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Contents

Cover picture: Lenticular cloud over the 8012 meter Xixabangma Feng in the Himalayas as seen looking south from the 1997, 7200 meter Dasuopu Ice core drilling site (Photograph by Lonnie G. Thompson)

Scanning electron micrograph of the ice crystal used in headings by kind permission of William P. Wergin, Agricultural Research Service, US Department of Agriculture

From the Editor

Dear IGS member

This is the second *ICE* you have received in approximately 2 months. Yes, we are trying to catch up on *ICE* as well. But the publication of *ICE* does not only depend upon the editor thinking up things to include and IGS correspondents sending in reports. We would like to see more contributions from you, our members. As we indicated in the last editorial in *ICE*, we are trying to make the Society more members-oriented now that the publications are running smoothly. We would thus like to see more 'members' material' in *ICE*. After all, this is the newsletter of the IGS and it is supposed to carry news of what our members are up to. Perhaps you have had an interesting field season you would like to share with your colleagues. Maybe you have noticed an interesting cryospheric phenomenon that you are trying to explain; you are not yet ready to publish in the *Journal* or the *Annals* but you would like some input from others. Please write it up and send it to us here at the IGS office and we will include it in the next *ICE*.

If you are planning a meeting or a workshop, however small or however big, please send us a description of what it is about and we will include it in our column 'Future meetings'. And, once over, you could write up a report from that meeting and we will also publish that. This is an excellent way of keeping your colleagues informed about what is taking place. Of course, all meetings will be included in the calendar on our website and in *ICE*. But the accuracy is dependent on you keeping us informed of what is taking place.

If there is something specific you would like to discuss and draw your colleagues' attention to, *ICE* is a good venue for that. A recent example is the article by our former president, Bob Bindschadler, about the naming of subglacial lakes. Maybe you would like to share with your colleagues some of the interesting projects that you or your colleagues in your department or institute are working on, in more detail than is possible in the regular contributions by your country's correspondent.

If you are feeling a bit more ambitious and would like to host an IGS symposium, please get in touch with us at igsoc@igsoc.org and we will take your idea further. Bear in mind that we are planning symposia several years in advance, e.g. now we are looking at 2010 and beyond, based upon two IGS symposia per year.

I would again like to take this opportunity to advertise for ideas as to what we can do for you, our members, to make the Society a better organization that every person with links to the cryospheric sciences feels they should belong to. The IGS is a learned society and as such is quite often contacted by outside organizations and the media about matters related to the study of snow and ice. We quite often refer these enquiries to our members so it is important for all of us that the IGS membership roster is made up of a diverse selection of scientists from all aspects of the cryospheric sciences.

Magnús Már Magnússson
Secretary General

Recent work

Russia

GLACIOLOGICAL RESEARCH IN RUSSIA

The real development of glaciological research in Russia began in International Geophysical Year, when some research institutions were established at the Academy of Sciences and universities. These studies were coordinated by the Glaciological Council of the Soviet Geophysical Committee, which has been organizing professional symposia every 4 years. The first symposium was held in 1961 in Moscow, the second in Alma-Ata, Kazakhstan in 1962, the third near Issyk-Kul Lake, Kirgisia in 1965, the fourth in Terskol, Elbrus area. in 1968, the fifth in Tashkent, Uzbekistan in 1972, the sixth in Alma-Ata, the seventh in Tomsk, Siberia in 1980, the eighth in Tallinn, Estonia, the ninth in Tbilisi, Georgia, the tenth in Obninsk, near Moscow, in 1993, the 11th and 12th in Puschino, Moscow area, in 1996 and 2000 and the 13th in St Petersburg in 2004.

The Glaciological Association was established in 1993 after the collapse of the USSR and united glaciologists from Russia and from the Former Soviet Union republics (president V. Kotlyakov). The Association publishes twice a year *Data of Glaciological Studies, a* journal in Russian and English. The 100th issue of the journal will be published in 2006.

Russian glaciologists have been studying snow cover and avalanches, the glaciers of the Antarctic, the Russian Arctic and Svalbard, and all the mountain systems of northern Eurasia. Summary monographs on Franz Josef Land, Novaya Zemlya, Svalbard, Severnaya Zemlya, the Polar Urals, the Caucasus, the Pamirs, Tien Shan, Suntar Khayata in Siberia, and many others have been published during this period. A *Glacier Inventory of the USSR* was published in 1970 in 100 issues (an electronic version is available at World Data Center A for Glaciology, Boulder, CO, USA). The *World Atlas of Snow and Ice Resources* was published in 1997. The Atlas was produced by 300 glaciologists over 15–20 years.

Main glaciological research teams work at the Institute of Geography, Russian Academy of Sciences (Moscow), the Arctic and Antarctic Research Institute (St Petersburg), and the Universities of Moscow, St Petersburg, Kazan, Tomsk, Barnaul and other cities. Some results of the last years' studies that were reported at the 13th Glaciological Symposium in 2004 are given below.

ANTARCTICA

Recent biological studies of Vostok ice core, Antarctica

S.A. Bulat, I.A. Alekhina, PNPI and LGGE; J.R. Petit, LGGE; D. Marie, SB; V.Ya. Lipenkov, V.V. Lukin, AARI

The molecular biology studies showed that the accretion ice contains essentially no bacteria and is archaea-free. Up to now, the only accretion ice type 1 featured by mica–clay sediments presence, and namely one horizon of four studied (3607m), allowed the recovery of a few bacterial phylotypes. This unexpectedly included the chemolithoautotrophic thermophile *Hydrogenophilus thermoluteolus* and two more unclassified phylotypes all passing numerous contaminant controls. In contrast, the deeper and cleaner accretion ice 2 (three cores) with no sediments presence and near detection limit gas contents gave no reliable signals. The microbes detected in accretion ice 1 are not believed to resist an excess of oxygen in the lake water body (700–1300 mg O_2/l as expected), since *Hydrogenophilus* is known from culturing trials to be unable to stand such conditions. They are supposed to be thriving in rather warm anoxic sediments in deep faults at the lake bottom and sporadically flushing out along with sediments to the lake veins in a shallow depth bay due to a seismotectonic activity likely operating in the lake environment. A few geophysical and geological evidences support this scenario (Bulat et al., 2004). In the bay the presence of mica–clay sediments, higher accretion rate due to relief rise and likely oxygen-depleted upper layer of water can provide microbes with a chance to escape the high oxygen tension by the rapid entrapment into accretion ice 1. In addition, clay minerals encountered in only accretion ice 1 are well-known as protecting well DNA from degradation. On a contrary, the sediment-free accretion ice 2, which forms above a deeper part of the lake, shows no evidence for reasonable source for microbe contribution given highly oxygenated lake water environment. Deep glacial ice horizons more than 140 kyr old also showed no confident DNA signals, thus serving a life-barrier between Lake Vostok ecosystem and surface biota for at least 15 Ma. Such a 'sterility' of deep glacial ice could be caused by both the liquid water veins between ice crystals and the oxygen dissolved in ice matrix (up to 1.0 mg O_2/l), which are apparently hazardous for cells and DNA preservation over long time. This

additionally implies that thick and old Antarctic ice sheet seems to be inappropriate for archiving a long-ago Aeolian deposited life. The only exception found is the basal glacier layer (a mixture of Aeolian dust and bedrock particles – e.g. 3483m) which allowed recovering two phylotypes – a known psychrophile and unclassified *Bacillus sp.*, both passing all contaminant criteria. However, they seem to represent 'ice sheet bedrock life' rather than lake life.

Internal structure of East Antarctica ice sheet from radio-echo sounding data

S.V. Popov, D.V. Mandrikova, PMGRE; V.Ya. Lipenkov, AARI

Radio-echo sounding data collected by Polar Marine Geological Research Expedition in 1998–2004 have been used to investigate the internal structure of the Antarctic ice sheet over the vast area of subglacial Lake Vostok. The analysis of the RES data and the 3D mapping of isochrones over the area of 100×300 km has been successfully completed. The dating of the Vostok ice core was extended to the northern part of the lake. In the narrow bay that exists at the northern coast of Lake Vostok, the isochrones are found at considerably greater distances from the ice-sheet base than at Vostok Station. This result implies the paleoclimatic record longer than at Vostok can be obtained in case of deep ice drilling implemented in the northern area of Lake Vostok. The dated internal layers provide a good reference to validate the numerical model calculations and thereby to find the most suitable site for deep ice coring.

Reconstruction of air temperature in Central Antarctica from isotope studies of snow thickness and the ice core from the deep borehole at Vostok Station

A.A. Ekaykin, V.Ya. Lipenkov, AARI

The relationship between meteorological parameters at the near-surface level and at the level of snow formation has been investigated. It has been found that weighted temperature of precipitation formation in Vostok area is nearly equal to the temperature at the upper boundary of surface inversion layer. The study of seasonal variability of snow isotope composition and its relation to meteorological conditions at Vostok has been carried out. The regression coefficient between precipitation isotope composition and air temperature is significantly less than corresponding coefficient currently used in calibration of isotope profiles from deep ice cores. A mathematical model and computer program have been developed to simulate the process of solid precipitation isotope composition formation in Central Antarctica. Testing and tuning of the model have been commenced using available data on temporal (intra- and inter-annual) and spatial variability of isotope composition of snow precipitation, as well as meteorological and balloon-sounding data.

Modeling the gas budget of subglacial Lake Vostok (Antarctica) on the basis of deep ice core data

V.Ya. Lipenkov, AARI; V.A. Istomin, ARRING

It is demonstrated that the gas budget of Lake Vostok is substantially controlled by transport of atmospheric air through the overlying ice sheet and its accumulation in the lake due to exclusion of gases during ice accretion. A general algorithm of the predictive model for the evolution of the lake water gas composition has been elaborated. Based on these developments, we estimate that approximately 30 water renewal times are needed to reach the saturation of air dissolved in lake water (corresponds to equilibrium between gases in solution and those encaged in hydrate). Further evolution of the gas composition in water solution and hydrate phase, after reaching the saturation level in the lake, is qualitatively considered. Preliminary reconstruction of dissolved nitrogen and oxygen concentrations in the lake water is performed using the gas analysis data form accretion ice core. It is shown that the actual concentration of dissolved gases in the upper layer of the lake water under the Vostok Station is far below the saturation level. It is proposed that potential for the gas hydrate formation has not been realized in this particular part of the lake.

Non-stationary temperature field simulation along the ice flow line 'ridge B – Vostok Station', East Antarctica

A.A. Salamatin, E.A. Tsyganova, KSU; V.Ya. Lipenkov, A.A. Ekaykin, AARI

As part of an international collaborative project an average time scale for the Vostok ice core down to a depth of 3350 m is deduced, being consistent with datings of different origins within the standard deviation limits of ±3.6 kyr. Its accuracy is estimated as 2.2 kyr on average. A refined isotope fractionation model for predicting the isotope content of snow in Central Antarctica is implemented as an interactive computer system. To assess the amplitudes of temperature changes during the last glacial termination at Vostok, two independent approaches were used: (1) direct computations of isotopes in snow to infer the inversion (condensation) temperature transition from isotopic data and (2) the inverse method to deduce the surface temperature change from the borehole temperature profile by constraining the isotope/surface temperature transfer function. They result in respective estimates of about 6.0°C and 12.5°C.

Modelling formation of air-hydrate ensemble in transition zone of Antarctic Ice Sheet

Yu.A. Sheshukova, E.A.Tsyganova, KSU; V.Ya. Lipenkov, AARI; H. Ohno, T. Hondoh, ILTS

A Russian Basic Research Foundation project on evolution of air-inclusion ensemble in ice sheets has resulted in a development of a complete kinetic

model of the air-bubble-to-clathrate-hydrate conversion process in the transition zone. It describes evolution of gas-composition and size distribution functions of coexisting air-inclusion ensembles and takes into account diffusive mass transfer of air constituents (oxygen and nitrogen) between the gas and hydrate phases through ice matrix. In collaboration with Arctic and Antarctic Research Institute (St Petersburg, Russia) and Institute of Low Temperature Science (Sapporo, Japan), the model is validated on the ice core data from boreholes at Vostok and Dome Fuji in Antarctica. The most feasible kinetic regime of the clathrate–hydrate formation is simultaneous nucleation in air bubbles and in ice matrix with partial disappearance of bubbles due to diffusive outflow of air towards hydrates. A theory of polidisperse mixed air–hydrate crystal growth in ice matrix in an ice sheet below the transition zone is proposed and constrained on the Vostok ice core data.

Shore line of subglacial Lake Vostok and adjacent reservoirs

S.V. Popov, A.N. Sheremet'ev, V.N. Masolov, PMGRE; V.V. Lukin, RAE

Radio echo sounding in the Lake Vostok area has been executed during the austral summer field seasons of 1998–2004. The subsequent processing of data has allowed to identify the grounding line of the subglacial lake. 195 points of crossing RES routes were grouped by reliability and the grounding line have been identified. Their heights were determined. 22 sections of isolated subglacial water bodies located around the Lake Vostok have been found. Z-records and detailed analysis of their interpretation are presented. The total area of the Lake Vostok surface is about 17.1 thousand km^2, the length of the coastal line of the lake (without islands) is about 1000 km, and nine subglacial islands were discovered.

Water isotope composition of subglacial Lake Vostok

A.A. Ekaykin, V.Ya. Lipenkov, AARI; S. Jonsen, UCD; E.B. Prilepskiy, VSEGEI; Yu.A. Shibaev, AARI and SPBU

The isotopic composition (δD and δ^{18}O) of the deepest section of Lake Vostok (LV) accretion ice core (3611–3623 m), with resolution 50 cm and obtained 1.5 cm resolution δ^{18}O profiles for accretion ice 1 and 2 from depth intervals 3571.4–3574.0 m and 3620.0–3621.0 m, respectively, has been measured. It is shown that initial isotope variations that have been characteristic of lake ice soon after its formation must have been substantially erased with time due to fast diffusion of water isotopes in ice at elevated temperature. Effective diffusion length was estimated using the data on isotope composition of ice core from meteoric ice-accretion ice transition zone (3538.4–3538.8 m). Maximum diffusion length for lake ice was found to be 7.6 cm at 3539 m depth.

To simulate the time evolution of isotopic composition of lake water and accreted ice, we have built a simple model, which, in contrast with earlier developments, is not confined to the assumption on constant volume and isotopic steady-state of LV, takes into account possible mixing between melt and resident water, and also allows for additional (besides the ice sheet bottom melting) source of water in the lake. Applying the model to interpret available data on isotope composition of accretion ice core has allowed estimation of isotope composition of lake water for a number of scenarios with different parameters of hydrological regime and accretion ice formation process in LV. The reconstructed isotopic composition of melt water (δD = –444,25‰, δ^{18}O = –57,17‰) appears to be significantly different from that of accretion ice (δD = –442,7‰, δ^{18}O = –56,27‰). The latter suggests non-stationary isotopic state of LV or/and the existence of an additional water source characterized by unusual for meteoric water isotope composition. Most likely this additional source is associated with hydrothermal waters that can contribute to LV through the fault vents at the lake bottom, the scenario consistent with recent biological findings.

'Terrain-dependent' variations of snow pack parameters in Antarctica

A. Ekaykin, V.Ya. Lipenkov, AARI

Various forms of snow (glacier) surface in Antarctica can be divided, due to their size and origin, into three groups: 'micro-relief' (102–101 m), 'meso-dunes' (101–102 m) and 'mega-dunes' (103–104 m). A common feature of them all is their active role in the formation of physical and chemical properties of snow thickness. This influence is carried out through different orientation of dunes slopes relative to wind and insolation. The drift of the dunes leads to the formation of 'relief-related' (i.e. non-climatic) variations of the studied firn characteristics in a given point. Main features of micro-relief and mega-dunes (based on available literature) and of 'meso-dunes' (according to our studies) are briefly reviewed in the paper. Three types of meso-dune have been discovered in the vicinities of Vostok Station and they have been shown to influence the formation of time-series of snow accumulation rate and isotopic composition. Typical periods of temporal variations related to meso-dunes are 2–3, 4–5 and about 20 years. Based on the analysis of detailed isotope profiles measured on ice core samples from deep Vostok borehole it was shown that meso-dunes had likely existed in this area in the remote past. However, formation and drift mechanism of meso-dunes require additional studies. There is also indirect evidence of mega-dune existance around Vostok with characterisctic periods of temporal variations of about 1 ky.

ARCTIC

Spatial changes in radiophysical properties of temperate glaciers

.J. Navarro, PUM; Yu.Ya. Macheret, IGRAS

Radio wave velocity (RWV) measurements, using common mid-point (CMP) method and monopulse ice-penetrating radars with central frequencies of 20 MHz and 200 MHz, were performed in 2003 at temperate Johnsons and Hurd glaciers in Livingston Island, Antarctica, at 12 and 2 sites, respectively, to study the spatial variations in water content in temperate ice and firn; to apply these data for numerical modeling of regime and dynamics of the glaciers; and to interpret the radar profiling data at 200 MHz in terms of short-term and long-term annual accumulation rate.

Temporal changes in radiophysical properties of a polythermal glacier in Spitsbergen

P. Glowacki, IGPAS; Yu.Ya. Macheret, IGRAS; F.J. Navarro, PUM

Repeated radio wave velocity (RWV) measurements using common mid-point (CMP) method radar profiling with monopulse ice-penetraiting radars with central frequencies of 20 MHz and 25 MHz were performed in July–August 2003 and April 2004. Continuous radar measurements at a fixed point and air temperature observations and durfact ice velocity monitoring during 8 days in summer 2003 were performed at Hansbreen in South Spitsbergen. The data obtained show the remarkable seasonal and interseasonal changes in RWV, water content in lower temperate ice layer as well as in reflected power from cold-temperate surface temperate ice layer and bedrock and the quite close correlation of the latter parameters with air temperature and surface ice velocity with a half-daily lag.

Ground radio echo sounding of Shokalsky Glacier, Novaya Zemlya

A.F. Glazovsky, E.V. Vasilenko, Yu.Ya. Macheret, IGRAS

Ice thickness radar measurements were made on Shokalsky Glacier, Novaya Zemlya, in September 2003. The portable monopulse radar system VIRL-2a was used. Ground-based measurements were made along the transverse profile of 3.7 km length located 5.6 km upstream from outlet glacier front. The maximum thickness is 406 m and average value is 280 m. Minimum bedrock elevation is –212 m below sea level. Total cross-section area is 1.04 km^2 and cross-section area below sea level is 0.28 km^2. Ice flux estimated from these data and available ice velocity measurements is 57.6 $10^6 m^3 a^{-1}$. Taking into account the ice losses because of surface ablation at the area between radar profile and glacier front, the ice calving flux is estimated as 32 $10^6 t a^{-1}$. That is two times as many the previous assessment made in IGY studies and is close to the recent assessment based on satellite radar interferometry at glacier front.

Icebergs of Shokalsky Glacier, Novaya Zemlya

I.V. Buzin, AARI; A.F. Glazovsky, IGRAS

Pilot study of icebergs at the Shokalsky outlet glacier, Novaya Zemlya, was carried out in September 2003. The calving intensity, iceberg size, shape, drift and demolition were recorded using theodolite and laser distance measurements, photo- and video records, visual observations and water temperature measurements. The study shows that: (1) the iceberg size is strongly predetermined by the crevass pattern on the glacier tongue, (2) distribution of icebergs in the bay controlled by shore geometry and strong southern catabatic winds, (3) number ratio of ice blocks/growlers/small-size/medium-size icebergs observed is approximately 66:32:1.3:0.6. Less than 1% of icebergs drift away from the bay. (4) Maximum drift rate of icebergs exceeded 1.5 km h^{-1} at strong katabatic wind.

Iceberg field studies in Barents Sea

G.K. Zubakin, Yu.P. Gudoshnikov, I.V. Buzin, N.V. Kubyshkin, A.K. Naumov, AARI

During the sea ice research expedition on RV *Mikhail Somov* in May 2003 in the Eastern part of the Barents Sea, an unusual number of icebergs (more than 100) was found. Some icebergs had dimensions impressive for this region, e.g. the length of the biggest one exceeded 400 m. For investigation of their morphometry and physical properties of the glacier ice, the landing stations on some tabular icebergs were organized. Vertical distribution of temperature in the iceberg as well as the elements of non-glacier origin found on the upper surfaces of icebergs (pieces of sea ice, puddles of sea water and brine) are reported.

Surficial melting of snow and ice in the Arctic seas

N.N. Bryazgin, E.I. Aleksandrov, A.A. Dement'ev, V.F. Radionov, AARI

A proportion between snow and ice melting depends on two factors: solar radiation and air temperature. The role of solar radiation in ice-snow melting is estimated for two conditions: when it is constant, but air temperature changed, and when air temperature is constant and solar radiation changed. Average intensity of snow melting is 5.1 mm per day. A proportion between ice melting and meteorological conditions is presented. Value of fresh water which is dependent on snow and ice melting in the Arctic seas is calculated in the paper. The fresh water balance variability for the Kara Sea for 1920–2000 is presented. The increase of fresh water balance by 205 km^3 was fixed for a 30-year period. It corresponds to ice extent decrease and climate warming in the Arctic.

Interannual variations of sea ice cover and air temperature in the Northern hemisphere

G.V. Alekseev, V.F. Zakharov, N.E. Ivanov, AARI; S.I. Kuz'mina, NIRC

Recent analysis of the sea ice cover in the entire Northern Hemisphere and its regions revealed that significant decrease has occurred in the latter decades of the last century. The ice reduction was found to be different during different seasons and the most pronounced in the summer for the whole Northern Hemisphere. Mean surface air temperature increased during these decades. These opposite tendencies contributed to negative correlation between sea ice area and surface air temperature for the Northern Hemisphere. Maximum negative correlation was observed in June even after trend removal. Analysis of lag correlation between sea ice area and air temperature revealed that during summer sea ice area changes advanced temperature changes. Starting from July, in contrast, temperature changes anticipated sea ice changes. Northern Hemisphere regions with the strongest correlation between surface air temperature and sea ice cover were found. Analysis of these links with the use of the results from global climate models indicated some discrepancy between observed and modeled correlations.

Modelling of seasonal ice–hydrological cycles in Kara Sea

S.A. Kolesov, I.Yu. Kulakov, L.A.Timokhov, S.V. Shutilin, AARI

The ice model is based on the elastic–plastic constitutive law with ice mass and concentration described by distribution functions. Advection of the ice partial mass and concentration is parameterized by a fourth-order algorithm that conserves monotonicity of the solution. The ocean is described as a three-dimensional time-dependent baroclinic model with free surface. Atmospheric stratification is taken into account in the thermodynamic block by calculation of vertical turbulent fluxes of sensible and latent heat. Calculations have been performed for 2 years (October 1984–October 1985; October 1987–October 1988). Simulation results allow us to analyse monthly and seasonal peculiarities of ice drift for two chosen years. Ice outcome from the Kara Sea prevails throughout the year. Absence of ice outflow from the north-eastern part of the sea is possible in summer and early autumn. Ice exportation to the Arctic Basin is possible from all the sea water area.

Variation in hydrothermal structure of a polythermal glacier in Spitsbergen

J. Jania, B.A. Piwowar, USP; Yu.Ya. Macheret, A.F. Glazovsky, E.V. Vasilenko, IGRAS; F.J. Navarro, J. Lapazaran, PUM; P. Glowacki, IGPAS; K. Migala, IGWU; A. Balut, UST

Hansbreen Glacier, Spitsbergen, has a two-layered structure that was first detected from airborne radio-echo sounding (RES) in 1977–79. This structure (with upper cold and lower temperate layers) was later confirmed by ground-based RES and ice temperature measurements in boreholes. Radio wave velocity (RWV) measurements by common midpoint method (CMP) and diffraction hyperbolae, made before the melting period, also confirmed the two-layered structure. To study the seasonal and inter-seasonal variations in RWV, radiophysical investigations were made at Hansbreen, in July–August 2003 and in April 2004. These included: (a) repeated RES profiling (20 and 25 MHz) along a particular transverse profile near the equilibrium line; (b) repeated CMP measurements at a point within this profile; (c) continuous radar measurements, with 1 minute time interval during 8 days, at a fixed site within this profile; (d) meteorological observations by an automatic weather station; and (e) continuous ice surface velocity monitoring from differential GPS data. Seasonal and inter-seasonal changes in the RWV of the cold and temperate ice layers, as well as in the reflection power from their interface, from bedrock and the internal reflection from the temperate ice layer, were detected. These changes are interpreted as water content variations in temperate ice and compared against changes in air temperature and ice surface velocity.

Investigation of the input of the periodic variation of the Arctic sea ice extent in intra-seasonal and long-term variation of the Northern hemisphere atmospheric CO2 content

V.N. Golubev, P.B. Grebennikov, G.A. Rzhanitsyn, S.A. Sokratov, D.M. Frolov, A.V. Shishkov, MSU

The project estimates the effect of the sea ice extent on gas balance in the atmosphere. Spatially distributed observational data on amplitude of intra-seasonal variability of CO_2 content in the atmosphere correlate with the intra-seasonal sea ice extent variability and suggest that sea ice serves as an impermeable boundary for ocean–atmosphere gas exchange. Such dependencies can also be applied to explain the long-term variability in greenhouse effect.

MOUNTAIN GLACIERS

Elbrus western firn plateau ice-core and radio-echo sounding studies

V.N. Mikhalenko, M.G. Kunakhovich, S.S. Kutuzov, IGRAS; I.I. Lavrent'ev, MSU; L.G. Thompson, BPRC

Shallow ice core, 21.41 m depth, has been recovered on the Western firn plateau of Mt Elbrus (5150 m a.s.l.), Caucasus, in 2004. Firn density has been measured at the drilling site and ranged from 210 kg/m^3 at the upper part of ice core to 680 kg/m^3 at 21.4 m. Temperatures were measured in the bore-

hole and changed from –11.5°C near surface to –17°C at 10 m. Distinct seasonal fluctuations of stable isotope composition has been defined in ice core. Minimum values of the $\delta^{18}O$ and δD were –28‰ and –206‰. High correlation between $\delta^{18}O$ and δD has been revealed and the meteoric water equation ($\delta D = 8\,0071\ \delta^{18}O + 15\,173$) has been obtained. Detailed stratigraphic record indicates absence of surface melting and ice layers in firn pack. Radio-echo sounding measurements in 2003 and 2004 show that ice depth ranged from 70 m to 240.8 m. This record indicates that Western firn plateau of Mt Elbrus is the best site for ice-core studies in the Caucasus.

Mass balance and fluctuations of Kropotkin Glacier (Bolshoy Semyachik volcano, Eastern Kamchatka)

N.V. Golub, Ya.D. Muraviev, IVS

Changes of Kropotkin Glacier connected with climate fluctuations of Eastern Kamchatka during the past four centuries have been restored. The tongue of the glacier retreated by more than 1 km over this period, and its area decreased from 2.75 to 0.67 km^2. Its long-term (centuries) and decade-long fluctuations occurred synchronously with other glaciers of the eastern coast of the peninsula. Short-term changes in glacier regime are more closely connected with accumulation. Estimation of climate characteristics for different stages of the glacier retreat showed that its decrease is connected mostly with rise of summer temperature, approximately by 1°C. The last fact is connected both with general climate warming and with decrease of cooling effect of glaciation with respect to the maximum of Little Ice Age. Climatic conditions in the 20th century do not differ much from the contemporary ones.

Increase of surficial debris cover on Djankuat Glacier, Caucasus

V.V. Popovnin, A.V. Rozova, MSU

A hydrological (run-off-formative) effect of thawing under the cover of superficial moraine is considered in non-stationary cases, i.e. progressive debris piling up on the surface as a process, peculiar for glacier degradation stage. Geomorphological transformation of initially linear lengthwise features of morainic mesorelief into continuous debris cover with smoothed aspect and predominantly hummocky appearance of the day surface is traced in space (downstream of the snout) and in time (due to uninterrupted debris melting off with subsequent gravitational redistribution of lithogenic matter along the surface). Dynamics of the last process is described as a case study of the Djankuat Glacier. A time series of 6 large-scale topographic maps demonstrates the expansion rate of debris cover all over the snout during 1968–1999 from 0.104 km^2 (3% of the total glacier area) at the beginning to 0.293 km^2 (10%) at the end. This rate is reversely proportional to mass balance: the slowest debris area increment is observed in the case of prevalent positive balance values. The comparison of two moraine thickness maps, derived after repeated direct surveys all over the entire debris-covered glacier area in 1983 and 1994, shows the growth of both mean thickness value (26 cm in 1983 and 39 cm in 1994) and its local maxima (183 and 280 cm, respectively). The resultant reduction of subdebris ablation and run-off changes by altitudinal-morphological zones of the glacier. It is pronounced most of all in the lowermost belts, where debris cover reduced the mean annual bulk meltwater run-off by 17% in 1983 and by 25% in 1994. Moraine cover expansion (due to recent intensification of rockslide activity from the rocky revetment of the firn basin, in particular) results in hypsometrical eminence of the debris-covered areas above the adjacent clean ice surfaces, in different terminal fluctuation along the transversal line of the glacier front and in transformation of mass balance field patterns with time.

Gas outburst in Kolka Glacier cirque

Ya.D. Murav'ev, IVS

It is assumed that volcanic (or post-volcanic) phenomena along with glaciological, meteorological, and seismic causes produced the Kolka Glacier surge which had catastrophic sequences. Some volcanic events are discussed in the paper, such as volcanic–tectonic conditions for accumulation and income to the surface of great amount of volcanic gases which include in different proportions CO_2, H_2S and SO_2 as well as the explosive character of gases input into the environment of the Kolka Glacier and qualitative feelings of eye-witnesses. All this testifies to the possibility of explosive activity under the glacier, which in its turn is genetically connected with glacier body dynamics. It is possible that among the factors that caused the catastrophic character of the Kolka Glacier surge, an important place belongs to the processes of the hydrothermal system, which is located in the fissure zone of deep fracture in Kolka gap, and it is connected with Kazbek magma focus and/or neointrusions of this region. On the basis of these prerequisites, hypothesis of recurring gas eruptions on the Koka Glacier bed is proposed. Taking this into account, it is possible to explain some features of glacial catastrophes both in this valley and in the other glaciers of Kazbek–Dzhimaray volcanic massif.

Kolka Glacier in 2002: from activation to catastrophe

L.V. Desinov, V.M. Kotlyakov, IGRAS

The catastrophe on Genaldon Valley on 20 September was caused by a surge of Kolka Glacier.

The glacier became dynamically unstable earlier than expected because a few factors intervened. These factors are the interesction of two big geological faults on the back side of the glacier; increased level of seismological activity; the influence of Kazbek volcano, causing warming of some zones at the right slope of the glacier valley and increasing of fumaroles gassing; increase of precipitation and decrease of ice ablation. Reconstruction of the last surge of Kolka Glacier is made based on longstanding authors' experience in studying dozens of pulsation glaciers worldwide, longstanding IGRAS scientists' experience in studying Kolka Glacier, data from RAS and RAO EES Rossia seismological stations, photos and evidence of eye-witnesses. Suggestions of one-time fall of slope glaciers or rock block are not backed up by facts. Falls of slope glacier substance continued from 14 July till 2 September while rock falls continued from the middle of July 2002 till September 2003. Accumulation of a minimal critical mass on the back side of the glacier resulted in its surge, which happened at the end of the first decade, in August. Over the next 5 weeks the withdrawal zone of the glacier continued to be filled with ice and rocks. As a result, high tension occurred. Morphological features of Kolka Glacier are: direction of ice flow from the right slope to the left border moraine with a jerky turn at 90°; a narrow valley with a turn at 60° affecting the ice movement, resulting in the accumulation of a huge critical mass with the subsequent spiky and rapid movement. The surge began at 28 August 2002 with the culmination within the period from 13–20 September 2002. That culmination consisted of three stages. The gas–hydraulic blow at the foot of the back side of the glacier became the original cause of the catastrophe. It happened early in the morning of 20 September. Rapid sliding of ice began at 19.43. The glacier began its movement from the turn of the valley, as in 1902 and 1969. The sliding continued for 26 minutes, until the ice front reached the right slope of the valley. Then, after striking the left slope at a speed of 60 km/h the mud flow gathered speed up to 140 km/h in the straight trough.

Climatic factor of surge of Kolka Glacier, Caucasus, 2002

I.M. Lebedeva, O.V. Rototaeva, IGRAS

The unexpected advance of a Kolka Glacier in 2002 was promoted by basic changes in the climate of the Caucasian region. In the beginning of the 1990s there was a sharp change of epoch of northern meridional circulation of atmosphere on southern meridional one. The unprecedented flow of the Mediterranean cyclones has brought steady warming. Summer air temperature in the glacier basin exceeded the norm for 7 years before the advance, sometimes by up to 2°C, for the first time for 100 years. The account of water balance for these years has shown that water volumes in glacier basin were twice as large as the average. Under and in the glacier too much water has accumulated. Drainage has also occurred in part of a firn field above the glacier, where the strength of firn has decreased. The negative mass balance during the last decade has stopped the process of accumulation of superfluous weights of ice glacier body resulting to a motion. However it is possible that it could partially be compensated by an unusual volume of ice and rock falls on the glacier in summer and autumn of 2002 as well as activation of the endogenic process of Kazbek volcano massif.

Glaciers recession on Elbrus in the 20th century

E.A. Zolotarev, A.A. Aleynikov, E.G. Khar'kovets, MSU

Using digital technology, materials of the aerial survey of Elbrus glaciation of 1997 and a map of glaciation, of 1:10 000 scale, compiled by materials of phototheodolite survey during IGY at the Laboratory of Aerospace Methods, Department of Geography, Moscow State University, have been processed. High-accuracy measurements of different-time digital models made it possible to identify dimension of glaciation for the survey and its change over the time period between them with relative error not exceeding a fraction of a percent. On the basis of different-time digital models, the map of changes of Elbrus glaciation dimensions, including its firn area, was compiled, and it clearly presents unevenness of these changes. Considerable decrease of glaciation took place on the southern and eastern slopes of Elbrus while some glaciers of the northern and western slopes increased in size. For estimation of glaciation decrease during the 20th century the results obtained were compared with a map of 1:42 000 scale compiled by materials of plane-table survey at the end of the 19th century. It turned out that over the whole past period decrease of glaciation area was going on rather evenly, its annual rate was 0.188 $km^2 a^{-1}$ over 1887–1957 and 0.190 $km^2 a^{-1}$ over 1957–1997, which make it possible to assume a natural rather than anthropogenic cause of global warming.

Djankuat Glacier in the last 34 years (1967/68–2000/01)

V.V. Popovnin, D.A. Petrakov, MSU

Mean mass balance value is slightly negative (–160 mm w.e.), with average accumulation and ablation values coming to 2410 and –2570 mm w.e., correspondingly. As a result, orthogonal projection of the Djankuat Glacier area on the northern macro-slope of the Main Caucasian Range decreased by 12% in

1968–1999, while its surface lowered slightly less then by 6 m (in water equivalent). Variability of both mass balance components is practically the same at the Djankuat Glacier. Mass balance extrema coincide with the years of maxima of its components. The whole 34-year-long observation period is remarkable by trends towards growth of both balance constituents, well-pronounced for accumulation and weak for ablation. Dominant tendency towards the improvement of the Djankuat Glacier budget conditions have changed since 1998. It is not clear whether this pattern indicates the beginning of the new stage of glacier degradation in the Caucasus or it should be regarded only as a natural fluctuation of atmospheric processes.

Shallow ice-core drilling of the Gregoriev Ice Cap, Tien Shan

V.N. Mikhalenko, M.G. Kunakhovich, S.M. Arkhipov, S.S. Kutuzov, IGRAS; F.F. Fayzrakhmanov, ITP; O.V. Nagornov, MEPHI; L.G. Thompson, BPRC; A.N. Dikikh, R.A. Usubaliev, IGK

The 2001 and 2003 ice cores have been analysed for stable isotopes and concentration of radionuclides (^{40}K, ^{226}Ra, ^{232}Th, ^{235}U, ^{238}U, ^{137}Cs, ^{90}Sr). Ice cores have been dated on the base of set of reference horizons and annual microparticle concentrations. The detailed stratigraphic records for the top sections of the 1990 and 2001 cores indicate that 3.8 m of snow/firn accumulated in the 11 years. The mean annual net accumulation derived from this comparison is 0.35 m in ice equivalent (i.e.) (260 mm w.e.) for the period 1990–2001. The net accumulation 1963–1990 was 0.42 m i.e. (320 mm w.e.). Moreover decrease of firn pack depth from 9 m to 6 m has been observed at 4450 m site between 1962 and 2003. Over the same period infiltration ice concentration has been increased as a result of more intensive melt water percolation. Considerable enrichment in stable isotope composition for the top section of the 1990 and 2003 ice cores has been measured. Temperatures were measured in the boreholes on the top of the Gregoriev Ice Cap (4609 m) in 1990, 2001 and 2003. Their comparison shows an approximate 1°C warming at 10 m depth between 1990 and 2003. Likewise considerable warming has been measured in boreholes drilled at 4450 m in 1962 and 2003. The temperature rise is ~2.5°C at the depth 10 m and 0.5°C at 30 m. The comparison of airborne images from 1956 and 1988 and satellite image from 2001 show considerable retreat of glacier terminus since 1956. This rate of retreat is compared to that determined from the little ice age moraine positions.

Tree-ring and ice-core record combination for paleoclimatic reconstructions in the Tien Shan, Kamchatka, and Taymir/Franz Josef Land /Severnaya Zemlia

O.N. Solomina, V.N. Mikhalenko, M.G. Kunakhovoch, IGRAS; O.V. Nagornov, MEPHI

Both tree-rings and ice-cores records belong to the climatic proxy of the new generation with annual or sub-annual resolution. The weakness of tree-ring records is the lack of the long-term climatic signal, in order to remove the biological (growth) trend. In contrast the ice-core records may lose the annual accuracy due to the occasional melting and/or reworking of fresh snow. Therefore tree-ring could provide the ice-core records with the external annual chronological control, whereas the ice-core data (including measured borehole temperature) would be useful for checking and improving of the long-term climatic signal recorded in the tree-ring time series.

Glaciers of the Urals

A.F. Glazovsky, G.A. Nosenko, D.G. Tsvetkov, IGRAS

The Urals is the region of Russian subarctic glacier monitoring system. In spite of the small sizes (up to 1 km^2) of present-day glaciers, the research of Polar Ural glaciers has fundamental scientific meaning for the understanding of current climatic changes. In 1953–1981 glaciers were covered by ground topographical and air photogrammetric survey researches of oscillations of the glaciers' form and sizes. The data of air survey 1953, 1960, 1968 and 1973 (1:15 000–1:30 000) were also used. The remote sensing data from Terra (2000–2003) have allowed us to prolong this series of observations and to receive the new data about glaciers. The comparison of the obtained results to the observational data of previous years has allowed us to make a conclusion about a continuing degradation of the glaciers and possible full disappearance of them in the coming decades.

Current state of small glaciers on northern scarp of Lamskie Mountains (Putorana Plateau)

N.V. Kovalenko, V.V. Popovnin, MSU)

Small forms of glaciation are concluded to have features both of glaciers and snow-patches. Their recent evolutionary stage can be characterized as slow degradation. The areas of the glacier forms under investigation reduced by 12–18% for the last 30 years according to the aerial photographs and the present GPS-survey.

New data on glacier extent during the last Upper Pleistocene glaciation in Southeast Kamchatka

V.L. Leonov, D.V. Kobrenkov, IVS

New data on the last Late Pleistocene glaciation in Southeast Kamchatka are presented. It is shown that the glaciation was of the sheet or reticulated type, but

not of the mountain-valley type. The article contains the information on the areas and the types of glaciers as well as several tables. The largest glaciation centers in the Eastern mountain range, in the Volcanic Belt and in the Eastern peninsulas of Kamchatka were related with the highest mountain massifs. The area of glaciation in Southeast Kamchatka on the whole and in some individual areas in particular decreases with the reduction of the mountain altitude. The glacier distribution of the last Late Pleistocene glaciation emphasizes the existence of the peninsula transverse raises, which stretch on the tens of kilometers inwards of the peninsula.

Mathematical model of large-scale mudflow and glacier disasters

A.N. Bozhinsky, MSU

The examination of parameters of large-scale debris flows and possible water–ice–debris flows originating due to glacier surges was carried out using the mathematical model of motion of a two-phase debris flow. In the model, the separate motion of phases (water and debris inclusions) and their interaction into the flow is taken into account. The model describes decay of a debris flow in a stage of deceleration and deposition of a debris material. Using the model, the catastrophic debris flow at Tyrnyaus in 2000 is described. During calculations, the influence of side water inflows concentrated in the river Sakashily-su was taken into account. The distributions of the basic dynamic characteristics of the flow along its length are obtained. The flow velocities and depths at various sections, and run-out distance of the debris flow and volumes of debris depositions are defined. The outcomes are compared with available field data. For section, relevant to the beginning of the anti-debris flow chute, the statistical modelling, by the Monte-Carlo method, of dynamic characteristics of the debris flow is carried out. The histograms and distribution functions are constructed, on which it is possible to estimate a probability of realization of values of flow parameters. The possible description of the ice catastrophe at Karmadon valley in 2002, also using the two-phase debris flow model, is made. The ice and debris inclusions were considered as a uniform solid phase with an average density. As original impulse initiating the flow, the downfall of a hanging glacier was assumed. An ice avalanche simulated this short-term process. A series of numerical experiments using the model of the two-phase debris flow have allowed us to estimate characteristic velocities of motion, flow depths, first passage time by front of a stream in Karmadon Gate and volume of ice–debris depositions. The essential influence of volume of water in the Kolka glacier on the velocity and run-out distance of water–ice–debris flow is established.

SNOW COVER

Long-term variability of snow cover and fluctuations of river runoff in Northern Eurasia

V.V. Popova, IGRAS

Mean snow depth for February and annual runoff data (1936–2001) for five river basins: Volga, Northern Dvina, Ob, Yenisey and Lena, are analysed in order to evaluate impact of interannual snow depth variations on changes of annual runoff and to reveal tendency of the snow accumulation over the basins and associated runoff changes during last decades, characterized by more frequent positive NAO anomalies and global warming. Based on snow depth time-series for the grid points (with 5x5o resolution) corresponding to the river basin areas, patterns of spatial distribution of the following three parameters have been derived: mean snow depth; difference between average snow depth anomalies for the years with INAO >1 and INAO ≤1; correlation coefficient between snow depth and annual runoff. For the long Volga runoff time-series (1879–1995), variance spectrum and coherency function with winter NAO variations were estimated. Besides that, the cross-correlation and auto-correlation functions were estimated for all the basins.

Although the investigated river basins extend over the regions of influence of different circulation modes, for almost all of them NAO signal seems to be significant in the spatial distribution of the snow accumulation and interannual variations of the basin-averaged snow depth. In spite of the low correlation coefficients, decadal variations of the snow depth are reflected in the annual runoff. At the same time, the long-term changes of snow depth and runoff do not coincide for the entire period. This might be explained by significant share of summer precipitation variations, which is relatively high over Volga, Ob and Lena basins. Besides that, the positive trend of snow depth from the beginning of the period investigated did not coincide with runoff time-series, and might be associated with increase of spatial density of the data. Nevertheless, the positive trend of Volga and Yenisey runoff since 1970s is caused by increased frequency of positive NAO anomalies.

Characteristic effects of snow cover variability on air surface temperature dynamics

L.M. Kitaev, IGRAS; B.G. Sherstykov, WDC; O. Kruger, H. Hobe, MPI

Features of influence of snow cover upon dynamics of air temperature in autumn and spring at the moments of formation and melting of snow cover have been studied for Northern Eurasia. A method of estimation of air changes under formation and destruction of snow cover is proposed. The fall in temperature at the moment of snow cover appearance is 1.5°C on average, and destruction of snow cover in spring causes a rise inb temperature also by

1.5°C. For key sites in the south of Eastern Siberia, which include different vegetation communities, regularities of conjugate changes of snow thickness and air temperature have been determined. Higher average annual temperatures in winter and greater trend of their changes are characteristic of taiga areas, which in its turn can determine the least annual increase of snow cover. It can be explained by low albedo of taiga areas. After formation of snow cover, differences in albedo of different types of surfaces decreases, and negligible differences in temperature correspond to it. Especially strong negative temperature anomalies are registered at the beginning of winter in taiga, and in spring there are the least positive air temperature anomalies there, also albedo of the very coniferous forests is small and warming should be great within the taiga areas. It can be supposed that considerable snow masses of taiga areas and their long melting favor it.

Long-term changes of snow cover period in the Arctic

V.F. Radionov, E.I. Aleksandrov, V.R. Bayborodova, N.N. Bryazgin, A.A. Dement'ev, AARI

The study is based on the snow data and air temperature and precipitation measurements at the Arctic stations located on the coast and islands for 1951 to 2002 as well as at the drifting stations in the Arctic Basin for 1954–1991. During this period a steady tendency of the increased number of the days with snow cover was observed at most stations of the Eurasian sector of the Arctic, and on the contrary a trend for the reduced duration of the snow cover is observed at the stations of the North American sector. For time intervals of less than 52 years, the tendencies for the changes in snow cover duration in individual regions of the Eurasian Arctic are different. In particular over the last decade, its increase is observed in the Kara Sea area and vice versa its decrease is recorded in the East-Siberian and the Chukchi Seas. These tendencies are in good agreement with the temperature and precipitation trends. Earlier snow cover formation is noted for the entire Arctic coast of Eurasia. This is consistent with a below zero air temperature trend in the autumn season. At the same time there is a tendency for an earlier decay of the stable snow cover, which is also in good agreement with positive tendencies of long-term air temperature changes in spring.

Dynamic of snow storage in the Caucasus and submountain areas

.A. Volodicheva, A.D. Oleynikov, MSU; L.M. Kitaev, A.N Krenke, IGRAS

The general trend of snow cover increase in Caucasus reveals significant growth in the north and west of piedmonts, insignificant growth in the Greater Caucasus, and decrease in the eastern sector. The gain of snow cover of the Main Caucasian Ridge considerably exceeds a gain on plain: 0.500 and 0.084 cm a^{-1} that may be caused by the general difference of snow cover at mountains and plain determined by topography and meteorological regime. For the Greater Caucasus and its piedmont the extreme snowfall values governing 4–8% of cases with outmost moisture deficiency or excess are revealed. Values of snowfall which theoretically might result in catastrophic disastrous humidity or aridity are determined.

Study of isotopic fractionation in solid precipitations

S.A. Sokratov, V.N. Golubev, V.N. Konishchev, D.M. Frolov, A.V. Shishkov, MSU; Kang Shichang, Zhou Shiqiao, ITP

The work is directed to understanding the effects of postdepositional processes in natural snow cover on isotopic content of buried ice (glaciers, ice wedges). The investigation combines laboratory studies of snow stable isotopes change as the result of evaporation, snow recrystallization and melting, with field data collection on intraseasonal changes of isotopic content in snow cover. The results are expected to be used for improving of models of paleoclimate reconstructions based on ice cores and permafrost data.

Influence on snow vertical structure on hydrothermal regime and snow related economical aspects in Northern Eurasia

A. Shmakin, IGRAS; K. Rubinshtein, HMC; V. Golubev, MSU; M. Petrov, IGG; Z. Kostka, IHSAS; M. Breiling, VUT

The project aims to find ways to account for a vertical structure of snowpack in climate models and to estimate the snow cover effect on climate change and hydrothermal regime of the Northern Eurasia territory. At final stage the effect of the snow cover is planned to be interpreted in terms of its economical meaning. The study includes development of dynamical intra- and inter-year classification of snow cover at different spatial scales.

Role of coastal hydrodynamic processes in formation of ground ice

S.A. Sokratov, V.N. Golubev, V.N. Konishchev, G.A. Rzhanitsyn, A.V. Shishkov, MSU

The project combines physical/mathematical modeling and field studies of formation of tabular ice by periodic change of ground water level caused by sea level change. The results support the idea that genesis of at least part of massive ice lenses observed in recent and historical coastal zones of territories with permafrost could be formed by such water level dynamics, thus explaining presently controversial data on isotopic and chemical composition of the ice and the incorporating ground.

ABBREVIATIONS

AARI: Arctic and Antarctic Research Institute, St Petersburg, Russia
ARRING: All-Russia Research Institute of Natural Gases and Gas Technologies, St Petersburg, Russia
BPRC: Byrd Polar Research Center, Ohio State University, Columbus, OH, USA
HMC: Hydrometeorological Centre of Russia, Moscow, Russia
IGG: Institute of Geology and Geophysics, Uzbek Academy of Sciences, Tashkent, Uzbekistan
IGK: Institute of Geology, Bishkek, Kyrgyzstan
IGPAS: Institute of Geophysics of Polish Academy of Sciences, Poland
IGRAS: Institute of Geography, Moscow, Russia
IGWU: Institute of Geography, Wroclaw University, Poland
IHSAS: Institute of Hydrology Slovak Academy of Sciences, Bratislava, Slovak Republic
ILTS: Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan
ITP: Institute of Technical Physics, Snezhinsk, Russia
ITP: Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China
IVS: Institute of Volcanology and Seismology, Russian Academy of Sciences, Petropavlovsk-Kamchatski, Russia
KSU: Kazan State University, Kazan, Russia
LGGE: Laboratory of Glaciology and Geophysics of Environment CNRS, Grenoble France
MEPHI: Moscow Engineering and Physics Institute, Moscow, Russia
MPI: Max Plank Institute, Germany
MSU: Moscow State University, Moscow, Russia
NERI: North-East Research Institute, Magadan, Russia
NIRC: Nansen International Research Center, St Petersburg, Russia
PMGRE: Polar Marine Geological Research Expedition, St Petersburg, Russia
PNPI: Petersburg Nuclear Physics Institute, St Petersburg-Gatchina, Russia
PUM: Polytechnic University of Madrid, PUM, Spain
RAE: Russian Antarctic Expedition, St Petersburg, Russia
SB: Station Biologique de Roscoff France
SPBU: St Petersburg State University, Russia
UCD: University of Copenhagen, Denmark
USP: University of Silesia, Sosnowiec, Poland
UST: AGH-University of Science and Technology, Krakow, Poland
VSEGEI: Geological Institute, St Petersburg, Russia
VUT: Vienna University of Technology, Austria
WDC: World Data Center for Hydrometeorology, Obninsk, Russia

Vladimir Kotlyakov and Vladimir Mikhalenko

International Glaciological Society

NOTES FROM THE JOURNAL *CHIEF EDITOR*

Efforts over the past 2 years to accelerate the publication time (i.e. total time from submission to publication) of *Journal of Glaciology* papers are now paying off. Most papers are now published well inside the 1 year limit we have been aiming for. The publication time improvement, however, has been due primarily to improvements in the processing and printing of papers in the IGS office, and we should all be thankful to Magnús and his staff in Cambridge for the efforts they have made over the past 2 years. As I have previously reported, the largest delay in publication is now the time spent by authors carrying out revisions following review. Also, some reviewers continue to take an unacceptable time.

I encourage all of you who are called upon to review papers from time to time to make every effort to return your reviews within a 3-week period. If you cannot provide reviews within this time scale, please discuss your time restrictions with the Scientific Editor, so that progress with the paper review process can be kept active at all times until the paper is published. Even more importantly, if you are an author, make your revisions and responses to reviews your top priority once you receive the reviews. This is the only way we can substantially improve publication time. Delays in your own paper mostly affect your own publication time but also do damage to the reputation of the *Journal*, so it is in all our interests for these times to be kept to a minimum.

Most of you will by now have seen that the *Journal* and *Annals of Glaciology* are available on line. Furthermore, each *Journal* paper is now published on the Web as soon as it is finalised. I think this is a fantastic new facility provided by IGS and I encourage all to have a look at what is now available from the IGS web site. Further improvements are coming also, including electronic submission and reviewing of manuscripts.

Last year, 2006, we had a record number of submissions to the *Journal* – 122 papers. This is great news, but of course it does put extra pressure on the Editors, IGS staff and those of you who are asked to review papers. We have been getting tougher on authors, however, to help limit the work load. I have recently been more strict with the quality of the English in submitted publications. I do not believe we can afford any longer to accept papers that are not written in concise, high-quality English. I have spent many hundreds of hours (I do not exaggerate) correcting the English in papers submitted to the *Journal* (including sometimes, those written by scientists for whom English is the first language). None of us can afford that amount of time and unfortunately, therefore, I have little choice but to reject papers that cannot be clearly understood. While I do understand the financial limitations for many scientists and glaciological institutions, I strongly encourage authors for whom English is not the first language to seek assistance from a person who can ensure that manuscripts are written in clear, concise English. Furthermore, I believe it would be very worthwhile for institutions to employ an English-speaking person to carry out this task for all papers intended for publication in the international literature.

Jo Jacka

JOURNAL OF GLACIOLOGY

Papers accepted for publication between 1 October 2006 and 31 December 2006. The papers are listed in alphabetical order by first author.

Eleanor S. Boyce, Roman J. Motyka, Martin Truffer
Flotation and retreat of a lake-calving terminus, Mendenhall Glacier, southeast Alaska

Jacqueline Caplan-Auerbach, Christian Huggel
Precursory seismicity associated with frequent, large avalanches on Iliamna Volcano, Alaska

M. Dickinson, D.C. Mallard, P.J. Heard
Instruments and Methods: Application of cryo-SIMS to the analysis of polar ice

Kenneth Hewitt
Tributary glacier surges: an exceptional concentration at the Panmah Glacier, Karakoram Himalaya, Inner Asia

Matthias Huss, Andreas Bauder, Mauro Werder, Martin Funk, Regine Hock
Glacier-dammed lake outburst events of Gornersee, Switzerland

Julia Jaenicke, Christoph Mayer, Kilian Scharrer, Ulrich Munzer, Agust Gudmunsson
The use of remote sensing data for mass balance studies at Myrdalsjokull ice cap, Iceland

Hansruedi Maurer, Christian Hauck
Instruments and Methods. Geophysical imaging of apline rock glaciers

Carolyn A. Moeller, D.M. Mickelson, M.P. Anderson, C. Winguth
Groundwater flow beneath late Weichselian glacier ice in Nordfjord, Norway

Jacob Napieralski, Alun Hubbard, Yingkui Li, Jon Harbor, Arjen P. Stroeven, Johan Kleman, Göran Alm, Krister N. Jansson
Towards a gis assessment of numerical ice sheet model performance using geomorphological data

Rachel Obbard, Ian Baker
The microstructure of meteoric ice from Vostok, Antarctica

Thomas H. Painter, Noah P. Molotch, Maureen Cassidy, Mark Flanner, Konrad Steffen
Instruments and Methods: Contact spectroscopy for determination of stratigraphy of snow optical grain size

Manuela Pelfini, Maurizio Santilli, Giovanni Leonelli, Mauro Bozzoni
Investigating surface movements of debris-covered miage glacier (western Italian Alps) using dendro-glaciological analysis

Rickard Pettersson, Peter Jansson, Hendrik Huwald, Heinz Blatter
Spatial patterns and stability of the cold surface layer of Storglaciaren, Sweden

Martin Stuefer, Helmut Rott, Pedro Skvarca
Glaciar Perito Moreno, Patagonia: climate sensitivities and glacier characteristics preceding the 2003/04 and 2005/06 damming events

B. Turnbull, J.N. McElwaine
A comparison of powder snow avalanches at Vallee de la Sionne with plume theories

C.J. van der Veen, K.C. Jezek, L Stearns
Shear measurements across the northern margin of Whillans Ice Stream

Qinghua Ye, Shichang Kang, Feng Chen, Jinghua Wang
Monitoring glacier variations on Geladandong mountain, central Tibetan Plateau, from 1969 to 2002 using remote-sensing and GIS technologies

Zhang Yong, Liu Shiyin, Ding Yongjian
Glacier meltwater and runoff modelling, Keqicar Glacier, southwestern Tianshan, China

ANNALS OF GLACIOLOGY, VOLUME 44

Since the publication of ICE 140, the following papers from the International Symposium on Sea Ice held in Dunedin, New Zealand, 5–9 December 2005 have been accepted for publication in Annals of Glaciology *Vol. 44, edited by Patricia J. Langhorne and Vernon A. Squire*

Dmitri V. Alexandrov, Alexey P. Malygin and Irina V. Alexandrova
Solidification of leads: approximate solutions of nonlinear problem

W. D. Hibler III, J. K. Hutchings and C. F. Ip
Sea-ice arching and multiple flow states of Arctic pack-ice

M. Johnston
A comparison of physical properties and strength of decaying first-year ice in the Arctic and sub-Arctic

ANNALS OF GLACIOLOGY, VOLUME 45

The following papers from the International Symposium on Earth and Planetary Ice-Volcano Interactions held in Reykjavík, Iceland, 19–23 June 2006, have been accepted for publication in Annals of Glaciology *Vol. 45, edited by Garry Clarke and John Smellie*

Nuria Andrés, Jose J. Zamorano, Jose J. Sanjosé, Alan Atkinson and David Palacios
Glacier retreat during the recent eruptive period of Popocatépetl volcano (Mexico)

Carl Benson, Roman Motyka, Stephen McNutt, Martin Lüthi, and Martin Truffer
Glacier–volcano interactions in the north crater of Mt Wrangell, Alaska

Matthias Bigler, Anders Svensson, Jørgen Peder Steffensen and Patrik Kaufmann
A new continuous high-resolution detection system for sulphate in ice cores

Benjamin Brock, Andrés Rivera, Gino Casassa, Francisca Bown and César Acuña
The surface energy balance of an active ice-covered volcano: Volcan Villarrica, southern Chile

Susanne Lilja Buchardt and Dorthe Dahl-Jensen
Estimating the BasalMelt Rate at NorthGRIP using a Monte Carlo Technique

Jonathan L. Carrivick
Modelling transient hydrodynamics and rapid landscape change due to a high-magnitude outburst flood: an example from Kverkfjöll volcano, Iceland

G.W. Evatt and A. C. Fowler
Cauldron subsidence and subglacial floods

Magnús T. Guðmundsson, Þórdís Högnadóttir, Arnór Bergur Kristinsson and Snëbjörn Gudbjörnsson
Geothermal activity in the subglacial Katla caldera, Iceland, 1999–2005, studied with radar altimetry

James W. Head III and Lionel Wilson
Heat transfer in volcano–ice interactions on Mars: synthesis of environments and implications for processes and landforms

Christian Huggel, Jorge Luis Ceballos, Bernardo Pulgarin, Jair Ramirez and Jean-Claude Thouret
Review and reassessment of hazards owing to volcano–glacier interactions in Colombia

Kristín Jónsdóttir, Ari Tryggvason, Roland Roberts, Björn Lund, Heidi Soosalu and Reynir Böðvarsson
Habits of a glacier-covered volcano: seismicity patterns and velocity structure of the Katla volcano, South Iceland

Harry J.R. Keys
Lahars from Ruapehu Volcano, New Zealand, and risk mitigation

D.W. McGarvie, J.A. Stevenson, R. Burgess and A.G. Tindle
Volcano–ice interactions at Prestahnúkur, Iceland: rhyolite eruption during the last interglacial–glacial transition

Bergrun A. Oladottir, Thor Thorðarson, Gudrun Larsen and Olgeir Sigmarsson
Did the Mýrdalsjökull ice-cap survive the Holocene thermal maximum? Evidence from sulfur contents in Katla tephra layers (Iceland) from the last ~8400 years

Stephen F. Price and Joseph S. Walder
Modeling the dynamic response of a crater glacier to lava-dome emplacement: Mount St Helens, Washington, USA

Andrew J. Russell, Andrew R. Gregory, Andrew R.G. Large, P. Jay Fleisher, and Timothy D. Harris
Tunnel channel formation during the November 1996 jökulhlaup, Skeiðarárjökull, Iceland

Kilian Scharrer, Christoph Mayer, Thomas Nagler, Helmut Rott, Ulrich Münzer and Ágúst Gudmundsson
Effects of ash-layers of the 2004 Grímsvötn eruption on SAR backscatter in the accumulation area of Vatnajökull

J.C. Thouret, J. Ramirez C., B. Gilbert-Malengreau, C.A. Vargas, J.L. Naranjo, J. Vandemeulebrouck, F. Valla and M. Funk
Volcano–glacier interactions on composite cones and lahar generation: the Nevado del Ruiz (Colombia) case study

Hugh Tuffen, David W McGarvie and Jennie Gilbert
Will subglacial rhyolite eruptions be explosive or intrusive? Evidence from analytical models

Joseph S. Walder, Richard G. LaHusen, James W. Vallance and Steve P. Schilling
Emplacement of a silicic lava dome through the crater glacier: Mount St. Helens, 2004–05

Brian C. Welch, Kieran Dwyer, Michael Helgen, Christopher F. Waythomas and Robert W. Jacobel
Geophysical survey of the intra-caldera icefield of Mt Veniaminof, Alaska

Lionel Wilson and James W Head III
Heat transfer in volcano-ice interactions: synthesis and applications to processes and landforms on Earth

Thomas Zwinger, Ralf Greve, Olivier Gagliardini, Takayuki Shiraiwa and Mikko Lyly
A full Stokes-flow thermo-mechanical model for firn and ice applied to the Gorshkov crater glacier, Kamchatka

Corrections and errata

In *Annals 42*, published last August, two errata have surfaced.

In the paper Hodson A.J., J. Kohler, M. Brinkhaus and P.M. Wynn. 2005. Multi-year water and surface energy budget of a high-latitude polythermal glacier: evidence for overwinter water storage in a dynamic subglacial reservoir, pages 42–46, the name of one author was omitted. The fourth and missing author is Peter Wynn and his affiliation is:
School of Geography Earth and Environmental Sciences
University of Birmingham
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His email is p.m.wynn@bham.ac.uk

The paper needs to be cited thus:

Hodson A.J., J. Kohler, M. Brinkhaus and P.M. Wynn. 2005. Multi-year water and surface energy budget of a high-latitude polythermal glacier: evidence for overwinter water storage in a dynamic subglacial reservoir, *Annals of Glaciology*, **42**, 42–46.

Second, the imprint page of *Annals 42* accidentally contains the *Annals 41* ISBN number. The correct numbers are as follows. Please inform your library.

***Annals* 41**
ISBN 0-946417 36 9

***Annals* 42**
ISBN 0-946417 37 7

A REPORT FROM THE REYKJAVÍK SYMPOSIUM

The International Symposium on Earth and Planetary Ice–Volcano Interactions,
19–23 June 2006

The Reykjavík Symposium combined science, social activities and scenery to form a well-balanced and memorable whole. The talks were on topic and several of them gave me ideas that I would like to apply in my research; however, in this report I am going to focus on the social and scenic aspects of the symposium.

Pre symposium adventures

I arrived from the States to a dank, gray and misty Saturday morning in Reykjavík. For me it was the day before registration, but for Icelanders it was Independence Day. On 17 June 1944 Iceland officially became a republic, although it had been sovereign from Denmark since 1 December 1918. The Icelanders' celebration of independence began with speeches and flags, but it was the live music and performances that held my attention. There was a belly dancing performance that was particularly noteworthy, in part because the lead dancer was pregnant. I had never seen a pregnant belly dancer before. She was a very good dancer and the show was a big hit with the crowd. The pregnant dancer gave me a window into things to come, for in the following days I saw more small children and pregnant women than I have ever seen before in a Western nation. According to *Statistics Iceland* there is a high birth rate in Iceland: 15 live births per 1000 residents per year.

Figure 1 Belly dancers celebrating Independence Day

Sunday registration and slideshow

The registration went smoothly and the beverages provided helped pass the time pleasantly while we waited for the start of Oddur Sigurðsson's slideshow. The photos from the slideshow were amazing. They really made me look forward to the midweek trip and opportunities to see more of Iceland firsthand.

First day

The President of Iceland, Ólafur Ragnar Grímsson, opened the conference and spoke to us of the importance of communicating outside of our disciplines and conveying the import of our research to the public. Other introductory speeches were made by IGS President A. Ohmura and the rector of the University of Iceland (Háskóli Íslands), Kristín Ingólfsdóttir.

The icebreaker was a pleasant wrap up to the first day of talks. It was held at the Reykjavík City Hall, built into the Tjörnin pond. There were ducks, geese and gulls floating at knee height outside the windows. In the lobby there was a large three-dimensional model of Iceland. It was so large that I could only see the edges clearly and the center was lost in the miniature distance. The wine was good and there was a selection of hors d'oeuvres that were both familiar and more traditionally Icelandic. I liked the smoked salmon on flat bread in particular.

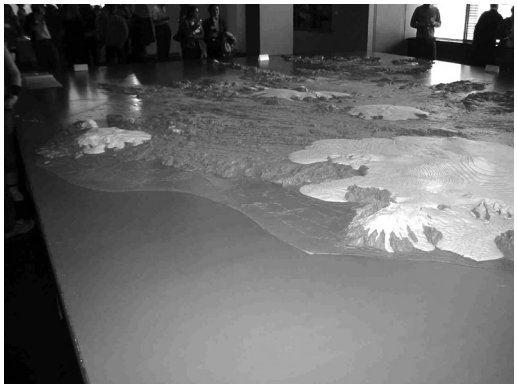

Figure 2 Map of Iceland in Reykjavík City Hall

Second day – dinner at the Icehouse

After a full day of lectures I went to the Ice Bar with my supervisor and several others. There I found the most extensive fish buffet I have ever seen. My supervisor counted seven types of halibut among the many offerings. There were salmon and some other type of dark red meat that we were unable to identify, but it was all tasty. During the dinner we were puzzled to see people in bulky poncho-shaped overcoats walking by. It was not until dinner was over that we discovered the

reason for the name 'Ice Bar'. There were literally tables and benches made of ice in an insulated room, and patrons of the bar would put on the special overcoats to enjoy the icy atmosphere.

Figure 3 Fish buffet at the Ice Bar

Third day – midweek excursion

The midweek excursion was a geological variant of the popular Golden Circle route, and the natural scenery was as awe-inspiring. Magnús T. Guðmundsson provided the trip commentary, which was both geologic and historic. The trip started with one of a field geologist's favorite places, a quarry. In the quarry the basalt was well exposed. There were pillows with glassy quenching rinds that showed classic radial fracturing. On the way to Hengill geothermal region we passed a number of hyaloclastic ridges and table mountains, many of them showing evidence of being polygenetic. There was a scenic if windy stop between Hengill and Thingvallvatn that had plumes of steam rising from below the hill and a good view of the lake and the surrounding mountains.

Our next stop combined cultural, historic, and geologic interests. Thingvellir is the site of the first parliament, which was founded around AD 930. From a geologic point of view it is a fissure zone that is part of the on-land expression of the mid-Atlantic spreading center. Nearby, there were lovely aquamarine pools in deep clefts in the black basalt. On the way to our next stop at Gullfoss, Magnús Guðmundsson pointed out a couple of shield volcanoes and told us that one of them probably contained a hyaloclastite core because its density was lower than expected for basalt. This was another example of the controls of eruption environment on the resultant volcanic features.

Gullfoss was amazing. It was a beautiful waterfall in and of itself, but the light was superb and a rainbow hung in the mist above the cataract. We followed the waterfall by visiting Geysir. Magnús Guðmundsson offered to buy all the people on the trip a drink if Geysir, the geyser for which all geysers are named, erupted. Magnús Guðmundsson kept his money, although we did see Strokkur, a nearby geyser, erupt several times. There was a lovely dinner ready for us across the street from the geysers at the Geysir Hotel. All in all, it was a very nice fieldtrip.

Figure 4 Strokur erupting

Fourth day

The Thursday night banquet on Videy Island was very nice, with both a pleasant atmosphere and good food and drink. The hall was the first stone building constructed in Reykjavík. The thick walls and solid wooden beams overhead gave the dining room a comfortable feel. Outside the grass was thick and green, and the basalt cliffs and cobble beaches provided a striking contrast between green and black.

Figure 5 Dessert at the Thursday night banquet on Videy Island

Friday night footie and revelry

Conferences often seem to lose much of their steam at the end, but this one kept right on rolling with interesting presentations right up to the last and a good-sized audience. It being Friday night,

many groups formed for a night out. There was World Cup footie to watch in the early evening and the start of runtar (the Icelandic pub crawl) in the late evening. I joined up with a group that visited a couple of the bars downtown for drinks and dancing. The beers were paler than I normally like, and expensive, but they were tasty. The dancing was fun and energetic. A fellow geologist, Stephanie Flude, showed off her tattoo of a trilobite, and she labeled it with a yellow sticky that had its scientific name and a scale bar. It was a fun night and a really good way to unwind from the week.

The Reykjavík IGS Symposium combined science, a good field trip, and abundant social opportunities for networking and fun. I can't think of a better combination for a conference.

Hunter Danque, University of Texas

Figure 6 Stephanie Flude, demonstrating her trilobite tattoo. Note the scientific name, *Calymene blumenbachi*, and scale bar on the yellow sticky

A REPORT FROM THE REYKJAVÍK SYMPOSIUM STUDY TOUR

Twenty people from seven countries took part in the 3-day-long study tour following the International Symposium on Earth and Planetary Ice–Volcano Interactions, held in Reykjavík, Iceland. The tour, which traversed southern Iceland, was led by Matthew Roberts of the Icelandic Meteorological Office and Haukur Jóhannesson of the Icelandic Geological Survey. True to both the theme of the symposium and Iceland's unique geological heritage, the tour took in features both glaciological and volcanological. Participants also visited historical sites reflecting the importance of geological phenomena for the inhabitants of Iceland.

Figure 1 20 people from 7 countries took part in the study tour

Iceland straddles two of the Earth's tectonic plates, the Atlantic and Eurasian, with plate divergence of 20 mm/a accommodated by two rift zones that cross the country from southwest to northeast. The first day of the tour, which departed from Reykjavík in fine weather on 24 June 2006, focused on exploration of the western rift zone. Leaving Reykjavík, the tour crossed basalts from several of the recent eruptions (12 within the last 1100 years) that have occurred on the Reykjanes Peninsula, then moved into terrain whose landforms, including tuyas (table mountains) and tindar ridges, are dominantly exhumed remnants of ice-contact volcanism. The typical geologic succession exposed in tuyas is a basal pile of pillow lavas overlain by hyaloclastite breccia and then capped by lava flows; tindars lack the capping lava flows. Tuyas and tindars are customarily interpreted to reflect an eruption that began in a meltwater-filled vault at the glacier base and, at least in the case of tuyas, culminated subaerially. Tuyas are particularly valuable for purposes of paleo-ice-sheet reconstructions, because their upper surfaces are thought to represent approximately the paleo-ice surface. Near the Hengill volcano, the tour visited the Nesjavellir geothermal power plant, which supplies hot (83°C) water to Reykjavík through a 27 km long pipeline.

Figure 2 The Nesjavellir geothermal power station

The hot water supplies the heating demands of roughly one-quarter of the inhabitants of Reykjavík and other nearby towns. In the rift zone to the northeast of Hengill, tour participants could see the lake Þingvallavatn, on whose northern shores lies Þingvellir, one of the most important places in Icelandic history, where in the year 930, the Alþingi, one of the oldest parliamentary institutions in the world, was founded, and where on 17 June 1944 the Republic of Iceland was proclaimed.

In the afternoon of 24 June, the tour visited the reconstructed medieval farmhouse in Þjósárdalur for a fascinating glimpse into the life of those who lived in southern Iceland 900 years ago and whose lives were disrupted by an eruption of the Hekla volcano. Continuing east, the tour then stopped for a most pleasant rendezvous with Helgi Björnsson and family at their summer home for a 'light tea' that featured a table spread with Icelandic delicacies. In their resulting happy state, tour participants proceeded onward to Hvolsvöllur to spend the night.

Figure 3 The group visited Helgi Björnsson's summer house for a taste of Icelandic delicacies

25 June was considerably more blustery than the previous day. The morning was spent primarily looking at features associated with the effects of subglacial volcanism, especially jökulhlaups, beginning at Mýrdalsjökull, the ice cap that overlies Katla volcano.

Figure 4 The group visited Sólheimajökull, a very accessible outlet glacier from Mýrdalsjökull

Volcanogenic jökulhlaups from Katla typically begin within only a few hours of the start of an eruption and escape from the ice cap along several pathways; like many jökulhlaups, those originating from Katla can be destructive of Iceland's ring road, the highway that circles the island.

Figure 5 The puffins most generously posed for pictures

Lunch was taken at the Dyrhólaey bird sanctuary in close proximity to puffins and other seabirds, after which the tour proceeded across the broad sandur (coastal plain), a geomorphically fascinating terrain shaped by lava flows and jökulhlaups. Lava flows that pass over wet sandy sediments give rise to 'rootless cones' as the water within the sediments turns to steam, pressure builds, and finally steam explosions occur. The resultant landscape is a dimpled one of mounds commonly

10–20 m high. Some of these fields of rootless cones formed in eruptions recorded by early human settlers of Iceland.

Figure 6 A field of rootless cones or 'fake craters' as they are known in Icelandic

Passing east of the rootless-cone fields, the tour went south of Vatnajökull, Iceland's largest ice cap, and across Skeiðarársandur, whose seemingly monotonous landscape of braided river channels is deceiving, of course: jökulhlaups from the subglacial lake Grímsvötn sweep the sandur with some frequency. The tour stopped for the night at an inn in Freysnes, near the eastern edge of the Skeiðarársandur.

Figure 7 Twisted girders of one of the bridges swept away in the 1996 jökulhlaup from the Grímsvötn caldera serve as a reminder of their devastating power

On 26 June, after a visit to the headquarters of Skaftafell National Park and a short hike, the tour proceeded eastward around the margins of one of the outlet glaciers of the Vatnajökull ice cap: Öræfajökull , another ice body capping an active volcano. Twice in historic times, in 1362 and 1727, eruptions beneath Öræfajökull triggered jökulhlaups that devastated human settlements.

Figure 8 Global warming? The post marks the 1988 position of this glacier

Continuing east, the tour crossed the sandur in front of the outlet glacier Breiðamerkurjökull, near sites of investigations by G.S. Boulton and others that triggered the modern-day interest in deformable glacier beds, and into terrain made dramatic in appearance by a succession of outlet valley glaciers draining Vatnajökull. The tour ended in the fishing village of Höfn, from which participants returned to Reykjavík by aeroplane.

Figure 9 Now where did we go?

Joseph S. Walder, US Geological Survey

IGS BRITISH BRANCH ANNUAL MEETING

2006: Keele University

This year's British Branch meeting was held at Keele University and hosted by Zoë Robinson and colleagues in Earth Sciences and Geography. The talks displayed the fascinating range of research underway in UK glaciology, but make writing a review like this rather difficult. In the first session there was jökulhlaup modelling (Jonathan Carrivick), karst development during Fenno-Scandian deglaciation (Trevor Faulkener), and Doug Benn's account of englacial channels in glaciers of the Nepalese Khumbu Himal. Furnished with many slides of eerie tunnels, crevasse fractures and bodies wriggling through what surely must be the claustrophobe's worse nightmare, Doug firmly illustrated why getting health insurance for in situ measurements of glacier hydrology remains important!

Peter Wynn then began a series of talks upon biogeochemistry in glacial environments, showing how natural abundance of stable isotopes in proglacial waters are indicative of microbial processes. Liz Bagshaw's informative look at the chemistry of Antarctic cryoconite holes was then followed up by Andy Hodson's quirky upscaling of this ecosystem, utilising High-Spy's remote control helicopters to gain aerial imagery of Midtre Lovenbreen's surface. Thereafter, Adrian Jenkins and Nick Rutter gave interesting accounts of snow physical processes. After the coffee break, talks then ranged from distributed modelling of mountain glacier mass balance (Katherine Arrell), through uncertainty in cloud observations over Greenland (Jennifer Griggs) to Alun Hubbard's pictorial account of the South Georgian terrain, inclement weather, and modelled glacier change. We then closed with an account of the interferometry of the Rutford Ice Stream and its calving line dynamics by Helena Sykes.

At the close of the third session, members made their way to the halls of residence and then swiftly convened on the wine and poster session. A very social pre-dinner drinks session then took place in the campus bar (and during the Annual General Meeting), taking advantage of the cheap drinks and short stumbling distance to the three course buffet that followed. Here several staff were on hand to take copious orders for a variety of identically priced bottles of wine. Most delegates promptly returned to the bar to continue 'festivities', which lasted until the small hours for the few, committed, 'usual suspect' all-nighters.

On the second day, turn out for the nine o'clock session was good – despite the frivolities of the preceding evening. The first session focused on the thermal regimes of snowpacks (Nick Rutter again), glaciers (David Rippin and Owain Bayley) and basal ice (Simon Cook). A glacier mass balance theme returned after coffee (Doug Mair, Jonathan Bamber and Andrew Wright), although Anne-Marie Nuttall's talk on teaching techniques offered more than a little distraction by using scantily clad Jordan and J-Lo to illustrate hypsometry – allegedly for undergraduate classes! Following lunch, Geoff Boulton and Sergei Zatsepin presented a slightly more mathematical slant on the audience with their Iceland mini-surge double act, followed by talks with a monitoring emphasis (Richard Hodgkins and Ruth Mottram) that included a subglacial sensor network (Jane Hart). The final session focused upon subglacial waters, with John Woodward discussing Lake Ellsworth, Anne Le-Brocq modelling subglacial water flow, Ed King describing geophysical evidence for water beneath Rutford ice stream and Tris Irvine-Fynn describing complex flowpaths through Midtre Lovenbreen.

The meeting closed as John Glen gave out the prizes for graduate student excellence to Owain Bayley for his oral presentation on near-surface ice temperature dynamics, and to Helen Freeman's poster regarding ice structure. Interestingly, both projects reported on data from Glacier de Tsanfleuron, Switzerland. All talks throughout the meeting kept to time well, in keeping with the smooth running of the entire conference. Although well attended, it was thought that more members of the British Branch could be encouraged to attend next year. The event at Keele was a very successful meeting, clearly enjoyed by all present, and thus a good example of why greater participation is worthwhile.

Tris Irvine-Fynn and Andy Hodson

Notes from the production team

New content on the IGS website
We continue to publish papers in PDF form on the IGS website as soon as they have been checked by the authors, proofread and corrected (see http://www.igsoc.org/journal/ and http://www.igsoc.org/annals/).

In addition, we have new, improved information for authors at http://www.igsoc.org/production/. This includes:

- general instructions for authors of *Journal* and *Annals* papers
- instructions on how to submit illustrations
- for TeX fans, a downloadable IGS LaTeX class file
- for authors submitting large or large numbers of electronic files, a link to the IGS ftp facility (or you can access this directly at ftp.igsoc.org). If you click on the link to the ftp site from the IGS website, it is sometimes necessary to refresh the page to bring up the logging in window. The User Name is 'igsoc'. Please apply to igsoc@igsoc.org for the password and we will e-mail it to you.

Send us your files
Would authors send us final electronic versions of the text and figures that make up their papers (via email or ftp) as soon as possible after acceptance. This will help us immensely in our aim to publish your papers with ever-increasing rapidity.

IGS staff changes

Last October, the IGS hired Margaret Margereson as an administrative assistant to Linda Gorman. Margaret is a former colleague of our Reference Editor, Rowena Baxter, at the Engineering Department of the University of Cambridge, where she was the Personal Assistant to the Head of Department. Her responsibilities included various administrative and secretarial duties. Adding her to our team will help Linda catch up with her backlog of invoices and various membership matters and ensure that our renewal notices will be sent out in a timely fashion and processed promptly when you respond to them.

In addition we have hired John Clegg, an English student at the University of Durham. He joins us during holiday breaks and helps wherever needed. His skills as a computer graphics person have proved very valuable to us and have helped us catch up on our *Journal* and *Annals* production.

INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on Snow Science

Moscow, Russia
3–7 September 2007

CO-SPONSORED BY:

Institute of Geography, Russian Academy of Sciences
Moscow State University
'Antistikhiya' Center of the Ministry of the Russian Federation
for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters
Apatit JSC
The Swiss Federal Institute for Snow and Avalanche Research
IUGG Commission for the Cryospheric Sciences

SECOND CIRCULAR

December 2006

Registered Charity

INTERNATIONAL GLACIOLOGICAL SOCIETY

The International Glaciological Society will hold an International Symposium on Snow Science in 2007. The symposium will be held in Moscow, Russia, with registration on 2 September and sessions from 3–7 September 2007.

SYMPOSIUM ORGANIZATION
Magnús Már Magnússon
(International Glaciological Society)

LOCAL ARRANGEMENTS COMMITTEE
V.M. Kotlyakov (chairman), S.A. Sokratov (co-chairman), A.N. Bozhinskii, V.R. Bolov, A.F. Glazovskii, M.Yu. Gnedovskaya, S.A. Dobrolyubov, N.S. Kasimov, N.I. Osokin, P.A. Chernous, A.L. Shnyparkov

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INFORMATION ABOUT THE SYMPOSIUM MAY BE OBTAINED FROM:
International Glaciological Society,
Scott Polar Research Institute, Lensfield Rd,
Cambridge CB2 1ER, UK.
Tel: +[44] (0)1223 355 974
Fax: +[44] (0)1223 354 931
Email: igsoc@igsoc.org
Web: http://www.igsoc.org/symposia/

A local symposium web site http://www.igs-moscow.org will be made active in January; access will also be possible from the symposium navigation page on the IGS website.

PARTICIPATION
This circular includes forms for registration and instructions for arranging accommodation. These can also be found on the symposium website. The registration form and accompanying payment should be returned by 3 June 2007. There is a surcharge for late registration. The participants' registration fee includes organisation costs, a set of abstracts, the icebreaker function, coffee breaks, the banquet, the mid-week excursion and a copy of the *Annals of Glaciology*.

Registration fees	UK£
Participant (IGS member)	270
Participant (not IGS member)	320
Student or retired IGS member	100
Accompanying person over 18	100
Late registration surcharge (after 3 August 07)	50

On-line registration will be through 'Monomax' travel agency web site http://www.onlinereg.ru/igs. Details on visa application, airport-Moscow transfers and accommodation will be available online starting January 2007.

Registration refunds will be made according to date of notification. Cancellations made before 3 July 2007 will receive a full refund. Cancellations between 3 July and 3 August 2007 will be eligible for 50% refund. After 3 August it may not be possible to make any refund.

THEME
Snow is a complex and short-lived sediment with many effects on its surroundings. The emphasis will be on the internal processes and external interactions of snow with natural and man-made systems.

A better understanding of the interfacial properties of snow is required to define exchange mechanisms that drive chemical, ecological and hydrological processes in many regions of the world. The snow interface also determines how roads, buildings, ski-pistes and other man-made systems are designed and used. How atmospheric interactions contribute to the formation of snow avalanches and other cold-region natural hazards will be a further conference topic, as will be snow in motion and modelling snow under static and dynamic loadings, since these are key issues in engineering problems. We hope to bring together researchers working on the physical properties of snow with scientists working on ecological, hydrological and engineering problems in which the understanding snow processes plays a key role. Snow will be examined at all scales – from the microscale of snow structure to the megascale of remote sensing. The conference theme is to pay homage to the International Polar Year 2007–2008.

TOPICS
The suggested topics include:

1. Observing and modelling of snow at different scales:
   a. Snow cover distribution and variability
   b. Snow and its stratigraphy
   c. Snow microstructure
   d. Scaling issues
2. Snow as a component of climate and of landscape:
   a. Snow-atmosphere interactions
   b. Snow-ground interaction
   c. Perennial snow cover in the Arctic, Antarctic and mountains
3. Snow physics and -chemistry
   a. Snow metamorphism- heat and mass transfer
   b. Snow chemistry and metamorphism
   c. Heat and mass transfer in snow
   d. Physical and mechanical properties of snows
4. Snow in motion
   a. Snow avalanches
   b. Snow drift
   c. Snow tribology
5. Snow engineering
   a. Avalanche engineering and warning
   b. Architecture and constructions in snowy regions
6. Snow and biosphere
   a. Vegetation
   b. Wildlife

SESSIONS AND POSTERS
Oral presentations will be held on four full days and one half-day. There will also be a poster session. The size of poster presentations will be given on the website nearer the dates of the symposium

The organizers plan to have 'round table' sections with preliminary topics:

- Snow science in International Polar Year
- Snow cover of northern Eurasia in currently changing climate

PUBLICATION
Selected papers from the symposium will be published by the Society in the *Annals of Glaciology*. All papers (including those based on posters) will be refereed and edited according to the Society's regular standards before being accepted for publication.

PAPERS
(1) Submission of abstracts
Participants who want to contribute to the Symposium should submit an abstract of their proposed presentation. This abstract must contain sufficient detail for its scientific merit and relevance to the symposium theme to be judged by the Editorial Board. A web site will be available at the beginning of 2007 where authors can upload their abstract and all the relevant contact information. The abstract itself should not exceed 400 words. References and illustrations should not be included.

You will be required to enter all your details with the submission and in particular to state whether you intend to submit a paper for publication in the *Annals of Glaciology*. We will only solicit referees for abstracts that have explicitly stated that they intend to submit a paper. Referees are a scarce commodity and we do not want to trouble them unnecessarily.

Those unable to submit their abstract via the internet can submit electronic files on a CD or diskette to the IGS office where a member of staff will upload them onto the web site.

Last date for receipt of abstracts: 12 March 2007

Final versions of papers accepted for publication should not exceed five printed pages in the *Annals of Glaciology*. Extra pages will be charged at the rate of UK £90 per page. Papers with colour figures will accrue page charges, at the colour rate of UK £150 for all pages. Honouring page charges (also £90 per page) for the first five pages in encouraged.

(2) Selection of abstracts
Each abstract will be assessed on its scientific quality and relevance to the Symposium theme. Authors whose abstracts are accepted will be invited to make either an oral or poster presentation at the Symposium and submit a paper for publication in the *Annals of Glaciology* (included in the ISI Science Citation Index®). First or corresponding authors will be advised by 30 April 2007 of the acceptance or otherwise; other authors will not be informed separately. Authors who have not received notification by that date should contact the IGS office in Cambridge in case their abstract was not received. Acceptance of an abstract means that the paper based on it should be submitted to the *Annals of Glaciology* and not to another publication. Note: abstracts alone will not be published in the *Annals of Glaciology*.

(3) Distribution of abstracts
A set of the accepted abstracts will be provided to participants upon registration on 2 September 2007.

(4) Submission of papers and publication
Manuscripts should be submitted electronically to the IGS office via e-mail or FTP. Papers should be prepared in accordance with the instructions sent to authors with the abstract acceptance notification and must be submitted as PDF's (portable document format). Authors who submit in other electronic formats will be asked to re-submit as PDF. Authors who are unable to transmit their paper electronically to the IGS can submit a copy of their manuscripts on a CD or diskette, to the Secretary General, International Glaciological Society, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, UK. All manuscripts should be submitted by 2 July 2007. ALL AUTHORS ARE EXPECTED TO ADHERE TO THIS DEADLINE. Papers will be refereed according to the usual standards of the Society before being accepted for publication. Final papers, based on presentations at the Symposium, which have been submitted and accepted by the Editorial Board following review, will be published in English in the *Annals of Glaciology* (Vol. 48). Final, revised versions of papers, diskettes and original art work must be submitted by 15 October 2007. Timely publication of the *Annals of Glaciology* will depend upon strict adherence to deadlines.

Last date for receipt of papers: 2 July 2007

Last date for receipt of revised papers: 15 October 2007

EXCURSIONS
In addition to the mid-week excursion in Moscow, a 'Golden circle' tour to some ancient Russian towns around Moscow is planned.

If enough participants are interested, a 2–3-day post symposium tour to St Petersburg will be organized. Details will be provided at http://www.onlinereg.ru/igs

ACCOMPANYING PERSON'S PROGRAMME
The accompanying person's registration fee includes the icebreaker, the banquet, and the mid-week excursion. The travel agency managing registration will be able to assist accompanying persons to make further arrangements.

LOCATION AND WEATHER
The symposium will take place in the building of the Presidium of the Russian Academy of Sciences, at the Moscow river bank close to the city centre (Leninskii prospect 32A), Moscow State University, and Gorky park.

The long-term mean temperature in Moscow in September is +11ºC, normally varying from +7 up to +16ºC, though the absolute minimum of –5ºC was recorded in 1976 and the absolute maximum of 29ºC was recorded in 1992. In recent years the September temperature has been slightly higher than the long-term mean. Mean humidity is 79%. Normally half of the days in this month are rainy and most are cloudy or partly cloudy.

TRAVEL AND ACCOMMODATION
Citizens of most countries need a visa to enter Russia. The two main types of visa are 'Business' and 'Tourist'. The local organizing committee strongly suggests 'Tourist' visa applications and the 'Monomax' travel agency can provide visa support. If a 'Business' visa is absolutely necessary for participation in the symposium, the local organizing committee must be informed as soon as possible.

Hotel accommodation in Moscow is expensive. The Local Organizing Committee has reserved rooms in three hotels at three different price-ranges for symposium participants. All are located within a reasonable distance from the conference venue. Details will be made available on the Monomax web page.

IMPORTANT DATES

Abstracts due	12 Mar 07
Notification of acceptance	30 Apr 07
Pre-registration due	30 Apr 07
Papers due	02 Jul 07
Deadline for full refund	16 Jul 07
Deadline for partial refund	18 Aug 07
Registration	02 Sep 07
Conference starts	03 Sep 07
Post-symposium tour starts	08 Sep 07
Final revised papers due	15 Oct 07

INTERNATIONAL GLACIOLOGICAL SOCIETY

International Symposium on Radioglaciology and its Applications

Madrid, Spain
9–3 June 2008

CO-SPONSORED BY:

SCAR Spanish National Committee
Ministerio de Educación y Ciencia
Universidad Politécnica de Madrid
ETSI de Telecomunicación

FIRST CIRCULAR

December 2006

Registered Charity

The International Glaciological Society will hold an International Symposium on Radioglaciology and its Applications in 2008. The symposium will be held in Madrid, Spain, from 9–13 June.

THEME
Radio echo-sounding of ice reveals the bed topography, the properties of the bed and the internal glacio-stratigraphy. In the 1970s and 80s the bed topography of the Antarctic and Greenland ice sheets were mapped using a relatively restricted range of frequencies, with analogue logging devices. Since then, ice-penetrating radar technology has developed, extending the frequency bands to target different parts and depths of glaciers, relating electromagnetic returns to the physical properties of the ice and bed, and using radar layers in forward and inverse models of ice flow.

The conference will encompass all aspects of radar-sounding of ice and glaciers and its applications to glaciology, earth science and climate studies. We will welcome studies from shallow and deep sounding of ice; how electromagnetic interactions affect satellite returns; satellite deep sounding of Earth and other planets; the physical interpretation of intra-glacial and basal returns; how crystal fabric affects electromagnetic wave propagation; snow and firn studies; estimation of accumulation rates from radar stratigraphy; synergistic coupling of radar sounding with other geophysical techniques; large-scale mapping and imaging of radar layers and basal reflections; electromagnetic modelling of radar sounding; flow modelling, dating and stratigraphic correlations from radar surveying.

TOPICS
The suggested topics include:

1. Deep sounding, including:
   Subglacial topography, ice-bed interface, bed structure, subglacial lakes, subglacial water channels, sounding subglacial material.
2. Internal structure, including:
   Internal stratigraphy and correlation of ice cores, detection of structures (buried crevasses, folding, faults, etc.), englacial water channels, polythermal structure, physical properties of ice (density-porosity, water content of temperate ice, etc.), electrical properties of ice, echo-free structure in ice.
3. Shallow sounding, including:
   Internal stratigraphy: snow, firn, superimposed ice, estimation of accumulation rates, sea ice.
4. Planetary/orbital sounding, including:
   Theoretical aspects, sounding ice masses from satellite, ice cover of Mars, Europa and Enceladus.
5. Numerical modelling (direct and inverse problems), including:
   Ice flow, dating layers, inversion of flow parameters.
6. Instrumentation and processing techniques, including:
   Radar equipment (coherent radar, synthetic aperture radar, etc.), complementary geophysical techniques, processing of radar data.
7. Theoretical and empirical aspects of propagation of electromagnetic waves in ice, including:
   Influence of ice fabric and physical properties, volume and interface scattering.

SESSIONS
Oral and poster presentations will be held on four and a half days. There will be ample opportunity for poster displays.

PUBLICATION
Selected papers from the symposium will be published by the Society in the *Annals of Glaciology*. All papers (including those based on posters) will be refereed and edited according to the Society's regular standards before being accepted for publication.

ACCOMMODATION
Details will be given in the Second Circular.

FURTHER INFORMATION
If you wish to attend the symposium please return the attached form as soon as possible. The Second Circular will give further information about accommodation, the general programme, and preparation of abstracts and final papers. Copies of the Second Circular will be sent to those who return the attached reply form. Members of the International Glaciological Society will automatically receive one.

SYMPOSIUM ORGANIZATION
Magnús Már Magnússon (International Glaciological Society)

SCIENCE STEERING AND EDITORIAL COMMITTEE
Richard Hindmarsh (Chief Scientific Editor), Don Blankenship, Howard Conway, Olaf Eisen, Shuji Fujita, Elisabeth Isaksson, Bob Jacobel, Yury Macheret, Tavi Murray, Francisco Navarro, Frédéric Parrenin, Frank Pattyn, Eric Rignot, Martin Siegert

LOCAL ARRANGEMENTS COMMITTEE
Francisco José Navarro (Chairman), Javier Jesús Lapazaran, María Isabel de Corcuera, María Luisa Cuadrado, Jaime Otero, Francisco Machío

INTERNATIONAL GLACIOLOGICAL SOCIETY

INTERNATIONAL SYMPOSIUM ON RADIOGLACIOLOGY AND ITS APPLICATIONS

Madrid, Spain, 9–13 June 2008

Family Name: _____

First Name(s): _____

Address: _____

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Tel: _____ Fax: _____

E-mail: _____

I hope to participate in the Symposium in June 2008 ☐

I expect to submit an abstract ☐

My abstract will be most closely related to the following topic(s):

_____

_____

I am interested in an accompanying person's programme ☐

I am interested in an extended post/pre-symposium tour ☐

PLEASE RETURN AS SOON AS POSSIBLE TO:

Secretary General, International Glaciological Society,
Scott Polar Research Institute, Lensfield Road, Cambridge, CB2 1ER, UK
Tel: +44 (0)1223 355 974 Fax: +44 (0)1223 354 931
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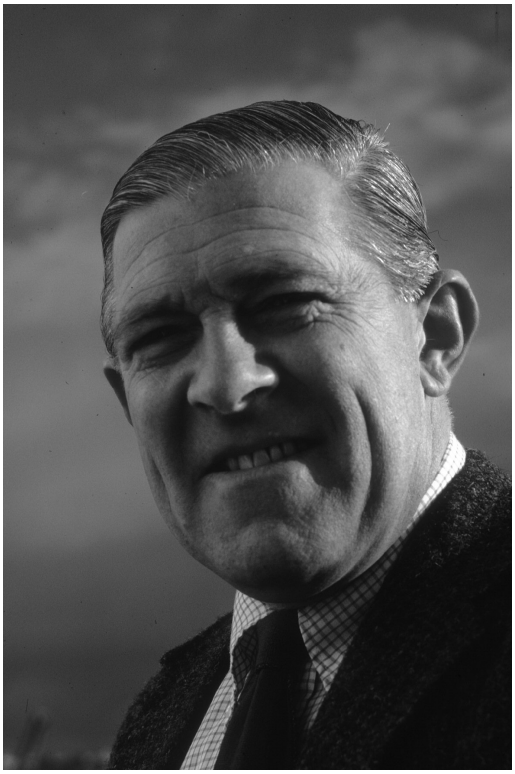
News

Raymond John Adie (1925–2006)



Ray Adie, who died in South Africa on 14 May 2006, was one of the longest serving members of the *Journal of Glaciology* team. He first joined as a member of the Editorial Advisory Committee in 1959, the following year becoming an Assistant Editor and a year later, in 1961, one of the Editors. In those days an individual Editor handled the whole process of refereeing a paper, copy editing it for press and dealing with proofs. He remained in this capacity until the way the journal was produced changed in 1984, when he assumed the role of House Editor, working in the Cambridge office to coordinate the work of a larger number of 'Scientific Editors' who handled the refereeing and acceptance of papers, and then ensuring the preparation of the papers for publishing. He continued in this role until 1999.

Raymond John Adie was born in Natal, South Africa, on 26 February 1925. He went to Maritzburg College before gaining his B.Sc. in Geology at Natal University. In 1946 he came to Britain to join the Falklands Islands Dependencies Survey and went south that same year to the base at Hope Bay where he spent the 1947 winter. The following year he began his geological work sledging south along the Larsen Ice Shelf and across Graham Land to the base on Stonnington Island, where he spent the 1948 winter and where Vivian Fuchs, the Commander of FIDS was base leader. Here Adie introduced Fuchs to the mysteries of dog-sledging, and in the 1948–9 summer they travelled together doing geological research. On their return to Stonnington Island they learned that the relief ship had been unable to get sufficiently far south to relieve them so Adie was forced to spend a third unplanned winter in the Antarctic – the press referred to the party as 'the lost eleven'. In the 1949–50 summer Fuchs and Adie sledged south across Marguerite Bay and along George VI Sound to Eklund Islands so that Adie became the first and only man to sledge with dogs the entire length of the Antarctic Peninsula, giving him the record for the distance travelled with dogs in Antarctica. It was during this journey, while snowed up for 3 days, that, as he recalls in the opening paragraph of *The Crossing of Antarctica*, Fuchs discussed with Adie the possibility of mounting such an expedition. During these expeditions Fuchs noted Adie's meticulous attention to detail and his record keeping, and his suitability to become the editor of the reports of the Falklands Islands Dependencies Survey and the other publications arising from its work.

On his return to Britain Adie joined St John's College, Cambridge and worked on his geological material, gaining his Ph.D. in 1953. In the summer of 1951 Adie joined the Cambridge Jøtunheim Expedition organised by Vaughan Lewis when a tunnel was driven right through a small cirque glacier, Vesl-Skautbreen, to make detailed measurements of its movement. A side tunnel was dug (known as 'Adie's hole') in which he conducted studies of the ice petrofabrics. Adie moved to Birmingham after his doctorate, at first working with Albright and Wilson, but he then returned to working for the British Antarctic Survey supervising its geological work from a base in the University of Birmingham where he was

made Honorary Reader in Antarctic Geology. He remained there until all the Survey's units were united in its own building in Cambridge. He was Deputy Director of the Survey from 1973 until his retirement in 1985. When Argentina invaded the Falkland Islands he was summoned to brief the Prime Minister on the help the Survey could give. He returned to Antarctica in an administrative capacity 22 times. Among many awards, he was given an O.B.E. in 1970 and received an honorary D.Sc. from the University of Natal in 1987. Adie Inlet on the east coast of Graham Land was named for him. Following his retirement he continued to help the Society in the role of House Editor while also spending more time in South Africa.

The Society owes him a great debt of gratitude for 40 years of faithful service to the *Journal of Glaciology.*

John W. Glen

Awards

Roger Barry receives the Goldthwaite Polar Medal

IGS member Roger Barry has been awarded the Goldthwaite Polar Medal from the Byrd Polar Research Centre in recognition of his outstanding contribution to polar research. The medal is named in honour of its founder Dick Goldthwaite, and was presented to Barry on 13 October at the Byrd Polar Research Centre.

Books received

David Archer. 2007. *Global Warming – understanding the forecast,* Blackwell Publishing. 194 pp. (ISBN-13: 978-1-4051-4039-3 (paperback), ISBN-10: 1-4051-4039-9, (paperback), £ 24.99.)

Glaciological diary

**** IGS sponsored** *** IGS co-sponsored**

2006

4–8 September

***III International Symposium on Avalanches and Related subjects**
The contribution of theory and practice to avalanche safety
Kirovsk, Murmansk region, Russia Contact: Pavel Chernous at PChernous@apatit.com
Web: http://www.cas.kirovsk.ru/

13–14 September

***IGS British Branch Annual Meeting 2006**
Keele University, UK
Contact the organisers at igs06@esci.keele.ac.uk
Web: http:// www.esci.keele.ac.uk/igs2006

14–22 September

9th International Symposium on High Mountain Remote Sensing Cartography (HMRSC-IX)
University of Graz, Austria Contact: Wolfgang Sulzer, wolfgang.sulzer@uni-graz.at
See: http://www.kfunigraz.ac.at/geowww/hmrsc/hmrsc_9/

15–16 September

Northwest Glaciology Meeting, 2006
Fairbanks, Alaska, USA
Contact: Martin Truffer at truffer@gi.alaska.edu
Web:http://www.northwestglaciology.org/

17–23 September

*** 6th International Workshop on Ice Drilling Technology**
US Fish and Wildlife Service National Conservation Training Center, Shepherdstown, West Virginia, USA
Convenors: Joan Fitzpatrick (US Geological Survey) and Frank Wilhelms (Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven)
Web: http://www.idt-workshop.unh.edu/index2.html

1–6 October

International Snow Science Workshop, ISSW 2006
Tellurite, Colorado, USA
See: http://www.ISSW.net/

2–6 October

***The Fourth International Conference on Mars Polar Science and Exploration**
Davos, Switzerland
The purpose of the conference is to assess the current state of Mars polar and climate research; discuss what might be learned from investigations of terrestrial analogs and the data returned from current and future missions; and identify the potential science objectives, platform options, and instrument suites for robotic missions to the Martian poles within the next decade
Conveners: Steve Clifford, Lunar and Planetary Institute; Walter Ammann, Swiss Federal Institute for Snow and Avalanche Research; Kathryn Fishbaugh, International Space Science Institute; David Fisher, Geological Survey of Canada; James Head III, Brown University
See:
http://www.lpi.usra.edu/meetings/polar2006

5–6 October 2006

Alpine 'Snow' Workshop
Munich, Germany
The workshop is organized by the Section Geography of the Faculty of Geosciences, University of Munich, and supported by the Berchtesgaden National Park administration (both Germany). The aim of the meeting is to bring together the snow research community for the exchange of ideas, experiences and visions. Meeting language is English
See: http://www.alpinesnowworkshop.org/

9–15 October

Water, ecosystems and sustainable development in arid and semi-arid zones
Urumqi, China
Organized by Ecole Pratique des Hautes Etudes (EPHE, France), Xinjiang University (China) and University of Tehran Contact: +33 (0)1.53.63.61.63 (Béatrice ARGANT) Watarid@ephe.sorbonne.fr
See: http://www.ephe.sorbonne.fr/watarid.htm

26–28 October 2006

***IGS Nordic Branch Annual Meeting 2006**
Polar Environmental Center, Tromsø, Norway. Contact Jack Kohler at jack.kohler@npolar.no
See: http://thor.npolar.no:8080/igs

9–12 November 2006

Open Science Conference in Beijing
Organized by The Earth System Science Partnership (ESSP)
Sessions of interest:
'Polar processes in global environmental systems', chaired by Dave Carlson, ICSU/WMO IPY and Vicky Lytle, WCRP CLIC
'Arctic environmental change: a cross-disciplinary, pan-Arctic perspective in the

context of Earth system studies', chair Peter Schlosser
'Climate research to risk management', Chair Peter Lemke
See: http://www.essp.org/ESSP2006/

2007

15–16 January
Periglacial and paraglacial processes and environments, past, present and future
Geological Society, London, UK
Joint meeting between the Geological Society of London and the Quaternary Research Association
Organisers: Dr Jasper Knight (j.knight@exeter.ac.uk) and Dr Stephan Harrison (Stephan.Harrison@exeter.ac.uk), University of Exeter, UK
See: http://www.geolsoc.org.uk/template.cfm?name=Periglacial_and_Paraglacial

15–17 January
Workshop on the dynamics and mass budget of Arctic glaciers
GLACIODYN (IPY) meeting
IASC Working group on Arctic Glaciology, Pontresina, Switzerland
Convenors: J. Oerlemans (IMAU, Utrecht University; (j.oerlemans@phys.uu.nl) and C.H. Reijmer (IMAU, Utrecht University; c.reijmer@phys.uu.nl)
See: http://www.phys.uu.nl/%7Ewwwimau/research/ice_climate/iasc_wag/activities.html

12–16 February
3rd WGNE Workshop on Systematic Errors in Climate and NWP Models
San Francisco, USA
See: http://www-pcmdi.llnl.gov/wgne2007/

1–2 March
11th Alpine Glaciology Meeting
VAW, ETH Zürich
Zürich, Switzerland
Contact Martin Lüthi at luethi@vaw.ethz.ch

19–26 March
Karst and Cryokarst
25th Speleological School
8th GLACKIPR Symposium
Sosnwiec-Wroclaw, Poland
Contact: Andrzej Tyc at atyc@us.edu.pl or andrzejtyc@wp.pl

26–28 March
Workshop on mass balance measurements and modelling
Skeikampen, Norway.
Convenor: Glacier section at Norwegian Water Resources and Energy Directorate (NVE).
See http://www.nve.no/modules/module_109/publisher_view_product.asp?iEntityId=10452

15–20 April
European Geosciences Union General Assembly 2007
Vienna, Austria
See: http://meetings.copernicus.org/egu2007/

21–22 May
Workshop on 'Advanced concept for radar sounder'
Cambridge, UK
Contact: David Blake, British Antarctic Survey (d.blake@bas.ac.uk)
See: http://www.antarctica.ac.uk/Meetings/2007/ACRAS2007/

28 May–1 June
Glacier and ice sheets – processes and modelling
St John's, Newfoundland, Canada
Joint CMOS-CGU-AMS Conference
Conveners: Gwenn Flowers, Simon Fraser University, gflowers@sfu.ca; Sara Boon, University of British Columbia; boon@unbc.ca
See http://www.cmos2007.ca/en/index.htm

17–20 June
Cryogenic resources of polar regions
Salekhard City, Polar Cycle, West Siberia
Vladimir P. Melnikov Academician, Scientific Council on Earth Cryology, Russian Academy of Sciences; Yu. V. Neyolov Governor, Yamal-Nenets Autonomous District; Jerry Brown, President, International Permafrost Association
See: http://www.ikz.ru/permafrost/

2–13 July
***Union Commission for the Cryospheric Sciences (UCCS) symposium**
24th General Assembly of the International Union of Geodesy and Geophysics, titled Earth Our Changing Planet.
Perugia, Italy.
See http://www.iugg2007perugia.it/

28 July–3 August
XVII INQUA Congress 2007
Cairns Convention Centre, Cairns, Australia
See http://www.inqua2007.net.au/

27–31 August
Workshop: Glaciers in watershed and global hydrology
Obergurgl, Austria
Sponsored by International Commission on Snow and Ice Hydrology (ICSIH) and Commission for the Cryospheric Sciences (CCS) Contact: Regine Hock (regine.hock@natgeo.su.se); Tomas Johannesson, Reykjavik (tj@vedur.is); Gwenn Flowers, Vancouver (gflowers@sfu.ca); Georg Kaser, Innsbruck (Georg.Kaser@uibk.ac.at)
See http://www.ees.su.se/Obergurgl2007

29–31 August
Polar Dynamics: Monitoring, Understanding, and Prediction
Open science conference
Geophysical Institute, University of Bergen. Allegt 70, N-5007 Bergen, Norway
See: http://www.gfi.uib.no/conference2007/info.htm
E–mail: conference2007@gfi.uib.no

3–7 September
****International Symposium on Snow Science, Moscow, Russia**
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK
Web: http://www.igsoc.org/symposia

11–22 September
Ice sheets and glaciers in the climate system
Karthaus, Italy
This summer course is meant for Ph.D. students who work on a glaciology-related climate project.
See:
http://www.phys.uu.nl/~wwwimau/education/summer_school/

12–15 November
International Symposium on Mitigative Measures against Snow Avalanches
Egilsstadir, Iceland

2008

26–28 March
Workshop on mass balance measurements and modelling
Skeikampen, Norway.
Convenor: Glacier section at Norwegian Water Resources and Energy Directorate (NVE).
See http://www.nve.no/modules/module_109/publisher_view_product.asp?iEntityId=10452

26–30 May
Interpraevent 2008 – 11th International Symposium
Dornbirn Exibition Centre, Dornbirn, Austria
See: http://www.interpraevent2008.at/

9–13 June
****International Symposium on Radioglaciology and its Applications, Madrid, Spain**
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK
See: http://www.igsoc.org/symposia

29 June–3 July
9th International Conference on Permafrost
Celebrating the 25th Anniversary of the formation of the International Permafrost Association
University of Alaska Fairbanks, Fairbanks, AK, USA
See: http://www.nicop.orgn

New members

Mr James Cheshire,
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NL-6333 CB Schimmert, Netherlands
Tel [31](45) 40-41-600;

International Glaciological Society

Secretary General M.M. Magnússon

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	I. Allison	2005–2008	2005
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	*G. Flowers	2005–2008	2005
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	*V. Morgan	2004–2007	2004
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	*A.J. Payne	2003–2006	2003
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	D.R. MacAyeal	2005–2006	2005
	D.K. Perovich	2005–2006	2005

*First term of service on the Council

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Publications	C.L. Hulbe (Chairman)

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Seligman Crystal

1963 G. Seligman	1986 G. De Q. Robin	2000 S.C. Colbeck
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1972 B.L. Hansen	1990 A. Higashi	2005 R.B.Alley
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1976 W. Dansgaard	1993 L. Lliboutry	
1977 W.B. Kamb	1995 A.J. Gow	
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1983 W.O. Field	1997 S.J. Johnsen	
1983 J. Weertman	1998 C. Lorius	
1985 M.F. Meier	1999 C.F. Raymond	

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1998 G.K.C. Clarke	

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International Glaciological Society

Scott Polar Research Institute, Lensfield Road
Cambridge CB2 1ER, UK

DETAILS OF MEMBERSHIP

Membership is open to all individuals who have a scientific, practical or general interest in any aspect of snow and ice. Payment covers purchase of the *Journal of Glaciology* and *ICE*. Forms for enrolment can be obtained from the Secretary General or from http://www.igsoc.org/forms/application.html. No proposer or seconder is required.

ANNUAL PAYMENTS 2006

Ordinary members	Sterling	£66.00
Supporting members	Sterling	£215.00
Contributing members	Sterling	£108.00
Retired members	Sterling	£22.00
Student members (under 30)	Sterling	£33.00
Institutions, libraries	Sterling	£259.00 for *J. Glaciol.* Vol. 52 (Nos. 176, 177, 178, 179)

Annals of Glaciology – prices vary according to size of volume. For further information, apply to the Secretary General.

Note: Payments in currencies other than £ sterling should be calculated at the exchange rate in force at the time of payment. Then add sufficient money to cover the bank charges. The Society needs the full payment, so bank charges should be paid by you. Payment may also be made by Access/Eurocard/ MasterCard or VISA/Delta.

ICE

Editor: M.M. Magnússon (Secretary General)

This news bulletin is issued to members of the International Glaciological Society and is published three times a year. Contributions should be sent to your National Correspondent or to the Secretary General, International Glaciological Society, Scott Polar Research Institute, Lensfield Road, Cambridge CB2 1ER, England.

Annual cost for libraries, etc., and for individuals who are not members of the Society:

Sterling £29.00

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