

ABSTRACTS of SESSION 2

Paper n°59

Lightning observation and field experiment with SAFIR system during Summer 2003 in Beijing-Hebei Area

Abstract: SAFIR network obtained data of three-Dimension temporal and spatial characteristics of VHF radiation events produced by lightning discharge in thunderstorm during summer 2003 in Beijing-Hebei areas. The relationship between the characteristics of lightning and thunderstorm are studied by analysis the observation data and comparison with radar echo data.

Keywords: Thunderstorm Lightning SAFIR

Paper n°63

Analysis of lightning electric field changes produced by Catalonia (Spain) thunderstorms

Abstract: One of the lightning parameters useful for engineering is the total electric charge related to the entire flash. This paper presents estimations of the total charge deposited by lightning as a result of the analysis of the electric field changes due to lightning. The measurements have been made by a field mill and a slow-antenna over the Catalonian region (NE of Spain) during the summer of 2003.

Keywords: Lightning, electrostatic field; electric field changes, electric charge, field mill and slow-antenna.

Paper n°77

Lightning Parameters Evaluation in the Colombian Highest Atmospheric Activity Zone

Abstract: This paper presents an evaluation of the lightning parameters characteristic of Nechí which is the place with the highest atmospheric activity in the Colombian territory. Such place presents a very special characteristic of its lightning parameters (GFD, polarity, multiplicity, etc).

Atmospheric activity of this place agrees with the NASA's Lightning Imaging Sensor (LIS) which data evaluation shows the same place in Colombia with the highest activity.

Lightning parameters have been studied for a long time especially in European countries and the United States of America, tropical countries like Colombia start to study this phenomena just two or three decades ago.

The research group PAAS-UN has been studying lightning phenomena for almost 20 years; during last 8 years PAAS-UN has analyzed the Colombian LLS data and with its lightning direct measurement experimental station called Ilyapa a characterization of the lightning activity has been done successfully showing places like Nechi with a very particular atmospheric activity characteristics that deserves an especial analysis.

Keywords: Lightning parameters, LLS, Tropical zone, Lightning activity.

Paper n°89

A wavelet approach for detection and classification of lightning electromagnetic field data

Abstract: The paper presents a method for detection and classification of electromagnetic field data, radiated by a lightning channel. The method utilizes the discrete wavelet transform and

is capable of recognizing noisy lightning waveforms due to various lightning events, including the first and subsequent Cloud-to-Ground (CG) lightning strokes and Cloud-to-Cloud (CC) lightning strokes. Results associated with measured CG and CC lightning data are presented to demonstrate the suitability of the method.

Keywords: Wavelet transform, lightning, electromagnetic field, detection and classification

Paper n°91

Comparison of data from a lightning location system and atmospheric parameters from a numerical weather prediction model

Abstract: This study presents a comparison between the occurrence of thunderstorms in Iceland as identified by lightning location systems and the properties of the atmosphere as analysed and predicted by a short range numerical meteorological forecast model. The purpose of the comparison is to identify thunderstorm prediction indices, suitable for Iceland. The French numerical meteorological forecast model, Arpège, was used for this study. On the basis of output from the Arpège, the key atmospheric variables were defined in a grid. The lightning locations of the ATD sferics system of the UK Met Office and the LLP-based lightning location system of the Icelandic Meteorological Office, were used for this study. Several thunderstorm indices based on the temperature and humidity profile of the atmospheric column of each element of the forecast model were calculated. The indices that best predicted occurrences of lightnings in a particular element were then used in a statistical similarity model that estimates thunderstorm probabilities. These were adjusted for annual variations and diurnal variations in the summer. The results enable the construction of probabilistic local thunderstorm forecasts for Iceland, based on output from an operational numerical weather prediction model.

Keywords: Thunderstorm prediction, Numerical weather prediction model, Thunderstorm index, ATD sferics, Iceland

Paper n°112

On the use of thunderstorm warning in active lightning protection

Abstract: A Short Abstract (typically 50 words and no more than one hundred words) should appear at first and precede the full text. The Short Abstract should clearly outline the objective, methodology and results of the contribution in order to provide a clear and useful summary for the reader.

Paper n°116

A new lightning detection network in Southern Germany

Abstract: We present results on the performance of a new lightning detection network with high spatial resolution and unprecedented total detection efficiency, operating in Southern Germany since May 1, 2003. Six sensor stations are placed mostly at locations provided by the German Weather Service with an average baseline of about 115 km and coverage of an area of more than 400 x 300 km. Principal aim of the network is the investigation of improved early thunderstorm detection and now-casting. Our experience with a smaller research system encouraged us to pursue the present update solution which combines both high quality lightning location and economic layout. The new network reports discharges in the VLF regime, exhibits very high efficiency for low amplitudes, and accepts cloud-to-ground (CG) and intra-cloud (IC) discharges. Discrimination is achieved by a new 3D-technique presently under examination. Results are compared with data from BLIDSALDIS, the interconnected network of the German and Austrian LLS and a subnet of Euclid, the European Cooperation

for Lightning Detection. While there is good agreement among high-amplitude events we find a wealth of additional low-amplitude discharges which allow excellent recognition of thunderstorm cells. The number of low-amplitude CG strokes is probably larger than hitherto assumed and might be considered in lightning protection. Amplitudes, distance law, inter-stroke time intervals and other characteristics are analysed.

Keywords: lightning detection, mapping techniques, thunderstorm-alert, now-casting.

Paper n°129

The estimation of cloud-to-ground Lightning discharges from satellite optical transient detector data

Abstract: The estimation of lightning discharge density's average value (N) distribution was done on Tomsk region's territory based on the results of satellite surveillance of lightning. The correction methods, worked out on the basis of comparison of satellite and ground observations of lightning discharge on the flat parts of South Germany's territory were used for this. The results of comparison with the maps of thunderstorm activity, constructed by other methods are given.

Keywords: thunderstorm days, number of lightning discharges to the ground.

Paper n°181

VHF Broadband Interferometer for Lightning Monitoring System

Abstract: Chubu Electric Power Company (CEPCO) and the Lightning Research Group of Osaka University (LRGOU) have been conducting a cooperative thunderstorm observation project during the last few summers. The main objective of the project is to realize use of an operational VHF broadband interferometer as a lightning monitoring system. The VHF broadband interferometer has been proposed independently and simultaneously by a group from New Mexico Tech(1) and LRGOU(2)(3). LRGOU has been working on developing the system, and has created an experimental VHF broadband interferometer. Following this, CEPCO and LRGOU have designed a special A/D converter and broadband VHF antenna for interferometers. They carried out field operations during summer thunderstorm seasons, and captured a lot of data. The locating of 3D VHF radiation sources has been accomplished. They conclude that the system is functioning well, and the VHF broadband interferometer for lightning monitoring is achieved with high accuracy from the aspects of time and space.

Keywords: Broadband interferometer, Lightning discharge, VHF radiation, Three-dimensional imaging

Paper n°202

Seasonal and Interannual Variability of Thunderstorms in Iceland and the Origin of Air masses in the Storms

Abstract: Variability and the meteorological conditions of thunder in Iceland are explored. Most thunderstorms occur in winter, where arctic air moves rapidly from N-America over a relatively warm sea towards Iceland. A secondary maximum in the thunderstorm frequency is in summer. The summertime thunderstorms are formed within an air mass that has been advected from Britain and/or continental Europe. These thunderstorms tend to be associated with a frontal or a convergence zone. There is substantial interannual variability in the frequency of thunderstorms at the south coast of Iceland, but there is not a sign of a long-term trend.

Keywords: Iceland, seasonal cycle of thunder, origin of air masses, variability of thunder.

Paper n°211*Determination of lightning currents from far electromagnetic fields: effect of a strike object*

Abstract: We discuss in this paper the influence of the presence of an elevated strike object on the peak of the lightning return stroke current determined from remote field measurements. We develop analytical expressions relating the lightning return stroke channel-base current and the far electromagnetic field for different specific cases, namely, (1) ground-initiated return strokes (classical TL model), (2) ground-initiated return strokes including possible reflections at ground level, (3) tall strike objects for which the current's zero-to-peak time is smaller than the travel time along the object, and (4) electrically-short strike objects. It is shown that, for tall structures, the field enhancement relative to a return stroke initiated at ground level is expressed through a factor equal to $k_{tall} = [1 + \frac{c}{v}(1 - 2\rho_t)] / (1 - \rho_t)$, where v and c are the return stroke front speed and the speed of light in vacuum, respectively, and ρ_t is the top reflection coefficient. For very short towers and/or very slow return stroke current wavefronts, when the condition $t_f \gg h/c$ applies, expressions relating the far electromagnetic field and the return stroke current were also derived. For the case (2), return strokes initiated at ground level, the field enhancement relative to a return stroke initiated at ground level, case (1), is expressed through a factor equal to $k_{short} = (1 + \frac{c}{v}\rho_{ch-g}) / (1 + \rho_{ch-g})$, where ρ_{ch-g} represents the reflection coefficient between the lightning channel and the grounding impedance.

Keywords: Lightning, strike object, tall towers, return stroke models, electromagnetic fields, return stroke current

Paper n°227*Comparative study of lightning data from Central European lightning detection network and SAFIR system in Poland*

Abstract: The lightning data in Poland are currently available from two independent lightning detection networks. There are: the Central European Lightning Detection Network (CELDN) created by Global Atmospheric Inc. in cooperation with BLIDS the operator of German lightning information system and ALDIS the operator the Austrian system, and SAFIR system operated by the Institute of Meteorology and Water Management in Warsaw. The CELDN have been continuously acquired lightning data over the territory of Poland since 1999, while the first full year of SAFIR operation was 2002.

In the paper some base characteristics of both systems detecting lightning over Poland as well as two years lightning statistical data are described. There are cloud-to ground lightning discharges and density maps, monthly trends of both polarity discharges and current distributions recorded in years 2002 and 2003 are presented.

Keywords: Lightning detection and location, CELDN, SAFIR, Poland.

Paper n°232*Statistics and dynamics of the lightning activity: a case study*

Abstract: The statistical and dynamical properties of the lightning activity over Belgium are investigated for time scales ranging from 5 minutes up to a few hours by means of tools developed in nonlinear dynamics. Two main regimes, for short and long time scales, are found whose properties are drastically different. The statistical analysis shows that they correspond to monofractal and multifractal processes, respectively. For the first regime a relatively sharp probability of the residence time around the active state and a low level of

activity is found, while for the second, a long tail in the residence time probability and a more intense lightning activity is apparent. Based on this, a probabilistic model linking the number of cloud-to-ground flashes and the duration of the activity is built.

Keywords: lightning activity, SAFIR data, nonlinear dynamics

Paper n°253

On quantifying the exposure to cloud-to-ground lightning

Abstract: Measuring systems can now determine the number and spatial distribution of cloud-to-ground (CG) lightning flashes under individual thunderstorms and over larger regions on monthly, seasonal, and annual time scales. Here, we show how a measurement of the average area density of strikes, N_g , over a given region, and an assumption of complete spatial randomness, can be used to determine the probability that the nearest (and usually the most dangerous) flash will be within any specified distance of an arbitrary point or line segment in that region.

Keywords: Risk assessment, Strike probability

Paper n°254

Performance Improvement of the German Lightning Location System during the 11 Years of Operation

Abstract: The German lightning location system (LLS) BLIDS (BLitz Informations Dienst von Siemens) is now in service for more than 11 years. During this time the system was improved several times. In this paper we are showing the effect of the performance improvements of the system by evaluating some lightning parameters given by the system during the individual years.
