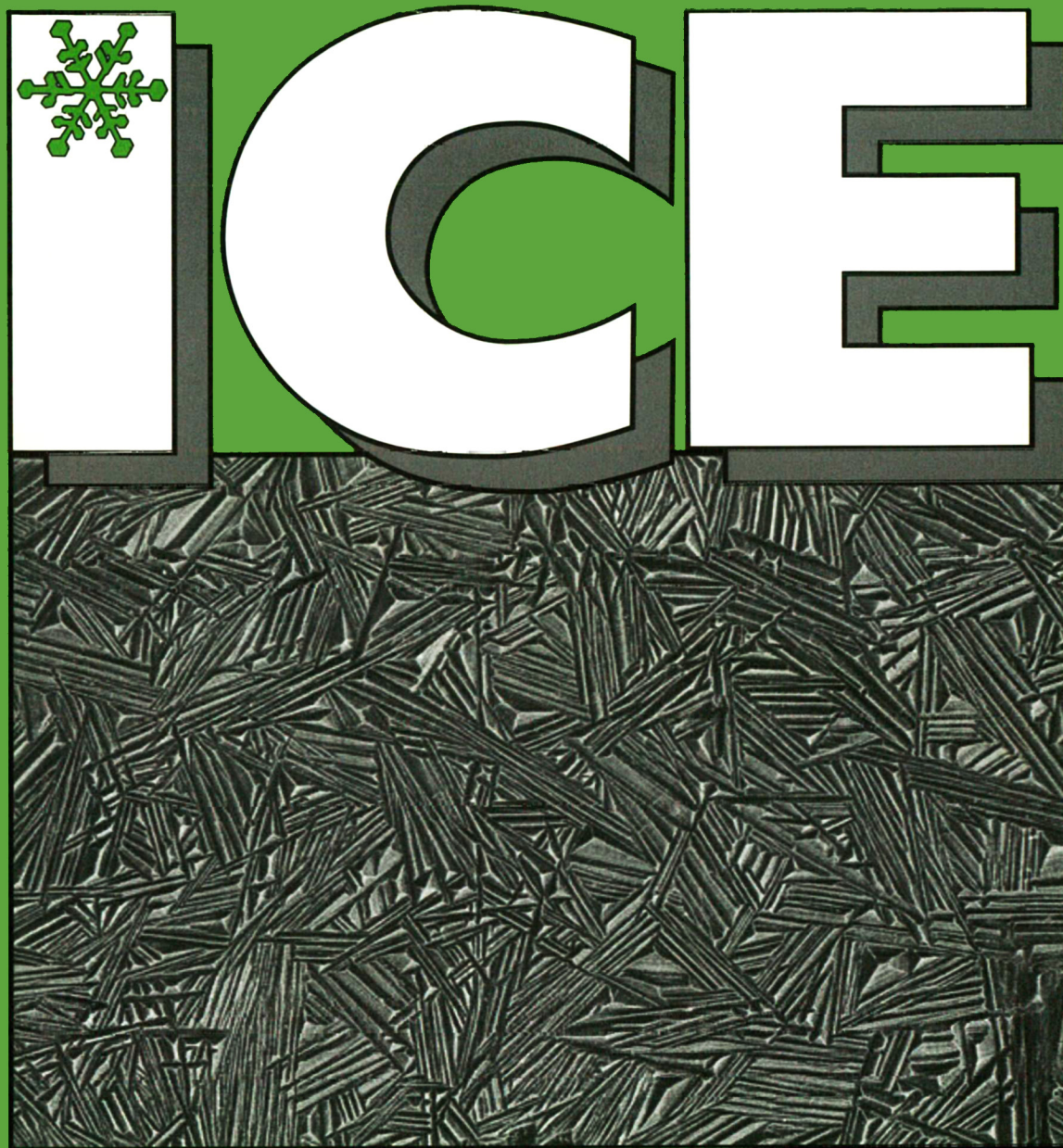


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ICE

NEWS BULLETIN OF THE INTERNATIONAL GLACIOLOGICAL SOCIETY

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COVER PICTURE: Crystalline structure on a lake in Copenhagen, Denmark, winter 2001.
(Photograph by Lars Berg Larsen)

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

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



RECENT WORK

CHINA

(For abbreviations used see page 5)

CHINA

Monitoring of Kuintun glacier No. 51, Tien Shan

(Jing Zhefan, Jiao Keqin, Li Zhongqin, Yang Huian, CAREERI)

A basic geographic information system (GIS) and flow model are being developed for Kuintun glacier No. 51. The glacier is about 1.48 km², 1.7 km long, located in the headwater of Kuintun River at Haxilegen, Tien Shan, with an ELA at 3400–4000 m a.s.l. The flow measurement and mass balance have been measured since 1999, using GPS and a map made in 2001. In 2003, thickness will be surveyed by radio-echo sounder and an automatic weather-station installed. Computation of 3-dimensional glacier parameters is made by merging the GIS with a digital elevation model (DEM). Glacier variations were assessed by comparing the 1:50,000 map with 1964–99 field observations. From 1999–2002 the terminus retreated faster than from 1964–99, showing an intensified retreat. The flow model takes into account geometrical and flow parameters, including: flowlines; velocity distribution; shape, thickness and extent; mass-balance distribution; and response to climatic variations. Geometrical parameters are based on the GIS. Observed surface velocity is used to determine the flow parameters and amount of basal sliding.

Glacier fluctuations and water resources in Northwest China

(Yao Tandong, Pu Jianchen, ITPR and CAREERI; Liu Shiyin, CAREERI)

Glaciers are a precious water resource in northwest China so it is important to study their fluctuations and predict the impact on local water resources. The study was carried out both for the Little Ice Age (LIA) and recent years (1980s to 1990s). The LIA state of hundreds of glaciers in western China were measured by various researches during the 1980s. In recent years, more measurements were made to understand the spatial patterns of glacier variations. There is now a dataset of 2260 glaciers for the LIA in western China. Glacier area shrinkage since the LIA was obvious, the average reduction being 17% from the LIA to the 1950s. However, there are regional differences: the west Kunlun Shan showed the smallest decrease, about 2–4%; the central Tien Shan and Qilian Shan showed a reduction of 30–40%. Recently, glacier retreat has intensified. Retreating from the 1960s to 1990s almost equalled that from the LIA to the 1950s. The average reduction in glacier area was 14%. After the mid-1990s, retreat has accelerated. Our study shows 95% of

glaciers retreating after the mid-1990s. Glacier retreat has resulted in a short-term discharge increase in northwest China; about 6% since the 1990s. In some regions like Quadam Basin, discharge has increased 10–13%.

Muztagata ice core project

(Yao Tandong, Xu Baiqing, Wu Guangjian, ITPR and CAREERI Pu Jianchen, CAREERI)

An ice core is being drilled at 7000 m a.s.l. on Muztagata ice cap. Glacier mass balance, fluctuations, hydrology, meteorology and stable isotopes in precipitation will be measured. Most ice cores obtained in the past 20 years have been from the monsoon region of the Tibetan Plateau. Therefore, recently reconstructed climates and environments may not be representative of the region under a westerly influence. The Muztagata ice cap, located in the Pamir Plateau (75°04'E, 38°17'N, 6350 m a.s.l.), is under a strong westerly influence and might be an ideal place to study the transition from monsoon to westerly influence. The project started in 2001. In 2001 and 2002 more than 200 m of ice cores were collected from the Muztagata mountain.

Insoluble microparticles in Muztagata ice core

(Wu Guangjian, Yao Tandong, ITPR and CAREERI)

In 2001, a 43 m ice core was recovered from Muztagata mountain. Microparticle parameters, including grain-size, number concentration and mass content, were analyzed by a Beckman Coulter Counter (Multisizer 3). The microparticle number concentration and mass content is generally higher than those in polar cores because Muztagata is near the central Asia dust source and strong dust storm and turbulences would carry coarse particles to such a high altitude. The number concentration changes in a range of 1×10^4 – 1×10^6 microparticles ($>1 \mu\text{m mL}^{-1}$ melted water), which is smaller than in Guliya and Dunde ice cores, but higher than in the Dasuopu ice core. The modal number size of microparticles is $>1 \mu\text{m}$, but coarse particles with diameter $>20 \mu\text{m}$ can be found in the results. For the high mass and number concentration samples, the volume-size distribution can be fitted with a lognormal function. However, the samples with low concentration don't reflect this distribution due to the few coarser particles representing a larger percent of the total volume. A size distribution different to that in Greenland might be because of the proximity to dust source, strong dust storms and air turbulence, high altitude and sorting in transport. In 2002, four new ice cores were drilled near the same site. The 94 m long ice core, which reached bedrock, has been cut into about 3130 samples and will be analyzed.

Stable isotope in precipitation on the High Asia (Yao Tangdong, Tian Lide, ITPR and CAREERI)

A stable-isotope monitoring network has functioned for the past 14 years in High Asia. It covers the Tibetan Plateau, the Pamir Plateau, the Qilian Shan to the Tian and Altai Shan. Oxygen isotope and deuterium in precipitation were studied through the network. There is a strong positive correlation between stable isotopes and air temperature in most of High Asia. The best correlation was found at the Delingha station and the Ürtmqi river basin. A temperature effect was also proved in shallow ice cores. The spatial variation of stable isotopes in precipitation shows an obvious impact of moisture sources. Those in the southern Tibetan Plateau are mainly affected by the monsoon, but by the westerlies in most of High Asia.

HIMALAYA

The Dasuopu ice core project

(Yao Tangdong, Wang Ninglian, Pu Jianchen, Duan Keqin, ITPR and CAREERI)

The Dasuopu ice core, recovered at 7200 m a.s.l. from Dasuopu glacier on Xixiabangma mountain (28°23'N, 85°43'E), is unique for climate reconstruction. The core not only provides evidence of a significant South Asian monsoon variability in the Himalaya over the past 300 years, but also contributes rather reliable methane concentration records for the mid-latitudes. Microbes in the ice core revealed a good correlation between microbes and climate change. The accumulation record shows that the Indian monsoon rainfall can be reconstructed from the Dasuopu ice core records, and that the Indian monsoon rainfall has experienced several major weakened stages in the past 300 years. The anti-correlation between the Dasuopu ice core record and Northern Hemisphere temperature demonstrates that decreasing accumulation corresponds to a warming Northern Hemisphere climate and vice versa. Over the past century, North Hemisphere temperature has increased about 0.5°C, while accumulation in the Dasuopu ice core has decreased by 400 mm, which really reflects that monsoon precipitation in the central Himalayas has decreased in the global warming over the past decades.

Puruogangri and Malan ice core projects

(Yao Tangdong, Wang Ninglian, Pu Jianchen, Xu Beiqing, ITPR and CAREERI)

Located in the central Tibetan Plateau, the climatic and environmental records in ice cores from the Puruogangri icefield and Malan ice cap are critical to an understanding of the environmental history of the whole Tibetan Plateau. However, there were no glaciological or climatic investigations in this region previously because access was so difficult. In addition to the acquisition of ice cores, the project will also observe glacier mass balance, fluctuations, movement and glacial deposits. The major field-work was on Puruogangri icefield, which is the largest mid-latitude icefield (>400 km²), in cooperation with U.S.

scientists. Three ice cores (220, 140 and 130 m respectively) were drilled and one 102 m ice core on Malan ice cap. Stable oxygen isotopes, chemical composition, microbes and micro-particle composition were analyzed for the samples from the 220 m Puruogangri ice core and for the Malan ice core. Combining with the 2001 and 2002 Mutztagata ice cores, these studies will reveal the coherence and difference of climate change throughout the Tibetan Plateau.

Climate record in the past 100 years from Malan ice core

(Wang Ninglian, Yao Tangdong, Wang Youqing, Pu Jianchen, ITPR and CAREERI; Sun Weizhen, CAREERI; Duan Keqin, ITPR and CAREERI)

Malan glacier (195 km²) is one of the largest typical continental glaciers in the Kekexili region, central Qinghai-Tibetan Plateau. Few investigations had been done before a 102.07 m ice core was drilled on Malan ice cap (35°48.4'N, 90°45.3'E, 5620 m a.s.l.) in May 1999, but which did not reach to bedrock. The ice core was sent frozen to Lanzhou for oxygen-isotope analyses by MAT-252; mainly used to reveal paleoclimate change in the central Qinghai-Tibetan Plateau. The $\delta^{18}\text{O}$ depth profile of the ice core clearly recorded the Little Ice Age and the mid-thermal. The annual $\delta^{18}\text{O}$ records in the upper ice core especially indicate that the global warming is global. However, the ice core also shows that in recent years the climate of the central Qinghai-Tibetan Plateau was colder, which suggests that short-term cooling may be occurring in some regions.

Abrupt climatic changes recorded in Tibetan ice cores

(Yang Meixue, Yao Tangdong, ITPR and CAREERI)

The wavelet-analysis method was used to examine abrupt climate changes archived in Tibetan ice cores. Based on high-resolution climate records recovered from the Guliya ice core, the abrupt climate changes in the past 300 years were detected. On a 100 year time-scale, two abrupt climatic changes were detected for $\delta^{18}\text{O}$ (proxy index for temperature). The typical years are 1788 and 1932, respectively. There are also two abrupt climatic changes for net accumulation on a 100 year time-scale, corresponding to 1805 and 1939. The abrupt climatic change for net accumulation (precipitation) lags behind that of the temperature. Detecting the years of abrupt change are important to understanding the climate-change mechanism.

Diversity of microorganisms revealed by DNA in Tibetan Plateau ice cores

(Yao Tangdong, Zhang Xiaojun, ITPR and CAREERI)

Five ice cores from three glaciers in the northern Tibetan Plateau have been used to study the diversity of microorganisms. DNA was extracted and amplified. Fragments of amplified rDNA were used to construct an SSU rDNA clone library. The results of sequence analyses show diverse DNA in the Malan, Puruogangri and Dunde

glaciers. In total, 45 bacteria, 16 algae and 9 protozoa sequences were found. Interestingly, although these glaciers are several hundred of kilometers away from each other, types of microorganisms among those glaciers are similar. Some rDNA sequences were grouped to a branch with a high similarity (more than 96%) in the phylogenetic tree. This group is similar to genus *Cytophagales*. This group of microorganisms may be a new group developed in special Qinghai–Tibet Plateau environment. The climatic significance of microbe amount in the ice cores is studied and compared with oxygen isotope and dust concentration. A close relationship between microbes and climate was found.

Chemical composition of aerosols from northern slope of Qomolangma (Mount Everest)

(Sun Junying and others, KLICCRE)

Daily aerosols were collected at the terminal moraine of Rongbuk Glacier (5140 m a.s.l.) from 12 June–20 August 1998, and at the accumulation zone (6250 m a.s.l.) of East Rongbuk Glacier from 26 May–12 June 1999. Major ions were measured in samples and field blanks. The mean aerosol loading is 33.8 neq m^{-3} . The measured cations exceed the measured anions in about 80% aerosol samples, which suggest that the atmosphere is usually alkaline. The dominant cationic species is ammonium, followed by calcium, whereas sulfate and nitrate are dominant anions. The equivalent ratio of Cl^- to Na^+ is smaller than their ratio in seawater (1.17) suggesting that the sea salt has been modified before arriving at the sampling site. $\text{NH}_4^+/\text{SO}_4^{2-}$ ratio has a mean value of 2.0 in 1999 aerosols and 5.4 in 1998 aerosols showing that only a fraction of NH_4^+ in aerosol is neutralized by SO_4^{2-} . An understanding of aerosol chemistry, especially in the remote sites, is useful for interpreting the ice-core record from there.

Monsoon rainfall variability in Himalayas under global warming

(Duan Keqin, CAREERI; Yao Tandong, ITPR and CAREERI)

The reconstructed annual accumulation record in the Dasuopu ice core ($28^\circ 23' \text{N}$, $85^\circ 43' \text{E}$, 7100 m a.s.l.), from the central Himalaya, provides evidence of a significant South Asian monsoon variability in the Himalaya over the past 300 years, which is interpreted as a good correlation between the accumulation record in the Dasuopu ice core and monsoon precipitation record in Northeast India and in Nepal, suggesting monsoon variability in the Himalaya can be examined in a longer perspective. The 300 year accumulation record showed that South Asian monsoon rainfall in the Himalaya had weakened in the 18th century, then strengthened from 1795–1850, weakened again between 1850–75 and strengthened during 1875–1920; after that it has weakened from early 1920 to the present. As mentioned above, there is a strong anti-correlation between the accumulation record and Northern Hemisphere temperature. With a mean Northern Hemisphere temperature increase of 0.1°C , accumulation decreases about 80 mm and vice versa.

Glaciological and climatic studies in monsoonal temperate-glacier region

(He Yuanqing, CAREERI; Yao Tandong, ITPR and CAREERI; W.H. Theakstone, Zhang Zhonglin, Pang Hongxi, CAREERI)

From 1999 to 2002 the project focused on: (1) recovery of a shallow ice core at Baishui glacier No.1, a sub-tropical temperate glacier on Yulong mountain, the southernmost currently glacier-covered area in Eurasia. The contemporary homogenization process of climatic signals in melting firn and ice was clear, indicated by variation of stable isotopes and soluble ions in the core. Climatic records in the shallow core were also compared with locally observed climate data; (2) collection and analysis of samples in the atmosphere–snow/ice–glacial-runoff system at some typical temperate-glacier areas, to investigate the special distribution pattern of environmental signals in China's monsoonal temperate-glacier region and the behaviour of the southwestern monsoon; (3) collection of climatic observation data, ice-core records, tree-ring indices and records of glacier variations which have been used and compared, to reconstruct the detailed history of climate and glacier changes in the monsoonal temperate-glacier region of southeastern Tibetan Plateau during the past 400 years.

ANTARCTICA

Distribution and variability of snow accumulation and mass balance, Lambert Glacier basin, East Antarctica

(Ren Jiawen and others, CAREERI)

Since it is the largest glacier system in the Antarctic ice sheet, Lambert Glacier plays an important role in its overall mass balance. The observed data and shallow-core studies from recent inland-traverse investigations show there are noticeable differences in distribution and variability of the snow accumulation rate between the east and west sides. On the east, accumulation is higher on average and has increased in past decades, while on the west it is contrary. Ice-movement measurements and ice-flux calculations indicate that the ice velocity and flux are larger in east than in west, meaning that most of the mass supply for the glacier is from the east side. Mass-balance estimated with the latest data show that the integrated accumulation over the upstream area of the traverse route is 13% larger than the outflow ice flux, suggesting that the glacier basin is in a positive mass-balance state and that ice thickness will increase if the present climate continues.

Comparison of climate change over past centuries from Antarctic ice cores

(Ren Jiawen and others, CAREERI)

Following the International Trans-Antarctic Scientific Expedition (ITASE), inland traverses for glaciological investigation have been made along a route from

Zhongshan station to Dome A. The shallow cores drilled during these traverses have revealed a 250 year high-resolution record of climatic change in west Princess Elizabeth Land, i.e. east side of the Lambert Glacier basin. Comparison with results from the west side of the basin shows that the Lambert Glacier valley is an important climate boundary in East Antarctica. Over the whole of Antarctica, the ice-core records indicate that the cold period characterized by the Little Ice Age (LIA) is relatively strong in East Antarctica, while it is weak or even contrary in West Antarctica. Again in East Antarctica, some differences between east and west of the Lambert Glacier valley can be still seen. In the east, e.g. Wilkes Land (Law Dome) and north Victoria Land (Hercules N  v  ), the cold period of the LIA is striking, but in the west, e.g. Dronning Maud Land and Mizuho Plateau, it is relatively weak. The Lambert Glacier basin is exceptional: although the LIA cold period exists, the remarkable high-temperature stage around 1850 and temperature decrease since then are very different from other regions in East Antarctica, but quite consistent with a 400 year core record from an island of the north Antarctic Peninsula. This is hard to explain at present.

Glaciological and meteorological study of Lambert Glacier basin (LGB)

(Xiao Cunde and others, CAREERI)

For the past decade, observations of surface accumulation, meridional moisture fluxes as well as $\delta^{18}\text{O}$ in surface snow and their relationships with mean annual temperature were carried out at the eastern and western sides of the LGB. These observations indicate that there exists a clockwise circulation of air masses, which lead to a remarkable difference in spatial distribution of these parameters between the two areas. Opposite trends in stable isotopic temperatures and accumulation variation over the past 50 years between the two sides are also yielded by the firm-core records. These trends have also been evidenced by the relevant meteorological parameters observed at the Davis (east LGB) and Mawson (west LGB) stations since 1950s. The changed circulation patterns in coastal Antarctica during the past decades can explain such patterns over the LGB. It has been shown that there is an important role in the location of the circumpolar pressure trough (CPT) and the timing of its contraction and expansion during the year. CPT activity in the past decades is in quantitative agreement with our results. This study reveals that the local circulation, mainly the semi-annual oscillation (SAO), could alter at least the annual to decadal time-scale climate records, and may result in completely different climate histories between even adjacent areas. .

Chinese Antarctic Cryospheric Information System

(Qin Xiang, Qin Dahe, Ding Yongjian, CAREERI)

A Chinese Antarctic Cryospheric Information System (CACIS) has been developed. The bottom level is composed of the Antarctic Fundamental Geo-spatial Database (AFGD) and data input, editing, management, communication, analysis and output, which offers online information service and query. The top level, Geo-spatial Data Warehouse (GDW) is based on AFGD by integrating cryospheric data, GIS and other methods. GDW offers query, online analysis and output by data maintenance and exchange. Based on a Microsoft Windows 2000 Server operating system, the CACIS was established using the database management system SQL Server 7.0. It consists of six sub-databases: glacier physics, glacier chemistry, sea ice, meteorology, remote sensing and GIS map. All the basic information and observational data on ice sheets, glaciers, frozen earth, snow, sea ice, topography are stored in 150 tables. The former four sub-databases mainly include: glacier movement, radar survey, glacier temperature, snow/ice crystallography, density, rigidity, mass balance; pH value, conductivity rate, main ions, isotopes, organic substances, surface snow gases, snow pits and ice cores; sea ice extent and areas, sea ice thickness and salinity; all kinds of weather elements on the ground and upper air. The last two sub-databases mainly include: remote-sensing images for the polar regions and topographic data. The homepage and web pages of CACIS, by Sybase PowerDynamo, Internet Information Server5.0 and FrontPage 2000 with two protocols in data translation in CACIS: HTTP and FTP, were established for internet users; for intranet users, a CACIS data management software by PowerBuilder 7.0 was manufactured independently. Users admitted by CACIS can query, download, manage, and export all required information.

Contributed by Yao Tandong

ABBREVIATIONS USED

- CAREERI Cold and Arid Regions Environmental and Engineering Research Institute, 260 Donggang West Road, Lanzhou, Gansu 730000, China
- ITPR Institute of Tibetan Plateau Research, Chinese Academy of Science, China
- KLICCRE Key Laboratory of Ice Core and Cold Regions Environment, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, Lanzhou, Gansu, 730000, China



INTERNATIONAL GLACIOLOGICAL SOCIETY

FAREWELL TO SIMON OMMANNEY

Davos, Switzerland, 5 June 2003

At the Society's International Symposium on Snow and Avalanches, the banquet on Thursday evening was used as an opportunity to honour Simon Ommanney, the retiring Secretary General. Magnús Már Magnússon, the new Secretary General, acting as master of ceremonies, introduced Walter Ammann, Director of the Swiss Institute for Snow and Avalanches (SLF).

Walter Ammann

Ladies and gentlemen, dear colleagues, dear Simon. After an excellent dinner, we have approximately three-quarters of the dinner behind us, we have approximately 80% of the congress behind us and we will have some more speeches in front of us and will have one more day of the conference tomorrow. The speakers after me will not be too long and will not be showing any transparencies or power-point presentations. I was asked to speak first and, among others, we are in the forthcoming minutes honouring Simon's great work for the IGS during the last decade.

For my part, I would like to focus on the excellent cooperation we had between you, Simon, as representative of IGS for us and us as SLF here in Davos; also, for example, again during the preparation and the operation of this IGS conference here in Davos.

Simon you always, and once more, did a great job. I strongly hope that also after your retreat as IGS Secretary General we will keep in excellent contact with you and that we will again meet here in Davos or anywhere else in the world.

May I ask you to come up to the stage.

As a symbol of our thankfulness we would like to give you a small gift, just a very small gift. It's a quartz crystal which developed some years ago, just nearby, it might be some millions of years ago. We would like to offer you a quartz crystal which is nicely and clearly structured, sparkling, versatile, very solid and unique as you are, as IGS is, and in that sense Hanni Ambuehl, our "Gute Fee" of the SLF, will hand over the quartz to you and Hanni's daughter, Ladinia will present you some flowers.

The quartz crystal will remind you of our fruitful



collaboration during your time as IGS Secretary General and I wish you all the best for your future. Thank you very much Simon, thank you.

C. Simon L. Ommanney

I would just like to say what a wonderful pleasure it has been working with Walter and with all the staff of SLF. It makes such an incredible difference if you have a really good local group. Margaret and I have organised very many conferences and I can assure you that the support we have had from everyone here has been absolutely wonderful. My heartfelt thanks go to all the staff of SLF for the tremendous job they have done and from which you have all benefitted so much at this meeting. I am not sure what other speeches are coming. I am a bit concerned

about this, but suspect that I am not required to make a major speech just yet. Thank you very much indeed.

Magnús Már Magnússon

That was part one, now we move onto part 2. Now Simon was Secretary General for 10 years, his rule lasted 10 years, and he served under four presidents. We are very happy to have two of those Presidents with us tonight. There is Norikazu Maeno, who came all the way from Japan, and there is Bob Bindschadler, who came all the way from Seattle. I would like to pass the podium onto Bob Bindschadler who would like to say a few words.

Robert A. Bindschadler, Past President of the IGS

Don't be worried Simon. If you don't enjoy this, then we haven't found the right words.

Simon, it is extremely difficult to thank you adequately in just 10 minutes for what you have given to the Society over the past 10 years. One way we planned to recognize you this evening was to have all four Ommanney Presidents, as we have come to call ourselves, present tonight and we came close. Each of us had made our arrangements to be here. Nori Maeno and myself are here and Nori will speak briefly after my remarks. Liz Morris, as you know was trapped in Resolute, Canada, by a

combination of bad weather and failed aeroplane mechanics, but she very desperately wanted to be here; and also Bjørn Wold. His rental car is waiting for him in Zürich, but he can't get there because of an airline strike. He is stuck in Corsica. But he too wanted to be here. We wanted all four of us to be here to honour you this evening. Liz was able to send a statement acknowledging your contributions to the Society and, as she is the current, and last, Ommanney President, I would like to begin by reading her message.

"In my first year as President, I have been very grateful to Simon for his professional support and impressed by his deep knowledge of the Society's affairs. It has been a pleasure to work with such a true enthusiast for glaciology and I am very disappointed not to be able to join you to celebrate his outstanding contribution to the IGS and mark Simon's transition from workaholic to gentleman of leisure. We will believe it when we see it.

I would also like to thank Margaret, whose loyal support for Simon and quiet and efficient presence at meetings has contributed so much to the Society over the last 10 years. I am sure all members of the Society hope that you will both continue to take an active interest in the IGS and that we will have the benefit of your experience and wise advice for many years to come."

Now I will continue with my own remarks. I freely admit that when I agreed to stand for the office of President it was only after Simon assured me that he would continue as Secretary General throughout my term. At that time, Simon had made it clear that even after only five years as Secretary General the reason that the Society ran so smoothly was because it was dependent on his steady hand at the helm. To appreciate his achievement it's important to recall the state of the IGS 10 years ago.

For those of us here tonight with grey hair (here it is!), this is just an exercise in recalling how things were. But for the many young researchers here, and there are more and more of them who attend each meeting, this is a history lesson.

Ten years ago, the Society was challenged financially. I am reminded by John Heap that at the end of Simon's first year it was not even clear whether we could meet all the salaries at that time. In addition, the accounts were kept in hand-written ledgers, membership hovered around 700 and we usually sponsored just one scientific meeting each year.

Simon, I don't know if you came to this job with a vision of what you wanted to accomplish or not, but if so, I doubt that you would have been so bold as to imagine the transformation that has taken place under your superb and untiring leadership.

In Canada, before coming to England to take up the Secretary General post, you demonstrated your leadership, your organizational skill, your high standards of excellence, your keen eye towards detail and your tactfulness with people. It is no surprise that Hilda Richardson saw you as a capable successor. Throughout the past decade, you have drawn on each of these strengths.

Today, the Society bears the indelible mark of your

unwavering devotion and energy. Some of your most notable achievements in my view are: you raised the Society's finances to a secure footing with substantial reserves; you modernized and computerized the entire operation of the home office in Cambridge; you expanded our visibility in the world by improving our website, and placing us on the path towards full electronic publication of both the *Annals* and the *Journal*; you have increased the number of pages published each year in the *Journal*; you have doubled the number of scientific meetings each year; and you have increased our membership more than 25% to a number that now exceeds 900. And all of that in just 10 years! That's a remarkable achievement.

But I am going to pause in my accolades of you for a moment to mention two other people. For just a moment I want to shine the spotlight of recognition on your wife, Margaret, because she has continuously shunned such recognition. But the truth has to be told and this may be our last opportunity.

IGS received an extra bonus when Simon was hired. Margaret has served the Society to an extraordinary degree. She has accompanied Simon to every, or nearly every meeting, arriving before the conference began, stuffed registration packets, shepherded us through registration and maintained a quiet presence at the front desk making sure our conference experience was a positive one. Council has tried repeatedly to compensate Margaret, but with very limited success. She has consistently demurred such recognition. But tonight I am going to cash in all those IOUs and insist on thanking her publicly. So please join me in a round of applause acknowledging Margaret's contribution during the Ommanney's reign. «applause»

I have to tell you, I am departing from what I have written here. We are about to enjoy chocolate mousse. That's one of my favourites, and for three years every visit I made to the Ommanneys, Margaret would make an enormous chocolate mousse, because she found out I liked chocolate mousse and it was all mine. Simon was not allowed to have even a taste, and I will really miss that. But I will find you wherever you live and come visit you for my chocolate mousse!

The retirement we celebrate tonight marks a transition, not only for the Ommanneys but also for the IGS. The other person I wish to recognize is Magnús Már Magnússon. The harder I saw Simon work through the many staff upheavals he suffered, the more I worried that the IGS would never find a successor. Magnús' unexpected interest in the upcoming vacancy instantly allayed my fears. The Search Committee was unanimously impressed with Magnús's record of accomplishments in Iceland. During his recent few months in Cambridge, he has shown himself to be a quick study. Under his new leadership not only will we continue to reap the benefits that are Simon's legacy, but we will rise to meet new challenges. I fully expect our growth to continue and ask that you join me again, this time in thanking Magnús for stepping up to such a critical position in our Society. «applause»

So, Simon and Margaret, you are free to go. Free to enjoy your retirement, your children, your grandchildren.

Go with our deepest thanks and our most heartfelt appreciation for all that you have done these past 10 years. But please don't stay away. You will be sorely missed. We will do our best to limit our requests for your experience and knowledge. You are too wise not to expect an occasional phone call or e-mail seeking your advice. And I expect that Simon relishes the opportunity to be co-opted on the Council so he can finally cast a vote after ten years of quietly and expertly leading us through our business.

I have probably gone on too long and taken more than my share of the time tonight. There are two others yet to speak. Nori Maeno has some remarks he would like to make as one of the other Ommanney Presidents. But I will pause with one final thought.

Everyone who has ever seen you perform your duties as Secretary General has been amazed at the long hours you work and how little you sleep. I can't honestly imagine you not working, but you're retired now! You're retired! So you can relax, you can kick back, you can enjoy the fruits of your labour, go to bed early, get up late, but be sure to stay in touch, watch the Society flourish and know that we know we have you to thank for the growth of the IGS into the prominent, successful and dynamic professional scientific society it is today. Thank you so very much for 10 years of extraordinary service.

And now I will pass the podium to Nori.

Norikazu Maeno, Past President of the IGS

My presidential period was from 1996 to 1999 and in this period we had conferences in Chamonix (France), Hobart (Tasmania, Australia) and Kiruna (Sweden), Lanzhou (China) and Zürich.

When I was elected as President, I didn't know almost anything I should do as IGS President, but I was so lucky because the Secretary General, Simon Ommanney, was so kind and at every difficult moment he gave me a very nice and adequate help. And I also can't forget the continuous help from the Secretary General's wife, Margaret. She was such a strong supporter for me, and at this special occasion of retirement, I would like to express my particular thanks to Simon and Margaret.

As a token of my gratitude I have brought a small present here. Could you come up, both of you, come here. This is just a small present, but this is a cloisonné plate describing an owl. An owl is a bird of happiness in Japan. In Japanese, owl is *sukkuro* and *sukku* means happiness. So I believe this owl plate will bring Simon and Margaret and their family in Canada much more happiness. Thank you very much.

C. Simon L. Ommanney

I don't know whether it is time for me to say something now or whether I should wait a little while longer. Anyway, I would like to thank both of our speakers very much indeed. I know what incredible efforts they went to to get here. Bob was out in Seattle. He flew here specially and has to go back tomorrow and that's an incredible trip. Then Nori came all the way from Japan. I have also heard through the grapevine of the extraordinary efforts that Bjørn Wold and his wife Unni have gone to to try and get

here. I really, really, appreciate all those tremendous efforts to be here to celebrate tonight with me.

Thank you.

Magnús Már Magnússon

I am getting a bit worried about what I am taking on, hearing all this about Simon, but I would like to introduce the next speaker, a Vice President of our Society who chaired the Council meeting on Wednesday night and the AGM this morning. I would like to invite Atsumu Ohmura to the podium in his capacity as Vice President of the International Glaciological Society.

Atsumu Ohmura, Vice President of the IGS

Ladies and gentlemen, representing so to speak all here present, on behalf of the International Glaciological Society I would also like to thank Simon and Margaret for the last 10 years of enormous personal dedication to the Society.

It seems to be a very strange coincidence that Simon's last service to the Society is going to be remembered with this place, because his professor was a Swiss and so was mine. We studied in the same place and so, I thought, for you to remember this place, Switzerland, and also our teacher, I chose something very special which will connect you always with Switzerland. But before going further, I would like to step aside a bit.

To also commemorate this very memorable evening, I would like to introduce two more of our past Presidents, in addition to the two who have already delivered messages. We have tonight with us Professor Marcel de Quervain and Mrs de Quervain «applause» and Professor Hans Röthlisberger and Mrs Röthlisberger. «applause»

I feel that whenever we read the *Journal of Glaciology* and *Annals of Glaciology* and compare them with the content of some decades ago, naturally there has been an enormous advance in our knowledge of glaciology. To a great extent we owe our present state of knowledge to the pioneers who are with us tonight. I must ask you and also Margaret both once again to come to the stage.

We thought it was appropriate for Linda [Gorman, assistant to the Secretary General] to present flowers to Margaret. It has been wonderful teamwork in Cambridge. (Atsumu then presented an engraved pen to Margaret.) «applause»

And something which Simon will always remember from Switzerland. To comment briefly, all of us are also connected to glaciers. 200 years ago there was an outstanding Swiss called Conrad Escher, later to be added the “von de Linth”, and he left a marvellous amount of “Aquarell” paintings of the Swiss alpine regions. Many of them depict glaciers of the stand of the Little Ice Age, 200 years ago, so when you compare the glacier stand with that of the present you will see the difference.

This is what was conceived with the glacier inventory and studying with you, one year behind him, I observed very carefully how the contemporary World Glacier Monitoring Service started there. It is a combination of the World Glacier Inventory and the Fluctuation of Glaciers. At the beginning, Fritz Müller, our professor, was rather reluctant to take it over, but it was Simon who pushed that

and eventually started with the pioneering work, the glacier inventory of Axel Heiberg Island. I am confident that unless Simon pushed our professor, probably we wouldn't have the glacier inventory at this stage. This is an episode which is not known outside our classroom. So I thought I should use this occasion to thank you, in addition to the last 10 years, also for your scientific contribution which sometimes is not much acknowledged among us. Thank you very much. «applause»

I was just going to step down from the stage, but there is something more. This is just a book! You need more books, so the Society decided to present you with a lifetime subscription to the *Journal* and *Annals*. With this, it is a bit egoistic intended from our side, we don't just give you the present, but want to bind you to the Society forever with it. We also want you to take a rather critical view of the later *Journals* and *Annals* and, whatever you notice, would you let us know. We can always improve the content.

I have this message which I received from the new Secretary General, and it reads. "At the Council meeting held on June 4th, 2003, the Vice President, acting on behalf of the President, after the recommendation of the Awards Committee, put before the Council to award Simon Ommanney the Richardson Medal. The Council unanimously approved."

According to our Constitution we also need approval from the President and here is a message from Liz who couldn't attend.

"Dear Magnús, please pass the following message to the Vice President of the IGS. I wish to inform you and Council that I fully support the nomination of Simon Ommanney for the Richardson Medal. Regards, Liz Morris."

I feel very much honoured and privileged that on behalf of the whole Society I am allowed to present this beautiful medal to Simon. So, Secretary General, with this, my function tonight is over.

C. Simon L. Ommanney

I am absolutely overwhelmed. I must say, I didn't expect this at all. And I am extremely grateful to all of you for this. I know it is getting late, but I think this may be my last chance, when I have a captive audience, to say a few words to you.

The first thing I would like to say is how honoured I am that we have so many Presidents here in the audience. Atsumu referred to Marcel de Quervain, to Hans Röthlisberger and you have already seen Bob and Nori up here. I am very honoured that they made the effort to be here tonight.

Some of the remarks I am about to make are really addressed to the IGS. Now I realize, and I am very sorry on your behalf, that many of you here are not IGS members. That is something you can rectify. But I will be talking to everyone in the audience as if you were all members. I want you all to feel totally included.

Atsumu referred to Switzerland as being somewhat special to me and, in fact, he is very right in that. When I

was a child, I came here and skied. I skied in Grindelwald and I skied in Engelberg and elsewhere. It wasn't with the critical eye of our Founder, Gerald Seligman. I wasn't looking at the snow as something that was of great scientific interest. I was just enjoying the mountains and the open air and probably the night life as well.

My first scientific experience was in Arctic Sweden measuring katabatic wind drainage in the middle of the night, rushing out and taking temperatures, measuring humidity and wind speeds.

My father had decided it would be good for my soul if I went to Canada to university and I was extremely fortunate that I ended up at McGill.

McGill in the early 1960s was a wonderful place. The Chairman of the Geography Department where I went was Ken Hare, a famous climatologist. We had Brian Bird, who wrote quite a well-known geomorphological treatise on Arctic Canada and, of course, my mentor, Fritz Müller.

I applied to go on the Axel Heiberg Expedition shortly after I arrived in Canada as a teenager and it was only two weeks before the expedition left that Fritz decided that maybe he would risk taking this young kid up north with him. I spent a good part of the first few months in Eureka shipping supplies across to the base camp and then I was stuck up on the ice cap for the rest of the summer.

It was while I was there that I came to appreciate a lot of the things the Swiss had done. Many of the mountains on Axel Heiberg Island had been climbed by Jürg Marmet. In the latter part of that summer, we decided to follow in his footsteps and climb White Crown, the highest mountain on Axel Heiberg Island.

I don't think any of you in the audience will be surprised to learn the date on which we chose to climb this mountain was the 1st of August. A date celebrating the founding of the three Forest Cantons and one of great significance in Swiss history.

This year, people are commemorating the first ascent of Everest, but when I think of that I don't think of Hillary and Tenzing. I think of the Swiss expedition that followed a few years later and the fact that Fritz spent, I think he told me, about two weeks up on the South Col studying the ice there, and then remained afterwards to work on the Khumbu Glacier.

After I graduated from McGill as an undergraduate, I then went to England and spent the winter teaching. I had a half-day which was a Wednesday. I used to drive like crazy through to Cambridge and spend time with the people in the Scott Polar Research Institute.

That was the first time I met Hilda Richardson, who was my predecessor. Many of you may not know that Hilda served the Society for 40 years. Now this year is my 40th year as a member of the Society, but when I took over her job there was no way I could envisage looking after the Society for 40 years, so I decided to settle for 10.

While I was there I went to Birmingham and met John Glen and Ray Adie who tried to persuade me to go to the Antarctic. I decided against that and went back to McGill and switched from an Arts into a Science program and ended up in glaciology, which took me along the career path that I have followed to date.

McGill was interesting from many different points of view. We had Fritz there. Those of you who have ever been involved in sea-ice work will know of Elton Pounder, and Max Dunbar was also there. There was a tremendous group and there was also the Swiss mafia, so indirectly I got to meet people like Hans Röthlisberger and Hans Weber who had worked with Pat Baird up on Baffin Island. Pat Baird was also in the Geography Department and I knew him quite well, spending time at the Galt Estate.

We had as students there people such as Atsumu Ohmura, Koni Steffen, Heinz Blatter and Almut Iken all names that are probably familiar to some of you because of their Swiss connections.

Koli Hutter referred to standing on the shoulders of giants and this was an expression that Bill Budd used when he received his Seligman Crystal. My feeling is that I haven't stood on the shoulder of any giants, but I have certainly rubbed shoulders with many of them. This largely happened initially at a meeting on glacier surges held at St Hilaire, when we had people such as Bill Field, Louis Lliboutry, John Nye, Hans was there, Gordon Robin, Valter Schytt, Hans Weertman and Mark Meier, amongst others. That was my first introduction to those who to many of you are quite well-known names in glaciology.

Through Fritz I was fortunate enough to meet many of the well-known people in glaciology. You may wonder if I have any particular interest in the subject of this meeting. I can tell you I spent 4 months in Ed LaChapelle's house in Alta, Utah, studying avalanches. That was a very interesting experience, not only to meet Ed but also to meet many of the scientists from CRREL who came down there to study snow (or ski).

I was sitting in my McGill office on Pine Avenue in Montréal one day and I opened up the newspaper. The Canadian government was advertising for glaciologists! I couldn't believe my luck. I thought, well it was time to stop being a student, time to get an honest job, so I wrote off an application and I wasn't even interviewed. The next thing I knew was I had been hired by the Canadian government. I worked for it for 27 years and that was a wonderful experience as well.

I started working for the government in 1967. We were fortunate then. It was a period of tremendous growth, growing about 20% a year at that time, and we also had resources to bring in post-doctoral fellows.

At the beginning of this meeting, Osamu Abe very kindly gave me a present and passed on regards from Tom Nakamura. Tom was one of the post-docs we had working in our group.

You may wonder why Paul Föhn and I get on so well together, well we go back a very long time, back to the days when he was in Ottawa as well. I met many people.

The Geographical Branch of the Canadian government was disbanded and the nucleus of what is now INSTAAR (the Institute of Arctic and Alpine Research) in Boulder was created by Jack Ives, Roger Barry and John Andrews. They were in Ottawa and I knew them.

We formed an Ottawa Glaciology Group. We used to meet about once a month and that also gave me an oppor-

tunity to meet a lot of people. Through the Northeastern North American Branch of the IGS we held annual regional meetings which brought us together with many of the people at CRREL (Cold Regions Research and Engineering Laboratory) in Hanover, New Hampshire.

It was at that time, when we were in Ottawa, I became the IGS Canadian National Correspondent and also the National Correspondent for ICSI (the International Commission on Snow and Ice) and for about six years I was the editor of *ICE*. This was a tremendous introduction into the affairs of the Society and gave me an opportunity to really get to know glaciologists in many parts of the world. Subsequently the government transferred us to Saskatoon. My wife will tell you that she thought we had gone to hell, but in fact it is one of the nicest places we have ever lived.

I was appointed for two years as Chief of the Scientific Information Division, in the National Hydrology Research Institute, which was a wonderful experience for what I subsequently had to do with the Society.

Anyway, I don't want to take up too much of your time but I would like to go back now to the time when I arrived in Cambridge in 1993.

Bob has covered many of the things that I had intended to touch on, the computerized system in the office, and so on, but I would like to put some numbers on the things that have changed. Looking back over the publication of the *Journal* for the last nine years, since I have been there, we have published 646 articles in 5717 pages as opposed to the previous nine years where the numbers were 564 articles and just over 4000 pages. For the *Annals* for that same period, when I was Secretary General, we published about 1800 articles and almost 11000 pages; for the previous nine years it was 628 articles and only 3500 pages. For comparison, the totals for my term were about 2500 articles and more than 16500 pages, as opposed to about 1200 articles and 7500 pages. So, as Bob pointed out, there has been a quite considerable growth in the publication activities of the Society. We have also republished *Glacier Ice*, which is a favourite of many of you, and recently, *Secrets of the Snow*.

For me, the IGS is like a large family. When I took over this job, one of the things I wanted to do was to try and retain the feeling that many of us had that it was like a family gathering whenever we met at symposia. It is a bit like two of my cousins getting married every year. I go to their weddings and I meet all the family that relates to their side of the family. It's a feeling that is very hard to describe, very hard to quantify, to say what it is about the Society that gives you that feeling, but that is the way I feel about it. It is a real pleasure to meet so many wonderful people and know that you will see them again at future meetings.

Margaret decided early that she wanted to be included. She is not an IGS employee, she is not paid by the IGS, but she has chosen to accompany me. I am not quite sure whether it is because we have a lot of beautiful female glaciologists now and she is worried I might be distracted, but for whatever reason, it has been a tremendous benefit for the Society, and for me, that she has been able to be with me at so many meetings.

I would like to say you have all enriched my life immensely and it has been an honour and a real pleasure to have served you. Thank you so much.
«applause/standing ovation»

Atsumu Ohmura, Vice President of the IGS

Ladies and gentlemen, we lose the Ommanneys to the other side of the ocean, but I would like to take this opportunity to introduce his successor and the new Secretary General, Magnús Már Magnússon. I am sure that many of you have seen him already, many places, in fact we had a formal introduction of the new Secretary General at yesterday's Annual General Meeting. However, as usual, the AGM was not so well attended, so I decided to take this opportunity when most of the participants are present. We will be very much dependent on Magnús' work in the future and are very happy that we found a competent, enthusiastic, efficient successor to Simon. We wish you really good work in Cambridge and lots of fun.

Magnús Már Magnússon, Secretary General

Thank you very much. I truly am very honoured to have been chosen for this position and I have told a few people, but I am going to disclose that to everybody now, that I have had a very long desire for this job.

Ten years ago, when Simon was hired, I seriously considered that maybe I should apply. Luckily it never

went further, we got Simon and I have been able to follow what he has been up to and kept a close eye.

When I heard that Simon was retiring, and the word got out, and resulted in me applying for this job and eventually getting it, I can't tell you how honoured and pleased I was.

Simon said he has been a member for 40 years. Well, I have only been a member for 21 years, but it has played a very large part of my life ever since I, as a 17-year-old, decided to investigate glaciers from the inside by falling into a crevasse. That incident proved to be a very valuable lesson when I was a student with Charlie Raymond in Seattle, because Charlie Raymond spent quite a while describing to us ways of calculating how glacier crevasses could never be deeper than about 30 m. I was able to put up my hand and tell him — well, how come I fell 40 m into a crevasse then. This is a phrase that Charlie tells me he has used ever since.

But you have heard enough of me tonight, interrupting all these speakers. I believe the musicians will come back on stage and play a piece and, following that, we will be able to experience some exciting Swiss culture. So thank you all very much for coming here, my first meeting as Secretary General. People have asked me how long I am going to be here and I have said Hilda was there for 40 years and Simon for 10, so the average is 25 years. So who knows. I hope to see you all very often in the future. Thank you very much.

ANNALS OF GLACIOLOGY

The following papers from the International Symposium on Physical and Mechanical Processes in Ice in Relation to Glacier and Ice-Sheet Modelling held in Chamonix Mont-Blanc, France 26–30 August 2002 have been accepted for publication in *Annals of Glaciology* Vol. 37, edited by P. Duval:

G Aðalgeirsdóttir, G H Gudmundsson and H Björnsson
A regression model for the mass-balance distribution of the Vatnajökull ice cap, Iceland

D J Baldwin, J L Bamber, A J Payne and R L Layberry
Using internal layers from the Greenland ice sheet, identified from radio-echo sounding data, with numerical models

J L Bamber, D J Baldwin and S P Gogineni
A new bedrock and surface elevation dataset for modelling the Greenland ice sheet

P D Bates, M J Siegert, V Lee, B P Hubbard and P W Nienow
Numerical simulation of three-dimensional velocity fields in pressurized and non-pressurized Nye channels

A Bauder, M Funk and G H Gudmundsson
The ice-thickness distribution of Unteraargletscher, Switzerland

B Benjumea, Y Ya Macheret, F J Navarro and T Teixidó
Estimation of water content in a temperate glacier from radar and seismic sounding data

R G Bingham, P W Nienow and M J Sharp
Intra-annual and intra-seasonal flow dynamics of a High Arctic polythermal valley glacier

M Bougamont, S Tulaczyk and I Joughin
Numerical investigations of the slow-down of Whillans Ice Stream, West Antarctica: is it shutting down like Ice Stream C?

F Carsey, C T Mogensen, A Behar, H Engelhardt and A L Lane
Science goals for a Mars polar-cap subsurface mission: optical approaches for investigations of inclusions in ice

D M Cole
A dislocation-based analysis of the creep of granular ice: preliminary experiments and modeling

D Dahl-Jensen, N Gundestrup, S P Gogineni and H Miller
Basal melt at NorthGRIP modeled from borehole, ice-core and radio-echo sounder observations

- B De Smedt and F Pattyn
Numerical modelling of historical front variations and dynamic response of Sofiyskiy glacier, Altai mountains, Russia
- O Eisen, F Wilhelms, U Nixdorf and H Miller
Identifying isochrones in GPR profiles from DEP-based forward modeling
- S H Faria, G M Kremer and K Hutter
On the inclusion of recrystallization processes in the modeling of induced anisotropy in ice sheets: a thermodynamicist's point of view
- A Fischer, H Rott and H Björnsson
Observation of recent surges of Vatnajökull, Iceland, by means of ERS SAR interferometry
- P-L Forsström, O Sallasmaa, R Greve and T Zwinger
Simulation of fast-flow features of the Fennoscandian ice sheet during the Last Glacial Maximum
- A C Fowler
On the rheology of till
- S Fujita, K Matsuoka, H Maeno and T Furukawa
Scattering of VHF radio waves from within an ice sheet containing the vertical-girdle-type ice fabric and anisotropic reflection boundaries
- G Gödert
A mesoscopic approach for modelling texture evolution of polar ice including recrystallization phenomena
- J Hedfors, V Peyaud, V Pohjola, P Jansson and R Pettersson
Investigating the ratio of basal drag and driving stress in relation to bedrock topography during a melt season on Storglaciären, Sweden, using force-budget analysis
- U C Herzfeld and H Mayer
Seasonal comparison of ice-surface structures in the ablation area of Jakobshavn Isbræ drainage system, West Greenland
- R C A Hindmarsh
Thermomechanical coupling of ice flow with the bedrock
- B P Hubbard, A Hubbard, H M Mader, J-L Tison, K Grust and P W Nienow
Spatial variability in the water content and rheology of temperate glaciers: Glacier de Tsanfleuron, Switzerland
- C S Hvidberg
Relationship between topography and flow in the north polar cap on Mars
- T H Jacka, S Donoghue, Li Jun, W F Budd and R M Andersen
Laboratory studies of the flow rates of debris-laden ice
- J Kohler, J C Moore and E Isaksson
Comparison of modelled and observed responses of a glacier snowpack to ground-penetrating radar
- Li Jun, H J Zwally, H Cornejo and D Yi
Seasonal variation of snow-surface elevation in North Greenland as modeled and detected by satellite radar altimetry
- K Melvold, T Schuler and G Lappegard
Ground-water intrusions in a mine beneath Höganes-breen, Svalbard: assessing the possibility of evacuating water subglacially
- L W Morland and R Staroszczyk
Strain-rate formulation of ice fabric evolution
- A Pälli, J C Moore, J Jania and P Glowacki
Glacier changes in southern Spitsbergen, 1901–2000
- A Pälli, J C Moore and C Rolstad
Firm-ice transition zone features of four polythermal glaciers in Svalbard seen by ground-penetrating radar
- B Paschke and M A Lange
Dynamics and mass balance of the ice sheet/ice shelf regime at Nivlisen, Antarctica, as derived from a coupled three-dimensional numerical flow model
- B A Patrick, A F Corvino and C J L Wilson
Ice-flow measurements and deformation at marginal shear zones on Sörsdal Glacier, Ingrid Christensen Coast, East Antarctica
- F Pattyn, B de Smedt, S de Brabander, W van Huele, A Agatova, A Mistrukov and H Declair
Ice dynamics and basal properties of Sofiyskiy glacier, Altai mountains, Russia, based on DGPS and radio-echo sounding surveys
- E C Pettit, H P Jacobson and E D Waddington
Effects of basal sliding on isochrones and flow near an ice divide
- V A Pohjola and J Hedfors
Studying the effects of strain heating on glacial flow within outlet glaciers from the Heimefrontfjella Range, Dronning Maud Land, Antarctica
- A Pralong, M Funk and M P Lüthi
A description of crevasse formation using continuum damage mechanics
- Qi Jilin, Lai Yuanming and Pu Yibing
Experimental study on the micro-fabric of frozen sediment using triaxial deformation and computerized tomography

- N Reeh, E Lintz Christensen, C Mayer and O B Olesen
Tidal bending of glaciers: a linear viscoelastic approach
- F Rémy, L Testut, B Legrésy, A Forieri, C Bianchi and I E Tabacco
Lakes and subglacial hydrological networks around Dome C, East Antarctica
- O Rybak and P Huybrechts
A comparison of Eulerian and Lagrangian methods for dating in numerical ice-sheet models
- F Saito, A Abe-Ouchi and H Blatter
Effects of first-order stress gradients in an ice sheet evaluated by a three-dimensional thermomechanical coupled model
- C Scapozza and P Bartelt
The influence of temperature on the small-strain viscous deformation mechanics of snow: a comparison with polycrystalline ice
- K G Schmidt and D Dahl-Jensen
An ice crystal model for Jupiter's moon Europa
- T Schuler and U H Fischer
Elucidating changes in the degree of tracer dispersion in a subglacial channel
- M J Siegert, A J Payne and I Joughin
Spatial stability of Ice Stream D and its tributaries, West Antarctica, revealed by radio-echo sounding and interferometry
- A Sinisalo, A Grinsted, J C Moore, E Kärkäs and R Pettersson
Snow-accumulation studies in Antarctica with ground-penetrating radar using 50, 100 and 800 MHz antenna frequencies
- A Sinisalo, J C Moore, R S W van de Wal, R Bintanja and S Jonsson
A 14 year mass-balance record of a blue-ice area in Antarctica
- S Sleewaegen, D Samyn, S J Fitzsimons and R D Lorrain
Equifinality of basal ice facies from an Antarctic cold-based glacier
- R Staroszczyk
Plane ice-sheet flow with evolving and recrystallizing fabric
- S Sugiyama, G H Gudmundsson and J Helbing
Numerical investigation of the effects of temporal variations in basal lubrication on englacial strain-rate distribution
- A Svensson, P Baadsager, A Persson, C S Hvidberg and M-L Siggaard-Andersen
Seasonal variability in ice crystal properties at NorthGRIP: a case-study around 301 m depth
- A Svensson, K G Schmidt, D Dahl-Jensen, S J Johnsen, Y Wang, S Kipfstuhl and T Thorsteinsson
Properties of ice crystals in NorthGRIP late- to middle-Holocene ice
- L Testut, R Hurd, R Coleman, F Rémy and B Legrésy
Comparison between computed balance velocities and GPS measurements in the Lambert Glacier basin, East Antarctica
- T Thorsteinsson, E D Waddington and R C Fletcher
Spatial and temporal scales of anisotropic effects in ice-sheet flow
- D E Voigt, R B Alley, S Anandakrishnan and M K Spencer
Ice-core insights into the flow and shut-down of Ice Stream C, West Antarctica
- W Wang, H J Zwally, C L Hulbe, M J Siegert and I Joughin
Anisotropic ice flow leading to the onset of Ice Stream D, West Antarctica: numerical modelling based on the observations from Byrd Station borehole
- Y Wang, S Kipfstuhl, N Azuma, T Thorsteinsson and H Miller
Ice fabrics study in the upper 1500 m of the Dome C deep ice core, East Antarctica
- C J L Wilson, D S Russell-Head and H M Sim
The application of an automated fabric analyzer system to the textural evolution of folded ice layers in shear zones
- D P Winebrenner, B E Smith, G A Catania, H B Conway and C F Raymond
Radio-frequency attenuation beneath Siple Dome, West Antarctica, from wide-angle and profiling radar observations
- C Zweck and P Huybrechts
Modeling the marine extent of Northern Hemisphere ice sheets during the last glacial cycle

JOURNAL OF GLACIOLOGY

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

- E E Adams and D A Miller
Ice crystals grown from vapor onto an orientated substrate: application to snow depth-hoar development and gas inclusions in lake ice
- P D Barrette and I J Jordaan
Healed cracks in iceberg ice
- D Benn and C R Warren
Correspondence. Reply to the comments of J.P. Kenneally on "Buoyancy-driven lacustrine calving, Glaciar Nef, Chilean Patagonia" by C. Warren, D. Benn, V. Winchester and S. Harrison
- R A Bindshadler
History of lower Pine Island Glacier, West Antarctica, from Landsat imagery
- F Carsey, A Behar, A L Lane, V Realmuto and H Engelhardt
Instruments and Methods. A borehole camera system for imaging the deep interior of ice sheets
- G K C Clarke
Review. Zryd, Amédée. 2001. *Les glaciers: la nature dans les Alpes*. Éditions Pillet. Société Valaisanne des Sciences Naturelles; Saint-Maurice, Switzerland
- A C Fowler
Correspondence. Rheology of subglacial till
- L W Gold
Statistical behaviour of the deformation for first loading of polycrystalline ice
- M A Granskog, T A Martma and R A Vaikmäe
Development, structure and composition of land-fast sea ice in the northern Baltic Sea
- G H Gudmundsson
Observations of a reversal in vertical and horizontal strain-rate regime during a motion event on Unteraargletscher, Bernese Alps, Switzerland
- W D Harrison, C F Raymond, K A Echelmeyer and R M Krimmel
A macroscopic approach to glacier dynamics
- T S Hooyer and N R Iverson
Flow mechanism of the Des Moines lobe of the Laurentide ice sheet
- U Jonsell, R Hock and B Holmgren
Spatial and temporal variations in albedo on Storglaciären, Sweden
- J P Kenneally
Correspondence. Comments on "Buoyancy-driven lacustrine calving, Glaciar Nef, Chilean Patagonia" by Charles Warren, Doug Benn, Vanessa Winchester and Stephan Harrison
- Liu Shiyin, Sun Wenxin, Shen Yongping and Li Gang
Glacier changes since the Little Ice Age maximum in the western Qilian Shan, northwest China, and consequences of glacier runoff for water supply
- A L Lowe and J B Anderson
Evidence for abundant subglacial meltwater beneath the paleo-ice sheet in Pine Island Bay, Antarctica
- D R MacAyeal, T A Scambos, C L Hulbe and M A Fahnestock
Catastrophic ice-shelf break-up by an ice-shelf fragment-capsize mechanism
- R J Motyka and K A Echelmeyer
Taku Glacier (Alaska, U.S.A.) on the move again: active deformation of proglacial sediments
- R A Peterson and W B Krantz
A mechanism for differential frost heave and its implications for patterned-ground formation
- J F Pinglot, R A Vaikmäe, K Kamiyama, M Igarashi, D Fritzsche, F Wilhelms, R Koerner, L Henderson, E Isaksson, Jan-G Winther, R S W van de Wal, M Fournier, P Bouisset and H A J Meijer
Ice cores from Arctic sub-polar glaciers: chronology and post-depositional processes deduced from radio-activity measurements
- J M Ramage and B L Isacks
Interannual variations of snowmelt and refreeze timing in southeast-Alaskan icefields, U.S.A.
- C Scapozza and P Bartelt
Triaxial tests on snow at low strain rate. Part II: Constitutive behaviour
- M Schmeltz, E Rignot, T K Dupont and D R MacAyeal
Sensitivity of Pine Island Glacier, West Antarctica, to changes in ice-shelf and basal conditions: a model study
- N P M van Lipzig, E van Meijgaard and J Oerlemans
The effect of temporal variations in the surface mass balance and temperature-inversion strength on the interpretation of ice-core signals
- D G Vaughan
Review. Kaser, G. and H. Osmaston. 2002. *Tropical glaciers*. Cambridge, etc., Cambridge University Press

A Vieli, J Jania and L Kolondra

The retreat of a tidewater glacier: observations and model calculations on Hansbreen, Spitsbergen

M Von Moos, P Bartelt, A Zweidler and E Bleiker

Triaxial tests on snow at low strain rate. Part I: Experimental device

J L Wadham and A-M Nuttall

Multiphase formation of superimposed ice during a mass-balance year at a maritime high-Arctic glacier

C J L Wilson and H M Sim

The localization of strain and *c*-axis evolution in anisotropic ice

JOURNAL OF GLACIOLOGY: REFEREE RECOGNITION

After five years as Chief Editors of the *Journal of Glaciology*, we have developed a deep appreciation for the essential volunteer work of two groups without whom the *Journal* would not exist. They are the Scientific Editors and the Referees. We think that members of the Society should be aware of their contribution.

The Scientific Editors handle the papers submitted to the *Journal*, solicit reviews, remind referees to be timely, and assess the reviews when they are turned in, and often provide reviews of their own. Theirs is the scientific judgment on which the excellence of the *Journal* is based. The Referees provide comments, scientific judgment, and constructive criticism that leads to higher quality papers. From our perspective, Scientific Editors and Referees, working together, make authors look better by helping their papers reach their full potential.

We thank all of our Scientific Editors and Referees. It is difficult and even arbitrary to single out individuals, but during the past several years, the following have provided particularly insightful or helpful reviews:

Paul Barrette

Charlie Bentley
David Cole

Andrew C. Fowler
Roger LeB. Hooke
Phillippe Huybrechts

Tómas Jóhannesson

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Will Harrison and Matthew Sturm



FUTURE MEETINGS (of other organizations)

THIRD INTERNATIONAL CONFERENCE ON MARS POLAR SCIENCE AND EXPLORATION

13–17 October 2003, Fairmount Chateau, Lake Louise, Alberta, Canada

The Third International Conference on Mars Polar Science and Exploration -- the latest in a continuing series of meetings that are intended to promote the exchange of knowledge and ideas between planetary and terrestrial scientists interested in Mars polar and climate research — will be held from 13–17 October 2003 at the Fairmount Chateau, Lake Louise, Banff National Park, Alberta, Canada.

In recognition of the broad scope, interdisciplinary nature, and strong international interest in this topic, any scientist with relevant theoretical, experimental, or polar field experience is strongly encouraged to participate and to submit an abstract.

For further information regarding the format and scientific objectives of the meeting, please check the full text of this announcement at:

<http://www.lpi.usra.edu/meetings/polar2003>

Further details regarding the program, topics for discussion, opportunities for participation, as well as guidelines for abstract and poster preparation, will be included

in the second announcement that will be posted on this LPI Web site by 9 May 2003.

To subscribe to a mailing list to receive electronic reminders and special announcements relating to the meeting via e-mail, please submit an electronic Indication of Interest form (available at the Conference website) by 11 April 2003.

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CONVENERS

Stephen Clifford, Lunar and Planetary Institute
Peter Doran, University of Illinois at Chicago
David Fisher, Geological Survey of Canada
Christopher Herd, University of Alberta

WORKSHOP ON EUROPA'S ICY SHELL: PAST, PRESENT, AND FUTURE

6-8 February 2004, Houston, Texas, U.S.A.

The Workshop on Europa's Ice Shell: Past, Present and Future will be held on 6-8 February 2004 at the Lunar and Planetary Institute (LPI) which is housed in the Center for Advanced Space Studies, 3600 Bay Area Boulevard, Houston, Texas.

Europa's ocean is currently covered by an icy shell of uncertain thickness and it is this icy shell that controls how the ocean and any biological agents within it interact with the surface of Europa. The purpose of this 3-day workshop is to discuss our current understanding of the Icy Shell, its physical state and evolution and its interaction with the putative sub-surface ocean. Our aim is to bring together divergent and diverse viewpoints to assess the limits of our current knowledge, to advance our collective understanding of this unique environment, and to foster new ideas and future strategies. All aspects of the Icy Shell will be considered, including composition, physical state (e.g. thickness, rheology), geologic history, present-day activity, biology, and exploration goals. Observational, theoretical, and speculative presentations are encouraged from the planetary and terrestrial communities.

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CONVENERS

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For further information regarding the format and scientific objectives of the meeting, please check the full text of this announcement at:

<http://www.lpi.usra.edu/meetings/europa2004>

Further details regarding the program, topics for discussion, opportunities for participation, as well as guidelines for abstract and poster preparation, will be included in the second announcement that will be posted on this LPI Web site by 17 September 2003.

To subscribe to a mailing list to receive electronic reminders and special announcements relating to the meeting via e-mail, please submit an electronic Indication of Interest form (available at the Conference website) by July 30, 2003.



NEWS

AWARDS

Robert A. Bindshadler, our Immediate Past President, has been elected a Fellow of the American Geophysical Union for fundamental contributions to understanding of the stability of ice sheets and glaciers and their potential to influence sea level.

Johannes Oerlemans, was one of the recipients of the 2001 Spinoza Prize of the Netherlands Organisation for Scientific Research. This award, also known as the "Dutch Nobel Prize" is the highest given for scientific achievements in the Netherlands, and is presented annually to eminent Dutch researchers whose work is acclaimed internationally. Hans was honoured for his significant contribution to climate and ice-sheet modelling.

The Royal Netherlands Academy of Arts and Sciences has awarded the 2002 Dr A.H. Heineken Prize for Environmental Sciences (US\$150,000) to Lonnie G. Thompson "for his pioneering work in research into ice cores in the polar regions and the tropics". The Prize has been awarded every two years since 1990.

Lonnie Thompson is convinced that ice forms the best archive of the Earth's climate. And that frozen history is located not only at the North and South Poles, but also in the

tropics (e.g. at the peaks of Mt. Kilimanjaro), where the ice caps are in fact melting rapidly. Thompson was one of the first to realise that global warming poses a threat to a number of the world's ice archives. Partly because of this, gathering data is high on his list of priorities. He has often moved heaven and earth to gain permission to work with his drilling team in a particular location. Under the most extreme conditions, at altitudes where even mountaineers can barely survive, he has succeeded in collecting ice cores. His ice samples come from all over the world: from Bolivia, Peru, China and a host of other locations. The freezers in his laboratory, where Thompson analyses the ice, are now full to overflowing.

The information on the climate and the atmosphere which is stored in the ice can go back 700,000 years. The ice contains a clear record of phenomena such as El Niño and the Asian Monsoon, somewhat similar to tree rings, except that the ice history goes much further back in time and contains much more information.

Thompson's research provides an insight into natural climate change, ultimately making it possible to assess the effects of human beings on the earth's climate, something which has been a source of heated debate among researchers for many years.

The Canadian Geophysical Union has awarded the J. Tuzo Wilson Medal to Garry K.C. Clarke, past President of the IGS. The medal honours Canada's premier geophysicist and first medal recipient. The CGU gives this award annually to recognize scientists who make outstanding contributions to Canadian geophysics. Factors taken into account in the selection process include excellence in scientific or technical research, instrument

development, industrial applications and/or teaching. Garry was awarded the 2003 medal for significant contributions in undergraduate and graduate teaching, scholarly activities and service to the geophysical community, and for pioneering contributions to theories of glacier dynamics as well as to methods for studying sub-glacial processes.

ONLINE GLACIOLOGY DISCUSSION FORUM

The Glaciology Discussion Forum is a new online bulletin board intended as an outlet for glaciologists to discuss all things related to glaciology, and to announce upcoming conferences, job postings and other events related to glaciology. Please visit the forums at <http://toddalbert.com/forum/>. This bulletin board is free to

use and open to the public. Advanced features are available to users who register (create a login name and password) such as changing your default language, private messaging, emailing to fellow users, and much more. Registration is free.

Current forum topics include (please suggest more):

Glacial geology
Glaciers
Greenland
Ice cores
Ice shelves
Ice streams
Mass balance
Models
Paleoclimatology
Permafrost and frozen ground

Remote sensing
Rock glaciers
Snow
Surging glaciers
Tropical glaciers
Other

Post-docs
Research
Teaching

Student forums
Research
Teaching

Announcements
Conferences
Positions
Talks and seminars
Other

General
Antarctica
Dynamics
Field measurements
Floating ice tongues

Todd Albert (me@toddalbert.com)



RECENT MEETINGS (of other organizations)

MIDWEST GLACIOLOGY MEETING 2002

The 2002 Midwest Glaciology Meeting, hosted by Bob Jacobel and Brian Welch, was held at St. Olaf College in beautiful, bucolic Northfield Minnesota. Participants travelled from far and wide for the annual meeting, now in its second decade, for two days of presentations, conversation, and good cheer. Among those in attendance was one of the meeting's founders, neither of whom now reside in the U.S.A. The fickle nature of glacier ice was a popular topic. The ice plain at the downstream end of Whillans Ice Stream, West Antarctica (WA), has been caught in the act of lurching forward, then stopping, then lurching forward again, and so on, in a manner that will yield insight into the properties of the subglacial till and the nature of the contact between ice and till. The velocity of Ice Stream D, a somewhat more stately flow farther north, is now known to vary cyclically, in what appears to be an elastic response of the ice to the ocean tide. On longer time scales, streaklines preserved in the Ross Ice Shelf (WA) show the Ross ice streams to suffer cycles of redirection near the grounding line, which may be due to the thermal consequences of downstream thinning in fast-flowing ice. The margins of paleo-ice sheets were also of interest, most strikingly in the geologic record of meltwater drainage systems at an unfrozen edge of the Des Moines Lobe of the Laurentide ice sheet. That record may have analogies to present-day

ice-stream systems. Ice-penetrating radar, that invaluable glaciological tool, was used in studies of thermal conditions at the base of Ice Stream C and within Storglaciären; of snow accumulation patterns in West Antarctica; and of possible drainage-divide migration in Thwaites basin (Amundsen Sea sector, WA). The base of Ice Stream C, and by inference the stream's flow history, was further interrogated, via spatial variability in the freshness of water samples collected by borehole at the base of the ice sheet. Not to be outdone, experimentalists also had their day, studying firm melt layers at Siple Dome, WA, using plexiglass boxes to incite snow to melt and then observing the meltwater in the act of refreezing. MGM attendees also previewed a work of beauty and of devotion to ice, an electronic illustrated guide to a glacier titled Blue Ice, which is available at <http://www.acad.carleton.edu/curricular/GEOL/Links/AlumContributions/blueice/book.html>. The meeting was declared by all to have been another great success. The 12th Midwest Glaciology Meeting was held in Orono, Maine on April 10 and 11, 2003. Further details can be found on the web at <http://www.ume.maine.edu/iceage/Seminar/mgmindex.html>.

Christina Hulbe (chulbe@pdx.edu)

CRYOSPHERIC SCIENCES

Cryospheric Sciences (CR) is a new section of the European Geosciences Union (EGU), formed at the end of last year's European Geophysical Society meeting. It was created because of the poor representation, profile and organisation of the subject at previous meetings. EGS 2003 was the first year that we had our own section, allowing some autonomy over the organisation of the sessions. However, being the first year, there were inevitably a few teething problems and the meeting was also a joint one between AGU, EGS and EUG. This led to extremely complex organisational and logistical issues (it's a long story!) and was partly responsible for the rather small room that many of the CR sessions were held in. It was also not ideal to have all the CR posters on one day, with oral sessions coming several days later. We very much hope to eliminate these problems at future meetings. On a more positive note, I was delighted by the consistently high attendance in all the sessions and the number of abstracts (~270) that were submitted to the CR section in its first year.

The cryospheric sessions during the 2003 meeting in Nice (several co-sponsored by other sections) were:
 CR1, Open session on cryospheric sciences
 CR2, Permafrost & greenhouse warming
 CR3, Advances in remote sensing of the cryosphere
 CR4, Seasonal snow cover monitoring and modelling
 CR5, Eco-hydrological and meteorological coupling in mountain areas

CR6, Ice sheet–climate interactions
 CR7, Ice Cores: glaciology and environmental change
 CR8, Worldwide glacier monitoring in the 21st century
 CR9, Ice in the Solar System
 CR10, Control of basal processes on motion and mass balance in glaciers and ice sheets
 CR11, Representation of sea ice in models
 US7, Frontiers in cryospheric sciences

There were, in addition, some 16 co-sponsored sessions in ocean, climate sciences, natural hazards (including glacier hazards and avalanches) and geodesy.

With the establishment of a CR section, I now need help with the organisation of future meetings through a small working group or technical committee. The members of the CR technical committee comprise secretaries of the four sub-sections (which are, 1: snow, 2: permafrost, 3: glaciers and ice sheets, 4: sea ice), vice president and president. I would like (self) nominations for the four secretary posts and the vice president post. Each of these involves relatively little work (may be one week a year at most) but can make a huge difference to the success of the meeting. It is useful if members of the technical committee can try to attend the EGU conference each year. I have had suggestions for some of these posts (1, 2 and 4) but not all.

Jonathan Bamber (j.l.bamber@bristol.ac.uk)



GLACIOLOGICAL DIARY

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2003

20–25 July 2003

Sixth International Conference on Mars, Pasadena, California, U.S.A.
 Lunar and Planetary Institute, P.O. Box 58407,
 Houston, TX 77058, U.S.A. (A. Albee, Division of
 Geological and Planetary Sciences, California Institute
 of Technology, Mail Stop 150-21, Pasadena,
 California CA 91125, U.S.A. (Tel [1](626)395-6367;
 Fax [1](626)585-1917; 6thMars03@gps.caltech.edu;
 www.lpi.usra.edu/meetings/sixthmars2003)

21–25 July 2003

* 8th International Conference on Permafrost, Zürich, Switzerland
 W. Haeberli, Department of Geography, University of
 Zürich-Irchel, Winterthurerstrasse 190, CH-8057
 Zürich, Switzerland (Tel [41](1)635-51-20; Fax
 [41](1)635-68-48; haeberli@gis.geogr.unizh.ch)

25–29 August 2003

14th International Symposium and Workshop,
 Northern Research Basins, Kangerlussuaq/Sdr.
 Strømfjord, Greenland
 Organizing Committee, 14th NRB Symposium,
 Institute of Geography, University of Copenhagen,
 Øster Voldgade 10, DK-1350 Copenhagen, Denmark
 (kb@geogr.ku.dk; <http://www.geogr.ku.dk/projects/nrb14/symp.htm>)

25–29 August 2003

* Seventh International Symposium on Antarctic
 Glaciology (ISAG-7), Milan, Italy
 G. Orombelli, Department of Environmental Sciences,
 Via Emanueli 15, I-20126 Milano, Italy (Tel
 [39](2)6447-4403; Fax [39](2)6447-4400;
 2a@alpha.disat.unimi.it)

3–8 September 2003

Sixth Symposium, International Commission on
 Glacier Caves and Karst in Polar Regions
 (GLACKIPR), Ny-Ålesund, Svalbard, Norway

- Carmen Domingez, Department of Applied Mathematics, University of Salamanca, P/ de la Merced s/n, ES-37008 Salamanca, Spain (Tel/Fax [34](923)600-637; karmenka@usal.es)
- 8–12 September 2003
International Symposium on Antarctic Earth Sciences (ISAES IX), Potsdam, Germany
H.-W. Hubberten, Alfred-Wegener-Institut für Polar- und Meeresforschung, Forschungsstelle Potsdam, Telegrafenberg A43, D-14473 Potsdam, Germany (Tel [49](331)288-2100; Fax [49](331)288-2137; isaes@awi-potsdam.de)
- 9–20 September 2003
Fourth Karthaus Course on Ice Sheets and Glaciers in the Climate System, Karthaus/Certosa, Schnalstal, Italy
J. Oerlemans, IMAU, Utrecht University, Princetonplein 5, NL-3584 CC Utrecht, The Netherlands (Tel [31](30)253-3272; Fax [31](30)254-3163; j.oerlemans@phys.uu.nl)
- 14–16 September 2003
* IGS British Branch Meeting, School of Civil Engineering, Queen's University of Belfast, Belfast, Northern Ireland
B. Kulesa, School of Civil Engineering, Queen's University of Belfast, Belfast BT9 5AG, Northern Ireland, U.K. (Tel [44](28)9027-4746; Fax [44](28)9066-3754; igs2003@qub.ac.uk; <http://www.qub.ac.uk/igs2003>);
- 4–9 October 2003
EuroConference on the Comparison of Ice Core Records with Marine Sediments and Climate Models, San Feliu de Guixols, Spain
H. Miller, Alfred-Wegener-Institute for Polar and Marine Research, Columbusstrasse, Postfach 120161, D-27515 Bremerhaven, Germany (Tel [49](471)483-1210; Fax [49](471)483-1149; miller@awi-bremerhaven.de; <http://www.esf.org/euresco>)
- 13–17 October 2003
* Third International Conference on Mars Polar Science and Exploration, Lake Louise, Alberta, Canada
S. Clifford, Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston, TX 77058, USA (Tel: [1](281)486-2146; Fax: [1](281)486-2162; clifford@lpi.usra.edu; <http://cass/jsc.nasa.gov/meetings/polar98/>)
- 2004
- 6–8 February 2004
Workshop on Europa's Icy Shell: Past, Present, and Future, Lunar and Planetary Institute, Houston, Texas, U.S.A.
<http://www.lpi.usra.edu/meetings/europa2004>
- 24–28 May, 2004
XIII Glaciological Symposium on Shrinkage of Glacosphere: Facts and Analysis, St. Petersburg, Russia
A. Glazovskiy, Institute of Geography, Russian Academy of Sciences, Staromonetny 29, 109017 Moscow, Russia (Tel [7](095)939-01-2; Fax [7](095)959-00-33; glazovsk@gol.ru; <http://icemass.narod.ru/symp.htm>)
- 5–8 July 2004
Fifth International Conference on Snow Engineering, Davos, Switzerland
B. Miller, Eidgenössische Institut für Schnee- und Lawinenforschung SLF, Flüelastrasse 11, CH-7260 Davos Dorf, Switzerland (Tel [41](81)417-02-24; Fax [41](81)417-08-23; miller@slf.ch; <http://www.snow2004.ch>)
- 26–30 July 2004
** International Symposium on Ice–Water Interactions: Ice–Water–Ice — Processes Across the Phase Boundary, Portland State University, Portland, Oregon, U.S.A.
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK (<http://www.igsoc.org/home.htm>)
- 23–27 August 2004
** International Symposium on Arctic Glaciology, Geilo, Norway
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK (<http://www.igsoc.org/home.htm>)
- 2005
- Dates to be announced
** Sea Ice, New Zealand
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK (<http://www.igsoc.org/home.htm>)
- Dates to be announced
** High-elevation Glaciers and Climate Records, Lanzhou, People's Republic of China
Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, UK (<http://www.igsoc.org/home.htm>)



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