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UNCLASSIFIED— SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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PLEASE NOTE

This report presents unevaluated information on Soviet Bloc activities in the International Geophysical Cooperation program from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

"INTERNATIONAL GEOPHYSICAL COOPERATION" PROGRAM -- SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Space Biology -- Re-entry Problems

The authors of this article state that mankind began to write a new page in the cultural development of the human race when the Soviet Union successfully launched its artificial earth satellites into outer space. Lively discussion is presently going on about sending men cruising among the planets and how to bring them back to earth.

The Soviet scientists have been analyzing the Sputnik II space dog's (Layka) principal physiological reactions. This information was radio-relayed to earth. Bioelectric phenomena occurring in the brain and muscles, respiratory movements of the chest, muscle contractions, and gland secretions in the occupant of an earth satellite's cabin can also be transmitted telemetrically with the aid of special pick-offs which convert mechanical processes into corresponding electric signals. It will not be surprising that physiologists in time may be able to watch an oscillograph in the laboratory and analyze the conditioned reflex of an animal flying through space in an artificial earth satellite.

We have arrived at the point where it has become necessary to define a new science, the science of space biology, and to outline its course of development.

Although space biology is in its infancy, the subject matter embraced by it is enormous. Some of the most significant problems embraced by space biology are the investigation of biological action of the varied and unusual factors present in outer space; the search for methods and means of maintaining the normal vital functions of a living organism both in outer space and on other planets; and the investigation of the forms of life that may exist on other planets.

Space biology has been growing rapidly in the past few years. This is due to the fact that progress in rocket engineering has been very great. Space medicine is a branch of space biology. The principal function of space medicine is to find ways to maintain the normal vital functions of the human organism in outer space.

There are two kinds of investigations carried on by specialists in space medicine: the first consists of laboratory experiments to determine the effects of acceleration, vibration, low barometric pressure, and prolonged stay in a small cabin; the second consists of medical and biological studies in rockets, balloons, and airplanes.

Information about the effects of relatively protracted action of various types of radiation on the human organism and the work of instruments at high altitudes was obtained from the Soviet artificial earth satellites. From a biological point of view, the information obtained from artificial earth satellites is the best information available.

Like many other new fields of knowledge, space biology is developing at a point of juncture of many sciences. Progress in space biology requires close cooperation between biologists, medical specialists, physicists, and engineers.

At present, it is possible to obtain all necessary information about a living occupant of an artificial earth satellite by means of a radio telemetering device.

Research work that has been done under laboratory conditions has rendered invaluable service. Important information was obtained about the biological action of low barometric pressure on a living organism, oxygen deficiency, the effects of acceleration, etc. Information gathered in laboratories made it possible to imagine the nature of phenomena that occur in a living organism flying through space and to develop protective equipment. As a result of research, aviation received oxygen supply apparatus, high-altitude survival suits, altitude helmets, anti-G and catapulting devices, hermetic cabins, and other equipment which reliably protects air crews from the adverse conditions encountered in space.

Further progress in the conquest of space by man, as was visualized by K. E. Tsiolkovskiy, appears to be closely connected with the development of rocket technology.

Conditions during flights in rockets differ substantially from flights in airplanes and balloons. During take-off, the animal in a rocket is subjected to the action of acceleration, vibration, and noise. After the engine ceases to function, a sensation of weightlessness is felt. This is reached when an object's outward speed or centrifigual force exactly balances and cancels out the downward pull of gravity exerted by the earth. During descent, when the rocket re-enters the dense layers of the atmosphere, friction is created and, when the parachutes open up, the living occupant of the rocket experiences the effects of braking. The frame of the rocket heats up, and the temperature of the air inside the cabin goes up.

Results of research showed that flight in rockets at altitudes of 100-110 kilometers can be endured by animals in a very satisfactory manner. However, while the engine of the rocket was operating, and during re-entry of the cabin, with the animal in it, into the dense layers of atmosphere, an increase in blood pressure and respiration frequency was noted.

Subsequent experiments, in which animals went up to an altitude of 200-212 kilometers, showed that changes took place in a living organism at that altitude. In evaluating the effects of various flight factors the Soviet scientists come to the conclusion that braking the fall of the rocket produces the greatest adverse effect on the animals. After landing, however, the animals seemed to be sufficiently calm: they reacted to situations around them in a lively manner, responded readily when called, and ate avidly.

Soviet scientists have been paying particular attention to solving the re-entry problem. This can be approached in two ways: by detaching the accupant, together with the cabin he is in, from the rocket; or by catapulting the occupant of the cabin in a special cart with an altitude suit protecting him from external conditions. Results of experiments with animals, sent up to altitudes of 100, 212, and 450 kilometers demonstrated the reliability of the safety devices developed in the USSR.

Exceptionally important was the information obtained from the second Soviet artificial earth satellite. In contrast to altitude rockets which, in essence, only probe the upper layers of the atmosphere, the second Soviet artificial earth satellite offered the possibility of observing Layka's behavior and physical conditions for a protracted period of time while the satellite was in its orbit several thousand kilometers from earth's surface.

The hermetic cabin in the second Soviet earth satellite was equipped with a special bed for the animal, and devices which, with the aid of highly active chemical compounds, removed carbon dioxide and water vapors and supplied oxygen. A feed box was placed before the animal. This feed box contained the necessary amount of jellylike substance and water. A device in the form of a rubber garment was used to carry away waste products.

Important data about respiration and circulation was transmitted to earth by means of a radio telemetering device. Deciphering and analysis of data received showed that, during the active portion of the flight, the general character of the changes in the physiological functions of the animal were approximately the same as those observed earlier in experiments on animals under laboratory conditions. The animal showed no signs of illness indicating that it endured all the stress factors during the active portion of flight.

Layka was the first living organism to experience a long period of weightlessness. It was found that soon after the artificial earth satellite was in its orbit, Layka's electrocardiogram, pulse, and respiration rate were almost normal.

The next necessary step in medical and biological research with regard to animals will be the construction of an artificial earth satellite which would guarantee conditions for the safe return of experimental animals back to earth. This will open up new vistas for expanding all methods of research and pave the way for knowledge as to the effects of such little-known factors as cosmic radiation and other types of radiation on a living organism.

Re-entry is one of the most complicated problems in cosmonautics. Aerodynamic heating arising when a flying object enters the dense layers of atmosphere at a high rate of speed is one of the most difficult problems. If the speed of the vehicle is five times greater than sound, its nose cone becomes heated to 1,000 degrees centigrade. This may increase the temperature in a hermetic cabin to the point which no human being can endure. Results of special experiments showed that when air humidity is 30 percent, a temperature of 100 degrees centigrade can be tolerated by humans for 30 minutes, but a temperature of 200 degrees centigrade can be tolerated for only 3 minutes. Temperatures above 200 degrees centigrade would rapidly cause burns to the unprotected parts of the body, particularly the eyes.

Another major obstacle of re-entry is the protracted action of acceleration which occurs with a decrease in the velocity of the rocket after it enters the dense layers of the atmosphere. It is known now that accelerations can be tolerated more easily when they act in a direction perpendicular to the long axis of the human body (from chest to back or vice versa). However, to maintain a definite level of efficiency, it is necessary that descent be such that the effects of acceleration be minimized. Under any other conditions of descent it would be necessary to use complicated anti-G devices which help increase human tolerance to acceleration.

Here is one idea of solving the re-entry problem. Man could abandon the space vehicle in a detachable hermetic cabin which possesses aerodynamic properties. At first, reduction in speed could be attained by reactive motors which would create thrust opposed to the direction in which the cabin is moving. When the speed is reduced to a certain point, braking parachutes open up. After that, the main parachute system opens up, providing a smooth descent of the cabin with its human occupant back to earth. Of course, all possible ideas of re-entry will have to be tried on experimental animals first.

The cabin of a space vehicle must meet the physiological and psychological needs of man. It is necessary to devise hermetic cabins which are very comfortable and in which suitable conditions exist for normal activity. Special automatic equipment will have to be installed in the hermetic cabin which would maintain proper gaseous composition, air pressure, temperature, and humidity. Automatic air regenerating equipment should be able to regulate properly the flow of oxygen and the elimination of carbon dioxide.

Another group of automatic devices is needed to protect a living organism in a hermetic cabin from the adverse effects of sharp changes in air temperature, acceleration, etc. Modern science and technology should have no difficulty in designing equipment for the maintenance of hygienic conditions in a hermetic cabin.

The most difficult problem which remains to be solved is whether a vehicle flying at high speed can maintain its course without any help from its human occupant. No perfect guidance systems have yet been devised which would keep a vehicle flying at high speed exactly on its course.

To guide a vehicle flying at great speed requires visual information from a great distance away so that the human occupant of the vehicle could have sufficient time to make a decision. However, sense organs, particularly the visual organs, do not always offer the possibility to evaluate situations sufficiently, rapidly enough, and correctly. Experience has shown that to evaluate an ordinary situation while flying, approximately 1.5 seconds are required; during that time, the cosmonaut would travel more than 10 kilometers. It is evident that no human being could possibly react in time when approaching some large object such as a meteor. It is not possible to imagine that a human, traveling through space at a high speed near some planet, could recognize the huge features of a planet (no more than a human could distinguish a railroad bed looking out of the window of a fast moving train).

The fact that physiological and psychological reactions of man are much slower than the speed of the flying vehicle limits the possibility of man's guiding it to its destination. Special guidance systems are, therefore, necessary. It is possible to increase considerably the scope of visibility by means of optical devices and thereby compensate inadequacies of the central nervous system.

Man's flight into outer space will differ from any of the flights of animals under laboratory conditions, because the pilot undoubtedly will actively participate in guiding the vehicle by means of instruments, and carry on communication by radio with the earth. All this make it necessary to continue research to ascertain the physiological peculiarities of man's flight in cosmic space.

There are limits to man's tolerance to stress encountered in outer space. In the first interplanetary travels, both the physiological and psychological stress will be especially great.

However, fear will be canceled by patriotism and the realization of the great scientific significance of cosmic space flight to the entire human race.

Some scientists abroad, particularly US scientists, place great importance on the protracted period of isolation which a cosmonaut will have to experience in a small cabin. They predict the possibility of the development, under such conditions, of a feeling of "detachment." A well-publicized experiment was conducted not so long ago in which an airman, D. Farrell, was isolated for 7 days in a hermetic cabin. The main purpose of this experiment, some specialists insisted, was to find out whether a human is able to withstand complete isolation for 7 days in a small steel cabin without going out of his mind.

The US press attached great significance to this experiment. It claimed that this was the preliminary step before man takes off into outer space. From the psychological point of view, however, the value of the experiment was not so great as was imagined, because Farrell knew that he was never in real danger; physicians watching over him were only a few steps away. The experiment could have been discontinued at any moment and Farrell could have been released any time he wanted to.

Psychological investigations conducted during initial parachute jumps by airmen, after being catapulted from airplanes, offer rich material for the study of the peculiarities of the behavior of a man subjected to great emotional stress. This data may be utilized both in the selection of future cosmonauts and in their training.

The experience of D. Simons, who went up in a single-seated hermetic cabin of a balloon to an altitude of 32,000 meters and stayed for 24 hours, is of definite interest. Simons faced considerable danger during the entire period of time that he remained aloft. He was conscious of the existence of this danger. He had to watch various instruments and guide the balloon. After the flight was over, Simons reported that he felt considerable emotional tension during the time he was waiting for the balloon to go up, and during the period of "soaring on the ceiling," when he experienced the full effects of environmental conditions. He said that he felt as if he had been in some sort of unusual state which was underlined by such symptoms as inability to easily discern the sky above, peculiar color of the horizon, and presence of an unusual and hard-to-discern form of the earth's surface below.

On the basis of all these experiments and psychological investigations, it may be assumed that it is quite possible that the first cosmonauts will be experienced test pilots who possess the capacity to maintain a high level of efficiency in the presence of considerable emotional tension and are able to make decisions rapidly under unusual and continually changing flight conditions.

Man's successful flight into cosmic space still requires intensive physiological research with animals in artificial earth satellites and cosmic rockets which can be returned to earth. Rocket technology is developing so rapidly that it is evident that humans will begin to fly into cosmic space in the not-too-distant future.

The authors of this article quote the forecast of K. E. Tsiolkovskiy: "Mankind will not remain on earth forever; but in his pursuit of light and space, man will at first timidly go beyond the earth's atmosphere and later conquer all of solar space." ("Biology of Flights into Cosmic Space," by Candidates of Medical Sciences, O. G. Gazenko and V. B. Malkin, Nauka i Zhizn', No 11, Nov 58, pp 17-22)

Deflection of a Satellite From an Elliptic Orbit

A study of the problem of determining the deviation of a satellite from the elliptic orbit on which it would have moved in the absence of air resistance is presented. As the disturbing force, only drag is taken into account, and, considering its influence weak, the method of small disturbances is applied by the authors in solution of the problem. Given the elements of modulus and eccentricity for an undisturbed orbit, the constructional parameter of the satellite and the value of density as a function of altitude, the descent and change in the period of revolution of the satellite may be determined by applying the functions derived in this work.

The work was performed at the Leningrad Military-Mechanical Institute under the Chair of Aerogasdynamics. ("Descent of a Satellite on an Elliptic Orbit," by A. I. Barabanov and B. A. Rayzberg; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Aviatsionnaya Tekhnika, No 4, 1958, pp 3-8)

Possible New Soviet Satellite?

The Bochum Public Observatory in West Germany picked up radio signals on 20.5 megacycles at 1946 hours (local time) on 31 January. These signals, which differ from those of Sputnik III, were heard three times in the space of 104 minutes and always began several minutes after the signals of Sputnik III were heard. Sometimes they were heard for 18 minutes. The director of the observatory, Kaminski, thinks it possible that Soviet scientists might have been able to make Sputnik III furnish new information or that they have launched a new satellite. According to the DPA news agency, the Bochum Observatory has always supplied rapid and exact radio observations on most of the artificial earth satellites. ("Radio Signals Not Broadcast by Sputnik III," Brussels, La Libre Belgique, 2 Feb 59, p 1)

II. UPPER ATMOSPHERE

Distribution of Aurorae in the Circumpolar Region

The following is a full translation of the article "Distribution of Aurorae in the Circumpolar Region," by Ya. I. Fel'dshteyn, Arctic Scientific Research Observatory at Dikson.

An analysis of the distribution of morning magnetic disturbances at high-latitude observatories and observation points in the Central Arctic made it possible for A. P. Nikol'skiy (New "Soviet Investigations and Discoveries in the Central Arctic," Izvestiya Akademii Nauk SSSR, Seriya Geografiya, No 5, 1954; "Geophysical Investigations in the Soviet Arctic," Trudy Arkticheskogo Nauchno-Issledovatel'skogo Instituta, Issue 1, No 83, 1956; and "The Geographic Distribution of Magnetic Disturbances in the Circumpolar Region of the Arctic," Doklady Akademii Nauk SSSR, Vol 109, No 5, 1956) to arrive at the conclusion that a second zone of heightened intensity of magnetic disturbances and aurorae existed in the high latitudes. This zone in the Western part of the Soviet Arctic is located approximately in the geomagnetic latitudes of 78 to 80 degrees.

Independently of A. P. Nikol'skiy, Alfven (H. Alfven, "Theory of Magnetic Storms and Aurorae," Tellus, Vol 7, No 1, 1955), examining the motion of an ionized flow of solar particles in the magnetic field of the Earth's dipole, drew the conclusion of the possibility of the existence, at latitudes $\phi \sim 80$ degrees, of a second zone of increased frequency of aurorae, which in intensity should be considerably weaker than the basic auroral zone which is located in the geomagnetic latitudes of $\phi = 65$ to 66 degrees.

In the Dikson Island observatory we analyzed the geographic distribution of aurorae in the western part of the Soviet Arctic according to materials on a number of aurorae which were located in the longitudinal interval of 50 to 110 Degrees E longitude. It was shown that the form of vector diagrams for the frequency of aurorae, according to different azimuths of the polar stations Rudolph Island ($\phi = 72.40^\circ$), Nagurskaya Bay ($\phi = 72.3^\circ$), Tikhaya Bay ($\phi = 71.5^\circ$), and also the latitudinal distribution of the frequency of the aurorae in the morning hours leads to the assumption of the existence of a second zone of aurorae at latitudes of about $\phi = 78^\circ$ (Ya. I. Fel'dshteyn, Geographic Distribution of Aurorae in the Western Part of the Soviet Arctic, Problemy Arktiki, No 4, 1958).

Direct proof of the existence of an additional zone of aurorae in the circumpolar zone must be the appearance of radiance at the zenith in the points located directly under this zone. In the territory of the Soviet Union, the supposed second zone passes through the Central Arctic, therefore the observations of the Soviet scientific drift stations are of inestimable value.

The distribution of the frequency of aurorae in relation to the geomagnetic latitude for the winter of 1955-1956, according to materials of several polar stations, among them Drift Station Severnyy Polyus 5 (the little cross on the axis of the abscissa indicates the location of the station) is presented in the appended figure. Hourly visual observations, in which, in addition to the azimuth, the zenith distance of the aurorae are also noted, serve as starting materials.

It is known that the most frequent altitude of the lower limit for all forms of aurorae is 100 kilometers. Starting from this, according to the zenith distance of the aurorae and the coordinates of the observation points, the latitude of the points where the aurorae under consideration must be visible at zenith were calculated. One degree, according to the geomagnetic latitude, in which the observer is located corresponds to the zenith distance 52 degrees, whereas in the visual angle $\sim$ 17 degrees located near the horizon, a geomagnetic latitude of 7 degrees is included. Therefore, we limit ourselves to a detailed calculation of the latitudinal distribution of aurorae only in the interval of 5 degrees, according to the latitude centered at the latitude of the observation point.

For the unit area in which the amount of luminescence was calculated, a zone at one degree geomagnetic latitude was selected. Any radiance appearing at the corresponding zenith distance was admitted in the calculations. The total number of cases of the appearance of aurorae was taken as 100 percent. The frequency of the appearance of aurorae to the north and to the south at zenith distances of more than 72 degrees were designated in percent to the right and to the left of the curves.

Polar station Tadibe-Yaga is considerably south of the first zone of aurorae. Therefore, the aurorae are located chiefly near the northern horizon and the amount of radiance increases according to the degree of change in latitude from 59 to 63 degrees. The number of aurorae near the southern horizon is negligible.

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Cape Vykhodnyy is near the southern limit of the first auroral zone. The aurorae appeared more frequently at the zenith and somewhat more north of the zenith.

In Krasnoflot Island, the aurorae are mainly located in the southern half of the firmament near the zenith, which testifies to the nearness of the observation point to the zone of the aurorae. Aurorae were rarely observed on the northern horizon.

In the presence of only one auroral zone at a latitude 65-66 degrees the latitudinal distribution of the frequency of aurorae at the observation points, located considerably north of the zone, would have to disclose the pre-eminent appearance of the aurorae at the southern horizon with a constant decrease in the number of aurorae to the north.

The results of the observations at Severnyy Polyus-5 actually indicate a large number of aurorae on the southern horizon. The frequency of the aurorae gradually decreased to 74 degrees latitude, but sharply increased thereafter at the expense of a large number of aurorae in the zenith. The aurorae were practically absent in the northern azimuths.

The distribution of aurorae at Severnyy Polyus-5 is direct proof of the presence of a second zone of aurorae at 74-75 latitude.

The latitudinal distribution of the frequency of aurorae was constructed on the basis of hourly observations for aurorae at 54 high-latitude stations. The probability of the appearance of aurorae, which was calculated as the relation of the number of hours with an aurorae to the total number of hours of observations, was used as an index of activity. A magnetically-quiet day and a day of increase magnetic activity were examined separately.

The probability of the appearance of aurorae near the first zone depends essentially on the state of the magnetic field, increased from 44 percent on a magnetically quiet day to 80 percent on a magnetically stormy day. This difference gradually decreases to the north of the zone, and in the latitude of the drift of station Severnyy Polyus-3 ($\phi = 80.3^{\circ}$) there is practically no difference between magnetically-stormy days (7.4 percent) and magnetically quiet days (6.1 percent).

In the region of the second zone we only arranged observations by station Severnyy Polyus-5. The probability of the appearance of aurorae is 27.4 and 18.4 percent correspondingly, for stormy and quiet days. The considerably lower probability of the appearance of aurorae in the region of the second zone supports Alfven's theoretical deliberations on the lower intensity of electromagnetic processes in the second zone in comparison with the principal auroral zone.

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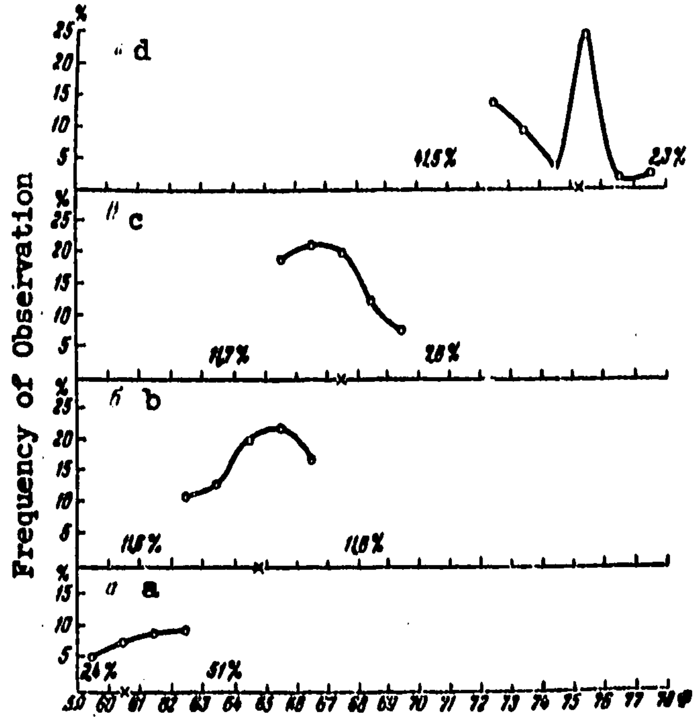

Location of Aurorae in relation to the geomagnetic latitude.

(a) Tadibe Yaga (70.4°N; 74.1°E; ϕ = 60.5°N);

(b) Cape Vykhodnyy (73.2°N; 56.7°E; ϕ = 64.8°N);

(c) Krasnoflot Island (78.6°N; 98.7°E; ϕ = 67.3°N);

(d) Severnyy Polyus-5 (86.5°N; 100°E; ϕ = 75.2°N).

("The Distribution of Aurorae in the Circumpolar Region," by Ya. I. Fel'dshteyn, Artic Scientific Research Observatory of Dikson; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 170-171)

Rocket Investigations of Short-Wave Radiation of the Sun

The explosive development of the technique of rocket investigations and the data of a great number of new experiments have caused many of the reviews on short-wave radiation of the Sun to be outdated. Also, the existing reviews do not reflect the latest achievements obtained during the International Geophysical Year, 1957-1958. An attempt to fill the gap in this field is made in an article by G. S. Ivanov-Kholodnyy, Institute of Applied Geophysics, Academy of Sciences USSR.

The following subject matter appears in the article:

1. The solar constant and the distribution of energy in the spectral region 2,000-70,000 Å.

2. The spectal region 2,000-3,000 Å and the Mg II radiation line.

3. Photographing the region of the spectrum from 1,000-2,000 Å.

4. Distribution of energy in the region of the spectrum λ = 1,500 Å.

5. Energy of x-ray radiation of the Sun.

6. Short-wave radiation of chromospheric flares.

7. Lα contour lines and the distribution of the intensity of Lα on the solar disc.

8. The discovery of ultraviolet radiation of nonsolar origin.

A list of 12 Soviet and 67 Western references is given. ("Rocket Investigations of the Short-Wave Radiation of the Sun," by G. S. Ivanov-Kholodnyy, Institute of Applied Geophysics, Academy of Sciences USSR; Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 108-121)

III. METEOROLOGY

Comparison of Equations on Freezing of Supercooled Aerosols

Different versions of calculations on the freezing of supercooled aqueous aerosols are examined. The role of the individual parameters entering the equations of freezing are discussed. It is shown that to select a method of calculating freezing, it is necessary to conduct measurements of the freezing rate of highly dispersed aqueous aerosols. ("A Comparison of Different Equations on the Freezing of Supercooled Aqueous Aerosols," by L. G. Kachurin, Leningrad Hydrometeorological Institute; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 122-130)

IV. SEISMOLOGY

Reflection of Elastic Waves in a Heterogeneous Medium

The problem of determining the influence of surfaces on which velocity and density gradients undergo a discontinuity, on the propagation of elastic waves in heterogeneous media is examined. It is shown that similar surfaces are reflecting surfaces, whereby coefficients of reflected and refracted waves are obtained, and it is also established that the change in the form (or the type of discontinuity in the fronts) of reflected and refracted waves is distinct with respect to form from that of the incident wave. ("Reflection of Elastic Waves in a Heterogeneous Medium," by N. V. Tsepelev, Leningrad Division of the Mathematics Institute, Academy of Sciences USSR, Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 11-17)

Reflection and Refraction of Seismic Waves in a Weak Boundary of Separation

Waves in a heterogeneous medium, reflected and refracted from the boundary of separation of two media in which the velocity gradients and Lame coefficients are discontinuous are examined in ray approximation. Coefficients of reflection and refraction are introduced. ("The Reflection and Refraction of Seismic Waves in a Weak Boundary of Separation," by B. S. Chekin, Institute of the Physics of the Earth, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 18-26)

Dispersion of Rayleigh Waves in a Two-Layer Model of the Earth's Crust

The dispersion of Rayleigh-type waves in a two-layer model of the Earth's crust with arbitrary relationships of thick granite and basalt layers is theoretically investigated. A preliminary comparison of the calculations with published experimental data is made. ("Dispersion of Rayleigh Waves in a Two-Layer Model of the Earth's Crust," by V. I. Keylis-Borok and I. M. Stesin, Institute of the Physics of the Earth, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 27-31)

Refracted Waves in Water-Bearing Sands

The results of an experimental study of the kinematic and dynamic characteristics of refracted waves for corresponding layers of water-bearing sands are presented. It is shown that using the frequency peculiarities of these waves, it is possible to distinguish the layers of water-bearing sands from other rock having nearly the same velocities. It is shown that the coefficients of absorption of the waves propagated in the water-bearing sands change within wide limits, whereas there is little change in the boundary velocities. ("Refracted Waves Corresponding to Water-Bearing Sands," by I. S. Berzon, Yu. I. Vasil'yev, and S. P. Starodubrovskaya, Institute of the Physics of the Earth, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 32-47)

V. GEOMAGNETISM

Effects of a Moving Medium in a Stationary Magnetic Field

The effects arising with the motion of a conducting medium in a stationary magnetic field are examined. Relationships connecting the velocity of marine currents with the magnitude of the intensity of the electrical field induced by the Earth's magnetic field and taking into account the terminal width of the current and the difference from zero of the conductivity of the sea bottom are obtained. ("Slowly Moving Conducting Medium in a Stationary Magnetic Field," by A. N. Tikhonov and A. G. Sveshnikov, Moscow State University imeni M. V. Lomonosov; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 1959, pp 49-58)

Measurements on Vertical Component of Earth's Electric Field

The results of observations on the vertical component of the Earth's electric field according to measurements conducted in the fresh-water Lake Baykal are presented. ("Measurement of the Vertical Component of the Earth's Electric Field in Lake Baykal," by P. A. Vinogradov, Irkutsk Magnetic-Ionosphere Station; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, Jan 59, pp 83-86)

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VI. ARCTIC AND ANTARCTIC

New Book About Antarctica

The Geografgiz (State Publishing House for Geographic Literature) recently published a book, K Shestomu Materiku (To the Sixth Continent), by Ye. M. Suzyumov. This book contains travel notes of a participant in the First Soviet Antarctic Expedition. The author describes the observations conducted and gives interesting information about the seas through which the Ob' passed on its way to the Antarctic. He also describes the first steps of the Soviet Antarctic Expedition on the Antarctic continent and the first flights of Soviet pilots over Antarctica. The aerial detachment of the First Expedition, headed by I. I. Cherevichnyy, consisted of two helicopters and four airplanes: one Il-12, two Li-2, and one An-2.

The book contains a description of the first Soviet flight into the interior to the south geomagnetic pole, 1,500 kilometers from the coast. The author gives details regarding the scientific research conducted by the Soviet scientists with the help of airplane pilots and regarding their visits to islands which were not shown on any map. ("To the Sixth Continent"; Moscow, Sovetskaya Aviatsiya, 24 Dec 58)

Flying Difficulties in the Antarctic

Flying in the Antarctic is extremely difficult and dangerous. It is made more complicated by the fact that no precise maps are available which would help to determine the location of the plane. The old maps are no longer adequate, since the moving glaciers are constantly changing the relief of the coastline. Also, these maps do not indicate any individual mountain peaks. The radio altimeters carried on board the plane are not very useful. These instruments can not always be used by the pilots because of the peculiarities of static electricity in the Antarctic.

It is very difficult to select a proper flight route over Antarctica. Radionavigational aids on the ground are almost completely absent, and radio beacons (homing stations) are not always available. Until now, the principal aid by which a flight course can be held in Antarctica has been the magnetic compass. ("Under Trying Conditions in Antarctica"; Moscow, Sovetskaya Aviatsiya, 19 Dec 58)

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New Discoveries in Antarctica

A group of Soviet polar explorers recently returned to Mirnyy from its long overland expedition to the pole of relative inaccessibility, where a new station for temporary observations has been established. The members of this expedition spent about 2 weeks at the new station, conducting a cycle of observations in the fields of meteorology, actinometry, and glaciology. Frequent magnetic observations were also conducted. Kh. Zakiyev, Candidate of Geographical Sciences, took temperature measurements at different depths in two 60-meter drill holes in the ice. As a result, it was possible to determine the mean annual temperature of the air in that area, which was found to be minus 58.5 degrees Centigrade, close to the mean annual temperature at Sovetskaya. These same drill holes were used to take ultrasonic, multichannel core samplings, thereby enabling the scientists to determine the physical properties of the firn cover.

O. Sorokhtin and V. Koptev, seismologists, made seismic soundings of the glacier to determine the thickness of the ice cover in the station area. According to preliminary data, the maximum ice thickness is 2,900 meters. The station Polyus Nedostupnosti (Pole of Inaccessibility) is 3,710 meters above sea level. Thus, the subglacial bed is at an elevation of 800 meters above sea level.

The observations conducted at this place wind up the cycle of scientific research carried out by the Soviet scientists through the central regions of East Antarctica from Mirnyy to the pole of relative inaccessibility. These investigations have provided the first available data on the thickness and structure of the ice and on meteorological and magnetic conditions in this remote area.

During the expedition into the interior, the Soviet polar scientists made a number of new geographic discoveries, which are of great scientific interest. According to preliminary results in the processing of data on the thickness of the ice cover, which was measured along the entire route, there is a very low subglacial plateau between the stations Pionerskaya (69-44 S, 95-30 E) and Komsomol'skaya (74-05 S, 97-29 E). Its elevation is not more than 250 meters above sea level. The average elevation of this plateau is 70 meters, and in some places it drops 20-30 meters below sea level. The layer of ice resting on this plateau is up to 3,400 meters thick.

A deep subglacial depression was discovered 60 kilometers south of Pionerskaya, at a distance of 435 kilometers from Mirnyy. This depression is up to 130 kilometers wide and its depth reaches 800-1,000 meters below sea level. The glacier above it is up to 3,770 meters thick. It was the first time such an enormous thickness of ice was found in the eastern part of Antarctica. It is known that in West Antarctica, on Marie Byrd Land, the greatest glacier thickness ever recorded, i.e., over 4,270 meters, was registered by US scientists during the last Antarctic summer.

The measurements taken between Komsomol'skaya and Sovetskaya (78-24 S, 87-35 E) showed that the subglacial relief of the continent in this sector is extremely irregular. In this area, the glacier bed rises to 1,000 meters above sea level. Between the Station Sovetskaya and the pole of relative inaccessibility, the subglacial relief is very complex. In this whole sector the elevation of the glacier bed is above sea level. At a distance of 300 kilometers from Sovetskaya, the sled-tractor train of the expedition was at an elevation of 4,000 meters above sea level. This was the highest point along the entire route. Seismic soundings at this spot revealed the presence of a subglacial mountain with an elevation of about 3,000 meters above sea level. Despite the high altitude, the temperature in the drill hole representing the mean annual temperature of the air, was 1.5 degrees Centigrade higher than at Sovetskaya.

The preliminary data obtained by Soviet scientists on the thickness of the ice cover in central regions of Antarctica will be revised after the final processing of the material. ("New Discoveries in Antarctica"; Moscow, Vodnyy Transport, 15 Jan 59)

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