

RECENT ADVANCES IN ATMOSPHERIC ELECTRICITY

*Proceedings of the Second Conference on
Atmospheric Electricity*

Held at
PORTSMOUTH, NEW HAMPSHIRE
MAY 20-23, 1958

Edited by L. G. SMITH

Sponsored by
AEROPHYSICS LABORATORY
GEOPHYSICS RESEARCH DIRECTORATE
AIR FORCE CAMBRIDGE RESEARCH CENTER
AIR RESEARCH AND DEVELOPMENT COMMAND

Coordinated by
WENTWORTH INSTITUTE
BOSTON, MASS.

Published by
SYMPOSIUM PUBLICATIONS DIVISION
PERGAMON PRESS
LONDON · NEW YORK · PARIS · LOS ANGELES

CONTENTS

Appendix—Agenda	x
List of Participants	xi
Foreword	xv
M. GREENBERG: Introductory Remarks	1
 I. FAIR WEATHER ELECTRICITY	
E. T. PIERCE: Some Topics in Atmospheric Electricity	5
P. J. NOLAN: Small Nuclei Produced by Discharge at a Point	17
R. C. SAGALYN: The Production and Removal of Small Ions and Charged Nuclei over the Atlantic Ocean	21
L. W. POLLAK and A. L. METNIEKS: The Diffusion Coefficient of Large Ions	43
G. A. FAUCHER: A Study of Air Flow in a Large-Ion Chamber	55
J. F. CLARK: The Fair-Weather Atmospheric Electric Potential and its Gradient	61
J. H. KRAAKEVIK: Electrical Conduction and Convection Currents in the Troposphere	75
S. P. VENKITESHWARAN: Measurement of the Electrical Potential Gradient and Conductivity by Radiosonde at Poona, India	89
L. KOENIGSFELD: Observations on the Relations between Atmospheric Potential Gradient on the Ground and in Altitude, and Artificial Radioactivity	101
H. O. CURTIS and M. C. HYLAND: Aircraft Measurements of the Ratio of Negative to Positive Conductivity	111
H. HATAKEYAMA, J. KOBAYASHI, T. KITAOKA and K. UCHIKAWA: A Radiosonde Instrument for the Measurement of Atmospheric Electricity and its Flight Results	119
H. W. KASEMIR and L. H. RUHNKE: Antenna Problems of Measurements of the Air-Earth Current	137
H. ISRAËL: The Atmospheric Electric Agitation	149
M. KAWANO: The Local Anomaly of the Diurnal Variation of the Atmospheric Electric Field	161
R. REITER and M. REITER: Relations Between the Contents of Nitrate and Nitrite Ions in Precipitations and Simultaneous Atmospheric Electric Processes	175
H. DOLEZALEK: Problems in Atmospheric Electric Synoptic Investigations	195
R. MÜHLEISEN: The Influence of Water on the Atmospheric Electrical Field	213
R. H. D. BARKLIE, W. WHITLOCK and G. HABERFIELD: Observations on the Reactions between Small Ions and (a) Cloud Droplets, (b) Aitken Nuclei	223
Short Contributions:	
H. ISRAËL: The Man-made Radioactivity of the Atmosphere at Aachen on April, 1, 1958, and its Origin	231
O. C. JONES, R. S. MADDEVER, and J. H. SANDERS: Radiosonde Measurement of Vertical Electric Field and Conductivity in the Lower Atmosphere	233
R. C. SAGALYN: Significance of the Ratio of the Polar Conductivities in Regions of Variable Pollution Content	235
G. P. SERBU: Atmospheric Electricity and Advection Fog Forecasting	239
D. L. HARRIS: Atmospheric Artificial Radioactivity	241

CONTENTS

II. THUNDERSTORM ELECTRICITY

	<i>Page</i>
D. R. FITZGERALD and H. R. BYERS: Aircraft Observations of Convective Cloud Electrification	245
Y. TAMURA: Investigations on the Electrical Structure of Thunderstorms	269
S. CHAPMAN: Corona-Point-Discharge in Wind and Application to Thunderclouds	277
H. HATAKEYAMA: The Distribution of the Sudden Change of Electric Field on the Earth's Surface due to Lightning Discharge	289
L. G. SMITH: Electric Field Studies of Florida Thunderstorms	299
J. A. CHALMERS: The Electricity of Nimbo-Stratus Clouds	309
B. VONNEGUT and C. B. MOORE: Preliminary Attempts to Influence Convective Electrification in Cumulus Clouds by the Introduction of Space Charge into the Lower Atmosphere	317
C. B. MOORE, B. VONNEGUT, and A. T. BOTKA: Results of an Experiment to Determine Initial Precedence of Organized Electrification and Precipitation in Thunderstorms	333
R. M. CUNNINGHAM: Cumulus Circulation	361
P. B. MACCREADY, JR.: The Lightning Mechanism and its Relation to Natural and Artificial Freezing Nuclei	369
M. BROOK: Laboratory Studies of Charge Separation During Ice-Ice Contact	383
J. P. KUETTNER and R. LAVOIE: Studies of Charge Generation During Riming in Natural Supercooled Clouds	391
B. VONNEGUT and C. B. MOORE: Giant Electrical Storms	399
P. B. MACCREADY, JR.: Equipment for Forecasting Lightning Danger	413
Short Contributions:	
J. A. CHALMERS, J. E. MAUND, and J. W. MILNER: Recent Results on Point Discharge	421
T. W. WORMELL and C. J. ADKINS: Effects of Splashing of Raindrops at the Ground	423
J. C. WILLIAMS: Some Properties of the Lower Positive Charge in Thunderclouds	425
V. J. SCHAEFER: The Electrification of Oil and Water Clouds	431
R. REITER: Observations on the Electricity of Nimbo-Stratus Clouds	435

III. THE LIGHTNING DISCHARGE

D. ATLAS: Radar Lightning Echoes and Atmospherics in Vertical Cross-Section	441
C. E. R. BRUCE: Terrestrial and Cosmical Lightning Discharges	461
E. L. HILL: Free Electrons in the Lower Atmosphere	469
M. M. NEWMAN: Lightning Discharge Channel Characteristics and Related Atmospherics	475
N. KITAGAWA and M. KOBAYASHI: Field-Changes and Variations of Luminosity due to Lightning Flashes	485
H. NORINDER and E. KNUDSEN: Combined Analysis of Daylight Photographs of Lightning Paths and Simultaneous Oscillographic Records	503
H. NORINDER, E. KNUDSEN and B. VOLLMER: Multiple Strokes in Lightning Channels	525
H. L. JONES: The Identification of Lightning Discharges by Sferic Characteristics	543
D. J. MALAN: Radiation from Lightning Discharges and its Relation to the Discharge Process	557
A. KIMPARA: Atmospherics in the Far East	565
H. ISHIKAWA and A. KIMPARA: Lightning Mechanism and Atmospherics Radiation	583
C. G. STERGIS and J. W. DOYLE: Location of Near Lightning Discharges	589

CONTENTS

	<i>Page</i>
R. E. HOLZER: World Thunderstorm Activity and Extremely Low Frequency Sferics	599
M. I. LARGE and T. W. WORMELL: Fluctuations in the Vertical Electric Field in the the Frequency Range from 1 Cycle Per Second to 500 Cycles Per Second	603
W. L. TAYLOR and L. J. LANGE: Some Characteristics of VLF Propagation Using Atmospheric Waveforms	609
H. W. CURTIS: The Nature of Lightning Discharges which Initiate Whistlers	619
P. H. WYCKOFF: Closing Remarks	625
Author Index	629