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M-RTC-39+

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CATALOGED BY ASTIA
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1. "The Searchlight Beam in the Atmosphere"
2. "Prozhektornykh luch v atmosfere"
3. Rozenberg, G. V. Moscow, Izdatel'stvo Akademii Nauk SSSR, 1960. 243 pp.
4. 5 typewritten pages
5. Date of Translation: June 1962
6. Translator: Robert Sholiton
7. Translated for Geophysics Research Directorate, Air Force Research Division, L. G. Hanscom Field, Bedford, Massachusetts, by the American Meteorological Society, Contract Number AF 19(604)-6113.
8. Unclassified
9. Complete



TABLE OF CONTENTS

Foreword

Chapter I. Problems of Forecasting Visibility and Searchlight Sounding of the Atmosphere (G. V. Rozenberg)

1. The problem of forecasting the visibility of distant objects illuminated by a searchlight.
2. Optical characteristics of the atmosphere and the problem of their measurement.
3. The problem of searchlight sounding of the atmosphere.
4. The history of the development of the searchlight method of sounding the atmosphere.
5. Methodological problems.

Chapter II. Optical Properties of the Atmosphere

1. Introduction (G. V. Rozenberg)
2. Transparency of the atmosphere.
 - a) Basic concepts and methods of measurement (G. V. Rozenberg)
 - b) Brief outline of data in the literature (G. V. Rozenberg)
 - c) Methodology and conditions of accomplishing measurements of atmospheric transparency at the Laboratory of Atmospheric Physics of the Institute of Physics of the Atmosphere of the Academy of Sciences of the USSR (G. V. Rozenberg)
 - d) Temporal and spatial variations in atmospheric transparency (A. Ia. Driving, N. V. Zolotavina, G. V. Rozenberg)
 - e) Spectral transparency of the atmosphere under high-mountain conditions (Iu. S. Georgievskii)
3. The matrix of scattering (G. V. Rozenberg).
 - a) Introduction
 - b) Brief outline of published data
 - c) Preliminary data on the nature of the matrix of light scattering by atmospheric air
 - d) Closing remarks

Chapter III. The Structure of a Searchlight Beam

1. Introduction (G. V. Rozenberg)
2. The angular structure of a searchlight beam at a great distance from the searchlight (V. S. Khazanov)
3. The light of the searchlight scattered into the forward hemisphere (V. S. Khazanov)
4. Transverse brightness profile of the projection of a searchlight beam on the firmament (A. Ia. Driving, N. V. Zolotavina, G. V. Rozenberg)

Chapter IV. An Approximate Theory of Visibility and a Theory of Searchlight Sounding of the Atmosphere (G. V. Rozenberg)

1. Statement of the problem. Basic designations
2. Visible intensity of primary scattered light of a searchlight.
 - a) General expression for the intensity of primary scattered light of a searchlight.
 - b) Intensity of primary scattered light of a searchlight when observed from the side.
 - c) Intensity of primary scattered light when observed after and toward the beam.
3. Illumination by a scattered light of a searchlight
 - a) Illumination on the side of the beam
 - b) Illumination on the axis of the searchlight beam
4. Visible contrast of the object illuminated by the searchlight
5. Theory of searchlight sounding of the atmosphere
 - a) Calculating the finiteness of the aperture of the receiving apparatus and the equation of searchlight sounding
 - b) Methods of solving the equation of searchlight sounding
6. Determining the component of the matrix of scattering

Chapter V. Quantitative Analysis of the Influence of Various Factors on the Intensity of Scattered Light of a Searchlight (E. M. Feigel'son)

1. Solving the equation of transfer in the case of scattering of light of a searchlight
2. Intensity of primary scattered light of a searchlight; method of calculation
3. Geometric laws
4. Dependence of the intensity of primary scattered light of a searchlight on optical properties of the atmosphere
5. Influence of the angular distribution of the intensity of light of a searchlight
6. Visible contrast of the object illuminated by the searchlight
7. Estimates of the intensity of secondary scattered light of a searchlight

Chapter VI. Experimental Verification of the Theory and Some Results of Searchlight Sounding of the Atmosphere

1. Measurements of the visible intensity of scattered light of a searchlight and comparison with the theory (A. Ia. Driving, N. V. Zolotavina, G. V. Rozenberg)
2. Contrast of the object illuminated by the searchlight according to experimental data (A. Ia. Driving, N. V. Zolotavina, G. V. Rozenberg)
3. Aerosol structure of the atmosphere (A. Ia. Driving, N. V. Zolotavina)

4. Characteristics of an atmospheric aerosol according to data of searchlight sounding (A. Ia. Driving)
5. Closing remarks (G. V. Rozenberg)

Literature Cited

THE SEARCHLIGHT BEAM IN THE ATMOSPHERE

by

G. V. Rozenberg

FOREWARD

Air and also the impurities contained in it -- dust, water drops and ice crystals -- possess the ability to scatter and absorb light. Even in clear weather, when the concentration of an aerosol is small, light scattering phenomena do not lose their significance. The brightness and color of the daytime sky convincingly remind us of this. A searchlight beam piercing the atmosphere becomes visible precisely because of the scattering of light by atmospheric air. As a result, the distant object illuminated by the searchlight emerges on a more or less bright background of the searchlight beam itself, which radically changes the conditions of the perceptibility of the object. Furthermore, scattering (and also absorption) of light by the air leads to an attenuation of the light beams passing through the atmosphere, and in the case of strong turbidity, also to a change in their structure. Therefore the real conditions of the visibility of distant objects illuminated by a searchlight beam depend essentially on the optical condition of the atmosphere. The latter, however, is subject to strong changes depending on the altitude and meteorological conditions influencing the concentration and properties of an atmospheric aerosol.

Moreover, the nature of light scattering in the atmosphere can serve as an indicator of its optical condition and of those atmospheric processes which are responsible for its variation. Thereby the searchlight beam becomes an instrument for studying the atmosphere in vivo to very great heights which are hard to reach by other methods and, what is especially important, in comparatively small and rather clearly localized spaces.

Both groups of problems mentioned -- the effect of atmospheric conditions on the visibility of distant objects illuminated by a searchlight

and the use of a searchlight beam for optical sounding of the atmosphere -- have attracted attention for a long time. In particular, for a long time they have been objects of theoretical and experimental investigations in the Laboratory of Atmospheric Optics of the Institute of Physics of the Atmosphere of the Academy of Sciences of the USSR (previously the Institute of Theoretical Geophysics and then the Geophysical Institute of the Academy of Sciences of the USSR). However, only in recent years has our information on the optical properties of the atmosphere at different heights and under different conditions reached a level which makes it possible to sum it up somewhat. This is our goal. We shall restrict ourselves to that side of the problem which is directly dependent on atmospheric factors. All problems connected with the psycho-physiological problem of visual visibility and also with searchlight engineering are beyond the scope of this book, the more so since there is sufficiently detailed literature on these problems (Cf. e. g. , /1, 2/). However, we shall give a rather detailed survey on contemporary data on optical properties of the atmosphere. As to the rest, we shall mainly concentrate our attention on the results obtained in the Laboratory of Atmospheric Optics, among them those in which the authors took part.

The authors express their deep gratitude to the staff of the Laboratory of Atmospheric Optics, all of whom in some measure participated in the fulfillment of this work.

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