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 GEOPHYSICS, ASTRONOMY AND SPACE

No. 403

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

#### SCIENTISTS AT CRIMEAN ASTROPHYSICAL OBSERVATORY STUDY RADIO WAVES

Moscow PRAVDA in Russian 5 Jul 77 p 6

[Unsigned article: "They Listen to the Voice of the Universe"]

[Text] On the shore of Goluboy Zaliv near Simeiz there is a 22-m radio telescope of the USSR Academy of Sciences' Crimean Astrophysical Observatory. Extensive studies of the sources of cosmic radio waves are performed there. This instrument is being used more and more in a system of two or more radio telescopes located at various points on the earth (in the USSR, United States, Australia and other countries) for the simultaneous reception of radiation from any space object. This complex forms what can be called a single gigantic intercontinental radio interferometer which makes it possible to determine with a high degree of accuracy any specific source of radio waves and occasionally its components. This can be done even when these space objects are located on the very edge of the visible universe at distances of billions of light years. Important discoveries have been made in the field of astronomy using a similar group of radio telescopes (from various countries) joined into a single system.

(Photographs show the director of the Department of Radio Astronomy, I. Moiseyev and engineers N. Nesterov and Ye. Korsenskaya performing studies and the radio telescope at Goluboy Zaliv "listening" to the universe.  
[5])

## Abstracts of Scientific Articles

### SOLAR FLARE ACTIVITY DURING ELEVEN-YEAR CYCLES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 234, No 6, 1977 pp 1284-1287

[Article by I. Ye. Pogodin, Scientific Research Institute of Physics at Leningrad State University, "Toward an Explanation of Some Characteristics of Solar Flare Activity in Eleven-Year Cycles"]

[Abstract] After reviewing the most significant observed facts concerning solar flare activity during the 11-year cycle, the author proposes a model of the development of solar flare activity. The magnetic elements of the "background" field, together with the magnetic fields of individual spots in the group, are capable of forming neutral points on the periphery of these groups and flares can occur there. Such situations are most probable near those spots the sign of whose field is opposite the sign of the "background" field. Accordingly, the direction of the latitudinal displacement of the flares: a) changes to the opposite near the maximum of the cycle when the "background" magnetic field of the sun changes sign; b) the changes in orientation in different solar hemispheres conform to this general law; c) the changes in orientation in different 11-year activity cycles conform to this general law. A similar role in the formation of peripheral zero points can be played by the magnetic fields of satellite spots. In addition, the dynamics of development of near-lying satellite spots can increase the probability of appearance of instability of the neutral current layer, leading to flares. Therefore, flare activity of a group is higher on that side where the probability of the presence of other groups is higher. As a result of these and other factors there will be an increase in total displacements and a decrease in the total number of flares. This decrease is manifested in the form of some gap in the course of solar flare activity which accounts for the presence of two maxima in the 11-year cycle. The model in its entirety makes it possible to give a physical interpretation to the spatial and temporal characteristics of the development of flare activity in the 11-year cycle.

[142]

## II. METEOROLOGY

### News

#### US-SOVIET CLIMATOLOGICAL SYMPOSIUM CONCLUDES IN LENINGRAD

Moscow PRAVDA in Russian 29 Jun 77 p 4

[TASS Report: "Climate is Becoming Warmer"]

[Text] Leningrad, 28 June. A symposium of Soviet and American specialists completed their work today with the signing of a protocol on further cooperation in the study of climate. The symposium took place within the framework of an intergovernmental agreement between the United States and USSR on cooperation in the area of environmental conservation.

Commenting on the results of this meeting, the well-known Soviet climatologist and Corresponding Member of the USSR Academy of Sciences M. I. Budyko emphasized that the results of the studies made by scientists of the two countries made it possible to establish that the cooling of the earth's climate, which has been observed in the last decade, has ceased and since the end of the sixties the planet's climate is again becoming warmer. [5]

#### LASER USED FOR CLOUD STUDIES

Moscow IZVESTIYA in Russian 24 Jul 77 p 4

[Article by Ye. Vostrukhov, "Laser and Cloud"]

[Excerpt] An aircraft attacks the clouds and unexpectedly the desired rain comes from the clear sky -- this is by no means a fantasy. This is a day-to-day episode in the work day of an expedition of the Tomsk Institute of Atmospheric Optics of the Siberian Department USSR Academy of Sciences. But the expedition, in actuality, is unusual.

The crammed laboratories of the institute have been abandoned by scientists for an aerial laboratory outfitted aboard an Il-14 aircraft. In the aircraft cabin the Siberian specialists have installed a laser

apparatus in combination with various sensors, generators and amplifiers mounted outside the ship. In order for the laser to be able to operate in the skies, it was necessary to fabricate instruments of a special design and to force them to operate under flight conditions. The first flights were made over Tomsk. Their geography gradually expanded: Western and Eastern Siberia, Leningradskaya and Vologodskaya Oblasts, the Baltic Republics. Recently the aerial expedition of Tomsk specialists arrived in Central Asia and flew over the Karakum.

The director of the expedition, a scientific specialist at the institute V. Shamanayev, states: "The scientific program for the aerial laboratory consisted of two parts -- investigations of clouds and atmospheric contaminants. The use of a laser makes it possible to study the dynamics of rapidly transpiring atmospheric processes and during a short time to obtain a reliable picture of the spatial distribution of its different components. Lasers make it possible, for example, to detect great concentrations of aerosol, including aerosol of industrial origin. Institute specialists have also developed methods for determining the boundaries and so-called aggregate structure of clouds. But all these data were obtained using stationary apparatus, at the institute polygons. And now an aerial experiment has demonstrated: the range of use of lasers can be considerably expanded."

The sky laboratory makes it possible to carry out investigations of clouds from a close distance and to obtain various kinds of information on the complex processes transpiring within thunderstorm clouds and ordinary clouds. Thus, the laser is becoming a reliable helper in solving the highly complex problem which is of enormous national economic importance -- weather control.

Even today specialists are capable of performing a "miracle" -- by means of the cannonading of clouds, for example, using special shells, thereby inducing rain which is unplanned by nature. Incidentally, such experiments are being carried out in our country for extinguishing forest fires and for the irrigation of agricultural plants.

But in order to induce rain when we want it, or, vice versa, clear the sky from hail-bearing clouds, it is necessary to know thoroughly the laws of formation of thunderstorms. It was found that a laser is a magnificent tool for carrying out this task: it can instantly glance within clouds and provide information of interest to scientists.

Every cloud is a reservoir of concentrated water floating in the sky. The largest of these contain thousands of tons of moisture. But in order that this abundant moisture fall to the earth, definite conditions must be created in the cloud for the condensation of water vapor.

Under what conditions are rain clouds generated, how are condensation centers formed, how are these and other complex processes controlled; scientists must still answer these questions. The unraveling of the secrets of thunderstorm formation will make it possible to take a step forward in creating a weather control service.

"In the Karakum we cannonaded the cloud with yellow-green streams of smoke containing very tiny crystals of silver iodide," explains V. Shamanayev. "They then become the basis for the formation of a focus of intensive condensation. Thus, rain created by human hands fell over the desert."

Such a processing of clouds makes it possible to "squeeze" the maximum quantity of moisture from them.

The participants of the last expedition spent more than 220 hours in the air. They covered a distance of 60,000 kilometers. The success of the aerolaser experiment, together with the scientists, is shared by the personnel of the West Siberian Administration of Civil Aviation, the ship commander Vladimir Nikolayev Chupis, the copilot Eduard Melkonyan. The pilots and researchers learned to act in the air smoothly and clearly, understanding one another with a half-word.

Now specialists have completed the systematic arrangement of the data collected in the air. And at the same time preparations for new experiments were initiated. One of these the Tomsk specialists are carrying out in collaboration with their Bulgarian colleagues: on the basis of data already collected it is necessary to carry out an investigation of hail clouds in Bulgarian territory.

[194]

Abstracts of Scientific Articles

INVESTIGATION OF THE DISPLACEMENT OF ATMOSPHERIC FRONTS

Budapest IDOJARAS in Hungarian No 1, 1977 pp 19-26

[Article by Pham Vu Anh, Hungarian Meteorological Service, Budapest, "Some Practical Analyses in Relation to Investigation of the Displacement of Atmospheric Fronts"]

[Abstract] The examples presented in this paper indicate that the thickness of the layer within which ground friction is effective can be registered by investigating the distribution of frontal speed. In the first example cited above (the case of a fast-moving cold front) the thickness was 1,800 m, whereas in the second case it was only 1,000 m. It is easily understood that in a particular region, such as over the Carpathian Basin, ground friction does not exert the same effects on the movements of cold fronts. The thickness of this layer is partly lesser, partly greater. It appears that this is dependent on the kinematic structure and the thermodynamic condition of the cold wedge. The numerical results presented here show the variety of displacement of fronts. Such analyses are undoubtedly necessary for the explanation of a number of phenomena associated with the movement of fronts. [156]

NUMERICAL MODELING OF DYNAMICS OF ATMOSPHERIC FRONTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 590-602

[Article by A. I. Romov, Ukrainian Scientific Research Hydrometeorological Institute, "Numerical Modeling of the Dynamics of Atmospheric Fronts"]

[Abstract] The article describes a method for modeling frontal processes by means of predicting the fields of meteorological elements with different variable initial conditions in the frontal zones. The author has developed a five-level forecasting model using total equations which is used in

numerical experiments. It has been possible to model processes of formation of cyclones and anticyclones, centers of ascending and descending movements, compression of warm sectors and the spreading of cold centers and the occlusion of fronts. There has been considerable refinement of the mechanism of occlusion and the dependence of frontal processes on a series of parameters. One of these is associated with the formation and evolution of thermal inhomogeneities of the frontal type in the form of waves with heat ridges and cold troughs; the second is associated with the advection of cold and warm air masses.

[198]

#### INTERNAL STRUCTURE OF PLANETARY JET STREAM IN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 603-610

[Article by L. N. Gutman, Computation Center, Siberian Division USSR Academy of Sciences, "Hydrodynamic Model of the Internal Structure of the Planetary Jet Stream in the Atmosphere"]

[Abstract] On the basis of development of an idea by Eliassen, the author has formulated the three-dimensional nonlinear stationary problem of the planetary jet stream: it is postulated that in one of the cross sections of the jet the distribution of the longitudinal component of wind velocity is stipulated. The purpose is to find the spatial fields of meteorological elements for some segment of the jet restricted in length. The existence and uniqueness of the solution is demonstrated. A series of physical conclusions are drawn. The example of specific computations is compared qualitatively with the materials on observations in nature.

[198]

#### NONLINEAR DEVELOPMENT OF DISTURBANCES IN TURBULENT FLOWS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 611-619

[Article by Ye. A. Novikov and S. G. Chefranov, Institute of Physics of the Atmosphere, "Nonlinear Development of Disturbances in Turbulent Flows and the Predictability Problem"]

[Abstract] The authors have made computations of the first few terms of expansion into a time series for the spectrum of the disturbances field in two- and three-dimensional turbulent flows of an incompressible fluid. The evaluation based on these computations shows that in the case of two-dimensional flows the prediction can be improved both as a result of the decrease in the scale of the initial field of errors and due to a sharper

decrease in the spectrum of the initial field of error in the region of small wave numbers (the latter can be attained by the choice of a suitable scheme for the interpolation of initial data). Both these effects are described by formula (21), whose derivation is given in the text. In the case of three-dimensional flows the maximum time for the forecast evidently cannot be made significantly greater than the characteristic time scale of the main flow.

[198]

#### DISSIPATION OF TURBULENT ENERGY IN ATMOSPHERIC BOUNDARY LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 620-628

[Article by V. P. Kukharets and L. R. Tsvang, Institute of Physics of the Atmosphere, "Rate of Dissipation of Turbulent Energy in the Unstably Stratified Atmospheric Boundary Layer"]

[Abstract] The article describes simultaneous measurements of the vertical profiles of the rate of dissipation of turbulent energy  $\varepsilon(z)$  and potential temperature  $\theta(z)$  in the atmospheric boundary layer and also the profiles of temperature and wind velocity in the surface layer. An analysis of the results of measurements from the point of view of similarity theory for the atmospheric boundary layer made it possible to establish regular correlations between the  $\varepsilon(z)$  profiles and the temperature and wind velocity profiles. A method is given for computing  $\varepsilon(z)$  in the unstably stratified atmospheric boundary layer on the basis of the temperature and wind velocity profiles.

[198]

#### OBJECTIVE ANALYSIS OF AIR TEMPERATURE FIELD OVER EQUATORIAL ATLANTIC

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 629-637

[Article by L. I. Koprova, O. M. Pokrovskiy and Ye. Ye. Ivanykin, State Scientific Research Center for the Study of Natural Resources and Leningrad State University, "Characteristics of the Statistical Structure and Possibilities of Objective Analysis of the Air Temperature Field Over the Equatorial Atlantic"]

[Abstract] On the basis of data obtained during the GATE-74 expedition, the authors have computed the statistical characteristics of the air temperature field over the tropical zone of the Atlantic. Also considered are the correlations of temperature in vertical and horizontal coordinates. The

article gives an analysis of the structure of the covariation matrices computed for different regions of the intratropical convergence zone. There is a discussion of the possibilities of realization of objective analysis of the temperature and geopotential fields on the basis of data from satellite observations. The results are compared with similar data for the middle latitude continental regions. The accuracy of the remote method for evaluating temperature and geopotential in the tropical zone of the Atlantic is investigated.

[198]

#### TRANSMISSION FUNCTIONS FOR CARBON DIOXIDE IN $15\mu\text{m}$ BAND

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 638-647

[Article by Yu. M. Timofeyev, V. Deler and D. Shpenkukh, Leningrad State University, "Comparison of the Computed and Experimental Transmission Functions of Carbon Dioxide in the  $15\text{-}\mu\text{m}$  Band"]

[Abstract] The article cited above gives the results of comparisons of the computed transmission functions and laboratory measurements of transparency in the region  $15\text{ m}$  in the carbon dioxide band used in solving the problem of thermal sounding of the atmosphere from satellites. The computations were made by the direct method on the basis of modern data on the parameters of the fine structure of the absorption band in a broad range of changes in pressure, absorbing masses of  $\text{CO}_2$  and temperature. The authors give an analysis of the possible reasons for the disagreements between theory and experimentation, ways to reduce them, the temperature dependence of the transmission functions and an approximate method for taking it into account.

[198]

#### NUMERICAL MODEL OF THERMAL REGIME OF ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 571-580

[Article by V. V. Penenko, Computation Center, Siberian Department USSR Academy of Sciences, "Numerical Model of Atmospheric Thermal Regime"]

[Abstract] The article describes numerical methods for solving the problem of the formation of the thermal regime of the atmosphere. Finite-difference approximations are formulated on the basis of the variation principle. The direct algorithm for solution of the problem is based on the method of separation of variables with the use of a rapid Fourier transform. The author

also presents elements of the theory of small perturbations for evaluating variations of functionals in a general form in dependence on variations of the input parameters and an iteration method of the gradient type for parameterization of the model.

[198]

#### LIDAR SOUNDING OF MICROSTRUCTURE OF STRATOSPHERIC AEROSOL

Moscow IZVESTIYA AN SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 13, No 6, 1977 pp 648-654

[Article by V. Ye. Zuyev, N. V. Kozlov, E. V. Makiyenko, I. E. Naats and I. V. Samokhvalov, Institute of Atmospheric Optics, "Some Results of Sounding the Microstructure of Stratospheric Aerosol Using a Multifrequency Lidar"]

[Abstract] This paper gives the results of lidar sounding of stratospheric aerosol with two- and three-frequency lidars at wavelengths of 0.53, 0.69 and 1.06 $\mu$ m. The soundings were carried out in June 1975 in the Tomsk region when there was a relatively pure atmosphere with a meteorological range of visibility of more than 25 km. The relative measurement error caused by the statistical nature of signals reflected by the atmosphere was, depending on altitude, 0.5-1.5% for the first and second wavelengths and 4-5% for the third wavelength. The authors briefly describe the method for inversion of optical measurements and evaluating the microstructural characteristics of the probed aerosol. The collected data are discussed and compared with data from direct measurements. The article gives a brief description of the measuring instrumentation and a description of an optical experiment for the optical probing of the stratosphere.

[198]

### III. OCEANOGRAPHY

#### News

#### "AKADEMIK KURCHATOV" DEPARTS FOR "POLIMODE" OCEAN EXPERIMENT

Moscow PRAVDA in Russian 30 Jun 77 p 6

[Article by A. Levit: "To the Bermuda Islands"]

[Text] Kaliningrad, 29 June. The scientific research ship "Akademik Kurchatov" left Kaliningrad on its 25th voyage. The ship will sail to the area near the Bermuda Islands where Soviet scientists together with American oceanographers are to begin studies under the POLIMODE program.

The head of the expedition, Professor V. Kort, commented on the purposes and tasks of the experiment: "Several years ago scientists discovered powerful vortical movements resembling cyclones and anticyclones in the central part of the Atlantic. They create peculiar "weather" in the upper layer of the ocean and this weather has a great effect on navigation, the fishing industry and meteorological forecasts. Considering the importance of this phenomenon, Soviet and American oceanographers have developed a research program for studying the ocean vortices." [5]

#### SCIENTISTS PERFORM OCEANIC STUDIES NEAR WRANGEL ISLAND

Moscow IZVESTIYA in Russian 24 Jul 77 p 4

[Article by A. Kazikhanov, untitled article]

[Text] Anadyr'. Having returned from an expedition carried out near the shores of Wrangel Island, scientists from the surveying party of the Providenskaya Hydrogeographical Base have finished processing the collected materials. For four months the scientists studied the ocean bottom around the island in detail. The generalized data will help to create more precise large-scale maps of this area of the country and will be a good guide for ships sailing near Wrangel Island. [5]

## Abstracts of Scientific Articles

### PHENOMENA IN STRATIFIED BOUNDARY LAYER AT BOTTOM

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 411-416

[Article by G. S. Dvoryaninov and A. V. Prusov, Marine Hydrophysical Institute Ukrainian Academy of Sciences, "Mass Transfer in the Stratified Boundary Layer at the Bottom Caused by Waves"]

[Abstract] Within the framework of boundary layer theory the authors analyze the structure of two-layer stationary boundary layers generated at the bottom by progressive and standing waves. An analytical solution shows that Lagrangian mass transfer, caused by progressive waves, has one and the same sign within the limits of both layers; the rate of mass transfer at the outer boundary of the upper layer in the case of a fixed ratio of the exchange coefficients in the upper and lower layers is not dependent on the ratio of densities. In the case of standing waves the Lagrangian velocities are sign-variable with depth. It is shown that in all three limiting cases, when: 1) the densities and exchange coefficients in the layers are equal, 2) the thickness of the lower layer tends to zero, 3) the exchange coefficient in the lower layer tends to infinity, the Schlichting result is obtained on the outer boundary of the boundary layer.

[192]

### INTERNAL WAVES AND SOUND SCATTERING LAYERS

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 440-444

[Article by I. B. Andreyeva and Ya. P. Makshtas, Acoustics Institute, "Internal Waves and Sound Scattering Layers in the Temperature Jump Layer"]

[Abstract] In the equatorial Atlantic specialists carried out prolonged simultaneous registry of the sound scattering layer, water temperature and its vertical gradient; the latter two were used in determining the vertical variations of the isotherms, that is, internal waves. The analysis showed

that in the region of relatively low frequencies (with a period of one hour or more) the spectra of internal waves and fluctuations of the boundaries of the sound scattering layers virtually coincided, whereas their cross-coherence function fell in the range 0.8-1. In the region of short-period waves the spectral level of internal waves with the selected registry methods was greater than the spectral level of fluctuations of the sound scattering layer, whereas the coherency of the processes was appreciably reduced.

[192]

#### TECTONIC MOVEMENTS OF ATLANTIC OCEAN FLOOR

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 479-483

[Article by V. M. Litvin, Atlantic Division Institute of Oceanology, "Vertical Tectonic Movements of the Atlantic Ocean Floor in the Mesozoic-Cenozoic"]

[Abstract] On the basis of materials from geological-geophysical investigations, data from deep drilling, data from cartographic sources and sources in the literature, the author has compiled a map of vertical movements of the floor of the Atlantic Ocean in the Mesozoic-Cenozoic. For the ocean floor the reference level was the mean position of the crest of the Mid-Atlantic Ridge -- a depth of about 2.5 km, whereas for the margins of the continents and the transition zones the ocean level was used. The compiled map accompanies the article in the form of a fold-out. The amplitudes and mean rates of the vertical movements were determined: the plunging of the continental margins in the Mesozoic-Cenozoic was as much as 3-6 km and the rate was 0.02-0.04 mm/year; the plunging of the basins in the transition zones in the Cenozoic was as great as 5-6 km and the rate was 0.12-0.15 mm/year; the plunging of the basins in the Mesozoic-Cenozoic was as much as 4-5 km and the rate was 0.03-0.04 mm/year.

[192]

#### DEVELOPMENT OF THE BARENTS SEA SHELF

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 490-496

[Article by G. G. Matishov, Polar Scientific Research Institute of Fishing and Oceanography, "Relief, Morphotectonics and Principal Features of Development of the Barents Sea Shelf"]

[Abstract] Analysis of materials from areal echo sounding and detailed maps of bottom relief compiled by the specialists of the Polar Scientific Research Institute of Fishing and Oceanography and also geological-geophysical data have made possible a new representation of the morphology,

morphostructural peculiarities and characteristics of development of the Barents Sea shelf. On the narrow coastal shelf there are socle denudation plains and plateaus, and beyond its limits — structural-denudation and monoclinical-bedded rises, structural and basaltic plateaus, accumulative depressions, synclises and plains. The principal events in the history of development of the morphostructures on the floor of the Barents Sea are datable to the recent (Cretaceous-Early Paleogene) and very recent (Pliocene-Early Quaternary) stages. In the Pleistocene the ancient subaerial relief was subjected to considerable glacial processing by continental glaciers.

[192]

#### MOVEMENT OF SUSPENDED CLASTIC MATERIAL IN UPPER PART OF SHELF ZONE

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 497-505

[Article by S. M. Antsyferov and R. D. Kos'yan, Institute of Oceanology, "Investigation of the Movement of Suspended Clastic Material in the Upper Part of the Shelf Seaward of the Swell Zone"]

[Abstract] This paper gives the results of investigations of the distribution of the concentration and size of sand and silt particles suspended by passing waves over the profile of the shore slope of a tideless sea under storm conditions. The observations were made in a 1 1/2-meter bottom layer at depths from 4 to 20 m during four storms. The collected data were used in evaluating the possibility of making use of known theoretical solutions for describing the distribution of the concentration of suspended matter. Preference is given to the N. A. Rzhanitsyn solution, which is deemed to be suitable above some bottom region occupying the first tens of centimeters. For the bottom region the authors propose an empirical expression and demonstrate the possibility of representation of the suspension-carrying wave flow by means of a two-layer model. The peculiarities of distribution of particle sizes are noted.

[192]

#### LAYER OF STORM REWORKING OF ALLUVIUM IN BAY

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 506-510

[Article by A. I. Vvedenskaya, Moscow State University, "Layer of Storm Reworking of Alluvium in Rudnaya Bay (Sea of Japan)"]

[Abstract] The author demonstrates the good prospects for the use of a combination of lithological methods in the study of storm reworking of bottom sediments. Lithological-facies, granulometric and mineralogical analyses

were used. It was established for the bottom deposits of one of the open bays in Primor'ye that the layer of wave reworking of sediments is laid down in a sort of blanket, being gradually wedged out at sea depths between 20 and 30 m; the thickness of the layer with an increase in depth is gradually reduced from 3 m to several centimeters. It was found by use of the mineralogical method that the layer is inhomogeneous and can be broken down into two horizons. Evidently, the upper layer, whose thickness is about 1 m, is a zone of constant or most frequently repeated wave action.  
[192]

#### INFLUENCE OF ROTATION ON WAVES IN STRATIFIED OCEAN

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 400-410

[Article by V. M. Kamenkovich and A. V. Kulakov, Institute of Oceanology, "On the Problem of the Influence of Rotation on Waves in a Stratified Ocean"]

[Abstract] A study was made of the problem of free small oscillations in a layer of an incompressible stratified fluid with the constant depth  $H$  on a sphere with the radius  $a$ . A study was made also of the influence of rotation with the angular velocity  $\Omega$  on surface, gravitational and internal waves having frequencies of the order of  $\Omega$  and a wavelength of the order of 1,000 km or less. It is shown that both for a thin layer ( $H \ll a$ ) and for a thick layer ( $H \sim a$ ) the influence of the horizontal component of the vector  $\Omega$  on the internal modes is determined by the relationship between the Väisälä frequency  $N$  and the angular velocity of rotation  $\Omega$ .  
[192]

#### SEDIMENTARY LAYER AND BASEMENT IN GILBERT ISLANDS REGION

Moscow OKEANOLOGIYA in Russian Vol 17, No 3, 1977 pp 470-474

[Article by Yu. P. Neprochnov, V. N. Moskalenko and N. A. Shishkina, Institute of Oceanology, "Structure of Sedimentary Cover and Basement in the Gilbert Islands Region"]

[Abstract] The data obtained on the sixth voyage of the scientific research ship "Dmitriy Mendeleev" supplement and broaden the available information on the structure of the sedimentary layer and basement of atolls. The atolls of the Gilbert Islands system have a conical asymmetry. Their steep slopes are without sediments and are smoothed by material slipping from the atolls; traces of slides are noted in the bottom relief at the foot of the slopes. The relief of the foot of the atolls is either leveled due to the uniform receipt of sedimentary material on the bottom or hilly, which can be evidence of the tectonic activity of this region. Stratified sediments are

the most widespread; they reached the bottom from the surface of the atolls and are probably to a significant degree the products of destruction of coral reefs. The total thickness of the sedimentary cover in the region of the Gilbert Islands attains 300-600 m. The greatest thicknesses are discovered at the foot of the atolls, on the warped sectors of the basement. The warping of the basement evidently occurs under the weight of the atolls. The acoustic basement of the atolls probably is of volcanic origin, as is confirmed by gravimetric and seismic data. The asymmetrical structure of the atolls present in the Gilbert Islands group reflects the general nature of the tectonics of this part of the Pacific Ocean, which in many respects is determined by a major submeridional fault.  
[192]

#### ELECTROKINETIC PHENOMENA ASSOCIATED WITH SEA WAVES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 502-506

[Article by A. B. Leybo, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Electrokinetic Phenomena Associated with Sea Waves"]

[Abstract] A study was made of the mechanisms by means of which electrokinetic effects can be manifested in sea waves. These mechanisms are: 1) accelerated motion of the fluid in a wave causes relative movement of suspended particles, which is the reason for the appearance of an electromagnetic field, 2) the pressure which the fluid exerts on the bottom is different at different points if waves are propagated along the water surface and accordingly there is movement of the fluid in some saturated bottom layer, 3) motion of the water along the bottom, during which some part of the charge present at the bottom surface is transported away by the current. An analysis of these effects shows that the strength of the electromagnetic field caused by these effects sometimes increases the strength of the field induced by water movements in the earth's permanent magnetic field.

[159]

#### TURBULENCE IN STRATIFIED FLOWS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, FIZIKA, ASTRONOMIYA in Russian No 1, 1977, pp 70-77

[Article by Ye. P. Anisimova and A. A. Speranskaya, Department of Physics of the Sea and Waters of the Land, Moscow State University, "Turbulence in Stratified Flows"]

[Abstract] The authors describe the results of an investigation of the statistical characteristics of the velocity and temperature fields in fresh water bodies with few tributaries when these water bodies are covered by ice. The measurements were made in Lake Baykal and in the Uchinskoye Reservoir. The article emphasizes the results obtained for Lake Baykal and the region of Bukhta Listvennichnaya, where the Angara River originates. The measurements of the mean values and fluctuations of temperature and current velocity were made from the lake ice at 14 points in the bay. The sensors of the measuring instruments were attached on the end of a metal rod which was balanced in the water in a horizontal position by means of a moving weight and oriented along the flow. It was possible to make measurements under the undisturbed ice cover at a distance of 1.5 m from a hole in the ice. It was found in the example of the underice current in the lake that near large density gradients a boundary layer is formed whose turbulent structure is similar to the structure of the boundary layer on a smooth solid wall. Both types of boundary layers are characterized by the presence of logarithmic sectors on the mean velocity profiles. The deviations of the measured profiles of the main turbulent characteristics observed in the underice layer of the lake from the laws of a plane pressure flow can be explained by taking into account the influence of dynamic stability on the turbulent characteristics of the water masses.

[171]

#### REVIEW OF MORPHOMETRY OF THE WORLD OCEAN

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 6, 1977 pp 76-86

[Article by V. N. Stepanov, "Modern Concepts Concerning the Morphometry of the World Ocean"]

[Abstract] This review covers the dimensions of the world ocean, the principal characteristics of structure of the world ocean and the volumes of characteristic water layers. The data and conclusions of different Soviet and foreign authors are compared. Table 1 is "Areas and Volumes of the World Ocean and Individual Oceans"; Table 2 -- "Areas of the World Ocean by Depth Gradations"; Table 3 -- "Areas of Waters of the World Ocean and Individual Oceans by Depth Gradations"; Table 4 -- "Volumes of Water Layers in Individual Oceans by Depth Gradations"; Table 5 -- "Volume of Water Within the Most Important Structural Subdivisions of the World Ocean"; Table 6 -- "Principal Ridges, Basins and Trenches in the Oceans". All the features listed in Table 6 are identified on a full page map which accompanies the text.

[187]

#### IV. TERRESTRIAL GEOPHYSICS

##### News

##### TASS REPORTS EARTHQUAKE IN YUGOSLAVIA

Moscow PRAVDA in Russian 7 Jul 77 p 5

[TASS Report: "Underground Tremor"]

[Text] Belgrade, 6 July. Yesterday afternoon an underground tremor registered force 4-5 on the 12-unit Mercalli scale in Skopje. Its epicenter was located 15 kilometers northeast of the city, which was seriously damaged in 1963 from an earthquake. [5]

##### TASS REPORTS EARTHQUAKE ON SAKHALIN ISLAND

Moscow IZVESTIYA in Russian 27 Jul 77 p 4

[Article by A. Pushkar': "Earthquake on Sakhalin"]

[Excerpt] Yuzhno-Sakhalinsk. On 25 July at 1100 hours local time the Yuzhno-Sakhalinsk seismic station registered a series of underground tremors of force 7 on the northeastern shore of Sakhalin in the area of the settlement of Nogliki. The epicenter of the earthquake was located 100 kilometers from it in the Sea of Okhotsk.

V. Vtonov, First Secretary of the Vostochno-Sakhalinsk CPSU district committee, reported that Party and Soviet organs of the region have taken measures so that all of the inhabitants of the region were moved to the streets and children and invalids were evacuated to safe places.

As a result of the earthquake a number of buildings were damaged and cracks appeared in them. In some places furnaces and flues were destroyed and glass was blown out. Due to the timely measures taken, there were no injuries or casualties. Now life has returned to normal. [5]

UNDERGROUND TREMORS REPORTED IN TASHKENT

Moscow IZVESTIYA in Russian 16 Jul 77 p 6

[TASS Report: "Underground Tremors"]

[Text] Tashkent. On 14 July at 1150 LT the "Tashkent" seismic station registered underground tremors whose epicenter was located in the Kyzylkum desert near the city of Gazli. At the epicenter the tremors reached force 6-7, at Navoi and Bukhara -- force 5-6, at Samarkand -- force 3-4, and at Tashkent -- force 2-3 on a 12-unit scale.

There were no damages or casualties. [5]

## Abstracts of Scientific Articles

### CHANGES IN GRAVITY FIELD IN PLEISTOCENE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 234, No 4, 1977 pp 802-805

[Article by Yu. A. Tarakanov and V. A. Shleynikov, Institute of Physics of the Earth, "Estimate of the Limiting Changes in the Gravity Field in the Pleistocene"]

[Abstract] The article gives an estimate of the possible changes in the gravity field from the Middle Pleistocene to the present time, that is, over a time interval of about 200,000 years. The authors worked from a map of relief of the modern geoid obtained in 1973 by the Goddard Space Center. Since the deviations of the heights of sea terraces relative to the mean value over the entire earth cannot amount to kilometers or even hundreds of meters, such deviations are of a clearly tectonic origin. A mean morphometric series obtained earlier using 20 terrace series revealed the mean height of a terrace in each geological epoch. Deviations exceeding the difference in ocean levels in two adjacent epochs can be considered tectonic displacements. An estimate of the heights of the Pleistocene Ocean was made using 80 continental and 45 island terrace series. Figure 2 in the text shows the distribution of the number of terraces with respect to their heights  $H$  relative to the modern ocean level. The distribution peaks corresponding to the climatic epochs coincide with the times -25, -130 and -200 thousand years. Data on the mean heights and the deviations from them are given in Table 1. For the epoch -200 thousand years the mean height of the terraces according to island data is 12 m less than can be caused by the bending of the ocean floor with a mean rate of 0.17 mm/year. The standard deviation of the heights of individual terraces relative to the mean value for 200,000 years ago was only 9 m. It is possible to estimate the maximum possible secular changes in potential if the entire variation of heights of the ancient ocean is attributed to change in the gravity field. It is concluded that during the last 200 thousand years the secular changes in gravity can be  $\sim 0.04-0.05 \mu\text{gal/year}$ .  
[104]

## DENSITY SECTION OF CRUST IN NORTHEASTERN USSR AT DEPTH OF 10 km

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 234, No 4, 1977 pp 907-910

[Article by Academician N. A. Shilo, Yu. Ya. Vashchilov and I. M. Migovich, Northeastern Integrated Scientific Research Institute, "Density Section of the Earth's Crust in the Northeastern USSR at a Depth of 10 km and its Mineralogical Interpretation"]

[Abstract] As a result of application of a fundamentally new approach to the interpretation of gravity anomalies based on concepts of a primarily block form of anomaly-forming objects, it has become possible to formulate models and maps of density inhomogeneities for different depths of the earth's crust and upper mantle. One of the first variants of such a map for the Northeastern USSR at a depth of 10 km is reproduced in this article (Fig. 1). The map is given a petrological-lithological interpretation carried out with allowance for existing geological information. The actual basis for its compilation was the results of computations of the depths of the upper and lower boundaries and density jumps in a horizontal direction. The entire range of change in densities at the 10-km level is broken down into five intervals. Rocks with a density characteristic for each interval are designated on the map by appropriate symbolization. Rocks having a density of  $2.69 \text{ g/cm}^3$  or less are granites, weakly metamorphosed sedimentary formations, granitogneisses. A density of  $2.70\text{--}2.77 \text{ g/cm}^3$  characterizes granodiorites and Precambrian metamorphic rocks corresponding to them in chemical composition, metamorphosed dacites, andesites and terrigenous rocks of the Mesozoic and Paleozoic, and in the upper interval of the range -- limestones. A density in the range  $2.78\text{--}2.85 \text{ g/cm}^3$  is characteristic of rocks of the dioritic series, limestones, metamorphic formations. Rocks with a density of  $2.86\text{--}2.99 \text{ g/cm}^3$  are regarded as magmatic and metamorphic rocks of basic composition. Rocks with a density of  $3.00 \text{ g/cm}^3$  or more are regarded as a mixture of basic-ultrabasic magmatic and metamorphic formations.

[104]

## PETROPHYSICAL CHARACTERISTICS OF PALEOGENE ROCKS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, 1977 pp 126-131

[Article by A. S. Sindeyev and I. V. Rozental', All-Union Scientific Research Institute of Geophysical Prospecting and All-Union Scientific Research Geological Institute, "Petrophysical Characteristics of Basic Paleogene Rocks of the Northern Periokhotia Region"]

[Abstract] A study was made of the physicommechanical (density, total porosity, velocity of elastic waves) and magnetic (natural remanent magnetization, magnetic susceptibility, Q factor) properties of Paleogene basalts, andesite basalts and andesites of the Northern Periokhotia region. The density differences of these rocks are associated for the most part with their mineral composition and textural-structural peculiarities and to a lesser degree with differences in chemical composition. The density and porosity in each density group are inversely proportional to the content of volatiles in the rock. Comparison of the physicommechanical parameters of the rocks makes it possible to assume that the relative rate of cooling decreased with a decrease in basicity. The magnetic susceptibility of slightly magnetic rocks is proportional to the concentration of ilmenite; in highly magnetic rocks there is a positive correlation between  $\chi$  and the total quantity of iron in the rocks and there is an inverse correlation with the rock content of  $TiO_2$ . The natural remanent magnetization of the rocks is dependent primarily on the conditions for cooling of the ferromagnetic. The maximum Q values are characteristic for rocks containing ilmenite. As the rocks crystallize the Q value decreases.  
[197]

#### HYDROLOGICAL INTERPRETATION OF SATELLITE PHOTOGRAPHS

Warsaw PRZEGLAD GEODEZYJNY in Polish Vol 49, No 4, 1977 pp 122-124

[Article by G. B. Gonin, State Hydrological Institute (USSR), "Techniques of Hydrological Interpretation of Satellite Photogrammetry"]

[Abstract] The possibilities of using satellite photos in photogrammetry for hydrological investigations are discussed. The artificial earth satellites "Meteor" and "Soyuz-9" have been used to obtain photos. Formulas making possible the use of satellite photos for their photogrammetric interpretations are given. The application of computation techniques for this purpose with the use of BESM-4, "Dnepr" and "Minsk-22" computers is also explained. Examples are given to illustrate precise determination of the surface of reservoirs. The article represents the Polish translation of a Russian article which appeared in No 237 (1976) of the Transactions of the State Hydrological Institute in Leningrad.  
[149]

## V. UPPER ATMOSPHERE AND SPACE RESEARCH

### News

#### ALL-UNION COSMIC RAY CONFERENCE OPENS IN YAKUTSK

Moscow IZVESTIYA in Russian 28 Jun 77 p 6

[TASS Report: "Studying Cosmic Rays"]

[Text] Physicists from Bulgaria, Hungary, Rumania and Czechoslovakia, together with Soviet scientists, are participating in the All-Union Cosmic Ray Conference which opened on 27 June. Siberian scientists are presenting papers on recent developments of this year at this meeting. [5]

#### "INTERKOSMOS" CONFERENCE HELD IN HAVANA

Moscow PRAVDA in Russian 6 Jul 77 p 4

[TASS Report: "In the 'Interkosmos' Program"]

[Text] Havana, 5 July. From 27 June to 4 July the latest conference of members of the "Space Physics" group from the socialist countries was held in Havana. The participants are working on the study and use of space in the "Interkosmos" program. Delegations from Bulgaria, Hungary, GDR, Cuba, Mongolia, Poland, Rumania, the USSR and Czechoslovakia took part in the conference. [5]

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-922"

Moscow PRAVDA in Russian 1 Jul 77 p 2

[TASS Report: "'Kosmos-922'"]

[Text] The "Kosmos-922" artificial earth satellite was launched in the Soviet Union on 30 June 1977. The satellite carries scientific equipment intended for the continuation of space research. The "Kosmos-922" was inserted

into an orbit with the following parameters:

- initial period, 89.5 minutes;
- apogee, 323 kilometers;
- perigee, 212 kilometers;
- orbital inclination, 62.8 degrees.

In addition to the scientific equipment the satellite carries a radio transmitter operating on a frequency of 19.995 MHz, a radio system for the precise measurement of orbital elements and a radiotelemetry system for transmitting data on the operation of instruments and scientific equipment to the earth.

The apparatus installed on the satellite is functioning normally. The coordination-computation center is processing the incoming information.  
[5]

#### TASS ANNOUNCES LAUNCHING OF "METEOR" WEATHER SATELLITE

Moscow PRAVDA in Russian 1 Jul 77 p 2

[TASS Report: "'Meteor' in Flight"]

[Text] On 29 June 1977 a "Meteor" artificial earth satellite was launched in the Soviet Union. The basic mission of the satellite is to obtain experimental information necessary for the continuation of operations in the study of the earth's natural resources, for developing methods of long-distance measurements of parameters of the underlying surface and also for obtaining meteorological information for use in the operational weather service. The satellite was inserted into an orbit with the following parameters:

- apogee, 685 kilometers;
- perigee, 602 kilometers;
- orbital inclination, 98 degrees;
- initial period, 97.5 minutes.

Along with the standard meteorological apparatus, the satellite carries experimental research scanning television apparatus for obtaining images of the underlying surface of the earth in several parts of the spectrum and a remote heat-sensing apparatus for determining the radiation characteristics of the underlying surface, the moisture content of the atmosphere and the boundaries of the ice cover.

In addition to research equipment, the "Meteor" satellite has: a system to maintain constant orientation of the satellite toward the earth, a power supply system with autonomous orientation of the solar cells toward the sun, a correction system for maintaining orbital stability, a radio system for precise measurement of orbital elements, and a radiotelemetry

system for transmitting data on the operation of the instruments and scientific equipment to earth.

The apparatus installed on the satellite is functioning normally. Scientific information goes to the State Scientific Research Center for Study of the Environment and Natural Resources and the USSR Hydrometeorological Center for processing and utilization. [5].

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-923"

Moscow PRAVDA in Russian 2 July 77 p 1

[TASS Report: "'Kosmos-923'"]

[Abstract] The artificial earth satellite "Kosmos-923" was launched in the Soviet Union on 1 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 101.4 minutes;
- apogee, 842 kilometers;
- perigee, 804 kilometers;
- orbital inclination, 74 degrees. [5]

#### NEW SOVIET SHIPS BEING BUILT TO MONITOR SPACE FLIGHTS

Moscow IZVESTIYA in Russian 3 Jul 77 p 2

[Article by V. Nevel'skiy, "Space Flotilla"]

[Text] Leningrad. The flag of the USSR Academy of Sciences has been raised on the scientific research ship "Kosmonavt Vladislav Volkov." It was constructed by shipbuilders at the Leningrad Plant imeni A. A. Zhdanov.

Scientific research ships play a significant role in the study and opening up of space because, during every space experiment, a special arrangement of various measurement and command radio engineering devices is necessary on the earth's surface. Just like older vessels of its type, the "Kosmonavt Vladislav Volkov" is a ship with an unlimited sailing range. It can receive information from space objects during any type of weather from any point in the world ocean. The equipment installed on the ship also makes it possible to perform a whole series of investigations connected with the study of the upper layers of the atmosphere.

The research fleet will soon be supplented with more such vessels -- "Kosmonavt Pavel Belyayev," "Kosmonavt Georgiy Dobrovol'skiy" and "Kosmonavt Viktor Patsayev." [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-924"

Moscow PRAVDA in Russian 6 Jul 77 p 2

[TASS Report: "'Kosmos-924'"]

[Abstract] The artificial earth satellite "Kosmos-924" was launched in the Soviet Union on 5 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 95.3 minutes;
- apogee, 560 kilometers;
- perigee, 514 kilometers;
- orbital inclination, 74 degrees. [5]

RESULTS OF UN COMMITTEE ON USE OF SPACE

Moscow PRAVDA in Russian 5 Jul 77 p 5

[Article by Igor' Mel'nikov: "Space -- Sphere of Cooperation"]

[Excerpt] The UN Committee on the Peaceful Use of Space has completed its 20th anniversary session in Vienna. The participants presented the latest results of the practical use of space technology.

The session gave much attention to the initiatives of the Soviet Union which are directed toward the development of equal international cooperation in space. The "Interkosmos" program, which combines the efforts of socialist governments in virtually all areas of cosmonautics, was of great interest.

An important landmark in the development of international cooperation in near-earth space was the launching of the "Sneg-3" French research satellite by a Soviet booster rocket. The Soviet-American agreement on cooperation in the study and use of space for peaceful purposes which was signed in May of this year also opens up broad possibilities. This agreement specifically provides for the carrying out of joint studies of the moon and planets in the field of space biology, medicine and meteorology, the study of natural resources, and the development of satellite search and rescue systems. Planned experimental flights of the "Salyut"-type Soviet long-lived orbital station and the American space shuttle will be a logical continuation of the successful flight of the "Soyuz" and the "Apollo" spaceships.

The Vienna session gave serious attention to the strengthening of international law and order in space. A draft resolution dedicated to the 10-year agreement on the principles of governmental activity in space study

has been received and submitted for consideration by the UN General Assembly. This draft resolution has already been signed by 72 countries. All countries which are UN members are invited to become participants in this agreement.

Significant progress has been made in the formulation of principles relating to legal consequences of remote sounding of the earth with satellites used for studies in the areas of geology, geodesy, cartography, prevention of natural calamities, agricultural pests, etc. [5]

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-925"

Moscow PRAVDA in Russian 8 Jul 77 p 2

[TASS Report: "'Kosmos-925'"]

[Abstract] The artificial earth satellite "Kosmos-925" was launched in the Soviet Union on 7 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 97.2 minutes;
- apogee, 645 kilometers;
- perigee, 622 kilometers;
- orbital inclination, 81.2 degrees. [5]

#### SAGDEYEV COMMENTS ON "SNEG-3" MISSION

Moscow PRAVDA in Russian 24 Jun 77 p 6

[Article by R. Z. Sagdeyev, "Listening to the Voice of the Universe"]

[Text] The flight of the French satellite "Sneg-3," put into orbit by a Soviet carrier-rocket, is successfully continuing. This is an important contribution to the investigation of space. A PRAVDA correspondent asked the director of the Space Research Institute USSR Academy of Sciences R. Z. Sagdeyev to tell about the tasks of the new international experiment.

"The space surrounding the earth is increasingly becoming the arena of broad cooperation. For example, with our French colleagues we have already launched into space tens of different experiments and have accumulated much experience in cooperation. Therefore, preparations for the launching of the "Sneg-3" proceeded in a businesslike, working fashion. At the same time, I would like to note that the new joint experiment causes much interest among scientists, especially astronomers."

"It is known that space objects emit into surrounding space electromagnetic radiation in a very broad range. The universe seemingly talks to us in different languages. The transport of instrumentation beyond the limits of the earth's atmosphere made it possible to observe this entire spectrum of frequencies. In 1962 the first source of X-radiation, other than the sun, was discovered and now more than 200 of them are known. Recently several sources of local gamma radiation have been discovered; these usually arise during some nuclear transformations and can give very important information concerning the extremal states of matter."

"A specific process whose study is one of the tasks of "Sneg-3" is that from time to time somewhere in the depths of the universe there are gigantic catastrophes. A flare-up lasts literally a few seconds and the released energy exceeds by approximately a factor of 100 million the energy emitted during this same time interval by our sun. The task of scientists is to ascertain what physical processes lead to such gigantic explosions."

"There is basis for assuming that these phenomena are associated with so-called "black holes," that is, with those cosmic formations which in the course of some years now have been attracting the attention of astrophysicists. In the neighborhood of "black holes" the physical conditions are unusual; these do not always fit within the framework of the already known laws of behavior of matter. Hence we can understand the interest of science in X- and gamma sources."

"Registering the entire process and detecting the time of its occurrence is by no means a simple matter. On the average there are one or two flares per month or week and they last, as already mentioned, for seconds. Therefore, the satellite instrumentation was designed in such a way that long period of time specialists ignored the relatively weak radiation, the so-called cosmic background, but very close attention was given to several of the most important seconds. The process is registered and then the collected information is sent to earth through the radio channel."

"The satellite work program also includes the search for and investigation of X-ray bursts of diffuse hard X- and soft gamma radiation of galactic and extragalactic origin, study of variations of UV radiation of the sun in dependence on its activity."

"In order to accelerate the processing of information, a direct digital communication line has been established between the Computation Center of our institute and the French Space Research Institute; using an ordinary telephone channel this makes it possible to transmit data at a speed of 2,400 binary digits (approximately 300 letters) per second."

"We feel that this joint experiment is opening up a new direction in research which will undoubtedly receive further development. One of the important problems is a determination in the celestial sphere of the

position of sources of gamma bursts. It can be solved if the observations are made simultaneously by several similar instruments spatially separated by a great distance. The fact is that even at the speed of light, with which gamma quanta are propagated, at different instruments they will be received with a certain delay whose time can be measured, and this means it is possible to determine the direction to the source of a gamma burst."

The 'Sneg-3' is not the only project which we are carrying out in collaboration with French scientists. There are also others, and not only in the field of astronomy, but also in the investigation of circumterrestrial space, the planets of the solar system."

"The scientists of the Space Research Institute USSR Academy of Sciences are also successfully cooperating with specialists of other countries. Within the framework of the 'Interkosmos' program specialists of the member countries in the socialist block are studying the structure of the earth's upper atmosphere, solar activity, and are engaged in investigations of the weather. They have carried out astronomical observations. The successful implementation of the Apollo-Soyuz program has demonstrated the desirability and effectiveness of joint work in different fields of space science between the scientists of the Soviet Union and the United States of America. We are carrying out such a major program of cooperation with Indian specialists. Now preparations are being made for the launching of a second Indian satellite using a Soviet carrier-rocket. We are carrying out joint work with colleagues from Sweden and a number of other countries."

"The striving to combine efforts for joint investigation and use of space is increasing with each passing year. This is being encouraged, in particular, by the global nature of the studied phenomena and the necessity for the introduction of multisided research methods."

"It is entirely obvious that a knowledge of the boundless expanses of the universe and the influence of space factors on terrestrial processes is vitally necessary for the future of all inhabitants of our planet without exception. And there is no doubt but that we will hear more about new and interesting projects which will be carried out through the joint efforts of different countries. [A photograph shows the joining of the "Sneg-3" with the carrier-rocket in the test assembly building.]

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TASS ANNOUNCES LAUNCHING OF "KOSMOS-926"

Moscow PRAVDA in Russian 10 Jul 77 p 2

[TASS Report: "'Kosmos-926'"]

[Abstract] The artificial earth satellite "Kosmos-926" was launched in the Soviet Union on 8 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 105.1 minutes;
- apogee, 1,025 kilometers;
- perigee, 997 kilometers;
- orbital inclination, 82.9 degrees. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-927"

Moscow PRAVDA in Russian 13 Jul 77 p 2

[TASS Report: "'Kosmos-927'"]

[Abstract] The artificial earth satellite "Kosmos-927" was launched in the Soviet Union on 12 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 90 minutes;
- apogee, 403 kilometers;
- perigee, 178 kilometers;
- orbital inclination, 72.9 degrees. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-928"

Moscow PRAVDA in Russian 14 Jul 77 p 1

[TASS Report: "'Kosmos-928'"]

[Abstract] The artificial earth satellite "Kosmos-928" was launched in the Soviet Union on 13 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 104.8 minutes;
- apogee, 1,022 kilometers;
- perigee, 977 kilometers;
- orbital inclination, 83 degrees. [5]

TASS ANNOUNCES LAUNCHING OF "RADUGA" COMMUNICATIONS SATELLITE

Moscow PRAVDA in Russian 25 Jul 77 p 2

[TASS Report: "'Raduga' Communications Satellite"]

[Text] In accordance with the program for the further development of communications and television broadcasting systems using artificial earth satellites, on 24 July 1977 a "Raduga" communications satellite was

launched in the Soviet Union. It has an on-board repeater apparatus to ensure continuous round-the-clock telephone and telegraph radio communication within the centimeter waveband and simultaneous broadcasting of color and black-and-white Central Television programs to the "Orbita" network.

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

- distance from the earth's surface, 36,600 km;
- period of rotation about the earth, 24 hours 27 minutes;
- orbital inclination, 0.4 degree.

Besides improved multichannel repeater communications and television apparatus, the satellite has a triaxial system for precise orientation on the earth, a power supply system with independent aiming and tracking of the solar cell, an orbital correction system, a heat regulating system, a radio-telemetric system for transmitting back to earth data on the operation of the on-board systems and a radio system for the precise measurement of the orbital parameters and for control of the satellite.

The apparatus of the "Raduga" is functioning normally. A command and measurement complex is controlling the satellite. The communications and television apparatus will be used in accordance with the planned program. The "Raduga's" international registration index is "Statsionar-2." [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-930"

Moscow PRAVDA in Russian 20 Jul 77 p 2

[TASS Report: "'Kosmos-930'"]

[Abstract] The artificial earth satellite "Kosmos-930" was launched in the Soviet Union on 19 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 94.6 minutes;
- apogee, 528 kilometers;
- perigee, 482 kilometers;
- orbital inclination, 74 degrees. [5]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-929"

Moscow PRAVDA in Russian 18 Jul 77 p 4

[TASS Report: "'Kosmos-929'"]

[Abstract] The artificial earth satellite "Kosmos-929" was launched in the Soviet Union on 17 July 1977. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.4 minutes;
- apogee, 298 kilometers;
- perigee, 221 kilometers;
- orbital inclination, 51.6 degrees. [5]

#### SATELLITE TRANSMISSION OF NEWSPAPERS FROM MOSCOW TO FAR EAST

Moscow IZVESTIYA in Russian 8 Jul 77 p 6

[Article by V. Belikov, "Newspaper Transmitted Through Space"]

[Text] In implementing the instructions of the 25th Congress CPSU on the speeding up of the delivery of central newspapers to the population, Soviet communication specialists have begun experimental transmissions of photo-images of newspaper pages from Moscow to Khabarovsk via communication satellites of the "Orbita" system.

For the inhabitants of tens of cities and a great many populated places in our enormous country it has already become customary to receive central newspapers at the same time that they are received by Muskovites. This has become possible due to the phototelegraphic transmission of copies of newspaper pages of numbers of PRAVDA, IZVESTIYA and other publications which have just appeared in the capital. In the local print shops these unusual "photographs" are used in preparing press plates.

Through the joint efforts of communication workers and printers, the network of stations receiving newspapers by phototelegraph is constantly expanding; now there are already 26 such places and by the end of the Five Year Plan there should be more than 40.

"When using surface cable and radiorelay lines," states the chief of the Main Telegraph Administration of the USSR Communications Ministry S. Martsenitsen, "each 200-300 km it is necessary to carry out a so-called correction of the photoimage of the newspaper page, eliminating the errors and distortions arising with such a transmission method. After all, the quality of the 'picture' at the reception point must be very high, much clearer, for example, than a frame on the screen of an ordinary television set. Otherwise it is impossible to prepare a press plate for printing which does not differ from the original in the Moscow print shop."

The space communication channel will make it possible to exclude repeated image corrections. Our scientists, designers and the workers at transmission and reception points had to overcome many difficulties in the development of highly complex electronic instrumentation and its preparation for experimental operation."

"The difference in the method employed from the procedures ordinarily used in the reception of television programs through space," continued S. Martsenitsen, "is the continuous checking of qualities of the image received at the Moscow station for the transmission of newspaper pages. In other words, there is assurance not only of direct communication, but also a constant feedback over a space bridge with an extent of tens of thousands of kilometers. The creators of the 'Gazeta-2SK' apparatus have been able to achieve a perfect matching of the operation of the transmitting and receiving apparatus."

"I note also," said S. Martsenitsen, "that the time expended on the transmission of one newspaper page does not exceed 2 1/2 minutes, whereas the accuracy in reproducing each element of print and pattern is measured in microns..."

My host extended to me several copies of central newspapers printed at Khabarovsk and sent as samples to the USSR Communications Ministry. The clear, distinct printing, the clean and sharp tones of the patterns, even the professional eye of the newspaperman could not find any flaws caused by the journey through space. On the July day when this interview took place seven central newspapers, including IZVESTIYA, had been transmitted to the Far East via satellite on a regular basis.

"The new method in essence makes it possible to organize the reception of an image at any point in the 'Orbita' system," emphasized the chief of the Main Telegraphic Administration, "but in addition to the communication apparatus there must be corresponding preparations and a printing base."

By the sixtieth anniversary of the Great October Revolution Soviet communication specialists are planning to complete the period of experimental operation and put the Moscow-space-Khabarovsk line into constant use. The plans for the years immediately ahead call for ensuring the space transmission of the originals of central newspapers for printing at Novosibirsk, Krasnoyarsk, Dushanbe, Magadan and other cities.

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## Abstracts of Scientific Articles

### HIGH-ENERGY ELECTRONS IN IONOSPHERE DURING MAGNETIC STORM

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 435-440

[Article by M. S. Kovner, V. A. Kuznetsova, V. I. Larkina and Ya. I. Likh-ter, "Extremely Low Frequency Radiation and Fluxes of High-Energy Electrons at Ionospheric Altitudes During the Magnetic Storm of 16 December 1971"]

[Abstract] The article describes variations in the intensity of extremely low frequency radiation (500 and 2,500 cps) and fluxes of high-energy electrons ( $E > 40$  keV) during a magnetic storm of 16 December 1971 on the basis of data from the artificial earth satellite "Interkosmos-5." In the course of the storm the radiation field and the electron fluxes increased by approximately an order of magnitude. By the end of the recovery phase of the storm the radiation at a frequency of 500 cps fell to a level observed before the storm, whereas at a frequency of 2,500 cps an increased radiation level persisted. The simultaneous modulation of extremely low frequency radiation and the fluxes of leaking electrons was observed near  $L = 4$  in the active phase of the storm. An interpretation of experimental data is carried out on the assumption that extremely low frequency radiation at frequencies  $< 2,500$  cps is excited by high-energy electrons at ionospheric altitudes in the mirror point region. The authors develop the idea that long-period surface waves at the plasmopause are the reason for the modulation of extremely low frequency radiation and fluxes of leaking electrons.

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### INVESTIGATIONS OF SOLAR RADIO EMISSION AND PARAMETERS OF EARTH'S IONOSPHERE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 412-420

[Article by V. I. Aksenov, O. V. Kas'yan, G. P. Komrakov, A. P. Modestov, I. V. Popkov and Ya. Khanash, "Investigations of Sporadic Solar Radio Emission and Parameters of the Earth's Ionosphere on the Satellite 'Interkosmos-Kopernik 500'. 2. Debye Screening and Electron Concentration Inhomogeneities"]

[Abstract] This paper presents the results of investigations of the parameters of the ion screen around a cylindrical antenna in ionospheric plasma and the amplitude-spatial characteristics of inhomogeneities of electron concentration in the ionosphere obtained on the satellite "Interkosmos-Kopernik 500" using low- and high-frequency impedance probes. It is shown that the input resistance of the antenna at a frequency of 50 KHz in the ionosphere is determined for the most part by the ion screen. It has been experimentally established that the thickness of the screen in the case of an antenna potential close to a floating potential is in the range from 2 to 3 Debye screening radii. The applicability of a homogeneous model of the screen is demonstrated when determining its characteristics. The spectra of inhomogeneities of the electron concentration in the ionosphere are obtained. In the middle latitudes the typical spectrum of inhomogeneities  $\Delta N$  with dimensions  $3 \ll l \ll 20$  km has the form  $\Delta N \propto l^n$ , where  $n = 1.5 \pm 0.12$ . Quasiperiodic inhomogeneities of the electron concentration were also registered.

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#### PARAMETERS OF SHOCK WAVES IN INTERPLANETARY SPACE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 392-400

[Article by V. P. Grigor'yeva and S. A. Kaplan, "Parameters of Shock Waves in Interplanetary Space According to Observations Aboard the 'Prognoz' Artificial Earth Satellite"]

[Abstract] The article gives the results of processing of observations of the low-frequency radioemission ( $f = 700, 350, 200, 100$  KHz) of type-II bursts generated by shock waves from strong chromospheric flares in May and August 1972. The authors determined the velocities of shock waves, the kinetic temperatures of the heated gas, the brightness temperatures of radioemission, and the parameters of the region of plasma turbulence. There is a qualitative correlation between the brightness temperature of radioemission and the shock wave velocity. It was found that the ratio of the energy density of plasma waves to the thermal energy is in the limits from  $5 \cdot 10^7$  to  $1.2 \cdot 10^{-6}$ ; this value varies little as the shock wave is propagated.

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#### SPATIAL OSCILLATIONS OF GRAVITATIONALLY ORIENTED ELASTIC SATELLITE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 384-391

[Article by Yu. N. Pavlov and V. N. Petruk, "Spatial Fluctuations of a Gravitationally Oriented Elastic Satellite. II. Investigation of Nonlinear Resonances"]

[Abstract] A study was made of small fluctuations relative to the center of mass of a gravitationally oriented satellite with elastic elements moving in a circular or slightly elliptical orbit in a central Newtonian field. Expressions are derived for the relationship between the characteristic frequencies at which nonlinear resonances arise in a nonrigid satellite. Using the solution of averaged canonical equations of perturbed motion in elliptical functions the authors investigate the characteristics of nonlinear resonance effects in the aspect of possible use of similar phenomena during the damping of spatial oscillations.

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#### SPACECRAFT DESCENT TRAJECTORIES IN MARTIAN ATMOSPHERE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 346-351

[Article by N. M. Ivanov, B. B. Kotov and A. I. Martynov; "Synthesis of Optimum Descent Trajectories of a Spacecraft in the Martian Atmosphere When Using a Parachute-Reactive Soft Landing System"]

[Abstract] The authors propose a method for constructing the optimum trajectories of a spacecraft in the Martian atmosphere from the condition of the minimum of the weight expenditures in ensuring a soft landing. In the segment of main aerodynamic braking the spacecraft is controlled by means of effective quality, whereas in the last segment a parachute-reactive soft-landing system is used. It is shown that the minimum weight of the parachute-reactive system is attained on minimum velocity trajectories at the end of the segment of main aerodynamic braking if one stipulates the altitude of activation of the parachute system and on trajectories ensuring a maximum of this altitude when there is restriction of the initial velocity of parachute activation.

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#### PUTTING SPACE VEHICLE INTO ORBIT OF ARTIFICIAL MARTIAN SATELLITE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 336-345

[Article by D. Ye. Okhotsimskiy, Yu. F. Golubev, A. P. Bukharkina, I. V. Filipovich and V. K. Shelukhina, "Putting a Space Vehicle into the Orbit of an Artificial Martian Satellite Using Braking in the Planetary Atmosphere"]

[Abstract] The authors propose a multi-interval adaptive algorithm for forming the command banking angle of a spacecraft during its entry at a hyperbolic velocity into the Martian atmosphere, making it possible to launch into the orbit of an artificial Martian satellite. A solution of

the navigational problem is attained as a result of refinement of the navigational parameters parallel to the process of control of motion in the course of the entire entry trajectory. In each control interval the command banking angle is formed for the entire impending segment of motion. For this purpose the author uses the numerical prediction of the trajectory. In the next control interval the adopted solution is refined. The article gives the results of mathematical modeling. These give evidence of the effectiveness of the used methods. It is shown that with the proposed algorithm the entry corridor with respect to the pericenter altitude is close in width to the physically possible width.

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#### EFFECT OF PRESSURE OF THERMAL RADIATION OF EARTH ON SATELLITE

Moscow IZVESTIYA VUZov, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 2, 1977 pp 73-78

[Article by Yu. M. Manakov, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Perturbing Influence Exerted on Artificial Earth Satellite by the Pressure of the Earth's Thermal Radiation"]

[Abstract] The article sets forth a theory for the representation of the averaged heat field of the earth in external space. The basis for the theory is the assumption of a conservative nature of the heat field. On the basis of data from Soviet and American meteorological satellites it was possible to obtain the zonal harmonic coefficients of the earth's heat field. On the basis of this formulated theory of representation of the heat field the author gives a theory of the pressure exerted on an artificial earth satellite by the earth's thermal radiation. For a satellite having a spherical configuration the pressure of the thermal radiation can be taken into account using an insignificantly modified theory of perturbed motion of an artificial earth satellite in the planet's gravitational field. Corrections are obtained for the influence of the heat field for satellites used in a Standard Earth III in determining the even zonal harmonics of geopotential.

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#### N-S ASYMMETRY IN INTENSITY OF PCA

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 445-449

[Article by A. V. Shirochkov, Arctic and Antarctic Scientific Research Institute, "North-South Asymmetry in the Intensity of PCA"]

[Abstract] Latitudinal chains of riometers in the polar regions of both hemispheres can be used effectively for studying N-S asymmetry in the intensity of solar cosmic rays during periods of equinoctial PCA. The energy range

of solar cosmic rays participating in the creation of the N-S asymmetry takes in particles with  $E_p = 1-40$  MeV. Experimental latitudinal distributions of absorption confirm the model of "illumination" of the polar regions with fluxes of solar cosmic rays proposed by Mørfill and Scholer (JGR, 78, 5449, 1973). This model explains better the experimental data on the N-S asymmetry of solar cosmic rays than the similar model formulated by Gall, Bravo and Orozco (JGR, 77, 5360, 1972). The results presented in this paper confirm the point of view expressed by Reid and Sauer (JGR, 72, 4383): with a definite orientation of the sectoral structure of the IMF the lines of force of one of the earth's polar caps are directly joined to the IMF. A change in the polarity of the IMF sector leads to a change in the sign of N-S asymmetry of the intensity of solar cosmic rays. With stable polarities of the IMF noted in some years this situation can be of prognostic importance. The phenomena accompanying the change in sign of the sectoral structure of the IMF during PCA periods can be traced on the basis of data from stationary latitudinal chains of riometers in greater detail than on the basis of data from a moving satellite. In this case it becomes possible to estimate the time of passage of the boundary of the sectoral structure of the IMF through the earth.

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#### CORRELATION OF ELECTRON FLUX IN GEOSTATIONARY ORBIT AND AURORAL BAY FORM

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 543-544

[Article by O. I. Shumilov and A. V. Frank-Kamenetskiy, Arctic and Antarctic Institute, "Correlation Between the Intensity of the Electron Flux in a Geostationary Orbit and the Form of Auroral Absorption Bays"]

[Abstract] In the investigation of the dynamics of auroral absorption it is assumed a priori that there is a correlation between the form of absorption bays and the intensity of the flux of high-energy ( $\geq 40$  keV) electrons drifting in the equatorial plane. However, until now there has been no experimental checking of this point. In order on the basis of data on auroral absorption to judge the dynamics of magnetospheric electrons, the authors examined the published results of observations of electrons with energies 50-150 keV obtained using the geostationary satellite ATS-1. A study was made of the characteristics of decrease in the intensity of the electron flux. The study indicated that the form of the absorption bays is unambiguously determined by the intensity of the electron flux in the equatorial plane of the magnetosphere. All the effects associated with the dispersion of electrons by energies in the process of gradient and centrifugal drift find their reflection in a change in the form of auroral absorption bays measured on the earth. The article has demonstrated the possibility of an investigation of the dynamics of magnetospheric plasma on the basis of the results of observations of auroral phenomena in general and auroral absorption in particular.

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## SOUNDING OF IONOSPHERE OVER KAZAKHSTAN FROM AIRCRAFT

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 527-528

[Article by A. Kh. Depuyeva, M. P. Rudina and A. A. Starovatov, Ionosphere Section Kazakh Academy of Sciences, "Results of Ionospheric Sounding Over Kazakhstan from Aboard an Aircraft"]

[Abstract] In September and October 1975 an experiment was carried out to clarify the role of relief of the earth's surface in the formation of large-scale inhomogeneities of electron concentration in the ionosphere. A standard ionosonde of the AIS type was carried aboard an IL-14 aircraft. After ascent to an altitude of about 6,000 m above sea level, the ionosphere was probed every minute. Several flights were made in the Alma-Ata region along 77°E so that one part of the flight line passed over the steppe and the other part passed over mountain ranges with an elevation up to 4,000 m. The length of the flight line was about 150 km. The ionograms obtained during the sounding from aboard the aircraft were compared with the relief of the underlying surface. It was established that the minimum frequencies on the ionogram were subject to intense and stable changes in dependence on local relief. Some of the results are presented. In all probability, changes in the electron concentration in the C and D regions reflect the relief of the earth's surface. For a final solution of this problem it is necessary to carry out direct measurements of absorption by surface ionospheric stations in steppe and mountain regions.

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## CHARACTERISTICS OF SHORT-WAVE SIGNALS DURING AURORAL SUBSTORMS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 534-536

[Article by D. V. Blagoveshchenskiy, N. F. Blagoveshchenskaya and Yu. A. Kurchenko, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Characteristics of Short-Wave Signals During Auroral Substorms"]

[Abstract] The article examines the dynamics of the statistical characteristics of short-wave signals during the time of auroral substorms on three high-latitude radio paths with a common reception point situated in the auroral zone. Radio path 1 with an extent of 1,400 km extended along the auroral zone, radio path 2 with a length of 500 km extended across the auroral zone, path 3, with a subauroral meridional direction, had an extent of 1,700 km. The working frequencies on path 1 were about 10 MHz, on path 2 -- 5 MHz and on path 3 -- 4 MHz. For determining the patterns of behavior of the statistical characteristics of SW signals in the course of a substorm the authors analyzed 11 negative bays of the H component of the magnetic

field at the place of signal reception for the winter and equinoctial periods. The observations were made on each of three radio paths at 15-minute time intervals, beginning several hours before the appearance of a negative bay, during the bay and after it. As a result of the joint analysis of the 11 geomagnetic bays and the statistical characteristics of the SW signals on different paths there was found to be approximately identical patterns of change in the parameters of signals for each of 11 cases. It is shown that using the patterns of change in the statistical characteristics of these SW signals on high-latitude paths it is possible to determine the onset of events associated with an auroral substorm. The characteristic changes in the statistical parameters for about one hour before the onset of a sharp decrease in the H-component to a certain degree make it possible to predict this phenomenon.

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#### MAGNETIC EFFECTS OF CHROMOSPHERIC FLARES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 496-501

[Article by M. I. Pudovkin and V. A. Sergeyev, Leningrad State University, "Magnetic Effects of Chromospheric Flares and the Electric Field in the High-Latitude Ionosphere. II. Region of the Auroral Electrojets"]

[Abstract] In an earlier study (V. A. Sergeyev, GEOMAGN. I AERONOMIYA, 17, 291, 1977) it was demonstrated that on the basis of data on disturbances of the crochet type it is possible to obtain information on the global distribution of the electric field in the high-latitude ionosphere. In this new study it is shown that using disturbances of the crochet type it is possible to study the structure of electric fields in the region of the auroral electrojets. On the basis of the collected data there is a discussion of the source of electric fields in the region of the electrojets and the problem of the interaction between electric fields of ionospheric and magnetospheric origin. It is concluded on the basis of extensive observations that the action of the ionospheric dynamo in the morning and afternoon sectors of the auroral zone can considerably inhibit magnetospheric convection in the tubes of force connected to the region of increased ionospheric conductivity.

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#### DETERMINING ORIENTATION OF UNSTABILIZED ARTIFICIAL EARTH SATELLITES

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 15, No 3, 1977 pp 363-375

[Article by V. V. Golubkov, "Analytical Method for Determining the Orientation of Unstabilized Slightly Perturbed Artificial Earth Satellites. I"]

[Abstract] This paper consists of three parts. The first part gives a formulation of the problem of determining the orientation of artificial earth satellites on the basis of measurement data. A nonlinear statistical method is presented for the successive evaluation of the parameters of rotational motion. There is an evaluation of the accuracy of the determined parameters and its dependence on the number of processed time intervals. The second part is devoted to a description of a model of rotational motion of a satellite corresponding to the Euler-Poinsot case, selection of the variables and the parameters to be determined, derivation of formulas for computing rotational motion, the functions to be measured and their partial derivatives. The third part gives an analysis of use of the method for determining the orientation of artificial earth satellites in the examples of processing of magnetometric information on specific satellites. There is a discussion of the results of processing of information. The speed of the method is evaluated. This is the first part of the study. Two other parts will be published later.

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#### SEASONAL ANOMALY OF ELECTRON CONCENTRATION IN F REGION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 418-421

[Article by N. M. Boyenkova, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation; "Seasonal Anomaly of the Electron Concentration in the F Region at Nighttime"]

[Abstract] A study was made of the vertical, temporal and spatial peculiarities of the nighttime seasonal anomaly on the basis of data on the  $n_e(h)$  profiles obtained using ground stations and the "Alouette-1" satellite and model profiles. There is a discussion of the possible reasons for the appearance of the nighttime seasonal anomaly at altitudes  $h \gg h_m F2$ . The observations were made primarily during a period of high solar activity. All the data were obtained under magnetically quiet conditions ( $A_p \leq 20$ ). The results relate to the middle latitudes of the northern hemisphere. It is shown that in the outer ionosphere the nighttime seasonal anomaly can arise due to an increase in  $(T_e + T_i)$  and a decrease in  $m$  in winter in comparison with summer. With respect to the reasons for the nighttime seasonal anomaly in the lower ionosphere, the situation is more complex. Here the photochemistry of the nighttime and daytime ionosphere is different and at altitudes of 100-180 km, where the seasonal anomaly is observed, it is different from the photochemistry of the upper part of the F region.

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## CHANGES IN E LAYER DURING GEOMAGNETIC DISTURBANCES

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 422-426

[Article by G. S. Ivanov-Kholodnyy and A. A. Nusinov, Institute of Applied Geophysics, "Changes in the E Layer During Geomagnetic Disturbances"]

[Abstract] It is shown that an increase in geomagnetic activity is accompanied by negative disturbances of electron concentration at the maximum of the ionospheric E layer. The multiple regression method is used in finding the quantitative relationship between the intensity of these disturbances and the  $A_p$  index of magnetic activity. The article gives an analysis of series of daily midday  $f_0E$  values obtained by the vertical sounding method at the middle latitude stations Krasnaya Pakhra, Lindau and Slough during the period from December 1968 through October 1969. It was found that the principal reason for the change in the electron concentration at the maximum of the E layer during geomagnetic disturbances is a change in the neutral composition of the atmosphere. An analysis of elementary processes in the E layer shows that a decrease in the electron concentration by several percent during the time of magnetic disturbances can be attributed either to an increase in the content of NO molecules by several tens of percent or a change in the relative concentration of O or O<sub>2</sub> by a factor of 2-3.

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## ELECTRON LOSS FUNCTION IN IONOSPHERIC D REGION

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 427-432

[Article by V. V. Belikovich, Ye. A. Benediktov and M. A. Itkina, Gor'kiy Radiophysics Institute, "Electron Loss Function in the Ionospheric D Region and Dependence of Anomalous Absorption of Radio Waves on the Solar Zenith Angle During Sudden Ionospheric Disturbances"]

[Abstract] This paper describes the results of numerical computations of the dependence of anomalous absorption during sudden ionospheric disturbances on solar zenith angle  $\Gamma(\gamma)$  for a  $\psi(h)$  model which takes into account negative ions and two species of positive ions. The results of the computations are compared with the experimental data obtained by V. V. Belikovich, et al., IZV. VUZov, RADIOFIZIKA, 16, 840, 1973. Computations were made using the following scheme. For different  $\gamma$  values the authors determined the ion formation function  $Q(h)$  governed by solar X-radiation during the time of sudden ionospheric disturbances. Then using the stipulated model of the electron loss function it was possible to find the vertical distributions of electron concentration  $N(h)$ . Quasi-equilibrium conditions are assumed to be correct and the influence of background ionization of the undisturbed ionosphere is not taken into account. The resulting

N(h) profiles were used in computing the total absorption of radiowaves and in determining the  $\Gamma(\chi)$  dependence. Latitudinal variations of the electron loss coefficient are noted.

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#### ENERGY DISTRIBUTION OF UV RADIATION OF SOLAR FLARE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 398-402

[Article by I. N. Odintsova and V. D. Novikov, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Spectral Distribution of Energy of UV Radiation of Solar Flare"]

[Abstract] The authors demonstrate the fundamental possibility of computing the spectral distribution of the energy of the UV radiation of the initial phase of a solar flare on the basis of the results of multifrequency observations of SFD. By having a series of  $\Delta q(h, t)$  profiles for different moments of time, it is evidently possible to evaluate the development of the spectrum with time. Such evaluations are of interest in connection with the fact that the measurement of energy distribution in the UV spectral region by the use of the existing spectrometers aboard artificial earth satellites takes considerable time and does not make it possible to trace spectral changes in the course of a flare and especially during such a rapid process as the explosive phase. The same can be said of measurements by the incoherent scattering method. Even a comparison of the unique results obtained by G. D. Thome (JGR, 76, 6883, 1971) with Doppler records for these same flares shows that individual peaks in the  $\Delta f(t)$  records have a duration of about five seconds, which is considerably less than the time resolution of the incoherent scattering method. It was possible to construct spectra of UV radiation in the range 1-796 Å for the flares of 28 August 1966 and 23 May 1967. This makes it possible to use SFD observations for the accumulation of data and establishing the general patterns of the spectral distribution of energy of UV radiation during the initial phase of the flare. A further breakdown of the spectrum is possible in a joint analysis of the results of observations of SFD and satellite measurements in individual UV lines with a high temporal resolution.

[159]

#### DETERMINING OUTER BOUNDARY OF RADIATION BELTS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 3, 1977 pp 403-409

[Article by S. N. Kuznetsov, G. B. Lopatina and V. G. Stolpovskiy, Nuclear Physics Institute, Moscow State University, "Outer Boundary of the Radiation Belts According to Data from the 'Kosmos-426' Satellite"]

[Abstract] The main influence on the position of the outer boundary of the radiation belts is exerted by geomagnetic activity and the diurnal variation in geomagnetic time. In an examination of the position of the boundary in a quiet time and in different MLT intervals it is possible to investigate its behavior in dependence on other factors: the slope of the axis of the geomagnetic dipole and the orientation of the interplanetary magnetic field. The influence of the slope of the geomagnetic axis is maximum during post-midnight hours MLT in the hemisphere with the summer solstice and is manifested in an increase in the latitude of the boundary with an increase in the slope to  $90^\circ$ . The influence of the N-S component of the interplanetary magnetic field is manifested in a greater latitude of the boundary during the periods of a northerly orientation of the vertical component of the interplanetary magnetic field almost in all MLT intervals except for the post-midnight hours (0200-0800 MLT), although the position of the boundary does not correlate with the value of the northerly component of the interplanetary magnetic field. The position of the boundary is related to a higher degree with the value of the southerly component of the interplanetary magnetic field. During the near-midday hours MLT there is a decrease in the latitude of the boundary with an increase in the value of the southerly component of the interplanetary magnetic field in both hemispheres. The behavior of the nighttime boundary is not fully determined. [159]

#### ESTIMATE OF MERIDIONAL TRANSPORT OF OZONE IN ATMOSPHERE

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, FIZIKA, ASTRONOMIYA in Russian  
No 1, 1977 pp 106-109

[Article by V. M. Berezin and N. F. Yelanskiy, Department of Atmospheric Physics, Moscow University, "Estimating Meridional Atmospheric Ozone Flow"]

[Abstract] Data on the global distribution of the total ozone content in the atmosphere help in carrying out a comparative estimate of the possible mechanisms of the meridional transport of ozone. The computations presented in this paper show that the principal role in interlatitudinal exchange ( $40^\circ\text{N}$ ) is played by mean meridional circulation. The influence of disordered movements is substantially less. The contribution of stationary vortices to the total transport exceeds the contribution of the moving vortices. The weak influence of the latter is evidently associated with the position of the planetary high-altitude frontal zone in the region  $35-42^\circ\text{N}$ , which is an impediment to the passage of the vortices across the selected parallel. On the other hand, an intensification of the stationary high-altitude subtropical anticyclones in the zone  $30-35^\circ\text{N}$  during the spring-summer season favors the active transport of ozone on their eastern periphery from the temperate latitudes of the northern hemisphere into the low latitudes which are poor in ozone. This southern transport must embrace the maximum thickness

of the atmosphere and attain the maximum level during the summer months, as is confirmed by the collected data.

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#### DETERMINATION OF VERTICAL PROFILES OF AEROSOL IN ATMOSPHERE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 235, No 1, 1977 pp 53-56

[Article by Corresponding Member USSR Academy of Sciences K. Ya. Kondrat'yev, A. A. Buznikov and O. M. Pokrovskiy, Leningrad State University, "Determination of the Vertical Profiles of Aerosol in the Atmosphere from the Results of Spectrophotometric Measurements of the Twilight Horizon from the 'Soyuz-13' Spaceship"]

[Abstract] This paper is a continuation of the investigations of the senior author and his associates reported earlier (K. Ya. Kondrat'yev, et al., *IZV. AN SSSR, SER. FIZIKA ATM. I OKEANA*, Vol 11, No 11, 1975; *IBID.*, Vol 12, No 4, 1976). This new article gives the results of use of the method described earlier for "inversion" of the brightness profile of the atmospheric twilight horizon obtained aboard the "Soyuz-13" spaceship using the RSS-2M hand satellite spectrograph. There is a discussion of the structure of the vertical profiles of aerosol in the stratosphere and mesosphere. The cited data confirm the hypothesis expressed earlier that there is a layer of increased concentration of aerosol particles in the atmosphere at an altitude of about 50 km; this is of great importance for investigating aerosol effects in the theory of climate. The spectrographic observations of the earth's horizon were made on 22 December 1973 on three revolutions. The spectrograms were processed on a microphotometer with an altitude interval of 1.3 km, and for a wavelength of 5 nm -- in the wavelength interval 400-700 nm. The registered brightness profiles belonged to the range of perigee altitudes of the sighting line from 15 to 40-45 km. In solving the inverse problem the authors used computed brightness profiles for altitudes exceeding these values. The error in tie-in caused by errors in the microphotometric method was about 2 km. Four specific frames are discussed. It would appear that such findings can be used in implementing a program for the remote global sensing of the aerosol content in the stratosphere and mesosphere.

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## VI. MISCELLANEOUS

### News

#### PREPARATIONS FOR TWENTY-THIRD SOVIET ANTARCTIC EXPEDITION

Moscow PRAVDA in Russian 6 Jul 77 p 6

[Article by V. Bardin: "To the Sixth Continent"]

[Abstract] This short article reports on plans for the 23d Soviet Antarctic Expedition. Preparations are now underway at the Main Administration of the Hydrometeorological Service and in the USSR Academy of Sciences' Interagency Commission for Study of the Antarctic.

The new expedition will have a total of 547 participants. As before, the main research task will be aerometeorology and will include the use of meteorological rockets to probe the atmosphere, reception of weather information from satellites, and development and implementation of numerical weather forecasting for Antarctic stations.

Plans call for maximizing the automation of aerometeorological research and data processing. This will require installation of new equipment and improvements in the computer center already functioning at Molodezhnaya station. This station will begin to operate as a regional meteorological center, providing other stations and ships in the southern ocean with information.

Reconstruction of the polar stations will continue. Reconstruction of Mirnyy Observatory is scheduled to be completed this year.

The tradition of having an American scientist at one of the Soviet stations and a Soviet representative at an American station will be continued.

Also mentioned in the article is Yu. A. Izrael', head of the Hydrometeorological Service and a Corresponding Member of the USSR Academy of Sciences. [5]

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