladimir A. Rakov, Keith J. Rambo, George H. Schnetzer, and Martin A. Uman authored a paper, submitted to JGR, titled "Electric Fields Near Triggered Lightning Channels Measured with Pockels Sensors". The electric fields in the immediate vicinity of triggered lightning channel were measured with Pockels sensors at the ICLRT. Electric field waveforms produced by leader/return stroke sequences at horizontal distances from the channel attachment point ranging from 0.1 to 1.6 m were obtained. Vertical electric field pulse peaks are in the range from 176 kV/m to 1.5 MV/m (the median is 577 kV/m), and horizontal electric field pulse peaks are in the range from 495 kV/m to 1.2 MV/m (the median is 821 kV/m). Additionally, vertical electric fields due to M components were measured and compared to electric fields produced by leader/return stroke sequences. The vertical electric field measured very close to the lightning channel tends to increase with an increase in the previous no-current interval, that is, in the time elapsed from the cessation of current of the preceding stroke (or of the initial-stage current).

Vladimir A. Rakov authored a paper titled "Transient Response of a Tall Object to Lightning". Experimental data showing the transient behavior of tall objects struck by lightning are reviewed. The influence of this transient behavior, illustrated by simple calculations, on measured lightning current and measured remote electromagnetic fields is discussed. The similarity of the statistical distributions of subsequent-return-stroke peak currents in (1) natural downward lightning, (2) natural upward (object-initiated) lightning, and (3) rocket-triggered lightning measured at objects with heights ranging from 4.5 to 540 m suggests that current peaks are not significantly influenced by the presence of a tall object, provided that measurements are taken at the top of the object. The peak current measured at

the bottom of a tall object is usually more strongly influenced by the transient process in the object than the peak current at the top. Observations and modeling suggest that a tall metallic strike object replacing the lower part of lightning channel serves to enhance the lightning-radiated electromagnetic fields relative to the fields due to similar lightning discharges attached directly to ground, this effect being more pronounced for the sharper lightning current pulses. The paper is accepted for publication in the IEEE Trans. on Electromagnetic Compatibility.

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Work on fair weather electrification continues in the Department of Meteorology, at the University of Reading, UK. This has included new instrumentation for ion and aerosol charge measurements, both at the surface and aloft using balloons. Another important aspect has been the European CLOUD project assessing effects of cosmic ray ionisation on climate.

Giles Harrison contributed to the Workshop on Ion-Aerosol-Cloud Interactions (http://cloud.web.cern.ch/cloud/iaci_workshop/index.html) at CERN, discussing atmospheric electrical effects on cloud microphysics. The theoretical work of Fangqun Yu and Rich Turco (*e.g. J.Geophys Res*, **106**, D5, pp4797-4814, 2001) on ultrafine aerosol formation from atmospheric ions opens new areas of application of fair weather atmospheric electricity. Linking non-thunderstorm atmospheric electricity with climate and cloud problems is of particular interest. This has motivated preliminary observations of free tropospheric aerosol and ion charges, undertaken on balloons carrying a modified radiosonde telemetry system. Using a new charge sensor making measurements at high vertical resolution, charged layers of aerosol can be detected under fair weather conditions.

Karen Aplin has published work on her new instrumentation for surface ion measurements, using the programmable ion mobility spectrometer. The combination of its two classical operating modes (voltage decay and ion current measurement) in one instrument allows self-calibration. A stable non-resistive 500fA current reference has also been developed for additional field calibration. The programmable ion mobility spectrometer (PIMS) will be deployed for further surface measurements of aerosols, charge and ionisation, but an airborne device is being planned to compliment the other radiosonde electrical measurements.

Related recent publications are listed in the publication section of this issue, and others are listed at http://www.met.rdg.ac.uk/~swshargi/.

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