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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

GEOPHYSICS, ASTRONOMY AND SPACE

No. 388

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GEOPHYSICS, ASTRONOMY AND SPACE

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This serial publication contains abstracts of articles 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

ASTROPHYSICAL RESEARCH AT TYRAVERE OBSERVATORY DISCUSSED

Moscow PRAVDA in Russian 2 Nov 76, p 6

[Article by A. Favorskaya, "Visible Far from Tyravere"]

[Summary] The specialists at the Institute of Astrophysics and Atmospheric Physics Academy of Sciences Estonian SSR at Tyravere carry out a vigorous program of astrophysical research. Among the astrophysicists here is Doctor of Physical and Mathematical Sciences Yaan Eynasto, who in the Astronomical Council USSR Academy of Sciences heads a working group which is studying the structure and dynamics of the entire Galaxy. When Tyravere specialists for the first time carried out complex computer processing of masses of accumulated data on galaxies it was found that estimates of the masses of galaxies making up constellations were obviously too low. The dynamic mass was found to be many times greater than that which is computed from the luminosity of the galaxies. The work of Eynasto on the "mass paradox" was confirmed first of all using data for Andromeda and then using data for over 100 other systems. It was possible to clarify in great detail the structure of the most interesting galaxies of different types. It is entirely possible that each star system is surrounded by a hidden mass -- an envelope of matter which cannot be seen. At Tyravere it was possible to make the first determination of the dynamic mass of galaxies beyond the limits of their apparent dimensions. The scientists postulate that the invisible matter probably is greater by a factor of ten than the mass of the visible matter of galaxies. With the discovery of galactic coronas the general picture of the universe is acquiring a new and unexpected appearance. A correct determination of the mean density of mass in the universe will make it possible to determine whether the universe is infinitely expanding or whether compression will someday occur. In studies carried out in collaboration with the Leningrad cosmologist A. D. Chernin, it was found that galaxies do not exist by themselves in the universe, but are bound into more complex physically unified systems -- hypergalaxies with a radius of several million light years. For example, our Galaxy and the nebula Andromeda constitute parts of a common hypergalaxy. The observatory has a new 1.5-m

telescope. It will enable Tyravere astronomers to observe objects with a diameter less than a second of angle and to observe stars which are six to seven times fainter than those which could be studied using old observatory instruments. The work program for this telescope will include attempts to refine the temperature and chemical composition of cold stars, such as one interesting star which is evolving exceedingly rapidly (in 20 years it has evolved from a hot to a cold star). Observations will be made in the IR spectrum and intensive work on galaxies will be pursued. [104]

Abstracts of Scientific Articles

MAGNETIC PUMPING OF ENERGY IN TURBULENT PLASMA

Moscow ASTRONOMICHESKIY ZHURNAL in Russian Vol 53, No 5, 1976, pp 1052-1059

[Article by Yu. A. Sinitsyn and S. F. Pimenov, Institute of Radio Physics and Electronics Ukrainian Academy of Sciences, "Magnetic Pumping of Energy into Nonequilibrium Turbulent Plasma as a Possible Energy Source in Solar Flares"]

[Abstract] In this paper the authors examine the absorption of energy of an external slowly varying magnetic field in a system of plasmons in which a nonequilibrium Kolmogorov distribution was established. Such a situation differs substantially from the case of partially equilibrium plasmons (which requires rather rigid external conditions, such as absence of external sources, etc.) and can be observed under flare conditions. A slow change in the external field entering into the expression for the frequency of plasmons and their distribution functions against a background of steady distributions of the Kolmogorov type deflects the system from a stationary state. Due to collisions of plasmons the absorption of field energy occurs. It is shown that the rate of dissipation of energy into nonequilibrium plasma can be substantially greater than in the case of a partially equilibrium system of plasmons. In the description of plasma processes the author uses an approximation of weak turbulence on the assumption of a randomness of the phases of plasma waves and weakness of nonlinear interaction between them. In this case the totality of the plasmons can be represented as a nonideal gas of quasiparticles, the interaction among which has the nature of collisions. The collisions in the system of plasmons form stationary distributions.
[119]

AN ASPECT OF SOLAR-TERRESTRIAL RELATIONSHIPS

Moscow ASTRONOMICHESKIY ZHURNAL in Russian Vol 53, No 5, 1976, pp 1060-1062

[Article by E. R. Mustel', V. A. Khvedeliani and V. Ye. Chertoprud, USSR Hydrometeorological Center and Astronomical Council USSR Academy of Sciences, "A New Aspect of Study of Solar-Atmospheric Relationships"]

[Abstract] For a study of solar-atmospheric relationships the authors propose use of daily charts of surface pressure and an analysis of the temporal variation of the mean dispersion (in longitude) of the daily differences in pressure near the moments of strong geomagnetic disturbances (t_m). The preliminary results of application of this method confirm the presence of a global effect of change in the dispersion of the daily differences in pressure on the fourth day after t_m at latitudes 50, 55, 60°; the amplitude of the effect is about 25%. The conclusion that there is a global effect of strong geomagnetic disturbances on surface pressure is definitely confirmed. It is shown that 30-40 reference times are adequate for reliable detection of the global effect at latitudes $\leqslant 60°$. This effect is virtually not dependent on season.
[119]

II. METEOROLOGY

Abstracts of Scientific Articles

FUNDAMENTALS OF AGROMETEOROLOGICAL FORECASTING

Budapest IDOJARAS in Hungarian Vol 80, No 5, 1976, pp 253-261

[Article by Zoltan Varga-Haszonits, Director, Central Forecasting Service]

[Abstract] The objective of weather forecasting for agriculture is to provide information which may be used for more effective adaptation, protection and intervention. In developing the procedures for agricultural forecasting the first objective is solving problems which will contribute to improvement of an important agricultural operation and which are likely to be solved with a high degree of reliability. The methods developed must be suitable for routine use with available personnel and must be verifiable. Solution of the problems involved is preferably on the basis of agrometeorological models. Preparation of the model involves theoretical formulation of the model and the simplifying conditions which are to be used and the selection of the predictors. Computers may be used to advantage in these operations. The following accuracy requirements apply to the forecasting methods: the forecast must be undistorted and the standard error of the forecast should be as little as possible. Compliance with these requirements can be accomplished by comparison of standard errors and determination of the convergence coefficient. If the probable error is determined one can not only find out whether a new method is more accurate than an earlier one, but also the probability of a given error which is risked when using the method.
[135]

III. OCEANOGRAPHY

News

SIXTEENTH VOYAGE OF "DMITRIY MENDELEYEV"

Moscow PRIRODA in Russian No 11, 1976, pp 51-53

[Article by L. A. Ponomareva, Institute of Oceanology, "Sixteenth Voyage of the 'Dmitriy Mendeleyev'"]

[Abstract] During the period 5 December 1975-26 March 1976 the scientific research vessel "Dmitriy Mendeleyev" of the Institute of Oceanology made its 16th voyage. The expedition had the purpose of studying the composition and genesis of benthos and necton in the Australia-New Zealand region and adjacent waters of Subantarctica, investigations of the structure of plankton communities in subantarctic and antarctic waters, including quantitative investigations of food chains and determination of elements of the energy balance, collection of material for evolution and ecological biochemistry and hydrochemistry, carrying out geomorphological and magnetometric observations, and also study of the complex of underwater Macquarie structures situated to the south of New Zealand. The work was carried out in accordance with the plan for Soviet-Australian scientific cooperation and during different stages the participants included scientists from Australia, New Zealand, United States and India. One of the important tasks was a geomorphological study of the abyssal Macquarie complex. At the same time, a study was made of fish in trenches living at a depth of 5,500 m. Scientists made extensive collections of fish in the Australia-New Zealand region. For the first time meridional runs were made for studying primary production, chlorophyll, bacteria and plankton. Extensive material was collected by the biochemical detachment. Interesting data were obtained on the hydrological structure of the Antarctic convergence, together with new data on the distribution of water masses and numerical values of their physical and chemical parameters. A map of the vessel's track accompanies the text and is reproduced here.

[116]

TWELFTH VOYAGE OF "AKADEMIK VERNADSKIY"

Moscow PRIRODA in Russian No 11, 1976, pp 112-115

[Article by Ye. M. Kukharkov, Oceanographic Commission USSR Academy of Sciences, "Twelfth Voyage of the Scientific Research Ship 'Akademik Vernadskiy'"]

[Abstract] The 12th voyage of the scientific research vessel "Akademik Vernadskiy" of the Marine Hydrophysical Institute Ukrainian Academy of Sciences took place during the period December 1975-April 1976. This voyage ended the around-the-world voyage of the ship begun in November 1974 and continued the study of the spatial-temporal variability of the principal hydrophysical fields of the equatorial zone of the Atlantic, Indian and Pacific Oceans. The track of the expedition was in the tropical zone of the Pacific and Atlantic Oceans. The objectives of the voyage included: study of the large-scale structure of the field of current velocities, especially that of the equatorial Cromwell subsurface current; investigation of the mesoscale variability of hydrological, hydrophysical and hydrochemical fields by means of standard observations at drifting stations; investigation of the spatial distribution of hydrological characteristics; investigation of the characteristics of turbulence of short-period waves. The program also included geological, biological and radiophysical investigations. During the voyage specialists measured water temperature, velocity field, conductivity, transparency and color index of water, intensity of bioluminescence, characteristics of the gravitational, magnetic and electromagnetic fields. Over a period of 120 days the ship occupied 30 stations, made three meridional runs across the equator, carried out gravimetric and geomagnetic measurements along the track with an extent of about 30,000 miles and collected a great amount of data on the hydrological characteristics of the sea. The program provided that the ship would participate in EXPO-75 on Okinawa, where it arrived on 22 December 1975. Visitors saw laboratories and scientific equipment aboard the ship and displays demonstrating the successes of the Marine Hydrophysical Institute in studying the world ocean.
[116]

"OSA-3-600" UNDERWATER CRAFT DESCRIBED

Moscow PRIRODA in Russian No 11, 1976, pp 116-117

[Article by M. P. Aronov, All-Union Scientific Research Institute of Marine Fishing and Oceanography, "'Osa-3-600' Underwater Craft"]

[Abstract] Technical tests of the new underwater craft "Osa-3-600" were carried out in December 1975 in the Gulf of Finland. This craft is rated for operation at depths of about 600 m. The new vehicle (chief designer V. P. Shmatok) was constructed in the Moscow Division of the GIPRORYBFLOT. It is distinguished from its predecessors by greatly enhanced research capabilities. The "Osa" has a sturdy hull which protects the crew (the article is accompanied by a color photograph of the craft). The sphere has engines which make it easy to change the direction of movement. Arrangement of the engines and configuration of the hull enable the vehicle to move in any direction. An automated control system ensures exceptional

maneuverability. The vehicle can hover with the necessary tilt near any object, the distance to which is determined precisely by hydroacoustic instruments. Automatic instrumentation also takes into account the current strength which must be overcome for maintaining the vehicle in place. The "Osa" has a three-man crew. The air within the craft is dried by a special apparatus. The observers have four windows. A television system makes it possible to increase the field of view. Automatic stabilization of the vehicle enhances its capabilities when using a manipulator. The "Osa-3-600" is intended for investigations in the waters and at the bottom of different seas and oceans. At the surface the craft has good seaworthiness. It can explore sectors of the continental shelf and slope, underwater rises in the open ocean and over any depths in the open sea. It can be used in exploring sectors to determine the distribution of marine organisms, including in areas with dissected relief. The vehicle will make it possible to study the vertical migrations of fish and plankton.
[116]

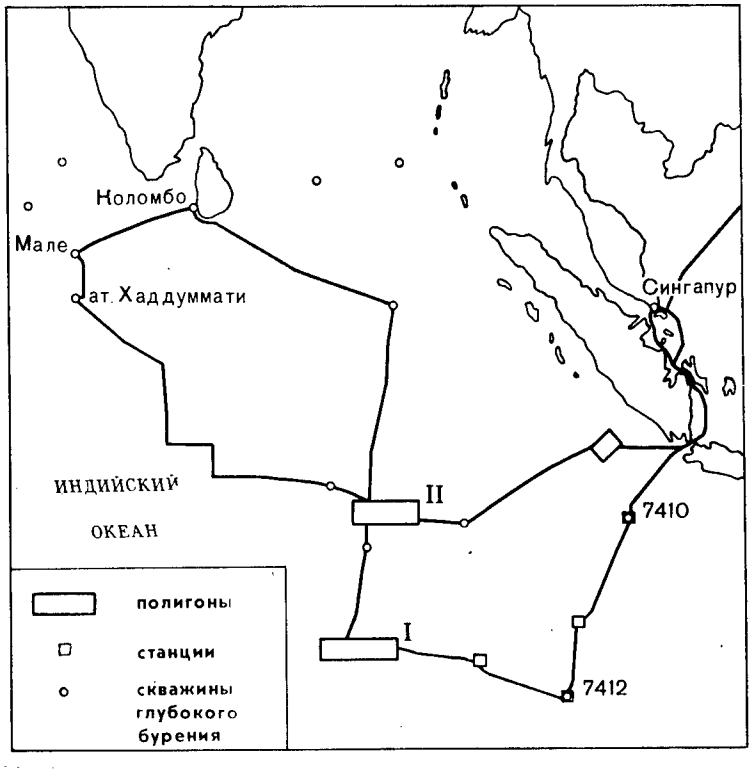
FIFTY-EIGHTH VOYAGE OF THE "VITYAZ'"

Moscow PRIRODA in Russian No 11, 1976, pp 118-121

[Article by Yu. P. Neprochnov, Institute of Oceanology, "Fifty-Eighth Voyage of the Scientific Research Vessel 'Vityaz'"]

[Abstract] The fifty-eighth voyage of the scientific research ship "Vityaz'" was carried out during the period December 1975-March 1976. The expedition included 46 scientists from the Institute of Oceanology, Institute of Physics of the Earth, Siberian Division and Far Eastern Scientific Center USSR Academy of Sciences, USSR Geology Ministry. The program provided for a comparative study of the East Indian Ocean Ridge and adjacent basins (Central, Cocos, West Australian) and the nature of their joining. According to deep seismic sounding, the earth's crust under the ridge differs from the crust of the basins by having an increased thickness of the so-called second layer. In the basins this layer has a thickness of 1.5-2 km and is characterized by a velocity of seismic waves of 5.0-5.5 km/sec. Beneath the crest of the East Indian Ocean Ridge its thickness is 4-5 km; it is divided into two layers: upper, with a velocity of seismic waves of about 4 km/sec and lower -- about 5 km/sec. In the course of the voyage a study was made of a large submeridional zone of deep faults to the east of the ridge. The surfaceward rising of dense rocks of the upper mantle discovered here explains well the anomalies of the gravity and magnetic fields known here earlier. On the basis of an analysis of petrographic, stratigraphic and geophysical data the participants proposed a new model of the structure and development of the ridge. The East Indian Ocean Ridge evidently began to form during the Upper Cretaceous on the already formed oceanic crust in a zone of a major linear fault. The article is accompanied by a map

showing the vessel's track, reproduced below. The rectangle represents polygons, the squares -- stations, the circles -- deep drilling boreholes.



[116]

Abstracts of Scientific Articles

EXCITATION OF OCEAN NOISE BY TURBULENT WIND

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V118

[Abstract of article by B. F. Kur'yanov; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 40-43, "On the Mechanism of Excitation of Ocean Noise by a Turbulent Wind"]

[Text] The article discusses the results of experiments described in the literature relating to study of the mechanism of creation of low-frequency noise in the ocean. These show that ocean noise at all frequencies down to the lowest contains a component which is almost completely correlated with wind velocity. The experimental data agree with the model of the mechanism of excitation of low-frequency ocean noise by the action of turbulent fluctuations of wind pressure (Isakovich and Kur'yanov, 1970). It is proposed that this model be used in solving the inverse problem of determining the characteristics of the turbulent wind on the basis of observations of low-frequency acoustic noise in the ocean. It is also shown that the dependence of noise pressure on depth, frequency and wind velocity is insensitive to the type of the cross spectrum of turbulent fluctuations at the ocean surface. Bibliography of four items.
[109]

SOUND PROPAGATION IN FRONTAL ZONE REGIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V120

[Abstract of article by V. A. Apanasenko; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 53-55, "On the Problem of Sound Propagation in Frontal Zone Regions"]

[Text] The article presents the results of experimental investigations of the propagation of pulsed sound signals in the region of a frontal zone with a complex nature of the speed of sound field. At a distance of 300 km in the surface layer (to depths of 300-400 m) there was an appreciable increase in the horizontal gradient of the speed of sound, which led to a change in the direction of the transmission of sound rays through this layer after reflection from the surface but not reflected from the bottom. The author gives an evaluation of the possible changes in angle caused by the horizontal gradient. It is shown that small changes in direction of the ray in the upper layer of the ocean caused by relatively small horizontal gradients of the speed of sound can cause secondary bottom reflections of the signal in the frontal zone region leading to a change in the structure of the sound field over great distances. It has been established from an analysis of three classes of rays at distances 250-280 km (in an underwater sound channel without reflections, reflected only by the surface and repeatedly reflected by the ocean surface and floor) that transition to the class of bottom reflections is possible only for rays which in an underwater sound channel uniformly on the path glance off the bottom. It is noted that secondary bottom reflections may also not develop if rays of the indicated type intersect the frontal zone at great depths. Bibliography of three items. [109]

FLUCTUATIONS OF SIGNAL PROPAGATING IN THE OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V121

[Abstract of article by L. M. Nefedov and V. A. Klychnikov; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 56-62, "Fluctuations of a Pulsed Signal Propagating in the Ocean"]

[Text] The article gives the results of experimental investigations. The measurements were made from drifting vessels at frequencies of 400 Hz and 3KHz with pulses of 10 and 5msec respectively. The pulse repetition rate was 2 sec. In one of the experiments the sound source and receiver were placed at a depth of 150 m with a distance of 700 m between them. In another experiment the source was placed at a depth of 70 m, two sound receivers were placed at depths of 50 and 120 m; the distances between the source and sound receivers were 0.5, 3.5, 10, 20, 30, 50 and 70 km. There is a detailed description of the experimental method and the method for processing the received signals. A study was made of the dependence of the variation coefficient for signal energy on distance and frequency. It is shown that with a small wave parameter D there is no dependence on frequency; in the case of large D values there is a linear increase of fluctuations with distance and a quadratic dependence of the variation coefficient on signal frequency is observed. The authors compare experimental and theoretical dependences of the variation coefficient with distance. At small distances from the source the main contribution to the field of fluctuations of sonic pressure

is made by the wave-covered ocean surface and at great distances -- for the most part by inhomogeneities of the medium. Bibliography of 11 items. [109]

REFLECTIONS FROM OCEAN FLOOR

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V124

[Abstract of article by I. P. Sharomov; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 81-90, "Experimental Determination of the Coefficient of Reflection from the Ocean Floor"]

[Text] The results of experimental studies made by different authors for investigating the coefficient of reflection of sound from the ocean floor and the losses experienced during reflection are given. The article analyzes factors exerting an influence on the value of the reflection coefficient as a function of the angle of incidence. It was established that the value of the reflection coefficient is influenced by the macro- and microrelief of the bottom, wave resistance and the multilayer structure of the floor. For low frequencies the reflection coefficient is determined primarily by the number and properties of the layers of bottom ground and for high frequencies -- by microrelief. The article describes four methods making it possible to obtain experimentally the dependence of the reflection coefficient on the angle of emergence of the signal from the source: standing waves, comparison of multiple reflections and a special case based on the use of diagrams expressing the dependence of the distance covered by the sonic ray for different cycles on the angle of emergence of the ray from the radiation source and the dependence of the distance between the true time of sound propagation along the ray on time, equal to R/C_0, on R (R is the distance from the sound source to the receiver; C_0 is the speed of sound at the level of the radiation source). Bibliography of 21 items. [109]

PULSATION MOTION IN THE OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V47

[Abstract of article by V. Z. Dykman, O. I. Yefremov, G. K. Korotayev and N. A. Panteleyev; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 30-40, "Investigation of Pulsation Motion in the Ocean in the Field of Scales of Short Internal Waves"]

[Text] In these investigations the authors used the method of obtaining the vertical velocities of displacements of isolines of the speed of sound [$W = (\partial C/\partial t)/(\partial C/\partial z)$], characterized by the fact that in place of the averaged gradient they measured its current value. This makes it possible to take into account the effects determined by the presence of inhomogeneities in the vertical structure of the thermocline and its spatial-temporal variability. Using a known series of W values it is possible to obtain a record of the vertical displacements of scalar isolines from an equilibrium position. The method is applicable in the case of fluctuations with sufficiently great vertical scales. Using this method it was possible to process measurement data at a number of 24-hour buoy stations in different regions of the Atlantic and Indian Oceans. The measurements were made using the "Gradiyent" automated complex (Marine Hydrophysical Institute Ukrainian Academy of Sciences). The collected spectra of the computed vertical displacements of the isolines of the speed of sound, spectra of speed of sound fluctuations at two horizons and the spectra of the horizontal components of current velocity regularly fall into one and the same frequency region; this can be evidence of the presence of a general mechanism of limitation of the energy of pulsation motion in the mentioned interval -- the influence of the saturated field of internal waves with an amplitude limited by an instability of some sort. Bibliography of four items.
[109]

SMALL-SCALE TURBULENCE IN OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V49

[Abstract of article by V. S. Belyayev, A. N. Gezentsvey, V. T. Paka and M. L. Pyzhevich; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 41-48, "Statistical Characteristics of Small-Scale Turbulence in the Ocean"]

[Text] A study was made of data collected at the Institute of Oceanology on the one-dimensional spectral densities of small-scale fluctuations of longitudinal flow velocity u, temperature T and conductivity σ in the range of wave numbers 10^{-1}-10^{-10} cm^{-1} in the upper 200-m layer of the ocean for 10 polygons in the Atlantic and Indian Oceans. Confirmation was obtained for the conclusion (V. S. Belyayev, et al., 1974) that the empirical distribution law for the values of the empirical integral distribution function $E_1(k)$ for velocity fluctions with $k = 1$ cm^{-1} is close to log-normal in the investigated k range. Also examined are the one-dimensional spectral densities of fluctuations of the signals for u, σ and T, obtained primarily when the instruments are being towed (December 1973-April 1974) at different depths. The values of the spectral densities when k =

1 cm^{-1} vary in a rather wide range: u -- from units (horizon 10 m) to 10^{-4} cm^3/sec^2 ($\sim$30-400 m), σ from n x 10^{-12} ohm^{-2}/cm to n x 10^{-15}, T from n x 10^{-4} $degree^2 cm$ to n x 10^{-5} ($1 > n > 10$). The authors have noted the diversity of forms of spectral curves. The level of turbulence and the shape of the spectral curves are determined primarily by the vertical gradients of current velocity and water density. Bibliography of four items.
[109]

OCEANIC TURBULENCE AND LOCAL BACKGROUND CONDITIONS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V50

[Abstract of article by V. S. Belyayev, I. D. Lozovatskiy and R. V. Ozmidov; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 49-58, "Dependence of the Characteristics of Oceanic Turbulence on Local Background Conditions"]

[Text] The paper presents some results of synchronous fluctuation and profile measurements obtained on the eleventh voyage of the "Dmitriy Mendeleyev" in an equatorial polygon. The measurements were made using a specially developed microstructure probe designed at the Institute of Oceanology. It was established on the basis of the investigations that in the vertical profile of mean temperature there are quasiperiodic inhomogeneities with scales $\sim$ 3 m which are most closely related to the corresponding inhomogeneities in the vertical distribution of the mean square conductivity fluctuations. Layers with an increased intensity of small-scale fluctuations are situated under intercalations with great temperature drops and the maxima of the mean square conductivity values are displaced $\sim$ 0.5 m upward relative to the position of the temperature gradient maximum. Ideas are presented concerning further investigations of this problem. Bibliography of two items.
[109]

NONSTATIONARY FLUCTUATION FIELDS IN OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V52

[Abstract of article by V. Z. Dykman, V. M. Kushnir, N. A. Panteleyev and E. A. Shevchenko; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 88-95, "Experimental Results of Investigation of Nonstationary Fluctuation Fields in the Ocean"]

[Text] A peculiarity of use of the methods for analyzing the nonstationary properties of fluctuation hydrophysical processes based on computation of the current sample evaluations is the necessity for a preliminary high-frequency filtering of the initial data. Taking into account what has been said, the authors carried out investigations of fluctuations of current velocity in the sea in the range of time scales of fluctuations from 0.2 sec to eight hours. The authors investigated the records of the AIST, AGAT instruments and the BPV-2 automatic recorder. For all cases of measurements there is a substantial variability of the evaluations of the statistical characteristics in a time exceeding the dimension of the zone bounded by the upper (Δ_W) and lower (Δ_N) confidence limits of the confidence intervals. The nonstationary changes are manifested most strongly on the graphs of sample evaluations of dispersion, spatial and temporal distributions of which evidently correspond to zones with different turbulence intensity levels. The conclusion is drawn that real fluctuation fields of the ocean in a broad range of scales are subjected to complex nonstationary fluctuations whose mechanism has presently not been studied adequately.
[109]

METHOD FOR ACCUMULATING HYDROACOUSTIC SIGNALS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V30

[Abstract of article by G. D. Filin; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 66-74, "Method for Accumulating Hydroacoustic Signals with Random Parameters"]

[Text] A method is proposed for processing an acoustic signal with a random duration which can be used in an analysis of channel propagation when there is a considerable drawing out of the echo signal caused by multiray propagation in the presence of a complex signal. It is shown that detection is possible only when the signal strength is greater than the noise. This requires the processing of physical parameters whose order of magnitude is equal to the magnitude of energy. These can be the areas of the surges of envelopes of the input process over some stipulated level. With accumulation of the energy of these surges it is necessary to use information on the duration of the useful signal. The article gives one of the variants of schemes for applying the proposed processing algorithm. The scheme consists of a nonlinear inertialess element discriminating the total field envelope; a device for shaping the flux of surges of the envelope (limitation from below); ideal accumulator and resolving circuit. The described method for the processing of hydroacoustic information can be used for research purposes for the registry of various types of low-frequency signals received from distances greater than 50 km. Bibliography of eight items.
[109]

DATA COLLECTION AND PROCESSING SYSTEM

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V19

[Abstract of article by B. M. Arvan, E. I. Karabasheva, L. M. Krivelevich, B. G. Konarev and V. T. Paka; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 169-195, "Investigation of a System for the Collection and Processing of Data for Studies of the Microstructure of Hydrophysical Fields in the Ocean"]

[Text] In the system for collecting and processing of data from hydrophysical measurements developed at the VNIIFTRI, signals are registered using a recording complex constructed on the basis of a high-speed digital magnetic recorder. In this complex provision is made for the reverse transformation of signals into analog form and synchronous registry of data using a multipen automatic recorder. This facilitates the monitoring of the correctness of functioning of the entire measuring channel and digital recording. The registry complex of the radiotemperature buoy is constructed on the basis of a digital magnetic recorder for slow signals. All 12 FM signals produced by the measuring device fit into the band 2-10 KHz and are fed along the same communication line with time separation of channels. Transmission through each channel occupies about 100 msec. Hydraulic trawls with a total number of sensors greater than six have analog magnetic recorders of the R-400 type produced by the TEAS corporation (four simultaneously) as recorders. Since the Minsk-22 electronic computer does not have other input devices except from punch cards and punch tape, for the input of data from standard carriers specialists have developed a special additional input device. This device connects the source of digital signals (analog-code converter or digital magnetic recorder) with a recorder for the electronic computer arithmetical device.
[109]

ERRORS IN ANALOG MAGNETIC RECORDING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V17

[Abstract of article by A. P. Ryzhuk, V. D. Divnogorskiy and Yu. S. Belavin; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 138-145, "Analysis of Errors in Measuring Apparatus for Analog Magnetic Recording"]

[Text] The authors have examined the influence of a series of factors on the accuracy of magnetic recording, the values of the errors in the transfer coefficient and the frequency characteristic of the recording-reproducing

device. The paper gives an analysis of the errors arising as a result of inconstancy of the relative performance and relative resolution of the magnetic tape; errors in tuning the registry-reproduction channel; errors in the registry-reproduction process. A quantitative evaluation of the magnitude of errors is given. Methods are proposed for reducing the errors, in particular by adjusting the registry-reproduction device for each used roll of magnetic tape or by means of calibration of the through channel.
[109]

ACOUSTIC APPARATUS FOR DISCONNECTING ANCHOR AND BUOY

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V16

[Abstract of article by Yu. F. Tarasyuk; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 122-130, "Acoustic Apparatus for Disconnecting Sunken Buoys from Anchor"]

[Text] The author examines the operating principle for acoustic apparatus ensuring remote disconnection from anchor of abyssal (3-6 km) buoy stations by means of signals transmitted through the hydroacoustic communication channel to the oceanographic ship; the paper describes the block diagram of the apparatus. The author analyzes some peculiarities of use of explosive and modulated signals for the purposes of communicating with deep-water stations. The article gives basic expressions and curves making it possible to evaluate the optimum parameters of the signals used in the indicated apparatus. Also considered are the problems involved in the noise immunity of the apparatus receiver complex. As an example, the article describes the operation of apparatus developed in Great Britain for the remote recovery of buoys using coded FM signals. Also cited are the comparative characteristics of devices of this sort developed in the USSR, United States and Great Britain. Bibliography of 15 items.
[109]

SELF-CONTAINED DEEPENING APPARATUS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian, No 8, 1976, 8V14P

[Abstract of patent awarded to B. N. Mansvetov and A. I. Potseluyko; Moscow, Author's Certificate USSR, No 477038 (1849629), published 5 November 1975, "Self-Contained Deepening Apparatus"]

[Text] The apparatus described in this patent is designed for the submerging of floating objects (containers with instruments, etc.) and contains a deepening weight with devices for attachment, release and raising of an object to the surface. For the purpose of automatic floating-up and simplifying the raising of the apparatus the weight is designed in the form of a ballast tank with loose ballast (gravel). The devices for the attachment and release of the object are attached above the center of gravity of the device and for raising the weight the device is so designed as to have the desired buoyancy.
[109]

PROBLEMS IN RAISING AND LOWERING REGISTRY APPARATUS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V13

[Abstract of article by Yu. S. Belavin, F. I. Konstantinov, U Ton Il' and V. A. Derevnin; --, TRUDY SAKHALIN. KOMPLEKS. NII DAL'NEVOST. NAUCH. TSENTRA AN SSSR, No 34, 1975, pp 115-121, "Determination of Vertical Velocity Components of Self-Contained Sea Stations During Their Free Submergence and Floating Up"]

[Text] The authors propose a method for analytical computation of the vertical velocity of free submergence and floating up of a self-contained station of spherical configuration. In the computations the authors take into account the change in the volume of the sphere in dependence on external hydrostatic pressure. The influence of horizontal and vertical components of currents and the presence of a density inhomogeneity of the water medium are not taken into account. The experimental data obtained in field tests of a model of the station at small depths (up to 30 m) satisfactorily (within the limits of 10-20%) agree with the results of computations. For reducing the instrumental error in determining the depth of submergence the authors propose a method for linearizing the characteristic curve of the vibrational frequency pressure sensor (type DDVT). Bibliography of three items.
[109]

"GRIF" TURBULENCE METER

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V20

[Abstract of article by B. M. Arvan, G. A. Bambizov, V. V. Kushnikov, B. G. Konarev, V. T. Paka, Ye. V. Tatarenko and V. I. Shkurenko; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 176-180, "'Grif' Turbulence Meter-Probe"]

[Text] This probe was developed in the Atlantic Division of the Institute of Oceanology for measuring local gradients and fluctuations of hydrophysical fields. The probe sensors are: hydroresistor thermoanemometer, device for measuring conductivity and thermoresistors for measuring temperature or its difference on a vertical base (in the range 1.5 m-15 cm), device for measuring the velocity of motion (electromechanical current meter with a magnetically controlled contact) and device for measuring the depth of submergence (vibrotron). The sensors were placed in small cylindrical containers connected to one another. The containers are attached to a massive body oriented by a tail fin in the direction of towing. The instrument is submerged with a cable winch on a 2-km three-strand connecting-electrical cable. In the recording complex of the probe there is a 17-channel magnetic recorder designed by the special design bureau of the Institute of Physics of the Earth USSR Academy of Sciences and a high-speed 11-place analog-code converter for converting fast and slow analog signals. Data processing is accomplished using a "Minsk-22" on-board computer. The probe underwent operational tests on the 11th voyage of the research ship "Dmitriy Mendeleyev."
[109]

AUTOMATED COMPLEX FOR INVESTIGATING TURBULENCE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V21

[Abstract of article by G. Yu. Aretinskiy, V. Z. Dykman, O. I. Yefremov, M. G. Prasolov and A. N. Timchenko; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 181-186, "Mathematical Support for a Complex of Automated Apparatus for Investigating Turbulence"]

[Text] Specialists at the Marine Hydrophysical Institute Ukrainian Academy of Sciences have developed self-contained measuring complexes for synchronous measurements of the three components of the fluctuation vector of current velocity and temperature fluctuations (AGAT) and also for registering the averaged values of the modulus and the direction of current velocity (AIST). Registry of the results in both complexes is accomplished in digital form on a magnetic carrier. Processing of the collected information is accomplished using an electronic computer in two stages: 1) with the direct input of digital information and after preliminary processing obtaining the fluctuation components of the current velocity vector and temperature fluctuations; 2) cross statistical processing of the fluctuation components by the choice of the operator. Mass processing of the results of measurements obtained using the AGAT and AIST complexes made it possible to investigate current velocity in the ocean in a broad range of time scales. Bibliography of four items.
[109]

CONTACT INSTRUMENTS FOR MEASURING TURBULENCE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V22

[Abstract of article by S. R. Stefanov, V. M. Sysak and G. S. Trubetskaya; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 187-192, "Some Contact Instruments for Measuring Turbulence"]

[Text] Specialists at the VNIIFTRI have investigated the possibility of creating instruments for measuring some characteristics of turbulence in the low-frequency range of wave numbers on the basis of those sensors which in the future can be used for creating sampling instruments. For measuring temperature fluctuations specialists fabricated a platinum resistance thermometer whose sensing element was made of wire 25 μm in diameter with a resistance of 110 ohms wound on a quartz cylinder. A temperature gradient measuring device was fabricated for measuring the temperature difference at two points in a flow of fluid. The sensing elements used in it were two sample platinum resistance (each 100 ohms) thermometers connected in streamlined capsules and mounted in a towed "fish." The temperature-measuring device uses as a sensing element a piezoelectric quartz converter with a nominal resonance frequency of 5 MHz (at a temperature of -10°). The sensing element of this instrument is mounted in a special capsule. The measurement of conductivity fluctuations was with a sensor in the form of a two-electrode cell of blackened platinum applied to a quartz backing. The fluctuations were measured using a device in the form of a Pitot tube with a piezoelectric pressure converter. Bibliography of three items.
[109]

DATA TRANSMISSION SYSTEM FOR SCIENTIFIC RESEARCH VESSELS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V9

[Abstract of article by A. G. Kolesnikov and V. M. Zaikin; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 161-168, "Data Transmission System for Routine Processing and Control of an Experiment on a Scientific Research Vessel"]

[Text] Specialists at the Marine Hydrophysical Institute Ukrainian Academy of Sciences have developed a system for the remote exchange of data with an arbitrary addressing of coded communications between user points on shipboard. A peculiarity of the system is a minimum dependence on the connected users. The sources and users of addressed and digital information are connected to the common line for data transmission. The connection is accomplished by means of identical "window" apparatuses -- the users'

panels. In the channel there is an asynchronous communication cycle which begins at an arbitrary moment of time upon interrogation from the panel. In the course of the cycle the channel leads to only one "window" device and only one communication is transmitted. The operation is controlled by the channel "dispatcher" -- a device reacting to interrogations and planning the work of the channel. The channel can operate in three regimes: by interrogation of the "window" device, programmed-controllable transmission of a communication and in a selector channel regime. The dispatcher ensures simultaneous servicing of up to 15 "window" devices. The duration of one cycle in the case of a frequency of $0.5 \cdot 10^6$ bits/sec is about 100μsec, that is, a cycle of 10 interrogations will be serviced in the course of 1 msec and the productivity in a selector channel regime is 10^4 cycles/sec. The possibilities of the developed system were checked during five to eight expeditions of the "Akademik Vernadskiy" scientific research ship.
[109]

WAVE INTERACTIONS IN STRATIFIED MEDIA

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 12, No 11, 1976, pp 1143-1151

[Article by V. P. Goncharov, V. A. Krasil'nikov and V. I. Pavlov, Moscow State University, "On the Theory of Wave Interactions in Stratified Media"]

[Abstract] The objective of this study was an examination of some peculiarities of propagation of waves of a finite amplitude in stratified media. A peculiarity of this problem is that wave motion in a stratified medium is nonbarotropic and vortical. The use of the Hamiltonian formalism method, whose principal difficulty is the determination of canonical variables and which has been successfully overcome for the case of homogeneous media, makes it possible from an integrated point of view to examine both linear and nonlinear problems in an extremely general formulation. In this paper emphasis is on the possibility of determining the canonical variables for stratified media. Transforms are found leading the Hamiltonian to a diagonal form. Dispersion expressions are derived for different branches of wave movements admissible in such a medium. As an example, the authors give an example of application of the formulated method for describing the radiation of low-frequency (internal) waves by a powerful acoustic packet -- an effect similar to the Cerenkov effect.
[134]

METHOD FOR DETERMINING DEPTH OF THERMOCLINE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian
Vol 12, No 11, 1976, pp 1224-1227

[Article by A. A. Lyubitskiy and A. D. Rozenberg, Institute of Radiophysics and Electronics, Ukrainian Academy of Sciences, "Possibility of Determining Depth of the Thermocline from a Scattered Sound Signal"]

[Abstract] The possibility of noncontact determination of the depth of the thermocline is related in most cases to the scattering of sound by plankton and fish. However, if it is postulated that the small-scale components of thermostructure responsible for the scattering of sound in the centimeter and decimeter wavelength ranges are unambiguously related to local peculiarities of the mean temperature field, the distribution of the intensity of a reverberation signal over distance during vertical acoustic sounding can also be related to the depth of the thermocline. This article gives the results of such measurements. The measurements were made in the summer of 1974 in the Caspian Sea from a fixed pile base situated 20 km to the northeast of the Apsheron Peninsula where the sea depth is 40 m (scientific station of the Institute of Atmospheric Physics, Institute of Oceanology and Geography Institute). The instrumentation employed is described and the measurement-processing procedure is discussed. The results of measurements of temperature fluctuations and the measured scattered sound signal are discussed. The quantitative comparison of the results of acoustic and temperature soundings was carried out within the framework of the resonance theory of volume scattering of sound on the assumption of local isotropy of the thermostructure in the region of scales comparable with the length of the acoustic wave. The presence of a correlation between the intensity of small-scale temperature inhomogeneities and its mean vertical gradient makes it possible to hope for the possibility of determining the position of the thermocline by a noncontact acoustic method.
[134]

IV. TERRESTRIAL GEOPHYSICS

News

COMMENTS ON EARTHQUAKE IN GULF OF FINLAND

Moscow IZVESTIYA in Russian 13 Nov 76 p 6

[Article by A. Nikonov: "Was the Glacier Guilty?"]

[Text] A recent message about an earthquake in the Gulf of Finland region surprised many. Actually it is strange to hear about activity of the earth's interior in such a flat and tectonically quiet region as the Baltic area. Even in special theoretical works on seismicity in the Soviet Union, the territory of the Baltic area and in general all of the northwestern European sector of the USSR, it is not considered.

The epicenter of this force 4-5 earthquake was situated in the southwestern part of the Gulf of Finland, several dozen kilometers from the northwestern coast of Estonia. Weak tremors have also occurred here earlier. It is precisely this region where the raising of the earth's crust occurs with the greatest rate.

Geodetic measurements and prolonged observations of the average sea level show that the rate of rising of the earth's crust in this section is three millimeters a year; in a southeastern direction it diminishes to zero. This occurs because the earth's crust is still regaining its equilibrium after the tremendous stress of the Scandinavian ice sheet which melted nearly 12,000 years ago. In southeastern Estonia it melted earlier and the crustal balance has already been restored there.

According to present scientific thought, the Gulf of Finland conceals beneath its depths the boundary of the Baltic crystalline shield and the Eastern European platform with a sheet of sedimentary deposits. The earthquake's focus is probably related to a fault which bounds the crystalline shield on the south. Such faults, including those along the coast of northwestern Estonia, have been detected by geophysical research. It was along one of these, evidently, that there originated an abrupt shifting which caused the seismic waves.

Although such earthquakes do not constitute a serious threat, scientists should devote more attention to studying the seismicity of our country's northwest.

Abstracts of Scientific Articles

GEOLOGICAL MODELING OF MAGNETIC ANOMALIES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 6, 1976, pp 99-103

[Article by L. V. Vitte and G. G. Rempel', Institute of Geology and Geophysics, Siberian Department USSR Academy of Sciences, "Method for Geological Modeling of Magnetic Anomalies"]

[Abstract] In the quantitative interpretation of magnetic anomalies over some complexes serious difficulties arise which are associated primarily with the absence of specific data on the disturbing objects. In the magnetic field there is expression of the total effect of redistribution of matter (including iron oxides) in the granitization process; the nature of the surface distribution gives only the most remote ideas concerning the interrelationships of magnetized and nonmagnetized bodies in depth. In this paper it is shown that in such situations a sufficiently sound idea concerning the nature of the disturbing object can be obtained from an analysis of a set of physical models satisfying computations of the magnetic anomalies by employing geological-petrological data for their interpretation. Such an analysis was carried out for several typical magnetic anomalies in the western part of the Aldan shield. The linear submeridional magnetic anomalies of this region with an intensity up to 1,000 gammas or more spatially extend to the central parts of anticlinoria made up of granitized rocks of Archean suites, granite-gneiss domes and formations of massive Proterozoic granites. The authors show how it is possible to characterize not only a final model of a magnetized body which is best in some sense, but also intermediate models, and also the reasons for moving on from one model to the next. Five models were formulated and analyzed before selecting the best fit. The results represent the first attempt at geological modeling of the magnetic field in regions with an exceptionally complex geological structure.
[75]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

TASS ANNOUNCES LAUNCHING OF "KOSMOS-870"

Moscow PRAVDA in Russian 3 Dec 76, p 1

[TASS Report: "'Kosmos-870'"]

[Abstract] The artificial earth satellite "Kosmos-870" was launched in the Soviet Union on 2 December 1976. 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.

EAST EUROPEAN COSMONAUTS BEGIN WORK AT GAGARIN CENTER

Moscow IZVESTIYA in Russian 7 Dec 76, p 5

[TASS Report: "Before Joint Flights"]

[Text] The first group of candidates, consisting of citizens from Czechoslovakia, Poland and the GDR have begun training at the Center for Training of Cosmonauts imeni Yu. A. Gagarin in accordance with the agreement about joint flights of the citizens of socialist countries in Soviet spaceships and stations.
[5]

SIMULTANEOUS LAUNCH OF EIGHT "KOSMOS" SATELLITES

Moscow PRAVDA in Russian 8 Dec 76, p 3

[TASS Report: "Eight Satellites are in Flight"]

[Text] On 7 December 1976 the following artificial earth satellites were launched in the Soviet Union: "Kosmos-871," "Kosmos-872," "Kosmos-873," "Kosmos-874," "Kosmos-875," "Kosmos-876," "Kosmos-877" and "Kosmos-878." All eight satellites were inserted into orbit by a single carrier-rocket.

The satellites carry scientific equipment intended for the continuation of space research.

Trajectories of all eight satellites are close to planned values. Initial orbital parameters are:
-- period of revolution, 115.3 minutes;
-- apogee, 1,520 kilometers;
-- perigee, 1,450 kilometers;
-- orbital inclination, 74 degrees.

In addition to the scientific apparatus, the satellites carry radio systems for the precise measurement of orbital elements and radiotelemetry systems for transmitting data on the operation of the instruments and scientific equipment to earth.

The apparatus installed on the satellites is functioning normally. The coordination-computation center is processing the incoming information. [4]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-879"

Moscow PRAVDA in Russian 10 Dec 76, p 2

[TASS Report: "'Kosmos-879'"]

[Abstract] The artificial earth satellite "Kosmos-879" was launched in the Soviet Union on 9 December 1976. The satellite was inserted into an orbit with the following parameters:
-- initial period, 88.9 minutes;
-- apogee, 241 kilometers;
-- perigee, 217 kilometers;
-- orbital inclination, 81.4 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-880"

Moscow PRAVDA in Russian 11 Dec 76, p 6

[TASS Report: "'Kosmos-880'"]

[Abstract] The artificial earth satellite "Kosmos-880" was launched in the Soviet Union on 9 December 1976. The satellite was inserted into an orbit with the following parameters:
-- initial period, 96.4 minutes;
-- apogee, 624 kilometers;
-- perigee, 562 kilometers;
-- orbital inclination, 66 degrees.

TASS ANNOUNCES COMPLETION OF PACIFIC ROCKET TESTS

Moscow PRAVDA in Russian 4 Dec 76, p 4

[TASS Report]

[Text] In connection with the successful completion of planned booster rocket launchings, TASS has been authorized to announce that the region of the Pacific Ocean bounded by a circle with a radius of 50 nautical miles with a center at coordinates 23 degrees 25 minutes North Latitude and 171 degrees 26 minutes East Longitude, as published on 26 November 1976, is open to navigation and aircraft flights as of 4 December 1976.
[5]

TASS ANNOUNCES PLANS TO CONDUCT ROCKET LAUNCHES IN PACIFIC

Moscow PRAVDA in Russian 8 Dec 76, p 4

[TASS Report]

[Text] During the period from 10 December through 30 December 1976 the Soviet Union will conduct launches of booster rockets into a region of the Pacific Ocean bounded by a circle with a radius of 100 nautical miles with its center at the coordinates 46 degrees North Latitude and 164 degrees East Longitude.

TASS has been authorized to announce that for purposes of safety the government of the Soviet Union requests the governments of other countries using the sea and air lanes in the Pacific Ocean to instruct appropriate agencies so that ships and airplanes will not enter this region of the Pacific Ocean and the air space above it from 2200 hours until 1200 hours local time during the indicated period.
[4]

Abstracts of Scientific Articles

VENUSIAN RELIEF DETERMINED BY BISTATIC RADAR METHOD

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 5, 1976, pp 693-696

[Article by A. I. Kucheryavenkov, O. I. Yakovlev, A. G. Pavel'yev, S. L. Azarkh, S. S. Matyugov, V. I. Kayevitser, V. I. Rogal'skiy, V. S. Polyakov and I. E. Kalashnikov, "Relief of Venus Based on the Results of Bistatic Radar Employing the 'Venera-9' and 'Venera-10' Satellites"]

[Abstract] The paper cited above gives the results of an investigation by the bistatic radar method to determine the relief of three regions on the Venusian surface. The "Venera-9" and "Venera-10" satellites were used in investigating a total of 55 regions situated near the limbs of the apparent disk of Venus. Comparison of the results obtained in this study with earlier experiments in studying the lunar surface, in which the moon was used as a test body, makes it possible with considerable certainty to interpret the results obtained for Venus. The correlation discovered for the lunar surface between the experimentally measured parameter γ and the type of relief is also confirmed for the Venusian surface. The relatively high γ values, equal to 3-5° (sectors A and B in the first and third regions) correspond to differences in elevation of 2-3 km. Sectors A and B correspond to hilly and possibly mountainous terrain. Lesser γ values, equal to 1-2°, correspond to terrain with small differences in elevation. The second region is characteristic in this respect; it is a plain about 800 km long, smoother than the surface of the lunar maria. It follows from the analysis of the Venusian relief for three regions with a total extent of 2,400 km that its surface in the investigated regions on the average is smoother than the lunar surface.
[141]

WIND VELOCITY AT THE VENUSIAN SURFACE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 5, 1976, pp 710-713

[Article by V. S. Avduyevskiy, S. L. Vishnevetskiy, I. A. Golov, Yu. Ya. Karpeyskiy, A. D. Lavrov, V. Ya. Likhushin, M. Ya. Marov, D. A. Mel'nikov, N. I. Pomogin, N. N. Pronina, K. A. Razin and V. G. Fokin, "Measurement of Wind Velocity at the Venusian Surface During Operation of the 'Venera-9' and 'Venera-10' Stations"]

[Abstract] In the experiment with the "Venera-9" the wind velocity at the Venusian surface was measured for a period of 49 minutes. Interrogations of the instrument by telemetric methods were made at a frequency of 0.4 Hz in the course of 16-second intervals which followed with a period of 2 minutes 8 seconds. Figure 4 in the text shows the mean values of local velocity measured using the instrument sensors. Averaging was accomplished at the rate of six points in 16 seconds. The measured wind velocities during the time of functioning of the station at the planetary surface were slightly variable relative to the mean value, close to 0.5 m/sec. It characterizes the local wind velocity in the region of landing of the "Venera-9" under conditions of a landscape with a jumble of rocks. In the experiment with "Venera-10" reliable information was obtained during the first 90 seconds after the landing, when in accordance with the telemetric program the readings of one of the sensors were transmitted with an interrogation frequency of 0.4 Hz. Stability in the level of readings make it possible to characterize the wind speed using one sensor. The mean wind velocity at the "Venera-10" landing site was $V \approx 1$ m/sec; variations relative to this value are also small. The smoothed surface of the landing region favors a decrease in the dependence of wind speed on local relief and also a decrease in the possible influence of position of the vehicle on the surface on measurement data. Therefore, in regions separated by almost 2,000 km the results were close. At a height of about 1 m above the Venusian surface there is a wind with a velocity of 0.5-1 m/sec.
[141]

PARAMETERS OF THE VENUSIAN CLOUD LAYER

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV No 5, 1976, pp 743-757

[Article by V. I. Moroz, N. A. Parfent'yev, N. F. San'ko, V. S. Zhegulev, L. V. Zasova and Ye. A. Ustinov, "Preliminary Results of Narrow-Band Photometric Sounding of the Cloud Layer of Venus in the Spectral Region 0.80-0.87μm on the 'Venera-9' and 'Venera-10' Descent Modules"]

[Abstract] The "Venera-9" and "Venera-10" carried two photometers for measuring scattered solar radiation: a) with wide filters (being a development of the "Venera-8" instrument) and b) with narrow filters and a narrow directional diagram. The article gives a brief description of the photometer with narrow filters and preliminary data on the results of measurements which were obtained with it. With respect to the cloud layer, it was found

that the main cloud layer with a scattering coefficient $\sim 1 \cdot 10^{-5}$ cm^{-1} and a concentration of particles ~ 200 cm^{-3} is situated above 50 km. Above the level 64 km there is still $\sim$10-20% of its total optical thickness. In the range of altitudes from 35 to 50 km the scattering coefficient is 2-3 times less. There may be a second layer of clouds at altitudes 35-45 km. Scattering in a gas Rayleigh atmosphere probably dominates below 35 km. In the entire investigated altitude range (64-34 km) there are evidently conditions close to conservative scattering: $1 - a \lesssim 10^{-3}$ with a total optical thickness ~ 25. The cloud layer consists of individual compact formations whose dimensions are in the range from several hundreds of meters to several kilometers. The relative abundance of H_2O/CO_2 is $\sim 10^{-3}$ in the range 25-45 km. [141]

LIGHT REGIME ON VENUS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV No 5, 1976, pp 735-742

[Article by V. S. Avduyevskiy, Yu. M. Golovin, F. S. Zavelevich, V. Ya. Likhushin, M. Ya. Marov, D. A. Mel'nikov, Ya. I. Merson, B. Ye. Moshkin, K. A. Razin, L. I. Chernoshchekov and A. P. Ekonomov, "Preliminary Results of Investigation of the Light Regime in the Venusian Atmosphere and at its Surface"]

[Abstract] The descent modules of the "Venera-9" and "Venera-10" were used in carrying out an experiment for measuring radiant fluxes in the Venusian atmosphere and at its surface. During the measurements the solar zenith angle was 33 and 27° for the "Venera-9" and "Venera-10" respectively. The radiant fluxes were measured in five spectral ranges in three directions (from the zenith, from the entire upper hemisphere and at an angle of 23° to the nadir). The measurements were made during the entire descent in the atmosphere and at the surface of the planet. The article cited above gives the preliminary results of the measurements and describes the instrumentation. The measurements revealed the general nature of measurements vertically from 63 km to the surface for radiant fluxes in five spectral intervals occupying the range $\Delta\lambda = 0.50\text{-}1.06\,\mu m$ and in three directions in space. It was possible to obtain the attenuation of the spectral and integral fluxes of solar radiation with altitude. Light attenuation in the atmosphere above 50 km can be attributed to the presence of the cloud layer. Between 15 and 50 km there can be a very fine aerosol or true absorption, and below 15 km light attenuation is almost completely determined by Rayleigh scattering, as is confirmed by model computations for a two-layer atmosphere. The illumination and the radiant flux in the range $0.5\text{-}1.06\,\mu m$ at the Venusian surface at the landing sites of the descent modules are 14,000 lux and 100 W/m^2 respectively. The data obtained from the two descent modules in general agree with the results of measurements on "Venera-8"; the differences

in the nature of attenuation of radiation vertically and the absolute levels of illumination at the surface are attributable to differences at the landing sites of the descent modules.
[141]

SPECTRAL BRIGHTNESS CONTRAST IN SPACE SURVEY

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 9, 1976, pp 38-43

[Article by Yu. V. Krylov and B. N. Rodionov, "Approximate Computation of Spectral Brightness Contrast Applicable to Multichannel Space Surveys"]

[Abstract] The article gives computations of spectral brightness contrast at the level of a spacecraft orbit. The computations were made by the approximate V. V. Sobolev method and this method generalized for the case of highly anisotropic scattering. The results are analyzed. It was found that the curves of change in relative contrast, in dependence on the sighting angle θ, have an asymmetrical shape. For wavelengths 450 and 700 nm they differ considerably from one another. Whereas for λ = 700 nm the dropoff in contrast in the directions "opposite the sun" is weaker with an increase in the θ angle than in the directions "toward the sun," in this case λ= 450 nm the opposite picture is observed. This can be attributed to the influence of Rayleigh scattering. For λ= 450 nm in the directions "toward the sun" the relative contrast in the region $\sim 35°$ is greater than unity, that is, in these directions the brightness of haze is less than in the vertical direction. With an increase in the degree of haziness in the atmosphere in all cases there is a sharp decrease in relative contrast. None of these peculiarities of change in spectral contrast contradict these data.
[113]

DISCHARGE IN NEIGHBORHOOD OF ROCKET

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 231, No 1, 1976, pp 71-74

[Article by A. A. Galeyev, Ye. V. Mishin, Academician R. Z. Sagdeyev, V. D. Shapiro and V. I. Shevchenko, Space Research Institute and Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Discharge in the Neighborhood of a Rocket During Injection of Electron Beams into the Ionosphere"]

[Abstract] The experiments carried out during recent years with the injection of powerful electron beams into the ionosphere have raised a whole series of problems on the physics of interaction between a beam of high-energy electrons and weakly ionized plasma (the ionosphere). This paper gives a qualitative theory of such a discharge in the region around the

rocket, which is a necessary element of this interaction. Estimates have been made of the rocket potential and the intensity of high-frequency radio emission from the discharge during active experiments. Under the conditions cited in the paper, using the derived expressions, it was found, as an example, that the spectral density of the radio emission flux at the distance R from an emitting volume is in order of magnitude comparable with the experimental data. The derived formulas and computation method described here in detail can be modified for different initial parameters and can be applied on a practical basis for ascertaining potential and radio emission, thereby constituting a significant contribution to the theory and practice of radio propagation and ionospheric investigations when using instrumentation and telemetric systems carried aboard rockets.
[97]

STRUCTURE OF BOUNDARY LAYER OF VENUSIAN ATMOSPHERE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 5, 1976, pp 691-692

[Article by V. I. Moroz, "Panorama of the Venusian Surface. Some Conclusions on the Structure of the Atmospheric Boundary Layer"]

[Abstract] The article makes reference to the Venusian panoramas reproduced in this issue of the journal on pages 680 and 684. Using these panoramas it was possible to determine the dependence of distance to the horizon and the angle of depression of the horizon on the temperature jump $\Delta T = (dT/dz)z_0$, where $z_0 = 1$ m. It is shown that the value $\Delta T \approx 1°$ can be correlated with a close distance to the horizon as observed on the "Venera-9" panorama. However, there is also another possibility -- approach of the horizon due to the convex geometrical configuration of the surface at the landing site. But both possibilities seem equally probable. If the second hypothesis is true, the estimate can be regarded as an upper limit. The value $\Delta T \approx 0.1°$ can agree with the fact of visibility of a quite sharp horizon on the "Venera-10" panorama. The mean value $(dT/dz)_{z=0}$ near the Venusian surface can probably vary in the range from several hundredths degree/meter to several tenths or more in dependence on local conditions. As a result, in different places (and even in one and the same place in different directions) the distance to the horizon can differ greatly. There evidently should also be great variations with time.
[141]

PHOTOMETRIC PROCESSING OF PANORAMAS OF VENUSIAN SURFACE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 5, 1976, pp 678-686

[Article by A. S. Selivanov, A. S. Panfilov, M. K. Narayeva, V. P. Chemodanov, M. I. Bokhonov and M. A. Gerasimov, "Photometric Processing of Panoramas of the Venusian Surface"]

[Abstract] The article gives full details on photometric processing of panoramas of the Venusian surface. The text is accompanied by reproductions of two panoramas. Accuracy characteristics are discussed. Photometric processing of the panoramas transmitted by the "Venera-9" and "Venera-10" is discussed separately. The results show that despite the different nature of relief at the landing sites of the two stations, separated by a distance of about 2,000 km, it was possible to obtain close reflective characteristics of the planetary surface: the reflection curve is orthotropic, albedo is 0.03-0.12, which are characteristic of dark rocks with an uneven surface. Both panoramas are characterized by high contrasts: relief -- up to 0.5; due to difference in albedo -- up to 0.7; as a result of both factors -- up to 0.9. Estimates of illumination in the spectrum of the emission calibration source give a mean level of 3,000-6,000 lux.
[141]

GEODETIC VECTOR DETERMINED USING SATELLITE OBSERVATIONS

East Berlin VERMESSUNGSTECHNIK in German Vol 24, No 7, 1976, pp 271-273

[Article by D. Schoeps, Chamber of Technology, Central Institute for Terrestrial Physics, GDR Academy of Sciences, Potsdam]

[Abstract] Tests were carried out involving two observation points and compensatory equations with various weighting systems. It was concluded that 1) with directional errors in the order of magnitude of ±1" first-generation laser devices providing accuracies of ±2 m may be used; 2) the magnitude of the mean error in zenith distance for the vector tested essentially depends on the simultaneity of the distance measurements at the two stations; 3) if distance measurements are made from one end point only, the error is strongly affected by satellite altitude; 4) the azimuth error is mainly a function of satellite altitude; 5) the distance measurements as the actual measurements obviously affect significantly the average vector length error; 6) if distance measurements are made from only a single vector end point, then the error will be much greater; 7) equipment of both stations with distance measuring equipment favorably affects the determination of the geodetic vector in an accurate manner. Overall, it is evident that equipment better than a first-generation laser device will not yield comparable benefits in terms of the accuracy of the geodetic vector.
[137]

DEVELOPMENT OF SOVIET COMMUNICATIONS SATELLITES

East Berlin ASTRONOMIE UND RAUMFAHRT in German No 5, 1976, pp 141-144

[Article by H. D. Naumann]

[Abstract] Past development in the field of Soviet communications satellites had three major phases: first, the experimental phase (until 1965); the test and buildup phase (1965-1967); the phase of domestic use (began in 1967 with the establishment of the overall national communication system); and the phase of international use (started in 1971 with the introduction of the Intersputnik system). In the Molniya-Orbita system, three generations of satellites (Molniya 1, 2 and 3) are used for the Molniya series. The Orbita (and also the Intersputnik) series are intended for international use. The international system was built up in three stages: first, the development of the ground station equipment to receive the signals; the testing and practical trials of cosmic communications with the Molniya satellites (second generation), and actual use of the Intersputnik system. The international system is built up in stages; eventually it will form part of a global network. There are two types of ground station; they feature 25 and 12 mm diameter dishes with 116 and 180 degrees of angle of aperture, respectively. Soviet-supported Intersputnik ground stations presently operate in Outer Mongolia, Cuba, Czechoslovakia and Poland; more will be set up. Studies on the establishment of a geostationary satellite system started in the USSR when the Kosmos 637 (1974-17A) was orbited. A second one (1974 97A) is also in orbit now. The first geostationary communications satellite was the Molniya 1-S (1974 60A). It operates on 17 different frequencies. Raduga 1 (Stationary 1) was the first stationary prototype; it was launched in 1975. There will be two stages in future development in the field of geostationary communication systems: first, the launching of three satellites, and then the launching of seven more satellites (expected to become operational at the forthcoming Olympic Games in Moscow). The Stationary system will not replace the Molniya system; the two are to function side by side.
[138]

DENSITY OF SURFACE ROCK ON VENUS

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol XIV, No 5, 1976, pp 697-703

[Article by Yu. A. Surkov, F. F. Kirnozov, V. K. Khristianov, B. N. Koruchganov, V. N. Glazov and V. F. Ivanov, "Density of Surface Rock on Venus According to Data from the 'Venera-10' Automatic Interplanetary Station"]

[Abstract] The article describes the results of a direct determination of the density of surface rock on Venus on the basis of data collected by the "Venera-10." The operating principle of the densimeter employed is described in detail. The graphic material includes a functional diagram of the radiation densimeter and a block diagram of the sensor. The reckoned density of Venusian rock is evidence that the outcrops of bedrock visible on the surface panorama constitute quite dense rock which has been only slightly modified by surface processes. It also agrees with prevailing concepts concerning a basaltic composition of the planetary crust in the region of landing of the station. A density of 2.7-2.9 g/cm^3 according to terrestrial analogues corresponds to basalts of a massive texture with a low porosity. Such rocks could be formed under conditions of a slow cooling of basaltic lavas with insignificant gas release. Proceeding on the basis of the determined density, relating to the upper layer of rock with a thickness of 5-7 cm, it can be concluded that the rock is chemically stable in the Venusian atmosphere. Evidently, it was also not subjected to strong mechanical weathering. The low effectiveness of these processes is also indicated by the morphological peculiarities of the surface observed in the panoramas. The experimental results therefore give basis for modifying the earlier prevailing concepts that intensive erosional processes occur on the Venusian surface.
[141]

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