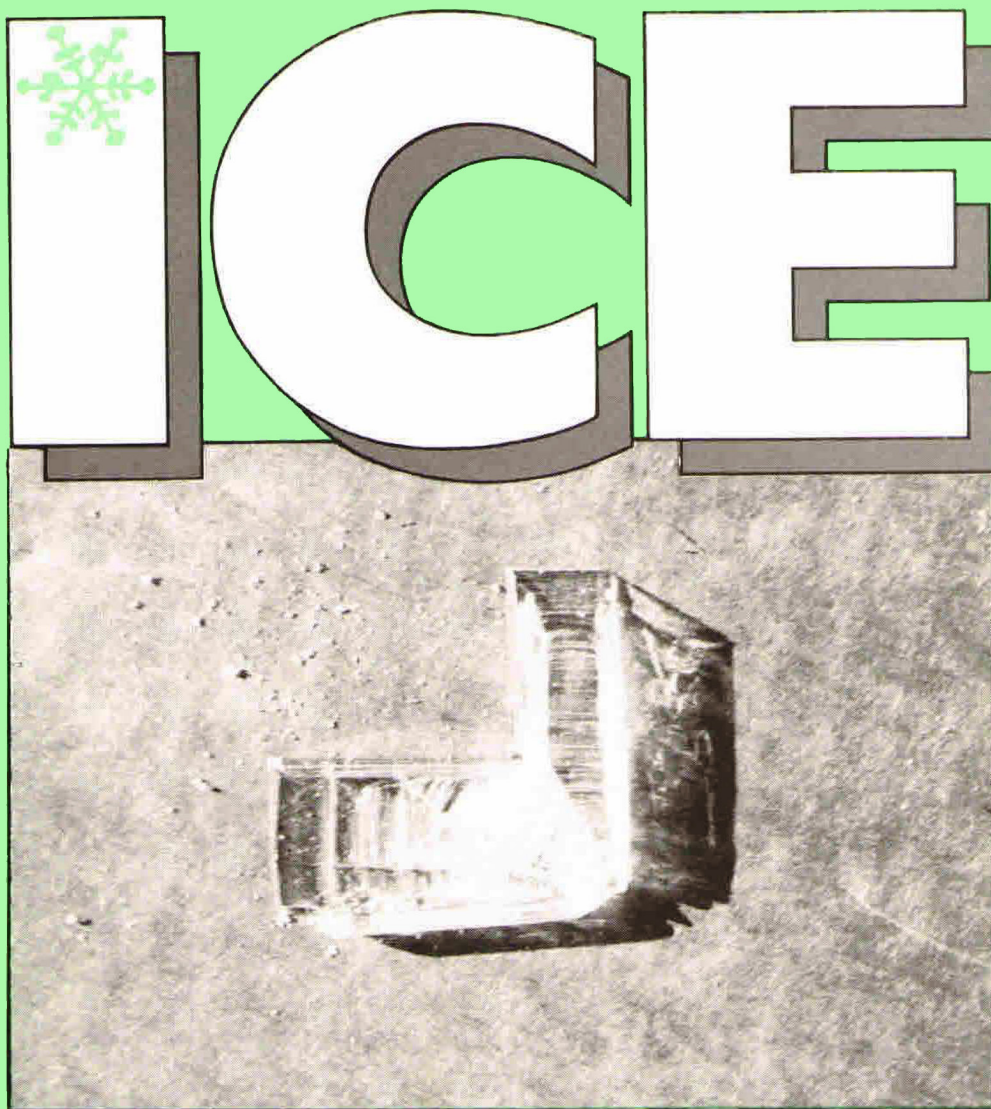


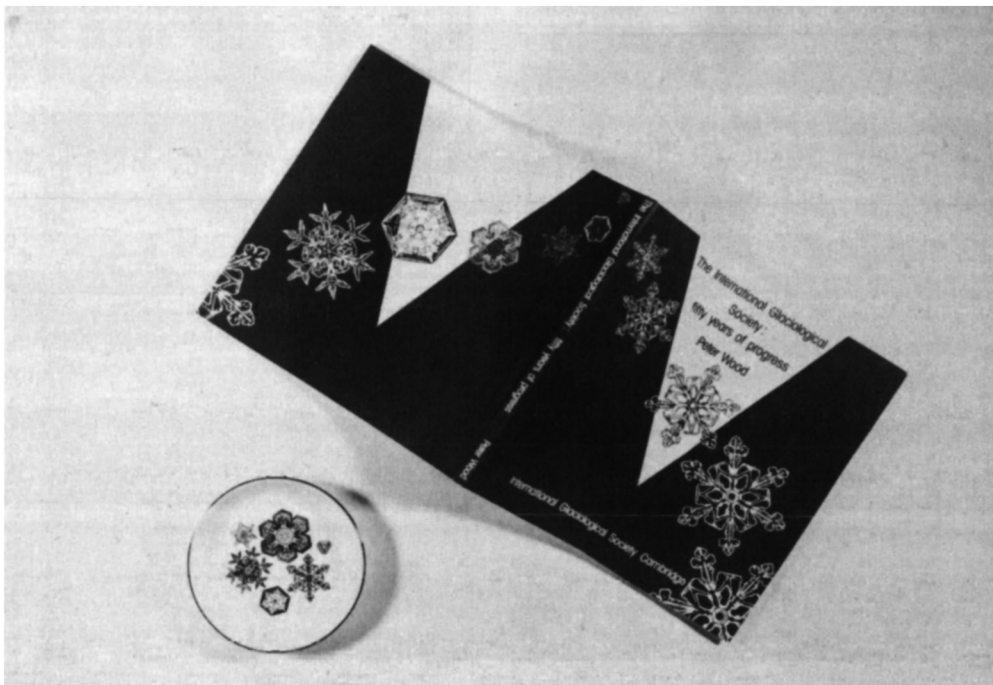
Number 91

3rd Issue 1989



**NEWS BULLETIN
OF THE INTERNATIONAL
GLACIOLOGICAL
SOCIETY**





HISTORY OF THE SOCIETY

This was published on 1 September 1986, to mark the 50th anniversary of the founding of the Society.

It was researched and written by Peter H. Wood and edited by Bernard Stonehouse: 120 pages of text, with illustrations, in a 210 mm × 210 mm format, with a blue and white cover. It costs £10, plus surface post and packing.

UNIQUE GLACIOLOGICAL DISH

A china dish 110 mm in diameter, specially commissioned from the Royal Worcester Company, shows some of the seven main types of ice crystals, formed under differing weather conditions. Variations in the basic hexagonal shape include a simple plate, a star, a fern. Those shown on the dish were reproduced from micro-photographs of ice crystals. The dishes cost £6 plus surface post and packing. Money raised from the sales of these two special items will be devoted to our publications.

The history and the dish may be obtained from the International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, U.K.

**ICE
NEWS BULLETIN OF THE
INTERNATIONAL GLACIOLOGICAL SOCIETY**

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COVER PICTURE: Hoar crystal from food pit, Agassiz Ice Cap, Ellesmere Island, Arctic Canada. The hexagonal symmetry of ice is not altogether obvious. The crystal is 4.4 cm long in its longest dimension. Photograph by M.F. Meier.

NEW AWARDS: The Council has agreed to award Seligman Crystals to Charles R. Bentley and Akira Higashi. The presentations will take place in Hanover, NH, U.S.A. in August 1990, during the week of the Society's Symposium on Ice-Ocean Dynamics and Mechanics.



USSR

SOVIET GLACIOLOGICAL RESEARCH IN 1988

In 1988 glaciological research was carried out in the Caucasus, Middle Asia, the Khibini Mountains, Siberia, the Far East and Kamchatka, in the Arctic and the Antarctic.

The investigations were carried out by the following organizations, which are identified in the text by their abbreviations:

Institute of Geography of the USSR Academy of Sciences	(IG AS),
Institute of Solid-state Physics of the USSR Academy of Sciences	(ISSP),
Institute of the Problems of Mechanics	(IPM),
Leningrad Department of the Institute of Oceanography of the USSR Academy of Sciences	(LD IO AS),
Institute of Geography of the Siberian Department of the USSR Academy of Sciences	(IG SD),
Pacific Far Eastern Department of the USSR Academy of Sciences	(PFED),
Institute of Water-ecological Problems of the FED of the USSR Academy of Sciences	(IWEP),
Academy of Sciences of the Kazakh SSR	(IG AS KazSSR),
Academy of Sciences of Georgian SSR	(IG AS GSSR),
Institute of Geology of the Academy of Sciences of Estonian SSR of Geology and Geophysics of the Siberian Department of the USSR Academy of Sciences	(IG AS ESSR),
of the UzSSR	(IG and G AS SD),
Geocryology Institute of the Siberian Department of the USSR Academy of Sciences	(IG and G AS UzSSR),
Institute of Volcanology of the FED of the USSR Academy of Sciences	(IG SD AS USSR),
Department of Protection and Efficient Use of Natural Resources of the TadshSSR Academy of Sciences	(IV FED),
by the Boards of the State Committee for Hydrometeorology of the USSR Middle Asia	(DPEUNR);
Ukraine	for
Transcaucasus	(MARI),
Arctic and Antarctic	(URI),
Kamchatka	(TRI),
Kazakh	(AARI);
and Tajik	(KBHEC),
East-Kazakh Hydrometeorological Observatory,	(KazBHEC),
Novosibirsk Institute of Railway Transport	(TBHEC);
the Industrial Research Institute of the Engineering Constructions of Gosstroy of the USSR	(PO "Apatity")
Enterprise No. 19 of SBCC,	(NIRT),
the Universities of Moscow (Institute of Mechanics – IM MSU, the Airspace Methods Laboratory),	(IRIEC),
Kharkov	(KSU),
Leningrad	(LSU),
Altai	(ASU),
Tomsk	(TSU),
Kazan	(KazSU);
Kazakh Pedagogical Institute named after Abay	(KazPI)
and Mari Pedagogical Institute	(MPI).

The information was compiled on the basis of reports of these organizations received by the Section of Glaciology of the Joint Geophysical Committee, and submitted by V.M. Kotlyakov and O.N. Solomina.

MATHEMATICAL MODELLING IN GLACIOLOGY

MODEL: ICE SHELVES-OCEAN

(IG AS)

A model was elaborated of interaction between ice shelves and the ocean, which made it possible to get qualitative characteristics of heat- and mass-exchange at their low boundaries.

MATHEMATICAL MODELLING OF ICE-SHEET GLACIATION

(LD IO AS)

A two dimensional non-stationary model of ice-sheet glaciation based on a numerical solution of the equation of evolution of sheet glaciation thickness was elaborated. This equation was obtained by substitution into vertically integral mass balance of expressions for components of horizontal rates, calculated from the equations of movement of isothermal linearly viscous ice. The equation is solved numerically by an explicit scheme on a sphere for a realistic relief of the underlying surface, averaged according to a 5° grid. The solution is periodical along a circle of latitude outside the continent where ice thickness is denoted as "0".

(KazSU)

Development and numerical realization of the model of spatial dynamics of surface glacier covers.

EVOLUTION OF THE ASTHENOSPHERE UNDER GRAVITY OF GLACIAL LOAD

(LD IO AS)

A two-dimensional non-stationary model of the asthenosphere's evolution is described by Gemgolt's equation. This equation is numerically solved according to the semi-explicit diagram on a sphere according to a 5° grid. The solution is found to be periodical along a latitudinal circle.

MODELLING OF GLACIAL PERIODS

(LD IO AS)

The evolution of climatic system during the Würm Ice Age is represented on the basis of the model combining simplified models of atmosphere and ocean and two-dimensional models of glacial cover and the asthenosphere. The task is solved on 5° grid taking into account real land surface relief. The geography of the distribution of glaciers is represented, and the causes of their origin and disintegration analyzed.

DISTRIBUTION OF TEMPERATURE WITHIN THE THICKNESS OF THE ARCTIC GLACIERS

(IM MSU and IG AS)

Calculations were made of the distribution of temperature in a borehole in the Austfonna ice field (North-Eastern Land) and on the ice divide of the Akademii Nauk Glacier (Severnaya Zemlya). The data on accumulation

and temperature of the surface were obtained from studies of the ice core. For Austfonna ice field the changes in height of the surface and temperature within the ice thickness were calculated for the last 3000 years, for the Akademii Nauk Glacier for the last 150 years. The results of the calculations and the data from the temperature measurements coincided well.

REACTIONS OF GLACIERS TO CLIMATIC CHANGES

(IM MSU)

Model calculations of the dynamics of different glaciers were made, taking into account changes in climate. The reaction to the climatic changes of surface ice sheets and floating sheets, the main ice discharge for which is calving, is different. In central regions, changes in accumulation of 20% result in a change of about 5% in the total thickness.

DYNAMICS OF THE GLACIERS OF NORTH-EASTERN LAND

(IM MSU)

Numerical calculations of the dynamics of the ice sheet of North-Eastern Land were carried out jointly with IG AS. It was determined that mass balance (as constructed by V. Schytt) considerably exceeds the average for many years. Proceeding from the assumption of stability of the ice sheet, the distribution of mass balance was constructed. Good agreement was received for the central part of the sheet where accumulation measurements were carried out (1987). Calculations were carried out of change in the ice-sheet thickness and area in relation to various changes in climate.

MODELLING OF PROCESSES IN SNOW COVER

(IM MSU)

A mathematical one-dimensional model of change in snow cover structure and its properties taking into account sublimation and thermal physics was developed. The model makes it possible to estimate the snow-cover strength and the origin of horizons of loosening. On the basis of standard meteorological information it is then possible to estimate the avalanche danger.

(IG AS)

A mathematical model of dust-polluted snow cover influenced by heat flow was developed and preliminarily approved.

(IMSU)

A mathematic one-dimensional model of thermal physics of the snow-firn thickness was developed, taking into account snow-melt water percolation. It was shown that for conditions in Spitsbergen, ice warming on firn plateaus can take place. The model makes it possible to describe the structural metamorphism of the firn and the occurrence of the density homogeneity within it.

MATHEMATICAL MODELLING OF THE CLIMATIC SYSTEM

(PFED)

The model of sea ice covered with snow was improved, taking into account its interaction with atmosphere and ocean. Various characteristics of the system, its sluggishness, sensitivity to change in internal parameters and external conditions, and the influence of parameters of a numerical scheme on the results of calculations were studied.

DRILLING AND MATHEMATICAL MODELLING

(KazSU)

The impact of temporary changes of various factors, determining conditions of snow-firn thickness formation on the distribution of glacier-ice density at depth was studied on the basis of mathematical modelling. As a result of numerical experiments, it was determined that stability in the sense of depth paleosignals on the vertical profile of ice porosity (density) is caused only by the change in the volume of air entrained at the ice formation stage. This made it possible to reconstruct past changes of atmospheric pressure at the level of closing of firn pores.

(KazSU and IG AS)

The problem was investigated of changes in temperature within the thickness of an ice sheet on the basis of registration of the rate of freezing of a borehole melted by a heat drill.

ICE PHYSICS

STUDY OF ELECTROMECHANICAL EFFECTS

(ISSP)

The nature of pseudopiezoeffect in ice, which can be observed with the application of heterogeneous elastic stresses to mono- and polycrystalline ice, was investigated. It was shown that dielectric polarization of ice results from movement of proton charge carriers (H_3O^+ and OH^- ions and LD defects) alongside the gradient of elastic deformations. Specific volumes of defects and their deformation potential constant were measured. It was shown that this effect may be associated with the electromagnetic emission of glaciers and ice sheets.

INVESTIGATION OF ADHESION AND FRICTION

(ISSP)

A considerable (i.e. several times) reduction was discovered of adhesion and friction of metals on ice when covered with double-charged coatings of high density ($\geq 10^{-4}$ kl/cm²).

OPTICAL PROPERTIES OF ICE

(ISSP)

A phenomenon of proton photoconduction of

ice over wave band (190-160) nm was found. Periods of the life and mobility of unbalanced charge carriers were investigated. Parameters of photo-emf were measured.

CRYSTAL GROWTH

(ISSP)

Two new methods of growing perfect mono-crystals of pure ice were worked out, one of double sublimation and one of cooling the water surface by pumping out by vacuum.

MECHANICS OF POLYCRYSTAL ICE

(ITTM)

A new method of determining the mechanical characteristics of ice and snow during the deformation process was worked out. It is based on a volumetrical sonic test of a sample with high frequency impulses and registration of acoustic emission signals. The main mechanism of ice destruction was defined. A generalized rheological model was developed and a defining relation was found which made it possible to calculate the mechanical characteristics in a wide range of temperatures and deformation rates according to a limited number of tests of an ice sample of this structure.

SNOW AND ICE CHEMISTRY

FORMATION OF CHEMICAL COMPOSITION OF CONGELATION ICE

(IWEP)

Two categories of factors and processes of formation of chemical composition of water and water-snow ice were singled out: fundamental and geological-geographical. Their action stipulates the two-level character of the formation of the chemical composition of continental hydrogenic ice massifs. Characteristic properties were identified of the chemical composition of aufeis, river, lake, and swamp ice in the Primaur'e territory, and it was determined that chemical composition can be an indicator of their genetic types. It was also shown that biological and biochemical factors prevail in comparison with the physical-chemical ones in the formation and transformation of composition and content of compounds of potassium, nitrogen, and phosphorus in ice and phase water-ice boundary.

POLLUTION OF NATURAL ICE

(IWEP)

The basis for a system of glaciochemical criteria for estimating anthropogenic pollution of ice and snow has been developed. Among criteria of pollution, the most important are values of the ratio of concentration of components to limited tolerance concentrations or background concentrations, values of the ratio of components concentration, values of fractionation and correlation coefficients, values of relative acidity, and instability of the type of chemical composition.

MONITORING POLLUTION OF THE SNOW COVER

(PFED)

Research into snow cover as an integral index of technogenic impact on geosystems was continued within the framework of the programme of working out a scientific basis of ecological monitoring. The work was carried out within zones of the impact of mining enterprises on the southern part of the Far East as well as on control background territories.

GLACIERS

BALANCE OBSERVATIONS

(IG AS)

Glaciological, hydrological and meteorological observations were carried out in the basin of the Bubistskali River in the Caucasus. On Tbilisa Glacier, these observations included ice and water melting, water discharge, sediment discharge, and chemical composition of glacial waters.

(MARI)

All-year round work continues at field stations on the Abramov Glacier (in the Pamir-Alai) on the hydrometeorological regime. Studies of the water-glacial balance and ecological conditions of the glacier area continued under the programme of background monitoring stations.

(TSU)

In the Altai, observations continued on components of water-ice balance in the Aktru (continuing the series of many years), describing the present tendencies of the glacial regime and dynamics. With regard to the climatic conditions, the year was anomalous, both in terms of the precipitation regime (a considerable excess of the climatic norm in winter and summer periods), as well as air temperature (basically because of low summer temperatures). The mass balance of the glaciers in the Aktru basin for 1987/88 is positive (on the Maly Aktru Glacier the total accumulation made 116 g/cm^2 , the balance $+47 \text{ g/cm}^2$). The run-off in the basin was close to the average. A detailed radio-echo survey of the tongues of the Maly Aktru and the Sofijsky glaciers was carried out.

(MARI)

The work on the estimation of the geological regime continued, and in the course of this work new data on morphometrical parameters of the western Tien Shan and Pamir glaciers were obtained on the basis of space photography, as well as statistical characteristics of the hydrological regime of glaciers in the basin of the Gissaro-Alai basins. A method of calculation was worked out for the glacial run-off regime in the basin of the Inyl'chek River.

(KBHEC)

Observations were made on the mass balance of glacier No. 341 on the north-western slope of the Avachinsky volcano. The mass balance is 89 g/cm^2 .

(IG AS)

The altitudinal belt of maximum accumulation of snow (3600–4000 m) on the glaciers of the southern slope of Elbrus was defined. On the basis of the results of deep drilling, the main patterns of the internal structure of glaciers in this region were detected.

It was determined that mountain glaciers are characterized by various reactions to the external impact caused by differences in the processes of formation of their mass balance. On the basis of statistical analysis of instrumental data, the influence of changes of annual values of mass balance of alpine glaciers in their short periodical fluctuations was noticed.

The following research was also undertaken: determination of the mass balance of ice shelves for the periods between their major pulsation changes; the first estimation of the part played by mechanical ablation in the total losses of ice mass from Spitsbergen glaciers; a method of using radio echo sounding surveys to locate glacier ends from aboard vessels at sea.

GLACIER FLUCTUATIONS

(The Airspace Methods Laboratory, MSU)

Repeated phototheodolite survey of the Elbrus glaciation 30 years after IGG (1986–88) was completed. The data obtained indicate that the Elbrus glaciation experienced some activation lately, on the background on intersecular degradation which is especially noticeable in the north-south sector of the volcanic cone. A map of spatial change of the Elbrus glaciation for this period on a scale 1:50 000 is being compiled on the basis of the materials of this survey.

(IG AS GSSR)

A repeated phototheodolite survey was made of the Adishi and Tbilisa glaciers and fluctuations of the glacier ends noted. The glaciers Kvishi, Lakra, Naumkvani, Buba, and Kirtisho retreated at the rate of 8–11 m/year and the tongue of the Lekhzyri Glacier retreated by 40 m/year, but the Shkhara Glacier is in a stable state.

(TBHEC)

Fifteen glaciers of the Pamirs were investigated. The survey of the ends of the glaciers showed that all of them are in a state of degradation, though the rise of the surface of the TPO Glacier (3 m) and the tongue of the Medvezhy Glacier was noted. Surveys of the ends of the Ulugbek, Kosinenko, M. Tanyamas and Fedchenko glaciers were carried out. Since 1980, the tongues of the Kosinenko (600 m) and Fedchenko (175 m) glaciers had retreated considerably. Levelling of transverse

profiles from the end of the tongue up to the firn line was completed along the trunk of the Fedchenko Glacier. Its surface in this part on average was lower by 17 m for the last 8–10 years, which corresponds to the loss of almost 2 km³ of ice.

(DPEUNR)

In 1988 the mass-balance investigations continued of the Gurumdy Glacier (in the basin of the Gunt, south-eastern Pamirs). In 1983–87 the mass balance of the glacier was steadily positive from 35–52 g/cm², and in 1988 was equal to 33 g/cm².

(TSU)

Observations of the retreat of the ends of glacier tongues in the Katunsky, Severo- and Yuzhno-Chujsky ridges (24 glaciers) continued. They showed a slowing down of the rate of retreat of the tongues and an increase in the rate of ice movement in the middle of the tongues on the glaciers of the key basin of Aktru.

(Enterprise No. 19 of SBCC)

A map of changes of the Akshirak ridge glaciers from 1943–77 was compiled and is ready for publication. Investigations continued on automatization of the formation of numerical models for different timing of the surface relief of glaciers and their use for obtaining characteristics of the changes in glaciers. A field topographic survey of the surface of the Golubin Glacier was carried out.

RADIO-ECHO SOUNDING OF GLACIERS

(Enterprise No. 19 of SBCC)

(TSU)

Field work took place on the topographic survey of the bed relief of three small hanging glaciers on the northern slope of the Terskej Ala-Too ridge. Mathematical processing and compilation of maps of bed relief and ice thickness for 11 glaciers on Tien Shan were completed. The elaborated set of programmes for electronic computers makes it possible to reconstruct the glacier bed in the form of quasi-tangent to segments of a sphere with possible distribution of reflection points of a polyhedron, to draw working maps of isolines on a plotting device, and to obtain detailed numerical data on glaciers. Inadmissibility (especially for calculation of numerical characteristics) was proved for a method of mathematical processing when reflection points are considered to be situated in the nadir of reflection points.

PULSATING GLACIERS

(IG AS)

The mechanism was discovered of pseudo-turbulent internal friction in quickly moving very fractured pulsating glaciers.

INTEGRATED INVESTIGATIONS OF THE AKSU GLACIER, TURKESTANSKY RIDGE (IG and G AS UzSSR)

On the Aksu Glacier in the basin of the Khodzhakirgan glaciometeorological, hydrometric and geodetic observations were undertaken. Samples of water, snow and ice for hydrochemical analysis were taken, and lichenometrical and tacheometrical surveys were made. It was determined that the dynamics of a glacier are mainly influenced by the temperature of the air and precipitation — the integral indication of exogenetic factors. The response of glaciers to the impact of exogenetic factors depends on their size and the extent of moraine coverage. For a large glacier the time lag is 15–20 years, for a small one one or two years, or is absolute. Since 1934, the Aksu Glacier has lost about 54 million m³ of ice.

INTERACTION OF VOLCANISM AND GLACIATION

(IV FED)

In 1988, the accumulation of snow on eastern Kamchatka was lower than the annual multi-year value by 10–20, and the average summer air temperature was the highest for the previous 18 years, which resulted in a considerable negative mass balance of the glaciers. In 1987–88 on the key Kozel'sky Glacier accumulation was 290 g/cm², ablation –510 g/cm², so taking into account internal infiltration alimentation the mass balance of the glacier is equal to –205 g/cm². It was demonstrated that the daily range of ablation corresponds to the input from solar energy, with a varying time lag depending on the value of the dust content (from 1.5–2 hours for a clean surface to 0 with a dust content of 0.05 kg/m²). It was determined that the rate of ice accumulation varies from 15 g/cm² on the ice divide of the Shmidt and the Bogdanovich glaciers (altitude 3300 m) to 30–50 g/cm² within the altitude 2900–3100 m in the area of alimentation for these glaciers on the slopes of south-east and south-west exposures of the Klyuchevskoj volcano.

(KSU)

The presence of glaciation on Paramushir Island (the Kuril Islands) was confirmed. Three glaciers were described, including one for the first time. The impact of erupted volcanic ash on the dynamics of the glaciers was shown.

SNOW COVER AND AVALANCHES

DETERMINATION OF SNOW HARDNESS (IPM)

An investigation was carried out of the mechanical characteristics of snow cover, with the help of a penetrometer equipped with a piezoelectrical accelerometer and a trip of a special type which prevents the formation of

a compacted layer. An experimental type of penetrometer for the scientific study of avalanches in place of the existing frames was thought out and constructed.

EQUIPMENT FOR MEASUREMENTS OF PHYSICAL-MECHANICAL CHARACTERISTICS OF SNOW COVER

(Kaz PI)

A laser snow densimeter and an acoustic instrument were designed for snow hardness measurements. A way of determining the snow-cover structure was proposed (size of snow granules and a number of particles on a unit of length). The densimeter makes it possible to carry out measurements of density of fine snow; for coarse snow it is necessary to use a laser with great differences of frequency of radiation. Both instruments make it possible to carry out field measurements in any point at a depth of snow cover of up to 2 m, with intervals of up to 0.5–1 cm, without destroying the snow structure.

MAP-MAKING OF THE SNOW COVER OF ELBRUS

(The Airspace Methods Laboratory of the MSU)

Four maps were compiled of snow-cover boundaries on Elbrus on a scale 1:50 000, on the basis of air- and space-survey material. Comparison of the map showed a rather high degree of similarity between snow and ice spots in different years.

MAPS OF THE DEGREE OF AREAL COVERAGE OF SNOW AND AVALANCHE DANGER IN AFGHANISTAN

(The Airspace Methods Laboratory of the MSU)

According to the material from a space survey, a series of maps of the degree of areal coverage of snow and avalanche danger in Afghanistan was compiled. Peculiarities of formation of snow cover and avalanching and the patterns of distribution were detected.

CHANGEABILITY OF SNOW COVER

(IGAS)

The existence was proved of similarities on the snow cover field, consisting of localization of the spatial heterogeneity of snow-cover thickness both within a year and in annual cycles. Regular characteristics that determine the changeability of the structure and properties of snow thickness, resulting from the peculiarities of the relief of the underlying surface, were confirmed. Ways of defining local heterogeneities of snow cover thickness from single snow surveys and of mapping characteristics of local changeability and distribution of snow cover thickness were proposed.

DETERMINATION OF THE CHARACTERISTICS OF SNOW COVER IN MOUNTAINS

(MARI)

An ultrasound snow thickness meter, a recorder of the acoustic emission of snow, and an installation for measuring snow temperature were developed. An experimental specimen of a snow penetrometer, working on the principle of a piezoelectrical indicator, was constructed in cooperation with the Institute of the Problems of Mechanics.

SNOW MEASUREMENT

(KazBHEC)

Aerovisual routes of snow measurements in the basins of the Khamir and Turgusun rivers in east Kazakhstan oblasts were reconstructed.

(East Kazakhstan Hydrometeo-Observatory)

Snow surveys were made in 10 mountain river basins of the south-western Altai. It was detected that snow resources of the third decade of March 1988 in different basins were 120–150% of the norm.

REGIONAL AVALANCHE INVESTIGATIONS

(IG AS)

An informational-methodical basis for the engineering-geographical estimation and map-making of avalanche danger in the basin of Lake Baikal was developed. Patterns of formation and the regime of catastrophic avalanching and their territorial distribution were identified. A medium-scale map was compiled of avalanche danger in the Sayano-Baikal mountain territory.

(PO "Apatity")

Investigations of the avalanche regime of the Lovozerskiye mountains were carried out. Recommendations were made for the protection of the industrial units situated there. Investigations continued with the intention of working out a complex avalanche control for Kirovsk. Projects were completed and building begun of avalanche-defence dams and quarry-traps. Avalanche-defence terracing of slopes is being carried out.

(NIRI)

Avalanche regimes in Sakhalin, Kuznetsky Alatau, and the region of BAM in Kirgizia were investigated. Size of avalanche catchment, discharge line, possible volumes and distances of outbursts were determined, and the frequency of avalanching, including areas not studied previously, was ascertained.

(IRIEC)

Results were presented of snow avalanche investigations in the territories of Soviet Barentsburg and the Piramida mines in western Spitsbergen, completed in 1986–88 for the purpose of avalanche forecasting and the design of avalanche defence constructions and measures.

FORECASTING OF AVALANCHE DANGER

(IPM)

A new way of forecasting and diagnosing

snow stability on a slope was worked out, based on the detected correlation in the mechanism of snow destruction between frequency and signal strength of acoustic emission and the degree of snow-frame destruction.

(MARI)

New methods of avalanche forecasting were produced for the regions of western Tien Shan, Zabajkal'e and Sakhalin. For two regions of western Tien Shan special methods of avalanche forecasting using aerosynoptic information were worked out. For the region of the Udokanskoye deposit (the basin of the River Namanga), a method of avalanche forecasting was produced which provides an avalanche danger forecast 24, 12 and even fewer hours in advance, depending on the character of the avalanching processes and the information available.

(URI)

A method was determined for forecasting wet avalanches for high mountain regions in the Carpathians 12, 24 and 35 hours in advance, based on the possibility of forecasting air temperature of the above accuracy in the regions of snow avalanche stations and the corresponding calculation of thaw parameters. It envisages the use of a prognostic graph, the field of which (with coordinates of the duration and intensity of thaw and taking into account the threshold value of the temperature of the snow cover) is divided into two parts corresponding to the situations "avalanche danger" and "no avalanche danger". Justification of the methods tested on independent material worked out at 80%. Work during expeditions was carried out which made it possible to detect 289 avalanches in the Carpathian mountains and more than 100 in the Crimea. The peculiarity of the winter of 1987-88 in the mountain regions of the Ukraine was noted: with the average degree of snow coverage of the territories under investigation local areas were defined with intensive, heavy snow accumulation exceeding the maximum for many years and, consequently, active avalanching.

SIMULATION OF AVALANCHES

(NIRI)

On an artificial flume (Sakhalin) velocities, loads and distance of avalanche outbursts were studied. The range of velocities of artificial avalanches varied within 10-25 m/s. In connection with an insufficient degree of study of avalanche impact, the conditions of their physical modelling were worked out. On a special installation (Novosibirsk) the shock impact on fixed obstacles of loose snow and ground blocks with a mass of up to 300 kgs with velocities up to 30 m/s at different temperatures and with varying structures of block was investigated. A number of experiments were begun with the release of

blocks with a mass of up to 3 tonnes. Stress and deformation in the loose bumping mass is being studied, and an experimental flume for investigating sliding of snow along a slope with different parameters of the phenomenon on a scale of 1:1 was used for the first time.

A MODEL OF A TELEMETRICAL COMPLEX "RUTA"

(MARI)

A model of a new universal telemetrical device, "Ruta", was worked out. It is a modernized variant of AIS-910 "Lavina" and is intended to collect, process and provide meteorological and snow-avalanche information from almost inaccessible regions. The device is intended for automated measurement-informational systems of universal purpose.

SNOW-STORM TRANSFER

(P.O. "Apatity")

Measurements of snow-storms on the basis of various methods, taking into consideration temporary changeability of snow-storm flow, were begun in the Khibini Mountains. Snow loads on roofs of constructions taking into account snow-storm transfer were studied in cooperation with the Leningrad Civil Engineering Institute.

INVESTIGATION OF SNOW STORMS

(NIRT)

The volume of snow transfer at the stations and on parts of the Aktyubinsk-Berchogul' railway (western Kazakhstan) was determined. Calculated data were corrected on the basis of the results of the natural snow-storm measurements. In Kuzbass the volume of snow transfer did not exceed 300 m³/m, in western Kazakhstan the figure was 600 m³/m.

STABILITY OF SNOW ON A SLOPE

(WSRI)

A model algorithm and programme of calculation for snow thickness stability was worked out, taking into account its viscous flow. The results of this test of the algorithm based on the material of the snow avalanche station Dukant in 1986-88 practically coincide with those of the calculation of snow stability on a slope according to the method of "weakened horizon".

DESIGN OF SNOW DEFENCE

(NIRT)

Optimum correlations of the height and width of the ground profile were determined. Recommendations for the building of grooves which are drifted over with snow, on replacing traditional materials (wood, ferroconcrete) in fences by new ones (film, rubber-cord plates), on using electric heating and pneumo-airflow for the protection of switches from the effects of snow were worked out. *Instruction on protecting railways in mountains from snow avalanches* was completed.

DESIGN OF AVALANCHE DEFENCE (NIRT)

Projects of avalanche defence on the Mezhdurechensk-Abakan railway were fulfilled (the erection of preventive constructions on slopes and the building of a reso-sleeper wall). Heavy-duty avalanche braking constructions were erected on the Frunze-Osh automobile road. Recommendations were given for the construction a gallery and braking constructions in the valley of the Angarakan River.

WATER-SNOW FLOW (PO "Apatity")

A unique water-snow flow in the valley of the Yakmana River in the Khibini Mountains was investigated. The coefficient of general tractive resistance which is equal to 0.07 turned out to be lower than earlier minimum estimations. The bed slope in the position of the start of the flow was 5° , with total volume of deposits $40,000 \text{ m}^3$ ($38,000 \text{ m}^3$ of snow and 2000 m^3 of fine-grained earth and stones). The flow was of an impulsive character, with a total length of 5.2 km. Based on the results of the investigation, a project of protective constructions was planned and building started.

ENGINEERING GLACIOLOGY

CREATION OF ICE-COMPOSED MATERIALS FOR CONSTRUCTION IN THE ARCTIC AND ANTARCTIC (IRIEC)

A set of experiments on improving the strength property of artificial ice was completed. The introduction of water-dissoluble polymers into ice prepared by layered freezing increases its strength 1.5-2 times.

DANGEROUS GLACIAL PHENOMENA ON ROADS (IG SD)

The basic engineering-geographical tasks were formulated. Their solution will result in the working out of effective methods of prevention or of reducing the negative impact of dangerous glacial phenoema (snow coasting, slippery surfaces and others) occurring under the influence of transport and passage of pedestrians where precipitation falls. Ways of completing the programme of long-term investigations were suggested founded on winter regime observations.

ARTIFICIAL ICE STRUCTURES (IG AS)

Methods were worked out for the calculation of the economic effectiveness of freezing artificial ice and firn blocks in various physical-geographical conditions.

GLACIAL GEOLOGY AND PALAEO-GLACIOLOGY

GLACIAL COVER IN THE PLEISTOCENE (IG AS)

A map of the last glaciation of the territory of the U.S.S.R. on a scale 1:8 000 000 was compiled. Quantitative relations between glacio-eustatic and temperature rhythms of global changes in the Pleistocene were determined. The pattern of the instability of surface ice sheets was formulated and mathematically described.

ANCIENT GLACIATION OF THE ALTAI (TSU)

Study of traces of the Pleistocene nival-glacial systems in the mountains of south-eastern Altai and western Tuva continued. Data were obtained for compiling a more soundly based chronostratigraphic scale of Pleistocene glaciation and a scheme of location of the morpholithogenic complexes, which reflect the dynamics of this glaciation.

THE LATE HOLOCENE STAGE IN THE CAUCASUS (IG AS GSSR)

As a result of the interpretation of airspace materials and field investigation of the traces of ancient glaciation, the boundaries of the late Holocene glaciers in the basins of the Mestichichala and Dolra rivers were reconstructed.

DENDROCHRONOLOGY IN GLACIO- LOGICAL RESEARCH (KSU)

Using the luminescence-photometric method when analysing the wood from the annual rings of trees, it was possible to reconstruct interseasonal temperature fluctuations with high precision. Changes in composition of the chemical elements in the wood of the annual rings of trees depending on the hydrothermal conditions of the growing season were discovered.

LICHENOMETRIC INVESTIGATIONS IN THE ALTAI (IG AS AND IG AND G AS SD)

An attempt was made to construct a growth-rate curve of lichen indicators for the age of glaciogenic forms of relief. For this purpose, measurements of the size of lichens on 25 burial grounds of the Bronze Age as well as on the surface of a rock glacier dated by radio-carbon methods were carried out.

INFLUENCE OF RELIEF ON GLACIATION (IG AS)

According to the data provided by information and correlation analysis from four mountain glacial regions, the prevailing influence of relief on the distribution of present-day glaciation was proved.

**RECONSTRUCTION OF THE DEGREE OF
SNOW COVERAGE IN THE HOLOCENE ON
THE BASIS OF PHYTOINDICATION
(TSU)**

On the basis of ecologically-grounded and tested methods of phytoindication of the present quantitative characteristics of snow cover, a method of reconstructing the degree of snow cover in the Holocene was worked out. It was used for reconstructing the character of the snow cover for the south of the west Siberian plain during the whole of the Holocene. Qualitative tests of the dynamics of the degree of snow cover was completed by analysing the data on fluctuations of the level of enclosed lakes of the forest-steppe zone of this region and of the snouts of the Altai glaciers.

GLACIAL MUD FLOWS

(IG AS)

In the course of expedition work, factual data was collected on the composition, structure and age of glacial mud flows and rock glaciers of northern Tien Shan and the central Caucasus.

SUBSURFACE ICE

**SUBSURFACE ICE AND AUFEISES IN THE
SAYANY**

(IG SD)

A number of comprehensive glaciological and morphometric surveys of small basins in the mountain taiga and Holocene zones of the eastern Sayany were undertaken. Patterns of development of a complex of aufeises and subsurface ice were determined, depending on the peculiarities of the permafrost-hydrological regime and valley morphology.

STRATUM DEPOSIT "ICE MOUNTAIN"

(The Igarsk station of IG SD AS USSR)

Study continued of a thick stratum deposit of subsurface ice of buried glacial genesis on the right bank of the Enisei in the latitude of the Polar circle. As a result of natural wash-out of the neck dividing Schuch'e lake and the thermokarst, subglacial deposits were discovered which had not been studied previously. Earth and ice were tested for oxygen-isotope, radiometric, thermopuminescent and other analyses.

**ISOTOPE INVESTIGATIONS IN NORTH-
EASTERN U.S.S.R.**

(IG ESSR)

Close correlations between the isotope composition of present-day polygonal-lode ice and the average winter temperature of the air were determined. The results form the basis for a study of the isotope composition of ancient polygonal-lode ice for the purpose of palaeoclimatic reconstructions.

**INVESTIGATION OF FROZEN MORAINES
AND BURIED ICE IN TIEN SHAN**

(IG SD AS USSR)

Glacial deposits along the valleys of the Kum-Ter and Taragai rivers were drilled, and the geoindication signs of buried ice and moraine thickness containing a high quantity of ice determined. Temperature profiles for Late Pleistocene moraines formed within the interval of absolute heights of 4000–3300 m were obtained. For the upper level, temperatures equal to -6 , -7° were noted; for the lower one -2.5 – -3° .

RE-FORMED ICE WEDGES

(PFED)

The main regularities of the formation of patterns of re-formed ice wedges were formulated. A process of filling frost hollows and the formation of re-formed ice wedges was studied on models close to real conditions. Dependence of the depth of water penetration into the hollow on the temperature of the massif and the intensity of water flow was determined.

RIVER AND LAKE ICE, AUFEISES

**FREEZING OF THE BUKHTARMINSKOYE
RESERVOIR: CALCULATIONS AND
FORECAST**

(KazPI and KazRI)

The monthly average values of meteoroelements were calculated for Bol'shenarymskoye and Kuruchum stations. Dependency of the dates for the beginning of glacial phenomena (with deviation from the average for many of the years) on the determining factors is being analysed by screening methods.

**INFLUENCE OF THE AVERAGING OF
METEOELEMENTS ON THE CALCULATION
OF THE THICKNESS OF GLACIAL COVER**

(KazPI)

An analysis of the influence of the averaging of meteoroelements on the error value when calculating the thickness of glacial cover was carried out. It was found that the air temperature can be averaged for any period in time. Wind velocity, which considerably influences the value of the coefficient of convective heat exchange, can be averaged when calculating ice thickness without account of heat input from a water mass.

**CRYOGENIC SEPARATION OF ALLUVIUM
IN THE PROCESS OF AUFEIS
FORMATION**

(PTED)

Experiments in natural conditions were conducted on the reconstruction of processes of cryogenic separation of alluvium when aufeises and melt are formed. The effect of the concentration of heavy components was detected.

THE ARCTIC

THE DYNAMICS OF GLACIATION OF NOVAYA ZEMLYA

(IG AS)

The decrease in the rate of retreat of the Novozemel'sky glacier cover for the last 30 years was announced.

INVESTIGATION OF GLACIER CORES FROM SPITSBERGEN

(IG AS ESSR)

The analysis of concentration of general β -activity and tritium in three ice cores from Spitsbergen was carried out in collaboration with the Laboratory of Glaciology in Grenoble (France) and the Physics section of Freisberg Mountain Academy (DDR). It was ascertained that the accumulation velocity for the last 30 years on the Severo-Vostochnaya Zemlya produces approximately 80 cm of ice per year.

(IG AS)

The sequence of glacioclimate changes for the last 3000 years was reconstructed on the basis of a complex analysis of an ice core taken from the eastern ice field. As the result of numerical simulation of the dynamics and the regime of this glacier, the possibility of bottom melt and existence of a damp ice layer near the bed was confirmed. A possible response of Spitsbergen glaciation to the expected warming of the climate was determined. Geochemical investigation in the Arctic regions made it possible to determine a considerable increase of snow and ice pollution for the last century and to define regularities of spatial distribution of technogenic aerosols regulated by the peculiarities of the atmospheric circulation. Correlation of the results of isotope-oxygen investigations of ice cores made it possible to define the synchronism of climatic changes in high latitudes of Northern and Southern Hemispheres in the Holocene. The synchronism of the response of the Severnaya Zemlya glaciation and the degree of ice cover of the surrounding seas to the changes in climate was determined.

ANTARCTICA

FLUCTUATIONS OF THE ANTARCTIC GLACIERS

(IG AS)

It was ascertained that fluctuations of outlet and shelf glaciers in Antarctica are characterized by their periodically repeating and pulsatory nature. The biggest destruction of floating parts of the cover takes place in the periods of increased intensity of cyclonic activity in the Southern Hemisphere, which explains asynchronism in the trends of fluctuations of the frontal part of the cover and accumulation of snow in its interior. As the result of bottom melt, one of the largest

shelf glaciers in Antarctica, the Ross Glacier, loses about 150 km^3 of its mass, which is approximately equivalent to the losses due to calving of glaciers.

GLACIOMETEOROLOGICAL OBSERVATIONS IN ANTARCTICA

(LSU)

A set of glaciometeorological measurements with the purpose of determining the components of the heat balance of the snow surface was completed in January-February 1988 at Vostok Station. The analysis of vertical profiles of temperature and air humidity, obtained by means of a distant-recording psychrometer on seven levels in a 2 m-thick air layer above the snow surface, made it possible to suggest a new approach to the calculation of turbulent heat and moisture flows. The method is also useful for a number of cases of disturbance of conditions of stability along the turbulent flows connected with spatial inhomogeneity or instability or phase water transition in the periglacial layer of atmosphere.

Programme "GRAD" for determination of characteristics of the near-surface layer of atmosphere was worked out according to data from gradient measurements. Measurements of temperature of the surface glacial cover with the help of a narrow-band radiometer (developed in the LETI and named after V.I. Ul'yanov-Lenin) suitable for work in low temperatures, showed the necessity of further increasing the accuracy of the measurement by non-contact methods.

GLACIOCLIMATIC ZONING OF ANTARCTICA

(AARI)

A scheme of glacio-climatic zoning of the glacial cover of Antarctica was worked out. Qualitative and quantitative characteristics of the indications of climatic regions and the size of zones of ice-formation on the glacial cover were given, and the climatic changeability of boundaries of ice-formation zones considered.

DRILLING OF THE ANTARCTIC ICE SHEET

(LSU)

Drilling of a deep bore-hole at Vostok Station in the Antarctic continued. So far, the depth reached was 2400 m. At Vostok Station regular observations over the process of closing of a shaft of bore-hole No.1-2 bis were continued with the purpose of studying the process of deformation of the bore-hole shaft when not filled with a low-temperature liquid compensating for ice pressure. On the route Mirny-105 km a bore hole 740 m deep was drilled, and a complete set of geophysical investigations carried out. A mathematical model was made of the process of thermomass transfer while drilling by a jet-liquid tool with the use of a filling ectotemperature liquid as an intermediate heat-transfer agent. Methods of investigation of the process of

drilling ice and frozen rock by an electro-mechanical drilling tool were worked out and experimental investigations made.

SOUNDING OF THE ANTARCTIC GLACIERS

(MPI)

In East Antarctica in the region between Molodezhnaya Station and the Prince Charles Mountains (an area of about 300 000 km²) a survey of subglacial relief was completed on routes with a total length of around 12 000 km from on board the plane IL-18D, to help with interpretation of geographical data and compiling maps of the bedrock of Antarctica. With the information data of about 80%, the maximum registered thickness of the ice sheet was 3800 m, with the flight over the intercontinental station Vostok showing 3610 m. In West Antarctica with the help of the same equipment on board the plane IL-14, a route survey of each 5 km in an area of about 30 000 km² was carried out and radio-echo sounding measurements taken of the surface density of the glacial cover.

INVESTIGATION OF ICE CORES

(IG AS ESSR)

On Dome B samples were taken for isotope-geochemical analysis with the purpose of reconstructing the palaeoclimatic conditions of central Antarctica. During the march from Dome B to Mirny Station shallow pits were dug and samples taken from them for the study of changes in isotope composition, depending on the distance from the sea.

NUMERICAL EXPERIMENTS ON RECONSTRUCTION OF PALAEOCLIMATE (KazSU and AARI)

Numerical experiments on the reconstruction of palaeoclimate on the basis of the results of thermometry of a deep bore hole at Vostok Station in Antarctica were fulfilled. A possibility in principle of the reconstruction of temperature changes on the glacier surface in the Pleistocene was shown affecting the distribution of temperature with depth independent of the data from isotope analysis of the core.



International Glaciological Society

JOURNAL OF GLACIOLOGY

The following papers have been accepted for publication in the *Journal of Glaciology*:

D J EVANS

Apron entrainment at the margins of sub-polar glaciers, north-west Ellesmere Island, Canadian High Arctic.

J R DESLOGES, D P JONES, K E RICKER

Estimates of peak discharge from the drainage of ice-dammed Ape Lake, British Columbia, Canada.

V Ya LIPENKOV, N I BARKOV, P DUVAL, P PIMIENTA

Crystalline texture of the 2083 m ice core at Vostok Station, Antarctica.

D S MUNRO

Surface roughness and bulk heat transfer on a glacier: comparison with eddy correlation.

J RIDLEY, W CUDLIP, N McINTYRE, C RAPLEY

The topography and surface characteristics of the Larsen Ice Shelf, Antarctica, using satellite altimetry.

W AMBACH

Effects of climatic perturbations on the surface-ablation regime of the Greenland ice sheet, West Greenland.

E BRUN, E MARTIN, V SIMON, C GENDRE, C COLEOU

An energy and mass model of snow cover suitable for operational avalanche forecasting.

A J RUSSELL, J F AITKEN, C de JONG

Observations on the drainage of an ice-dammed lake in West Greenland.

J OERLEMANS, N C HOOGENDOORN

Mass-balance gradients and climatic change.

P MAYEWSKI, AND 9 OTHERS

The Dominion Range ice core, Queen Maud Mountains, Antarctica — general site and core characteristics with implications.

N REEH

The age-depth profile in the upper part of a steady-state ice sheet.

E M SCHULSON, M C GIES, G J LASONDE

The effect of the specimen-platen interface on internal cracking and brittle fracture of ice under compression: high-speed photography.

K ECHELMAYER

Jakobshavns Isbræ, West Greenland: seasonal variations in velocity — or lack thereof.

D S LOEWENHERZ, C J LAWRENCE, R L WEAVER

Analysis of the initiation of transverse ridges on a rock glacier.

J M HARBOR

Early discoverers XXXVI: W.J. McGee on glacial erosion laws and the development of glacial valleys.

MA WEILIN, HU RUJI

Relationship between the development of depth hoar and avalanche release in the Tian Shan mountains, China.

H VON DER OSTEN-WOLDENBURG

Icequakes on Ekström Ice Shelf near Atka Bay, Antarctica.

R A BINDSCHADLER, E P ROBERTS, D R
MacAYEAL

Distribution of net mass balance in the
vicinity of Crary Ice Rise, Antarctica.

S M HODGE, D L WRIGHT, J A BRADLEY, R W
JACOBEL, N SKOU, B VAUGHN

Determination of the surface and bed
topography in central Greenland.



Future meetings (of other organizations)

INTERNATIONAL CONFERENCE ON THE ROLE OF THE POLAR REGIONS IN GLOBAL CHANGE 11-15 JUNE 1990, FAIRBANKS, ALASKA, USA

An international conference on the Role of Polar Regions in Global Change will be held on 11-15 June 1990, at the University of Alaska, Fairbanks, Alaska, USA.

The goal of the conference is to define and summarize the state of knowledge on the role of the polar regions in global change, and to identify gaps in our knowledge. To this purpose, experts in a wide variety of relevant disciplines are invited to present papers and hold workshop discussions which will be published in a proceedings volume. Both disciplinary papers and interdisciplinary ones linking global change to atmospheric, oceanographic, cryospheric, or biological and social processes will be accepted. While there are numerous conferences on global change, this conference deals specifically with the important role that the polar regions play in global change including: early detection of climate change, permafrost sources of CO₂ and CH₄, ozone holes and their biological effects, Arctic haze effects on biota and climate, snow and ice feedbacks, deep-water formation and CO₂ sinks, glaciers, ice sheets and sea level, socio-economic impacts, paleoclimatic data from the polar regions.

G.E. Weller of the University of Alaska Fairbanks is Chair of the Organizing Committee.

Conference cosponsors include: Arctic Research Consortium of the United States (ARCUS), Scientific Committee on Antarctic Research (ICSU), American Meteorological Society, American Geophysical Union, Oceanography Society, and International Glaciological Society.

A call for abstracts will go out with the second announcement in October 1989. Abstracts are due no later than 31 December 1989.

Papers submitted, as well as conference workshop conclusions and recommendations, will be published subject to technical review.

Further information from: Cindy Wilson, Conference Coordinator, Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska 99775-0800, U.S.A.

INTERNATIONAL SYMPOSIUM ON THE INTERACTION OF GLACIERS WITH THE OCEAN AND ATMOSPHERE SEPTEMBER-OCTOBER 1990 LENINGRAD, USSR

An international symposium on the Interaction of Glaciers with the Ocean and Atmosphere will be held in Leningrad, USSR, in September or October 1990. The symposium will be organized by the Institute of Geography, Academy of Sciences of the USSR, Moscow, and by the Arctic and Antarctic Research Institute, Leningrad, under the umbrella of the International Commission of Snow and Ice, IUGG.

The interaction of glaciers with the ocean and atmosphere is of great importance to global change processes and thus can be considered as a glaciological contribution to the International Geosphere-Biosphere Program (IGBP).

The purpose of the symposium is to provide a forum for the review and exchange of recent scientific information related to the interaction of glaciers with the atmosphere and the ocean, its mechanism and consequences.

Primary attention will be given to the following topics: interrelations of glaciers and ice sheets, sea ice and the ocean — regional and global scales; modelling; ice discharge, icebergs and sea level; climate and global implications, palaeoaspects.

Papers are invited on any aspects of the topics outlined above. Summaries should have not more than 500 words in English. They should be sent before 1 December to the address below, stating clearly the purpose, results, and conclusions of the paper submitted. Authors will be notified of preliminary acceptance within one month of the summary being received. Final acceptance will depend upon the review of a full-length paper, which should not exceed 12 double-spaced pages and be received by 1 May 1990.

A five-day post-symposium tour to the Caucasus is planned.

A circular containing the details of plans for publication, sessions, accommodation and the tour will be sent to all interested persons. For further information contact: Professor V.M. Kotlyakov, Institute of Geography Academy of Sciences, USSR, Staromonetny 29, Moscow 109017, U.S.S.R.

INTERNATIONAL SYMPOSIUM ON THE PHYSICS AND CHEMISTRY OF ICE, SAPPORO, JAPAN, 1-6 SEPTEMBER 1991

An international symposium on the Physics and Chemistry of Ice will be held in Sapporo, Japan, 1-6 September 1991, and follows earlier symposia in this series held at Erlenbach (1962), Munich (1968), Ottawa (1972), Cambridge (1977), Missouri-Rolla (1982) and Grenoble (1986).

Registration will take place on Sunday 1 September and sessions will be from Monday 2 to Friday 6 September at the Hokkaido University Conference Hall.

Topics

The symposium will be concerned with all aspects of ice science, with particular emphasis on the following topics: (1) Structures: lattice dynamics, order-disorder transition, high-pressure phases, hydrates, etc. (2) Defects and properties: surfaces, grain boundaries, diffusion, mechanical, electrical, optical and thermal properties, etc. (3) Phase transformation: crystal growth, nucleation, etc. (4) Ice in biological systems. (5) Extraterrestrial ice. (6) Applied ice physics and chemistry.

Papers

The information about submission of summaries and final papers will be given in the Second Circular, to be published in April 1990.

Publications

The proceedings of the symposium will be published as a separate volume. Papers will be refereed and edited before being accepted for publication.

Sessions and excursions

The symposium will include oral presentations and poster sessions, all in English. An excursion will be held during the week.

Accommodation

Details of accommodation at various prices will be given in the Second Circular.

International Scientific Committee

J.W. Glen (UK, Chairman), J.P. Devlin (USA), A. Higashi (Japan), S. Kirby (USA), J. Klinger (France), M.C. Macklin (Australia), N. Maeno (Japan), V.F. Petrenko (USSR), P.L.M. Plummer (USA), J.P. Poirier (France), H. Suga (Japan), and E. Whalley (Canada).

Further information from: Local Organizing Committee PCI-91, c/o Professor N. Maeno, Institute of Low Temperature Science, Hokkaido University, Sapporo 060, Japan.

GLACIOLOGICAL CONGRESSES IN SWITZERLAND

Within the framework of the working group on mountain permafrost of the International Permafrost Association, a workshop or symposium will very probably be held in Interlaken, Switzerland, in September 1991.

1994 is the centenary of the International Glacier Commission, today represented by the International Commission on Snow and Ice (ICSI) and the World Glacier Monitoring Service (WGMS). ICSI and WGMS are planning a Jubilee congress or symposium in Innsbruck and Zürich during 1994.

UNESCO-SPONSORED GRADUATE COURSE IN HYDROLOGY

This course will be held at Kensington (Sydney), New South Wales, Australia, from 23 February to 8 June 1990, in English. The deadline for application is before December 1989. Applications for admission, requests for fellowships and travel grants or enquiries for additional information should be addressed directly to the course organizer: Head, School of Civil Engineering, The University of New South Wales, P.O. Box 1, Kensington, NSW 2033, Australia.

EXCLUSION CLAUSE. While care is taken to provide accurate accounts and information in the Newsletter, neither the editor nor the International Glaciological Society undertakes any liability for omissions or errors.



Glaciological Diary

** IGS Symposia

* Co-sponsored by IGS

1989

5-9 December

* American Geophysical Union Fall Meeting, San Francisco, California, U.S.A. Sessions on snow, ice and permafrost, to be held jointly with the American Society of Limnology and Oceanography winter meeting. (A.F. Spilhaus, Jr, A.G.U., 2000 Florida Avenue, N.W., Washington, DC 20009, U.S.A.)

1990

4-6 February

City of Mombetsu Northern Regions Center Fifth International Symposium on Okhotsk Sea and Sea Ice, Mombetsu, Hokkaido, Japan. (Masaaki Aota, Sea Ice Research Laboratory, Hokkaido University, Minamigaoka 6-4-10, Mombetsu, Hokkaido 094, Japan)

13-14 February

National Hydrology Research Institute and Canadian Water Resources Association Workshop on Application of Remote Sensing in Hydrology, Saskatoon, Saskatchewan. (C.S.L. Ommanney, Scientific Information Division, National Hydrology Research Institute, 11 Innovation Boulevard, Saskatoon, Saskatchewan, Canada S7N 3H5)

18-23 February

9th International Conference on Offshore Mechanics and Arctic Engineering, Houston, Texas, U.S.A. (Nirmal K. Sinha, Offshore Mechanics and Arctic Engineering Division (OMAE/ASME), Institute for Research in Construction, National Research Council of Canada, Ottawa, Ontario, Canada, K1A 0R6)

4-6 April

Conference on Britain in the Arctic, Scott Polar Research Institute, Cambridge, U.K. (William Mills, Information Officer, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER, U.K.)

12 May

Royal Meteorological Society, Specialist Group on the History of Meteorology and Physical Oceanography, meeting on "The history of polar meteorology and oceanography", Scott Polar Research

Institute, Cambridge, U.K. (J.M. Walker, Department of Maritime Studies, University of Wales, P.O. Box 907, Cardiff CF1 3YP, U.K.)

14-18 May

3rd International Conference on Ground Penetrating Radar, Denver, Colorado, USA. (Gary R. Olhoeft, U.S. Geological Survey, P.O. Box 25046 DFC MS964, Denver, CO 80225-0046, U.S.A.)

11-15 June

* International Conference on the Role of the Polar Regions in Global Change, Fairbanks, Alaska, U.S.A. (Cindy Wilson, Conference Coordinator, Geophysical Institute, University of Alaska Fairbanks, Fairbanks AK 99775-0800, U.S.A.)

12-15 June

International Symposium on Water Resources Systems Application, Winnipeg, Canada. (S.P. Simonovic, Civil Engineering Department, The University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2)

10-12 July

Northern Hydrology Symposium, Saskatoon, Saskatchewan, Canada. Sponsored by the National Hydrology Research Institute and Canadian Water Resources Association. (C.S.L. Ommanney, Scientific Information Division, National Hydrology Research Institute, 11 Innovation Boulevard, Saskatoon, Saskatchewan, Canada S7N 3H5)

20-23 August

10th IAHR International Symposium on Ice, Helsinki University of Technology, Espoo, Finland. (Mauri Määttänen, Helsinki University of Technology, Department of Mechanical Engineering, Otakaari 1, SF-02150 Espoo, Finland)

27-31 August

** IGS Symposium on Ice-Ocean Dynamics and Mechanics, Hanover, NH, U.S.A. (Secretary General, IGS, Lensfield Road, Cambridge CB2 1ER, U.K.)

18-20 September

2nd International Conference on Ice Technology, Cambridge, U.K. (Elizabeth Newman, Conference Secretary, Computational Mechanics Institute, Ashurst Lodge, Ashurst, Southampton SO4 2AA, U.K.)

24-28 September

3rd General Assembly of the European Network of Experimental and Representative Basins, Conference on

- Hydrological Research Basins and the Environment, Wageningen, The Netherlands. (IAC-Section OCC, P.O. Box 88, 6700 AB Wageningen, The Netherlands)
- September or October
ICSI International Symposium on Interaction of Glaciers with the Ocean and Atmosphere, Leningrad, USSR. (V.M. Kotlyakov, Institute of Geography, Academy of Sciences USSR, Startomonetny 29, Moscow 109017, U.S.S.R.)
- 1991
- 2-9 August
XIII INQUA Congress, Beijing, China. (Chinese Academy of Sciences, 52 Sanlike, Beijing 100864, China)
- 11-24 August
20th General Assembly of the International Union of Geodesy and Geophysics, Vienna, Austria.
- 26-30 August
** IGS Symposium on Mountain Glaciology relating to Human Activities, Lanzhou, China. (Secretary General, IGS, Lensfield Road, Cambridge, CB2 1ER, U.K.)
- 1-6 September
- Symposium on the Physics and Chemistry of Ice, Sapporo, Japan. (Norikazu Maeno, Institute of Low Temperature Science, Hokkaido University, Sapporo 060, Japan)
- 29-31 October
IWAIS '90: 5th International Workshop on Atmospheric Icing of Structures, organized by the Japanese Society of Snow and Ice, Tokyo, Japan. (IWAIS '90 Secretariat, c/o Inter Group Corporation, Akasaka Yamakatsu Bldg., 8-5-32, Akasaka Minato-ku, Tokyo 107, Japan)
- 1992
- May
** Symposium on Remote Sensing in Glaciology III, Boulder, CO, U.S.A. (Secretary General, IGS, Lensfield Road, Cambridge CB2 1ER, U.K.)
- September
** Symposium on Snow and Snow-Related Problems (as part of an International Forum on Snow Areas), Nagaoka, Japan. Co-sponsored by the Japanese Society of Snow and Ice and the City of Nataoka. (Secretary General, IGS, Lensfield Road, Cambridge CB2 1ER, U.K.)



Sam Colbeck
President, IGS

Eilert Stang Lund
Chairman, Bremuseum Board

Jon Ivar Naalsund
Deputy Minister of Industry

Pictured in September 1988 at the ceremony to mark the purchase of the site in Fjaerland where the Norsk Bremuseum will be built



News

Professor V.M. Kotlyakov, recently elected a People's Deputy of the USSR, is now on the Permanent Committee of the Supreme Soviet of the USSR on the Questions of Ecology and Rational Use of Natural Resources.

Dr Andrei Glazovski, of the Institute of Geography, Academy of Sciences, Moscow, USSR, and Deputy Chairman of the Soviet Section on Glaciology, has taken over from Dr Kotlyakov as IGS Correspondent for the USSR. On 5 September 1989 he gave a lecture in the University of Alaska-Fairbanks on early Russian records of climate, volcanoes, glaciers, rivers, etc. from the Russian period in Alaska (Russian America). His visit to Fairbanks was jointly sponsored by the Arctic Institute of North America, the Geophysical Institute, the Institute of Marine Science, the Institute of Northern Engineering, and the Rasmuson Library. Dr Glazovski had spent the previous two weeks at the IGS Symposium on Ice and Climate in Seattle, WA, and on the post-symposium tour of the coastal regions of southern Alaska, from Juneau to Glacier Bay, Yakutat, Prince William Sound and the Anchorage area.

We regret to announce the death of David Sexton on South Inyl'chek Glacier, in the central Tien Shan mountains, USSR.

ESTABLISHMENT OF NORSK BREMUSEUM – THE NORWEGIAN GLACIER CENTRE

The Norwegian Glacier Centre, a non-profit foundation, is to be established at the gateway to Jostedalbreen National Park in Fjaerland. It is sponsored by the Universities of Bergen and Oslo, the Norwegian Polar Research Institute, the Norwegian Water Resources and Energy Association, Sogn and Fjordane Regional College, and the Norwegian Mountain Touring Association.

The aim of the Norwegian Glacier Centre is to collect, create and transmit knowledge of snow, ice and glaciers. This includes understanding both the natural environment and the interaction between mankind and nature. The glacier centre will stimulate the curiosity of those who know little about glaciers and inform those who know much.

It will be a show case for glacier research, and a natural base for field work on the Jostedal Glacier.

The Glacier Centre will have rooms and teaching programmes aimed at students. There will be a library, communications equipment and offices for visitors' use.

The Council of the International

Glaciological Society agreed at a recent meeting that the Society should also be a sponsor and give support by donating sets of back issues of *Journal of Glaciology*, *Annals of Glaciology*, and *Ice* to the Centre's library.

Several IGS members were present in September 1988 at the ceremony to mark the purchase of the site in Fjaerland where the Centre will be built. It was held at the end of a post-symposium tour after the IGS meeting in Lom. The President, Sam Colbeck, joined local dignitaries and other sponsors in wishing the Centre well. Some members of the IGS tour had brought publications to Fjaerland, as early donations to the Centre's library.

ARCTIC CENTRE

The Arctic Centre, at the University of Lapland, P.O. Box 122, 96101 Rovaniemi, Finland, officially began operation in February 1989.

The Arctic Centre is a separate institute of the University of Lapland and is administered by a director and a 10-member executive board. The Centre has an international advisory committee, with a maximum of 17 members.

Construction of the Arctic Centre will begin in 1990, with stage one, which includes an Arctic Science Centre, due for completion in 1992. This project forms part of the 75th anniversary celebrations of Finnish independence.

The role of the Arctic Centre is "to maintain an information service, to facilitate research into natural conditions, culture, economics, resources and technology in the Arctic and sub-Arctic regions, to maintain an Arctic Science Centre and to practise and promote education, research and co-operation in these fields on an international level."

Of fundamental importance is the aim of promoting Arctic collaborative and multidisciplinary research. To this end, the Arctic Centre will promote relevant research, exhibition and information services on a national and international level. The UNESCO-affiliated MAB Northern Sciences Network (Secretary: Dr Kyllikki Kauppinen) is an international secretariat already in operation, which, with others of its kind, will form an important aspect of our work.

In addition, an international Working Group on High-latitude Lakes and Rivers of the Societas Internationalis Limnologiae will be based at the Arctic Centre.

Development of the information service has already begun, with the aim of compiling a

complete register of international polar research institutes.

The Science Centre is intended for both the general public and for specialists in various fields. It aims to present conditions in the Arctic and northern areas, Arctic research methods, recent research results and their implementation and special Arctic phenomena and associated problems, while seeking to inspire the viewing public to conduct further investigations for themselves. The exhibits will show the relationship between mankind and nature from the viewpoint of nature, and various aspects of Arctic culture and will be designed to complement those of the Lapland Provincial Museum. The Arctic Centre examines the whole of the Arctic, while the Lapland Provincial Museum concentrates on the history, nature and culture of Finnish Lapland.

The main feature of the Science Centre will be the "Polarium" auditorium with advanced audiovisual facilities for congresses and other events.

Periodic exhibitions will be both constructed by the Centre and loaned from national and international institutes.

ANNOUNCEMENT OF THE FIRST IGBP SCIENTIFIC STEERING COMMITTEE ON GLOBAL CHANGES OF THE PAST

The condition of the global environment of the past can be observed in ice cores and tree rings, in ocean and lake sediments, as well as in terrestrial deposits and pollen records. This opportunity to study global change of the past has provided compelling new evidence for linkages among the life processes and the physical and chemical conditions of the Earth system. These and other insights into the past can be used to interpret observed trends in contemporary data in the broader context of past changes, to evaluate Earth system models, and to hypothesize and investigate other interconnections. Breakthroughs in this area, exemplified by the evidence contained in ancient polar ice for systematic glacial-interglacial changes in the atmospheric abundance of trace gases such as carbon dioxide and methane, have led to new conceptual views of the linkages among biogeochemical processes and the physical aspects of climate. These and related findings have served to focus attention on not only the effect of climate change on life processes, but, of equal importance, the potential of these processes to feedback to climate.

In studying global change, the International Geosphere-Biosphere Programme (IGBP) will

depend on these invaluable records in order to understand better the causes and effects of contemporary changes. This will require careful assessment of the state-of-the-art and present limitations of various techniques, the development of new technologies, and improvements in the analysis of these data in order to facilitate more refined interpretation of past records. Integration and inter-comparisons of the different records of the past will be an important aspect of this activity of the IGBP.

Opportunities in this area have been highlighted in the deliberations and reports of the Special Committee for the IGBP since its inception, affirming that the study of past geosphere-biosphere linkages is clearly an important component of a study of Global Change. However, the collective effort to study aspects of past change relevant to the themes of the IGBP have to date been without the broad transdisciplinary focus as well as the international support that is essential for full exploitation of these opportunities.

Thus, the Special Committee for the IGBP decided at its meeting in Stockholm (October 1988), following the first meeting of the IGBP Scientific Advisory Council, to give particular emphasis to research into records of the past global change by charging the first of the programme's Scientific Steering Committees with project development in this area. This project will encompass the past 150 000 years to include a full glacial-interglacial cycle. Particular studies will focus in greater detail on changes which have occurred during the Holocene (10 000 years B.P.), and especially during the past 1000 years, when the human perturbation to the Earth system began to take on global proportions. Terms of reference for this new committee will include:

- (1) assessing the possible contributions of planned or existing national and international efforts, including those of, for instance, the International Union for Quaternary Research (INQUA), as they pertain to the underlying themes and objectives of the IGBP;
- (2) developing, within one year of appointment, plans for an initial multi-technique core IGBP project for coordinated field activities focussed on the IGBP themes and objectives;
- and (3) initiating, within two years of appointment, pilot segments of this project.

Chairing the new Scientific Steering Committee is Professor Hans Oeschger of the Department of Physics, University of Bern, Sidlerstrasse 5, CH-3012 Switzerland.

Further information can also be obtained from the IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden.



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