Malkevich, M. S. Metod teoreticheskogo opredeleniia vertikal'nogo gradienta temperatury vozdukha. [A method for determining theoretically the vertical air temperature gradient.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, No. 6:676–688, June 1956. 3 figs., table, 15 refs., 27 eqs. DLC—A method for solving the integral equation describing the distribution with height of the atmospheric temperature gradient is presented. The method consists of approximating the core of equation by characteristic functions and subsequently replacing the integral equation with an equivalent differential equation. The selectivity of absorption of radiation is taken into account since its distribution is variable. *Subject Headings:* 1. Mathematical techniques 2. Vertical temperature gradient.—*I.L.D.*

MALKEVICH, M.S.

60-37 -4/7

AUTHOR: Malkevich, M. S.

TITLE: Atmospheric Cooling due to Radiative Heat Transfer (Vykholazhivaniye atmosfery pod vliyaniyem luchistogo teploobmena)

PERIODICAL: Trudy Geofizicheskogo instituta Akademii nauk SSSR, 1956, Nr 37(164), pp. 89-101 (USSR)

ABSTRACT: The author discusses the effect of radiative heat transfer on temperature changes in the atmosphere, with time, at different altitudes. The selectivity in the absorption of long-wave radiation by vapor is taken into account. The presence of cooled and heated layers in the atmosphere is shown to be due to long-wave radiation. Other small-temperature fluctuations are connected with the re-radiation of long-wave radiation. There are 2 tables, 6 figures, and 8 references, all of them USSR.

AVAILABLE: Library of Congress

Card 1/1

MALKEVICH, M.S.

60-37-5/7

AUTHOR: Malkevich, M. S.

TITLE: Variations in Air Temperature with Time due to Turbulent Mixing and Radiative Heat Transfer (Izmeneniya temperatury vozdukha so vremenem pod vliyaniyem turbulentnogo peremeshivaniya i luchistogo teploobmena)

PERIODICAL: Trudy Geofizicheskogo instituta Akademii nauk SSSR, 1956, Nr 37 (164), pp. 102-119 (USSR)

ABSTRACT: The author investigates a given distribution of air temperatures, taking into account heat transfer in soil and turbulent and radiative heat exchanges. A two-layer problem is considered: the variable coefficient of temperature conductivity (a linear function of height) and the constants of air and vapor densities are taken for the near-surface layer of air; in the free troposfere the temperature-conductivity coefficient is constant, and the densities vary exponentially with height. It is shown that in the boundary layer (2-3 km thick) temperature variations are basically determined by the thermal effect of the subjacent surface and turbulent

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60-37-5/7

Variations in Air Temperature with Time (Cont.)

mixing. Outside the boundary layer, temperature changes occur mainly as a result of radiative heat transfer. There are 2 figures, 1 table, and 8 references, all USSR.

AVAILABLE: Library of Congress

Card 2/2

MALKEVICH, M.S.

60-37-6/7

AUTHOR: Malkevich, M. S.

TITLE: Theoretical Computation of Solar Radiation Absorbed by the Atmosphere During Various Time Intervals (Teoreticheskiy raschet solnechnoy radiatsii, pogloshchayemoy atmosferoy za raznyye promezhutki vremeni)

PERIODICAL: Trudy Geofizicheskogo instituta Akademii nauk SSSR, 1956, Nr 37(164), pp. 120-131 (USSR)

ABSTRACT: Formulas are developed for computing solar radiation absorbed by the atmosphere at various altitudes and any given periods of time. After working out averages for daily or other periods, it is shown that with elevation the distribution of absorbed radiation hardly ever deviates from the exponential law. There are 5 tables, and 3 references, all USSR.

AVAILABLE: Library of Congress

Card 1/1

MALKEVICH, M. S.

3(7) PHASE I BOOK EXPLOITATION SOV/1685

Akademiya nauk SSSR. Komitet po geodezii i geofizike.

Tezisy dokladov na XI General'noy assambleye Mezhdunarodnogo geodezicheskogo i geofizicheskogo soyuza. Mezhdunarodnaya assotsiatsiya meterologii (Abstracts of Reports at the 11th General Assembly of the International Union of Geodesy and Geophysics. The International Association of Meteorology) Moscow, 1957. 38 p. /Parallel texts in Russian and English or French/ 1,500 copies printed. No additional contributors mentioned.

PURPOSE: This booklet is intended for meteorologists.

COVERAGE: These reports cover various subjects in the field of meteorology. Among the specific subdivisions discussed are: the heat balance of the Earth's surface, jet streams, transference of heat radiation, electric coagulation of cloud particles, turbulent diffusion, cloud studies, and others. Abstracts of all the articles are translated into either French or English. There are no references given.

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AUTHOR: Malkevich, M. S. 49-5-8/18

TITLE: The scattering of light in the atmosphere, taking into account non-uniformities in the underlying surface. (Ob uchete neodnorodnostey podstilayushchey poverkhnosti v zadachakh rasseyaniya sveta v atmosfere).

PERIODICAL: "Izvestiya Akademii Nauk, Seriya Geofizicheskaya" (Bulletin of the Ac.Sc., Geophysics Series), 1957, No.5, pp. 628-643 (U.S.S.R.)

ABSTRACT: Most of the work which has been done up to now on the propagation of radiation in a turbid medium is based on the assumption that the medium is uniform in the horizontal direction. Although this assumption simplifies considerably the problem of propagation of radiation it is, nevertheless, an idealisation for media such as, for example, the Earth's atmosphere. The presence of clouds in the atmosphere, the variation in turbidity in the horizontal direction and also the non-uniformity in the underlying surface, all make it necessary to reject the above assumption in theoretical studies of the radiational regime in the terrestrial

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atmosphere. The absence of experimental data on the intensity of the radiation and considerable mathematical difficulties contributed to the fact that, up to now, there has been no

49-5-8/18

The scattering of light in the atmosphere, taking into account non-uniformities in the underlying surface. (Cont.)

work done in this direction. Ambartsumyan, V. A. (1), Chandrasekar, S. (2) and Kuznetsov, Ye. S. (3) have studied special cases only. Approximate methods of solution of equations of transport of radiation, the intensity of which depends on the horizontal coordinates, were treated by Jefferies (4 and 5). In the present work an attempt is made to calculate the intensity of scattered radiation as a function of one of the horizontal coordinates. The latter expresses the variation in the albedo of the underlying surface. The atmosphere is assumed to be uniform horizontally and to scatter light equally in all directions. Its upper layer is assumed to be irradiated by a parallel beam of solar radiation and the underlying surface is assumed to scatter light according to Lambert's law. It is shown that the solution can be expressed in terms of functions of the form:

$$\psi_n^{(m)}(x,y;\beta) = \int_0^\infty \exp\left(-x\sqrt{s^2+\beta^2}\right)J_o(mys)\frac{s\,ds}{(s^2+\beta^2)^{\frac{n+1}{2}}}$$

$$(x > 0;\ n,m = 0,1,2\ \ldots)$$

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49-5-8/18

The scattering of light in the atmosphere, taking into account non-uniformities in the underlying surface. (Cont.)

(these are generalisations of Gold's functions). They occur in solutions of a set of independent integral equations. It is demonstrated that the problem of taking into account non-uniformities of the underlying surface does not present any fundamental difficulties compared with the problem of the uniform surface and appears to be a simple generalisation of the one-dimensional problem as developed by Kuznetsov (9) for an isotropically scattering atmosphere.
There are 9 references, 6 of which are Slavic.

SUBMITTED: December 19, 1956.

ASSOCIATION: Ac.Sc. U.S.S.R. Institute of Physics of the Atmosphere.
(Akademiya Nauk SSSR Institut Fiziki Atmosfery).

PHASE I BOOK EXPLOITATION SOV/2545

Feygel'son Ye. M., M. S. Malkevich, S. Ya. Kogan, T. D. Koronatova, K. S. Glazova, and M. A. Kuznetsova

Raschet yarkosti sveta v atmosfera pri anizotropnom rasseyanii, ch. 1 (Computation of Light Intensity in the Atmosphere in a Case of Anisotropic Scattering, Pt. 1) Moscow, Izd-vo AN SSSR, 1958. 101 p. (Series: Akademiya nauk SSSR. Institut fiziki atmosfery. Trudy, nr 1) Errata slip inserted. 2,000 copies printed.

Ed.: G. V. Rozenberg, Doctor of Physical and Mathematical Sciences; Ed. of Publishing House: V. I. Rydnik.

PURPOSE: This book is intended for physicists and scientists engaged in the study of atmospheric optics.

COVERAGE: This work contains the results of computation on the intensity of light scattered anisotropically in the atmosphere under various physical parameters and functions of scattering. The solution of integro-differential equations of the theory of radiative transfer in an anisotropically scattering medium

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Computation (Cont.)

was obtained by the method of successive approximations. The work was carried out by the staff members of the Laboratory of Atmospheric Optics within the Institute of Physics of the Atmosphere, Academy of Sciences, USSR. No personalities are mentioned. There are 23 references: 14 Soviet, 4 English, 4 German, and 1 French.

TABLE OF CONTENTS:

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SOV/49-58-8-6/17

AUTHOR: Malkevich, M.S.

TITLE: The Influence of Horizontal Changes in Albedo of an Underlying Surface on Light Scattering in a Homogeneous Atmosphere (Vliyaniye gorizontal'nykh izmeneniy al'bedo podstilayushchey poverkhnosti na rasseyaniye sveta v odnorodnoy atmosfere)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, 1958, Nr 8, pp 995 - 1005 (USSR)

ABSTRACT: Expressions obtained in Ref 1 for intensity and flow of radiation in a turbid medium can be used in a simplified form when the atmosphere overlying the inhomogeneous surface has the same optical properties at all heights. It is assumed (1) that there is a spherical scattering index; 2) parallel rays of solar radiation are incident on the upper boundary of the atmosphere; 3) the underlying surface scatters according to Lambert's Law. Also, the albedo of the surface is given by:

$$q(\xi) = q_0 + q_1 \sin \xi \qquad (1)$$

(where ξ is a dimensionless, horizontal co-ordinate

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The Influence of Horizontal Changes in Albedo of an Underlying Surface on Light Scattering in a Homogeneous Atmosphere

and q_0, q_1 are certain numbers $(q_0 + q_1 \leqslant 1$; $q_0 - q_1 \geqslant 0)]$. From Ref 1, it can be shown that the source function, $K(\tau, \xi)$, and also the intensity of the inward and outward radiation, $I^{(1)}$ and $I^{(2)}$, have the forms (2), (3) and (4) . (Where τ is the optical thickness of a column of air at the given height, θ and ψ are the zenith and azimuth angles of the direction of propagation of the radiation; $\delta = \sigma L$ is a dimensionless parameter characterising the scale of the horizontal inhomogeneities on the underlying surface L for a fixed atmospheric scattering coefficient, σ ; τ^* is the total optical thickness of the atmosphere.) The functions $\varphi_0(\tau)$, $R_n(\tau)$ are defined by the integral equations (5), (6) and (7) (where ζ is the zenith distance of the sun and the constants X_n and Y_n are determined by the Eqs.(8)). Thus, the basic task is the solution of the integral Eqs.(5) and (6). Almost

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completely accurate solutions for $n = 0$ have been obtained by Ye.S. Kuznetsov and B.V. Ovchinskiy (Ref 2) and these are used throughout this paper.
To solve Eq.(6) for $n = 1, 2 \ldots$, the functions $\Psi_k^{(n)}$ were tabulated for $\delta = 0.1; 1; 10$ (i.e. $L = 1; 10; 100$ km). The equations were solved according to the method given in Ref 3 with an error 1-2% for $\tau^* = 0.3$ and 5% for $\tau^* = 0.6$. As an example, Table 1 gives the solutions of (6) for $\tau^* = 0.3$; $\delta = 0.1$, 10 and $n = 1.2$. The constants Y_o, X_n, Y_n ($n = 1.2$) are determined from the system of equations (8) with $q_o = 0.5$; $q_1 = 0.3$ (the albedo changes from 0.2 for $\xi = -\pi/2$ to 0.8 for $\xi = \pi/2$). In future calculations, only the first three terms of the series (2) - (4) need be taken.
The source function $K(\tau, \xi)$ obtained from Eq.(2) for $\xi = -\pi/2$; 0; $\pi/2$ (corresponding to albedos, $q = 0.2, 0.5, 0.8$) is compared with the analogous function

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$\varphi_q(\tau)$ taken from Ref 2 (calculations refer to $\zeta = 60^o$). Tables 2-4 show p (the difference between $K(\tau, \xi)$ and $\varphi_q(\tau)$ in percent) which indicates that $K(\tau, \xi) > \varphi_q(\tau)$ for small values of albedo and $K(\tau, \xi) < \varphi_q(\tau)$ for large albedos. If the function $\varphi_q(\tau)$ always increases and has a maximum at the upper boundary of the atmosphere, then $K(\tau, \xi)$ follows an analogous course only over large-scale inhomogeneities, or over areas with small or average albedo with small-scale inhomogeneities.
Over areas in which the average albedo is exceeded, $K(\tau, \xi)$ dies away with height, reaching a minimum in the middle of the scattering layer and then changing in a similar fashion to $\varphi_q(\tau)$.
As τ increases, $K(\tau, \xi)$ for different ξ approximates to $K(\tau, 0)$ or to $\varphi_{0.5}(\tau)$, i.e. the variation of the underlying surface is smoothed out as the height increases.

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The Influence of Horizontal Changes in Albedo of an Underlying Surface on Light Scattering in a Homogeneous Atmosphere

Inhomogeneities are smoothed out less in the case of large-scale variations than small ones - as can be seen from Table 5, which shows the difference between $K(\tau, \xi)$ and $K(\tau, 0)$ for $\xi = \pm \pi/2$. Comparison of Tables 2 and 3 shows that the difference between $K(\tau, \xi)$ and $\varphi_q(\tau)$ diminished with increase of the scale.

Figure 1 shows the horizontal variation of intensity of the outgoing radiation at levels $\tau = 0$, 0.16, 0.30 ($\delta = 0.1$, $\tau^* = 0.3$, $\theta = 60^\circ$, $\psi = 90^\circ$) as calculated from Eqs.(3) amd (4). The intensity variations at the given levels can be in the opposite direction to that in surface layer, and are gradually smoothed out with height. The reason for the changes is obvious - in a fixed direction of observation, the incident light can be reflected from various regions of the surface. This is clearly shown in Figure 2, where the continuous line represents the vertical distribution of the radiation intensity $I^{(1)}$ at the point $\xi = \pi/2$ ($\theta = 60^\circ$, $\psi = 90^\circ$) and the dotted line gives

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the results obtained from Ref 2 for a vertical change, $\tilde{I}^{(1)}$, with a homogeneous surface of albedo 0.2 . The continuous curve in Figure 3, represents the vertical variation in $I^{(1)}$ at the point $\xi = 0$, in the direction of the point $\xi = -\pi/2$ and the dotted line represents $\tilde{I}^{(1)}$ for a homogeneous surface of albedo 0.2 . It can be seen that, for a comparatively transparent atmosphere, the observed effect can reach 15%.
The brightness of the sky, $I^{(2)}(\varrho; \xi; \theta, \psi)$ for the given albedo variation law ($\theta = 60^{\circ}$, $\psi = 90^{\circ}$) deviates slightly from that calculated for a homogeneous underlying surface of average albedo q = 0.5 (Figure 4 - continuous and dotted lines, respectively). The deviation attains 3.5% in places; hence, the variation in albedo can be ignored to this order of accuracy.
The inward and outward flow of scattered radiation can be calculated with the help of Eqs.(9) and (10). Table 6 indicates that the outward flow of radiation increases over areas of the surface with small albedo and decreases

The Influence of Horizontal Changes in Albedo of an Underlying Surface on Light Scattering in a Homogeneous Atmosphere

over areas with large albedo, reaching a minimum in the middle of the layer and then increasing again. The deviation of the flow $F^{(1)}$ from its average value decreases with height (Figure 5). Figure 7 shows that the inward flow of radiation $F^{(2)}$ always decreases with height.

Comparing $F^{(1)}(\tau, \xi)$, $F^{(2)}(\tau, \xi)$ with $\tilde{F}_q^{(1)}(\tau)$, $F_q^{(2)}(\tau)$ (calculated for a homogeneous surface from Ref 2), it is found that, for areas with $q(\xi) \geqslant 0.5$, $F^{(1)} \leqslant \tilde{F}^{(1)}$ (i = 1, 2), whereas the reverse holds true for $q(\xi) < 0.5$ (Figures 6 and 7). Figures 8 and 9 show similar graphs for an atmosphere with $\tau^* = 0.6$. The change in total albedo with height can now be calculated from Eq.(11).

Table 7 and Figures 10 and 11 illustrate the variation of albedo with height and along a horizontal for $\tau^* = 0.3$, 0.6 and $\delta = 0.1$.

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The Influence of Horizontal Changes in Albedo of an Underlying Surface on Light Scattering in a Homogeneous Atmosphere

The magnitudes of the total albedo (Eq.(12)) are considerably smaller than the corresponding values of $q(\tau, \xi)$ (reaching 50% of $\tilde{q}(\tau)$). Over areas with an albedo exceeding the average ($q = 0.5$), the total albedo dies away like $F^{(1)}(\tau, \xi)$, whilst $q(\tau, \xi)$ increases. For $\xi > 0$ (i.e. large albedos), $q(\tau, \xi) < \tilde{q}(\tau)$, whilst for $\xi = 0$ (i.e. average albedo), they practically coincide. The results obtained require experimental verification but show that, for example, in measurements of albedo from aeroplanes, the inhomogeneities of the underlying surface must be taken into account.

The idealised model used in these calculations (i.e. homogeneous; isotropic scattering) can be applied to the boundary layers of the real atmosphere for several km. As is shown in Ref 8, isotropic scattering can be assumed since the outward radiation depends only slightly on the extension of the scattering index.

There are 11 figures and 7 tables and 8 references, 7 of which are Soviet and 1 English.

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Ac. Sc. USSR, Inst of atmospheric Physics

FEYGEL'SON, Ye.M.; MALKEVICH, M.S.

Calculation of light intensity and haziness coefficients in anisotropic scattering. Trudy Lab.aeromet. 7:37-44 '59.
(MIRA 13:1)

1. Institut fiziki atmosfery AN SSSR.
(Photography, Aerial) (Atmospheric transparency)

S/049/60/000/02/012/022
E032/E414

AUTHOR: Malkevich, M.S.

TITLE: An Approximate Method for Taking into Account Horizontal Changes in the Albedo of the Underlying Surface in Calculations of the Scattering of Light in the Atmosphere

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1960, Nr 2, pp 288-298 (USSR)

ABSTRACT: The present author (Ref 1) has shown that horizontal changes in the albedo of the underlying surface have only a slight effect on the corresponding changes in the intensity and the flux of downward scattered radiation. In practical calculations, it may be assumed as a first approximation that these quantities remain constant along the horizontal axes of coordinates. In this way, one obtains a one-dimensional theory of scattering for a certain average value of the albedo (either overall average or local average). This approach excludes the non-linearity in the boundary condition on the underlying surface and enables a simplification to be made of the method suggested by the present author in Ref 2 for taking into account horizontal changes in the

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An Approximate Method for Taking into Account Horizontal Changes in the Albedo of the Underlying Surface in Calculations of the Scattering of Light in the Atmosphere

albedo $q(\xi)$ (ξ is a dimensionless horizontal coordinate). In fact, one can replace the discrete Fourier series for $I^{(1)}(\tau, \xi; \theta, \phi)$, $K(\tau, \xi)$ in the transport equations (1) and (2), and the boundary condition on the underlying surface (3), by the integral functions (4) and (5), where $I^{(1)}(\tau, \xi, \theta, \phi)$ is the intensity of upward radiation, $I^{(2)}(\tau, \theta)$ is the intensity of downward radiation, which is assumed to be independent of ξ and the azimuth ψ and can be calculated according to the method given in Ref 3, τ is the optical thickness of an air column of height z, τ^{*} is the optical thickness of the entire atmosphere, $d\omega$ is a surface element on a unit sphere, θ is the zenith angle of a ray, ζ is the zenith distance of the sun and $a = \sigma L$ is a dimensional quantity which, for a fixed value of the scattering coefficient σ, characterizes the scale of irregularities in the underlying surface L. Application of the transformations (4) and (5) to Eq (1) and (2) and the boundary condition (3), leads to

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Eq (6) and (7). The function $\varphi_{q_0}(\tau)$ is borrowed from Ref 2 for a mean value of the albedo q_0. Bearing in mind Eq (8), and the equation immediately above it, the integral Eq (7) can be reduced to the set given by Eq (9) to (11), whose solutions do not depend on the law of change of the albedo and are, in that sense, universal. Eq (9) and (10), which are independent of n, can be solved relatively simply by the method of successive approximations. The solution of Eq (11) is complicated by the fact that it is strongly dependent on n. However, it can also be obtained by the method of successive approximations. Thus, if $I^{(1)}$ and K are determined with the aid of the two formulae at the top of p 290, the inverse transformation need only be carried out for the functions $Q(n)\varphi_3(\tau, n)$. Consequently, the first approximation for the function K is in the form given by Eq (12). An analogous expression can be written for $I^{(1)}$. If the function $q(\xi)$ can be

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represented by an expansion of the form given by Eq (13), the expression for $K(\tau, \xi)$ is given by Eq (15). It is then sufficient to solve Eq (11) for integral values of the parameter n. Equally simple expressions can be obtained for the intensity $I^{(1)}$ and the vertical and horizontal components of the upward flux of radiation $F_{\tau}^{(1)}$, $F_{\xi}^{(1)}$. For example $F_{\xi}^{(1)}(\tau, \xi)$ is given by Eq (16). Fig 1 shows the function ξ_K calculated from Eq (12) for the following values of the parameters: $\tau^{*} = 0.3$; $\zeta = 60°$; $a = 0.1$; $q_0 = 0.5$; $p_1 = 0.3$; $q_1 = q_k = p_k = 0$ $(k = 2,3,...)$ and for fixed values of $\xi (= -\pi/2, 0, \pi/2)$ (continuous curves 1, 2 and 3, respectively). Deviations from the analogous results (dotted curves) obtained in Ref 1, which are practically exact, are of the order of 3%. Eq (15) and (16) can easily be improved by determining the intensity of the downward radiation using Eq (12), which is initially taken to be independent of ξ. This leads

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to an improved value for K, which is given by Eq (18). This method for taking into account the changes in the albedo is also used for the special cases defined by Eq (20) and (21), where ε is a small positive quantity which is eventually made to vanish. This applies to the scattering of radiation by an atmosphere above two differently reflecting surfaces whose outer boundaries are at great distances from the separation boundary. When the change in the albedo of the underlying surface can be represented by a step-function and the scattering indicatrix is spherical, it is sufficient to consider changes over a band of 1.5 to 2 km on either side of the separation boundary. Outside this band, the scattered radiation is calculated as for a uniform underlying surface. The method can be extended to the case when the albedo is a function of two variables. Acknowledgment is made to G.I.Marchuk. There are 4 figures, 1 table and 3 Soviet references. VC

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AS, USSR, Inst of Atmospheric Physics

S/049/60/000/03/009/019
E032/E614

AUTHOR: Malkevich, M.S.

TITLE: On the Effect of Non-Orthotropism of the Underlying Surface on the Scattered Light in the Atmosphere

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1960, Nr 3, pp 440-448 (USSR)

ABSTRACT: It is usually assumed that the intensity of radiation reflected from the underlying surface does not depend on the direction (Lambert's law) and reflecting properties are described by the albedo, i.e. the ratio of the flux of radiation reflected from the surface to the flux incident on the surface. However, experiments show (Refs 2-5) that natural surfaces do not reflect radiation in accordance with the Lambert law. Their reflecting properties are characterized by the reflectance R(r,r'), which is defined as the ratio of the reflected intensity in a given direction to the illumination of the surface and, consequently, in general it depends on the directions of the incident (r') and reflected (r) rays. The reflectance of natural surfaces depends on many factors which are unknown a priori. The present

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APPROVED FOR RELEASE: 06/20/2000 CIA-RDP86-00513R001031820016-9"

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On the Effect of Non-Orthotropism of the Underlying Surface on the Scattered Light in the Atmosphere

paper is concerned with estimating the function

$$f(\tau) = K_R(\tau) - K_q(\tau)^{**},$$

which characterizes the difference between the scattered radiation calculated for the direction dependent case and the pure Lambert's law case. The analysis is based on the theory put forward by Kuznetsov (Ref 6). A general expression is now derived for $f(\tau)$ (Eqs 4 to 9). As an example, the case defined by Eqs (10) and (11) is considered. It is shown that the absolute magnitude of the difference between K_R and K_q depends on direction, and for those directions r for which the quantities K_R and K_q are themselves small, the relative magnitude of the difference may be up to 20%. Conditions are formulated under which the difference can be regarded

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On the Effect of Non-Orthotropism of the Underlying Surface on the Scattered Light in the Atmosphere

as small. The numerical results obtained are summarized in Tables 1 and 2. Acknowledgment is made to G.V. Rozenberg for important remarks. There are 5 figures, 2 tables and 9 references, 8 of which are Soviet and 1 English.

ASSOCIATION: Akademiya nauk SSSR, institut fiziki atmosfery (Academy of Sciences USSR, Institute of Physics of the Atmosphere)

SUBMITTED: February 14, 1959

Card 3/3

MALKEVICH, M.S.; GLAZOVA, K.S.

Variability of some parameters used in calculating the flow of scattered radiation. Izv. AN SSSR. Ser. geofiz. no.8:1246-1251 Ag '60. (MIRA 13:8)

1. Akademiya nauk SSSR, Institut fiziki atmosfery.
(Solar radiation)

3,5000

87978
S/049/60/000/010/013/014
E032/E414

AUTHOR: Malkevich, M.S.

TITLE: An Approximate Method for Solving the Equation of Radiative Transfer in the Atmosphere

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya geofizicheskaya, 1960, No.10, pp.1541-1546

TEXT: The equation of transfer for plane-parallel, purely scattering atmosphere can be written down in the form

Eq.1.

Eq.2.

$$(-1)^{i-1}\cos\theta\frac{\partial I_c^{(i)}}{\partial\tau} = -I_c^{(i)}(\tau, r) + \frac{1}{4\pi}\int [I_c^{(1)}(\tau, r')\gamma_{1i}(\tau; r', r) + I_c^{(2)}(\tau, r')\gamma_{2i}(\tau; r', r)]\,d\omega' \qquad (i = 1,2); \qquad (1)$$

$$I_c^{(2)}(\tau^*, r) = \pi S\delta(r - r_{\odot}); \quad F_c^{(1)}(0) = qF_c^{(2)}(0), \qquad (2)$$

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where $I_c^{(1)}$, $I_c^{(2)}$ are the intensity of upward and downward total (direct and scattered) radiation respectively, τ is the optical thickness of the given layer of the atmosphere, θ is the zenith angle, ψ is the azimuth angle, γ is the normalized scattering function (indicatrix), τ^* is the optical thickness of the entire atmosphere, πS is the solar constant, q is the albedo of the underlying surface, $\sigma(r - r_{\odot}) = 0$ when $r \neq r_{\odot}$ and $\int \delta(r - r_{\odot}) d\omega = 1$ and finally

$$F_c^{(i)}(\tau) = \int I_c^{(i)}(\tau, r) \cos\theta \, d\omega$$

where the integration is carried out over a hemisphere of unit radius. Kuznetsov (Ref.1) has shown that one of the principal difficulties in solving these equations is the complicated dependence of $I_c^{(i)}(\tau, r)$ on r. In the case of anisotropic

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An Approximate Method for Solving the Equation of Radiative Transfer in the Atmosphere

scattering in the atmosphere, the functions $M_c^{(i)}$, $\Gamma_c^{(i)}$ will depend not only on τ^* and q but also on the zenith distance of the sun ζ, and on the scattering function. The dependence on ζ can be partly reduced, and the dependence on q entirely excluded, if the contribution due to direct solar radiation is removed from Eq.(1) and the scattering of radiation reflected from the underlying surface is considered separately as was done by Feygel'son et al (Ref.4). On this approach, Eq.(1) can be split into two independent systems of equations of the same form, one of which is

Eq.7.

$$(-1)^{i-1}\cos\theta\,\frac{\partial I_i}{\partial\tau} = -I_i(\tau,r) + \frac{1}{4\pi}\int\left[I_1(\tau,r')\gamma_{1i}(\tau;r',r) + I_2(\tau,r')\gamma_{2i}(\tau;r',r)\right]d\omega' + \frac{S}{4}\exp\left[-(\tau^*-\tau)\sec\zeta\right]\gamma_{2i}(\tau;r_\odot,r) \quad (i=1,2) \qquad (7)$$

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with the boundary conditions

$$I_2(\tau^*, r) = 0 \quad I_1(0, r) = 0$$

This equation determines the intensity of scattered radiation for a perfectly black underlying surface. The second equation is

Eq.8

$$(-1)^{i-1} \cos\theta \frac{\partial \tilde{I}_i}{\partial \tau} = -\tilde{I}_i(\tau, r) + \frac{1}{4\pi} \int [\tilde{I}_1(\tau, r') \gamma_{1i}(\tau, r', r) + \tilde{I}_2(\tau, r') \gamma_{2i}(\tau; r', r)]\, d\omega' \quad (i = 1, 2) \tag{8}$$

with the boundary conditions

$$\tilde{I}_1(0, r) = 1 \quad \tilde{I}_2(\tau^*, r) = 0$$

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and describes the scattering of the reflected radiation. The intensities and fluxes of the integral radiation are then given by

$$I_c^{(i)}(\tau, r) = I_i(\tau, r) + C\widetilde{I}_i(\tau, r) + \pi S(i-1)\,\delta(r - r_{\odot})\exp[-(\tau^* - \tau)\sec\theta],$$

$$F_c^{(i)}(\tau) = F_i(\tau) + C\widetilde{F}_i(\tau) + \pi S(i-1)\exp[-(\tau^* - \tau)\sec\zeta]\cos\zeta,$$

где

$$C = q\,\frac{\pi S\exp(-\tau^*\sec\zeta)\cos\zeta + F_2(0)}{1 - qF_2(0)}.$$

X

For each of the systems given by Eq.(7) and (8) one can obtain equations of the form given by Eq.(3). The functions given by
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Eq.(4) and (5) will in the case of Eq.(7) be less strongly dependent on ζ, while in the case of Eq.(8) they will be independent of both q and ζ. These functions are determined by the present author by an approximate procedure. $M_i(\tau)$ and $\Gamma_i(\tau)$ are approximated to by $m_i(\tau)$ and $\gamma_i(\tau)$, which are obtained when in Eq.(4) and (5) one uses the intensity of singly scattered radiation instead of $I_c^{(i)}$. The scattering function is expressed as a series of Legendre polynomials, and m_i and γ_i can then be expressed by analytical formulae. If it is then assumed that m_i and γ_i are sufficiently close to the true values M_i and Γ_i, then one can obtain a reasonable approximate solution of Eq.(3) by replacing M_i, Γ_i by m_i, γ_i. It is found that this procedure gives quite a good fit, and the calculated flux found on this approximation is not in error by more than 10 to 15%. There are 3 figures, 4 tables and 7 Soviet references.

AS, USSR - Inst. of Atmospheric Physics

Card 6/76

S/169/62/000/003/057/098
D228/D301

3,5150

AUTHOR: Malkevich, M. S.

TITLE: An approximate method of taking into account the horizontal changes in the albedo of the underlying surface in the problem of light scattering in the atmosphere (Theses)

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 3, 1962, 27-28, abstract 3B224 (V sb. Aktinometriya i atmosfern. optika, L., Gidrometeoizdat, 1961, 260-261)

TEXT: A method is proposed for approximately solving the problem of light scattering in the atmosphere, with allowance for the arbitrary changes of the albedo of the underlying surface along one of the horizontal coordinates. Two examples are considered. [Abstractor's note: Complete translation.]

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3.5150

S/169/62/000/003/058/098
D228/D301

AUTHOR: Malkevich, M. S.

TITLE: The influence of the anisotropy of light reflection by the underlying surface on light scattered in the atmosphere (Theses)

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 3, 1962, 28, abstract 3B225 (V sb. Aktinometriya i atmosfern. optika, L., Gidrometeoizdat, 1961, 261-262)

TEXT: The particular problem of radiation transfer in the atmosphere is solved. The differences between the quantities, characterizing sky radiation when the surface is orthotropic and does not reflect according to Lambert's law, are determined. It is established that the albedo depends on the brightness coefficient and the optical characteristics of the atmosphere, and a means of approximately calculating the albedo, if the brightness coefficient and optical parameters are known, is suggested. /Abstracter's note: Complete translation./

Card 1/1

ATROSHENKO, V.S.; GLAZOVA, K.S.; MALKEVICH, M.S.; FEYGEL'SON, Ye.M.; Prinimali uchastiye: KIM, E., studentka; TOMASHOVA, L., studentka; ROZENBERG, G.G., prof., doktor fiz.-matem.nauk, otv.red.; PENKINA, N.V., red.izd-va; SUSHKOVA, L.A., tekhn.red.

[Calculation of light intensity in the atmosphere during anisotropic scattering. Part 2] Raschet iarkosti sveta v atmosfere pri anizotropnom rasseianii. Chast' 2. Moskva, Izd-vo Akad.nauk SSSR, 1962. 222 p. (Akademiia nauk SSSR. Institut fiziki atmosfery. Trudy, no.3). [MICROFILM] (MIRA 15:8)

1. Moskovskiy gosudarstvennyy universitet (for Kim, Tomashova).
(Light—Scattering) (Atmosphere)

S/913/62/003/000/014/033
D405/D301

AUTHOR: Malkevich, M.S.

TITLE: On horizontal fluxes of scattered radiation

SOURCE: Akademiya nauk Kazakhskoy SSR. Astrofizicheskiy institut. Trudy. v. 3. 1962. Rasseyaniye i polyarizatsiya sveta v zemnoy atmosfere; materialy Soveshchaniya po rasseyaniyu i polyarizatsii sveta v atmosfere. 89 - 96

TEXT: The differnce between the horizontal fluxes of scattered radiation can serve as an (easily-measurable) criterion of the azimuthal asymmetry of the scattered-radiation field. By expanding the radiation intensity in a trigonometric series and by introducing this series in the formulas for the components of the flux vector, one obtains simple expressions for the horizontal flux ($F_y(1)$ and $F_y(2)$). The quantities $F_y(1)$ and $F_y(2)$ are the characteristics of the azimuthal asymmetry of the ascending-

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and descending radiation fields, whereas their sum characterizes the asymmetry of the overall scattered-radiation field. These quantities are tabulated (by utilizing the intensity values calculated in the references) for a two-layer model of the atmosphere. $F_y^{(1)}$ vanishes on the ground and increases in absolute value with altitude, attaining its maximum at the interface of the two layers. On passing into the upper layer, $F_y^{(1)}$ decreases by almost 2-3 times. On the other hand, $F^{(2)}$ decreases with altitude. For small ζ (which denotes the thickness of the atmosphere), the total horizontal flux decreases with altitude, thus indicating a corresponding decrease in the asymmetry of the scattered-radiation field. Yet for large ζ the total flux can also increase up to a certain altitude, attaining its maximum inside a turbid layer. Thus the horizontal flux constitutes a true measure of atmospheric turbidity. The lower turbid layer has a great effect on the asymmetry of the ascending-radiation field, and no effect whatsoever on the asymmetry of the descending-radiation field in the upper layer. The asymmetry of the ascending-radiation field decreases with increasing atmospheric turbidity.

On horizontal fluxes ... S/913/62/003/000/014/033
D405/D301

The dependence of the vertical fluxes on the zenith distance of the Sun is different at different levelc and for different optical thicknesses of the atmosphere. In the case of a plane-parallel model of the atmosphere or a plane and homogeneous ground-surface, the horizontal flux does not contribute to the radiant-energy balance; this is, however, not true if the above conditions do not hold. There are 6 figures and 2 tables.

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44831

S/560/62/000/014/002/011
A001/A101

35110

AUTHOR: Malkevich, M. S.

TITLE: The angular and spectral distribution of radiation reflected by the Earth into outer space

SOURCE: Akademiya nauk SSSR. Iskusstvennyye sputniki Zemli. no. 14, 1962, 30 - 48

TEXT: Intensity of radiation outgoing from the Earth's atmosphere upper layer into outer space can be directly measured by Earth's artificial satellites and space rockets. Also the problem of angular distribution of reflected short-wave radiation can be solved by means of receivers with small angular resolution, mounted on satellites or rockets, scanning the visible portion of the Earth along various directions. This problem can also be solved in a theoretical way, by solving the equation of radiation transfer for various atmosphere models and reflecting surface. The problem of analyzing the angular and spectral variation of outgoing short-wave radiation represents the purpose of the article. To solve the radiation transfer equation, the author uses the plane-parallel model

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of atmosphere and assumes that the Earth's surface reflects radiation according to Lambert's law. Various factors affecting the distribution are considered. The factors analyzed are the following: the degree of atmospheric turbidity; characteristics of the underlying surfaces which are divided, according to their optical properties into 4 categories: 1) orthotropic and "gray" objects, 2) orthotropic but not-gray formations, 3) horizontally heterogeneous orthotropic and "gray" surfaces, and 4) un-orthotropic surfaces whose brightness coefficient depends on the direction of incidence and reflection of radiation. It is concluded that variations of albedo of reflecting surfaces affect the variations of angular and spatial distribution of outgoing radiation in a considerably higher degree than variations of the atmospheric optical properties. The distribution of cloudy formations, upon which depends mainly anisotropy of outgoing radiation, can be determined on the basis of statistical processing of radiation measurements. On the basis of solution of transfer equation, one can determine the spectral composition of outgoing radiation for various conditions of atmosphere illumination and reflection of terrestrial objects. The main difficulty of this determination consists in that relations of optical thickness and scattering indicatrix of turbid atmosphere to the wavelength are poorly known. It is possible, varying scattering indicatrices, to evaluate their effect on the spectral variation of outgoing radiation intensity. Reflection of natural surfaces, such as water, several types of soil, snow cover, and also clouds depends slightly on the wavelength in the spectrum region considered. Therefore, the data presented on the variation of spectral composition may have a direct application to interpretation of measurements of radiation characteristics from satellites and rockets. In particular, these results can be used to distinguish snow cover from clouds in the case of equal neutral reflection of these objects. Another practical application is determination of the upper boundary of clouds. This method is based on the fact that the ratio of intensities of outgoing radiation, corresponding to short and long waves of the spectrum range considered (0.35 - 0.75 microns) will vary with the altitude of the reflecting boundary of the cloud. This altitude can be also determined by measuring outgoing radiation in absorption bands of those atmospheric gases which are distributed uniformly over the height, e.g., carbon dioxide and the band of molecular oxygen centered on 0.76 μ. In conclusion the author discusses the effects of heterogeneity and non-orthotropism of the reflecting surfaces and points out that to solve the equation of radiation transfer, one can at first suppose that incident radiation does not depend on coordinates x, y and Fourier transformations can be employed. There are 8 figures and 4 tables.

SUBMITTED: March 7, 1962

MALKEVICH, M.S.; POKRAS, V.M.; YURKOVA, L.I.

Measurements of the radiation balance from the Explorer-7 satellite. Isk.sput.Zem. no.14:105-132 '62. (MIRA 15:11)
(Artificial satellites in meteorolcgy)
(Atmosphere)
(Heat—Radiation and absorption)

L 14542-63 EWT(1)/BDS/ ES(v) AFFTC/ASD/ESD-3/APGC/SSD Pi-4/Po-4/
Pq-4/Pe-4 GW

ACCESSION NR: AP3002307 S/0053/63/080/001/0093/0124

AUTHORS: Malkevich, M.S.; Samsonov, Yu. B.; Koprova, L. I.

80

76

TITLE: Water vapor in the stratosphere

SOURCE: Uspekhi fizicheskikh nauk, v. 80, no. 1, 1963, 93-124

TOPIC TAGS: stratosphere, mesosphere, water content, local measurement, spectral measurement, indirect measurement, source, sink

ABSTRACT: The results of recent research on the vertical distribution of water vapor in the stratosphere are surveyed and compared with some indirect estimates of the moisture content at high altitudes. Various methods and instruments for local measurements of moisture content are described and their relative accuracies discussed. Estimates are made of the total water vapor content in the stratosphere under various assumptions and the results tabulated. The results are also compared with those obtained by spectral measurments, based on the presence of strong absorption lines in the infrared spectrum of the water vapor, measured at different altitudes with airborne instruments. The spectrometers employed and their characteristics are described. The possible errors in the interpretation of the spectral

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data are listed. Other indirect methods of estimating humidity are briefly mentioned and the vertical profiles suggested by these methods are discussed. The main conclusions of all the methods is that there are two layers in the stratosphere, a lower one (10--20 km) in which the water vapor concentration is low, about 0.001 g/kg, and an upper one where the concentration is one or two orders of magnitude higher. The possible physical mechanism that causes the increase in water concentration in the mesosphere is analyzed. The connection between high water vapor concentration and the high temperature in the mesosphere is pointed out and the correlation with the production of silver clouds is discussed. The bearing of the water content in the mesosphere on the hydroxyl emission of the night sky is also discussed briefly. Indirect estimates of the water-vapor content, based on measurement of the flux of long-wave radiation in the stratosphere and on the analysis of the conditions for the formation of silver clouds and the hydroxyl radiation, are in agreement with the hypothesis that there is a high moisture content in the upper stratosphere. It is concluded that although all measurements admit of an interpretation such that the vertical profile of the water-vapor concentration can be described by a simple exponential function whose parameters exhibit a scatter correlated with the difference in the conditions of the individual measurements, such an interpretation must be regarded at best as tentative. It is further concluded that

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that spectroscopic measurements with instruments carried by high-altitude rockets and satelites offer the greatest promise of reliable data in the future. Orig. art. has: 10 figures, 20 formulas, and 5 tables.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 12Jul63 ENCL: 00

SUB CODE: PH, AS NO REF SOV: 015 OTHER: 038

Card 3/3

L 52759-65 EWT(1)/EWG(v) Pe-5/Pae-2 GS/GW
ACCESSION NR: AT5011152 UR/0000/64/000/000/0025/0031

32
31
B+1

AUTHOR: Koprova, L. I.; Malkevich, M. S.

TITLE: Thermal radiation of a spherical earth

SOURCE: Mezhvedomstvennoye soveshchaniye po aktinometrii i optike atmosfery. 5th, Moscow, 1963. Aktinometriya i optika atmosfery (Actinometry and atmospheric optics); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1964, 25-31

TOPIC TAGS: thermal radiation, transmission function, absorption band, nadir, mesosphere, stratosphere, ascending radiation, geographical latitude, temperature gradient

ABSTRACT: Thermal radiation leaving a spherical earth was studied. A radiation equation containing transmission functions of various atmospheric layers with different gas densities and temperatures was developed. A rapid decrease in radiation leaving the region of absorption bands occurs when the angle between the radiation direction and the nadir is less than 60°. The radiation suddenly increases

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L 52759-65
ACCESSION NR: AT5011152

in the O_3 band. For some wavelengths the radiation intensity in the mesosphere is twice that in the lower stratosphere. A graph shows the dependence of intensity of the ascending radiation upon the geographic latitude and cloudiness. The latitude is more important than the cloudiness. The intensity of the radiation leaving depends upon the temperature gradient, the vertical distribution of absolute temperatures, and the angle between the nadir and the direction of radiation. The spectral composition of this radiation differs from that of the black body at various K temperatures. The variations in the intensity of radiation of different wavelengths are represented graphically for atmospheric levels of 12 km and 60 km. Orig. art. has: 6 figures and 2 formulas. [EG]

ASSOCIATION: Institut fiziki atmosfery AN SSSR, Moscow (Institute of the Physics of the Atmosphere, AN SSSR)

SUBMITTED: 25Nov64 ENCL: 00 SUB CODE: ES

NO REF SOV: 005 OTHER: 007 ATD PRESS: 4011

Card 2/2

MALKEVICH, M. S.

"Some problems of interpretation of radiation measurements from satellites."

report submitted for 15th Intl Astronautical Cong, Warsaw, 7-12 Sep 64.

S/0049/64/000/003/0394/0407

ACCESSION NR: AP4030341

AUTHORS: Malkevich, M. S.; Monin, A. S.; Rosenberg, G. V.

TITLE: The three dimensional structure of a radiation field as a source of meteorological information

SOURCE: AN SSSR. Izv. Ser. geofiz., no. 3, 1964, 394-407

TOPIC TAGS: artificial satellite, weather forecasting, radiation field, troposphere, stratosphere

ABSTRACT: The authors have pointed out the importance of world-wide observations in order to make satisfactory weather predictions, and they have found the use of artificial satellites for collecting meteorological data to offer both economy and geographic distribution of observational points. But, though the amount and universality of the information is increased, the type of information is qualitatively altered. The single source of information (for the lower layers of the atmosphere--the troposphere and stratosphere) is electrical radiation of various wavelengths reflected or emitted by the earth's surface and the surrounding atmosphere. Essentially the problem becomes a matter of spectral analysis of radiation

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ACCESSION NR: AP4030341

being lost by the planet. The authors describe the connection between structure of a radiation field and meteorological and other processes that have some effect on the radiation field. They describe the inhomogeneities of various scales in the radiation field and outline the physical origin of these inhomogeneities as well as the contribution they make in the recorded streams of radiation. They propose a method for computing atmospheric distortion when recording the structure of the underlying surface, and they also furnish definite recommendations for a method of observing the radiation field from artificial satellites. This involves principally a hemispherical receiver turned toward the earth and a device with the proper solid angle of view. Orig. art. has: 5 figures and 18 formulas.

ASSOCIATION: Akademiya nauk SSSR Institut fiziki atmosfery* (Academy of Sciences SSSR, Institute of Physics of the Atmosphere)

SUBMITTED: 20Jun63 DATE ACQ: 29Apr64 ENCL: 00

SUB CODE: ES NO REF SOV: 009 OTHER: 000

Card 2/2

MALKEVICH, M.S.

Some aspects of the interpretation of the field of radiation leaving the earth. Part 1. Determining the temperature of the underlying surface and the upper cloud limit. Trudy GGO no.166: 102-116 '64.

Some aspects of the interpretation of the field of radiation leaving the earth. Part 2. Distinction of clouds on the background of natural surfaces. Ibid.:117-127 '64. (MIRA 17:11)

KATULIN, V.A.; MALKEVICH, M.S.; MALKOV, I.P.; ROZENBERG, G.V.; YURKOVA, L.I.

Air-borne device for measuring the radiation balance and some results of atmospheric sounding. Trudy GGO no.166:282-294 '64. (MIRA 17:11)

KOPROVA, L.I.; MALKEVICH, M.S.

Thermal radiation of a spherical atmosphere. Kosm. issl. 2 no.6:881-900 N-D '64. (MIRA 17:12)

L 21027-66 FSS-2/EWT(1)/FCC TT/GS/GW

ACCESSION NR: AT5023571 UR/0000/65/000/000/0104/0111

12
B+1

AUTHOR: Malkevich, M. S.; Tatarskiy, V. I.

TITLE: Using terrestrial radiation measurements made from artificial satellites to determine atmospheric temperature and humidity

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 104-111

TOPIC TAGS: planetary radiation, atmospheric temperature, atmospheric humidity, spectrographic analysis, gas spectroscopy, satellite data analysis

ABSTRACT: An analytical method is developed for determining the vertical distribution of temperature and humidity in the atmosphere on the basis of spectral measurements made from artificial satellites of radiation emanating from the earth in the regions of carbon dioxide and water vapor absorption bands. Since the concentration of CO_2 in the atmosphere is known, radiation in the carbon dioxide band is used for determining the vertical distribution of temperature $T(p)$ without regard to the overlap of the CO_2 and H_2O bands (p is pressure at standard levels). The $T(p)$

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obtained in this way from radiation in the H_2O absorption band may be used to determine the vertical distribution of specific humidity $\overline{q}(p)$, after which $T(p)$ is determined more accurately with consideration given to the overlap in the bands of both gases in the 15 μ range. It is assumed that static characteristics of the vertical structure of temperature and humidity fields are used in solving the problem. The differential measurement method should be used for determining deviations of the lapse rate and vertical humidity profiles from the mean distributions of $T(p)$ and $\overline{q}(p)$. The radiation of a black body should be taken as a comparison standard equal to terrestrial radiation at the $T(p)$ and $\overline{q}(p)$ over the measurement region in a given time interval. To determine $T(p)$ for the troposphere with an error which is 3—5 times greater than the error in measurement of the radiation intensity $I\nu$ emanating from the upper boundary of the atmosphere in a given direction, it is sufficient to measure this radiation in two or three suitably selected intervals of the 15 μ CO_2 absorption band, provided the transmission coefficient of the atmosphere is known with perfect accuracy. To reduce this error factor to 2—3, $I\nu$ must be measured in 10—12 spectral intervals. The error is somewhat greater for use of a similar method in determining $q(p)$ in the troposphere: the error exceeds the $I\nu$ measurement in the 6.3 μ absorption band for water vapor by a factor of 5—8 when three spectral intervals are selected, and by a factor of 2—5 when eight intervals are used. It is

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assumed that deviations of the lapse rates and vertical humidity profiles from the average values must be kept within 30% of the rms deviation (this means 2–3° in temperature and 0.5–1 $g \cdot kg^{-1}$ in humidity when the temperature of the underlying surface is 300°K, and its humidity is 3–5 $g \cdot kg^{-1}$). In this case, the differences between true terrestrial radiation and that of the standard should be measured with an error of less than 5%, and the radiation of the standard should be recorded with an error of no more than 0.1%. Orig. art. has: 6 figures, and 17 formulas. [14]

ASSOCIATION: none

SUBMITTED: 02Sep65 ENCL: 00 SUB CODE: ES, SV

NO REF SOV: 004 OTHER: 005 ATD PRESS: 4106

Card 3/3 BK

KONDRAT'YEV, K.Ya., doktor fiz.-matem. nauk, prof.; MALKEVICH, M.S., kand. fiz.-matem. nauk

The 15th International Congress on Astronautics ("Meteorological Satellites Systems" section). Meteor. i gidrol. no.3:38-41 Mr '65. (MIRA 18:2)

L 20474-66 FSS-2/EWT(1)/FCC TT/GW

ACC NR: AP6012061 SOURCE CODE: UR/0384/65/000/006/0031/0035

AUTHOR: Malkevich, M. S. (Candidate of physicomathematical sciences)

ORG: none

50
B

TITLE: Satellite meteorology

SOURCE: Zemlya i vselennaya, no. 6, 1965, 31-35

TOPIC TAGS: earth radiation, meteorologic satellite, atmospheric temperature, atmospheric humidity, absorption band

ABSTRACT: The article cited below is a brief review of the merits of meteorological satellites and the contributions they are expected to make. Particular attention is given to two problems: a) determination of temperature of the earth's surface and the cloud cover and b) determination of the vertical profiles of atmospheric temperature and humidity. In the latter case, for example, it is noted that some gases in the atmosphere have a concentration which is known to very great heights. Therefore, by measuring terrestrial radiation in the absorption bands of these gases the air temperature will be the only unknown value on which radiation is dependent. Moreover, if radiation is measured in different parts of the absorption band it is possible to determine the vertical temperature distribution. In that part of the band where the atmosphere is quite transparent radiation is

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L 20474-66

ACC NR: AP6012061

determined by the temperature of the lower layers. With displacement into the region of lesser transparency the radiation will be characterized by the temperature of the higher layers because the radiation of the lower layers is completely absorbed. This problem is solved by measuring radiation in the carbon dioxide band (near 15 μ). Radiation in any part of the spectrum consists of the total radiation of different layers of the atmosphere. The contribution of each layer is dependent on its temperature, which must be determined, and atmospheric transmission, which is known. Humidity can be determined from measurements of water vapor emission in its absorption bands, such as in the 6.3-μ band; it is necessary to know the temperature of each of the emitting layers of the atmosphere. The unknown value is the transmission of these layers, dependent on the unknown concentration of water vapor. The article describes how these circumstances can yield much valuable information when meteorological satellites are used. Orig. art. has: 7 figures. [JPRS]

SUB CODE: 04, 20, 22 / SUBM DATE: none

Card 2/2

KOPROVA, L.I.; MALKEVICH, M.S.

Empirical orthogonal functions for the optimum parameterization of the temperature and humidity profiles. Izv. AN SSSR. Fiz. atm. i okeana 1 no.1:27-32 Ja '65. (MIRA 18:5)

1. Institut fiziki atmosfery AN SSSR.

KONDRAT'YEV, K.Ya.; MALKEVICH, M.S.

The 15th International Astronautical Congress. Izv. AN SSSR. Fiz. atm. i okeana 1 no.1:122-124 Ja '65. (MIRA 18:5)

ACCESSION NR: AT5011190

AUTHOR: Katulin, V. A.; Kozyrev, B. P.; Malkevich, M. S.; Feraponova, G. P.; Rozenberg, G. V. (Professor)

TITLE: Airplane device for measuring radiation balance and some results of measurements

SOURCE: Mezhvedomstvennoye soveshchaniye po aktinometrii i optike atmosfery. 5th, Moscow, 1963. Aktinometriya i optika atmosfery (Actinometry and atmospheric optics); Trudy soveshchaniya. Moscow, Izd-vo Nauka, 1964, 55-59

TOPIC TAGS: radiation pulsation, radiation thermoelectric element, terrestrial radiation, atmospheric radiation, upwelling radiation, downwelling radiation, albedo

ABSTRACT: Pulsations of shortwave and longwave radiation fluxes have been measured by a Kozyrev, small, vacuum, thermoelectric radiometer with a 180° scope. This device measured solar shortwave and terrestrial and atmospheric longwave radiation. Regions of strong absorption by water vapor were found and separated. The device measured upwelling and downwelling radiation fluxes during airplane flights above steppe and sea regions with clear and cloudy skies. A decrease in the downwelling flux was observed in the atmospheric layer 1—3 km above both regions. A very slight decrease in the

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L 52038-65

ACCESSION NR: AT5011156

downwelling flux was observed above the clouds in the 3—5-km atmospheric layer. A decrease in the upwelling flux was also observed in this layer. Pulsations of cloud albedo were measured and found to vary greatly. Orig. art. has: 3 figures and 1 table. [EG]

ASSOCIATION: Institut fiziki atmosfery AN SSSR, Moscow (Institute of the Physics of the Atmosphere, AN SSSR)

SUBMITTED: 25Nov64 ENCL: 00 SUB CODE: ES

NO REF SOV: 005 OTHER: 000 ATD PRESS: 4009

Card 2/2

ACCESSION NR: AP4034796 S/0293/64/002/002/0257/0265

AUTHOR: Malkevich, M. S.; Malkov, I. P.; Pakhomova, L. A.; Rozenberg, G. V.; Faraponova, G. P.

TITLE: Determination of the statistical characteristics of radiation fields over clouds

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 2, 1964, 257-265

TOPIC TAGS: meteorology, cloud, atmospheric radiation, radiation field

ABSTRACT: A study has been made of the possibility of applying statistical analysis to fields of outgoing radiation for determining the structure of cloud formations. Computation of the structural parameters of the cloud cover is accomplished using aircraft measurements of radiation with narrow- and wide-angle instruments. The following conclusions are drawn from this preliminary investigation: 1. Statistical characteristics of the intensity of reflected radiation can be used for an objective analysis of clouds of various types and a reliable identification can be made on the basis of the full set of statistical parameters. 2. The most informative parameter is the spectral density of fluctuations of brightness, which is quite sensitive to a difference in the character of nonhomogeneities of different cloud types and at the same time is statistically stable. 3. An investi-

ACCESSION NR: AP4034796

gation of the statistical characteristics of radiation fluxes, considered as random functions, makes it possible to take into account fluctuations of the radiant flux of heat under conditions of arbitrary cloudiness. In this case spectral density makes it possible to obtain the distribution of radiant energy by frequencies and determine those scales of nonhomogeneities which make the principal contribution to the flux of radiation heat. 4. The spectrum of fluctuations is similar to comparable spectra of fluctuations of wind velocity and temperature obtained in investigations of turbulence in the surface layer of the air. The spectrum was displaced into the region of somewhat lower frequencies, evidence of an increase in the scales of the eddies responsible for the nonhomogeneity of cloud formations. Orig. art. has: 10 formulas, 6 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 23Dec63 DATE ACQ: 20May64 ENCL: 00

SUB CODE: ES NO REF SOV: 009 OTHER: 003

Card 2/2

ACCESSION NR.: AP4034795 S/0293/64/002/002/0246/0256

AUTHOR: Malkevich, M. S.

TITLE: Certain problems in the interpretation of radiation measurements from artificial satellites

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 2, 1964, 246-256

TOPIC TAGS: artificial satellite, atmospheric radiation, cloud, cloud boundary, earth satellite

ABSTRACT: This article describes methods for determination of certain physical parameters of the atmosphere and underlying surface from measurements of radiation in different parts of the spectrum obtained using artificial satellites. The proposed methods for solution of the corresponding inverse problems (determination of the temperature of the underlying surface and the atmosphere, the masses of matter absorbing radiation and the height of the upper cloud boundary) are illustrated by examples. The paper consists of an introduction, description of the method for determining the temperature of the underlying surface, the procedures for determining the vertical temperature profile, the method for determining the mass of absorbing matter, a discussion of the characteristics of the random radiation field and certain conclusions. The principal conclusion drawn from the study is

ACCESSION NR.: AP4034795

that in the interpretation of radiation measurement data from satellites it is necessary to use certain determined physical dependences between the characteristics of the radiation field and atmospheric parameters, using statistical relationships for this purpose. A problem of the greatest importance is selection of physically sound methods for taking the absorptivity and emissivity of the atmosphere and underlying surface into account; this is particularly important in the solution of inverse problems. In solution of such problems it also is very important to find algorithms ensuring the stability of solution of the inverse problem. With respect to the use of statistical methods the most important problem is determination of the parameters of radiation fields, thereby making it possible to use the most economical and summary methods in describing the enormous volume of data obtained from satellites. The solution of these problems is dependent on improvement of experimental methods and increase in the sensitivity of measurement instruments. "In conclusion the author thanks G. V. Rozenberg for valuable comments during discussion of the problems discussed in the paper". Orig. art. has: 5 formulas, 6 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 23Dec63 DATE ACQ: 20May64 ENCL: 00

SUB CODE: AA NO REF SOV: 014 OTHER: 009

Card 2/2

L 21756-65 EWT(1)/EWG(v)/FCC/EWA(h) Po-4/Pe-5/Pq-4/Pae-2/Pt-10/Peb/Pi-4
GW

ACCESSION NR: AP5000170 S/0293/64/002/006/0881/0900

AUTHOR: Koprova, L.I., Malkevich, M.S.

TITLE: The thermal radiation of a spherical atmosphere

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 6, 1964, 881-900

TOPIC TAGS: atmospheric thermal radiation, atmospheric outgoing radiation, ozone, mesosphere, water vapor absorption band

ABSTRACT: The authors have solved the thermal radiation transport equation for the case of a spherically symmetrical atmosphere. The solution is expressed by the transmission function, averaged for individual spectral intervals. An approximation of the transmission function is proposed which ensures its reliable extrapolation into the region of large masses of absorbing matter. The authors have also derived expressions for determination of the intensity, flux and increment of radiation escaping from the upper boundary of a spherical atmosphere, both for averaged parameters of the atmosphere and for their random variations. In addition, the authors have computed the angular variation of the intensity of thermal radiation in different parts of the spectrum escaping from the upper boundary of a pherically symmetrical atmosphere. Also considered is the variability

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of the field of outgoing radiation, determined by variations in the temperature of the underlying surface and atmosphere, cloud cover and other factors determining outgoing radiation. Although it is noted that the real field of the earth's radiation is not spherically symmetrical and that the transmission function has not been computed sufficiently reliably for large masses of absorbing matter, the results presented in the paper lead to the following basic conclusions. The field of radiation escaping from the upper boundary of the atmosphere into universal space is most homogeneous and isotropic in the parts of the spectrum corresponding to the central parts of the absorption bands. In intervals of atmospheric transparency the radiation field is less homogeneous and isotropic and most clearly reflects the varied temperature pattern of the underlying surface. The intensity of outgoing radiation for broad spectral intervals decreases with approach of the direction of sighting to the horizon ("darkening" of the limb of the planetary disk); in the central parts of the absorption bands, on the other hand, there is a "brightening" of the limb. An exception is the absorption band of ozone in which the radiation intensity decreases toward the limb and has a noticeable jump on the earth - atmosphere discontinuity. The angular distribution of the intensity of outgoing radiation is not sufficiently sensitive to variations in the vertical distribution of atmospheric temperature for it to be used for determination of temperature profiles. The thermal nonhomogeneity of the underlying surface and clouds, which

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ACCESSION NR: AP5000170

4

primarily will determine the angular structure of the field of outgoing radiation, apparently will exclude the possiblity of reliable solution of this problem. The variability of the field of outgoing radiation is related for the most part to variations in the temperature of the underlying surface and clouds. The vertical distributions of temperature and the content of absorbing matter exert a lesser influence on the checkered character of the field of outgoing radiation. The radiation of the mesosphere itself makes an appreciable contribution to the absorbing matter exert a lesser influence on the checkered character of the field of outgoing radiation. The radiation of the mesosphere itself makes an appreciable contribution in the field of the absorption bands of water vapor and carbon dioxide. "In conclusion the authors express deep appreciation to G. V. Rozenberg for discussion of certain of the results of this study and also to V. G. Alekseyev, L. V. Medvedeva and L. N. Markina for preparation of the program and making calculations on the "Ural-1" computer." Orig. art. has: 30 formulas, 8 figures and 2 tables.

ASSOCIATION: None

SUBMITTED: 17Mar64 SUB CODE: ES ENCL: 00

NO REF SOV: 010 OTHER: 010

Card 3/3

L 34956-65 EWT(1)/FCC GW

S/0362/65/001/001/0027/0032

ACCESSION NR: AP5007594

AUTHOR: Koprova, L. I.; Malkevich, M. S.

TITLE: Empirical orthogonal functions for optimum parametrization of temperature and humidity profiles

SOURCE: AN SSSR. Izvestiya. Fizika atmosfery i okeana, v. 1, no. 1, 1965, 27-32

TOPIC TAGS: temperature profile, humidity profile, parameter presentation, atmospheric physics, empirical function, statistical othogonal analysis

ABSTRACT: Systems of empirical and orthogonal vectors assuring optimum determination of vertical distributions of temperature and specific humidity in the atmosphere are determined on the basis of statistical processing of data from aerological sounding over the city of Bismark (46° 50' N, 100° 35' W) and from the ship "S" (52° 45' N, 35° 30' W) in July and January. Certain properties of orthogonal vectors and their universality are considered. Orig. art. has: 4 figures, 2 tables and 3 formulas.

ASSOCIATION: Institut fiziki atmosfery Akademiya nauk SSSR (Atmospheric physics institute, Academy of sciences, SSSR)

Card 1/2

L 34956-65

ACCESSION NR: AP5007594

SUBMITTED: 16Jun64 ENCL: 00 SUB CODE: ES

NO REF SOV: 005 OTHER: 001

Card 2/2

MALKEVICH, M.S.

Relation between the characteristics of the vertical structure of the long-wave radiation field and the temperature and humidity fields. Izv. AN SSSR. Fiz. atm. i okeana 1 no.10:1039-1049 0 '65. (MIRA 18:10)

1. Institut fiziki atmosfery AN SSSR.

TITLE: The role of vertical temperature and humidity profiles during the determination of the Earth's surface temperature from outgoing radiation

SOURCE: AN SSSR. Izvestiya. Fizika atmosfery i okeana, v. 1, no. 7, 1965, 703-714

TOPIC TAGS: weather satellite, window transparency measurement, atmospheric temperature, atmospheric humidity, atmospheric radiation absorption

ABSTRACT: Satellites of the "Tiros" series carried out measurements of the Earth's surface temperature utilizing radiation leaving the Earth through the so-called "transparency window" existing in the 8-12 μ range. However, due to various absorption effects, the errors of such measurements may be as high as 20C. Consequently, a method for the determination of the true surface temperature from satellite measurements of outgoing radiation is proposed. It is based on the use of the vertical temperature and humidity structure. Following an outline of the theory, the authors present some examples of such profiles and

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ACCESSION NR: AP5019152

vertical profiles of temperature-humidity mutual correlation coefficients for different regions of the Soviet Union and the rest of the world. Examples are worked out illustrating the proposed method; however, the general use of the proposed method presupposes further extensive research for the collection of pertinent data, particularly relative to vertical profiles in the presence of cloudiness. Orig. art. has: 25 formulas, 2 figures, and 5 tables.

ASSOCIATION: Institut fiziki atmosfery, Akademiya nauk SSSR (Institute of the Physics of the Atmosphere, Academy of Sciences SSSR) Mirovoy meteorologicheskiy tsentr (World Meteorological Center)

SUBMITTED: 04Sep64 ENCL: 00 SUB CODE: SV, ES

NO REF SOV: 006 OTHER: 001

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L 62105-65 EWT(1)/EWG(v)/FCC/EWA(h) Pe-4/Pe-5/Pq-4/Pae-2/Peb/Pi-4 GW

UR/0293/65/003/003/0444/0456

ACCESSION NR: AP5015672

551.524.7:629.195.2:551.5

46

38

B

AUTHORS: Malkevich, M. S.; Tatarskiy, V. I.

TITLE: Determining the vertical temperature profile of the atmosphere by measuring the radiation, in the CO_2 absorption band, issuing from the upper boundary of the atmosphere

SOURCE: Kosmicheskiye issledovaniya, v. 3, no. 3, 1965, 444-456

TOPIC TAGS: radiation measurement, upper atmosphere, absorption band, temperature gradient

ABSTRACT: A method is proposed for determining the temperature profile of the atmosphere by measurements (by means of artificial satellites) in the CO_2 absorption band of radiation issuing from the upper boundary of the atmosphere. The method is based on analysis of the desired temperature profile by using a statistical orthogonal system of functions of the temperature field. For any desired precision of approximation the number of analytical members may be reduced to a minimum and may thus diminish the effect of instability when solving the reciprocal problem. Computation of the statistical properties of the vertical

temperature profile of the atmosphere (when solving this reciprocal problem of transfer theory) substantially increases the precision of the solution if the number of parameters describing the temperature distribution is restricted. Great precision is required in measuring when the temperature profile is reconstructed from measurements on radiation in different parts of the absorption band. If the number of spectral zones in which radiation values are measured is increased, the precision for each measurement may be reduced.

band. If the number of spectral zones in which radiation values are measured is increased, the precision for each measurement may be reduced. "In conclusion, the authors thank A. M. Obukhov for valuable counsel, and also K. S. Glazov for making the computations." Orig. art. has: 4 figures, 5 tables, and 28 formulas.

ASSOCIATION: none

SUBMITTED: 04May64 ENCL: 00 SUB CODE: ES, NP

NO REF SOV: 004 OTHER: 011

Card 2/2

L 34808-66 EWT(l)/FCC GW/WS-2

SOURCE CODE: UR/0362/66/002/006/0585/0594

31
B

ACC NR: AP6022217

AUTHOR: Gorchakova, I. A.; Malkevich, M. S.

ORG: Institute of Physics of the Atmosphere, AN SSSR (Institut fiziki atmosfery AN SSSR)

TITLE: Change in outgoing radiation in the 15 μ carbon dioxide absorption band

SOURCE: AN SSSR. Izvestiya. Fizika atmosfery i okeana, v. 2, no. 6, 1966, 585-594

TOPIC TAGS: ~~vertical~~ temperature distribution, spectral absorptivity , carbon dioxide, integral equation, atmospheric temperature, upper atmosphere radiation, atmospheric pressure, band spectrum [12]

ABSTRACT: Vertical temperature distribution in the atmosphere is computed mathematically on the basis of the pressure and the radiation entering space from the upper surface of the atmosphere, which is measured in the 15 μ spectral band, known as the carbon dioxide absorption band. The outgoing radiation is computed using an integral equation containing Planck's radiation function, and the absorption function is determined from an exponential integral equation. The heterogeneity of the atmosphere is compensated for by the effective mass of carbon dioxide, which is introduced. The absorption function, computed under such conditions, is represented graphically. This function depends upon the values of the parameters used. A table in the original article shows temperature values at various pressure levels computed using various absorption functions. Changes in the spectral distribution of

UDC: 551.521.3

Card 1/2

L 34808-66

ACC NR: AP6022217

outgoing radiation depend not only upon temperature variations in the vertical section, but also upon the changing concentrations of carbon dioxide and water vapor in the atmosphere. Bands of carbon dioxide absorption overlap water vapor bands. This superposition was computed in order to correct the temperature at certain pressure levels. Orig. art. has: 2 tables, 9 figures, and 7 formulas. [EG]

SUB CODE: 04/ SUBM DATE: 10Feb66/ ORIG REF: 002/ OTH REF: 004/ ATD PRESS: 5031

Card 2/2

L 09183-67 EWT(1) GW SOURCE CODE: UR/0362/66/002/004/0367/0379
ACC NR: AP7002320

26

AUTHOR: Malkevich, M. S.

ORG: Institute of Physics of the Atmosphere (Institut fiziki atmosfery AN SSSR)

TITLE: Spatial structure of the field of terrestrial long-wave radiation

SOURCE: AN SSSR. Izvestiya. Fizika atmosphery i okeana, v. 2, no. 4, 1966, 367-379

TOPIC TAGS: cloud cover, earth radiation

ABSTRACT: M. S. Malkevich has determined the relations between the statistical characteristics of the spatial structure of the field of terrestrial long-wave radiation and the temperature, humidity and cloud cover fields. He describes the mechanism of filtration of high-frequency variations of nonhomogeneities of meteorological fields during the transmission of radiation in the atmosphere and with averaging for directions. Orig. art. has: 2 figures and 31 formulas. [JPRS: 36,285]

SUB CODE: 04 / SUBM DATE: 11Nov65 / ORIG REF: 006

UDC: 551.521.2

Card 1/1 nst 0925 0597

LIPOVSKIY, V.M., kand.tekhn.nauk; ZAVDOKIMOV, V.A.; KURSHIN, A.S.;
MALKEVICH, P.P.

The E-15-14 excavator. Mekh. stroi. 18 no. 2:25 F '61.
(MIRA 14:2)

1. Glavleningradskoy.
(Excavating machinery)

B/P

87920

S/191/60/000/004/001/015
B016/B058

15.8115

AUTHORS: Malkevich, S. G., Chereshkevich, L. V.

TITLE: Fluorostyrenes. Report I. Synthesis of p-Fluorostyrene and 2,5-Difluorostyrene

PERIODICAL: Plasticheskiye massy, 1960, No. 4, pp. 1-4

TEXT: The authors report on the synthesis of styrenes fluorinated in the ring: p-fluorostyrene and 2,5-difluorostyrene, as well as on their polymerization to polyfluorostyrenes. In their experiments they wanted to find out how this method of fluorination affects the properties of the polymers. For this purpose, they synthetized the initial and intermediate products: fluorobenzene was obtained by the diazonium fluoroborate method from aniline (Ref. 20). The yield amounted to 54% related to aniline; p-difluorobenzene was produced in several stages via p-nitrofluorobenzene → p-fluoroaniline → diazonium fluorophenyl fluoroborate. The synthesis of the intermediate products was carried out as follows: p-nitrofluorobenzene: from fluorobenzene by nitration with KNO_3-H_2SO_4 mixture; p-fluoroaniline: from p-nitrofluorobenzene by reduction with iron turnings and HCl. The yield was

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87920

Fluorostyrenes. Report I. Synthesis of p-Fluorostyrene and 2,5-Difluorostyrene

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B016/B058

79% related to nitrofluorobenzene. The conversion of p-fluoroaniline into p-difluorobenzene was also obtained by the diazonium fluoroborate method and did not notably differ from the production of p-fluorobenzene from aniline. The yield was 44% related to fluoroaniline. p-fluorostyrene and 2,5-difluorostyrene were obtained from fluorobenzene and p-difluorobenzene, respectively. These were converted into acetophenones which were subsequently reduced to carbinols. p-fluorostyrene and 2,5-difluorostyrene, respectively, were formed by dehydration of the carbinols. The authors describe next the synthesis of the p-fluoroacetophenone of 2,5-difluoroacetophenone (for the first time), of p-fluorophenylmethyl carbinol, 2,5-difluorophenylmethyl carbinol (for the first time), 2,5-difluorostyrene (for the first time), and difluorobromobenzene (for the first time). The constants and properties of all substances were described. A. V. Pavlova is thanked for her participation in the studies. There are 20 references: 6 Soviet, 10 US, and 6 German.

X

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87877

S/191/60/000/005/002/020
B004/B064

15.8115

AUTHORS: Malkevich, S. G., Chereshkevich, L. V.

TITLE: Fluoro Styrenes. Information II Polymerization of Parafluoro Styrene and 2,5-Difluoro Styrene

PERIODICAL: Plasticheskiye massy, 1960, No. 5, pp. 3 - 5

TEXT: This paper discusses the block- and emulsion polymerization of p-fluoro styrene and 2,5-difluoro styrene, and compares the properties of these polymers with those of polystyrene and poly-2,5-dichloro styrene. Block polymerization took place at 50° and 70°C in sealed glass ampuls with initiator (benzoyl peroxide) or without initiator. Solid, colorless transparent polymers were obtained which externally did not differ from polystyrene and polydichloro styrene. With respect to their rate of polymerization, the compounds studied showed the following order: dichloro styrene > difluoro styrene > fluoro styrene, styrene. The molecular weights depended on the polymerization temperature. Emulsion polymerization took place in water with 0.2 % ammonium persulfate as initiator, and 1 % sodium oleate as emulsifier. The ratio between monomer and water was

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87877

Fluoro Styrenes. Information II. Polymerization of Parafluoro Styrene and 2,5-Difluoro Styrene S/191/60/000/005/002/020 B004/B064

between 1:5 and 1:10. Powdery polymers had a molecular weight of between 100.000 and 230.000, and could be molded into transparent, colorless plates. Colored polymers of low molecular weight were obtained with the use of hydrogen peroxide as initiator and "Mopanzine sulfonic acid" as emulsifier. As in block polymerization, polystyrene and polydifluoro styrene had a considerably higher molecular weight than polyfluoro styrene and polydichloro styrene. The heat resistance according to Vicat depended on the monomer content of the product. In this respect, fluorine-containing polymers were not superior to polystyrene, and did not reach the same heat resistance as poly-2,5-dichloro styrene. The authors thank A. V. Pav... for her collaboration. There are 7 tables and 1 Soviet reference.

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83411

S/191/60/000/006/003/015
B004/B054

5.3830

AUTHORS: Malkevich, S. G., Tarutina, L. I., Chereshkevich, L. V.

TITLE: Spectroscopic Investigation of the Structure and Thermal Aging of the Copolymer From Tetrafluoro Ethylene and Ethylene

PERIODICAL: Plasticheskiye massy, 1960, No. 6, pp. 5 - 7

TEXT: The authors studied the thermal stability of the copolymer $(-CF_2-CF_2-CH_2-CH_2-)_n$. Films 60-80 μ thick or powdered copolymer were heated to 200, 240, 275, and 290°C in the presence of air or in vacuum (10^{-3} torr). The structural changes were observed by means of an infrared absorption spectrum taken on an ИКС-11 (IKS-11) apparatus with NaCl prism. At 200°C, the spectra were not changed even after 300 h. The authors found that the copolymer samples exhibited differently strong branching which became evident in the intensity of the 1390 cm^{-1} band (deformation oscillations of the CH_3 group)(Fig.1). After 5 h of heating to 275°C,

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branched samples lost in weight up to 4%. Fig. 2 shows the weight losses as a function of the intensity of the 1390 cm^{-1} band. Unbranched samples were stable. Fig. 3 shows that the weight loss depends on the extent of the contact area with air. Half an hour of milling of branched samples at 150°C accelerated aging, the weight loss rose to 10%, whereas unbranched samples remained unchanged even after 1 h of milling. The difference between branched and unbranched samples becomes obvious at 240°C. While the latter show an unchanged spectrum, the spectrum of branched samples shows new bands (Fig. 4): 1615 cm^{-1}, 1780 cm^{-1} (acid groups), 1755 cm^{-1} (C=O valence oscillations of the carboxyl group), and a not identified 1677 cm^{-1} band. Heating to 290°C accelerates the oxidation process (Fig. 5) while hydrogen fluoride is set free. The separation of HF becomes evident in new absorption bands: 1720 cm^{-1} (C=C stretching vibrations), 1850 cm^{-1} (dehydrogenated fluorine groups), and 3116 cm^{-1} (stretching vibrations of the =C-H group); thus, the authors assume a

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formation of -CF=CH- groups. The destruction also becomes evident in a reduction of viscosity of the melt and a lowering of the softening temperature (Table). No double bonds were observed when heating in vacuo. Viscosity and softening temperature increased. The authors thank Professor V. M. Chulanovskiy for advice, I. A. Marakhonov for viscosity determinations, A. I. Kornyushina for production of preparations, and G. I. Lapotnikova for taking the spectra. There are 5 figures, 1 table, and 4 references: 2 Soviet, 1 US, and 1 British.

21136

15 8560 2209, 1372, also 1043, 1477

S/190/61/003/004/011/014
B101/B207

AUTHORS: Kabin, S. P., Malkevich, S. G., Mikhaylov, G. P., Sazhin, B. I. Smolyanskiy, A. L., Chereshkevich, L. V.

TITLE: Study of the dielectric losses and polarization of some fluoroplasts

PERIODICAL: Vysokomolekulyarnyye soyedineniya, v. 3, no. 4, 1961, 618-623

TEXT: This paper studies the effect of crystallization upon the dielectric constant ε and tan δ of the dielectric losses. Substances with the following parameters were studied:

Substance:	Denotation	d_{20^o}, g/cm^3	ε, 10^5 cps, 0°C	tan δ, 10^5 cps, 0°C	melting point, °C
polyvinylidene fluoride	F-2	1.86	7.0	0.19	180
copolymer from tetrafluoroethylene and fluorovinylidene 1:4	CF-1	1.86	6.4	0.18	145

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B101/B207

Study of ...

Substance:	Denotation	d_{20^0}, g/cm^3	ε, 10^5 cps, 0°C	tan δ, 10^5 cps, 0°C	melting point, °C
ditto, ratio 1:2	CF-2	1.91	8.6	0.09	160
ditto, ratio 1:1	CF-3	1.98	8.0	0.08	205

ε and tan δ were measured between -150°C and melting point of the polymer at frequencies of 5-10^7 cps on 0.1-0.5 mm thick samples according to a method described in Ref. 4 (G. P. Mikhaylov, B. I. Sazhin, Vysokomolek. soyed., 1, 9, 1959; Zh. tekhn. fiz., 25, 2186, 1955). The maximum error was less than 10%. Fig. 1 shows ε and tan δ as a function of temperature. The maxima occurring therein which are caused by relaxation, were also observed when tan δ was a function of frequency. Since tetrafluoroethylene has a symmetrical molecule with small dipole moment, the increase of ε and tan δ in the copolymers, is due to the polarity of vinylidene fluoride. Three ranges of dielectric losses owing to relaxation were observed. 1) high-frequency relaxation at CF-2 and CF-3 in the range of from -180- -100°C

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Study of ...

(maximum of tan δ); 2) medium-frequency relaxation in all substances investigated in the range of from -50- +50°C, and 3) low-frequency relaxation at +100- +200°C in all substances. Experiments carried out with hardened CF-3 showed a falling of high-frequency relaxation and a rise of middle-frequency relaxation as compared to the non-hardened polymer. Fig. 4 shows the frequency of the maximum of high-frequency and medium-frequency relaxation as a function of 1/T. The discussion of the experimental data led to the following conclusions: 1) The dielectric properties in the range of from 100-200°C cannot be explained by relaxation only. The structural transformations must also be taken into account. 2) The maxima of low-frequency relaxation lie close to the melting point of the polymers concerned, thus due to thermal motions in the crystalline phase. 3) The dielectric losses decrease with the degree of crystallization of the copolymers. 4) Orientation of polymers, i.e., increase of the degree of crystallization, may be accompanied by a considerable increase of ε. There are 4 figures, 1 table, and 11 references: 8 Soviet-bloc and 4 non-Soviet-bloc. The 2 references to English-language publications read as follows: M. E. Convoy et al., Rubb. Age, 76, 543, 1955; A. H. Willbourn, Trans. Faraday Soc., 54, 717, 1958.

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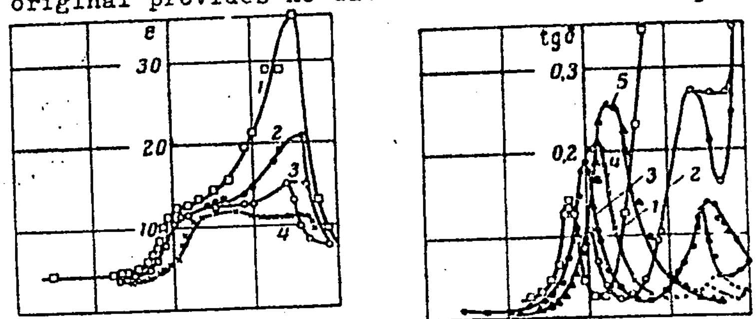
B101/B207

Study of ...

SUBMITTED: August 17, 1960

Fig. 1. Dielectric constant ε and tan δ of fluoroplasts as a function of temperature. Legend: a) F-2; ε: 1) 500; 2) $5\cdot10^3$; 3) $2\cdot10^4$; 4) $8\cdot10^5$ cps; tan δ: 1) 500; 2) $2\cdot10^4$; 3) $8\cdot10^5$; 4) $8\cdot10^6$ cps; б) CF-1; ε: 1) 500; 2) $2\cdot10^4$; 3) $8\cdot10^5$ cps; tan δ: 1) 500; 2) $2\cdot10^4$; 3) $6\cdot10^4$; 4) $1.5\cdot10^5$; 5) $1.5\cdot10^6$; 6) $1.2\cdot10^7$ cps; в) CF-2; ε: 1) 10^3; 2) $2\cdot10^4$; 3) $1.5\cdot10^5$ cps; tan δ: 1) $2\cdot10^4$; 2) $6\cdot10^5$; 3) $1.5\cdot10^5$; 4) $1.5\cdot10^6$; 5) $1.2\cdot10^7$ cps; г) CF-3; ε: 1) 10^3; 2) $2\cdot10^4$; 3) $1.5\cdot10^5$ cps; tan δ: 1) 500; 2) $5\cdot10^3$; 3) $6\cdot10^4$ cps [Abstracter's note: The original provides no data for curves 4) and 5)].

a



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21136

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B101/B207

Study of ...

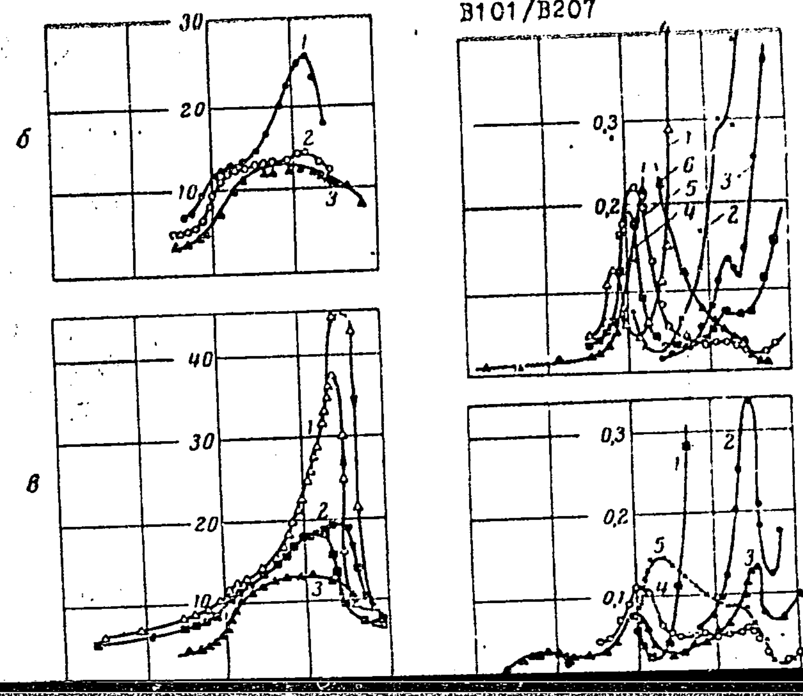

Fig 1 cont.

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