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 GEOPHYSICS, ASTRONOMY AND SPACE

No. 407

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. ASTRONOMY

News

SOLAR X-RAY RADIATION STUDIES

Moscow PRAVDA in Russian 20 Sep 77 p 6

[Article by V. Prokof'yev, "Roentgen Image of the Sun"]

[Text] For a long time the sun, giving light and heat to everything living on earth, has been under a constant monitoring of the world network of observatories. However, surface observations were inadequate for a detailed investigation of many phenomena occurring in its chromosphere and corona. The fact is that they emit for the most part UV and X radiation which are absorbed by the earth's atmosphere. Scientific instruments are put beyond the limits of the atmosphere for their study. This became possible only with the beginning of the space era.

The data from optical and radio observations of the sun accumulated by the beginning of the 1950s indicated that grandiose processes occur in the chromosphere and corona; these are associated with the 11-year activity cycle. The most rapidly transpiring phenomena -- flares -- are of special interest for solar physics and the problems of solar-terrestrial relationships. Suffice it to mention that during flares, affecting only a small part of the surface of the celestial body and lasting only a few minutes, setting free an enormous quantity of energy, an insignificant part of this, reaching the earth's neighborhood, leads to the appearance of auroras, magnetic storms, sudden deterioration of distant radio communications, etc. There is a discussion even of the possibility that solar activity processes are the "triggering mechanism" responsible for changes in weather and climate on a global scale and for the disruption of biorhythms.

The study of our star from space has brought us new data. In the USSR the center for investigation of solar X-radiation by means of space vehicles is now the Physics Institute imeni P. N. Lebedev USSR Academy of Sciences. Under the direction of Professor S. L. Mandel'shtam numerous investigations have been carried out on high-altitude geophysical rockets,

satellites, spaceships and long-range probes.

A study has been made of the structure of X-ray active regions of the solar corona -- so-called "condensations." Their density and temperature were measured and the chemical composition of the corona was ascertained. A detailed study was made of the relationship between the radiation of the "quiet" sun and its centimeter radio waves which arise in these same condensations, but are accessible for surface observations. On this basis a method was developed for predicting the flux of X-ray radiation on the basis of radio data.

By means of this apparatus a study was also made of the structure and dynamics of development of solar flares. It can be postulated that their hard X-radiation evidently arises during the deceleration of directed beams of high-energy electrons in coronal matter. X-ray spectra of flares have been obtained with a record high resolution; they contain hundreds of lines of the "hottest" iron ions. The correctness of their interpretation was confirmed recently using laboratory apparatus.

A distinguishing characteristic of the described experiments is their complex nature. During the period of operation of on-board rocket and satellite instruments it was possible to carry out an extensive program of optical and radioastronomical observations by the solar observatories of the Soviet Union and other socialist countries.

Investigations carried out at the Crimean Astrophysical Observatory show that during flares there is a rapid restructuring of the local magnetic field, accompanied by the setting free of a great amount of energy. But the specific effect of this mechanism to a large extent remains unclear. Investigations by a group at the Physics Institute made it possible to advance further in this complex problem. It can be assumed that in the course of the flare a considerable part of the energy of the flare field is imparted to electrons accelerated almost to the speed of light. They, moving along the magnetic lines, impart their energy to denser layers of the corona or chromosphere, causing their rapid heating. A confirmation is measurements of the polarization of X-radiation carried out for the first time on the "Interkosmos" satellites.

It should be noted that the polarization and spectral measurements by the group at the Physics Institute can be regarded as very precise and difficult experiments. They became possible only due to the high level of scientific on-board instruments.

The accumulated information on variations of solar X-radiation and its effects on the earth's upper atmosphere have already served as a basis for formulating a more precise theory of ionospheric disturbances and this is used in computations of the stability of construction materials for spacecraft. The laws of development of flares established in the studies of the Physics Institute make possible a deeper understanding of the processes

of development of this grandiose phenomenon. As a result of the studies carried out by this group of specialists, scientists in the USSR have developed a new direction in solar investigations: the basis has been laid for solar X-ray astronomy. Therefore the cycle of studies "Solar X-Radiation" quite rightly has been nominated for award of the State Prize.

[24]

Abstracts of Scientific Articles

INSTABILITY OF LAPLACE SOLUTIONS OF UNRESTRICTED THREE-BODY PROBLEM

Moscow PIS'MA V ASTRONOMICHESKIY ZHURNAL in Russian Vol 3, No 8, 1977
pp 376-380

[Article by A. L. Kunitsyn and V. N. Tkhay, Moscow Physical Engineering Institute, "Instability of Laplace Solutions of Unrestricted Three-Body Problem"]

[Abstract] The problem of the stability of constant Laplace solutions of the unrestricted three-body problem has not been finally solved. In an effort to solve the problem, the authors have used the methods of internal resonance theory in making an analysis of the stability of Laplace solutions on all third-order resonance curves. Computations of the coefficients of the normal form of the equations of perturbed motion, solving the stability problem, were carried out on an electronic computer. The authors examine constant Laplace motions in the unrestricted problem of three bodies with the masses M_0 , M_1 , M_2 in which all three points are situated at the vertices of an equilateral triangle uniformly rotating about its center of mass. Lyapunov variables and equations are used in the derivations of perturbed motion. It is shown that in the region of satisfaction of stability conditions in the Routh-Zhukovskiy first approximation there is a "resonance" set of values for the masses of the three bodies for which the Laplace solutions of the unrestricted three-body problem are rigorously unstable in the Lyapunov sense.

[6]

II. METEOROLOGY

Abstracts of Scientific Articles

LIGHT SCATTERING BY PARTICLES OF ATMOSPHERIC AEROSOL

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 8, 1977 pp 828-837

[Article by A. P. Prishivalko, Physics Institute, Belorussian Academy of Sciences, "Relative Humidity and Light Scattering by Systems of Homogeneous and Two-Layered Atmospheric Aerosol Particles"]

[Abstract] A study was made of the change in the size of atmospheric aerosol particles in dependence on relative air humidity and the content of dissolved substance in condensation nuclei. The indices of attenuation and scattering of light are insensitive to the internal structure of the particles and their value is determined by the mean value of the refractive index for the volume. The most characteristic differences of the light-scattering properties of systems of two-layer particles in comparison with homogeneous particles is the lower values of the maximum degree of ellipticity and the substantially different variation of the angular dependences of the four nonzero elements of the scattering matrix with $\beta > 150^\circ$.

[33]

NUMERICAL MODEL OF STATIONARY HAIL PROCESS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 13, No 8, 1977 pp 838-844

[Article by B. M. Vorob'yev, Leningrad Hydrometeorological Institute, "Numerical Model of Stationary Hail Process Under Natural Conditions and When Seeding a Convective Cloud by Ice Particles"]

[Abstract] The author has formulated an approximate theory of the formation of hail with the seeding of a convective cloud by ice particles. The numerical model was formulated on the basis of a theory proposed earlier by the author for the artificial crystallization of a fine-drop convective current

supplemented by kinetic equations for computations of the formation of hail nuclei as a result of natural and forced (contact) crystallization of large supercooled droplets. A series of numerical experiments was carried out. It is shown that it is possible to intensify the hail formation process with relatively small concentrations of introduced reagent. A physical explanation of the results is given.

[33]

OPTICAL METHOD FOR DETERMINING NITROGEN DIOXIDE CONTENT IN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 896-899

[Article by G. I. Kuznetsov and K. S. Nigmatullina, Moscow State University, "Determination of the Content of Nitrogen Dioxide in the Atmosphere by an Optical Method"]

[Abstract] The authors determined the content of nitrogen dioxide in a vertical column of the atmosphere over Abastumani (elevation 1,650 m) on the basis of the intensity of visible solar radiation measured during the period 21-25 October 1974 under conditions of a very pure and uncontaminated atmosphere. In contrast to earlier investigations, the authors studied NO₂ absorption in six parts of the spectrum falling primarily at the absorption maxima and minima. Registry of solar spectra was with a special instrument constructed on the basis of a DMR-4 double quartz monochromator. Computations of NO₂ were made by a method similar to that used by A. W. Brewer, et al. (PROC. THIRD CONF. ON THE CLIMATIC IMPACT ASSESSMENT PROGRAM, 257-263, 1974), although they used three pairs of wavelengths. For the first time in determining NO₂ it was possible to take into account the attenuation of radiation by atmospheric aerosol. (Attenuation by ozone and water vapor was not taken into account due to its insignificance.) In the daytime variation of NO₂ there was a small increase toward evening on the average by 20%. This increase is probably attributable to the photolytic decomposition of N₂O₅ in the course of the day by a complex photochemical cycle with the formation of NO and NO₂. The observations do not show the clearly expressed near-midday maximum in the daytime variation described by Brewer. It was found that it is necessary to make a careful allowance for the attenuation of radiation by aerosol when using observations of the necessary number of wavelengths.

[33]

KINETIC PARAMETERS OF CRYSTALLIZING REAGENTS OF THE AgI TYPE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 900-903

[Article by L. G. Kachurin, Kh. Kh. Medaliyev and A. Kh. Adzhiyev, Leningrad Hydrometeorological Institute, "Kinetic Parameters of Crystallizing Reagents of the AgI Type"]

[Abstract] Experiments were carried out for determining the probability of artificial crystallization of water droplets under the influence of particles of silver and lead iodide. In each experiment it was possible to determine the relative number of droplets crystallizing during cooling in a unit temperature interval ($-dW/dT$) and in the interval from T_0 to $T(W(T))$ (where W is the probability of formation of a droplet). The suspension used in the experiments was prepared by the introduction of a definite number of ice-forming particles into doubly distilled water. These particles were obtained by thermal sublimation on a platinum plate. The concentration and the size of particles of the ice-forming substance in the suspensions were determined using an electron microscope. For this purpose the droplets were placed on a special film backing which after evaporation of the droplets was subjected to investigation. Similarly there was a selective checking of the content of particles in freezing droplets and also in distilled water. The experiments were carried out in a special chamber with a volume of about 50 cm^3 which was cooled by liquid nitrogen. The crystallization process was monitored using an MBS-2 optical microscope with an eyepiece scale which made it possible to measure the size of each droplet with a relative error not exceeding 2-3%. Figure 2 in the text shows the results of computations of Ω' (Ω' — an invariant of the experiments, the probability of formation of two-dimensional ice nuclei on the boundary surface between the reagent and the water) for different rates of cooling and different concentrations of silver iodide particles. It is shown that Ω' is not a rigorous invariant but that the scatter of data is far less than when freezing temperature is selected as a function. Figure 3 shows Ω' averaged by rates, size of droplets and concentrations of particles of the ice-forming substances AgI and PbI₂.

[33]

III. OCEANOGRAPHY

News

STUDIES OF BLACK SEA BOTTOM COMPLETED

Moscow PRAVDA in Russian 14 Sep 77 p 6

[Unsigned article: "Preserving the Sea Bottom"]

[Text] A cycle of investigations has been completed on the bottom of the Black Sea along the shores of Georgia. The scientists worked in a self-contained underwater vehicle.

A PRAVDA correspondent turned to the directors of the experiment -- winner of the Lenin Prize, Professor V. P. Zenkovich and Candidate of Geographical Sciences Docent A. G. Kiknadze with a request to tell about the results of the observations.

Q: Why are scientists interested in the Black Sea floor?

A: More than half the total extent of the shores of Georgia is subject to erosion by the sea. For some resorts and coastal cities this progressive process has been transformed into a real misfortune. The copious mountain rivers of Georgia annually transport into the sea many millions of tons of sand and gravel, material which makes up the modern beaches. However, almost nine-tenths of the material coming from the rivers is lost in the numerous submarine canyons of the Black Sea. Mixing with the fine silt, the alluvium slides to a depth of hundreds of meters. As a result, the shore in many places is constantly retreating.

Is it possible to slow this process and thereby maintain the shoreline intact? What effect is there on this from the construction of dams on rivers? Can at least a small part of the coarse river sediments be used for the needs of construction? In order to answer these questions there must be a direct examination of the steep slopes underwater. An experiment was carried out by a group of young scientists of the Institute of Geography imeni Vakhushti of the Academy of Sciences Georgian SSR under the direction of experienced specialists.

Q: What could you see on the bottom?

A: Descents were made into the Batumskiy and Chorokhskiy submarine canyons. A surprisingly complex structure of the bottom was registered by the side-scan ultrasonic sensors on long "sheets" of iodized paper. The instrument readings cover a strip of the bottom a kilometer in width. The main floor of the canyons has a great many side "feeders." Mudslide cirques and ridges occur extensively on the slopes. The nature of the relief of relatively even places is similar to the sand ridges and barchans which are piled up by desert winds.

The entire bottom at a depth of a hundred meters was covered by a thick layer of silt. Only in a few places, carefully descending, was it possible to detect visually and photograph exceptionally steep slopes covered by silt. In the photographs it is possible to distinguish sea shells. This means that the silt was brought here, to a depth of a hundred meters, through the canyons from the coastal zone. After all, mussels live at a depth no greater than 60 meters.

Q: What are the results of the first investigations?

A: Before the beginning of the deep-water descents aqualung divers investigated the floor of the canyons to a depth of 40 meters. It was almost everywhere gravelly. However, at the lower levels to which the underwater vehicle descended the observers did not see even one pebble. Is it possible that underwater "storehouses" of pebbles and sand are formed somewhere in the interval between the region now investigated and the coastal shallow waters? The key to the mystery will be found in further investigations.

The vehicle with the researchers descended to a considerable depth. Photographs were taken and the instruments recorded relief forms and current velocities. When the records are interpreted we hope to see the channel through which the pebbles and sand move from the mouths of the mountain rivers for 20 or more miles from the shore.

After rising to the surface, the young researchers were anxious to learn: what had the instruments registered? They carried out a preliminary processing of the data collected at sea. When the records of the underwater acoustic sensors had been interpreted the scientists could see that at great depths there was a fantastic picture of steep ridges, fractures, gullies, with unusual canyons seemingly continuing the relief of the Caucasus Mountains on the floor of the Black Sea...

Next season the research region will be broadened. Scientists will obtain data for a quantitative analysis of the processes transpiring on the sea floor.

[23]

NEW RESEARCH ICEBREAKER "OTTO SHMIDT" TO BE BUILT

Moscow PRAVDA in Russian 11 Sep 77 p 6

[Article by Zh. Chesnokov, "Ship of Science"]

[Text] Murmansk. News has reached here that Leningrad shipbuilders have begun work on the new scientific research icebreaker "Otto Shmidt."

Murmansk will be the port of registry for the new vessel. The "Otto Shmidt" will carry a unique floating institute intended for further study of the Arctic. The new icebreaker will be able to operate in landfast ice. Its cruising range will be 11,000 miles. [4]

Abstracts of Scientific Articles

NEW DATA ON RED SEA BRINES

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 603-611

[Article by V. A. Bubnov, V. S. Fedorova and A. D. Shcherbinin, Institute of Oceanology, "New Data on Red Sea Brines"]

[Abstract] The article discusses the results of measurements of temperature and salinity in the Atlantis II and Discovery depressions in the Red Sea. A detailed study was made of the two-layered structure of bottom waters in the Atlantis II depression and warm bottom brine in the Discovery basin. A more correct method for determining anomalously high salinity and temperature made it possible to refine the quantitative relationship of these properties in the warm and hot bottom brines of the Red Sea. A matter of particular interest is the nature of their change from the time of the first measurement in October 1966 to June 1976. With a relative stability of salinity (about 270^o/oo) the temperature of the lower hot brine in the Atlantis II depression increased quasilinearly approximately from 56 to 62^o at a mean rate of about 0.5^o per year; this is evidence of an unceasing geothermal activity of the bottom in this depression.

[32]

VARIATIONS OF HYDROPHYSICAL CHARACTERISTICS IN STRAIT OF TUNIS

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 612-617

[Article by V. B. Titov, Southern Division, Institute of Oceanology, "Periodic Variations of Hydrophysical Characteristics in the Strait of Tunis"]

[Abstract] The paper gives an analysis of the periodic (diurnal and semi-diurnal) variations of temperature, salinity and density obtained by filtering of series of measurements of these characteristics at multiday hydrological stations. The author evaluates the role of periodic variations in the temporal variability of hydrophysical fields, which exceed by a factor of 1.5-2 the value of the aperiodic mesoscale changes. It was possible to establish a qualitative relationship between the intensity of the

periodic variations and the vertical gradient of the corresponding hydro-physical characteristics. Also examined is the influence of the phase relationships between variations of temperature and salinity on the formation of aperiodic density variations. Thus, in the Strait of Tunis there are periodic diurnal (of inertial origin) and semidiurnal (of tidal origin) variations of hydrophysical characteristics whose total amplitudes often exceed the aperiodic variations. This indicates a significant contribution of the periodic variations to the variability of the hydrophysical fields and also a necessity for taking them into account when computing currents by the dynamic method for obtaining correct results.

[32]

CONTINUOUS SEISMIC PROFILING IN PACIFIC OCEAN

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 646-652

[Article by I. G. Goltvyanitsa and A. Ya. Il'yev, Sakhalin Multidiscipline Scientific Research Institute, "Continuous Seismic Profiling in the Western Part of the Pacific Ocean"]

[Abstract] The data collected on the fifth voyage of the scientific research ship "Pegas" make possible a more detailed description of the structure of the sedimentary cover and a refinement of the structural characteristics in the region of framing of the Pacific Ocean in its southwestern and western parts. All the principal defined structural elements are bounded by tectonic dislocations which are traced not only in the sedimentary cover, but also in the acoustic basement. The distribution of thicknesses of uncompacted sediments along the sections clearly illustrates the influence of tectonic factors and a pattern of inversion of thicknesses which is customary for the region of calcareous sedimentation. The article is accompanied by a foldout with a series of geophysical profiles along the bottom in the region of the Solomons Islands and elsewhere; each of these profiles is discussed. The results of continuous seismic profiling in the region of the Idzu-Bonin Rise are also presented.

[32]

AUTOMATIC REGISTRY OF DATA FROM ECHO SOUNDER

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 734-738

[Article by V. N. Latyshev, L. S. Sitnikov and L. L. Utyakov, Institute of Oceanology, "Unit for Automatic Registry of Data from Echo Sounder"]

[Abstract] This is a brief description of the basic principles of construction and the technical specifications of a unit for converting the signals of an echo sounder into a depth code. It is designed for joint use

with nondirectional pulse-type echo sounders, for example, with Soviet-produced instruments of the GEL series and foreign instruments of the "Kelvin & Hughes Ltd. MS26-K" type. The unit can be employed on scientific research ships which are carrying out hydrographic work and complex investigations of physical fields in the ocean. It makes possible a sharp reduction in expenditures on manual work for the registry of data from echo sounding measurements and the input of the collected information into an electronic computer. A block diagram of the unit is included in the article and serves as a basis for a discussion of its operating principles and the functioning of individual components. Most important of these is the "Ladoga" phototelegraphic receiving apparatus for recording the information in digital and graphic form.

[32]

SPATIAL CHARACTERISTICS OF TIDAL INTERNAL WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 856-866

[Article by K. D. Sabinin, V. A. Shulepov and A. Ye. Filonov, Acoustics Institute USSR Academy of Sciences, "Spatial Characteristics of Tidal Internal Waves in Iberian Basin"]

[Abstract] This paper is an analysis of polygon measurements of temperature and current velocity at four anchored buoys in the region of the Iberian basin. The authors examine methodological problems associated with an evaluation of the three-dimensional spectra of internal waves on the basis of the phase-amplitude relationships of signals. It was possible to obtain the spatial spectra of the semidiurnal wave at the horizons 45 and 150 m. A comparison of the spectra with independently obtained data on wave direction and the profile of vertical and horizontal amplitudes of orbital movements leads to the conclusion that the field of semidiurnal waves in the considered region was determined by the simultaneous existence of variations of two modes of relatively high numbers propagating in one direction.

[33]

COMPARISON OF TWO METHODS FOR COMPUTING OCEAN CURRENTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 876-881

[Article by V. N. Drozdov, Institute of Oceanology, "Comparison of Two Diagnostic Methods for Computing Ocean Currents"]

[Abstract] The author gives a comparison of the results of computations of currents in the oceans using the A. S. Sarkisyan model with the results obtained using the dynamic method. The article gives a comparison of the velocities obtained by these methods for the Pacific and Indian Oceans with a horizontal interval of 5° and the region of the northwestern part of the Pacific Ocean (Kuroshio) with an interval of 1° from the surface to the bottom. A study was made of the influence of choice of the "zero" surface on the results of the comparison. The conclusion is drawn that the quasidynamic method is the best first approximation to the diagnostic model. Deeper than 500 m the differences in velocities obtained by the compared methods are most significant. The use of the diagnostic model makes it possible to obtain a more reliable picture of the currents, especially at the subsurface horizons.

[33]

WATER CIRCULATION IN CASPIAN SEA

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. GEOGRAFIYA in Russian No 3, 1977 pp 90-96

[Article by B. R. Zaripov, A. N. Kosarev and D. G. Rzhaplinskiy, Oceanology Department, Moscow State University, "Horizontal Circulation of Waters in the Caspian Sea"]

[Abstract] The article discusses computations of the horizontal circulation of waters in the Caspian Sea using the A. S. Sarkisyan diagnostic model. The calculations are made for the average long-term density field in a layer 0-150 m deep for February and August in the absence of a wind and with southeasterly and northwesterly winds of 5 to 9 and 10 to 15 meters per second. Gradient currents were found to have a uniform vertical pattern and low velocities and their distribution is similar to that shown on dynamic maps. The currents obtained by summation in the layer 0-10 m are oriented along the direction of the wind (with velocities of 10 to 60 cm/sec), whereas at a depth of 20 to 30 m there is a compensatory movement of the waters against the wind. Below the depth of friction (a 50-100-m layer) currents are reduced to 5-10 cm/sec. In August, when there is a marked baroclinicity of the water layers, the current velocities are higher and their distribution is more complex than in February. The results of these computations agree with actual observational data.

[38]

NONLINEAR STATIONARY WAVES IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 850-855

[Article by Al. B. Odulo, An. B. Odulo and M. A. Chusov, Institute of Oceanology, "One Class of Nonlinear Stationary Waves in Ocean"]

[Abstract] A study was made of the problem of plane stationary internal waves in a continuously stratified fluid, of nondivergent Rossby waves in a stratified fluid and topographic Rossby waves. It is shown that the solution of all three problems is described by some equation formally coinciding with the equation for a one-dimensional oscillator with nonlinear friction in which the friction coefficient is linearly dependent on an unknown function. The authors give a detailed analysis of this equation, which is also encountered in solution of other physical problems (see L. A. Ostrovskiy and M. I. Rabinovich, NELINEYNYE I NESTATSIONARNYYE VOLNY, Ryazanskiy Radiotekhnicheskiy In-t, 1975).

[33]

VARIABILITY OF THE NORWEGIAN CURRENT

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 578-583

[Article by V. G. Kort and V. M. Tarasenko, Institute of Oceanology, "Synoptic Variability of the Norwegian Current"]

[Abstract] The spatial-temporal variability of currents in the southern part of the Norwegian Sea during the summer-autumn period of 1975 was investigated. Three hydrological surveys were made between 7 July and 21 September 1975, accompanied by a full complex of meteorological and aerological observations. The first two surveys were made in a uniform grid of hydrological stations with an interval of observations of 30 miles and a depth of observations up to 2,000 m, whereas the third was with a grid of stations each 20 miles and with a depth of observations to 1,000 m. Analysis of the horizontal structure of the velocity field of geostrophic currents on the basis of data from the three quasisynchronous hydrological surveys indicates that in this region under the influence of the wind and bottom relief there can be an intensive meandering of the Norwegian Current. Taking into account that the regime of geostrophic currents quite fully reflects the processes of restructuring of the field of masses, it can be said that the data indicate a rapid adaptability of the field of masses to the velocity field.

[32]

VARIATIONS OF THERMOCLINE IN NORWEGIAN SEA

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 591-596

[Article by V. M. Kushnir, A. N. Paramonov and V. I. Zaburdayev, Marine Hydrophysical Institute, "Structure of Variations of the Thermocline in the Norwegian Sea"]

[Abstract] For studying the mechanism of variability of thermohaline fields in the upper stratified layer of the ocean in the range of time scales from tidal oscillations to periods of about one hour, specialists on the 21st voyage of the research vessel "Akademik Kurchatov" carried out a series of observations which included repeated soundings with the ISTOK probe at time intervals of 30 minutes for 60 hours. The ISTOK measurements were made to a depth of 600 m in the immediate neighborhood of a buoy station to which BPV automatic current meters were attached at depths of 50, 100, 200, 300 and 500 m, operating with a discreteness of 20 minutes for a period of eight days. The mean square errors in determining temperature, salinity and density were 0.014°C , $0.020^{\circ}/\text{oo}$ and 0.02 arbitrary units. The measurements and their analysis indicate that the current velocity field and the thermohaline elements of the thermocline in the Norwegian Sea are subject to variations with a broad frequency spectrum. In the range of quasitidal frequencies the internal waves are manifested in the form of inertial-gravitational waves whose wave vector has an angle of inclination to the horizon close to 90° . Short-period oscillations with frequencies of the order of 1/6 cycle/hour or more are manifested in the form of gravitational internal waves. The measurements made here and their analysis indicated a quite good correspondence between the field of current velocity and vertical movements of thermohaline elements for the entire range of thermocline depths within the framework of known models of internal gravitational waves. [32]

INTERACTION BETWEEN GRAVITATIONAL WAVES AND TURBULENCE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 8, 1977 pp 845-849

[Article by G. I. Barenblatt, Institute of Oceanology, "Strong Interaction Between Gravitational Waves and Turbulence"]

[Abstract] A study was made of the self-similar problem of turbulent entrainment of a fluid. It is shown that in the case of a zero initial turbulence the front of turbulence excited with a constant energy influx on the boundary of a semi-infinite region is sharp and propagates at a constant velocity. An explanation is given for the effect of smoothing of the waves on the surface of two layers of fluid of different density by turbulence excited at the upper boundary of the upper layer as observed by

O. M. Phillips ("Energy Loss Mechanisms from Low-Mode Waves," Report at the Soviet-American Conference on Internal Waves, Novosibirsk, December, 1976).

[33]

WHITE SEA CONVECTION IN WARM AND COLD YEARS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. GEOGRAFIYA in Russian No 3, 1977
pp 85-90

[Article by Yu. O. Gnatovskiy and B. S. Zalogin, Oceanology Department, Moscow State University, "Principal Characteristics of Convection in the White Sea in Anomalously Cold and Anomalously Warm Years"]

[Abstract] A study was made to ascertain the principal characteristics of convection in the White Sea in anomalously cold and anomalously warm years. It was found that in both cases the nature of the convection is predetermined by hydrometeorological processes of different types preceding and accompanying density mixing. In the first case it is primarily anticyclonic synoptic situations which play the leading role, whereas in the second case cyclonic pressure situations govern. The prevalence of synoptic conditions of the anticyclonic type is associated with the arrival of cold air and accordingly a rapid and intensive cooling of the sea. Thermal convection begins earlier than usual and arises when there is a relatively small heat transfer from the sea surface. With an intensification of autumn cooling the loss of heat by the sea increases and density mixing is propagated in depth, reaching the horizons 40-45 m. Thermohaline winter vertical circulation by the end of the cold season penetrates to the horizons 80-100 m, which are close to the limits of propagation of density mixing in the White Sea. Increased cyclonic activity leads to an influx of warm air. This causes a good heating of the sea and a lag in the onset of thermal convection. In the first stages of its development it transpires with a rather considerable heat transfer, but the sea cools slowly and density mixing develops poorly. Only by the end of autumn with an intensification of cooling does thermal convection transpire more intensively and penetrates to the horizons 40-45 m. Thermohaline winter vertical circulation, as a result of the relatively small growth of ice, penetrates to horizons of about 60 m; this differs relatively little from its propagation under average hydrometeorological conditions.

[38]

DETERMINING WIND WAVE PARAMETERS AT AUTOMATIC BUOY STATIONS

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 722-727

[Article by M. V. Kozlov, G. V. Matushevskiy and I. P. Trubkin, State Oceanographic Institute, "Method for Determining Wind Wave Parameters at Automatic Buoy Stations"]

[Abstract] Accelerometers are used at the present time as a wave sensor at automatic buoy stations. The signal arriving from the accelerometer is integrated twice and on the basis of the received signal indicating the displacement of the free surface of the sea it is possible to find the parameters of the wave oscillations. This method involves the necessity of precise integration. The article gives two other variants for processing the acceleration signal in which it was possible to obtain an acceptable level of accuracy despite less precise integration.

[32]

SOVIET-BULGARIAN OCEANOLOGICAL EXPEDITION

Moscow OKEANOLOGIYA in Russian Vol 17, No 4, 1977 pp 755-756

[Article by Ya. P. Malovitskiy, P. S. Dimitrov, S. V. Chabashvili, N. K. Karpenko, N. V. Yesin, Kh. T. Markov, D. G. P"rlichev and V. G. Zolotarev, "Soviet-Bulgarian Complex Oceanological Expedition (Fifth Voyage of the Scientific Research Vessel 'Akademik L. Orbeli')"]

[Abstract] During the period 12 September-5 November 1976, aboard the scientific research vessel "Akademik L. Orbeli," an expedition was carried out in the western part of the Black Sea in accordance with the research plan on the problem "Study of the World Ocean Within the Framework of the Agreement of Member Countries of the Socialist Bloc." The expedition was carried out by the personnel of the Southern Division of the Institute of Oceanology and the Institute of Marine Research and Oceanology of the Bulgarian Academy of Sciences. It had a complex oceanological character and included investigations in the fields of geomorphology, geology and geophysics of the sea floor, hydrophysical and hydrochemical observations. A total of 210 stations were occupied and more than 3,200 km of profiles were run with echo soundings and hydromagnetic surveys which included 110 temperature soundings (a map accompanying the text shows the profiles run and the stations occupied). The report cited above summarizes the substance of the geological-geomorphological program, magnetometric research, thermometric studies and hydrophysical program. In a brief time it was possible to collect considerable oceanological information on the western part of the Black Sea.

[32]

IV. TERRESTRIAL GEOPHYSICS

Abstracts of Scientific Articles

STATISTICAL EVALUATIONS OF SPECTRA OF SEISMIC EFFECTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 8, 1977
pp 25-42

[Article by V. M. Lyakhter and N. I. Frolova, All-Union Institute "Gidroyekt" and Interdepartmental Council on Seismology and Seismic Resistant Construction, "Statistical Evaluations of Spectra of Seismic Effects"]

[Abstract] A study was made of the statistical properties of the amplitude spectra (moduli of the Fourier transform) of accelerograms of strong earthquakes. The accelerograms were classified on the basis of macroseismic intensity. The processing was carried out separately for full sets (without additional allowance for local ground conditions) and for partial sets of accelerograms registered on rocky ground. The difference in the spectra, averaged by sets, was insignificant. The stochastic regularities of the spectral components were detected and analyzed. It was established that with angular frequencies ω greater than 30-40 sec⁻¹ the averaged spectra decrease proportionally to ω^{-2} regardless of earthquake intensity. The correctness of a log-normal distribution of the spectral probabilities was established. The correlation coefficients between the spectral values at different frequencies were found. A method for the practical prediction of spectra of a given probability is presented.

[4]

RADIOISOTOPIC METHOD FOR PREDICTING EARTHQUAKES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 8, 1977
pp 56-61

[Article by P. I. Chalov, T. V. Tuzova and V. M. Alekhina, Institute of Physics and Mathematics, Kirgiz Academy of Sciences, "Prediction of Earthquakes from Changes in the Radioisotopic Parameters of Waters in Faults in the Earth's Crust"]

[Abstract] On the basis of an analysis of radioisotopic indices of waters in faults in the earth's crust and other waters in seismic regions in Northern Kirgizia it has been possible to detect radiological situations in the waters of faults which cannot be caused by their mixing with waters of other types. These situations can be critical for the prediction of seismic phenomena if the correlation between the latter and the change in radioisotopic parameters objectively exists and is unambiguous. Here it is shown that when there is an unambiguous correlation between the preparation of the focus of a tectonic earthquake and the change in the radioisotopic parameters of waters in faults the prediction of earthquakes is the most probable when these waters exhibit an increase in the content of helium, radon and the Rn^{222}/Ra^{226} ratio. A decrease in these three parameters and the ratios Rn^{226}/Ra^{238} , U^{234}/U^{238} , and also an increase in the uranium content in the waters in faults cannot be interpreted unambiguously and therefore the use of such changes in the mentioned radioisotopic indices for these purposes is difficult.

[4]

BRIEF VARIATIONS OF RADIOISOTOPIC PARAMETERS AND EARTHQUAKE PREDICTION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 8, 1977
pp 62-72

[Article by P. I. Chalov, T. V. Tuzova and V. M. Alekhina, Institute of Physics and Mathematics Kirgiz SSR, "Brief Variations of Radioisotopic Parameters of Waters in Faults in the Earth's Crust and Their Relationship to Earthquake Predictions"]

[Abstract] Investigations have shown that for some radioisotopic parameters of faults in the earth's crust there are significant brief changes even during periods of absence of significant earthquakes. The greatest variations have been noted for the He content (up to 40% of the mean value) and Ra (up to 60%). These variations are not caused by changes in the proportions of mixing of fault waters with ground water, since they do not have a clearly expressed periodicity and are not synchronous for different parameters. During the periods preceding an earthquake, even the region of earthquake preparation does not coincide territorially with the region of outpouring of fault water springs; in the latter it is possible to observe a general increase and brief changes in the content of He, Rn and sometimes Ra of a great frequency and amplitude. Such changes are evidently related to the activation of tectonic processes within the limits of a seismic zone or large fault, which, in particular, can lead to the formation of an earthquake focus. [The data obtained in this study cannot be compared with the results of observations of Rn content in ground water prior to the Tashkent earthquake of 1966 since the region of circulation of the investigated fault waters in this case was not in an earthquake focus.] The

results presented in this paper show the necessity for organizing systematic observations of the content of He and possibly Rn in the fault waters in the earth's crust in tectonically active zones for monitoring the activation of tectonic processes.

[4]

CORRELATION BETWEEN SEISMIC ACTIVITY AND INTENSITY OF EARTHQUAKE SOURCES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 8, 1977
pp 91-97

[Article by G. A. Vostrikov, Institute of Physics of the Earth, "Correlation Between Seismic Activity and the Intensity of Earthquake Sources"]

[Abstract] In an earlier study (IZV. AN SSSR, FIZIKA ZEMLI, No 12, 1973) the author demonstrated that for large seismically active regions and for long periods of time seismic activity is the greater the greater is the intensity of the earthquake sources. In this new study the results obtained in the earlier investigation are checked for local earthquakes. A study was made of the dependence of the intensity of sources of relatively strong ($K = 11-14$) local tremors on seismic activity in the epicentral zone during the period directly preceding an earthquake. A study was also made of the correlation between temporal variations of seismic activity and the corresponding changes in the intensity of sources of weak earthquakes. It was found that the spatial and temporal changes in the regime of the process of deformation of rocks, being the reason for seismicity, the same as variations of the effective properties of rocks, cause variations in the intensity of the sources of earthquakes and are manifested as variations in seismic activity. The intensity of earthquake sources and seismic activity are related by a direct dependence. The linear dimensions of earthquake foci, equivalent in energy, with a close spatial grouping, can differ by an order of magnitude. Seismic activity is subject to corresponding temporal variations.

[4]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

COMMENTARY ON SPACE LAW

Moscow PRAVDA in Russian 20 Aug 77 p 3

[Article by V. Vereshchetin, "Space and Law"]

[Text] In the year of the 50th anniversary of the Great October Revolution we note still another remarkable anniversary -- the 20th year from the launching of the first artificial earth satellite in our country. "We regard the victories in the mastery of space as achievements not only of our people, but of all humanity. We are happy to put them at the service of all peoples, in the name of the progress, happiness and welfare of all the peoples on the earth," as it states in the declaration of the Central Committee CPSU, the Presidium of the USSR Supreme Soviet and the USSR Council of Ministers on the occasion of the flight of Yu. A. Gagarin in April 1961.

The goal of strengthening peace and developing international cooperation is proclaimed in the draft of the new constitution of the USSR as one of the principal goals of our state. The cooperation principle is clearly manifested as well in the international space programs of the Soviet Union. In their implementation our country uses as a point of departure the determination that space will not be transformed into a zone of international conflicts and that the most favorable conditions will be created for the development of broad scientific and technical cooperation in the exploitation of the expanses of the universe.

With the leading role of the Soviet Union and the other socialist countries there is now a code of juridical principles, basic rules which must be followed by states and international organizations in the implementation of their space projects and programs. The basis of international space law is the treaty on the principles of activity of states in the investigation and use of space, including the moon and other celestial bodies, which has been signed by more than 70 countries.

The treaty includes a paragraph on the freedom of investigation and use of space by all countries. It is emphasized in this paragraph that this activity should be carried out for the well being and interests of all countries, without any discrimination whatsoever, on the basis of equality and in accordance with international law, including the UN Charter. There is a ban on the national appropriation of space and its parts, as well as a ban on definite types of military activity in space, such as the orbiting around the earth of any objects with nuclear or other types of weapons of mass annihilation. The treaty provides for measures against unfavorable changes in the earth's environment and the contamination of space and celestial bodies. It has been established that states have an international responsibility for activity in space, regardless of whether it is carried out by governmental agencies or by nongovernmental, juridical entities.

Together with the treaty of 1967, there are three other multilateral international agreements in which the principles of international space law have been developed and made specific. These agreements were developed within the framework of the UN with the most active and constructive participation of the Soviet Union. One of these regulates the questions of rendering assistance to cosmonauts in the case of their forced landing and also establishes the order for the return of objects which have landed on foreign territory. Another is devoted to the matters of responsibility for the losses which can be inflicted on individuals and property as a result of space activity. Finally, the third defines the order of national and international registry of objects launched into space.

The totality of the obligatory rules for the behavior of states which are contained in these documents and also in the bilateral and multilateral agreements of a scientific-technical character forms a new branch of law -- "international space law."

Striving for a further consolidation of law and order in space, the Soviet Union during recent years has presented a series of drafts of documents which are being discussed actively in the UN committee on the use of space for peaceful purposes and its juridical subcommittee. Among the matters which are now attracting the greatest attention of these agencies we note the draft of the treaty on the moon and also the formulation of juridical principles regulating the activity of states on the remote sensing of the earth from space and the use of satellites for direct television broadcasting.

The drafts proposed by the Soviet Union are based on the proposition that the freedom of space must not be used as a pretext for abridging sovereign rights on the earth. Adhering to this position, our country has proposed the formulation in the UN of international norms which would exclude the use of information on the resources of foreign countries obtained using space methods in the abridgement of the legitimate interests and sovereign rights of these countries. In the field of direct television broadcasting,

the Soviet Union, like many other countries, proposes the establishment of a rule that such broadcasting to foreign territories will be carried out only with the agreement of the corresponding countries.

International space law even now is faced with many problems. Their number, naturally, will increase with the further development of research and its practical application and also with a broadening of cooperation in the mastery of space. The solution of these problems will require the collective work of representatives of the natural and social sciences and specialists in different fields. The formulation of new norms of space law must correspond completely to the needs of practical cosmonautics.

In addition to international norms, in some countries national legislation has been enacted for regulating activity in space by departments, state and private organizations. Evidently, the time has come to think about the systematizing of the corresponding laws and regulations in force in the USSR and on the formulation of the principles of Soviet space law.

A report by Comrade L. I. Brezhnev at the 25th Congress of the CPSU noted that the USSR, like other countries of the socialist camp, cannot stand aside from the solution of global problems affecting the interests of all mankind, problems which in the long run will exert an increasingly greater influence on the life of all peoples, on the entire system of international relationships. The conquest of space is among these problems, together with such problems as the raw material or energy problems, the elimination of the most dangerous and widespread diseases, preservation of the environment and use of the resources of the world ocean.

It seems entirely logical that the mentioned global problems to be solved by our country have found their reflection in the new constitution of the USSR, Article 18, where it states, in particular, that the environment must be preserved. In my opinion, this article should be supplemented by a statement that the USSR is carrying out the conquest of space in the interest of the present and future generations. The country which has blazed man's path into space has every basis for mentioning this in its constitution.

[224]

FEATURE ARTICLE ON "KOSMOS-936" BIOSATELLITE

Moscow KRASNAYA ZVEZDA in Russian 5 Aug 77 p 3

[Article by L. Nechayuk, "Biolaboratory in Orbit"]

[Text] Report from the Institute of Biomedical Problems USSR Health Ministry. The next launching of a satellite in the "Kosmos" series, No 936, has taken place. It carries on its space voyage representatives of the animal world

from our earth. Scientists are continuing a careful study of the unusually great possibilities of the mastery of the forces of nature and space for the well-being of mankind.

Today, on the twentieth anniversary of the space era, whose beginning was laid by our country on 4 October 1957, man has penetrated surprisingly far in the mastery of circumterrestrial space. But it is necessary to do much else, including in the field of space biology and medicine.

"The learning of the fundamentals of vital functioning of terrestrial organisms beyond the limits of our planet," emphasized Academician O. Gazenko, Director of the Institute of Biomedical Problems of the USSR Health Ministry in a conversation with journalists, "has now been transformed into a field of science without which it is unthinkable that there will be any further scientific or economic activity in space. Now that in manned flights there is a possibility for prolonged, months-long work in orbit, our science is faced with other problems, specifically: how to increase the effectiveness of those means and methods which will assist man in overcoming the unaccustomed habitation conditions."

On the eve of launching of the "Kosmos-936," I visited the laboratories of the institute which is headed by Academician O. Gazenko. Here in one of the halls is a precise replica of the new space biolaboratory. Within a silvery sphere with a diameter of about two meters there are the same biological objects and scientific instrumentation as were put into orbit. There will be careful reproduction of all the spaceflight factors, except, it goes without saying, weightlessness. In short, parallelly, with a shift of four days, biologists on the earth are to carry out a control experiment in precise accordance with what will occur in space.

The flight program includes tens of different experiments. About 20 scientific research organizations of the USSR, other socialist countries, the United States and France are participants in the present experiment. In this sense the satellite is international. But nevertheless most of the concern has rested on the shoulders of the scientists and specialists of the Institute of Biomedical Problems.

"If you recall," he says, "in the 'Kosmos-782' -- the preceding biological satellite, no animals were placed on the centrifuge. Now the remarkable white rats have become the object of a very important and interesting investigation with the use of the centrifuge. It was not easy to achieve this. The design had to be complicated considerably."

The centrifuge aboard the "Kosmos-936" will enable scientists to investigate the effects of artificial gravity.

"Incidentally, the carrying out of such an experiment with artificial gravitation in flight, for example, on man, is for the time being an extremely complex problem," says the laboratory head at the institute, Candidate of

Medical Sciences V. Oganov. "And what is more, premature from the biomedical point of view. As you see, the 'Kosmos-936' is a sort of reconnaissance into the future of manned space flights."

Here, in the laboratories of the institute one can clearly feel the amplitude and scale of the experiment. Hundreds of specialists are now working at the cosmodrome, at the flight control center, on preparations for a control ground experiment. And they are working with special zeal.

"The institute personnel," says the deputy secretary of the Party committee R. Kuzin, "in the course of socialist competition for a meritorious meeting of the 60th anniversary of the Great October Revolution, have taken upon themselves the faultless preparation for and implementation of the space experiment. We have been supported in this by other Soviet institutes and organizations participating in the general work with the biosatellite. And our colleagues from the socialist countries have dedicated their investigations to the 60th anniversary of the Great October Revolution."

The "Kosmos-936" is circling the planet. The biological exploration of space is continuing.

[226]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-948"

Moscow PRAVDA in Russian 3 Sep 77 p 1

[TASS Report: "'Kosmos-948'"]

[Abstract] The artificial earth satellite "Kosmos-948" was launched in the Soviet Union on 2 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89 minutes;
- apogee, 265 kilometers;
- perigee, 217 kilometers;
- orbital inclination, 81.4 degrees.

Incoming information is being transmitted to the State Scientific Research and Production Center "Priroda" for processing and use. [4]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-949"

Moscow PRAVDA in Russian 8 Sep 77 p 1

[TASS Report: "'Kosmos-949'"]

[Abstract] The artificial earth satellite "Kosmos-949" was launched in the Soviet Union on 6 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.5 minutes;
- apogee, 348 kilometers;
- perigee, 184 kilometers;
- orbital inclination, 62.8 degrees.

LAUNCHING OF "MOLNIYA-1" COMMUNICATIONS SATELLITE

Moscow IZVESTIYA in Russian 1 Sep 77 p 2

[TASS Report: "Molniya-1"]

[Text] On 30 August 1977 a "Molniya-1" communications satellite was launched in the Soviet Union. The "Molniya-1" communications satellite is intended for operation in the system of long-range telephone and telegraph radio communication and also for transmission of USSR Central Television programs to points in the "Orbita" network situated in regions of the Far North, Siberia, the Far East and Central Asia.

The satellite was inserted into a high elliptical orbit with the following parameters:

- apogee, 40,800 km in the northern hemisphere;
- perigee, 480 km in the southern hemisphere;
- period of revolution, 12 hours 16 minutes;
- orbital inclination 62.8 degrees.

In addition to the apparatus for transmission of television programs and for providing long-range multichannel radio communication, the satellite has on board a command and measurement complex and also systems for orientation, orbital correction and power supply for the satellite.

According to the data received, the apparatus installed on the satellite is functioning normally. Communication sessions using the "Molniya-1" satellite will be conducted in accordance with the planned program.

LAUNCHING OF "VERTIKAL'-5" GEOPHYSICAL ROCKET

Moscow PRAVDA in Russian 31 Aug 77 p 1

[TASS Report: "'Vertikal'-5'"]

[Text] In accordance with the program of cooperation among the socialist countries in the area of exploration and use of space for peaceful purposes, on 30 August 1977 at 0530 hours Moscow time the "Vertikal'-5" geophysical rocket was launched to an altitude of 500 km from the territory of the European USSR in the middle latitudes.

The "Vertikal'-5" geophysical rocket is designed to perform studies of the short-wave radiation of the solar corona and also to study meteor particles.

A high-altitude astrophysical probe separated from the rocket at an altitude of 100 km. The probe contained an x-ray spectrometer, a wide-band photometer and an instrument for obtaining imagery of the sun. The apparatus was manufactured in the Polish People's Republic and in the Soviet Union. The probe also carried apparatus manufactured in the Czechoslovak Socialist Republic for recording meteor particles.

In accordance with the flight program, a recoverable capsule containing the scientific apparatus and the results of the measurements taken was separated from the probe on the descent portion of its trajectory. The capsule landed with the aid of a parachute system.

Specialists from the USSR, Poland and Czechoslovakia participated in the assembly and testing of the scientific apparatus carried by the "Vertikal'5" rocket as well as in the launching of the rocket.

Scientific organizations of the countries participating in the joint experiment have begun processing the information obtained. [4]

COMMENTARY ON "VERTIKAL'5" ROCKET LAUNCH

Moscow PRAVDA in Russian 31 Aug 77 p 2

[Article by V. Gubarev, "Space Needle"]

[Text] Preparation for the launch of a geophysical rocket is just as prolonged and labor-consuming as that which puts an artificial satellite into near-earth orbit. Both the development of scientific apparatus and the experiments sometimes demand years even though the astrophysical probe is in operation for only one-quarter hour. But the space minutes are so valuable to science that they more than justify the efforts of scientists of a number of countries.

The essence of the flight of the "Vertikal'" is expressed in its name. The geophysical rocket is launched perpendicular to the surface. The astrophysical probe, which is located on its top, is covered by a cowling. As soon as the space needle penetrates the dense strata of the atmosphere, the "cap" protecting the apparatus is released. Having made an arc in space, the

probe returns. Parachutes open and the recovery group awaits the capsule with the apparatus.

"Scientists of the socialist countries are participating in the preparation of experiments on the 'Vertikal' geophysical rockets, which are regularly launched from the Soviet cosmodrome," says G. S. Narimanov, Deputy Director of the USSR Academy of Sciences' Institute of Space Research. "Similar studies supplement satellite experiments. We must go into space for a short time in order to register interesting phenomena. For example, there occurs such a rare occurrence as the eclipse of the Crab Nebula by the moon. It lasts only a few minutes. There is no sense in mounting the instruments on a satellite; it is more effective to put the apparatus into space on a geophysical rocket. Or the complex study of the short-wave radiation of the solar corona, which was conducted on "Vertikal'-5." Data collected by the astrophysical probe in one-quarter hour are totally sufficient for obtaining abundant scientific information about the processes occurring in the corona."

Today the range of studies of solar activity from space is great -- and geophysical rockets play a very large role. That is why each launch of a "Vertikal'" is a noted event in the international cooperation of scientists of socialist countries. [5]

ANALYSIS OF "SALYUT-4" SOLAR FLARE PHOTOS

Moscow IZVESTIYA in Russian 2 Sep 77 p 2

[TASS Reports: "Portraits of the Sun"]

[Text] Simferopol'. Soviet astrophysicists have for the first time compiled a detailed picture of the spatial temperature distribution of solar flares. They have established that the temperature range fluctuates according to the depth of the flare from 10 thousand to 1 million degrees. These are the first preliminary results of the complex analysis conducted at the Crimean Astrophysical Observatory of the photographic film taken in space by crews working in the orbital station "Salyut-4." The major result of this work, which was done under the supervision of A. Severnyy, can be considered to be a catalogue with a description of 145 solar emission lines at various wavelengths. [5]

REVIEW OF PHOTOGRAPHIC EXPERIMENTS ABOARD "SALYUT-3"

Moscow IZVESTIYA VUZov, GEODEZIYA I AEROS"YEMKA in Russian No 3, 1977
pp 51-57

[Article by P. R. Popovich, Yu. P. Artyukhin, V. D. Bol'shakov and N. P. Lavrova, "Scientific Photographic Experiments from Aboard the 'Salyut-3' Orbital Station"]

[Abstract] The flight of the "Salyut-3" orbital station made it possible to carry out scientific photographic experiments in different spectral zones and make a near-vertical - oblique survey of individual sectors of the earth's surface. The materials from the space survey make it possible to carry out mapping of the earth at small and ultrasmall scales. The article enumerates the problems which were formulated for the carrying out of scientific photographic experiments aboard the station. A description of the interpreted photographs taken on the flight is given. Among the subjects discussed are the interpretation of ice, snow and glaciers appearing on the photographs. The photos have yielded unique materials for the study of earth and space.

[5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-950"

Moscow PRAVDA in Russian 15 Sep 77 p 2

[TASS Report: "Satellites in Orbit"]

[Abstract] The artificial earth satellite "Kosmos-950" was launched in the Soviet Union on 13 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.4 minutes;
- apogee, 305 kilometers;
- perigee, 213 kilometers;
- orbital inclination, 62.8 degrees.

The satellite carries a radio transmitter operating on a frequency of 19.995 MHz.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-951"

Moscow PRAVDA in Russian 15 Sep 77 p 2

[TASS Report: "Satellites in Orbit"]

[Abstract] The artificial earth satellite "Kosmos-951" was launched in the Soviet Union on 13 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 105 minutes;
- apogee, 1,029 kilometers;
- perigee, 989 kilometers;
- orbital inclination, 83 degrees.

"INTERSPUTNIK" AGREEMENT SIGNED

Moscow PRAVDA in Russian 16 Sep 77 p 4

[TASS Report: "Agreement Signed"]

[Text] In Moscow on 15 September 1977 the USSR government and the International Organization of Space Communication "Intersputnik" signed an agreement on questions connected with the residence of the "Intersputnik" organization in the USSR. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-952"

Moscow PRAVDA in Russian 17 Sep 77 p 1

[TASS Report: "'Kosmos-952'"]

[Abstract] The artificial earth satellite "Kosmos-952" was launched in the Soviet Union on 16 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.7 minutes;
- apogee, 278 kilometers;
- perigee, 258 kilometers;
- orbital inclination, 65 degrees.

CONTINUED COOPERATION WITH SWEDEN ON "INTERKOSMOS"

Moscow PRAVDA in Russian 16 Sep 77 p 4

[TASS Report: "Cooperation in Space"]

[Text] In Moscow on 15 September 1977 representatives of the USSR Academy of Sciences' "Interkosmos" Council and the Swedish Directorate for Space Activities signed a memorandum concerning the continuation of cooperation between the two countries in the area of space research.

This cooperation began with the establishment of the joint project to study ultraviolet solar radiation using the Swedish spectrometer, which was inserted into near-earth orbit aboard the Soviet satellite "Interkosmos-16."

The information received, which is of great scientific interest, is presently being analyzed in detail.

The memorandum foresees, in particular, an experiment aboard a Soviet high-apogee satellite to study magnetospheric plasma, further launches of balloons from the Swedish test area to study the ionosphere, possible future joint studies of materials under space conditions, and the remote sounding of the earth.

The memorandum was signed by Academician B. N. Petrov, Chairman of the "Interkosmos" Council, and J. Stiernstedt, Chairman of the Swedish Directorate for Space Activities. [5]

TASS ANNOUNCES LAUNCHING OF "EKRAN" SATELLITE

Moscow PRAVDA in Russian 22 Sep 77 p 2

[TASS Report: "Satellite 'Ekran'"]

[Text] On 20 September 1977, in accordance with the program of further development of television broadcasting systems using artificial earth satellites, the "Ekran" television broadcasting satellite was launched in the Soviet Union. On board is a repeater apparatus providing for transmission, in the decimeter range, of color and black-and-white programs of the Central Television to a network of collective use receivers situated in populated areas in Siberia and the Far North.

The "Ekran" satellite was inserted into a near-stationary circular orbit with the initial parameters:

- distance from the earth's surface, 35,560 kilometers;
- period of revolution around the earth, 23 hours 45 minutes;
- orbital inclination, 0.4 degree.

Besides the perfected repeater apparatus, the satellite carries: a triaxial system for precise orientation on the earth, a power supply system with independent aiming and tracking of solar cells on the sun, an orbital correction system, a thermoregulation system, a radiotelemetry system to transmit data on the functioning of on-board systems to earth, and a radio system for the precise measurement of orbital parameters and the control of the satellite.

The apparatus installed on the "Ekran" satellite is functioning normally. A command-measurement complex controls the satellite.

The "Ekran" satellite has the international registration index "Statsionar-T." [5]

TASS ANNOUNCES LAUNCHING OF "PROGNOZ-6"

Moscow PRAVDA in Russian 23 Sep 77 p 2

[TASS Report: "'Prognoz-6' in Flight"]

[Text] In accordance with the space research program, the automatic station "Prognoz-6" was launched in the USSR on 22 September 1977 at 0351 hours Moscow time. It is intended to continue studies initiated in 1972 by the automatic observatory "Prognoz."

"Prognoz-6," like the five preceding stations of this type, will conduct studies of corpuscular and electromagnetic radiation, solar plasma streams, and magnetic fields in near-earth space in order to determine the effect of solar activity on the interplanetary medium and the earth's magnetosphere, and also studies of galactic ultraviolet-, X-ray and gamma radiation. In order to conduct these studies, installed aboard the station is scientific apparatus made in the Soviet Union, the Czechoslovak Socialist Republic and France in accordance with a program of international cooperation in the field of space research. The station weighs 910 kilograms.

The "Prognoz-6" station was inserted into a high-elliptical orbit as an earth satellite. Orbital parameters are:

- apogee, 197,900 kilometers;
- perigee, 498 kilometers;
- period of revolution, 94 hours 48 minutes;
- orbital inclination, 65 degrees.

The insertion of the station into the calculated trajectory occurred from an intermediate orbit as an artificial earth satellite.

On board the station, besides the scientific apparatus, there are: a radio transmitter operating at a frequency of 928.4 MHz, a radio system for the precise measurement of orbital elements and a radiotelemetry system to transmit to earth data on the functioning of the instruments and scientific apparatus.

According to the telemetry information, the station's on-board systems and scientific apparatus are functioning normally. The coordination-computation center and institutes of the USSR Academy of Sciences are processing the incoming information. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-953"

Moscow PRAVDA in Russian 17 Sep 77 p 1

[TASS Report: "'Kosmos-953'"]

[Abstract] The artificial earth satellite "Kosmos-953" was launched in the Soviet Union on 16 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.6 minutes;
- apogee, 354 kilometers;
- perigee, 188 kilometers;
- orbital inclination, 62.8 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-954"

Moscow PRAVDA in Russian 20 Sep 77 p 1

[TASS Report: "'Kosmos-954'"]

[Abstract] The artificial earth satellite "Kosmos-954" was launched in the Soviet Union on 18 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.6 minutes;
- apogee, 277 kilometers;
- perigee, 259 kilometers;
- orbital inclination, 65 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-955"

Moscow PRAVDA in Russian 21 Sep 77 p 2

[TASS Report: "'Kosmos-955'"]

[Abstract] The artificial earth satellite "Kosmos-955" was launched in the Soviet Union on 20 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 97.5 minutes;
- apogee, 664 kilometers;
- perigee, 631 kilometers;
- orbital inclination, 81.2 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-956"

Moscow PRAVDA in Russian 25 Sep 77 p 2

[TASS Report: "'Kosmos-956'"]

[Abstract] The artificial earth satellite "Kosmos-956" was launched in the Soviet Union on 24 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 96.9 minutes;
- apogee, 865 kilometers;
- perigee, 358 kilometers;
- orbital inclination, 75.8 degrees.

COMMENTARY ON "METEOR-PRIRODA" RESOURCES SATELLITE

Moscow PRAVDA in Russian 11 Sep 77 p 6

[Article by I. Andronov: "Distinct from Those Before"]

[Text] On 30 June 1977 TASS reported on the launching of the artificial earth satellite "Meteor" with what at first glance seems to be a small change in the flight parameters -- the inclination of the orbital plane to the equator was 98 degrees instead of the usual 81-82 degrees. In contrast to earlier satellite launchings, this launching was against the earth's rotation.

Without delving into the astronomical details, we will only say that such a trajectory enables the "Meteor" to remain virtually constantly over the illuminated side of the earth. Moreover, it will appear at approximately identical time over the same geographic point each day. As a result there is a great increase in its possibilities for obtaining information on the planet's natural resources. It is not by chance that the new "Meteor" has still another name -- "Priroda" [Nature].

In actuality, the possibility of photographing one and the same sectors of the earth under identical illumination conditions is very convenient for a study of soils, state of vegetation and sown crops, land surveys, etc. The new trajectory is equally important for a study of the moisture content of soils, erosion of river shores and lakes, surveys of snow, ice, high waters and marine navigation conditions.

For solution of these problems the satellite carries experimental instrumentation making it possible to obtain images of the underlying surface of the earth in several spectral regions. The satellite also carries a spectrometer-interferometer developed by the personnel at the institutes of the Academy of Sciences of the German Democratic Republic for sounding of the atmosphere with a determination of vertical temperature profiles, as well as registry of the thermal emission of the earth's surface in the infrared range.

For the normal operation of the instrumentation it was necessary to use improved special systems ensuring a constant orientation of the satellite on the earth and systems of electric supply, taking into account the new conditions for orientation of the cells on the sun. Electrojet engines are used for imparting stability to the orbit. Finally, continuously

operating interconnected radio systems are used for precise measurement of the orbital elements and tie-in of the recorded images to the terrain. Thus, reference in fact is to the creation of a cosmic robot observing, registering, storing and transmitting highly important information concerning natural conditions on the earth.

The work of the "Meteor" on the new trajectory raises serious problems with respect to the improvement of means and methods for the interpretation and identification of the information received from a satellite. It is necessary to create conditions for obtaining the optimum number of different characteristics of the studied object. This will make it possible to give reliable qualitative and quantitative evaluations of this information on the basis of a systematic, prolonged accumulation of primary data and its reprocessing into statistical data. This will broaden the possibilities for practical solutions in agriculture and forestry, in fishing and in geology, for routine weather forecasts.

[9]

TASS ANNOUNCES LAUNCHING OF "INTERKOSMOS-17"

Moscow PRAVDA in Russian 26 Sep 77 p 1

[TASS Report: "'Interkosmos-17' in Flight"]

[Text] In accordance with a program of cooperation between socialist countries in the area of space research and utilization for peaceful purposes, the artificial earth satellite "Interkosmos-17" was launched on 24 September 1977.

The purpose of the "Interkosmos-17" launch is to study the distribution of energetic charged and neutral particles and micrometeorite streams in near-earth space.

Installed on board the satellite is scientific apparatus developed by scientists and specialists of the Hungarian People's Republic, the Socialist Republic of Rumania, the Soviet Union and the Czechoslovak Socialist Republic.

The artificial earth satellite "Interkosmos-17" was inserted into an orbit with these parameters:

- apogee, 519 kilometers;
- perigee, 468 kilometers;
- period of revolution, 94.4 minutes;
- orbital inclination, 83 degrees.

Specialists of the countries participating in the experiment prepared the scientific apparatus at the cosmodrome and control its operation.

The satellite's on-board systems are functioning normally.

Ground stations of the Soviet Union's command-measurement complex regularly receive incoming scientific information from the satellite. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-957"

Moscow PRAVDA in Russian 1 Oct 77 p 1

[TASS Report: "'Kosmos-957'"]

[Abstract] The artificial earth satellite "Kosmos-957" was launched in the Soviet Union on 30 September 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.9 minutes;
- apogee, 381 kilometers;
- perigee, 181 kilometers;
- orbital inclination, 65 degrees.

TASS ANNOUNCES LAUNCHING OF "SALYUT-6"

Moscow PRAVDA in Russian 30 Sep 77 p 1

[TASS Report: "'Salyut-6' in Flight"]

[Text] On 29 September 1977, in accordance with the space research program, the orbital scientific station "Salyut-6" was launched in the Soviet Union.

The "Salyut-6" station was inserted into a near-earth orbit with the following parameters:

- apogee, 275 kilometers;
- perigee, 219 kilometers;
- period of revolution, 89.1 minutes;
- orbital inclination, 51.6 degrees.

The purpose of the "Salyut-6" launching is to conduct scientific-technical studies and experiments and to develop the design of the on-board systems and apparatus of orbital stations.

The flight control center near Moscow, aided by tracking stations located in the territory of the Soviet Union and the USSR Academy of Sciences' scientific research ships "Kosmonavt Yuriy Gagarin," "Akademik Sergey Korolev" and "Borovich" located in the Atlantic Ocean, controls the flight of the orbital station and processes the incoming information.

According to the telemetry information, the on-board systems of the "Salut-6" station are functioning normally. [5]

COMMENTS ON SATELLITE METEOROLOGY

Moscow IZVESTIYA in Russian 30 Sep 77 p 5

[Article by L. Aleksandrov, "Weather Watch of the Planet"]

[Text] Now the meteorological service of any country is unthinkable without the use of space information for servicing aviation and the merchant marine, preparation of short- and intermediate-range weather forecasts, and most importantly, improvement of the methods for long-range forecasting.

Since February 1967 the "Meteor" meteorological system has been operating in our country. Two or three "Meteor" satellites are constantly working in orbit; twice a day they scan our planet, transmit the collected information, which is used by our weather service and which after processing is directed to other countries. At the same time, we are using information received from American satellites. Now, in essence, a world weather service is being established which is making active use of meteorological satellites. Cooperation is intensively proceeding in the field of space meteorology, work being done by scientists of the socialist countries within the framework of the "Interkosmos" program.

Meteorological satellites are being improved with each passing year. Using satellite data we are learning to determine the vertical temperature profile, which is especially important for a "coverage" of desert regions and ocean expanses. In addition to visible light and IR rays, radio rays are coming into use for observations. These are capable of carrying a great volume of information under virtually any weather conditions. In the years immediately ahead use will evidently be made of laser apparatus capable of giving a number of interesting characteristics of the atmosphere, especially its contamination.

Experimental satellites of the "Meteor" type are now also used for investigations of natural resources. The information received from these satellites in different parts of the spectrum is transmitted for practical use to the Ministries of Geology, Agriculture, Melioration and Water Management, the Academy of Sciences and other departments. The instrumentation carried on the last of such satellites, given the name "Meteor-Priroda," makes it possible to obtain an image of the earth's surface in four parts of the spectrum. In a zone with a width of 1,800 km it was possible to distinguish details with linear dimensions from one kilometer, and in two sectors with a width of 1,200 km -- from 250 to 500 meters.

The data from such satellites make it possible to trace clearly the state of the ice cover, the boundaries of the snow, to estimate the intensity of the high water in large and intermediate rivers, to judge the area of inundated territories. On the images obtained from satellites it is easy to see the centers of fires and the extent of burned areas. This will enable the forest services to operate on a routine basis. From satellites it is possible to evaluate the state of pastures effectively and to determine the reserves of fodder over extensive areas in our country. This is of great importance for livestock raising.

The new direction in the use of satellites is intensively developing. The technical difficulties in the interpretation of space images are being successfully overcome. And there is no need to be a prophet in order to assert that in the years immediately ahead these investigations will pass from the stage of experiments into everyday, working practices. In addition to satellites of the "Meteor" type, use will be made of geostationary vehicles and meteorological satellites which will make possible regular and routine taking of photographs of the earth under identical illumination conditions. Mankind will soon receive an effective method for observing the state of the environment on our planet. These data can be used extensively in the national economy. This can give a maximum effect in the economy of the socialist countries.

[37]

Abstracts of Scientific Articles

ENERGY-WEIGHT EFFICIENCY IN INTERORBITAL FLIGHTS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 4, 1977 pp 540-545

[Article by V. F. Safranovich, A. A. Chinarev and L. M. Emdin, "Energy-Weight Efficiency of Interorbital Flights of Spacecraft of Different Types"]

[Abstract] The authors have derived analytical expressions making it possible to compare the energy-weight efficiency of spacecraft with engines of different types in interorbital flights. For a series of cases it was possible to obtain simple formulas suitable for engineering computations. The article gives examples of computations for determining the regions of effective use of spacecraft with different types of engines. The compared spacecraft had initial weights of 100 tons and carried ion engines, nuclear engines with a solid-phase reactor or a liquid-fuel engine using oxygen-hydrogen fuel and which make flights from a circular orbit with an altitude of 200 km.

[223]

DAMPING IN SHOCK ABSORBERS OF DOCKING MECHANISMS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 4, 1977 pp 554-558

[Article by V. S. Syromyatnikov and I. Kh. Khayrullin, "Magnetolectric Damping in the Shock Absorbers of Docking Mechanisms"]

[Abstract] Dampers are used for absorbing energy in the shock absorbers of docking mechanisms. In contrast to the hydraulic dampers used in the United States for the docking devices of the Gemini and Apollo craft, magnetolectric dampers are used in Soviet docking mechanisms. Such dampers are used in androgynous peripheral docking mechanisms of the "Soyuz" ship. Each of these damping methods has its advantages and disadvantages. Magnetolectric dampers make it possible to create a completely electromechanical docking mechanism without using hydraulic or pneumatic systems. The basis

for magnetoelectric dampers is the magnetoelectric brake. This brake includes a hollow rotor which rotates in an annular gap between two permanent magnets. The operating principle of the magnetoelectric brake is based on the interaction between the resultant magnetic field in the gap and the eddy currents induced in the hollow rotor. The mechanism is fully described.

[223]

MINIMIZED FUNCTION FOR ENERGY-OPTIMUM FLIGHTS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 4, 1977 pp 626-627

[Article by G. V. Ufimtsev, "Construction of Mimimized Function for Impulse Flights Optimum in Energy Expenditures"]

[Abstract] With the flight of a spacecraft from one trajectory to another by means of engines with a great specific thrust the segments of active motion can be approximated by points at which the velocity vector instantaneously changes its value under the influence of an impulse which in turn approximates the result of the effect of the thrust in the active segment. Such an approach makes it possible to simplify the problem and the finding of the optimum trajectory can be reduced to the finding of the nominal minimum of the function of many variables. Solution of the problem in an impulse formulation gives a good evaluation of the required fuel expenditure and the flight parameters if the minimized function correctly describes the selected optimality criterion. The form of the minimized function is obtained when the initial map of the spacecraft is used as the optimality criterion. Formula (9) derived in this study quite precisely reflects the real energy expenditures in making flights and its use as an optimality criterion makes it possible to find trajectories closer to those optimum with respect to energy expenditures.

[223]

STUDY OF RELIEF OF MARTIAN SURFACE FROM PHOTOGRAPHS OF ITS LIMBS

Moscow IZVESTIYA VSESOYUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian Vol 109, No 4, 1977 pp 362-369

[Article by I. K. Lur'ye, L. I. Permitina, V. A. Poloznikov and A. P. Tishchenko, "Study of Relief of the Martian Surface from Photographs of its Limbs"]

[Abstract] For the purpose of studying the relief of the Martian surface and constructing elevation profiles specialists in the Laboratory of Aerospace Methods in the Geography Faculty at Moscow State University carried

out photogrammetric processing of five photographs in the first series, three photographs in the second series and five photographs in the third series of photographs of the Martian limbs. The measurements of the coordinates of point on the limbs on the photographs were made monocularly with an accuracy to 0.02 mm; the mean square error in the measurements, computed from the differences in double measurements, was ± 0.05 mm. Using rectified photographs it was possible to compute the polar coordinates of points on the limbs in a coordinate system with its origin at the center of mass of the planet and an x-axis directed to the north. The results of the investigations made it possible to obtain additional information on Martian relief. The results agree with those obtained by other researchers. The method for studying planetary relief described in this paper, based on photographs of the Martian limb and tested in the processing of photographs from the "Mars-3," can be used for studying the relief of any planet in the solar system. When there are a great number of space photographs of the visible horizon of a planet obtained from different segments of the orbit of an automatic station it is possible to solve the problem of constructing elevation maps of a planet, using an electronic computer for processing the resulting profiles.

[221]

F-REGION DISTURBANCES CAUSED BY GRAVITATIONAL WAVES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 634-638

[Article by R. G. Gachechiladze and A. G. Khantadze, Geophysical Institute Georgian SSR, "Disturbances in the Ionospheric F Region Caused by Internal Gravitational Waves"]

[Abstract] The article gives a solution of the continuity equation for the nighttime nonstationary F region of the ionosphere, taking into account wave disturbance of horizontal velocity of the neutral atmosphere caused by internal gravitational waves. An analytical approach is used in obtaining the dependence of electron concentration, phase velocity and wavelength of the disturbance on the altitude and period of the disturbance. It was found that for the entire interval of considered periods of the disturbances the variations of the electron concentration are maximum in the region of the F maximum and decrease with a transition to greater and lesser altitudes. The relative variations of the electron concentration increase with an increase in the period of the disturbances. Waves whose period is less than 20 minutes virtually do not change the altitudinal profile of the electron concentration in the stationary F region. With $T = 30$ minutes the relative deviation of the electron concentration at the F-region maximum does not exceed 6%, but in the case $T = 3$ hours -- 30%.

[14]

MODEL OF GENERAL CIRCULATION OF ATMOSPHERE ABOVE 100 KM

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 692-700

[Article by G. V. Vergasova, Ye. I. Zhovtyy and E. S. Kazimirovskiy, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Empirical Model of General Circulation of the Atmosphere at Ionospheric Levels Above 100 km"]

[Abstract] The authors have formulated an empirical model of the spatial-temporal distribution of the principal parameters of general circulation of the atmosphere at ionospheric levels. The model is based on the results of a physical-statistical analysis of a mass of experimental data from measurement of horizontal ionospheric drifts by the spaced reception method using a short base and employing data from the world network of stations for 1958-1970. It was found that despite the fact that drift velocity varies in wide limits (from 10 to 500 m/sec), a predominating velocity of 60-80 m/sec persists stably for all observation points. In winter and with a decrease in solar activity the drift velocity usually increases by 15-30%. The direction of movement experiences complex variations, but the predominant direction can be discriminated (especially during the solstice periods). There is a definite system -- to the southwest in the high and middle latitudes of the northern hemisphere and to the southeast in the equatorial zone. The region of the change in the sign of circulation is at about 35°. In the southern hemisphere the pattern is symmetric relative to the equator. The nature of diurnal variations is determined by geomagnetic latitude and season. The diurnal tide, as in the E region, is most intense in the low latitudes. With a decrease in solar activity there is a broadening of the region where drift is directed to the west and an intensification of meridional transfer.

[14]

ANALYTICAL REPRESENTATION OF FIELD OF MAGNETIC DECLINATION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 4, 1977 pp 719-721

[Article by V. I. Pochtarev and G. I. Pil', "Investigation of the Error in Analytical Representation of the Field of Magnetic Declination at Near-Surface Altitudes"]

[Abstract] A study was made of the error in analytical representation of the field of magnetic declination by the use of Gauss series for the earth's surface and altitudes of 10 and 30 km. It was possible to determine the distribution laws and the first two moments of errors. It is shown that the error in representation of the field of magnetic declination at an altitude of 30 km does not exceed 1°. Large regional anomalies

(with mean dimensions 300-800 km) are relatively rare and therefore are not considered in this study, nor are small local anomalies (with dimensions up to 5 km). World anomalies with an extent of 3,500-5,000 km or more are caused by the magnetic nonuniformity of the upper mantle and also by the characteristics of the main field. These anomalies are represented by a Gauss series developed to the first 8-10 harmonics, whereas anomalies associated with the crust can be represented by a series containing 350 harmonics or more. The results presented here give basis for assuming that at altitudes of about 30 km the accuracy in representing the field of magnetic declination by the analytical method will in many cases be satisfactory.

[14]

VI. MISCELLANEOUS

News

TASS ANNOUNCES PREPARATIONS FOR 23d SOVIET ANTARCTIC EXPEDITION

Moscow IZVESTIYA in Russian 1 Sep 77 p 5

[TASS Report: "Expedition is Outfitted"]

[Text] Leningrad. The outfitting of the new 23d Soviet Antarctic Expedition has begun here. More than five hundred polar research scientists of various fields of specialization are involved. Six ships, including the scientific research and expeditionary vessels "Mikhail Somov," "Professor Zubov," diesel-electric ships and passenger motorships will transport them to the ice continent. The first ship will depart Leningrad for the Antarctic at the end of October.

The seasonal detachments of the expedition face a large work program to be fulfilled. There will be expeditions of sledge-caterpillar trains over the ice expanses of the Antarctic for distances up to 1,000 km, during which time glacial and geophysical studies will be conducted. According to tradition, polar researchers from the GDR and the United States will participate in the expedition. [5]

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