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PLEASE NOTE

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SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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I. GENERAL

Report of Conference on Dynamic and Thermal Interaction of the Atmosphere and Hydrosphere

The following is a complete translation of an article entitled, "The Dynamic and Thermal Interaction of the Atmosphere and the Hydrosphere," by S. Ye. Mostakhov, which reports on a scientific conference held at Leningrad in March of this year.

A scientific conference on the problem of the dynamic and thermal interaction of the atmosphere and the hydrosphere in the northern part of the Atlantic Ocean was conducted in Leningrad, 26-29 March, under the auspices of the Oceanographic Commission under the Presidium of the Academy of Sciences and the [Leningrad] Hydrometeorological Institute. The summarization of the first results of expeditionary work and the improvement of future investigations included in the program of the IGY was the aim of the conference.

The speeches concerned works on atmospheric and oceanic circulation, ocean currents, the theory and experimental study of the state and shifting of ice floes, the study of heat balance, and other problems.

Reports on problems of atmospheric circulation touched on the perennial transformations of forms of atmospheric circulation of the northern hemisphere and the fluctuations in the level of the Atlantic Ocean associated with them (A. A. Girs), variations in solar activity as bases for superlong period prognoses of the hydrological conditions of the seas (I. M. Soskin), the perennial variability of the meridional transfer of heat in the atmosphere as a basis for prognoses of water temperatures on the Kola meridian (D. A. Drogaytsev), and the interrelation of variations in the over-all circulation of the ocean and the atmosphere in the North Atlantic (K. N. Fedorov). A definite connection between conversions of the basic forms of atmospheric circulation and the variability of large-scale hydrological characteristics of the Atlantic Ocean was successfully shown to the investigators.

D. A. Drogaytsev's conclusion that the field of the indexes of the meridional transfer of heat predetermines the underlying field of water temperatures in the upper layer of the sea (to a depth of several tens of meters) is extremely interesting. This conclusion is extremely important for studying the perennial fluctuations of the temperature of the water on the open sea, where regular hydrological observations are not conducted, but according to akvatorii [parts of the surface of the water] from which synoptic charts are compiled, and also for the prognosis of water temperature, and hydrobiological and fishing industry prognoses in the sea.

In recent years, sea physics has almost arrived at a solution of the problem of calculating wind waves, wind currents, and the drift of ice associated with them. The calculation of these elements of a hydrological regime should precede work on the characteristic wind conditions, otherwise it is impossible to construct charts of wind fields in the seas and oceans. A method of constructing such charts was discussed in the report of A. I. Sorkin. M. A. Valerianova reported on an attempt to typify the pressure fields over the North Atlantic for calculating the currents and the drift of ice floes.

In the future, work must be done on the more accurate definition of the characteristics of the varieties of the basic forms of circulation over the North Atlantic and for the study of the conversion of the characteristics of atmospheric circulation with the aim of obtaining prognostic relationships of both meteorological as well as hydrological characteristics. The study of the perennial conversions of the basic forms of circulation, a knowledge of which is necessary for quantitative characteristic associations between fluctuations of the level of the Atlantic Ocean and changes of microsynoptic processes, and also the investigation of the effect of solar activity on large scale processes in the atmosphere and the hydrosphere. Such a study of the conditions of the formations and characteristics of relatively stationary cyclones and anticyclones over the North Atlantic have a significant value.

The materials presented on the study of the current systems of the North Atlantic show that despite certain successes in the development of a theory of ocean circulation, the results obtained are still insufficient for solving many problems of the dynamics of currents and are not sufficiently worked out to be of practical use.

In the opinion of the conference, special groups attracting young specialists must be created for the intensification of investigations in the field of dynamics of ocean currents. Also, systematic, prolonged observations aided by squadrons of ships and automatic buoy stations must be organized. Practical instructions for calculations of currents must be compiled on the basis of the completed work.

In reports devoted to the investigation of ice floes, problems of the theory of ice floes drifted by the wind (D. L. Laykhtman), the calculation of the steady drift of ice floes in the Arctic basin (A. I. Fel'zenbaum), the experimental study of the motion and state of ice floes by aeromethods (V. V. Timonov), etc., are considered.

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In the field of thermics of the sea, interesting results were obtained on the thermal interaction of the ocean with the atmosphere, the radiation and heat balance of the northern part of the Atlantic Ocean, and the use of heat balance data for the calculation of the water temperature in the layer of convective intermixing.

Similar investigations conducted in the Barents and Norwegian Seas have a substantial methodical and practical value.

The absence of calculations of vertical turbulent heat exchange and of the analysis of advective heat transfer is a great problem in the investigation of heat balance. While methods for calculating the component of the heat balance of the surface of the ocean are continuously perfected and improved, equations of heat balance for determining the advection of heat by currents and deep heat exchange are treated, as before, mainly by closure.

The conference pointed out substantial differences in the method for calculating the different elements of radiation balance and heat balance used in the various institutes, as a consequence of which the results of the calculations appeared to be not fully comparable. To eliminate this discrepancy, it was decided to hold a special conference.

In conclusion, a report was heard concerning the progress and plan of work of the Interdepartmental Expedition of the Atlantic Ocean and the Norwegian and Greenland Seas. Academician V. V. Shuleykin reported on the investigations conducted in 1957 during the cruise of the Sedov in the Atlantic Ocean. (Vestnik Akademii Nauk SSSR, No 7, Jul 58, pp 128-129)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Soviets Continue Meteorological Rocket Launchings

In accordance with the IGY program, the Soviet high-latitude observatory on Ostrov Kheysa (Zemlya Frantsa-Iosifa) [Heiss Island, Franz Josef Land] is continuing its regular studies of the upper atmosphere with the help of vertical launchings of meteorological rockets.

The distribution of temperature and air pressure in the central stratosphere is measured with the help of instruments installed in the meteorological rockets. Air temperature is measured with the aid of electric resistance thermometers, and air pressure, with thermal and membrane manometers. The instruments are placed in the head section of the rocket, which becomes separated from the rocket body during flight and descends to earth by parachute. The instrument readings are transmitted to earth by radiotelemetering devices.

The Third Antarctic Marine Expedition on the Ob' also launched meteorological rockets while the ship was sailing in the waters of the southeast section of the Indian Ocean and the southern part of the Pacific Ocean.

It was previously reported that the first four meteorological rockets were launched from the Ob' during the period from December 1957 to February 1958 in the coastal waters of East Antarctica, while the Ob' was sailing from Mirnyy to the Oates Coast.

The fifth rocket was launched in the vicinity of the Snares Islands, New Zealand, on 16 February 1958; the sixth and seventh rockets, from 38 58 S and 142 08 E, on 9 March 1958; the eighth rocket, in the Tasman Sea; the ninth to 13th rockets, along the northern edge of the Ross Sea; the 14th rocket, from 66 22 S and 128 03 W, on 21 April 1958; and the 15th to 22d rockets, in the meridional sector from Bellingshausen Sea to Easter Island, on 28 April and 7 May 1958.

Thus, during the IGY, from November 1957 to May 1958, a total of 36 meteorological rockets were launched from Ostrov Kheysa and from the expedition ship Ob'. As a result, data have been received on the distribution of temperature and air pressure in the central stratosphere in the Arctic and Antarctic. Launchings of meteorological rockets for the study of the upper atmosphere will be continued until the end of the IGY. The results of rocket soundings of the atmosphere are being processed and summarized. (Moscow, Vodnyy Transport, 31 Jul 58)

Shternfeld Discusses Problems Posed by Manned Satellites

The following is a complete translation of an article by A. Shternfeld entitled, "The Day Will Come When Manned Satellites Will Be Necessary," which was published on page 4 of the 6 August 1958 issue of Le Drapeau Rouge, Brussels Communist daily:

"Automatic satellites are insufficient for the study of processes which take place in the universe. The day will come when we will need satellites manned by technicians and scientists. But there are still many difficulties to overcome to build a manned satellite.

The cosmic vehicle, notably the artificial satellite, resembles a submarine, in that the crew must live in a tight cabin entirely isolated from its environment. Because of the lack of air resistance which brakes the progress of the satellite at high altitudes, the builder can give it any form whatsoever, for example, that of a ring. The model of such a satellite is on exhibit at the Soviet Pavilion of the Brussels World's Fair.

It is possible that, because of the danger from meteorites and harmful radiation, it will not be possible to install windows looking directly outside. Therefore, a narrow channel provided with a system of mirrors and lenses will be necessary to permit the entry of light rays.

Apprehensive statements are often made about the danger of a collision with large meteorites. How can this be avoided?

No one has yet found effective protective measures. Some propose the use of a double (or greater) revetment, hoping that the explosion which would take place during a collision with the outer covering would not affect the inner covering.

It is not at all excluded that this problem could be resolved by shooting down the meteorite. As soon as the meteorite is detected, the radar would keep it in view on its screen. At each instant, the speed, direction, and location of the 'enemy' would be determined. Guns would begin firing after a fraction of a second, and the meteorite heading for the satellite would explode at a great distance from it.

As is known, objects and men within the satellite would be weightless; this is why satellites with artificial gravity will have to be built, as Tsiolkovskiy had proposed. After having forced the satellite to turn on its axis, a centrifugal force would be created to replace gravity.

Will it be necessary to forcibly maintain normal air pressure in the capsule? It is possible that the astronauts will be able to breathe normally, since the composition of the air will be adequate, even in pressure lower than atmospheric pressure. Therefore, the thinner the partitions of the hull, the simpler will be the construction of the cabin and the pressure suits, and the less dangerous the escape of air into space. As for the respirable 'used' air, it can be replaced by fresh air by 'aerating' the capsule. The carbonic acid from this air will be eliminated also by means of chemical processes, as in a submerged submarine. This method was used in Sputnik II with a dog on board. In addition, the number of substances taking part in these chemical reactions was automatically regulated.

It would be useful to carry the necessary oxygen reserve in liquid form. It could be sent from earth to the satellite even in solid form which would necessitate very light encasement. Oxygen in a composition of sodium peroxide, which absorbs carbonic gas and the excess moisture and at the same time releases oxygen, could also be carried. But oxygenated water in solid form would be preferable.

It is said that the smallest raindrop contains a tremendous amount of potential energy. The satellite can justly be compared to a raindrop, flying through space under the vertiginous beam of solar rays. But the manned satellite will have to do more than simply reflect the sun's rays to regulate its internal temperature, according to which side is facing the sun.

The difference in temperature between the side facing and the side away from the sun is greater than on earth, and thanks to this, the coefficient of efficiency of the solar installations can be higher.

Soviet scientists are attempting to perfect solar installations which will be able to operate continuously and which will supply power to all the satellite's apparati.

The construction of large satellites will necessitate entirely new assembling methods. For example, some time after the launching of the first rocket, it will be joined by another rocket which will be guided to the first. Other rockets, launched in exactly the same way, will form a celestial body of sufficient size to be able to accommodate men and all the necessary reserves, mechanisms, and apparatus.

It is remarkable that at the beginning of the century, the Russian scholar Yu. Kondratyuk already believed that 'it would be preferable to send up into space the pay load and the objects (everything encased except sensitive apparatus)...capable of enduring without danger, accelerations of several thousands of meters per second, using unmanned rockets.'

The satellite could first be built on earth and the efficiency of its construction tested. It would then be dismantled and placed in orbit where all its parts would then be assembled." (Brussels, Le Drapeau Rouge, 6 Aug 58)

Measuring Corpuscular and X-Radiation of Sun With Artificial Satellite

An article entitled "The Study of the Corpuscular Radiation of the Sun With the Aid of an Artificial Satellite of the Earth," by V. I. Krasovskiy, Yu. M. Kushnir and G. A. Bordovskiy, contains the following discussion of instrumentation:

"An artificial satellite of the earth may be used for investigations of the corpuscular radiation of the sun in two ways: First, through the installation of a special mass spectrometer, to determine directly the chemical composition of corpuscular flows. A more effective method of registration, connected with photographic processes, requires a special design of the satellite with guaranteed delivery of data back to the earth. An accurate orientation of the instrument in the right direction is, obviously, also necessary. Secondly, it is presently feasible to investigate the distribution and penetration of corpuscles according to geomagnetic latitude and longitude, particularly during daylight, which provides verification of various hypotheses on the nature of corpuscular flows. For this purpose, instruments have been designed and built, the principal scheme of which is briefly shown in Figure 5 [block diagram]. The corpuscle indicator is a fluorescent screen which glows under the influence of the corpuscles. The recording of corpuscles by means of a sounding method is not feasible, because the upper atmosphere contains a large number of its own ions and electrons, which, when there is a difference between the potentials of the electrodes of the sonde, produce a considerable current which conceals the flow of solar corpuscles. The emission of light by the fluorescent screen is recorded by means of photoelectric cells; then, the photoelectric current is amplified, stored, and transmitted over the proper radiotelementering equipment. In front of the fluorescent screen there is a metallic foil, the duty of which is twofold. On the one hand, with the use of foils of various thicknesses it is possible to obtain a coarse estimate of the transit of corpuscles. On the other hand, the foil shields the fluorescent screen and the photocell from the direct effect of solar radiation. The shield limits the angular effect of the corpuscles. The current I, which originates in the photocell, is determined according to the following expression:

$$I = iSU \pi \alpha \eta,$$

where i = the corpuscular flow in $a.cm^{-2}$, S = the area of the fluorescent screen and of the photocathode in cm^2, U = the difference of the potentials, in volts, required for accelerating the corpuscles up to their energy, α = the light emission of the fluorescent screen in candles per watt according to the Lambert distribution of emission, and η = the sensitivity of the photocathode in a per lumen. Let us take $i \sim 10^{-12}$ $a \cdot cm^{-2}$, which corresponds to an aurora at a background level of the night sky, $S \sim 30$ cm^2, $U \sim 10^5$ v, $\alpha \lessapprox 10$ candles per watt, and $\eta \sim 10^{-4}$ a per lumen. Then $I \sim 10^{-8}$a. It is quite evident, that the amplification of such currents as 10^{-8} and lower, corresponding to the general background of corpuscles on a quiet day, does not involve any difficulty. The metallic foil to be used is expected to be an aluminum foil with a thickness of 0.6 - 1.0 $mg \cdot cm^{-2}$. These foils are practically opaque to solar radiation and prevent it from reaching the photocells.

"It is feasible to use the described apparatus at the same time along with an apparatus for the study of X-radiation of the sun (Uspekhi Fizicheskikh Nauk, Vol 63, No 1b, 1957, p 163) and micrometeorites (Ibid, p 253). The simultaneous investigation of solar X-radiation is necessary to exclude this radiation whenever the recording equipment is directly exposed to the sun and to be able to record the X-radiation in addition to the corpuscular radiation. Moreover, the thin metallic foil, thus also the thin metallic filters used for the determination of solar

X-radiation, will, during use, be punctured continuously by micrometeorites, and the reading of the instrument in the daytime will give a certain gradually increasing component. In this way, the instrument, as a device for the study of solar X-radiation and as a device for the study of solar corpuscular radiation, will serve also as a supplementary indicator of micrometeorites. The presence of an independent control for micrometeorites affords the possibility of taking into account the parasitic illumination through small holes produced by micrometeorites.

"Soft corpuscular radiation of the sun may be detected without metallic foil only at night during the absence of sunlight. An instrument in such a regime may be switched on and off by means of special command signals from a programming device." (Moscow, Uspekhi Fizicheskikh Nauk, Vol 64, No 3, Mar 58, pp 425-434)

Optical Satellite Observations in USSR

The problem of determining the spatial coordinates of artificial earth satellites with regard to time by optical ground observations is discussed by I. S. Shklovskiy and P. V. Shcheglov in "Optical Observations of Artificial Earth Satellites."

The importance, value, and need of obtaining precise coordinates of an Earth satellite are reviewed.

The authors mention the method of photographic observation used in the US, using the Schmidt camera and also the network of visual observation stations.

The USSR has a network of 66 visual observation stations.

In the USSR, observations on the larger, brighter Soviet satellites are conducted with photographic apparatus, which are much simpler than the Schmidt camera and have a smaller diameter objective. A special apparatus for photographing bright satellites was built in the State Astronomical Institute imeni Shternberg by V. F. Yesipov, V. G. Kurt and one of the authors. This device was based on the NAFA-3c/25, a standard aerial survey camera. Photoplates were used for increased accuracy in the measurement of the coordinates. Some difficulty was encountered in the registration of the exact exposure intervals because of a lag in the closing of the mechanical contacts of the shutter mechanism. This difficulty was eliminated by placing a lead-sulfide photoresistor [photo conductor] inside the camera at the suggestion of Yu. N. Lipskiy. It was activated by a source of infrared light passing through the objective and shutter in such a way that it did not affect the photoplate. The current throughout the photoresistor was equal to the second impulse of an astronomical clock with a standard signal of 500 cycles and the moment of shutter action was recorded on a loop oscillograph. Shutter openings and closings were sufficiently fast (2-3 milliseconds).

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Another method for precisely recording the moment of the passage of a bright satellite was proposed, independently, by P. P. Dobronravin of the Crimean Astrophysical Observatory Academy of Science USSR, and by V. I. Moroz of the State Astronomical Institute imeni Shternberg. In this case, the image is projected by the objective on an opaque diaphragm with perforations which are located according to known stars. A photomultiplier is placed behind the plate. Its current is registered on a recorder. Thus, the moment of passage of the satellite's image through the slit is recorded.

In Moroz's apparatus, the diaphragm serves as a photoplate on which the stars and the satellite's track are photographed. This gives a more favorable determination for location of the slits and the track of the satellite relative to the stars.

The coordinates of dim satellites can also be determined using optical instruments with comparatively small diameters, if radiation collectors are used which are more sensitive than photoplates, for example, electron optical converters (EOP). Such a system can increase the photographing sensitivity by 100, compared with the best existing photographic emulsions. A disadvantage in the use of electron-optical converters is the comparatively small sizes of their working areas (10-12 millimeters).

Observations of satellites from the time they enter the denser layers of the atmosphere up to the time they burn and disintegrate can be made at night. Various receivers of infrared radiation, as the electron-optical converter with an oxygen-cesium photocathode and photoresistance can be used for these observations. Spectroscopic observations of satellites during the period of burning in the Earth's atmosphere are of great interest. In principle, these observations are similar to the spectrographing of meteors.

Prismatic cameras and slit spectrographs used in astronomy for star spectrography cannot be used in satellite observations because of their comparatively small dispersion and low lens power.

Spectra of satellites can be obtained by preparing special objective prisms with a small refractive angle and using the camera described above. The dispersion and resolving power will be rather small. However, the basic qualitative and possibly the quantitative characteristics of the spectrum will be obtained.

The article contains a photograph showing Sputnik II's flight which was obtained with the described photographic apparatus of the State Astronomic Institute imeni P. K. Shternberg by V. G. Kurt and I. V. Shcheglov at the Tashkent Astronomical Observatory.

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The shutter operating time (according to sidereal time) is given opposite the ends of each track, with an accuracy of 2 milliseconds. The mean quadratic error by hair sighting with the measuring instrument at the end of the track was 4 microns, which, in a camera having a focal length of 250 millimeters, corresponds to 3 inches.

The change in the satellite's brightness due to rotation can also be seen in the photograph. (Uspekhi Fizicheskikh Nauk, Vol 64, No 3, Mar 58, pp 417-424)

III. UPPER ATMOSPHERE

Auroral Observations at Eysk

The Eysk marine hydrometeorological station reports observations of aurorae, a phenomena rare for this locale. The station is located on the shore of the Taganrogskiy Zaliv of the Sea of Azov (46 44 N latitude)

An aurora was seen from 0530 to 0600 Moscow time on 11 February 1958. It appeared on the horizon from northwest to west. At the moment of greatest intensity the lights reached almost to the zenith. A narrow band of noctilucent clouds were observed near the horizon.

Aurorae were also observed at Eysk on 30 September 1957 between 2000 and 2300 hours. (Meteorologiya i Gidrologiya, No 6, Jun 58, p 38)

IV. METEOROLOGY

Czechoslovak Press Reports on Soviet Radiotheodolite

The measuring of high altitude winds under difficult meteorological conditions and at night has, until recently, been a major problem for the Czechoslovak meteorological service. High altitude winds could be determined only by optical measuring of a rubber balloon by means of a theodolite.

This problem has been eliminated by the new Soviet instrument, the "Malakhit" radio theodolite. The principle on which it operates is the exact measurement of a transmitter of meteorological radio sonds, sent up into the atmosphere in a balloon. It is possible to determine the exact position by means of the antenna system which has four dipoles in a cross formation. The signals received by the antennas are processed by the receiver and converted into optical images. The operator should adjust the antenna system (according to the optical images) by means of a servomechanism so that the signals received by all antennas are equally strong. Data on the elevation and lateral angles are read from the instrument once each minute. The remaining operations are the same as those used with a normal theodolite. The "Malakhit" is capable of measuring winds at an altitude of up to 20-25 kilometers. The radio transmitter operates on frequencies from 215-220 kilocycles per second. The instrument operates on line current of 120 or 220 volts, 50 cycles per second. (Prague, Kridla Vlasti, 24 Jun 58, p 11)

Character of Surface Air Layer Turbulence

Formulas and nomograms are presented by A. B. Kazanskiy and A. S. Monin of the Institute of Physics of the Atmosphere, Academy of Sciences USSR, for determining the characteristics of surface air layer turbulence according to gradient measurements (air temperature and wind speed curves).

On the basis of the theory of similarity for a turbulent condition in the surface layer of air and experimental data, it is established that with unstable stratification outside the thin under layer of dynamic turbulence, the mechanism of air movement is practically the same as that of free convection. (Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 6, Jun 58, pp 741-751)

Czechoslovak Press Describes Soviet Meteorological Station

In "Soviet Remote Meteorological Stations," Jiri Langer, describes the Soviet remote meteorological station, model "DMTs-G-53," as being designed for determining temperatures, relative humidity, and speed and direction of the wind at airfields.

It is made up of three parts. The elements measuring temperature and relative humidity form one unit, which is placed in a small louvered booth. A four-cup anemometer with a weather vane forms the second. The third is the control box which indicates the values from the individual elements. The equipment operates on a principle whereby the quantities sensed by the meteorological elements are converted into quantities of electrical current. This method makes it possible to read values at a distance of up to 100 meters.

The wind speed is measured by the anemometer and a so-called "measuring generator" (merny generator) which produces electrical current. This means that the energy of the wind is converted into electrical energy, which can be precisely measured. The wind speed indicator is a voltmeter appropriately graduated in meters per second.

The direction of the wind is determined by a direct method based on transmissions by a revolvable electromagnetic field or a command induction system. The wind direction finder uses a special resistance transducer and, on the receiving side, the indicators use a system with a three-phase stator. A two-pole permanent magnet is used as an armature (the so-called "magnesyn" system). This system makes it possible to see the direction of the wind on the indicator as soon as the switch is turned on.

The "DMTs-G-53" measures the temperature of the air by means of an electric thermometer. The resistance of the thermometer varies in direct proportion to the temperature of the surrounding atmosphere (a non-balanced resistance bridge with an electric measuring instrument, a microammeter, attached to the cross bar).

The relative humidity is determined by an indicator made from a hair hydrometer with remote (electric) control of the indicator.

The station operates on line voltage of 110-127 or 220 volts and also on a 30-volt battery. The battery is able to keep the station in operation for 6-8 months. The station is connected with the indicators by a 100-meter cable. The indicator box is also equipped with a precision clock.

The instruments can measure wind speeds from 2 to 30 meters per second, wind directions from 0 to 360 degrees, air temperature from plus 45 to minus 45 degrees centigrade, and relative humidity from 30 to 100 percent. The total weight of "DMTs-G-53" is 80 kilograms. (Prague, Kridla Vlasti, 8 Jul 58, p 25)

1956 International Pyrheliometric Scale Adopted by USSR

The new pyrheliometric scale, recommended by the International Conference on Radiation held in Davos in September 1956, has been adopted by the Hydrometeorological Service of the USSR.

According to an article by Yu. D. Yanishevskiy, "The International Pyrheliometric Scale, 1956," the new scale, used in the study of solar radiation, has been in use in the USSR since 1 January 1957.

For conversion to the new scale, it was necessary to: (1) increase the conversion multiplier of all pyrheliometers, actinometers, pyranometers and balance meters tested according to pyrheliometers of the Main Geophysical Observatory which were checked in Potsdam; (2) to increase the results of actinometric observations conducted from 1 January 1957 with the instruments mentioned in (1); and (3) not to change instruments which were checked in the Main Geophysical Observatory during the period 1946-1952.

The necessity of comparing all USSR pyrheliometers with the test instruments of the Main Geophysical Observatory is noted.

Among the recommendations made at the Conference was one requesting observations using pyrheliometers with a very narrow aperture angle (up to 4 percent) for which radiation near the sun is reduced from 4 to one percent. However, this recommodation requires a special method of investigation. (Meteorologiya i Gidrologiya, No 5, Jun 58, pp 46-47)

V. OCEANOGRAPHY

Mikhail Lomonosov Completes Four-Month Cruise

The Mikhail Lomonosov, expeditionary ship of the Marine Hydrophysical Institute of the Academy of Sciences USSR, has arrived in Riga after a 4-month, 12,000-mile voyage in the Atlantic Ocean during which it conducted investigations under the IGY program. A description of the work performed by the expedition was given by G. Ponomarenko, assistant chief of the Atlantic Expedition.

One of the most important problems of the expedition was the study of ocean currents. Currents at great depths were especially investigated. On the basis of the data obtained it is said that navigation will be improved and the fishing industry will be benefited. In addition, it is necessary to know the over-all circulation of the waters of the Atlantic Ocean in order to determine the quantity of water entering the North Sea and the Arctic Ocean and hence to determine the amount of heat which these waters carry and can transfer to the air masses.

The study of the origin, development, and dying out of sea waves also entered into the expedition's program. Ponomarenko says that there is still a lack of sufficient data on sea waves to take their characteristics into consideration in shipbuilding and ship handling.

Depths were measured for a distance of about 9,000 miles along the course of the ship. Comparatively large submarine rises, depressions, volcanoes, and other features of the depths were discovered.

Much time was spent on the problem of heat exchange between the atmosphere and the ocean. Special instruments and automatic recorders were installed on the ship. These continuously recorded the amount of heat coming from the Sun and the heat which the water shed as a result of evaporation and radiation.

Together with the usual meteorological observations, radiosondes were launched at least twice a day. These fed back information on changes of air temperature, pressure, and humidity up to altitudes of 30 kilometers. For the first time in the history of oceanographic investigations data on the velocity and direction of a radiosonde, and by this the direction and velocity of the motion of air masses, were successfully gathered with the aid of the "Malakhit" radiotheodolite. Preliminary processing of data on the motion of air masses showed that their velocity was considerably greater than previously determined by other methods of computation.

The variability of the heat and chemical content of the waters of the Atlantic Ocean was another subject of study. As a result, new data concerning the amount of oxygen, phosphorous salts, nitrogen silicon, and other biogenic matter were obtained. These data not only will make it possible to arrive at a better determination of the water masses but also will be considered in determining the productiveness of the waters of the ocean.

Measurements of the temperature of the waters, the taking of sea-water samples for chemical analysis, measurement of currents, and other work were performed in 145 drift stations and three 24-hour anchor stations. These anchor stations were made at depths of 4,300-5,100 meters.

The most interesting scientific conclusion made by the expeditions on the Mikhail Lomonosov (in November 1957 and in March-June 1958) was that the surface waters of the northeastern part of the Atlantic Ocean have a higher temperature than was anticipated from the average of many years' data, for example, those data given in the Marine Atlas. These waters carry much heat into the Arctic, changing the icing conditions in the northern seas.

Members of the expedition are now preparing for another voyage. (Moscow, Vodnyy Transport, 1 Jul 58)

Vityaz' Operations Reviewed

An interesting result of the investigations conducted by the Vityaz', expeditionary ship of the Institute of Oceanology, Academy of Sciences USSR, on its second voyage in the Pacific is revealed in an article by N. Sysoyev, Candidate of Technical Sciences, assistant director of the institute.

A geographic zonality in the central part of the Pacific Ocean was established by Soviet scientists. The relationship among solar radiation, prevailing winds, air and water temperatures, transparency, salinity, and the content in the water of oxygen, phosphates, nitrates, bacteria, plankton, and fish was revealed and some data on the influence of these factors on life at the bottom of the ocean and on the sedimentation processes were gathered.

The rest of the article is a brief summary of the three Pacific voyages and research operations of the Vityaz' during 12 months of the IGY. This material has been previously reported. (Moscow, Vodnyy Transport, 1 Jul 58)

In another article Sysoyev claims a record for the Vityaz' -- anchoring in the open sea over a depth of almost 9,600 meters [29,760 feet] in the Kurile depression. This exceeds a depth of 5,780 meters achieved by the German expeditionary ship Meteor.

Anchoring a ship of such a large displacement as the Vityaz' (about 6,000 tons) required the creation of a special cable and winch of original design. Using this apparatus, the Vityaz' established about 140 long-period deep-water stations. A number of Soviet oceanographic ships, among them the Mikhail Lomonosov, have recently been equipped with deep-water anchoring apparatus.

For anchoring ships at depths greater than 10,000 meters, a special stepped cable, the diameter of which gradually increases from the anchor to the winch, is used. Such a deep-water cable was used by the Vityaz'. It consisted of lengths of cable of specified lengths and diameter ranging from 14 to 25 millimeters. In this way the increasing weight of the cable as it is paid out is countered by the increasing strength of the cable.

In deep-water anchorages two 300-kilogram anchors joined by a cable are dropped about 50 meters apart. The anchoring cable is 30-40 percent longer than the depth of water where the ship stands. For example, at the 9,600-meter depth, 12,500 meters of cable were paid out.

For paying out and retrieving the anchor cable, (the weight of which exceed 16 tons for a length equal to 14 kilometers), a special winch is used. The main feature of this winch is that its pulling mechanism and apparatus reduce the great tension of drawing the cable from the water (which reaches a weight of 18 tons) down to several hundred kilograms, after which it is wound on a reel located in the hold of the ship. Direct winding on the reel would be impossible because the reel could not withstand the pressure accumulating with each turn of the cable about it.

The winch apparatus also includes a shock absorber which dampens the shock on the ship while riding at anchor, a dynamometer and counter which indicate the tension on the cable and its length, and a device for wiping and greasing the cable and the cable stacker. Anchoring in 5,000 meters of water requires 1 1/2-2 hours.

The Vityaz' deep-water winch was developed in the Soviet Union and built by Soviet plants. It is claimed to be the best winch of this type. (Sovetskiy Flot, 22 Nov 57)

VI. ARCTIC AND ANTARCTIC

Wind Characteristics Over Eastern Antarctic Studied by Soviets

The seasonal variation of zonal circulation over the shore line of eastern Antarctica is considered in an article titled "Some Characteristics of the Change in the Wind With Altitude Over the Eastern Shore of the Antarctic" by N. G. Leonov.

The data of weather balloon observations made by the Mirnyy (66 33 S, 93 00 E) and Mauson (67 36 S, 62 53 E) stations were used as basic material. These stations lie in approximately the same latitude near the south polar circle about 1,500 kilometers apart. The general features at these stations can be said to be characteristic for all of the eastern shore of the Antarctic (and possibly for all of the shore as a whole), but stable differences are associated with seasonal characteristics of the baric field.

The zonal components of the velocity of the wind at ground level and at the altitudes of 1.5, 3, 6, 9, 12, 15, and 18 kilometers were calculated for the period from March 1956 to February 1957. Data on the number of observations considered and the frequency of east and west components of the wind at the different altitudes for different months are presented in tables.

The frequency of west and east wind components at different altitudes in the different seasons are discussed, and the following conclusions are presented.

On the eastern shores of the Antarctic in the lower layers, up to 1.5 kilometers in the overwhelming majority of cases east wind components of the wind were observed. This confirms the well-known position that as a rule a high-pressure field is observed over the Antarctic.

With an increase of altitude the frequency of east wind components decreases and the frequency of west wind components increases. If at an altitude of 3 kilometers east components prevail on the average during the year, then at an altitude of 6 kilometers west components are predominant. This attests to the fact that, beginning with an altitude of 3-6 kilometers, a low-pressure field is frequently observed over the Antarctic. That is to say, the thickness of an anticyclone over the eastern part of the Antarctic on the average does not exceed 6 kilometers. In the upper layers (at altitudes of 12-15 kilometers) the frequency of west wind components over the shore is approximately 85%; that is, as a rule a field of low pressure is located in these layers over the Antarctic.

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The transition from high anticyclonic circulation to cyclonic circulation has certain seasonal characteristics; as follows.

1. In the autumn period the transition from east components to west components occurs in lower layers than in other seasons. An anticyclone over the eastern part of the Antarctic in autumn does not develop along the vertical as well as in other seasons. Beginning with an altitude of 12 kilometers, a low-pressure field is always located over the Antarctic.

2. In summer, in a sufficiently large number of cases (not less than 30%) the east wind components over the eastern shore of the Antarctic are maintained at all altitudes. Beginning from an altitude of 12 kilometers, the frequency of east components begins to increase. This is proof that over the Antarctic in a number of cases the low pressure in the upper troposphere is changed by the high pressure in the stratosphere, that is, the air in the lower stratosphere over the Antarctic on the average is warmer than that over the ocean. The principal reason for this is the direct absorption of solar radiation by the ozone, a layer of which drops down lower over the Antarctic than over the ocean, or is at these altitudes more saturated. This last is only a hypothesis since direct observations on ozone content have not been made.

3. Winter and spring as a whole differ little from each other and occupy an intermediate position between autumn and summer. November is the only exception.

In November, as in the summer months, from altitudes of 12-15 kilometers an increase in east components is observed. According to the quantitative characteristics of the problem being considered, November approaches near enough to the summer month of February. Thus it can be said that the activity of the ozone layer over the Antarctic appears in the period from November to February. It is best expressed in January.

The transition from summer type circulation at high altitudes to the autumn type comes about rather sharply, as a jump. This can be explained in two ways: either the ozone activity in the given layer over the Antarctic lessens sharply, or the active layer of ozone shifts to the side of the ocean.

In the course of the whole year cases are encountered when a high-pressure field is located over the Antarctic in all of the troposphere. Such cases are found comparatively rarely in the autumn, and more frequently in the summer.

In the course of the greater part of the year, with the exclusion of the summer period, the antarctic anticyclone at Mauson develops according to altitude on the average not as well as in the region of Mirnyy (the frequency of west components in the lower 3 kilometers in Mirnyy increases considerably less than in Mauson).

The activity of the ozone layer in summer in the region of Mauson is considerably better expressed than in the region of Mirnyy (the frequency of the east wind in the 12- to 18-kilometer layer in Mirnyy increased 8% and in Mauson 21%). (Meteorologiya i Gidrologiya, No 6, Jun 58, pp 8-13)

Operations at Soviet Drift Station SP-7

Systematic scientific observations are continuing at the Soviet drifting ice station Severnyy Polyus-7 (SP-7) for the third month. All operations are being conducted in accordance with an IGY program including oceanology, the ionosphere, aerology, meteorology, and actinometry. However, according to N. Belov, director of station SP-7, ice observations have been curtailed in favor of a broadened oceanology program.

Station SP-7 crossed the 87th parallel on 18 June and was continuing its drift toward the 88th parallel. It had covered less than 50 miles on a general course but a total of more than 150 miles. According to preliminary data, drift of the ice field in the region of the station was determined mainly by the direction of the wind.

A 1,495-meter upheaval was discovered on the bottom of the Arctic Ocean on 15 June in a region with a general depth of 2,600-2,700 meters. This upheaval extends for 560 kilometers and has a relative height of 1,100-1,200 meters. Analysis of all previous depth data for this region showed that a new mountain range had been discovered which appears to be a spur of the central Arctic upheaval.

An unusually early onset of summer resulted in rapid melting of snow and formation of large fresh-water lakes around the living quarters of the station. However, expedient drainage of several thousand tons of water ensured normal station operation. (Moscow, Vodnyy Transport, 1 Jul 58)

New Minimum Temperature Recorded in Antarctic

During the last week of July, the antarctic interior stations Vostok and Sovetskaya registered a new low in temperature, previously not recorded anywhere on the Earth. On 24 July, the station Vostok registered an air temperature of minus 81.4 degrees C. On 25 July, Sovetskaya recorded a new absolute minimum of air temperature, i.e., minus 83 degrees C, with a wind velocity of 5 meters per second.

Despite extremely severe weather conditions, Soviet scientists are continuing their scientific observations under the IGY program. (Moscow, Vodnyy Transport, 29 Jul 58)

Ob' Visits South America

After completing its oceanographic work in antarctic waters, the Ob' visited the capitals of Argentina and Uruguay. A press conference was held aboard the Ob', during which Prof V. G. Kort, chief of the Soviet Antarctic Marine Expedition, and Capt I. A. Man of the Ob' told press and radio representatives about the scientific work done by the expedition in the waters of the Southern Hemisphere.

During a 2-day period in Buenos Aires, about 6,500 persons visited the Ob'; and in Montevideo over 2,500 persons came aboard in a 4-hour period. The visitors inspected the ship and the scientific laboratories and equipment with great interest.

An official visit was made to the Ob' by Rear Admiral Panzarini, director of the [Argentine] Institute of the Antarctic; Captain Kapura [Capura?], chief of the Argentine Antarctic Expedition; Dr Garcia, chief of the Argentine Meteorological Service; and members of institutes of Argentine-Soviet and Uruguay-Soviet cultural relations. In honor of the members of the Soviet Antarctic Expedition, the Institute of Argentine-Soviet Cultural Relations arranged a reception, which was held in an atmosphere of cordiality and friendship.

During the 15-day stopover in Buenos Aires, the Soviet scientists and sailors went sight-seeing in the city. They visited the university, museums, parks, and theaters and made a number of excursions.

After filling the hold of the ship with Argentine export articles, such as leather and wool, the Ob' went to Montevideo to refuel and pick up more cargo. During a 3-day stopover at this port, the expedition and crew members saw the city and its suburbs. On 8 July, the Ob' left Uruguay and headed for home. (Moscow, Sovetskiy Flot, 15 Jul 58)

During a period of 10 months, the Ob' traveled a distance of 44,000 miles, spending time in the Antarctic and the Atlantic, Indian, and Pacific oceans.

Members of the Antarctic Marine Expedition conducted numerous scientific studies and collected a large amount of material for the IGY program. The main areas of research work conducted on the Ob' were the coast of East Antarctica, the southeast portion of the Indian Ocean, and the Antarctic part of the Pacific Ocean. The expedition considerably expanded the program of research activities by including cartographic aerial photography and geological-geographical explorations of the coast of East Antarctica, as well as studies of the upper atmosphere with the help of meteorological rockets and radiosondes. The expedition was composed of ten detachments: aerometeorology, hydrology, hydrochemistry, geology, marine geophysics, biology, astronomy and geodesy, radio-aerial photography, hydrography, and aviation. The total number of expedition members was 166, including 69 crew members. Two AN-2 airplanes and a small three-passenger YaK-12 plane were assigned to the expedition for taking aerial photographs of the coast.

On 10 January, the Ob' with the marine expedition on board left Mirnyy on a long oceanological research voyage to study the antarctic waters according to the IGY program. From 11 January to 11 February, the coast was explored from the Davis Sea to the Ross Sea. In this sector, over 6,000 miles of hydrographic depth measurements were taken, and cartographic aerial photographs were taken of the antarctic coast from the 110th to the 166th degree eastern longitude, covering a total area of about 42,000 square kilometers. The aerial photography was coordinated by the radiogeodetic system and, in addition, tied to 20 astronomic points evenly distributed over the survey region.

As a result of aerial photography, the coast outline has been considerably revised and many new geographic objects have been discovered, including mountains, glaciers, inlets, and islands, especially in the region of the Banzar Coast, King George V Coast, and Oates Coast. Geologists and geographers studied all the main outcrops of rock in that region of Antarctica.

Having completed its coastal studies, the expedition stopped at Wellington, where the leading Soviet scientists took part from 18 to 23 February in the work of the International Antarctic Symposium organized at the initiative of New Zealand scientists.

On 11 March, the complex oceanological work was begun. From that time until 17 June, the expedition conducted deep-sea observations at 155 oceanological stations in the antarctic section of the Pacific Ocean, which had until then been the least studied area of the Antarctic and of all the oceans in the world. Observations conducted in the Drake Passage have provided information on its hydrological regime during the winter season.

The extensive program of aerometeorological research conducted by the Third Antarctic Marine Expedition included the development of new methods of actinometric research. B. G. Rozhdestvenskiy and V. I. Shlyakhov, senior scientific associates of the expedition, designed and built the first actinometric radiosonde in the world. This extremely interesting and significant device was launched in the Atlantic Ocean, in the area of Madeira Island, and has given excellent results.

The material collected by the marine expedition is undergoing preliminary processing, but it can already be said that the work presents a valuable contribution to the fulfillment of the IGY program.

During the voyage of the Ob' in the Pacific Ocean, the scientists of the expedition established contact with members of the University of Concepcion, which is about 15 kilometers from the port of Talcaguana. The Soviet biologists received a gift of specimens of South American flora.

During all the Ob's visits to foreign ports, including those in Italy, South Africa, New Zealand, Australia, Chile, Argentina, and Uruguay, friendly relations were established between the Soviet scientists and the residents of the countries visited. Soviet scientists visited foreign scientific institutions and exchanged scientific information and research results. During the visits to foreign ports, a total of about 24,000 persons, including scientists and important public officials, came aboard the Ob'. The visits of the Ob' became a mission of friendship and contributed to the mutual understanding between the Soviet people and the peoples of the foreign countries visited.

During the homeward voyage from the Antarctic, preparations were being made on the ship to put the equipment in readiness for an Arctic voyage. (Moscow, Vodnyy Transport, 31 Jul 58)

Return of Ob'

On 2 August 1958, the Ob' arrived in Leningrad with the returning members of the Third Antarctic Marine Expedition. The expedition and crew members were welcomed at the port by M. Somov, deputy director of the Arctic Institute, and a number of other officials. (Moscow, Izvestiya, 3 Aug 58)

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