CLASSIFICATION SECRET **SECRET**

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1948
SUBJECT	Scientific - Geophysics, hydrology	DATE DIST.	9 Jan 1951
HOW PUBLISHED	Bimonthly periodical		
WHERE PUBLISHED	Leningrad	NO. OF PAGES	8
DATE PUBLISHED	Sep 1948	SUPPLEMENT TO REPORT NO.	
LANGUAGE	Russian		

THIS IS UNEVALUATED INFORMATION

SOURCE Meteorologiya i Gidrologiya, No 5, 1948, pp 3-13.

HYDROLOGICAL STUDIES IN THE USSR

M. I. L'vovich

The 30-year development of Soviet hydrology can be divided into the following four periods: (1) from the Revolution to the first years of the Stalin Five-Year Plans; (2) from the years of the Stalin Five-Year Plans to the beginning of World War II; (3) during World War II; and (4) the postwar years.

A. First Period of Soviet Hydrology (1917-1923)

The most important event of the first period was the organization in 1919 of the State Hydrological Institute (GGI), which was the first complex scientific institution in the field of hydrology. Even now, the GGI remains almost the only scientific institution of its kind in the world. The initiative in the creation of the GGI was taken by the Academy of Sciences and GGI activity began on 6 October 1919.

Many important problems were set up in the first years of GGI activity. These include the development of methods of forecasting spring floods (V. O. Askinazi, A. A. Kaminskiy, V. N. Lebedev, B. P. Mul'tanovskiy, and S. A. Sovetov); the development of the theory of formation of bottom ice and study of its harmful effects (V. Ya. Al'tberg); the study of floods and the winter regime of the Neva River (V. Ye. Lyakhnitskiy); the development of the theory of movement of ground waters (N. N. Pavlovskiy); and the selection of efficient methods of hydrometry.

The GGI was not detached from practical problems even in the first years of its activity. For example, the Presidium of the Supreme Council of the National Economy entrusted the GGI with the hydrological work required in the electrification plans of 1920. The staff of the GGI grew rapidly and its activity expanded. Systematic forecasts of the spring high-water and on the freezing and debacle of rivers of the European RSFSR were initiated in 1922 under the direction of V. N. Lebedev. These forecasts were of great practical and methodological importance. Lebedev's method was the first that was not

CLASSIFICATION SECRET **SECRET**

STATE	X	NAVY	X	NSRB		DISTRIBUTION
ARMY	X	AIR	X	FBI		

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370270-1

SECRET

50X1-HUM

based on purely hydrological processes inasmuch as it also took into consideration the so-called index of atmospheric circulation established by B. P. Mul'tanovskiy. Thus, the Lebedev-Mul'tanovskiy forecasts served as a starting point for the development of many of the more recent methods of hydrological forecasting, including that now employed.

Another important development in the history of the GGI during the first period, and in the history of hydrology in general, was the development by M. A. Velikanov of the first scientific theory of floods. This theory served as a basis for genetic studies of floods and was a prerequisite for their practical calculation in advance.

The GGI did a great deal of work in collecting and processing data from river stations which had been discarded or left unprocessed up to the Revolution. This data made it possible to analyze formation processes and to make scientific generalizations on the hydrological regime of rivers and lakes. These were only rought attempts at broad generalizations, but some of them were useful in the solution of practical problems. These include a formula for calculating yearly runoff devised by M. A. Velikanov and D. L. Sokolovskiy, studies of the water balance of Lake Ladoga, and others.

Field investigations made up a large part of the works of the GGI. Outstanding examples of these were the investigations of Lakes Onega, Ladoga, Issyk-Kul', Sakskiy, etc., directed by L. S. Berg, I. V. Molchanov, V. K. Davydov, G. Yu. Vereshchagin, B. V. Perfil'yev, and others.

In the first period, hydrological studies were still not unified in a single center and a number of studies, many of which were of great practical importance, were carried out by organizations other than the GGI. Among these works, the following should be mentioned:

1. Hydrological works connected with implementation of the electrification plan by the Volga, Svir, and Dnepr hydroelectric power plants.

2. In the 10 years following the Revolution, the Peoples' Commissariat for Productive Forces (I. F. Molodykh, B. V. Zonov, and others) and the Academy of Sciences, in cooperation with the GGI, conducted large-scale hydrographic surveys and studies which covered almost all the previously unstudied large rivers of the USSR (the Kolyma, Yana, and Vilyui rivers and the Aldan, Kazakh, and Bashkir expeditions of the Academy of Sciences).

3. The Administrations of the Water Economy of Union and Autonomous Republics, organized under the Narkomzem (People's Commissariat of Agriculture), conducted large-scale hydrological surveys and studies. The most active organizations of this system included the Hydrometeorological Service of the Ukrainian SSR (A. V. Ogiyevskiy and V. A. Nazarov); the Hydrometeorological Service of Central Asia, which was one of the first in the USSR to produce regular forecasts of the amount of water in rivers in order to plan irrigation (E. M. Ol'dekop and L. K. Davydov); the Sevan Hydrometeorological Bureau of the Armenian Water Economy Administration (V. K. Davydov and B. D. Zaykov); hydrological works in Transcaucasia (B. A. Apollov and M. A. Lukashin); and others.

The hydrological network continued to be under the jurisdiction of official organizations (People's Commissariat for Productive Forces, People's Commissariat of the River Fleet, and the People's Commissariat of Agriculture). By the beginning of the five-year plans, the number of river posts and stations exceeded 2,200 and had more than doubled in comparison with 1917.

SECRET

Of the studies on generalization of the hydrological regime, the work of D. I. Kocherin on norms of yearly runoff for the European USSR deserves special mention.

Two all-union congresses, organized by the GGI in 1924 and 1928, played an important role in the development of Soviet hydrology. At these congresses, the results of previous studies were summarized and future trends of development were outlined.

The rapid development of hydrological studies required many trained hydrologists. In connection with this, the training of specialists with a higher hydrological education was initiated in the first period of Soviet hydrology. The first Hydrology Chair, headed by S. A. Sovetov, was organized in 1928 in the Geographical Institute, Leningrad. When the Geographical Institute was combined with Leningrad University in 1925, it continued its work as the Geography Faculty of the latter. At the same time, hydrologists with hydrophysical interests were trained at the Geophysical Department of the Physicomathematical Faculty of Leningrad University.

B. Prewar Stalin Five-Year Plans

An important event in this period was the establishment in 1929 of the Hydrometeorological Committee, affiliated with the Council of People's Commissars, which became in 1933 the Central Administration of the Unified Hydrometeorological Service and, in 1936, the Main Administration of the Hydrometeorological Service. The State Hydrological Institute became part of the Hydrometeorological Service as an All-Union Scientific Research Institute.

The first important measure of the Hydrometeorological Committee was the unification of the network of hydrological stations, which had been administered by individual official organizations, and the creation of local administrations of the Hydrometeorological Service to supervise this network Its second important measure was the organization and development, in conformity with a GOSPLAN decree of 9 July 1931, of works by GGI on the Inventory of Water Resources of the USSR.

For direct hydrological service to economic problems, hydrological and water economy units were maintained in planning and building organizations of the People's Commissariat of the River Fleet, Transportation, Agriculture, in the Supreme Council of the National Economy, and in a number of other offices.

Among the most important official hydrological works of this period were the surveys undertaken in connection with the drawing up of plans: (a) for water-power utilization and sluicing of the Volga River, (b) for power stations on the Kama and the Oka rivers and on the Altai rivers, and (c) irrigation of the Transvolga. Others include the surveys on the lower Dnepr, the extensive hydrological works undertaken in connection with the construction of the Moscow-Volga and White Sea-Baltic navigable canals and the planning of the Volga-Don and other navigable canals.

Considerable progress was made in the works of the Expeditionary Section of the GGI, which by order of the planning and construction organizations, conducted large-scale surveys and expeditions and compiled hydrological data for hydrotechnical, railroad, and industrial constructions, among which the following should be mentioned: the Turkestan-Siberian Railroad, the Karaganda, and Kuznets fields, the Gor'kiy Automobile Plant imeni Molotov, large-scale surveys in the Far East, and the Ukrainian and Belorussian SSRs.

The increasing volume of hydrological works required the attraction of large numbers of hydrological specialists, and the two chairs (hydrology and geophysics) of Leningrad University could no longer meet this requirement. Therefore, the first Hydrometeorological Institute (now the Leningrad Hydrometeorological Institute) was created in Moscow in 1930, and several years later a second was established in Khar'kov (now the Omsk Hydrometeorological Institute). The Hydrological Faculty of the Moscow Hydrometeorological Institute, under the direction of M. A. Velikanov, B. P. Orlov, B. A. Apollov, Ye. V. Bliznyak, B. V. Polyakov and others, trained and graduated several hundred hydrological engineers in the prewar years.

So many hydrological works were completed during the three Stalin Five-Year Plans that it is impossible to list them all here; therefore, we mention only the main divisions of hydrological studies.

1. The hydrological network, which had approximately 2,200 stations in 1928, grew to 2,700 stations in 1936 and to 4,250 stations in 1941. The work of the network was greatly broadened, e.g., more than half the stations measured water discharge and estimated runoff; ice-cover thickness was measured at all stations, while at some stations water samples were taken for hydrochemical analysis and alluvial deposits were determined; finally, more than two-third of the hydrological stations were drawn into the operational service of reports and forecasts. Local administrations of the Hydrometeorological Service played an important part in the development of the network and the orientation of its work.

The following accomplishments should be listed as among the more outstanding: (1) the hydrological network began to operate according to unified programs and instructions developed under the supervision of V. V. Ukhanov, N. A. Garillovich, and others. The leadership and courses of B. A. Apollov, M. A. Lukashin, A. V. Ogiyevskiy, and B. V. Polyakov also played an important role in the development of measurement methods and in the training of personnel for the network of hydrological stations; (2) domestically produced instruments began to be used exclusively in the network. Production of these instruments was developed by V. V. Kuznetsov, N. N. Sysoyev, N. Ye. Zhestovskiy, and others.

2. Hydrographic studies of rivers continued to develop but obtained a slightly different content in the second period. Hydrographic work was conducted by the GGI and the People's Commissariat of the River Fleet on large rivers in order to draw up detailed navigation guides. At the same time, the GGI and transportation organizations began to study average-size and small rivers and also made extensive investigations of swamps.

The main handbook for hydrographic studies was Ye. V. Bliznyak's repeatedly republished work Proyzvudstvo issledovaniy rek, ozer, i vodovazdelov (Production of Investigations of Rivers, Lakes, and Water Divides).

Many works were completed by the GGI and the Academy of Sciences USSR on the study of lakes. Among the most important were the studies of the following lakes: Baykal (G. Yu. Vereshchagin), Balkhash and Issyk-Kul' (L. S. Berg and V. P. Matveyev), Onega (I. V. Malchanov and V. K. Davydov), Teletskiy (O. A. Alekin), and Sevan (V. K. Davydov and B. D. Zaykov).

3 The inventory of water resources of the USSR, which was completed in 1949, constituted an entire epoch in hydrology and played an outstanding role in hydrological service to the economy. Important data on the hydrological regime of rivers and lakes, which had been stored in various archives in unprocessed form for many years prior to 1936, became accessible for both hydrological investigations and generalizations, as well as for planning and construction organizations, due to the extensive inventory work done by the

GGI under the direction of L. K. Davydov, D. L. Sokolovskiy, A. A. Sokolov, S. Yu. Belinkov, and A. V. Fedorov, jointly with a large collective association of hydrologists of local administrations of the Hydrometeorological Service.

The inventory of river resources alone contained more than 7,000 author's sheets. M. S. Protas'yev, T. N. Kochukova, A. M. Norvatov, A. M. Gavrilov, D. A. Danovich, Z. P. Bogomazova, and many others participated in the editing of this valuable data. Of the inventory data, the series Spravochniki po vodnym resursam SSSR (Handbooks on the Water Resources of the USSR), in which there was collected, systematized, and generalized all available hydrological data, played an especially important role in satisfying the practical problems of the prewar Stalin Five-Year Plans.

4. Studies and calculations of runoff developed rapidly owing to the inventory of water resources and to the solution of several theoretical and practical problems by M. A. Velikanov and D. I. Kocherin.

Along with regional runoff characteristics, D. I. Kocherin studied the maximum runoff of the spring high water of the European USSR. These studies together with a generalization of the average yearly runoff, served as the main source for runoff calculations in the First Five-Year Plan and part of the Second Five-Year Plan. The investigations of Kocherin, who can be called the founder of the Soviet school of hydrological calculations, were continued by B. D. Zaykov and S. Yu. Belinkov on mean perennial runoff and by D. L. Sokolovskiy on maximum runoff. Similar works were conducted by A. V. Ogiyevskiy and V. A. Nazarov in the Ukrainian SSR. We should also mention, the method of calculating "safety" curves for yearly runoff which was first devised by V. A. Uryvayev. The method devised by D. L. Sokolovskiy of "safety" calculations for yearly and maximum runoff had great influence on the development of hydrological calculations.

The Dubelier norms, used for a number of years for calculations of the spans beneath small bridges, were subsequently replaced by M. M. Protod'yakonov's norms. The method of devising norms for calculations of bridge spans based on field studies was first used in 1928. This method, which was discussed in the works of P. P. Kokin and P. V. Pokrovskiy, was devised when information had to be provided for the construction of railroads in previously unstudied regions (Turkestan-Siberian, Emba, and others). This method produced positive results and is still important at present.

Norms and a method of calculating showers were devised by Z. P. Bogomazova and Z. P. Petrova in connection with calculations of rain runoff.

Among the more important works on hydrological calculations done by official organizations were those by S. N. Kritskiy, M. F. Menkel', B. V. Polyakov, and others.

Some credit for the large volume of field experimental works in this period on runoff study at special runoff stations should be given to M. A. Velikanov, who first advanced the idea of studying runoff formation processes under typical physicogeographical conditions. More than 20 years ago, Velikanov opened the first runoff station on the Pekhorka River near Moscow; and, in 1930, he published a program of studies for runoff stations. Since that time, runoff stations have gradually been developed in the Hydrometeorological Service and in other offices. The results of these investigations have been published by S. I. Nebol'sin, G. R. Eytingen, A. D. Dubakh, A. I. Reshetnikov, O. A. Spengler, V. I. Rutkovskiy, and others. The works by B. D. Zaykov on the runoff of European rivers and by M. I. L'vovich on the runoff of world rivers were important as generalizations of the runoff regime.

50X1-HUM

5. Hydrological forecasts are of great importance in the planned economy and this branch of hydrology developed so rapidly during the Five-Year Plans that no other country can compare with the USSR in this field.

The main results obtained by the Soviet scientific school (the GGI group) and the operational service for hydrological forecasts (the GGI and local administrations of the Hydrometeorological Service) in this period were:

a. A methodological basis for hydrological forecasts was created which made it possible to establish how long in advance forecasts can be made and to verify them objectively. This basis helped to eliminate unreliable and incorrect forecasting methods. G. R. Bregman, S. Yu. Belinkov, V. D. Komarov, O. A. Spengler, and B. S. Pushek took an active part in the organization and development of the service for hydrological forecasts.

b. Long-range forecasts were developed extensively.

c. The method of basic long-range hydrological forecasts of the water and ice regime of rivers was developed and used in practice. This method was of great practical importance, since it enabled the forecaster to predict or evaluate expected phenomena for rivers or sections on which stationary hydrological observations has not been made.

d. A Central Service of Hydrological Forecasts was organized, developed, and equipped. This has been directed since 1943 by the Central Forecasting Institute, to which the forecasting subdivisions of the GGI were transferred.

e. The entire service for hydrological forecasts, headed by the Main Administration of the Hydrometeorological Serivce, produces an enormous volume of operational work, as is amply illustrated by its more than 60,000 forecasts per year, with an over-all verification of about 85 percent.

6. Hydrophysical investigations were developed along three main lines:

a. Studies of the physical and mechanical properties of ice and snow, developed by the works of R. P. Veynberg.

b. Studies of heat-exchange and water-exchange processes between the water-air and snow-air media, i.e., investigations of processes of evaporation and condensation from soil and water surfaces and ice-formation processes. Important works in this field were completed in the GGI by V. Ya. Al'tberg on formation processes of under-water ice, (ice forming below water level), by V. V. Piotrovich on the selective capacity of underwater ice and on evaporation from a water surface, by P. P. Kuz'min on heat exchange between water and air, and by V. Ye. Sochevanov on condensation of moisture in soils. Although the hydrophysical studies made by V. V. Shuleykin were related to sea conditions, they were of great importance for hydrophysical studies of inland waters. The methods of thermal calculations devised by B. V. Proskuryakov are now used widely in engineering practice.

c. The third line includes a number of works on geographical generalization of elements of heat and water balance. These studies include works of A. A. Kaminskiy on transfer of atmospheric moisture, the work of P. S. Kuzin on evaporation from the soil surface in the USSR, the work of Ye. M. Sokolova on the moisture deficit, and that of V. K. Davydov on evaporation from the water surface of the European USSR.

50X1-HUM

The Main Geophysical Observatory also produces many hydrophysical investigations.

7. Investigations on the dynamics of the flow and beds of rivers were developed in the following fields:

a. Studies of the kinematic structure and velocity field of flow.

b. Study of alluvial movement and transport by the flow.

c. Investigations of deformation of river beds.

d. Investigation of flood movements.

The first three fields are inseparable parts of a general problem which grew, due to the works of M. A. Velikanov and V. M. Makkaveyev, into an independent field of study. Their works on turbulence of flow and the structure of the velocity field of flow were of great importance.

Alluvial movements in a flow and the formation of river beds were also studied by N. M. Bernadskiy, A. I. Losiyevskiy, B. V. Proskuryakov, A. P. Zegzhda, M. V. Potapov, and others.

The prolonged investigations of the dynamics of river flow and river beds were summarized in three works; namely, Dinamika rusiovykh notokov (The Dynamics of River Flows) by M. A. Velikanov, Rechnaya gidravlika (River Hydraulics) by N. M. Bernadskiy, and Gidravlika (Hydraulics) by V. M. Makkaveyev.

Investigations of flood movements were conducted by S. A. Khristianovich, V. M. Makkaveyev, and N. M. Bernadskiy.

Hydrochemical studies of rivers and lakes were furthered by the development of methods for hydrochemical determinations and their standardization for the hydrological network (O. A. Alekin, P. P. Voronkov, S. A. Shchukarev, and others) and in the generalization of hydrochemical observations in the hydrological network (O. A. Alekin and P. F. Martynov).

C. World War II

From the first days of World War II, the Hydrometeorological Service devoted all its work to defense problems. The successful solution of hydrological problems advanced by the war was possible through the efforts of a large collective association of hydrologists, some of whom worked under the difficult conditions of the Leningrad blockade. Much important work was done by hydrologists directly at the various fronts.

D. Postwar Period

Hydrology in the USSR has been confronted with two new problems in the postwar period:

1. Restoration of Hydrological Network Destroyed in Occupied Areas

This work was initiated by the Main Administration of the Hydrometeorological Service and local administrations of the Hydrometeorological Service before the war ended and, for the most part, is now completed. To automatize and to increase the accuracy of river station observations, the GGI designed and partially put into production special instruments and improved the design of measurement units. A great deal of work lies ahead, however, particularly in re-equipping and restaffing the network.

50X1-HUM

2. Development in Conformance With New Requirements of Fourth Stalin Five-Year Plan

A number of practical problems have already been discussed in publications, and therefore we touch only upon two of the most important: (a) the investigation of small rivers, mainly in connection with the development of rural electrification, and large-scale irrigation work in semidesert regions; and (b) improving the accuracy of hydrological forecasts and calculations in connection with problems of hydrotechnical constructions (hydroelectric stations, irrigation and navigation canals, water supply, and bridges) and with the requirements for economic and cultural development of the USSR.

Further refinement of the theory of formation of hydrological phenomena and development of experimental studies is required to increase the accuracy of hydrological calculations and forecasts.

Theoretical and experimental studies of snow and rain floods and the factors accounting for them have been developed extensively to solve the main problem in hydrology, i.e., flood prediction. Flood studies are conducted by the GGI, the Central Forecasting Institute, and the Kiev Hydrological Observatory. In the postwar years, the Central Forecasting Institute has devised a number of new methods of hydrological forecasts and has organized an operational forecasting service in the USSR.

Construction of an experimental base of the GGI has already begun, but a great deal of work lies ahead in equipping the laboratories and field station and in the training of personnel. A number of hydrophysical investigations, including investigations of the physical properties of ice and development of methods and instruments to combat interference from underwater ice in the exploitation of hydrotechnical constructions, have been carried out in some GGI laboratories. These laboratories, built since the war, were constructed as models of the laboratories in the base now under construction.

The general trend of hydrological investigations which was adopted in the first years of the Soviet power has completely justified itself. It was impossible to develop hydrology in the direction accepted and still retained in a number of Western European countries (Germany, Austria, France, Sweden, etc.). This measurement science is based upon the mistaken idea that it is necessary to organize such a thick network of stations for observations on the hydrological regime that almost all applied problems can be solved directly from this observational data.

Soviet hydrology rejected this Western European example and pursued another path: a comparatively small but representative network of hydrological stations was organized and the problem of interpolating the elements of the hydrological regime in space and time was solved by theoretical studies. In other words, the development of theoretical and empirical studies of geographical and physical processes of formation of hydrological phenomena not only supplemented the sparse network of stations, but sharply raised the level of hydrology as a science.

- E N D -