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THE INFLUENCE OF AEROSOLS ON THE ELECTRICAL PARAMETERS IN THE F--ETC(U)

JAN 81 J M ROSEN, D J HOFMANN

DAA629-77-6-0046

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

LEVEL II

12

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 14-14048.5-GS	2. GOVT ACCESSION NO. A095149	3. RECIPIENT'S CATALOG NUMBER 9
4. TITLE (and Subtitle) The Influence of Aerosols on the Electrical Parameters in the Free Atmosphere		5. TYPE OF REPORT & PERIOD COVERED Final Report 1 Jan 77 - 31 Dec 80
7. AUTHOR(s) 10 J. M. Rosen D. J. Hofmann		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Wyoming Laramie, WY 82071		8. CONTRACT OR GRANT NUMBER(s) 13 DAAG29-77-G-0046
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Research Office Post Office Box 12211 Research Triangle Park, NC 27709		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 126
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 11 Jan 81
		13. NUMBER OF PAGES 5
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) NA		
18. SUPPLEMENTARY NOTES The view, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) aerosols earth atmosphere electrical properties ion concentration atmospheric physics		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A comparison of all past measurements of the vertical profile of the small ion concentration shows that there is a significant discrepancy between observers. The research described here centered around resolving these disagreements which at first was thought due to the presence of aerosols. The problem was attacked by developing a reliable ion counter and then obtaining simultaneous ion density and aerosol profiles. In addition an international workshop was held for the purpose of simultaneously comparing the many instruments and techniques used in atmospheric electrical measurements.		

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FINAL REPORT

TITLE: The Influence of Aerosols on the Electrical Parameters in the Free Atmosphere

GRANT NUMBER: DAG 29-77-G 0046

SUBMITTED BY: J. M. Rosen and D. J. Hofmann, Department of Physics and Astronomy, University of Wyoming, Laramie, Wyoming 82071

DATE: January 1981

STATEMENT OF PROBLEM:

A comparison of all past measurements of the vertical profile of the small ion concentration shows that there is a significant discrepancy between observers. The research described here centered around resolving these disagreements which at first was thought due to the presence of aerosols. The problem was attacked by developing a reliable ion counter and then obtaining simultaneous ion density and aerosol profiles. In addition an international workshop was held for the purpose of simultaneously comparing the many instruments and techniques used in atmospheric electrical measurements.

SUMMARY OF MOST IMPORTANT RESULTS:

1. The discrepancy in all past ion density measurements can be attributed to the poorly known and fluctuating sample rate through the counters.
2. Ion density profiles obtained from instruments having a rigorously known flow rate are relatively smooth and highly consistent.
3. The natural aerosol has very little affect on the ion density except in the boundary layer.
4. This research produced the first real ion density profiles.
5. The results of the international workshop and the improved ion density measurements have led to the first reliable determination of average ion mobility to 30 km.

6. The international workshop has produced an internally consistent set of atmospheric electrical parameters that will hold up to theoretical scrutiny.
7. As a result of the international workshop it was discovered that all previously reported direct measurements of the air-earth current were a factor of two too small.
8. This research has produced a new awareness in the problems of measuring ion density.

LIST OF PUBLICATIONS AND TECHNICAL REPORTS:

1. Balloon Borne Measurements of Atmospheric Electrical Parameters I: The Ion Production Rate
2. Balloon Borne Measurements of Atmospheric Electrical Parameters II: The Small Ion Concentration
3. Balloon Borne Measurements of Atmospheric Electrical Parameters III: Conductivity, Mobility and the Recombination Coefficient
4. Results of an International Workshop on Atmospheric Electrical Measurements

All of these reports have been submitted for publication and abstracts were included with the semi-annual progress reports.

PARTICIPATING PERSONNEL:

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A. L. Fuller
J. Harder
D. Kelly

No degrees granted

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PROGRESS REPORT

(TWENTY COPIES REQUIRED)

1. ARO PROPOSAL NUMBER: DRXRO-GS-14048
2. PERIOD COVERED BY REPORT: July 1 - Dec. 31, 1980
3. TITLE OF PROPOSAL: The Influence of Aerosols on Electrical
Parameters in the Free Atmosphere
4. CONTRACT OR GRANT NUMBER: DAA G 29-77-G-0046
5. NAME OF INSTITUTION: University of Wyoming
6. AUTHOR(S) OF REPORT: D.J. Hofmann and J. M. Rosen
7. LIST OF MANUSCRIPTS SUBMITTED OR PUBLISHED UNDER ARO SPONSORSHIP
DURING THIS PERIOD, INCLUDING JOURNAL REFERENCES:

Results of an International Workshop on Atmospheric Electrical
Measurements. Submitted to J. Geophy. Res.
8. SCIENTIFIC PERSONNEL SUPPORTED BY THIS PROJECT AND DEGREES AWARDED
DURING THIS REPORTING PERIOD:

None

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BRIEF OUTLINE OF RESEARCH FINDINGS

During this final reporting period (July 1 - Dec. 31, 1980) we have revised the three papers mentioned in the last progress report to satisfy reviewers' comments and presented two papers at the International Conference on Atmospheric Electricity held in Manchester, England during July 1980. A subsequent paper has been written and submitted for publication and the abstract is included with this report.

In summary of the overall project, we are happy to report that the research was much more successful than we had originally expected. In addition to conducting our own instrument development and balloon soundings we were able to host a successful international workshop on atmospheric electrical measurements. As of this date four papers have been submitted for publication that deal exclusively with the results of this overall project. Although there is certainly room for improvement and expansion of present results, our original research goals have been successfully met. This work has served to help renew interests in an area that has not received enough recent attention. We thank the Army Research Office for their support.

Results of an International
Workshop on Atmospheric
Electrical Measurements*

ABSTRACT

An Atmospheric Electrical Measurements Workshop was conducted at the University of Wyoming in which balloon borne comparisons of ionization, conductivity, ion density, air-earth current and electric field measurements were made. After some deliberation there now appears to be relatively good agreement between the various experimental groups with a major exception being the ion density measurements. The source of this discrepancy is perhaps the poorly defined flow rate through some types of ion counters. Another important experimental result indicates that the direct measurements of air-earth current are almost exactly one half the value calculated from the total conductivity and electric field profiles. The values of the small ion mobility calculated from the workshop data suggests a relatively constant value to about 30 km, the maximum altitude of the soundings.

*Submitted to Journal of Geophysical Research

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