ICSI Bureau Meeting, November 3–4, 2003.
Scott Polar Research Institute (SPRI), Cambridge, United Kingdom.
Minutes

Present:
Gerry Jones, President;
Georg Kaser, President-Elect;
Peter Jansson, Secretary-Treasurer
Jon Ove Hagen, Vice President
Konrad Steffen, Vice President
Julian Dowdeswell, Head, Division on Glaciers and Ice Sheets
Paul Föhn, Head, Division on Seasonal Snow Cover and Avalanches

Absent (with regrets):
Kumiko Goto-Azuma, Vice President;
Manfred Lange, Head, Division on River, lake and sea Ice
Wilfried Haeberli, Director, World Glacier Monitoring Service.

Invited participants :
Liz Morris, SPRI, (items 9 & 11.6);
Michael Hambrey, University of Wales, Aberystwyth (items 13 & 18);
Gwyn Rees, CEH, Wallingford (item 12).

1. Opening remarks

The President opened the meeting by emphasizing that this was a period of important discussions and decisions for the Commission during the process of seeking Association status within IUGG

2. Welcoming address by our Host, the Director of SPRI

Professor Dowdeswell, welcomed Bureau Members to SPRI. He outlined a brief history of the Institute and the main axes of research. He also served as the guide during the subsequent visit to the institute facilities including the library and the museum.

3. Thanks to the outgoing Bureau (1999–2003); Welcome to the incoming Bureau (2003–2007)

The President thanked the out-going Bureau for the work that they had accomplished during their term of office, 1999-2003. He welcomed the in-coming Bureau and particularly explained the transition period 2003-2005 during which the new President-Elect will gradually familiarize himself with the responsibilities of office before he assumes the Presidency in April 2005 at the IAHS VII Scientific Assembly in Foz de Iguassu.

4. Agenda: additions/modifications

No additions or modifications to the agenda were tabled .

5. Minutes of the 2003 Bureau Meeting, Muenster

5.1. Corrections/modifications/additions

No corrections, modifications or additions to the Minutes were tabled.

5.2. Acceptance

Minutes accepted: Proposed by Paul Föhn; seconded by Julian Dowdeswell. Accepted unanimously.

6. Activities following on the Minutes of 2003

6.1. Action items

Actions from Münster reviewed, all but two actions were completed. (*APPENDIX A*).

The President noted that the two uncompleted action items (4.2, National Representatives; and 4.9, WGMS Director's Report) were wholly or in part the responsibility of the Director of WGMS. The Bureau expressed the desire to see the work on these two items completed and will thus contact the Director as soon as possible.

Action:

Kaser/Jansson: complete list of national representatives, Action item 4.2 in Münster-minutes

Dowdeswell/Hagen: Continue discussions with WGMS according to Action item 4.9 in Munster-minutes.

5.2. Other

No other activities were raised.

7. Secretary-Treasurer: Report on ICSI finances

The President-Elect presented the report as given in Sapporo when he was the out-going Secretary-Treasurer. Only change since then includes fees to banks when closing account in Innsbruck. Treasury now handed over to Jansson who now occupies the office of Secretary-Treasurer. Additional expenses associated with meeting are reimbursements to the President, Jones, for travel costs. (*APPENDIX B*) Acceptation of the Secretary Treasurer's Report was proposed by J-O Hagen and seconded by K. Steffen. Accepted unanimously.

8. Sapporo IUGG 23rd General Assembly

The President reported on ICSI activities at the General Assembly

8.1. Report on the ICSI Plenary and the Election of the New Bureau

The Plenary Administrative Session was not well attended (approximately 20 of whom only 2 were members of the old Bureau and 1other of the in-coming Bureau). The President's Quadrennial Report was distributed (*APPENDIX C*) and discussions on some items took place. Particular attention was focused on the request by ICSI to assume Association status in IUGG and most of the questions were devoted to this issue. The Secretary-Treasurer presented the finances of the Commission. No election was held for the new Bureau since no alternative candidates were put forward once Syed Iqbal Hasnain withdrew his candidacy. The new Bureau was then elected by acclamation.

8.2. Report on the ICSI presentation to the IUGG Executive Committee on the Commission's Proposal for a change of status within IUGG

The President reported on his presentation to the IUGG Council. A typewritten resume was circulated beforehand to Council members. (*APPENDIX D*) The talk appeared to be well received although support from other associations was non-committal during the subsequent discussion.

Action:

Jones to reproduce his presentation in printed form.

8.3. ICSI proposal to IUGG/SCOPE

The President had submitted a proposal on behalf of the Bureau to the Scientific Committee on problems of the Environment (SCOPE/ICSU) through the offices of the IUGG Representative on the SCOPE. Acknowledgment from SCOPE of the submittal has been received . (*APPENDIX E*)

Action:

Kaser: Report to GCOS and GTOS on Friend activities via *Steffen*.

8.4. Report on Symposium JSH01 >Remote sensing of the Cryosphere

The President tabled the report received from Richard Armstrong the ICSI convenor (*APPENDIX F*)

8.5. Report on Workshop JWH01 >Snow Processes: representation in atmospheric and hydrological models

The President tabled the report received from John Pomeroy Armstrong the ICSI convenor (*APPENDIX G*)

9. Relations with IUGG: status of ICSI

IGS president, immediate past ICSI president, Liz Morris adjunct.

9.1. Reply of the IUGG Executive Council to the ICSI request for change of status

The President tabled the reply by the IUGG Executive to the official request for change in status (*APPENDIX H*). He also tabled a discussion paper on the next steps in the process (*APPENDIX I*). Upon discussion, the President was given the task to write up a proposal following guidelines given by the Bureau's communal analysis of the situation. The proposal will be expediently circulated through the bureau and also scrutinized by an external advisory board consisting of Roger Barry, Atsumu Ohmura, Richard Alley, and Hartmut Grassl (none approached on the subject at the time of writing the minutes). In a final stage the proposal will go to Jo Ann Jocelyn Secretary General of IUGG for a insider check of its feasibility. She will also be the recipient of the proposal on Apr. 15 to be put on the agenda for the meeting of the IUGG Executive Committee in Boulder September 1–2, 2004.

9.2. Discussion on future steps to be taken 2003–2007/9

New name for association: International Association on Cryospheric Sciences (IACS).

Newsletter issued by ICSI/IACS was suggested

Action:

Jansson: type up and distribute comments on ICSI position relative other org's. COMPLETED

Steffen: provide CliC perspective on relations with ICSI, IGS and other org's

Steffen/Kaser: to meet Davies and Ohmura in Zürich to discuss steps

Jones: To inform Lange to approach IAPSO on issue

Jansson: produce report for ice to be sent to *Kaser/Jones* for review and revisions

Dowdeswell/Hagen: write letter of support to organizations and provide "raison d'etre" (ref to #4)

Kaser: produce welcome letter to national rep's on ICSI status to be signed and sent to SPRI for distr. With Geogr. Ann. Mass balance volume.

Jones: Prepare IUGG proposal for Jan 15 to be sent to all bureau members

All bureau members: Provide feed back on proposal before Jan. 31.

Jones: Bureau requires dates on IAHS, IAPSO and IAMAS events during 2005 – Completed.

Kaser: Contacts Roger Barry for inclusion in new advisory committee (Barry, Ohmura, Alley, Grassl) on the status of ICSI in IUGG

Steffen: contacts Atsumu Ohmura, Richard Alley, and Hartmut Grassl for inclusion in new advisory committee on status of ICSI in IUGG

Jones: Provides final draft for JoAnn Jocelyn for comments before submitting to IUGG EC

10. Relations with IAHS

The President reported on significant improvements during relations with IAHS in the last year. IAHS now seems to be our best support in the process of changing status.

10.1. National Representatives to ICSI

The President-Elect reported on attempts so far to establish National representatives (NR's) in all relevant countries. Despite many no-shows, the number of NR's is now at a probable all-time high. The major problem in establishing NR's does not lie in low interest but in the, sometimes, problematic series of contacts that must be made in order to obtain official rep. status. *APPENDIX J* – list of countries and NR's

10.2. ICSI contribution to Prediction in Ungauged Basins (PUB), the IAHS initiative

John Pomeroy, nominated as the ICSI representative to PUB. He has been very successful in establishing ICSI-sponsored activities in PUB in the short time at his disposal up to date.

10.3. IHP-VI: Andean-FRIEND (12.2)

See 12.2

10.4. IAHS: Report on Bureau Meeting(s) and Plenary, Sapporo, July 2003

The President reported on the Bureau Meetings and the Plenary held at Sapporo. The Minutes of these meetings will soon be posted on the IAHS website. At the first Bureau meeting the ICSI President outlined the proposal of the Commission to attain association status and he received the support of the other commissions to proceed with the process.

10.5. IAHS 7th Scientific Assembly, Foz de Iguassu, Brazil, April 2005; ICSI participation

Information. At the time of the meeting the ICSI proposed workshops have not been verified. ICSI will, through Kaser, stand for a field trip, which seems to be a very attractive feature of the meeting.

Action:

Kaser: coordinates ICSI activities with the IAHS Scientific Committee

10.6. Hydrology 2020

Report from P. Etchevers, the ICSI delegate in Hydrology 2020. During meeting in Sapporo snow and ice was identified as one of the major topics to be of concern in future changes in hydrological regimes due to its sensitivity on climate. *APPENDIX K*

10.7. IAHS-DFID Submission: the ICSI Proposal

The President tabled the ICSI contribution of August 26, 2002, to the IAHS proposal to DFID *APPENDIX L*. The ICSI contribution was sent to Alan Gustard, President, ICSW, who is coordinating the IAHS submission. No response has been received by Alan Gustard, from DFID. As DFID is now in a restructuring process, it is likely that the IAHS submission will not be acquiesced to in this funding cycle.

10.8. IAHS-WMO WG on GEWEX: ICSI representative

The President stated that John Pomeroy has been named as the ICSI representative to the IAHS WMO WG on GEWEX. Dr Pomeroy was named on the recommendation of the outgoing ICSI representative, Eric Brun.

10.9. IAHS-WWAP collaboration: the ICSI Proposal (12.3)

See 12.3

10.10. IAHS-IYPE (IUGG-UNESCO) collaboration: possible ICSI participation

Within the IUGG initiative of IGY+50 IAHS, IAMAS, IASPEI and IAVCEI organize the IYPE and IAHS, IAMAS, IAGA, IAPSO, IASPEI organize the International Polar Year IPY to which ICSI could contribute. The Bureau agreed that ICSI should contribute in a positive manner to IYPE and IPY and will follow the progress of the programs with interest.

Action:

Hagen, Dowdeswell: to keep track on evolution of IPY and IYPE and keep the Bureau informed.

11. Relations with other Associations of IUGG, IPA, and IGS

11.1. IAMAS

11.1.1. Report on cosponsored Symposia, Sapporo, JSM10, JSM11, JSM15, JSM16

No reports were tabled.

11.1.2. ICSI participation, 9th Scientific Assembly, Beijing, China 2005

Information. Proposals for two workshops were submitted; both were accepted by the IAMAS Scientific Committee *APPENDIX M*

Action:

Jansson: coordinates ICSI activities with the IAMAS Scientific Committee

11.2. IAPSO: Report on the cosponsored Symposium, Sapporo, JSP04

No report

Action:

Jones: contacts Lange for coordinating ICSI activities at next IAPSO assembly – Completed

11.3. CliC/WCRP: Conference IGS/ICSI/CliC 2005-2006?

The President opened the discussion on the opportunity of sponsoring a major conference on the Cryosphere in 2005 or 2006. This would be an important part of the process to attain the status of an association in IUGG. The Bureau unanimously agreed that ICSI should make a major effort on this issue – particularly in concert with IGS, CliC and IPA.

Action:

Steffen: convey date of 2006 for IGS/ICSI/CliC symposium to CliC community. Tentative title: Cryosphere-Climate Interactions.

Steffen: update bureau on St. Petersburg meeting

11.4. IPA: Report, IPA Eighth International Conference on permafrost, Zurich, 21st–25th July 2003.

The President tabled a report of the meeting taken from the IPA website. The report contained information on new WG's and the new members of the IPA Executive Council 2003–2008. *APPENDIX N*

11.5. IPA-ICSI future collaboration

The President tabled a report on the resolutions of the IPA Executive Council passed during the Zurich meeting as taken from the IPA website. The resolutions included two resolutions of direct interest to ICSI; a resolution to collaborate on a joint IPA-ICSI project on ice-permafrost interactions and a second to develop a terrestrial Cryosphere component of the CliC Programme (*APPENDIX O*)

Action:

Jones: Contact Jerry Brown, IPA, on joint WG

Jones: Contact IPA on their administration of workgroups for ICSI consideration. #3 on IPA resolution concerns common workgroup

11.6. IGS: future collaboration

Liz Morris adjunct. Conflicts in interest between ICSI and IGS should be minimal. It is important to maintain close contact and to continue the good dialogue marking our contacts so far. Co-sponsorship of symposia and IGS publication of ICSI symposia are ingredients in the fruitful symbiotic relationship between the organizations. Peter Jansson presented a brief perspective of IGS, ICSI and other organisations in the cryospheric field (*APPENDIX P*).

12. Relations with UNESCO

The President-Elect, Kaser, chair, Gwyn Rees adjunct: ICSI initiatives on glacier mass balance networks (GMN) in the HKH region and in the Andes are within the UNESCO/IHP/FRIEND programs. G. Rees reported on HKH-FRIEND, already active since many years, and an ANDEAN-FRIEND to be installed soon. ICSI/GMN could be a kick off project for ANDEAN-FRIEND. UNESCO provides seeding money to get projects started.

12.1. ICSI/UNESCO-IHP/HKH-FRIEND: UNESCO funded activity for 2004

Status HKH/GMN: training course held and stake network installed at Chhota Shigri, India; Extension of GMN and evaluation of Chhota Shigri measurements to be organized with UNESCO.

Action:

Kaser: organize, extend and evaluation of HKH activities in cooperation with UNESCO/IHP

12.2. ICSI/UNESCO-IHP/Andean-FRIEND:

12.2.1. Report on the Valdivia Workshop

The President and the President-Elect tabled a report on the Workshop on an Andean Glacier Mass Balance Network. The workshop, which was embedded in a Symposium on Andean Glacier Mass Balance was judged to be highly successful. *APPENDIX Q*. A follow-up workshop will be held in 2004.

12.2.2. Interim Steering Committee of Andean-FRIEND

Representatives from all Andean countries (except Venezuela) set up a steering committee chaired by G. Casassa. G. Kaser representing ICSI. SC to organize further steps toward a GMN within UNESCO/IHP/FRIEND

12.2.3. UNESCO funded Guayaquil Workshop

The planned UNESCO workshop in Guayaquil (Dec. 03) and training course in Huaraz (Jul. 04) have had to be postponed because of UNESCO financial policies.

12.2.4. Future Activities, 2004-2008

Negotiations with UNESCO Paris and Montevideo will be continued in order to finance and organize a coordination workshop and a training course – hopefully in 2004.

Action:

Kaser: Provides Gwyn Rees on Andean Friend to Sigfried Demuth GTZ
Kaser: organize next steps in ANDEAN/GMN in cooperation with UNESCO/IHP

12.3. WWAP: request for IAHS participation – the ICSI Proposal

The ICSI document on the perspectives of the Bureau to contribute to the second edition of WWAP was tabled. The original document was submitted by the President in August 2003 (*APPENDIX R*) No reply has been so far received.

13. ICSI sponsored Conferences/Workshops

13.1. Glacial Sedimentary Processes and Products: Aberystwyth, August 25–27 2005; Hambrey, Glasser, Hubbard (UWA); Seigert (UB); Jansson (SU & ICSI).

Michael Hambrey presented workshop plans. ICSI will co-sponsor the meeting with IAS, IGS, QRA, and ACE/SCAR.

Action:

Jansson: representing ICSI as co-convenor

13.2. Other conferences/workshops 2004- other than those of IAHS (item 10 v), IAMAS (11 i b), CliC (11 iii) and UNESCO-FRIEND (12 ii c)

"Recent Glacier Shrinkage in the Andes and Consequences for Water Resources" IRD-Huaraz, July 6-9, 2004

Action:

Kaser: representing ICSI at Huaraz symposium as co-convenor
Steffen: discuss Moscow workshop co-sponsorship with Kotlyakov

14. ICSI discussion on activities for IPY-4, 2007

The ICSI Vice President, J-O. Hagen, chaired the discussion and presented an outline of IGY+50. ICSI primary goal will be IPY. Reasonable goal is to have workshop participation at Perugia-meeting

Action:

see Action item 10.10

15. Publications

15.1. Sapporo General Assembly: Workshop JWH01, special issue of "Hydrometeorology"

The special issue will be published in the Spring of 2004.

15.2. Snow and Climate, CUP

Book is progressing, however, slowly and not without interruptions.

15.3. Other works

Maastricht proceedings out, 13 contrib. (J. Hydrol. 2003, 282).

Valdivia-proceedings have gathered 20-30 contrib. aimed for Global and Planetary Change.

16. WGMS

16.1. Director's Report

The President tabled the WGMS Director's Report (*APPENDIX S*). Discussion focused on the long-term financing of WGMS activities and on the budget of the WGMS recent proposal to the US Department of State (DOS) for support in establishing a Global Terrestrial Network of Glacier observations within the framework of GCOS/GTOS. The Bureau noted that the proposal did not contain any indication of the official status of WGMS with regard to ICSI.

Action:

Dowdeswell/Hagen: Letter to the Director of WGMS requesting clarification on the budget and the official submission of the document to DOS.

16.2. Publications

No discussion of note in the absence of the Director

16.3. Funding

No discussion of note in the absence of the Director

17. New Bureau: Responsibilities regarding Current and Future Activities

The President tabled a list of suggested responsibilities (*APPENDIX T*).

17.1. President

Accepted responsibilities; in addition will also handle IPA

17.2. President-Elect

Accepted responsibilities except for IPY

17.3. Secretary-Treasurer

Accepted responsibilities

17.4. Vice-presidents

Hagen and Steffen accepted responsibilities. Steffen will also handle WDC. Reply expected from Goto-Azuma

17.5. Heads of Divisions

17.5.1. Division on Seasonal snow cover and Avalanches

Accepted responsibilities

17.5.2. Division on Ice Sheets and Glaciers

Dowdeswell will not handle IAMAS but will handle IGS; Föhn accepted responsibilities. Reply expected from Lange.

17.5.3. Division on River, Lake and Sea Ice

17.6. Director WGMS

18. Discussion on the Opportunity of adding a new Division

Michael Hambrey presented his ideas on glacial geology.

18.1. Replacing the Division "Ice as a Material" with 'Glacial Geology'

Discussion resulted in consensus around the addition of a workgroup under the Division on Glaciers and Ice Sheets. Hambrey was in complete agreement.

18.2. Open discussion on future Division/Commission structure

Permafrost and planetary ice is a possible theme for a future new division/Commission. Further discussion will have to be done at 2004 meeting. The term Ground ice should also be considered.

19. Update on ICSI Activities

19.1. ICSI Web Page

Jansson presented suggestion for new logo because no original exists for the old. Work can proceed on new logo. New web-site was also shown and briefly discussed. Important that all contribute material to the site. The location of the future site is undecided and in need of further thought and discussion. Minutes and documents leading up to bureau meetings will be posted and updated on the page.

Action:

All bureau members: Check web page
www.glaciology.su.se/ICSI
and submit material on: ICSI publications, ICSI sponsored events/activities, general info.
All material and suggestions to be sent to Jansson for updates.

19.2. Current Working Groups: Reports of Division Heads

Report from Paul Föhn (tabled) and Julian Dowdeswell (oral)

19.3. New Working Groups

New working groups accepted.

19.3.1. SnowMIP2; Richard Essery

Proposal from R. Essery on "Intercomparison of forest snow process models" = SnowMIP2 (*APPENDIX U*). Accepted unanimously

Action:

Jones: informs Essery about approval Completed

19.3.2. Snow Classification: Charles Fierz

(*APPENDIX V*) accepted unanimously

Action:

Föhn: informs Fierz about approval

19.3.3. Glacier and Permafrost Hazards: Andreas Kääb

(*APPENDIX X*) accepted unanimously

Action:

Kaser: contact John Reynolds about representing ICSI in ICSI/IPA workgroup on hazards and informs Kääb about approval. Completed by e-mail, 19 Nov., 2003

19.4. Other

20. Any Other Business

None

21. The Next Bureau Meeting

Decision to make Paris 2004 next meeting; the time will probably be during the month of June.

Action:

Jones/Kaser: provide dates on 2004 Paris bureau meeting; on-going

22. Closure

The President closed meeting at 5:45, November 4th 2003

GH Jones	G. Kaser	Peter Jansson
President	President-elect	Secretary

ICSI bureau meeting, Cambridge Nov. 2004: Appendix A

Action Items from the Minutes of the Bureau Meeting at Münster 2003

Item # refers to Münster Document

Item 3. Minutes of the 2002 Bureau Meeting, Paris

Action: the Secretary of ICSI to send the Minutes of 2002 to the Secretary general of IAHS.

Item 4. Activities following on the Minutes of 2002

4.1) Abramov Station

Action: Eric Brun will check with Ludwig Braun, Munich, regarding the coordinates of the person responsible for the station in 1999. **Completed**: Braun supplied information (Felix Pertziger – now in New Zealand)

4.2) National Representatives

Action: Liz Morris to supply Georg Kaser with IGS member and country list

Action: Wilfried Haeberli to write a communiqué that the ICSI Secretariat can distribute to the IAHS Newsletter (and other media – if need be) to attract interest and potential NRs for ICSI;

4.9) WGMS Director's Report

Action: indicated for 2002 but not completed: The Director of WGMS to prepare a document on the future directions of WGMS, which takes into account the elements presented in the discussion on the issue.

Item 6. Relations with IAHS

***6 i)* National Representatives to ICSI**

Action: The Secretary to continue the updating of the ICSI NR; the President and other Bureau Members will collaborate by suggesting names for ICSI NRs in those cases where information is not forthcoming from National Committees and Representatives. **Completed** (for the ICSI Elections at Sapporo): 29 countries now have confirmed ICSI NR.

***6 iii)* ICSI contribution to Prediction in Ungauged Basins (PUB), the IAHS initiative**

Action: the President will contact John Pomeroy and inform him of the interest of the two divisions (Division of seasonal Snow and Avalanches; Division of Glaciers and Ice Sheets) in his suggestion on formalizing ICSI's PUB effort through a proposed PUB/ICSI Inter-Division Working Group. **Completed**: the President has contacted John Pomeroy on the issue e-mail April 2003.

***6 vii)* ICSI Status in IUGG: Task Force Report**

Action: Liz Morris will request written support from IGS for ICSI's proposal before the IUGG General Assembly in Sapporo. **Completed**: the President received a letter of support prior to the Assembly.

Action: Pierre Hubert will inform ICSI as to when he requires a copy of the new proposal

Action: The President will write a new proposal for IUGG before the General Assembly in Sapporo. A first draft must be circulated to Bureau Members and Roger Barry (Chair of the ICSI/IPA Task Force) for comment and correction well before the Assembly takes place. **Completed**: the President sent on the new proposal to the Secretary general of IUGG in April 2003. It was tabled at the IUGG Executive meeting on the 8th of July

Item 9. Elections of Officers to the Bureau, Sapporo 2003

***9 iii)* Nomination Group: Interim Report**

Action: Liz Morris to contact Kumiko Goto-Azuma before April 1st to see if she will stand for election. **Completed**: Ms Goto-Azuma stood for Vice-President

Action: The President of ICSI as Secretary of the ICSI Nomination Group will send the ICSI Slate plus the other candidate eligible for election to Jake Peters by April 1st. **Completed**

Action: The Secretary will send a list of ICSI National Representatives to the President before mid-April. **Completed**

Action: The President will send all the relevant information on the Plenary Session and the elections including the list of candidates, the voting procedure and appropriate time delays before April 29th. **Completed**

Item 12. WGMS

12 iii) **WGMS Funding**

Action: the President will write to the Director of WGMS to ask him to clarify clear how the activities listed in the WGMS Workplan for 2003 relate to the budget of $220, 000. **Completed:** e-mail February 2003

Item 14. Work of the Divisions and Working groups

14 iiia) **Report by Head of Division on Ice Sheets and Glaciers on WG on Andean Glaciology**

Action: Georg Kaser to confirm the replacement of the WG Chair, J.C. Leiva, by Gino Casassa, CECS, after the Valdivia Workshop. **Completed**

Item 16. Conference on the Cryosphere in 2006 (CliC/IGS/ICSI)

Action: Liz Morris will consult the IGS agenda for a possible date that would allow the Society to participate in the organisation of the conference.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix B

INTERNATIONAL COMMISSION ON SNOW AND ICE

Secretary:
Georg Kaser, Institut für Geographie, Innrain 52, A - 6020 Innsbruck, AUSTRIA
e-mail: georg.kaser@uibk.ac.at URL: http://geowww.uibk.ac.at/research/icsi/

ICSI balance 30.9.1999 - 30.6.2003

30.9.1999 in from A. Fountain	**5674.36**
IAHS contributions	**6000.00**
Bureau meetings ICSI	-6295.00
other meetings (IAHS, CliC)	-1610.00
bank fees/savings	-285.10
donation (debris covered glaciers-Seattle)	**822.24**
UNESCO 2 contracts HKH	**15857.90**
2 HKH projects	-14123.30
30.6.2003 to P. Jansson	**6041.10**

ICSI bureau meeting, Cambridge Nov. 2004: Appendix C

International Commission on Snow and Ice (ICSI):

President's Quadrennial Report to the Plenary Administrative Session, Sapporo, July 9th 2003

This report covers the period from the XXII IUGG General Assembly at Birmingham in August 1999 to the XXIII IUGG General Assembly at Sapporo in 2003. During this period the Commission held five Bureau Meetings – Paris, France, 1999; Karthaus, Italy, 2000; Maastricht, Holland, 2001; Paris, France, 2002; Münster, Germany, 2003. The following sections resume some of the major activities during this period. More detailed information on these, and other activities, maybe found in the minutes of the annual ICSI Bureau Meetings, 1999-2004, and the contributions of the Commission to the IAHS Newsletters no.69 to 76.

1) *The status of ICSI within IUGG*: Since 1999 ICSI has been involved in a process of reflection and dialogue on the status of the Commission in IUGG. ICSI has solicited counsel from glaciologists and both a working group and task force have tabled reports on the problems that the Commission has faced in reaching out to the international glaciological community. The result of this process has led to the production in 2003 of a proposal to the IUGG Council that ICSI attain the status of an association within IUGG.

2) *ICSI/UNESCO/HKH-FRIEND project:* This is an ongoing project in the field of Technology Transfer and Science in the Service of the Community. The main objective is to establish a regional Glacier Monitoring Network to assess the evolution of major water resources and their management in the Himalayas. Major steps have included a workshop in 2001 on "Mass Balance Monitoring of Himalayan Glaciers" held at the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal, and a training course (2002) in New Delhi, Manali, and on the Chhota Shigri Glacier, Lahaul-Spiti Valley, Himachal Pradesh, India.

3) ***ICSI/UNESCO/Andean-FRIEND Andean Glacier Monitoring Network project****:* This project is similar to that of the ICSI/UNESCO/HKH-FRIEND project above. The Andean project, however, is much more recent. The first step was taken at a workshop held during the "Symposium on the Mass Balance of Andean Glaciers" at Valdivia, Chile in March 2003. Centro de Estudios Científicos (CECS), ICSI, Institut de recherche pour le développement (IRD), and the International Glaciological Society (IGS) sponsored the meeting. An Andean-FRIEND Interim Steering Committee has been formed to oversee the next steps in the development of the project.

4**)** ***ICSI contribution to the VI Scientific Assembly of IAHS and the XXIII General Assembly of IUGG****:* The contribution of ICSI to the VI Scientific Assembly at Maastricht in 2001 was the symposium '*Snow-vegetation interactions'* and the workshop '*High-mountain Hydrology'*. The ICSI contribution to the Sapporo XXIII General Assembly consists of the symposium, '*Remote sensing of the Cryosphere'* and the workshop '*Snow processes: representation in atmospheric and hydrological models'* as lead sponsor. ICSI also cosponsors other inter-association symposia at the Assembly. Four with IAMAS ('*Cryosphere-climate interactions' 'Global sea-level rise, Global climate change and Polar ice sheet stability' 'Special Nakaya-Mangono Celebration: the growth of ice crystals and snow'* '*The role of atmospheric processes in mass balance exchange in the Polar regions')* and one with IAPSO ('*Arctic environmental change').*

5) ***Other ICSI cosponsored Symposia and Workshops (year, venue, title and main sponsors):***

2000, Fairbanks, "*International Symposium on Sea Ice and its Interactions with the Ocean, Atmosphere and Biosphere*" (IGS); 2000, Seattle, "*International Workshop on Debris-Covered Glaciers*"; 2000, Innsbruck, "*International Symposium on Snow, Avalanches and Impact of the Forest Cover*" (IGS); 2000, Reykjavik, "*The Extreme of Extremes: International Symposium on Extraordinary Floods*" (Hydrological Service, National Energy Authority, Iceland, IAHS); 2000, Nice; European Geophysical Society XXV Assembly "*Water balance components of high mountain basins*" (EGS-HS); 2001, Innsbruck, IAMAS 2001, "*SNOWMIP Workshop*"; 2002, Beirut, "*International Workshop on Snow Hydrology in Mediterranean Regions*" (USJ, IRD); 2002, Dunedin, 16th International IAHR Symposium "*Ice in the*

Environment" (IAHR); 2003, Zurich, "*Eighth International Conference on Permafrost*" (IPA); 2003, Valdivia, "*Symposium on Mass Balance of Andean Glaciers*" (CECS, IRD, IGS); 2003, Tokyo, The 3rd World Water Forum, Session "*Water Resources Management in Mountainous Areas*" (UNESCO).

6) ***ICSI sponsored publications (year, publisher, title):*** 1999, IAHS RedBook 256, "*Interactions between the Cryosphere, Climate and Greenhouse Gases*"; 1999, Special issue of Global and Planetary Change, 22, (1-4), "*Glaciers of the Southern Hemisphere*"; 1999, WGMS/UNESCO "*Glacier Mass Balance Bulletin No. 5*"; 1999, Special issue of Geografiska Annaler (81A), "*Mass Balance Measurements and Modelling*"; 2000, Hokkaido University Press, "*Physics of Ice Core Records*"; 2000, IAHS RedBook 264, "*Debris covered glaciers*"; 2001, WGMS/UNESCO, "*Glacier Mass Balance Bulletin No 6*"; 2001, Cambridge University Press/UNESCO-IHP International Hydrological Series, "*Tropical Glaciology*"; 2001, Cambridge University Press "*Snow Ecology*"; 2002, IAHS RedBook 270, "*Soil-Vegetation-Atmospheric Transfer Schemes and Large-scale Hydrological Models"* 2002, Special Issue of Hydrologic Processes, "*Hydrology of River and Lake Ice";* 2003, Journal of Hydrology, Workshop Proceedings, "*High-Mountain Hydrology" ;* 2003, UNESCO IHP-VI, Technical Documents in Hydrology, No. 59, "*A manual for monitoring the mass balance of mountain glaciers"*.

7) ***ICSI contributions to International Programmes:*** ICSI has affinities with certain IHP-VI projects 1.1, 1.3, 3.5 and 5.1. The ICSI/UNESCO/HKH-FRIEND and ICSI/UNESCO/Andean-FRIEND activities come within the scope of these IHP-VI projects. ICSI also participates in GEWEX through the IAHS-WMO WG on GEWEX. ICSI also contributes to the IAHS Decade for PUB. The Chair of the ICSI WG on Snow-Vegetation Interactions represents ICSI and serves on the Science Steering Group. ICSI also collaborates with the "Climate and Cryosphere" Programme (CliC)

8) ***World Glacier Monitoring Service (WGMS):*** ICSI is responsible for WGMS - a service of the Federation of Astronomical and Geophysical Services (FAGS). Current activities include the preparation of '*Fluctuations of Glaciers 1995-2000*', which is nearing completion. '*Glacier Mass Balance Bulletin No 7*' will also be published in 2003. ICSI is concerned at the lack of funding of WGMS and how it hinders some activities such as direct access to the database of WGMS via the Internet.

H.G. Jones, President, International Commission on Snow and Ice, June 16, 2003.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix D

A proposal that the International Commission on Snow and Ice (ICSI) attain Association status within the IUGG structure: A presentation by the ICSI Bureau to the IUGG Executive Council at the XXIII General Assembly of IUGG, Sapporo, Japan, July 8th 2003.

An overview of the ICSI Position: H.G. Jones, President.

The problems faced by the Commission in carrying out its mandate within IUGG

These problems are:

- The difficulty the Commission has to attract many members of the International Glaciological Community to Symposia and Workshops particularly during IAHS Scientific Assemblies.

- The inability of the Commission to act as a forum for the Glaciological Community within IUGG due to the fragmentation of Glaciology and Cryospheric Sciences within the IUGG structure.

The Commission's approach to resolving these issues

The approach that ICSI has taken over the period 1999-2003 includes:

- Consultation and discussion of the problems with individual colleagues of the Glaciological Community and other interested parties (IGS, IPA), 1999-2001.

- Production of a Working Document by ICSI on the definition of the problems and possible avenues for the resolution of the impasse within IUGG, 2001.

- Production on a joint ICSI/IPA paper on common scientific interests and possible avenues of co-ordination, 2002.

- Formation of a Task Force on redefining the role of ICSI within IUGG, 2002.

- Acceptation of the Task Force Report and recommendations on the change of the Commission's status within IUGG, 2003.

The Task Force Recommendations and the ICSI Proposal

- The principal recommendation is that ICSI should seek an equivalent status to the other associations, which represent the seven disciplines recognized by IUGG.

- The ICSI proposal to IUGG is that the Union approve the submission and implement Association status and that the said Association assumes the present scientific mandate of ICSI, i.e. the advancement of the study of naturally occurring snow and ice, within the IUGG structure.

The next steps: overall goals and timetable

Formation of an IUGG/ICSI Interim Steering Committee (ISC), 2003 –2004. The ISC will guide the Commission through the necessary steps of the following phases for the period 2003-2007:

- Defining the objectives of the future Association and the means of communication and international co-operation in promoting its mandate, 2003-2004.

- Establishing the Statutes and Bye-laws, 2004-2005.

- Collaboration with other IUGG association(s) in a joint Scientific Assembly, 2005.

- Collaboration with International Glaciological Organisations, 2005-2006.

- Formation of the Association and first Bureau Meeting, XXIV General Assembly of IUGG, 2007.

Question Period: H.G. Jones; Georg Kaser, ICSI Secretary; Roger Barry, Chair, Task Force on the Status of ICSI within IUGG

ICSI bureau meeting, Cambridge Nov. 2004: Appendix E

Letter to Jake Peters, IUGG Representative to SCOPE (Scientific Committee on problems of the Environment) in reply for suggestions as to participation in SCOPE activities.

As far as ICSI and SCOPE are concerned I have two points to bring to your attention.

1) ***Regional Glacier Monitoring Networks:*** One of the main ongoing ICSI projects is to encourage and participate in setting up Glacier Monitoring Networks (GMN) in the two most important mountainous areas of the World harbouring considerable snow and ice resources i.e. the Himalayas (HKH-GMN) and the Andes (A-GMN). The objective of the project is to continuously monitor the mass-balance changes on a network of benchmark glaciers in these areas so as to provide long-term data sets on regional resource fluctuations. In this respect the project could be covered by the IPEC in Cluster 2.

The project, however, is not limited to data acquisition for scientific analyses but is strongly directed to the utilisation of the data by regional resource management personnel and resource users. The glaciers and high-altitude snowfields are the prime source of water for lower-lying hydrological systems and depletion of the resource due to glacier retreat is a potential long-term threat to the social and economic livelihood of the regional populations. Recent rapid glacier wastage can also lead to the problem of unstable glacier lakes, which can give rise to burst-out discharges of immense volumes of water with disastrous results downstream.

Integration of science, management and local technical personnel has been initiated through workshops and technical training courses for local manpower in collaboration with regional government agencies, academic institutions and international programs such as FRIEND, IHP, and UNESCO's Division of Water Sciences. In the past two years ICSI has held workshops in Kathmandu, Nepal (HKH-GMN) and Valdivia, Chile (A-GMN) and a training course was held in India for technical personnel from Nepal, Bhutan and India in 2002.

2) ***The Cryosphere and Global Contaminant Cycles***: The second point I would like to make concerns the strong links between SCOPE and IUGG i.e. the transport vectors - water and the atmosphere in the earth system. You have described the concept extremely well and I agree with the focus that you have developed. I would, however, like to add to your ideas the notion of the roles of fluidity (ease of flow) and rigidity (arrested flow) in global cycles. I am referring of course to the Cryosphere (cold-region ecosystems) where the presence of solid water (snow and ice) reduces fluid transport of contaminants and nutrients and where low temperatures have a dominant effect on biological productivity and metabolism.

I realise that a suggestion that the cryosphere become a SCOPE concern is certainly debatable and some may say that it is only an aspect of water transport as after all it is associated with water - albeit in another phase. However, I would beg to voice an alternative opinion. It holds that the role of the Cryosphere is of such an importance in the dynamics of major earth systems that it merits as much attention as continental hydrological and oceanic systems.

I say this because one of the significant findings in the past 10 years or so is the fact that large ice fields and snow covers are not passive but are dynamic systems of chemical and microbiological change. One can only refer to the recent studies on the photochemical reduction of mercury in snow fields and nitrate reduction to NOx in ice caps and the results of these chemical reactions on the atmospheric composition of cold regions. Glaciers and snowfields have unique communities of life in an extreme environment. Although the biological productivity of icefields is low, the communities are examples of a fragile but significant part of the biodiversity in cold regions.

In addition, the accumulation of Persistent Organic Pollutants (POPs) in ice bodies and other components of cold regions through 'grasshopper' transport from warm to cold regions is cause for concern as they continuously accumulate in ice bodies and have deleterious effects on the biota. On release during melt, transport of these contaminants in glacier streams and river systems causes incorporation into aquatic food chains and ultimately effects local populations. The warming of cold-region ecosystems will thus cause large-scale repercussions in other earth systems. One such change is the melting of ground ice. The melting of permafrost will result in physical subsidence and possible release of methane from clathrates affecting

both terrestrial ecology and land use and atmospheric composition.

I would appreciate it if you could give some consideration to my thoughts. At the end of your text, you cite some future themes/projects. I would like to suggest one "The Earth's cryospheric systems: apprehended changes and effects on global biogeochemical cycles"

If you would like any further details on the HKH-GMN or A-GMN, Georg Kaser, Secretary of ICSI is the person to contact

You can contact me if you require any details on the chemical dynamics or any other ecological aspect of cryospheric systems.

H.G. Jones, President of the International Commission on Snow and Ice

April 21st 2003

ICSI bureau meeting, Cambridge Nov. 2004: Appendix F

Report on JSH01 Symposium "Climate and the Cryosphere" Sapporo 2003.

(Richard Armstrong (e-mail report to H.G. Jones, ICSI, and Pierre Hubert, IAHS, 29-08-03).

On the positive side, I feel that the attendees did benefit from the session, not only by way of the formal presentations but also by way of the apparently creative and energetic conversations among small groups gathering well before and sometimes rather long after the scheduled sessions. In some cases I overheard what were clear efforts for international collaboration on various topics of common interest.

You are well aware of the negative aspects and I will not go into detail. "No shows" were truly surprising in number, not only among the participants but unfortunately all three of my co-conveners failed to arrive. Fortunately two of my good colleagues (Daqing Yang and Tatiana Khromova) assisted me in co-chairing the sessions. The simultaneous scheduling of JSH01 and JSM10 was unfortunate while persistent efforts by Siobhan O'Farrell and myself to at least locate the two sessions in the same building failed. These sorts of logistical complications will always be a possibility at such large meetings but in the future every effort should be made to identify them as early in the process as possible. When identified early there might be at least some chance for a compromise solution which would offer more for those participants who have traveled so far with the hopes of obtaining the most information and interaction for their efforts. There was frequent disappointment expressed by participants at the fact that these two sessions overlapped.

Having said that, I will close by noting that it was both an honor and a pleasure to convene JSH01 and I only hope all participants enjoyed the interaction and exchange of scientific information as much as I did.

Thank you both for all of your hard work towards the success of IUGG 2003.

Sincerely,

Richard

ICSI bureau meeting, Cambridge Nov. 2004: Appendix G

Report on IAHS/IAMAS/ICSI Workshop JWH01:
'SNOW PROCESSES: REPRESENTATION IN ATMOSPHERIC AND HYDROLOGICAL MODELS'
JULY 9-10 2003, IUGG, SAPPORRO, JAPAN

This workshop was convened to summarise the findings of two International Commission on Snow and Ice working groups, the Snow-Vegetation Interactions Working Group (SVIWG) and the Snow Model Intercomparison Working Group (SNOMIP). The purpose of the workshop was to bring together researchers from the hydrological and climatological communities to examine current methods of modelling snow in order to develop a more consistent and comprehensive approach to representing snow in various models. In particular a goal was to improve cryospheric representations in climate and hydrological models, with particular attention to the interaction of snow and vegetation. Cryospheric interactions with the atmosphere and vegetation are being increasingly recognised as extremely important factors for the regulation of the global climate and water supply. However, recent inter-comparisons of snow models for open and vegetated environments have shown widely divergent results, possibly because current parameterisations have not included the full range and dynamics of snow processes.

The workshop had two lively oral sessions, one on open environments and the other on forested environments; in both sessions, papers covered a range of topics from snow accumulation to ablation and from process studies to modelling and snow interfaces from soil to vegetation to the atmosphere and hydrosphere. The Workshop also held a poster session with papers on related atmospheric and chemical properties of snow.

A total of 35 talks and posters were given, with representation from Europe, Asia and North America. Research focussed on environments such as Antarctica, Russia, Japan, Europe, Canada and the USA. Many papers demonstrated critical advances in spatial up and down scaling and model parameterisation. Vegetation effects due to shrubs and forests on snow processes are now included in many models and described with increasing sophistication and at many scales for both atmospheric and hydrological models. The sensitivity of snow processes to vegetation has been explored and is being used to guide further model development. Blowing snow redistribution and sublimation were shown from process physics to macroscale representations and are included in an increasing number of models. Advection of energy in complex terrain and mixed snow/non-snow surfaces is addressed at scales from small to meso to large scale and used in energy balance modelling of snowmelt. The depletion of snow covered area due to variable sub-grid snow mass is now parameterised at the global scale and shown to have important large scale impacts on snow-atmospheric dynamics. Physically-based snow models are able to drive sophisticated hydrological models with minimal calibration in both large and small cold regions catchments. A synthesis discussion at the end of the second day highlighted recommendations on improving representations of snow

processes in various modelling strategies and scales. Of particular interest is that the snow modelling intercomparisons should focus now on vegetated sites. It is expected that the workshop will result in more realistic inclusion of snow processes and vegetation interactions with snow in atmospheric and hydrological models and renewed process research on less well understood environments such as winter leafless canopies, highly heteorogeneous, mixed-vegetation, complex terrain and the interaction of these processes with soils, hydrochemistry and ecology. Currently, a number of manuscripts from the Workshop are being reviewed for a special issue of the *Journal of Hydrometeorology* that will be devoted to the workshop and should be published in 2004.

Convenor:
Professor John Pomeroy,
Department of Geography,
University of Saskatchewan,
Saskatoon, Canada S7N 5A5
email: pomeroy@usask.ca

Co-convenors:
Dr. Richard Essery (Aberystwyth, Wales),
Dr. John King (Cambridge, England),
Professor Lev Kuchment (Moscow, Russia),
Dr. Eric Martin (Grenoble, France),
Professor Tetsuo Ohata (Sapporo, Japan)

ICSI bureau meeting, Cambridge Nov. 2004: Appendix H

Report from the Minutes of the IUGG Executive Committee Meeting of 8 July 2003 on the ICSI Proposal to attain the status of an Association (agenda item 16)*.

As agreed at the first EC meeting, the IAHS International Commission on Snow and Ice made a presentation in support of their request to pursue acceptance as an 8th Association of IUGG. Dr. R Barry, Dr. HG Jones, and Dr. G Kaser distributed an information sheet and showed slides that illustrated their points. As an IAHS Commission, they felt that they could not adequately carry out their goals and objectives because they could not attract enough people to their symposia at either IAHS scientific Assemblies or the IUGG General Assemblies. Further, they felt unable to act as a forum for the glaciological community within IUGG due to the fragmentation of glaciology among several Associations.

ICSI had formed a task force with the objective collecting data and reporting possible solutions to these issues; the task force recommended that ICSI should seek equal status with the other Associations in IUGG. They had consulted with the IUGG Secretary-General regarding the requirements to become an Association (proof of a scientific constituency of reasonable size, statutes and by-laws, etc.) and were prepared to work to meet these requirements by 2007.

Under discussion, Dr. Kennett wondered why ICSI felt the need to be its own Association when their activities are very similar to SEDI, a successful inter-Associations body. Dr. Barry responded that their activities were more on a par with those of the Associations and Dr. Jones added that their history proved that they were capable of being an independent Association. They had also received a letter of endorsement from the President of the International Glaciologial Society encouraging them to proceed.

Dr. Sparks asked if they were expecting to take over the work on snow and ice now distributed among several Associations. Dr. Barry said that they did not expect to do that, preferring to simply focus on topics of glaciology in general and liaison with the existing commissions and working groups as appropriate.

Dr. Kono asked for additional questions to the presenters (there were none) and then asked the Associations to speak more generally to the issue.

Dr. Sanso preferred the intermediate step of forming an inter-Associations group because he thought that the issues surrounding formation of a new Association were more involved than simple science. Dr. Rizzoli agreed, preferring an inter-Associations Commission. Dr. Barry responded by pointing out that the American Geophysical Union had just implemented a commission on snow and ice, as had the European Geophysical Union. He also said that many glaciologists currently did not interact with IUGG because of their poor visibility within IUGG, and that an inter-Association Commission would not be sufficient to attract them. Dr. Kennett pointed out that an inter-Associations Commission would be easy to accommodate while a new Association would require a complete reworking of the IUGG structure and rules of operation. Dr. Jones worried that the venerable IUGG structure, in place for more than 80 years, was inhibiting logical thinking on the issue.

Dr. Takeuchi reported the discussions that had taken place on this issue at meetings of the IAHS Bureau. They supported the ICSI request for more independence, but hoped that they maintain their links to IAHS because of the importance of the science. Dr. Shamir asked when the next ICSI symposium was planned. Dr. Barry replied that they were considering a major symposium on the cryosphere in collaboration with the International Glaciological Society and the Climate and Cryosphere Programme of WCRP in 2005/6. They expected to demonstrate that ICSI could convene an assembly similar to those convened by the IUGG Associations and draw an attendance of 300 to 400 scientists. Dr. Davies noted that IAMAS had scientists working on relevant topics in the cryosphere, and was concerned about fragmentation in the Union. At this point, Dr. Kono asked that discussion cease because of time constraints, and decided that the issue should be referred to the new EC. *The ICSI task force was invited to present a plan of action to the next EC aimed toward becoming an Association, but with the understanding that they may be asked to become an inter-Associations Commission first in order to allow time for the Associations to consider the impact of an 8th Association on Union structure.* He thought that ICSI heard a good amount of advice to walk away with and further consider, and thanked them for their presentation.

*Original text but paragraphed by HGJ to separate different points of discussion. Corrections also added as per correspondence with Pierre Hubert, Secretary General IAHS.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix I

Points of discussion concerning the document to be submitted to IUGG Executive Council on April 15th 2004, which outlines the process of how ICSI will accede to the status of an Association within IUGG.

Background.

The official response of IUGG to the presentation by the ICSI Bureau of its proposal to attain the status of an association within IUGG may be found in the Minutes of the IUGG Executive Committee=s third meeting in Sapporo. The recommendation of item 16 of the Minutes states that:

A*The ICSI task force was invited to present a plan of action to the next EC aimed toward becoming an Association, but with the understanding that they may be asked to become an inter-Associations Commission first in order to allow time for the Associations to consider the impact of an 8th Association on Union structure*.@

This recommendation, plus the informal comments of two members of the Executive Committee, suggests that IUGG looks upon the ICSI proposal favourably. However, the consensus also seems to be that the impact of a new association on the present IUGG structure has to be tempered over time. Thus, the present context dictates that IUGG neither refuses the ICSI request for association status per se nor agrees to it. IUGG prefers to choose a middle road where ICSI will accede to association status by proving it has the capacity to do so through the intermediate step of an inter-association committee. This is deemed acceptable to the ICSI Bureau as the IUGG Executive Council specifically states that the plan of action is *Aaimed toward becoming an Association@* .

ICSI now has to define a plan of action, which has to be presented at the next Executive Council Meeting at Boulder, Colorado, in September 2004. This document should be submitted to the IUGG Secretary General by the 15th of April at the latest.

The ICSI President, President-Elect and Chair of the ICSI Task Force on the status of ICSI within IUGG will present the document at Boulder.

The content of the Plan.

The Plan should consist of a time-line of specific steps. The steps should be well defined within certain periods between 2004 and 2007. Many of the steps should commence in 2003. If need be, some indicators of performance that will demonstrate the capacity of ICSI to play a role in IUGG equal to and complementary with the existing associations, should also be included.

The Steps:

1) Assuming the role of an inter-association commission. This step involves working in concert with IUGG associations, notably IAHS, IAMAS and IAPSO, in convening symposia and workshops. This would occur in 2005 during the Scientific Assemblies of IAHS at Foz de Iguassu, Brazil, IAMAS at Beijing, China, and IAPSO at Cairns, Australia. Glaciologists having interests in Hydrological Sciences, Atmospheric Sciences and Oceanographic Sciences will attend these meetings respectively. The performance of ICSI could then be judged on the total participation at the ICSI sponsored meetings of the three assemblies. A combined total of 300- 450 would be judged to be a positive indicator of the potential of the new association to draw participants from across the whole spectrum of glaciological disciplines to its own scientific assemblies. Period: 2003 to 2005.

2) Co-sponsoring a major conference in Glaciology and the Cryospheric Sciences with recognised international organisations and major international programmes. This could be the major conference that has been proposed by CliC. Co-sponsorship with CliC, IPA,and GIS are distinct possibilities. This would justify the role of ICSI as one of the major forums for the international glaciological community. This forum would be the one identified with IUGG and the Union would consequently act to recognize the new ICSI role within its own structure. Period: 2003 to 2005 or 2006.

3) Defining the mandate and role of the new association within IUGG and its relationship to the International Glaciological Community i.e. producing the Statutes and Bye-Laws. These would be published in draft form in 2006. Period: 2004 (after the IUGG Executive Council Meeting in Colorado) to 2007.

4) Building support for the new association through International and National Scientific Bodies with an interest in Glaciology and the Cryospheric Sciences e.g. IGS, Japanese Society of Snow and Ice, AGU, CGU, EGU, SCAR, ESC, WSC, WMO etc. Support should be sought through contacts with established organizations and the current ICSI National Representatives. A document resuming the ICSI position will be circulated to these interested parties. The extent of the support for an association can then be judged on the response from the recipients. Period: 2003 to 2006.

5) A four-year program of projected activities following the accession to association status. The description of activities will include an overview of organizational aspects including co-partnerships and preliminary estimates of budgets on the work to be done. The activities should include: Consolidation of the new association=s commissions, potential working groups, major conferences and workshops, promotion of training courses and technology transfer, and the First Scientific Assembly in 2009. Period: 2006 to 2009.

Preparation and editing of the proposal.

Needless to say that the document should be clear as to the process that ICSI intends to attain association status, sound as to the justification to play this role in IUGG, and credible as to the degree of scientific expertise to act as a forum for the glaciological

community. This will necessitate a concerted effort by all members of the Bureau in the preparation of the document. It will also require an advisory body of glaciologists (Advisory Committee) who are not members of the Bureau to assure that the document is well positioned to achieve its desired objective of approval by the IUGG Executive Council. The Executive Council should also be invited to participate in the exercise.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix J

ICSI National Representatives (02-2003)

Argentina: mail no reply
Juan Carlos Leiva
jcleiva@lab.cricyt.edu.ar
jleiva@raiz.uncu.edu.ar

Australia

Dr Ian D.Goodwin
Environmental Geoscience Group
School of Environmental and Life Sciences
Geology Building
University of Newcastle
Callaghan 2308 NSW AUSTRALIA
Ph INT 61 2 4921 8870, Fax INT 61 2 4921 6925
Ph INT 61 2 4942 7652 (home)
email:Ian.Goodwin@newcastle.edu.au

Austria:
Prof. Dr.. M. Kuhn
Institute of Meteorology and Geophysics
University of Innsbruck
Innrain 52
A-6020 Innsbruck
AUSTRIA
Ph: (43)512-507-5450
Fx: (43)512-507-2924
meteorologie@uibk.ac.at

Belgium

Prof. Hugo DECLEIR
Department of Geography
Vrije Universiteit Brussel
Pleinlaan 2,
B-1050 Brussel
BELGIUM
hdecleir@vub.ac.be
Tel: +32-2-629.33.83
Fax: +32-2-629.33.78
URL: http://www.vub.ac.be/DGGF

Bolivia (presently not member of IUGG):
Edson Ramirez
Instituto de Hidraulica e Hidrologia
Universidad Mayor de San Andres
Calle 30 Cota Cota
CP 699
La Paz
BOLIVIA
Fax: (591-2) 2795724
website: www.megalink.com/ihh.html
ramirez@lsce.saclay.cea.fr

Brasil:
Jefferson Cardia Simoes
Laboratório de Pesquisas Antárticas e Glaciológicas
Instituto de Geociencias - Universidade Federal do Rio Grande do Sul
Av. Bento Gonþalves 9500
91501-970 - Porto Alegre, RS - BRASIL
Tel: (55) 51 3316-7327 ou 6341
Fax: (55) 51 3316-7324
e-mail: jefferson.simoes@ufrgs.br
http://www.mct.gov.br/clima/comunic_old/glaciolo.htm

Bulgaria:
Dr. Nikolai Mikhnevski
National Institute of Meteorology and Hydrology
Blvd. Tsarigradsko chaussee 66
1784 Sofia, Bulgaria
Nikolai.Mikhnevski@meteo.bg

Canada:
Dr Mike Demuth
Geological Survey of Canada,
Terrain Science Division
601 Booth Street Ottawa
CANADA
Tel.: + 1 613 996 0235
Fax.: + 1 613 996 5448
mdemuth@nrcan.gc.ca, mike.demuth@nrcan.gc.ca

Chile: mail no reply
????Dr. Gino Casassa
Centro de Estudios Científicos
Av. Prat 514
Valdivia
CHILE

Tel. 56.63.234540 & 234538
Fax. 56.63.234517
gcasassa@cecs.cl
http://www.cecs.cl

China: e-mail no reply new attempt 26.3.03
Dr. Yao Tandong
Lanzhou Inst. Of Glaciology and Geocryology
Chinese Academy of Sciences
Lanzhou 730000
Peoples Republic of China
tdyao@ns.lzb.ac.cn

Colombia mail 26.3.03
Jair Ramirez Cadena
Diagonal 53 No. 34-53
INGEOMINAS
Area De Geoamenazas
Bogota
COLOMBIA
jairamir@ingeomin.gov.co

Czech Republic: mail no reply, new mails to IUGG off. On 26.3.03

Croatia: mail no reply, new mails to IUGG off. On 26.3.03

Danmark:
Dr. Carl Egede Bøggild
Senior Research Scientist
Dept. of Quaternary Geology
The Geological Survey of Denmark and Greenland (GEUS)
Ïster Voldgade 10
DK-1350 Copenhagen K
DENMARK
Phone: +45 38 14 27 94
Fax: +45 38 14 20 50
ceb@geus.dk

Ecuador

Eire

Ex-Yugoslavian Republic of Macedonia mail on 26.3.03

Ex-Yugoslavia mail on 26.3.03

Estonia: mail no reply, new mails to IUGG off. On 26.3.03

Finland:
Dr Esko Kuusisto
Hydrologist
Finnish Environment Institute
P.O.Box 140, 00251 Helsinki
Kesakatu 6, 00260 Helsinki
Tel: +358-9-4030 0566
Fax: +358-9-4030 0590
E-mail: esko.kuusisto@vyh.fi, esko.kuusisto@ymparisto.fi

France:
Prof. Louis Lliboutry
3, avenue Foy
38700 Corenc

Germany:
Dr. Hans Oerter
Alfred-Wegener-Institut für Polar- und Meeresforschung
Columbusstrasse
D-27568 Bremerhaven
GERMANY
Tel: +49 471 4831 1347
E-mail: hoerter@awi-bremerhaven.de

Georgia (Andrey Glazowsky will look for, 25.6.2003)

Grece: mail no reply

Hungary: mail no reply; new mail on 26.3.03

Iceland:
Dr. Helgi Björnsson
Science Institute of the University of Iceland
Dunhagi 3
IS-107 Reykjavík
ICELAND
E-mail: hb@raunvis.hi.is

India: mail no reply; new mail on 26.3.03
Syed Iqbal Hasnain
iqbalhasnain@hotmail.com

Italy
Prof. Claudio Smiraglia
Dipartimento di Scienze della Terra
UniversitÓ degli Studi di Milano
Via Mangiagalli 34 - 20133 Milano
Tel +39-02-50315516
Fax +39-02-50315494
http://users.unimi.it/glaciol/
e-mail: claudio.smiraglia@unimi.it

Iran: mail no reply

Japan: mail no reply; new mail on 26.3.03
Shun'ichi Kobayashi, Professor, Dr. Sci.
Research Institute for Hazards in Snowy Areas,
Niigata University
Niigata, 950-2181
Japan
Phone: 65291;81-25-262-7052 65288;direct in)
Fax: 65291;81-25-262-7050
e-mail: kobashun@cc.niigata-u.ac.jp

Kirgisia (Andrey Glazowsky will look for, 25.6.2003)

Kazakhstan (Andrey Glazowsky will look for, 25.6.2003)

Macedonia: mail no reply

Nepal

Nhe Netherlands fax am 1.4.03 (they will nominate only in Sapporo)

New Zealand mail am 26.3.03

Norway
Dr. Jan-Gunnar Winther
Head of Polar Climate Group and Antarctic Section
Norwegian Polar Institute
N-9296 Tromsø
NORWAY
Tel.: (47)7775 0500 (switchboard); (47)7775 0531 (direct line)
Fax.: (47)7775 0501
winther@npolar.no

Pakistan

Peru (still to be confirmed by the IAHS rep.)
Ing. Marco Zapata
Unidad de Glaciologia y Recursos Hidricos
INRENA
Tel.: ++51 43 721611
mail: marcozapata@viabcp.com

Poland

Dr Marek Grzes
Institute of Geography
Dept. of Cryology and Polar Research
N. Copernicus University
Fredry Str. 6/8
Pl 87 - 100 Torun
POLAND
tel. (47) 56 611 31 29
mobile tel.: 605 032 487
gmark@geo.uni..torun.pl
fax: (47) 611-47- 00
www. uni.torun.pl/~geopolar/stacja/

Romania (mail am 1.4.03 failed)

Russia
Andrey Glazovsky
109017 Staromonetny-29 Institute of Geography RAS
(Glaciological Department)
Moscow
Russia
Home: 117234 Voro'evy Gory-1, M-147
tel: (007095)-939-01-21
glazovsk@gol.ru

Slovakia
Dr. Ladislav Holko
Experimental Hydrological Base EHZ
Ondrasovecka 16
031 05 Liptovsky Mikulas
Slovakia
tel./fax.: (+421 44) 5522522
Mail: holko@svslm.sk

www.ih.savba.sk

Slovenia (mail am 1.4.03)

Spain
Alberto Fernandez
Instituto Nacional de Meteorologia
S. de Aplicaciones Meteorologicas
C/ Leonardo Prieto Castro 8
Ciudad Universitaria
28040 Madrid
Spain

Tel: (34)91.5819.709
fax: (34)91.5819.767
Email: albertof@inm.es

Sweden
Dr. Peter Jansson
Stockholm University
Department of Physical Geography
106 91 Stockholm
SWEDEN
Ph.: 0046 8 162000
Fx.: 0046 8 164818
peter.jansson@natgeo.su.se

Switzerland (mail am 1.4.03, no reply so far)
Sugg. M. Funk statt B. Stauffer
funk@vaw.baug.ethz.ch

United Kingdom
Dr. David N. Collins
Department of Geography
University of Manchester
Manchester M13 9PL
United Kingdom
Ph: (44)161-275-3646
Fx: (44)161-273-4407
d.n.collins@salford.ac.uk

United States of America

Dr. Richard L. Armstrong
CIRES/NSIDC CB 449
University of Colorado
Boulder, CO 80309
USA
Ph: (1)303-492-1828
Fx: (1)303-492-2468
rlax@kryos.colorado.edu

Uzbekistan (Andrey Glazowsky will look for, 25.6.2003)

Venezuela

ICSI bureau meeting, Cambridge Nov. 2004: Appendix K

Report of the IUGG meeting session « Geosciences : the future »

1) General presentation

The session took place during the IUGG meeting in Sapporo, on Friday, 11 July 2003. Each of the association member of the IUGG was invited to give an overview of the future of its scientific field and had mandated a scientific personality to present the main perspectives. Three presentations mentioned a particular interest in cryosphere research :

- Oceanography (IAPSO) : the study of sea ice appears as one of the main challenge for oceanographic sciences, as it controls oceans-atmosphere exchanges for high latitude.
- Geodesy (IAG) : the presenter underlined the applications of geodesy related to ice sheets variations knowledge. Further collaboration between geodesists and glaciologists are needed to validate the remote sensing measurement, which could bring very precise information on ice volume of poles.
- Hydrology (IAHS) : cryosphere is a major component of hydrological system, particularly in mountainous areas. The studies of seasonal snowpack, glaciers and permafrost will allow to improve the understanding of hydrological processes in complex terrain.

A particular presentation was devoted to interdisciplinary collaboration projects. Three main themes will continue to gather geosciences in the future:

- High level scientific collaboration : this collaboration will take the form of global projects (like high resolution earth system modelling, world data centers, expensive spatial observing system) or specific scientific issues (like hydrological cycle, solar forcing or interactions between thermosphere and atmosphere).
- Collaboration with less developed countries : these collaborations will deal with specific problems like SO2 pollution, Tsunami or water resources in arid areas.
- Social demand : the pressure of society over sciences will support cooperation with other sciences like biology, social and political sciences, engineering. Specific themes will be concerned, like natural risks and water resources.

2) The IAHS presentation : HYDROL2020 group intermediate report

In order to identify the future of hydrological sciences, the IAHS support a group of young scientists (called HYDROL2020) representing the main components of hydrology. The group's mission statement, as discussed during the first group meeting (January 2002) is

"*We will explore how hydrological sciences can evolve into a discipline capable of meeting the world water challenges that are expected to prevail by 2020. We will undertake a broad range of tasks, from identifying knowledge gaps and hydrological*

research priorities to determining ways to improve communication between hydrological scientists and those involved with developing and implementing water policies. Our intention is to formulate a vision that will be embraced by practising hydrological scientists and will also persuade younger scientists to become involved in hydrological science research."

The three main questions the group will try to answer are : what will be hydrology in 2020? What should be hydrology in 2020? What can (should) we do to reach the goals?

An intermediate report has been prepared for the Sapporo meeting and was presented by the group leader (Dr Taikan Oki). A particular attention will be paid tome some keys points :

- The uniqueness of hydrology : hydrology is defined by a set of characteristics which make it unique : it needs a multi-scale knowledge and description of physical processes, it is an interdisciplinary science, it answer to numerous social demands (natural hazard, water resources,…), the response to water problems appear more and more to be global (as proved by recent international references like the report of the millennium or the Evian G8 action plan).
- Technology : large progresses in hydrology will come from recent advances, both in observational and analysis techniques.
- Bottlenecks : main bottlenecks are technical (cost of observation networks,…), organizational (need of a water policy, educational strategy,…) and scientific (incomplete understanding of hydrological processes, a lack of links with atmospheric and human sciences;…).
- Social demand : hydrology has to better answer to society problems. Strategy has also to be elaborated in order to improve the diffusion of information toward the policy makers and the people in general (need of education). A particular attention should be paid to the technological transfer and adaptation to less developed countries.

Finally, some general keys questions were formulated:

- how to predict water balance for catchments with few data ? (PUB problematic)
- how will change hydrology with climate ?
- what kind of measures can be taken in order to mitigate the anticipated water crisis?

The HYDROL2020 work is now continuing with the production of a final report, which will be published in 2005 and presented during the next IAHS meeting.

P. Etchevers, mandated by ICSI as member of the HYDROL2020 Group.
October 17, 2003.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix L

A Perspective of ICSI activities of interest to DFID.

Part 1: Report on activities 1999-2002

During this period the International Commission on Snow and Ice (ICSI) concentrated its activities in the Hindu Kush Himalayas (HKH). The activities concerned the efforts of ICSI, UNESCO and HKH-FRIEND to develop a Glacier Monitoring Network in the HKH, which would monitor the long-term changes in water reserves (mass balances) of regional glaciers through local technical personnel. The mass-balance data will be the basis for regional and international management of glaciers with respect to resource capacity during changes in socio-economic conditions and global climate change. The international scope of the management potentially involves Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

The project involved a workshop and a training course. The workshop was held at the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal, from the 20th to the 24th of March 2001. The purpose of the meeting was to lay the groundwork for the training course on the mass-balance measurements of glaciers within the HKH-FRIEND research programme. The principal objectives of the workshop comprised the production of a manual on the measurement of glacier mass balance adapted to the characteristics of regional glaciers, the choice of representative glaciers, and the determination of the logistical and equipment requirements for a field training of technical personnel. Representatives from UNESCO, HKH-FRIEND, ICIMOD, ICSI and the Department of Hydrology and Meteorology of His Majesty=s Government of Nepal (DHM/HMG) included experts in glacier mass balance measurements and regional glacier hydrology from Austria, Canada, China, France, India, Japan, Nepal and the United States of America.

The Manual has been produced and will be published as a UNESCO-IHP Technical Report. The training course will be held in New Delhi and on the Chhotta Shigri Glacier, Lahul-Spiti Valley, Himachal Pradesh in September/October 2002. Chhotta Shigri has been selected as a benchmark glacier of the HKH-FRIEND Glacier Monitoring Network. The Department of Science and Technology, Government of India, the UNESCO Division of Water Sciences, Paris, and the UNESCO Regional Office in New Delhi, ICSI and HKH-FRIEND finance the course. The trainees will come from India (10), Nepal (6) and Bhutan (4) while the ICSI Training Contingent consists of instructors Ageta (Japan), Francou (France), Jansson (Sweden), Kaser (Austria), Knaus (Austria) and Mayer (Denmark), and observers Chevalier (France) and Bhakta (Nepal/Japan). The training course will begin with a theoretical course in mass-balance theory and measurement techniques in New Delhi, September 24-27. The subsequent on-site training in mass balance techniques on the Glacier is scheduled for the period of September 28 to October 12, 2002.

H.G. Jones, President; Georg Kaser, Secretary Treasurer;

International Commission on Snow and Ice

August 2002

Part 2: A proposal by the International Commission on Snow and Ice (ICSI) to set up a Glacier Monitoring Network (GMN) through the auspices of ANDEAN-FRIEND involving Argentina, Bolivia, Chile, Columbia, Ecuador, Peru, and Venezuela 2002-2008.

1) ***Introduction***

1.1) *The International Commission on Snow and Ice (ICSI)*

ICSI is the responsible body within the International Association of Hydrological sciences (IAHS) of the International Union of Geodesy and Geophysics (IUGG) for the advancement of the study of naturally occurring snow and ice. ICSI carries out its mandate through means that include the promotion of scientific investigation into the dynamics and physical characteristics of snow and ice systems, which comprise the Cryosphere, and the interactions between the Cryosphere, Atmosphere, Hydrosphere and Biosphere. The Commission also participates in programmes on problems of snow and ice that require international co-operation through the initiation and co-ordination of studies as well as providing a forum for the discussion, comparison and publication of research results. ICSI officers and members are able to provide expert advice on glaciological issues to governmental and non-governmental organisations.

In recent years the Commission has been active in the fields of education and technology transfer via the establishment of a Glacier Monitoring Network (GMN) in the Himalayas through the auspices of the Hindu Kush Himalayas Flow Regimes from International Experimental and Network Data (HKH-FRIEND) project. HKH-FRIEND has official and unofficial members from eight countries encompassed by HKH-FRIEND i.e. Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. The objective of the HKH-FRIEND GMN is to provide a long-term database for the management of regional water resources through the monitoring of glacier reserves and glacier-fed runoff regimes.

1.2) *Climate Change: Global glacier freshwater reserves*

The education and training activities of ICSI in establishing GMN are driven by the concern of the Commission on the interaction between the cryosphere and climate - particularly with respect to the effects of climate change on the reserves of freshwater that are found in glaciers and ice caps. Recent changes in glacier characteristics have been noted on all continents and wastage of ice reserves is now acknowledged to be significant, albeit to different degrees, in mountainous regions of the World. The annual rate of increase or decrease in individual glacier ice reserves can be measured by the changes in the mass balance of the glacier ice. Changes in the mass balance of glaciers in most of the Earth glacier regions have been compiled and archived by the World Glacier Monitoring Service (WGMS). The data is made available through the publication series A Glacier Mass Balance Bulletin @, A Fluctuation of Glaciers @ and other associated works (e.g. WGMS, 2001; WGMS; 1998; UNESCO, 1998). ICSI is responsible for WGMS, which is a permanent service of the Federation of Astronomical and Geophysical Services (FAGS), United Nations Environment Programme (UNEP). However, in many parts of the World the data on the mass balance changes of regional glacier reserves are non-existent or so sparse as to be practically of no use for the management of local glacier-fed river basins. The global overview of glacier reserves has thus to be complemented by regional glacier monitoring networks, which can supply the mass balance data appropriate for the control of river flow and for modelling the longer term evolution of glacier reserves.

1.3) *The Andean Glaciers: Regional reserves and implications for resource management.*

The Andes represent important regional glacier ice reserves for many of the South American countries – notably Argentina, Bolivia, Chile, Columbia, Ecuador, Peru and Venezuela. Andean glaciers are also significant factors in the potential effects of Global Change. The wastage of Andean ice can contribute potentially to13% to the total meltwater volume released from all of World glaciers and ice caps - excluding the ice in Antarctica and the Greenland Ice Cap (Haeberli, 1998). The amount of meltwater from Andean glaciers may thus seem insignificant compared to that which could be released from Antarctica and Greenland as these two latter regions harbour over 95% of the freshwater reserves of the Planet. However, the consequences of loss of regional glacier freshwater supplies to the downstream areas of Andean hydrological basins will bring about profound changes to the environment and social and economic life, particularly of heavily populated areas, as flow regimes become radically altered. Andean glaciers thus need to be continually monitored with respect to the demand of local populations and to climate change through a Glacier Monitoring Network. The resulting data can then be used for the elaboration of regional hydrological models that will allow optimal management of water resources and sustainable development within a framework of both short- and long-term changes in downstream flow regimes.

1.4) *The Measurement and Monitoring of Glacier Change.*

Measurements of glacier change can include changes in length, area, volume and thickness and mass balance (UNESCO 1970/1973). Mass balance provides a direct signal of climatic change. The method of measurement involves selecting a number of individual points on a glacier surface from tongue to crest and determining the net balance (accumulation of snow/ice minus the ablation of snow/ice) between two time steps. Accumulation is calculated from the depth and density of the snow pack on the glacier. Ablation is measured on graduated ablation stakes installed into glacier ice. The difference between stake heights during the measurement period multiplied by the density of ice gives ablation. Iso-lines of net mass balance are drawn from point data and the total mass balance then calculated for the whole glacier (a detailed description of climate-glacier interaction and the theory and measurement of glacier mass balance can be found in ICSI/UNESCO-IHP/HKH FRIEND, 2001). The long-term monitoring of regional glacier mass-balance changes involves the selection of a number of benchmark glaciers, which constitute a regional Glacier Monitoring Network (GMN).

2) ***The Proposal***

2.1) *The Valdivia Workshop of March 2003*

A Symposium on the Mass Balance of Andean Glaciers will be held in Valdivia, Chile, 12-13 March 2003. The Symposium is organised by the Working Group of the International Commission on Snow and Ice and is hosted by the Centro de Estudios Cientificos. Immediately following the symposium there will be a one-day workshop devoted to the planning of the Andean GMN. There will also be a discussion of the proposed ANDEAN-FRIEND.

The main objectives of the one-day workshop will be to:

1) Identify researchers, NGO, regional and national institutions that need to participate in the Andean GMN and ANDEAN-FRIEND projects.

2) Select the venue (Peru/Bolivia) and time (March/October, 2004) for a follow-on five-day workshop on the criteria for the definition of an Andean GMN, the methodology of mass-balance measurements and the training of regional technical personnel.

2.2) *The Follow-on Peru/Bolivia Workshop of 2004*

The objectives of the follow-on workshop will be to:

1) To set up a small working group (ICSI/UNESCO-IHP/FIGCC) that will lead to the formation of an ANDEAN-FRIEND Steering Committee.
2) To select representative basins in the ANDEAN-FRIEND region for mass balance measurements of glaciers,
3) To select techniques of mass balance measurement suitable for Andean glaciers,
4) To develop a training course for technical personnel in mass balance measurements
5) To publish a manual for the training course.

The ANDEAN-FRIEND Steering Committee will be made up of regional scientists and resource management experts. ICSI will participate in recommending researchers with expertise in Andean Glaciology. UNESCO-IHP will identify and facilitate communications with the good offices of IHP Committees and UNESCO regional representatives. FIGCC will advise on the formation, the modus operandi and integration of an ANDEAN-FRIEND into the global FRIEND community.

The framework for the selection of glaciers for the Andean GMN will consist of the criteria that are proper to the regional glaciers themselves. The criteria include the science of glacier processes, the ease of access to glacier bodies and on-ice safety considerations.

The measurement of mass balance will focus on simple reliable methods such as snow-pit stratigraphy and the use of stakes placed according to glacier geometry, and complementary remote sensing techniques of glacier morphometry.

2.3) *The Training Course of 2005/6*

The training course should be held within two years of the workshop i.e. 2006. It will be developed for the hands-on-training of the chosen monitoring techniques. Trainee candidates will be regional technical staff preferably with experience in fieldwork, which should carry out the monitoring on a regular basis. The course would consist of basic lectures in glacier and snow cover dynamics, field training in measurement techniques, safety measures and the archiving of data. A two-week course is probably sufficient to cover these activities and the instructors will be made up of international and regional glacier experts selected by ICSI. A training manual on both the theoretical aspects and field techniques of mass balance measurement will also be prepared by ICSI prior to the field campaign.

3) ***Deliverables-Progress reports***

1) August 2003, Report on the Valdivia Workshop of March 2003
2) November 2004, Report on the Peru/Bolivia Workshop of March/October 2004; status of ICSI/UNESCO-IHP/ANDEAN-FRIEND and the Andean GMN

3) 2006/2007, Report on the ICSI/UNESCO-IHP/ANDEAN-FRIEND Training Course and perspectives for ANDEAN-FRIEND and the Andean GMN

4) ***The Budget (US$).***

4.1) **Year 1, 2003**, The Valvidia Symposia and Workshop, March 2003,

ICSI Participation only;

Goerg Kaser, University of Innsbruck, Symposium Organizer and ICSI Secretary

Airfare Innsbruck-Valdivia, 2,000

Per diem (lodging, meals and incidental services) 5 days @ $ 100 a day, 500

Gerald Jones, University of Quebec, Canada, Workshop participant and ICSI President

Airfare Quebec-Valdivia, 2,800

Per diem (lodging, meals, and incidental services) 5 days @ $ 100 a day, 500

Total estimated cost for ICSI participants, Valdivia Workshop, Year 1, 2003 $5, 800

4.2) **Year 2, 2004**, The Peru/Bolivia Workshop for ANDEAN-FRIEND and GMN development,

The venue of the Workshop will be decided at the Valdivia Workshop (above). However, Huaraz, Peru and La Paz, Bolivia are the two most probable locations.

The Workshop will host from 15-20 regional participants and 5 international participants.

Workshop organisation:

Rent of workshop venue (1 room, 5 days @ $ 90 a day) 450

Rent of audio-visual equipment 100

Workshop Secretariat 2,200

Workshop participants:

Partial contribution to travel and per diem of Workshop regional participants: 10,000

Partial contribution to travel and per diem of international participants: 7,500

Estimated partial contribution to Workshop organisation, Year 2, 2004 $20,250

4.3) **Year 3, 2005/6**, The Peru/Bolivia Training Course on Mass-Balance Monitoring,

The time and venue of the Training Course will be decided at the Peru/Bolivia Workshop (above). However, a benchmark glacier in Peru or Bolivia will be chosen.

The Training Course will involve 5-20 regional technical personnel and 5 international participants.

Training Course organisation:

Equipment; type and shipping costs:

Steam Drills, 3, @ $2,660 per drill kit (Euro 2961; Heucke Ice Drill) 7,980

Densitometers 8 @ $100 per kit (University of Innsbruck)	800	
On-ice operational gear: ropes, poles, GPS, ice axes etc	1,750	
Equipment shipping costs	500	
Training Course participants:		
Partial contribution to travel and per diem of regional participants:		10,000
Partial contribution to travel and per diem of international participants:		7,500

Estimated partial contribution to Training Course organisation, Year 2, 2004 $28,530

Total budget requirement, 2003-2006 $54,580

5) ***References***

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ICSI bureau meeting, Cambridge Nov. 2004: Appendix M

IAMAS 9th Scientific Assembly Beijing, China, 2005

ICSI Workshop Proposals:

MModelling Forest Snow Processes.

Principal Convenor. Richard Essery, University of Wales, Aberystwyth, United Kingdom.

Intercepted snow on forest canopies has a large exposed area for exchanges of mass and energy with the atmosphere. Snow on the ground beneath a forest canopy, compared with snow in open areas, is sheltered from wind and solar radiation, but receives increased longwave radiation from the canopy. Forests thus influence the timing and quantity of runoff from snowmelt, and changes in forest cover, whether managed or in response to changing climates, modify this influence. Contributions are invited on how snow processes can be represented in large-scale atmospheric and hydrological models, and on how such process models perform in composition with observations.

Glacier mass balance and its coupling to regional to hemispheric circulation.

Principal Convenor, Peter Jansson, University of Stockholm, Sweden.

Glacier mass balance measurements constitute an important contribution to our understanding of climate change. From a climatological perspective, glacier mass balance constitutes a point measurement in relation to large-scale atmospheric climate factors. However, local factors can be important. For example, snow accumulation is governed by a combination of direct snowfall and wind transport. To extract the mesoscale circulation pattern from the mass balance data, local and mesoscale influences need to be distinguished. The aim of this workshop is to examine how mass balance data can be used to infer mesoscale circulation patterns. If successful, we can use GCM's to predict future glacier changes and past glacier extents. This workshop follows on two previous ICSI workshops on glacier mass balance (Melbourne, 1997; Tarfala, 1998).

ICSI bureau meeting, Cambridge Nov. 2004: Appendix N

Current IPA News

The 8th International Conference on Permafrost met in Zurich, Switzerland, July 21-25, 2003. Approximately 300 representatives from 24 countries participated. A total of 230 papers were published and an additional 97 extended abstracts were published and available for poster presentations. The conference cochairs were and Professors Sarah Springman, Swiss Federal Institute of Technology (ETHZ) and Charles Harris, University of Cardiff, UK. Professor Wilfried Haeberli, University of Zurich, was the host organizer and Vice President of the International Permafrost Association.

The International Permafrost Association held its Council meetings during the conference and approved activities for 10 exisitng and new working groups:

- Permafrost and Climate
- Periglacial Processes and Environments
- Permafrost Engineering
- Cryosol
- Coastal and Offshore Permafrost

New Working Groups

- Antarctic Permafrost and Periglacial Environments
- Glaciers and Permafrost Hazards in High Mountains
- Isotopes and Geochemistry of Permafrost
- Mapping and Modelling of Mountain Permafrost
- Permafrost Astrobiology

The Council approved membership of Iceland as its 24th member, and elected the new Executive Committee for the period 2003-2008. Members are:

Dr. Jerry Brown, President (USA)

Professor Charles Harris, Vice President (United Kingdom)

Dr. Georgy Perlshtein, Vice President (Russia)

Mr. Don Hayley, Member (Canada)

Dr. Hans Hubberten, Member (Germany)

Professor Zhu Yuanlin, Member (China)

The Council approved the invitation from the University of Alaska Fairbanks to convene the 9th International Conference on Permafrost in Fairbanks, Alaska, in early summer 2008. Interim permafrost meetings are planned for Tyumen, Russia in May 2004, and in China in 2006 to highlight the construction of the Qinghai-Tibet railroad.

More information is available at http://www.geodata.soton.ac.uk/ipa/.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix O

IPA Council Resolution (approved 25 July 2003)

Zurich, Switzerland

Resolution 1: Planning and implementing activities that contribute to international programs

Recognizing the inter- and multi-disciplinary nature of permafrost science and engineering and its representation in many diverse bodies, scientific unions, associations, and professional societies with related interests, the International Permafrost Association resolves to endorse and participate in the continuation of existing collaboration and the establishment of new joint programs including, but not limited to:

- Continuation and expansion of the IPA-coordinated, GCOS/GTOS Global Terrestrial Network-Permafrost (GTN-P) monitoring program including CALM, PACE, and other networks (see Yellowknife Resolution 1, 1998);
- Planning and implementation of the WCRP Climate and Cryosphere (CliC) Project Area on Terrestrial Cryosphere, and other WCRP related projects (GEWEX, CLIVAR);
- Developing a joint project with ICSI on ice–permafrost interactions;
- Planning and participation in the Fourth International Polar Year (IPY4 2007/8) and other related programs including the IUGS Planet Earth project (2004/7);
- Planning and implementation of an Antarctic permafrost and periglacial working group and the development of a program in cooperation with SCAR (see Yellowknife Resolution 2, 1998);
- Coordination of a planetary permafrost activity and development of a Working Group with interests on both biological and physical processes;
- Participation in international planning conferences including the IASC organized Second International Conference on Arctic Research Planning (ICARP II/2005); impact assessments (IPCC, ACIA); and symposia such as the Northern Research Basins (NRB);
- Encourage the development of a new IGU/IPA agreement for an IGU Commission related to cold regions processes;
- Contributions to the planning and implementation of relevant IGBP projects and activities such as the Mountain Research Initiative and LOICZ, as well as the Earth System Science Partnership project on Global Carbon, among others programs: and
- Participation in relevant national and regional programs such as SEARCH, CRYSYS, and existing and new national committees that address cryology (National CliC Committees in China, Japan, Russia, etc.).

Resolution 2: Coordination of Activities Related to Permafrost Responses to Climate Changes

Recognizing that responses to climate are complex and multiple-dimensional in both time and space, and that currently many of these complex problems are approached at various scales and levels of resolution by individuals and small teams of experts, be it resolved that the IPA Working Parties consider several key problems that include, but are not limited to:

- Examination of the development of a unified approach to the definition of permafrost and delineation of permafrost boundaries at various spatial resolutions and scales (for past, present, and future climate scenarios).
- Inter-comparison of regional and global models and development of models for diverse environmental conditions.
- Mapping of existing permafrost and ground-ice conditions and monitoring of changes at regional and

continental scales (including mountains).

- Assessing responses of permafrost processes (including coastal, slope, geomorphic) to changes in environmental forcing.
- Assessing responses of infrastructures to changing permafrost regimes.
- Continued development of the Global Geocryological Database (GGD) and updating of metadata and archives related to permafrost-climate investigations.

Furthermore, accomplishments resulting from these resolutions be reported periodically at appropriate scientific and engineering meetings and at the 9th International Conference on Permafrost, in Fairbanks, Alaska, June 2008.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix P

Comments (expanded) from Peter Jansson on the role of ICSI (as an association) in the glaciological community

These comments should e seen as the view from my position as a glaciologist working primarily on glacier-related issues. The purpose is to put ICSI in the context of existing frameworks within the glaciological community.
Existing frameworks

IGS is the main, and in some perspective the only, dedicated framework for glaciology, especially in terms of publishing and organization of symposia. IGS organizes large (100–200 persons) symposia (typically two per year) on relatively wide topics. Although topics may occasionally seem narrow the list of possible subtopics is usually wide enough for most glaciologists to participate. The only exception to this rule is that symposia can be divided into Antarctic and non-Antarctic topics, which limits participation to some extent. IGS publishes symposia proceedings in *Ann. Glaciol.* (citation indexed journal). The large IGS-symposia have relatively large impact on the glaciological community in terms of distributing ideas through publications. IGS tasks do not explicitly include promotion of specific tasks to the community (a form of leadership role). IGS provides a unique basis for glaciological publication through *J. Glaciol.* and *Ann. Glaciol.*

EGU/AGU provides a forum for small workshops on specific topics and presentation of new results (biannually/annually). There are no proceedings except for conference abstracts. These workshops have large importance through their dissemination of new, and therefore unpublished, results, and thereby providing rapid access to new ideas. Their lasting value is limited for non-participating glaciologists.

Other organizations (and this is where I am really on soft grounds) typically organize self-oriented workshops that may or may not have associated proceedings published in assorted journals. These workshops primarily further the work within the organizations and tend to only affect the general community indirectly.

ICSI organizes small to medium-sized workshops initiated by assorted individual interests. Proceedings are either published in the IAHS “Red Book”-series (of highly variable quality) or in single issues of assorted, sometimes prestigious, peer-reviewed journals (with the notable exception of IGS-journals; I do not consider co-sponsored events here). Results are often lost to the larger glaciological community because of the diversity of publication venues and the lack of advertisement for the products. ICSI, does shoulder the responsibility to promote specific tasks, mainly through its active divisions and workgroups.

Future role of, or major area of contribution from, ICSI as an association
Based on the above, I believe that the most important void that ICSI can fill is to provide

leadership in identifying, sponsoring and promoting medium-sized (30–50 person) workshops on specific and highly relevant topics, including workgroup tasks. This does not in any way indicate that co-convening or co-sponsoring larger symposia should be dropped from the ICSI agenda. It is also vital to provide a collected venue for publishing proceedings from medium-sized workshops in a highly respected peer reviewed journal (e.g. in collaboration with IGS, potentially as a new, third, journal series co-sponsored by the new Association).

In short and in order of priority:

1. Provide platform and forum for medium-sized specialized workshops
2. Promote and launch workshops on identified problem areas
3. Provide unified publishing platform for 1 and 2
4. To provide leadership in promoting specific tasks.
5. Co-convene and co-sponsor larger symposia.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix Q

Proceedings of the 1st Mass Balance Workshop on Andean Glaciers, Valdivia Chile, March 13, 2003.

Summary

A half-day Workshop, '1st Mass Balance Workshop on Andean Glaciers' was held during the 'Symposium on Mass Balance of Andean Glaciers', which took place from the 12th to 14th of March, 2003 at the Centro de Estudios Científicos (CECS), Valdivia, Chile. The Symposium was sponsored by CECS, International Commission on Snow and Ice (ICSI), Institut de recherche pour le développement (IRD), and the International Glaciological Society (IGS). The Workshop was held on March 13 and attracted 62 participants from 17 countries.

The objectives of the Workshop were to examine the opportunity and means of establishing an Andean Glacier monitoring Network (A-GMN) through international co-operation between research workers and institutions, national agencies and international organisations and programs. In particular, the participants set out to identify researchers and other qualified personnel from different Andean countries, who could form the nucleus of a Working Group on Snow and Ice within the framework of an Andean-FRIEND (Andean - Flow Regimes from International Experimental and Network Data). There is presently no Andean-FRIEND and the concomitant establishment of A-GMN and Andean-FRIEND was judged to be the most opportune method of developing an integrated glaciological and hydrological program for regional monitoring and management use in a region where snow and ice reserves are such an important part of water resources.

The Workshop consisted of 4 sessions:

A) A presentation and open discussion on the organisations and programs interested in the development of an Andean Glacier Monitoring Network (A-GMN) and a description of an existing network i.e. Hindu Kush-Himalayan Glacier Monitoring Network, HKH-GMN, in HKH-FRIEND.

B) A presentation and open discussion on long-term mass balance observations in the Andes and the value of such data to the study of climate change.

C) Presentations and open discussion on current research and monitoring of Andean Glaciers and the need and opportunity to initiate the A-GMN and Andean-FRIEND.

D) Discussion on structuring the next steps in the development of the A-GMN and Andean-FRIEND.

At the end of session D the workshop concluded on a very practical note. A Working Group (WG) on Snow and Ice was formed. The WG will also serve as an Interim Steering Committee (ISC) for Andean-FRIEND.

The composition of the WG/ISC is:

Gino Casassa, Chair (Chile); Jair Ramírez (Colombia); Bolivar Cáceres (Ecuador); Marco Zapata (Peru); Edson Ramírez (Bolivia); Juan Carlos Leiva (Argentina); Jefferson Simões (Brasil); Georg Kaser, ICSI Representative, (Austria); Bernard Francou, IRD Representative (France).

The WG/ISC has the mandate to prepare a proposal for a follow-on workshop to be held in late 2003/early 2004. The Regional Office of UNESCO in Montevideo has been suggested as a venue. The Workshop should bring together interested parties from UNESCO, FRIEND, and ICSI together with Glaciologists active in the study of Andean Glaciers and Regional Hydrologists, and Representatives of National IHP Committees to discuss and plan the implementation of an Andean-FRIEND. Technical sessions will focus on the specific criteria for the definition of an Andean-GMN and the integration of the A-GMN and Andean-FRIEND.

Introduction

The half-day Workshop, '1st Mass Balance Workshop on Andean Glaciers' was held during the 'Symposium on Mass Balance of Andean Glaciers', which took place from the 12th to 14th of March, 2003 at the Centro de Estudios Científicos (CECS), Valdivia, Chile. The Symposium was sponsored by CECS, International Commission on Snow and Ice (ICSI), Institut de recherche pour le développement (IRD), and the International Glaciological Society (IGS).

The Montevideo Regional Office of UNESCO also provided financial assistance to ICSI, which allowed the ICSI President to participate in the Workshop.

The Workshop was held on the morning of March 13 and attracted 62 participants from 17 countries (Appendix). The objectives of the Workshop were to examine the opportunity and means of establishing an Andean Glacier monitoring Network (A-GMN) through international co-operation between research workers and institutions, national agencies and international organisations and programs. In particular, the participants set out to identify researchers and other qualified personnel from different Andean countries, who could form the nucleus of a Working Group on Snow and Ice within the framework of an Andean-FRIEND.

The Workshop consisted of 4 sessions. The first session (A), chaired by H.G. Jones was devoted to background information on the organisations and programs interested in the development of an Andean Glacier Monitoring Network (A-GMN) and a historical description of an existing network (Hindu Kush-Himalayan Glacier Monitoring Network, HKH-GMN). The aim of the Workshop to initiate a process to build A-GMN and the steps to achieve it was also discussed. The second session (B), also chaired by H.G. Jones, was devoted to a presentation on long-term mass balance observations in the Andes and the value of such data to the study of climate change. The third session (C), chaired by Gino Casassa, featured presentations on current research and monitoring of Andean Glaciers and concomitant discussion on the need and opportunity to initiate the A-GMN in this context. The fourth and final session (D), chaired by Gino Casassa, was concerned with structuring the next steps in the development of the A-GMN.

Session (A)

Introduction and background to the workshop: the interest and support of ICSI, FRIEND, and UNESCO in the creation of an Andean-FRIEND and the associated Andean Glacier Monitoring Network (H.G. Jones, Chair. Speakers, H.G. Jones and Georg Kaser).

The workshop opened with a presentation by H.G. Jones, the President of ICSI. Mr Jones described the role that ICSI plays within the International Union of Geodesy and Geophysics (IUGG), i.e. the advancement of the study of naturally occurring snow and ice, and the organisational structure of the Commission. ICSI is presently one of the nine commissions of the International Association of Hydrological Sciences (IAHS), which, in turn, is one of the seven associations of IUGG. The President outlined some of the current activities that ICSI pursues to promote and encourage the study of the Cryosphere and also some of the complementary projects more specifically devoted to science in the service of society and the pooling and exchange of international data. As an example of the latter, Mr Jones briefly reviewed the project on the Himalayan Glacier Monitoring Network (HKH-GMN), which ICSI has initiated in collaboration with the Hindu Kush-Himalayan regional project of the Flow Regimes from International Experimental and Network Data (HKH-FRIEND) program. FRIEND has been an ongoing contribution to the International Hydrological Programme (IHP) of UNESCO since IHP-III. FRIEND has been designated as a stand-alone cross-cutting theme for IHP-VI.

Georg Kaser, the Secretary Treasurer of ICSI, gave an overview of the world-wide distribution of the eight FRIEND regional projects i.e. Northern Europe, Alpine and Mediterranean (AMHY), Southern Africa, West and Central Africa (AOC), Nile Basin, Asian Pacific, Hindu Kush Himalayas (HKH), and Mesoamerica and the Caribbean (AMIGO). Mr Kaser also described the aim of FRIEND to develop better understanding of hydrological variability and similarity across time and space through the mutual exchange of data, knowledge and techniques at regional levels. Research covers low flows, floods, regime variability, rain/runoff modelling, streamflow generation, sediment transport, snow and glacier melt, climate change, and land-use impacts.

Mr Kaser emphasised that, in spite of the importance of snow and ice in the regional hydrology and climate of South America there was no regional FRIEND for the Andean area. He further suggested that the experience that had been obtained in setting up the Himalayan Glacier Monitoring Network (HKH-GMN) through HKH-FRIEND could serve as a template for the formation of an Andean-FRIEND and an Andean Glacier Monitoring Network (A-GMN) at the same time. This capacity-building initiative by local hydrologists, glaciologists and water practitioners would involve training courses, technical workshops, conferences, symposia, and subsidised distribution of technical literature and support to post-graduate students. Encouragement to start up the initiative has already been obtained from FRIEND, the UNESCO Division of Water Sciences and the Regional Office for UNESCO at Montevideo.

The challenges that HKH-FRIEND faced in initiating the HKH-GMN are comparable to those of the future Andean FRIEND i.e. high mountains with extreme relief, highly seasonal flow regimes, the impact of snow and glacier ice and data availability. Of the eight regional FRIEND projects only HKH-FRIEND includes a working group (WG) on snow and glacier hydrology. It was this WG that assumed the responsibility for developing the HKH-GMN. The base for the first steps of an Andean FRIEND and A-GMN could thus be the formation of a Andean WG on snow and ice similar to that of HKH-FRIEND. This group would initiate a program, which should include a technical workshop on the methodology related to the measurement of mass balance of Andean glaciers, training courses for technical personnel, and the choice of benchmark glaciers for an A-GMN. A brief review of the role that ICSI had played in the creation of the HKH-FRIEND GMN was given.

Mr Jones completed the introduction in stating that the immediate aim of the workshop should be to define the process for building the A-GMN. He suggested that this could involve a number of steps, which could be carried out during and subsequent to the workshop. These steps are:

1) To publish the Workshop proceedings by May 2003. The proceedings will identify researchers and other qualified personnel from different Andean countries, who could form the nucleus of a Working Group on Snow and Ice.

2) The proceedings will also include a recommendation to hold a follow-on four or five-day Technical Workshop at a South American venue during late 2003/early 2004. The Technical Workshop will focus on the specific criteria for the definition of an Andean-GMN, the methodology of mass-balance measurements on Andean Glaciers, the requirements for the training of regional technical personnel in glacier monitoring, integration of the A-GMN and Andean-FRIEND, and possible avenues of financial support.

3) The Working Group on Snow and Ice will prepare in concert with colleagues from regional and national institutions, FRIEND and UNESCO-IHP a document, which will define the precise objectives, program, organisation and financial assistance for the follow-on workshop.

In the long term, the concomitant formation of the A-GMN and Andean-FRIEND will lead to research that will better quantify the evolution of regional glacier reserves and allow the development of models for the optimal management and long-term conservation of glacier resources in the spirit of regional collaboration.

Session (B)

Long-term mass balance observations in the Andes and its relation to world-wide climate-glacier observations (H.G. Jones, Chair. Speaker, Wilfred Haeberli).

Wilfred Haeberli, the Director of the World Glacier Monitoring Service (WGMS) gave a comprehensive presentation on glacier evolution and world-wide climate change. The IPCC report (2001) states that glacier recession is the key variable for global climate change in terms of public awareness. However, glaciers are not just retreating anymore but are also undergoing collapse. Mr Haeberli described GTOS (Global Terrestrial Observation System) and the three cryosphere variables -snow, glaciers and permafrost – that are the subject of study. GTOS emphasis is on the long-term understanding of scientific processes. The difference between cold

and temperate based glaciers was discussed and the link between climate signal and tongue reaction was defined.

The Global Hierarchical Observing Strategy (GHOST) was also outlined. It comprises 5 concepts:

1. transects along environmental gradients
2. extensive process-oriented glacier mass balance change – for calibrating models
3. regional glacier mass changes within major mountain chains
4. representative long-term observations (and how to assess 'representative')
5. global coverage – inventories by means of remote sensing

Mr Haeberli recommended that there be:

1. high-priority given to the need for systematic mass balance data for the study of world-wide climatic change
2. high priority given to such a framework for the Andes
3. concerted endeavour to fit ANDEAN mass balance data into the present framework of global study
4. development of criteria (changes in mass and length and inventory compilation) for a representative network
5. use all of modern technology such as GIS, remote sensing, and modelling in glacier-climate studies.

In conclusion, the establishment of an A-GMN would contribute significantly to our knowledge on the evolution of glaciers world-wide and provide invaluable data for the study of climate change.

Session (C)

An overview of current studies in the Andes (Gino Casassa, Chair. Speakers, Jair Ramírez, Ramón Chango, Bolívar Cáceres, Bernard Francou, Marco Zapata, Pierre Ribstein, Javier Mendoza, Chris Degrassi, Juan Carlos Leiva, Gabriel Cabrera, Luis Lenzano, Rodolfo Iturraspe, Cedomir Marangunic, Maria Angélica Godoi, Andrés Rivera, Margit Schwikowski, Christoph Schneider, Pablo Wainstein).

Glacier studies in Colombia

Speaker

Jair Ramírez of INGEOMINAS, Colombia.

A main thrust of the research is volcanic risks at Nevado del Ruiz. Work has been carried out since the 1980s in collaboration with French and other European colleagues. Properties such as ice thickness, ablation and possible lahar generation were studied. Work was also carried out on Nevado del Tolima Volcano, Nevado de Santa Isabel Volcano, Nevado del Huila Volcano, and Sierra Nevada del Cucuy. Moraine belts and debris-covered ice were characterised. Funds from abroad are now being sought to install climatic stations. Some equipment has been obtained from Germany and presently there is a stake camp on one glacier as well as an automatic weather station. There is a desire to start a mass balance programme but the aim of the future studies must focus on volcanic risks as well as hydrological applications.

Colombia is interested in becoming a member of the A-GMN and wishes to work through collaboration between the Government and other agencies such as INGEOMINAS, IDEAN, and Universidad Nacional de Colombia.

Glacier studies in Ecuador

First speaker

Ramón Chango, Instituto Nacional de Meteorología e Hidrología del Ecuador (INAMHI).

Work was started in 1994 in collaboration with Bernard Francou of IRD. Studies were carried out on Antizana, a glacier located close to Quito, and very important source for water supply to the capital. A network of stakes (monthly measurements) was installed and one automatic weather station (snow pillow, T, PP, and others) fixed in place. Two automatic hydrological stations are also in operation. The mass balance of the glacier is monitored on an on-going basis. Measurements were also started in June 1999 at a second glacier, Carihuairaso, as well as on the ice cap at the summit of Chimborazo. Work is being carried out in collaboration with INAMHI as well as IRD.

Ecuador is also very interested in participating in the A-GMN.

Second speaker

Bolívar Cáceres of INAMHI.

Work on Antizana and Carihuayrazo was described. The problem with Carihuayrazo is the lack of ELA on the small glacier. Follow-up glaciological studies of Antizana, and maybe also with Carihuayrazo will involve estimating the frontal and areal variations of the glaciers, based upon aerial photographs. In addition, Mr. Cáceres is presently working on the glacier inventory of Ecuador.

Third speaker

Bernard Francou of IRD, France.

Mr Francou described the work of IRD in Bolivia, Peru and Ecuador. IRD stresses the importance of efforts to contact regional expertise in South America to initiate a mass balance programme. At the present time the emphasis is on the choice of a representative (large) glacier for each country as well as a second smaller glacier, more sensitive to climate change. The French Government has offered funds for the generation of a network for glacier monitoring purposes (two glaciers in Europe, two in the Andes and two in Antarctica). The Andean part of the network would be established in collaboration with South American countries. IRD is also involved in the study of Himalayan glaciers. Ice core drilling activities have been carried out at Tapado, Illimani, and Chimborazo and plans are being made to drill Nevado de Curupuna in the near future. The main applications of the studies are hydrological (water supply) and risk analysis. IRD is also interested in the education of regional scientists, e.g. in providing grants for PhD students like Edson Ramírez from Bolivia, who will obtain his doctoral degree shortly.

Glacier studies in Peru

First speaker

Marco Zapata, Head of Glaciology and Water Resources of Instituto Nacional de Recursos Naturales (INRENA-UGRH), Peru.

The first department of glacier studies in Peru was organised in 1966 by Benjamín Morales Arnao at Corporación Peruana del Santa in Cordillera Blanca, mainly for aiding in engineering studies and flood prevention. Work was continued later at Electroperú. Instituto de Geología y Minería extended the glacier studies to virtually the entire country, completing the glacier inventory of Peru in 1988 based upon aerial photographs. Work has been performed on glaciers and pro-glacial lakes, totalling approximately 300 glaciers and 200 lakes. Studies are mainly confined to the Cordillera Blanca on 4-5 western glaciers, and more recently (since 2000) two eastern glaciers are being monitored. The glacier inventory is being updated based on satellite imagery, and changes with the previous inventory will be able to be detected. Collaboration is carried out with IRD and the University of Innsbruck. Studies on one western glacier, Artesonraju, are foreseen in collaboration with IRD.

Peruvian glaciologists desire more collaboration and co-ordination with colleagues from Bolivia and Ecuador. The main problems of the glaciological group of INRENA are ongoing support from its administration and changes of governmental policies. The group looks forward to

communicating and collaborating with other South American colleagues as well. As an example Peru will host the Second Symposium on Mass Balance of Andean Glaciers in Huaraz, Peru, between June 29 to July 4, 2004. For this meeting the support of ICSI and IRD is being established. The group from INRENA is the only governmental institution doing research on glaciology in Peru. It is hoped that offices will be established in Huancayo and Cuzco, in order to facilitate work in southern Peru.

Second speaker

Bernard Pouyaud, IRD, France.

Mr Pouyaud emphasised three balance methods in glacier studies: (hydrological method, glaciological – stake – method - and energy balance), which have been performed by IRD in collaboration with Servicio Nacional de Meteorología e Hidrología (SENAMHI).

Glacier studies in Bolivia

First speaker

Javier Mendoza, Universidad Mayor de San Andrés, Bolivia

Work was commenced in collaboration with Bernard Francou in 1991. Studies were carried out on Chacaltaya (a small glacier near La Paz) and Zongo, a very important glacier for water supply and energy generation for La Paz and El Alto. On glaciar Zongo, there is a stake network, AWS, and a hydrological station. Measurements on the glaciological mass balance, energy balance, and hydrological balance are carried out. A study of a third glacier, Charquin, is now being launched. This study will replace that of Chacaltaya, which is wasting rapidly due to retreat and thinning and may disappear in less than two decades. Long-term changes of glaciers are of particular interest both for short-term water resource applications and for climate change studies. In Bolivia, melt water from glaciers contributes almost 30% of the total runoff.

The work involves students from Bolivia of which one is pursuing his PhD in glaciology (Edson Ramírez). The help of IRD has been very important in this regard.

Second speaker

Chris Degrassi, Appalachian University, USA.

Mr Degrassi presented a very brief outline of his work on glaciar Alcahuma. He wants to pursue his studies as a part of a thesis on glaciology in Bolivia and, in this regard, would like to collaborate with his Bolivian colleagues.

Glacier studies in Argentina.

First speaker

Juan Carlos Leiva, Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA), Argentina

IANIGLA started research on glaciers in 1974 and mass balance since 1979, mainly in the Andes of Mendoza, but also in the Southern Patagonian Icefield (SPI). Current work is centred in the Mendoza area. The Institute's projects cover many other disciplines such as climatology and hydrology. Other institutions working on glaciology in Argentina are Universidad Nacional del Comahue, Neuquén, Instituto Antártico Argentino (IAA), Buenos Aires and Centro Austral de Investigaciones Científicas (CADIC), Usuahia. Traditional methods for glacier study are applied by IANIGLA but there is a desire to develop new techniques, including widespread use of geodetic-quality GPS receivers, in order to estimate mass balance for more glaciers. However, the lack of financial support is dramatic and has reduced considerably the number of glaciers that can be studied. Work is now being carried out on glaciar Piloto, which is a small glacier near Las Cuevas, west of Mendoza, but there is a need to study a larger glacier, for instance in the Aconcagua region. Measurements will also be necessary at the Southern Patagonia Icefield if the relationship between the latitudinal gradient of glacier variations and climate change is to be elucidated. Such an objective is relevant to other international programs such as the Pole-

Equator-Pole Transect of the Americas (PEP1) of the IGBP Past Global Changes (PAGES) Project.

The initiation of the mass balance network (A-GMN) is a good idea and should be supported. The association of A-GMN with international programs and organisations should offer some stability in view of national political fluctuations and budget cuts.

Second speaker

Gabriel Cabrera, IANIGLA, Argentina.

Mr Cabrera, expounded on the financial constraints of carrying out glacier studies in Argentina.

Third speaker

Luis Lenzano, IANIGLA, Argentina.

Mr Lenzano has collaborated in application of geodetic techniques to mass balance studies. At Nevado del Plomo glacier partial funding was obtained from the owner of a local farm.

Fourth speaker

Rodolfo Iturraspe, Centro Austral de Investigaciones Científicas (CADIC), Argentina.

Work on Holocene and historical glacier fluctuations, their volumetric changes and mass balance in Tierra del Fuego began in 1984. A detailed mass balance program, in progress since March 2000, is being developed on the Martial glacier. Other glaciers around Usuahia are more suitable for mass balance studies but there are several logistical difficulties in approaching them. Nevertheless, the study of the mass balance of Vinciguerra glacier will start this (2003) fall. Work is being carried out together with Jorge Strelin, a geomorphologist of IAA (Instituto Antártico Argentino) with working place at CADIC Tierra del Fuego, studying glacier morphology and periglacial landscape evolution in Antarctica, Tierra del Fuego, and Patagonia. Other areas of interest are the Cordillera Darwin and the Isla Hoste in Chile, where collaboration with Chilean colleagues is sought. However, financial support is badly needed.

A note was added as to the absence of representatives from IAA, who are actively studying glacier areas of Antarctica and Patagonia.

Glacier studies in Chile

First speaker

Cedomir Marangunic, Geoestudios Ltda., Chile.

Mr Marangunic is a geologist and glaciologist working as private consultant and carrying out research for private and public companies, which have invested more than 5 million US$ in glacier studies in recent years. He explained the need to establish closer ties between state institutions (universities for example) and private companies, which could lead to increased funding. Many private studies on rock glaciers (ice thickness, velocities, monitoring its dynamics, runoff, etc.) have been accomplished but there is little interaction with research institutes. In Chile there is only one long-term mass balance programme, which is the study on glaciar Echaurren Norte since 1975. This glacier was selected because of relatively easy access but it is small and not very suitable for a representative mass balance programme. However, the results are very revealing in that they show rapid wasting in recent years.

Finally Mr Marangunic touched on the education in science of snow and ice. Although it is presently not substantial, it could well become significant if the demand for new specialists increases in the future.

Second speaker

Mrs María Angélica Godoi, Universidad de Magallanes (UMAG), Chile.

Mrs. Godoi described the studies that UMAG is performing on temperate glaciers, especially the

work on radio echo sounding of glaciar Tyndall (Southern Patagonia Icefield). UMAG is also collaborating with the German project on Gran Campo Nevado. Collaboration with Brazilian glaciologists has also been done on King George Island, Antarctica.

Third speaker

Andrés Rivera, Universidad de Chile (UCh) and Centro de Estudios Científicos (CECS).

Mr. Rivera gave an overview of the work that UCh and CECS have been performing on many of Chile's glaciers since 1992. Fieldwork has been carried out on glaciers near Santiago and Patagonia. In the Santiago area, work has concentrated on glaciar Juncal and San Francisco (ablation areas), and glaciar Esmeralda (accumulation area). Measurements have included radio echo sounding, stake measurements with differential GPS, geomorphological, hydrological and meteorological measurements. An annual field trip to glaciar Juncal has been established with undergraduate students of the Dept. of Geography of Univ. de Chile, at the end of a glaciology course. In Patagonia, field measurements have been performed for a number of years, both on the accumulation and the ablation areas of glaciers. Particularly fruitful campaigns have been undertaken to the upper glaciar Chico, thanks to the logistic support of the Chilean Air Force. Work has also been carried out in Antarctica with the sponsorship of the Chilean Antarctic Institute and the Chilean Air Force. In many cases the glaciological work has been performed with the valuable collaboration of foreign collaborators, for example from Paul Scherrer Institut, Switzerland, Univ. of Freiburg and Trier, Germany, Univ. of Washington, USA, JPL, USA, Univ. of Hokkaido and Tsukuba, Japan, and IANIGLA, Argentina. There are plans to start glaciological measurements on the volcanoes of the Chilean Lake District near Valdivia. Efforts are under way to develop capabilities for airborne sensing of glaciers, including ice radar, laser altimetry and metric photographs, in collaboration with USA and Danish scientists. There is high interest in becoming a member of the A-GMN. Under the umbrella of the A-GMN, some of the current glaciological studies could develop into mass balance monitoring programmes.

Fourth speaker

Margit Schwikowski, Paul Scherrer Institute (PSI), Switzerland.

Mrs Schwikowski reported on her work on the Tapado glacier and on the Southern Patagonian Icefield. PSI is particularly interested in paleochemical analyses of ice cores. Currently PSi is planning deep drilling at cerro Mercedario, Argentina. The studies in Chile are being performed with collaboration from CECS and UCh and in Argentina with collaboration from IANIGLA.

Fifth speaker

Christoph Schneider, Universitaet Freiburg, Germany.

Mr Schneider gave an account of his studies of mass balance and energy balance measurements on Gran Campo Nevado (Patagonia), where the Universities of Freiburg and Trier have an ongoing program for the last 5 years. Glacier inventories and assessment of glacier variations have been performed. Several meteorological stations have been deployed.

Sixth speaker

Pablo Wainstein, Instituto Chileno de Campos de Hielo (ICCH), Chile.

ICCH is building a hut for scientific and logistic purposes in the upper reaches of glaciar Chico, Southern Patagonia Icefield. ICCH is open to offer the use of this hut as a base for ice monitoring programmes.

Session (D)

Concluding session: formation of a working group on snow and ice and an interim steering committee of FRIEND

Speaker and facilitator, Gino Casassa, CECS

Mr Casassa reviewed the deliberations of the workshop to show the need for the Glacier Monitoring Network in the Andes (A-GMN). He emphasised that it was an excellent opportunity

to initiate the project through international co-operation between the individual nations, their universities, research institutes and agencies. Support of international programs such as FRIEND and the help of UNESCO would be highly desirable. He also noted that there was strong support from all participants for the A-GMN and the time was now at hand to set in motion the process of creating the A-GMN.

With reference to the steps outlined by H.G. Jones in session A, Mr Casassa called on the participants to form the Working Group on Snow and Ice. The WG would also serve as the Interim Steering Committee for FRIEND.

By common agreement of the participants, the members of the Working Group/Interim Committee were selected to be the following:

Gino Casassa, Chair (Chile)

Jair Ramírez (Colombia)

Bolivar Cáceres (Ecuador)

Marco Zapata (Peru)

Edson Ramírez (Bolivia)

Juan Carlos Leiva (Argentina)

Jefferson Simões (Brasil)

Georg Kaser, ICSI Representative, (Austria)

Bernard Francou, IRD Representative (France)

The main activity of the WG/IC will be to prepare a proposal for the follow-on workshop to be held in late 2003/early 2004. The Regional Office of UNESCO in Montevideo has been suggested as a venue.

Mr Casassa thanked all participants and hoped to see them all again in Huaraz, Peru, in July 2004.

Acknowledgements

These proceedings have been made possible through the records of the Workshop Rapporteurs, Christoph Schneider and Andrés Rivera.

Their notes were compiled and edited by H.G. Jones, Georg Kaser and Gino Casassa

Appendix

Workshop Participants:

	Name	***Country***	***Affiliation***
1	Gerald Jones	Canada	ICSI
2	Georg Kaser	Austria	ICSI
3	Eleanor Haresign	UK	Univ. of St Andrews
4	Christian Degrassi	USA	Appalachian State Univ.
5	Baker Perry	USA	Appalachian State Univ.
6	Rolf Sinclair	USA	CECS
7	Marco Zapata	Perú	INRENA-UGRH
8	Irmgard Juen	Austria	Univ. of Innsbruck
9	Francisca Bown	Chile	Univ. of Chile
10	Margit Schwikowski	Switzerland	Paul Scherrer Institut
11	Jorge Quinteros	Chile	Direccíon General de Aguas
12	Cedomir Marangunic	Chile	Geoestudios Ltda.
13	Claudia Guarda	Chile	Univ. Austral
14	Jutta Hammer	Germany	Univ. Trier
15	Anja Poetzsch	Germany	Tech. Univ. Dresden
16	Shiro Kohshima	Japan	Tokyo Inst. of Tech.
17	Rodolfo Iturraspe	Argentina	CADIC
18	Jean-Denis Taupin	France/Ecuador	IRD

19	Rolf Kilian	Chile/Germany	Univ. Trier
20	Marcelo Arévalo	Chile	UMAG
21	Mathias Vuille	USA	Univ. Massachusetts
22	Gabriel Cabrera	Argentina	IANIGLA
23	Bolívar Cáceres	Ecuador	INAMHI
24	Luis Maisincho	Ecuador	INAMHI
25	Jair Ramírez	Colombia	INGEOMINAS
26	Ramón Chango	Ecuador	INAMHI
27	Jefferson Simoes	Brasil	Univ. Fed. Rio Grande do Sul
28	Jonathan Bamber	UK	Univ. of Bristol
29	Blair Fitzharris	New Zealand	Univ. of Otago
30	Gonzalo Barcaza	Chile	Inst. Chileno Campos de Hielo
31	Pablo Salucci	Chile	Inst. Chileno Campos de Hielo
32	Pablo Wainstein	Chile	Inst. Chileno Campos de Hielo
33	Nivaldo Lucero	Chile	UMAG
34	María Angélica Godoi	Chile	UMAG
35	Jorge Carrasco	Chile	Dirección Met. de Chile
36	Rosemary Vieira	Brasil	Univ. Fed. Rio Grande do Sul
37	Francisco Ferrando	Chile	Dep. of Geogr., Univ. de Chile
38	Al Rasmussen	USA	Univ. of Washington
39	Luis Lenzano	Argentina	INANIGLA
40	Victor Popovnin	Russia	Moscow State Univ.
41	César Acuña	Chile	CECS
42	Marta Mateluna	Chile	Univ. de Chile – DIFROL
43	Rubén Carvallo	Chile	UMAG
44	Javier Mendoza	Bolivia	Univ. Mayor de San Andrés
45	Greg Scharfen	USA	Nat. Snow and Ice Data Center, Boulder
46	Antoine Rabatel	France / Bolivia	IRD
47	Vincent Jomelli	France	Lab. Geogr., CNRS
48	Robert Gallaire	Bolivia	IRD
49	Anton Seimon	USA	CIRES/NSIDC, Univ Colorado
50	Adina Racoviteanu	USA	INSTAAR, Univ. Colorado
51	Ricardo Gomez	Peru	INRENA
52	Jorge Yerren	Peru	SENAMHI
53	Nelson Santillan	Peru	INRENA-UGRH
54	Alvaro Soruco	Bolivia	IRD
55	Christoph Schneider	Germany	Univ. Freiburg
56	Gino Casassa	Chile	CECS
57	Andrés Rivera	Chile	CECS, Univ. de Chile
58	Bernard Francou	France	IRD
59	Pierre Ribstein	France	IRD
60	Juan Carlos Leiva	Argentina	IANIGLA
61	Wilfried Haeberli	Switzerland	WGMS and Univ. Zurich
62	Bernard Pouyaud	France/Peru	IRD

ICSI bureau meeting, Cambridge Nov. 2004: Appendix R

International Commission on Snow and Ice (ICSI): Perspectives for the contribution of ICSI to the second edition of the World Water Development Report (WWDR) of the World Water Assessment Programme (WWAP).

Common interests of WWAP and ICSI

The aim of the World Water Assessment Programme (WWAP) is to systematically assemble knowledge world-wide on the use of water resources and the ability of societies to cope with the problems of managing supply and demand – often in the context of dwindling reserves. The International Commission on Snow and Ice (ICSI) of the International Association of Hydrological Sciences (IAHS) is concerned with the study of snow and ice in all its forms, that is, glaciology. Among the subjects of interest to the Commission is the influence of snow and ice on the hydrological cycle in many parts of the World. Although the focus of ICSI activities is the science of snow and ice, we acknowledge that much of the data that is gathered can be of use in the assessment of water in snow-covered and glacial basins for other purposes. The principal output of WWAP is the series of World Water Development Reports (WWDR). The following text is a brief summary of ICSI activities and of how ICSI could contribute to the second edition of WWDR.

ICSI fields of study of interest to WWAP

The establishment of Regional Monitoring Networks: ICSI members and colleagues in the International Glaciological Community have worked in many catchment areas (e.g. European Alps, Sierra Nevada, Himalayas, Andes) where both seasonal snow and glacier ice contribute significantly to the hydrological regime of river basins harbouring large populations. The reserves of water in such regions are sensitive to changes in climate and the observed recent retreat of many glaciers has led to concern that the water reserves of many river basins may be dwindling significantly. To better assess the evolution of glacier reserves, ICSI has recently proposed the establishment of Glacier Monitoring Networks (GMN). The overall goal of a GMN is to monitor the mass-balance changes of certain benchmark glaciers, which are representative of a particular region. Mass-Balance changes in individual glaciers are related to specific river basins while the analyses of a combined GMN data set will permit the estimation of the rate of change in regional reserves. In addition, the long-term study of regional glacier change and climatic conditions will lead to a better understanding of global processes in climate-cryosphere interactions and improved predictive models of changes in the hydrological cycle of high mountain regions. A Himalayan Hindu-Kush GMN has recently been established for the Himalayas in collaboration with HKH-FRIEND and UNESCO-IHP. A similar network for the Andes A-GMN is now in the advanced planning stage and will soon be established in collaboration with Andean-FRIEND and UNESCO-IHP.

Cold-region Hydrology: Processes and Prediction of Flow Regimes: Both surface water and ground water regimes in high-latitude depend not only on glacier reserves but also on the extent and water equivalent of seasonal snow covers. This is of particular importance in the Northern Hemisphere where the recent evolution of seasonal snow covers has shown significant changes attributed in the main to changes in climate. The concomitant change in the extent of permafrost and forest cover may also have substantial repercussions on the sustainability of water resources in certain northern basins. The hydrological modelling of these high latitude basins is very restricted due to the lack of knowledge on the biogeophysical processes for streamflow generation and on the inherent difficulties in the acquisition of good scientific data in arduous conditions. Remote sensing techniques offer the chance to improve real-time estimation of snow reserves but the data cannot be translated satisfactorily into subsequent redistribution of water resources without better knowledge of processes and model parameters based on the physical characteristics of the basins themselves. ICSI Working Groups (WGs) are presently investigating certain aspects of northern hydrology through WGs on Snow and Vegetation Interactions, Modelling of meltwater generation from snow, and the modelling of snow/forest-canopy dynamics. In addition, ICSI also participates in the IAHS project on Prediction (of streamflow) in Ungauged Basins (PUB) through studies of cold-region basins.

Data Sources: ICSI is responsible for the World Glacier Monitoring Service, a permanent service of the Federation for Astronomical and Geophysical Services (FAGS) funded by the United Nations Environment

Programme (UNEP). WGMS is in charge of collecting and publishing data on glacier variations ('Fluctuations of Glaciers' series, first published 1967) and mass balances ('Glacier mass Balance Bulletin' series, first published 1991) at given sites. The work is co-ordinated with the International Council of Scientific Unions (ICSU) World data centres for Glaciology (WDC). In addition to WGMS there are other sources for data on glaciers, particularly, national archives and academic institutes. Long-term databases for seasonal snow-covers also exist, which can be accessed through WDC. They include national snow-course networks of many countries, scientific institutions and private hydropower companies.

Possible avenues for ICSI-WAAP collaboration

Use of current databases on glacier and snow cover: A possible avenue for immediate collaboration between ICSI and WWAP may be envisaged through the use of currently available data on changes in glacier reserves (GMN/WGMS) and seasonal snow-cover extent. Analyses of these databases in basins of interest to WWAP will lead to an assessment of the recent changes in water reserves where snow and ice are major inputs and permit an evaluation of future short-term supply if present trends continue. This would seem an appropriate subject for collaboration in the case of the WWDR (2nd edition).

Models of glacier-climate and snow-climate interactions: The second avenue concerns the longer-term assessment of regional water supplies based on the modelling of glacier-climate interactions. However, it should be realised that this integration of physically-based models for large ice bodies and climate variability is a science in its infancy and fraught with uncertainties on the dynamics of surface exchange, feedback processes, the question of scale and whole-system equilibrium states. This is presently a pure research issue and of limited use to WWAP in any short term practical assessment exercise. Similar problems also exist for snow-climate relationships. WWAP must consider long-term science programmes on regional glacier-climate and snow-climate interactions as an essential step in the long-term assessment of water resources in areas of glacier ice and snow cover. In doing so the WWAP support of such programmes will lead to a more efficient utilisation of data and the development of models for future WWDR.

Conclusion

ICSI recognises the importance of WWAP and welcomes any collaboration that may permit the Commission to contribute to the second edition of WWDR. The use of glacier databases to assess recent changes of regional water resources in certain areas of interest to WWAP is a possible project for the Report. With the regard to long-term collaboration, ICSI cannot commit itself to any collaboration that does not involve basic scientific programmes on the Cryosphere fully supported by WWAP.

H.G. Jones (for the ICSI Bureau).

August 19th 2003.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix S

ICSI/IAHS
GEMS/UNEP
FAGS/ICSU
UNESCO

WORLD GLACIER MONITORING SERVICE (WGMS)

Prof. Dr. W. Haeberli, Director
Department of Geography, University of Zurich-Irchel,
Winterthurerstrasse 190, CH-8057 Zurich
Phone +41/(0)1/635 51 20/21
Fax +41/(0)1/635 68 48
e-mail haeberli@geo.unizh.ch

REPORT TO THE INTERNATIONAL COMMISSION ON SNOW AND ICE (ICSI/IAHS) ON ACTIVITIES IN THE YEAR 2003 OF THE WORLD GLACIER MONITORING SERVICE (WGMS)

The five main tasks of the service as defined in 1986 by a corresponding expert/steering meeting have been unchanged and are still to

(1) collect and publish standardized data on glacier fluctuations at 5-yearly intervals;
(2) manage and upgrade the existing inventory of glaciers and ice caps;
(3) prepare a bulletin reporting mass balance results of selected reference glaciers and ice caps at 2-yearly intervals;
(4) stimulate satellite observations of remote glaciers and ice caps in order to reach global coverage; and
(5) periodically assess ongoing changes.

A short description of the service and links to related glaciological sites are given on the WGMS homepage

http://www.geo.unizh.ch/wgms

The page also provides a list of relevant publications prepared within the framework of the activities of the service as well as information on the monitoring strategy. Mass balance results are reported one year after the measurement year. Data are available from the WGMS databank (World Glacier Inventory data and Glacier Fluctuation data) as well as from the mirror site at the World Data Center in Boulder, Colorado (World Glacier Inventory data).

Fluctuations of Glaciers

Preparation of volume VIII, the FLUCTUATIONS OF GLACIERS 1995-2000, is in its final stage. About 90% of the data has arrived and is being processed. A full set of 18 glacier maps depicting

historical and present glacier extents and glacier changes in different regions of the world (e.g. Antarctica, European Alps, Uganda) is ready for inclusion. Printing is planned for spring 2004. To produce a printed version is still considered to be an important option for a number of reasons (safety, accessibility in all parts of the world, enclosed maps, accompanying texts and bibliographies, etc.) and should in any case be done for this last volume of the 20th century. However, funding of the printing costs is still not assured.

Glacier Mass Balances

The GLACIER MASS BALANCE BULLETIN No. 7 is ready for printing. Distribution is planned for January 2004.

Within the GTOS glacier network and according to corresponding agreements with the participating countries, mass balance summary results are made available on the WGMS homepage at the end of the year following the measurement year. The summary data for the year 2002 will be presented on the Internet by 31 December 2003.

Extraordinary conditions were observed during summer 2003 in the european mountains. First estimates indicate that the average mass balance in the Alps may be around –3m w.e. or even more, roughly twice the maximum loss so far measured; the total loss may be close to 10% of the remaining ice volume.

Glacier Inventories and Satellite Observations of Remote Glaciers

Within the USGS-led GLIMS initiative (Global Land Ice Measurements from Space) a number of countries presently start with compiling respective satellite-derived glacier inventories mainly based on the Landsat7 ETM+ and ASTER instruments. Due to problems with Landsat7 the present focus is mainly on ASTER data. The new inventories of Switzerland (cf. references below) and Canada are presently most advanced. The design of the GLIMS database at NSIDC is completed to a large extent. The integration of first test data sets has started. An interactive tool for data acquisition and editing is presently being developed at USGS and NSIDC (glimsview).

Paul, F., A. Kääb, M. Maisch, T. Kellenberger and W. Haeberli (2002): The new remote sensing derived Swiss glacier inventory: I. Methods. 4th International Symposium on Remote Sening in Glaciology, Maryland. Annals of Glaciology 34, 355-361.

Kääb, A., Paul, F., Maisch, M., Hoelzle, M. and Haeberli, W. (2002): The new remote sensing derived Swiss glacier inventory: II. First results. 4th International Symposium on Remote Sening in Glaciology, Maryland. Annals of Glaciology 34, 362-366.

Kääb, A., C. Huggel, F. Paul, R. Wessels, B. Raup, H. Kieffer and J. Kargel (2003): Glacier monitoring from ASTER imagery: accuracy and applications. EARSeL eProceedings, 2, 43-53.

Paul, F., Huggel, C., Kääb, A. and Kellenberger, T. (2003): Comparison of TM-derived glacier areas with higher resolution data sets. EARSeL eProceedings, 2. 15-21.

Periodical Assessments

Contributions about worldwide glacier monitoring strategies have been made to (a) the Mountain Research Initiative MRI ("mountain glaciers in global climate-related observing systems") for their state-of knowledge-overview which is in press now, (b) for a book about remote sensing and geoinformatics in

worldwide glacier monitoring by Michael Bishop("an integrated, multy-level strategy for worldwide glacier observations") and (c) for a book on glaciers, ice sheets and the environment by Peter Knight ("Integrated Perception of Glacier Changes: a Challenge of Historical Dimensions"). In March, W.H. represented WGMS in two important workshops which took place in Valdivia (Chile) on Andean glaciers and in Boulder/Co on global glacier monitoring.

Administration and funding

The service continued its work with funding being almost entirely provided by Switzerland. Continuation of work during the year 2004 is possible but still at a reduced intensity level due to the unsatisfactory funding situation. As a consequence, direct connection to the database of WGMS via Internet is still interrupted because of the lack of funding for website management and updating work but will now be made possible again within the framework of the new EU-project ALPIMP. The full information remains to be available via members of the WGMS staff.

Contacts have been strengthened with UNEP/GRID and the Swiss GCOS programme. In addition, a proposal has been submitted via the GCOS Secretariat in Geneva to the US Department of State for adequate funding of the GCOS/GTOS component withing WGMS (cf. appendix).

In view to adequate international funding and new data formats relating to modern observational technologies, new structures for coordinating and publishing tasks must be designed. Within this framework, it is necessary to formally design an adequate evaluation system with reviews optimally being carried out at 3-year time intervals by representatives of ICSI and the involved climate related observing systems. Such reviews will have to consider - among other points - the tasks of the service/network, the means available, the monitoring strategies followed and, especially, the still serious problems of data production in various countries involved with the observational network.

On a longer term, steps should be considered towards an integrated cryosphere monitoring system for GTOS possibly led by ICSI and the International Permafrost Association (IPA). Contacts between the presidents of ICSI and IPA have been established.

Zurich, November 2003 ***Wilfried Haeberli, Regula Frauenfelder, Martin Hoelzle, Andreas Kääb***

Workplan 2004

Activities under ongoing data management will be:

1. Development of an adjusted directing structure for WGMS in view to new methodologies/data formats and improved funding

2. Publication of Volume VIII, the FLUCTUATIONS OF GLACIERS 1995-2000

3. Maintenance and management of the existing data base in cooperation with the WDC for Glaciology at Boulder, Colorado

4. Operation of the Global Terrestrial Network for Glaciers (GTN-G) within the Global Climate Observing System (GCOS)/ Global Terrestrial Observing System (GTOS)

5. Cooperation with the ASTER/GLIMS project concerning remote sensing for glacier monitoring

6. Methodological development and analysis with respect to glacier fluctuation and inventory data

7. Reporting to the International Commission on Snow and Ice (ICSI/IAHS)

Appendix A

GTN-G: Implementation of an Integrated, multi-level strategy for a Global Terrestrial Network of Glacier Observations within the framework of GCOS/GTOS

Proposal to the US Department of State (DOS)

Wilfried Haeberli & Martin Hoelzle
World Glacier Monitoring Service
Zurich, Switzerland

Worldwide climate-related glacier monitoring has a long tradition but now increasingly develops into a task of historical dimensions and potentials. The present proposal attempts at facing these challenges by integrating (a) traditional approaches and new technologies, (b) in-situ and remote observations, and (c) process understanding and global coverage. It is based on discussions and results of recent international workshops in Valdivia (Chile, 12–14 March 2003) on Glacier Mass Balance, and in Boulder (Colorado, 16–18 March 2003) on Assessing Global Glacier Recession. The proposal aims at establishing this important part of global climate-related observations by (1) developing a web-based data managmement and dissemination system, (2) creating an information system for new observational technologies, (c) supporting new mass balance measurements in the southern hemisphere, and (c) building up a new lead-structure for global glacier monitoring.

Background

For more than a century, fluctuations of glaciers and ice caps have been systematically observed in various parts of the world (Haeberli et al., 1998). Changes of mountain glaciers and ice caps are considered to be highly reliable indications of worldwide warming trends (cf. Fig. 2.39a in IPCC, 2001) and, hence, constitute key variables for early-detection strategies in global climate-related observations. The Second Adequacy Report for the Global Climate Observing System defines the top priorities for global glacier observations as follows:

- Most major mountain ranges of the world are represented in studies of glaciers and ice caps. A key priority is to continue long-term mass balance observations and expand these into additional regions such as Patagonia, the Andes and the mountains of New Zealand. More numerous observations of glacier area, thickness and length changes by application of remote sensing technologies (aerial photography, visible and infrared imagery from systems such as ASTER and Landsat, high-resolution satellite imagery, laser altimetry) must be coordinated with the *in situ* measurements being collected by the World Glacier Monitoring Service (WGMS).
- Numerical modelling studies confirm that many if not most glaciers of the presently existing worldwide mass balance network could disappear within decades if warming trends continue or even accelerate. An appropriate strategy for dealing with this problem will have to be developed.
- Concerning the sensitivity with respect to sea-level rise, effects of (a) firn warming in presently cold subarctic and high-mountain accumulation areas, (b) possible runaway trends with the mass balance/altitude feed-back on large/flat glaciers with long dynamic response times and (c) large ice volumes below sea level in the case of many important meltwater producers in maritime environments must be considered.
- Most importantly, worldwide glacier monitoring must receive adequate funding and a new enlarged and internationally organized leading structure in view to the increasing public interest and new data formats. The opportunity of the presently running ASTER/GLIMS project should be used to further develop links with the remote sensing community.

Glacier observations and the Global Hierarchical Observing Strategy (GHOST)

Within the framework of the global climate-related terrestrial observing systems, a Global Hierarchical Observing Strategy (GHOST) was developed to be used for all terrestrial variables. According to a corresponding system of tiers, the regional to global representativeness in space and time of the records relating to glacier mass and area should be assessed by more numerous observations of glacier length changes as well as by compilations of regional glacier inventories repeated at time intervals of a few decades - the typical dynamic response time of mountain glaciers (Haeberli et al., 2000). The individual tier levels can be described as follows:

Tier 1 *(multi-component system observation across environmental gradients)*
Primary emphasis is on spatial diversity at large (continental-type) scales or in elevation belts of high-mountain areas. Special attention should be given to long-term measurements. Some of the already observed glaciers (for instance, those in the American cordilleras or in a profile from the Pyrenees through the Alps and Scandinavia to Svalbard) could later form part of Tier 1 observations along large-scale transects.

Tier 2 *(extensive glacier mass balance and flow studies within major climatic zones for improved process understanding and calibration of numerical models)*

Full parameterization of coupled numerical energy/mass balance and flow models is based on detailed observations for improved process understanding, sensitivity experiments and extrapolation to areas with less comprehensive measurements. Ideally, sites should be located near the centre of the range of environmental conditions of the zone which they are representing. The actual locations will depend more on existing infrastructure and logistical feasibility rather than on strict spatial guidelines, but there is a need to capture a broad range of climatic zones (such as tropical, subtropical, Monsoon-type, midlatitude maritime/continental, subpolar, polar).

Tier 3 *(determination of regional glacier volume change within major mountain systems using cost-saving methodologies)*
There are numerous sites to reflect regional patterns of glacier mass change within major mountain systems, but they are not optimally distributed (Cogley and Adams, 1998). Observations with a limited number of strategically selected index stakes (annual time resolution) combined with precision mapping at about decadal intervals (volume change of entire glaciers) for smaller ice bodies or with laser altimetry/kinematic GPS (Arendt et al., 2002) for large glaciers constitute optimal possibilities for extending the information into remote areas of difficult access. Repeated mapping and altimtery alone provide important data at lower time resolution (decades).

Tier 4 *(long-term observations of glacier length change within major mountain ranges for assessing the representativity of mass balance and volume change measurements)*
At this level, spatial representativeness is the highest priority. Locations should be based on statistical considerations (Meier and Bahr, 1996) concerning climate characteristics, size effects and dynamics (calving, surge, debris cover etc.). Long-term observations of glacier length change at a minimum of about 10 sites within each of the mountain ranges should be measured either in situ or with remote sensing techniques at annual to multi-annual frequencies.

Tier 5 *(glacier inventories repeated at time intervals of a few decades by using satellite remote sensing)*
Continuous upgrading of preliminary inventories and repetition of detailed inventories using aerial photography or – in most cases - satellite imagery should enable to reach global coverage and to serve for validation of climate models (Beniston et al., 1997). The use of digital terrain information in GIS greatly facilitates automated procedures of image analysis, data processing and modelling/interpretation of newly available information (Haeberli and Hoelzle, 1995; Kääb et al., 2002; Paul et al., 2002). Preparation of data products from satellite measurements must be based on a long-term program of data acquisition, archiving, product generation, and quality control.

This integrated and multilevel strategy aims at integrating in-situ observations with remotely sensed data, process understanding with global coverage and traditional measurements with new technologies. Tiers 2 and 4 mainly represent traditional methodologies which remain fundamentally important for a deeper understanding of the processes involved, as training components in environment-related educational programmes and as unique demonstration objects for a wide public. Tiers 3 and 5 constitute wide-open doors for the application of new technologies. The planned global network of glacier sites, called Global Terrestrial Network for Glaciers (GTN-G), is expected to evolve over time. It would be structured to allow global and regional analyses of glacier changes and to take advantage of different intensities of measurements at various sites.

A network of 60 glaciers representing Tiers 2 and 3 is established. This step closely corresponds to the data compilation published so far by the World Glacier Monitoring Service (WGMS) with the biennial Glacier Mass Balance Bulletin and also guarantees annual reporting in electronic form. Such a sample of reference glaciers provides information on presently-observed rates of change in glacier mass, corresponding acceleration trends and regional distribution patterns. Long-term changes in glacier length must be used to assess the representativity of the small sample of mass balance values measured during a few decades with the evolution at a global scale and during previous time periods. This can be done by (a) intercomparison between curves of cumulative glacier length change from geometrically similar glaciers, (b) application of continuity considerations for assumed step changes between steady-state conditions reached after the dynamic response time (Hoelzle et al., 2003), and (c) dynamic fitting of time-dependent flow models to present-day geometries and observed long-term length change (Oerlemans et al., 1998, cf. also Reichert et al. 2002). New detailed glacier inventories are now being compiled in areas not covered so far in detail or, for comparison, as a repetition of earlier inventories. This task is greatly facilitated by the launching of the ASTER/GLIMS programme (Kieffer et al., 2000). Remote sensing at various scales (satellite imagery, aero-photogrammetry) and GIS technologies must be combined with digital terrain information (Kääb et al., 2002; Paul et al., 2002) in order to overcome the difficulties of earlier satellite-derived preliminary inventories (area determination only) and to reduce the cost and time of compilation. In this way, it should be feasible to reach the goals of global observing systems in the years to come.

Goals

The proposed project helps establishing this important part of global climate-related observations by

- developing a WEB-based data management and dissemination system;
- creating an information system (data formats, standards) with respect to new measurement techniques such as SAR, laser altimetry, GIS, etc.;
- **initially supporting new mass balance measurements in areas with few or no existing long-term records such as New Zealand and Patagonia on the Southern hemisphere; and**
- **building up an adequate funding basis and a new lead structure for the global observation network, with closer participation of specialists from different fields (in-situ observations, satellite imagery, geoinformatics, numerical modelling) and various countries.**

As with other components of GCOS, lack of funds is a major problem. Continuous data management, periodical assessments and especially the development and integration of new technologies in data collection and in data storage demand extraordinary financial support. Mass balance measurements require a team of three to four people for several days each year. The funds required for drilling and surveying equipment and salaries are modest but must be available on a long-term basis. Moreover, even modest amounts can be beyond the means of many developing countries, for which scarce resources are needed for higher priority purposes. In such cases, the low priority assigned to glacier observations has meant inadequate funds have been available to undertake long-term monitoring. In some countries, lack of scientific capacity is a problem. Adequate training and provision of field equipment can remedy the problem, but this too requires funding. Tensions in remote mountainous border areas in certain parts of the world (e.g., Central Asia) have limited mass balance observations to some extent. Finally, some potentially valuable data (including survey records, maps, and aerial photographs) exist in countries of the former Soviet Union that have not been recorded and are in danger of being lost. High staff turnover in many of these countries as a result of general instability, as well as lack of funds, is at the root of this problem.

In 1989, a first attempt was made to build a glacier database with the WGMS data. With the help of this database, it was possible to publish Volume VI and VII of the "Fluctuations of Glaciers". The database was subsequently increased by adding more tables and loading older data. The World Glacier Monitoring Service (WGMS) has today two main databases storing two different data sources: the World Glacier Inventory Data (WGI) and the Fluctuations of Glaciers and Mass Balance Bulletin Data (FoG, MBB). Both data sources are available from WGMS as well as from the National Snow and Ice Data Centre (NSIDC) in Boulder Colorado. New detailed glacier inventories are being compiled now and in the future in areas not covered so far or as a repetition of earlier inventories for comparison. This task will be greatly facilitated by the launching of the ASTER/GLIMS program.

Work Plan

The development of a WEB-based data management and dissemination system and the creation of an information system (data formats, standards) with respect to new measurement techniques such as SAR, laser altimeter, GIS, etc. focus on electronic data access and storage. Supporting mass balance measurements in the southern hemisphere helps closing gaps in key regions of the world.

Increasing capabilities and use of WEB-based data access world-wide today requires an efficient WEB-supported information system for users and data managers. Therefore, the WGMS intends to create a new WEB-based data access system, which is based on the existing glacier database in the system ORACLE. A fast interface between the database and the WEB-clients should be developed. An existing WGMS-WEB-application should be evaluated and improved within this project. This task will be done in close cooperation with the NSIDC in Colorado, which is an existing data mirror site of WGMS.

New glacier information collection technologies like SAR or laser altimeter and spatial data storage possibilities in GIS demand the development of new database architecture. These capabilities have to be built up at the WGMS. At the University of Zurich a new glacier inventory is compiled based on new satellite technologies in connection with the ASTER/GLIMS project. The collected glacier information data will be archived, using GIS as a database storage system. Based on this experience and existing knowledge, a world-wide information system will be built up in close connection to the GLIMS center of USGS in Flagstaff and to the NSIDC in Colorado USA.

Long-term glacier mass balance series mainly cover mountain ranges in the Northern Hemisphere. An urgent need exists for long-term information in the Southern Hemisphere to fulfil the goals in Tier 1 to 3 of GTN-G/GHOST. Therefore, regions such as Patagonia and New Zealand will be selected to initiate new long-term measurement programs. WGMS will help

initiating such programs with a single support.

As a whole, the project provides key information about climate-related changes in the world's cryosphere, builds up an appropriate lead structure for the global observation network, enables integration of spatial data from new technologies (remote sensing, GIS), initiates an innovative development of user friendly interfaces for online data access, strengthens the international cooperation between WGMS and about 30 countries all over the world, improves information transfer from scientific specialists to non-specialists by compiling and assessing the data, helps with world-wide dissemination of glacier network data, and promotes and support scientists in developing countries

Detailed financial budget

Financial Needs

Salaries

Postes	*Function*	**Salary**	
WEB-Designer (30% employment)	Design and implementation of WEB-based data management	1. year 2. year 3. year	22,380 USD 22,380 USD 22,380 USD
Database development and maintenance, and scientific analyses and publishing (70% employment)	Development of Glacier Monitoring Information System (GMIS)	1. year 2. year 3. year	52,220 USD 52,220 USD 52,220 USD
Total			223,800 USD

Consumables

Overheads	1,000 USD
Total	1,000 USD

Travel Costs

Cooperation meetings with NSIDC (Colorado) and GLIMS-center (Arizona)	5,000 USD
Congresses and Invitations 2 expert meetings	1,000 USD 30,000 USD
Total	36,000 USD

Others

Development and initial support of new GTN-G in New Zealand	10,500 USD
Development and initial support of new GTN-G in Patagonia	10,500 USD
Total	21,000 USD

Summary

Total	281,800 USD

Available resources at WGMS for this project

8. Staff
   - Proposer W. Haeberli (5%)
   - Co-Proposer M. Hoelzle (5%)
   - Scientific assistant (10%)
   - Secretary (on request)
   - Other posts as applied for in the outlined financial budget

9. Available Infrastructure
   - 1 SunBlade100 (Unix-workstation)
   - 1 Power-Macintosh G4
   - 1 Pentium4 PC

10. Available Software
    - GIS: Arc/Info, ArcView, ArcGis
    - Database: ORACLE
    - Different Desktop Publishing Software and WEB-Tools

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ICSI bureau meeting, Cambridge Nov. 2004: Appendix T

New ICSI Bureau (2003-2007): Responsibility for relations with IUGG, IAHS, and UNESCO-IHP, collaboration with IGS and IPA, and participation in International Programmes CliC and IPY4.

President (2003-2005) Past President (2005-2007), **H.G. Jones**. *Relations with IAHS and IUGG concerning change of status 2003-2005; Relations with IGS*

President-Elect (2003-2005) President (2005-2009), **Georg Kaser**. *Relations with IAHS and IUGG concerning change of status 2005-2009; UNESCO-IHP HKH-FRIEND, Andean-FRIEND (with Jansson); IPY4 (with Steffen, Hagen and Dowdeswell)*

Secretary Treasurer, **Peter Jansson**. *UNESCO-IHP HKH-FRIEND, Andean-FRIEND (with Kaser)*

Vice-President, **Jon-Ove Hagen**. *Relations with IAPSO (with Lange), IPY-4 (with Steffen, Kaser and Dowdeswell)*

Vice-President, **Loni Steffen**. *Relations with IAMAS (with Dowdeswell); CliC; IPY4 (with Kaser and Dowdeswell)*

Vice-President, **Goto-Azuma**. *Relations with IAHS (with Foehn)*

Head, Division on River, Lake and Sea Ice, **Manfred Lange**. *Relations with IAPSO (with Hagen)*

Head, Division on Seasonal Snow Cover and Avalanches, **Paul Foehn**. *Relations with IAHS (with Goto-Azuma)*

Head, Division on Glaciers and Ice Sheets, **Julian Dowdeswell**. *Relations with IAMAS (with Seffen); IPY4 (with Kaser, Hagen and Steffen)*

Head, Division on Ice as a Material, **A.N. Other**. *Proposal for a New Division.*

Director, WGMS, **Wilfred Haeberli**, *Relations with IPA, WDC.*

ICSI bureau meeting, Cambridge Nov. 2004: Appendix U

Proposal for formation of an ICSI working group on "Intercomparison of forest snow process models"

Richard Essery (rie@aber.ac.uk)
Institute of Geography and Earth Sciences
University of Wales, Aberystwyth, UK

A large fraction of the land surface in regions with seasonal snowcover is forested. The interaction between snow and forests in these environments, their influence on the climate and their responses to changing climates have attracted much recent attention.

Snow falling on a forest canopy is partitioned into interception by the canopy and throughfall to the ground. Intercepted snow may sublimate, unload or melt within the canopy. Snow on the ground is sheltered from wind and solar radiation by the canopy but subjected to increased thermal radiation and may melt at a significantly different time from snow in clearings. The accumulation and ablation of snow in forests are thus determined by many complex and interacting processes. Several models have been developed which aim to represent these processes for meteorological and hydrological applications, but the performance of these models in a range of environments is not yet well known. It is therefore proposed that an ICSI working group should be formed to perform an intercomparison of models of forest snow processes. This will provide a natural continuation of two ICSI working groups that have recently completed their four-year programmes - the Snow–Vegetation Interactions working group and SnowMIP, which compared simulations of snow melt at unvegetated sites - and will aid with the interpretation of results from two PILPS projects (2d and 2e) involving snow processes. The new intercomparison project will be designated SnowMIP 2.

An intercomparison project of this nature requires good quality driving and evaluation data with high temporal resolution over at least one complete winter. Suitable datasets for coniferous forest sites in Saskatchewan, Oregon and Switzerland have been identified, and the owners of the datasets have agreed to make them available. Observations of snow loads on forest canopies, on the ground beneath the canopies and in clearings will be compared with model predictions. Simulations of turbulent and radiative heat fluxes to snow beneath canopies will also be compared.

The intercomparison project would be coordinated from the University of Wales, Aberystwyth, and steered by a scientific committee chosen to represent interest in forest snow process modelling, data providers and continuity with the original phase of SnowMIP. Results from the working group would be delivered at two workshops (a symposium on this subject at the 2005 IAMAS General Assembly has already been proposed) and a series of refereed journal publications.

The working group could begin work as soon as approved by ICSI, with the following draft schedule :

Year 1: Identification and preparation of datasets. Preparation of instructions for simulations. Call for participants.

Year 2: Participants to run simulations and document models. Informal meeting of committee and participants at IAMAS assembly
Year 3: Analysis of simulation results. Further simulations as necessary.
Year 4: Analysis of simulation results. Preparation of publications. Concluding workshop at IUGG assembly.

ICSI bureau meeting, Cambridge Nov. 2004: Appendix V

Proposal for formation of an International Commission on Snow and Ice (ICSI) working group on

"SNOW CLASSIFICATION"

Charles Fierz (fierz@slf.ch)
WSL Swiss Federal Institute for Snow an Avalanche Research SLF
Davos Dorf, Switzerland

There is a broad consensus that the "International Classification for Seasonal Snow on the Ground" (Colbeck, S.C. and others, 1990) is now well accepted by most snow scientists and practitioners around the world. Besides the English version, which includes a French-German-Russian-Swedish glossary, Italian, Japanese and Slovenian translations are available too. However, some scientific communities (modellers, ecologists, biologists) hardly know the 1990 classification and it is barely used in important countries like India or Russia. Furthermore, snow scientists feel some points need to be revised. Most problems are spotted within the classification of wet snow and crusts, but also in conjunction with polar snow, blowing snow, snow in forests or on how well a non-specialist end-user may be able to use the classification.
Finally, new developments since the 1990ties ought to be included, e.g. from remote sensing (grain size), work on microstructure (e.g. the notion of bonds) or snow-cover modelling (e.g. colour codes for model outputs). Specialties like snow ecology, artificial – machine-made – snow or packed snow on roads may have to be considered too.

The aims of the proposed working group are

- to revise and adapt the 1990 classification to actual state-of-the-art, not including either perennial snow (firn) or snow in the atmosphere
- to promote an even more widely used and accepted snow classification, including efforts in translating the classification into other languages than nowadays available

while keeping in mind the main objective of the former classifications, i.e. to

> *"… set up a classification as the basic framework which may be expanded or contracted to suit the needs of any particular group ranging from scientists to skiers. It has also to be arranged so that many of the observations may be made either with the aid of simple instruments or, alternatively, by visual methods. Since the two methods are basically parallel, measurements and visual observations may be combined in various ways to obtain the degree of precision required in any particular class of work. …"*

The working group will consist of two committees. First, a technical committee of 6 to 7

people (including the chair) representing snow practitioners as well as snow scientists from various fields of research and second, a ‘political’ committee (including chair and co-chair) which will make the link to the wide range of potential users.
The technical committee will work out the revision of the actual classification. A final draft of the revised classification should then be discussed some time at a meeting in 2005 (e.g. at the EGU Meeting 2005, Nice, France, 25-29 April 2005 or at the Western Snow Conference). This draft will then be submitted to the ‘political’ committee for comments and subsequently for final approval. The last stage will involve both committees and be devoted to the translation and the dissemination of the revised classification. It is envisaged to produce both a hard copy English version (e.g. as a UNESCO Technical Document in Hydrology) as well as downloadable web versions (e.g. from the World Data Centre in Boulder), the latter including translations in various languages.

It is planned to present and distribute the printed final version of the classification at the XXIV General Assembly of the International Union of Geodesy and Geophysics IUGG 2007, Perugia, Italy, July 2007.

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Davos, 27 October 2003, Charles Fierz

List of contact persons:

Georg Kaser, ICSI Secretary & President-elect, Institute of Geography, University of Innsbruck, Innsbruck, **Austria**
georg.kaser@uibk.ac.at

Paul M.B. Föhn, Head of the ICSI Division on Snow and Avalanches, Swiss Federal Institute for Snow and Avalanche Research SLF, Davos Dorf, **Switzerlan**d
foehn@slf.ch

Richard Armstrong, NSIDC/CIRES, University of Colorado, Boulder, CO, **U.S.A.**
rlax@nsidc.org

Karl W. Birkeland, U.S.D.A. National Avalanche Center, Bozeman, MT, **U.S.A.**
kbirkeland@fs.fed.us

Jean-Bruno Brzoska, Centre d'Études de la Neige, Météo-France, Grenoble, **France**
brzoska@meteo.fr

Anselmo Cagnati, ARPAV - Centro Valanghe di Arabba, Arabba di Livinallongo, **Italy**
acagnati@arpa.veneto.it

Yves Durand, Centre d'Études de la Neige, Météo-France, Grenoble, **France**
yves.durand@meteo.fr

Richard Essery, Centre for Gaciology, Institute of Geography and Earth Sciences, University of Wales, Aberystwyth, **U.K.**
rie@aber.ac.uk

Pierre Etchevers, Centre d'Études de la Neige, Météo-France, Grenoble, **France**
pierre.etchevers@meteo.fr

Ethan Greene, Research Chair of the American Avalanche Association, **U.S.A.**
ethangreene@hotmail.com

Erik Hestnes, Avalanche Section, Norwegian Geotechnical Institute (NGI), Oslo, **Norway**
eh@ngi.no

J. Bruce Jamieson, Department of civil Engineering, University of Calgary, Calgary, Alberta, **Canada**
jbjamies@ucalgary.ca

Kouichi Y. Nishimura, Nagaoka Institute of Snow and Ice Studies, National Research Institute for Earth Science and Disaster Prevention, Nagaoka, **Japan**
nishi@bosai.go.jp

Matthew Sturm, Alaska Projects Office, Cold Regions Research and Engineering Laboratory, Fort Wainwright, AK, **U.S.A.**
msturm@crrel.usace.army.mil

List of countries/institutes and persons to be contacted after approval of proposal:

India (SASE Manali)

Russia (Professor Kotlyakov)

Slovenia, China, South America (e.g. Chile, Argentinia), Iran

Richard Harding, Institute of Hydrology, Wallingford, **U.K.**

Professor Roland List, IAMAS Secretary General, **Canada**

Professor Michael Kuhn, Institute for Meteorology and Geophysics, University of Innsbruck, Innsbruck, **Austria**

Liz Morris, President of the International Glaciological Society, Cambridge, **U.K.**

ICSI bureau meeting, Cambridge Nov. 2004: Appendix X

Proposal for an ICSI Working Group:

Glacier and Permafrost Hazards in High Mountains

A Working Group of the International Commission on Snow and Ice (ICSI)
within the International Association of the Hydrological Sciences (IAHS) of the International Union of Geodesy and Geophysics (IUGG)

Issues

Glacier- and permafrost-related hazards represent a continuous and growing threat to human lives and infrastructure **in high mountain regions. Related disasters can kill hundreds or even thousands of people at once and cause damage with a global sum on the order of 100 million EURO annually.**

Present atmospheric warming especially affects terrestrial systems with surface and subsurface ice involved. Changes in glacier and permafrost equilibrium are shifting hazard zones **beyond historical knowledge. Furthermore, human settlements and activities extend towards endangered zones. As a consequence, empirical knowledge will have to be increasingly replaced by improved process understanding.**

The recently accelerated retreat of glaciers in nearly all mountain ranges of the world has led to the development of numerous potentially dangerous glacier lakes. In spring 2002, the United Nations Environment Programme (UNEP), therefore, launched a high-level warning **in view of the dramatic growth of gigantic glacier lakes in the Himalayas.**

Despite of the significant impacts of glacier and permafrost hazards and disasters, and despite of the increasingly urgent need to improve understanding and prevention of glacier and permafrost hazards in high mountains, there is no collaborative scientific initiative **under the auspices of an international scientific lead body focussing on such hazards.**

Goals

The ICSI Working Group on Glacier and Permafrost Hazards in High Mountains aims at:

Improving the international scientific communication **on glacier and permafrost hazards**

Compiling of a state of knowledge **related to glacier and permafrost hazards in high mountains**

Working towards a greater transfer of information **and improved communication between the** scientific **and** governmental **communities**

Signposting sources of advice **to international and national agencies, responsible authorities and private companies**

Acting as a focal point **for information for international media during relevant crises**

The Working Group will address the following themes:

Processes **involved in the formation of glacier and permafrost hazards**
Techniques **and strategies for mapping, monitoring, modelling**
Methods of hazard, vulnerability and risk assessment
Methods of hazard mitigation **including styles and effectiveness of remedial works**
Raising awareness of protocols **for glacial hazard assessment and remediation**

The Working Group will among others cover the following glacier and permafrost hazards:

Outbursts of glacier lakes**, causing floods and debris flows**
Avalanche/landslide-induced displacement wave impacts **on glacial lake dams**
Ice break-offs and subsequent ice avalanches **from steep glaciers**
Stable and unstable (surge-type) glacier length variations
Destabilisation of frozen or unfrozen debris slopes
Destabilisation of rock walls**, as related to periglacial and glacial activity**
Adverse effects of rock glaciers
Earthquake **triggering of glacier and permafrost hazards**
Processes and hazards associated to interactions between volcanic activity **and glaciers, and**
Combinations or chain reactions **of these processes**

Activities

The following Working Group activities are planned:

Set-up of a Working Group homepage
Compilation and maintenance of a link list **related to glacier and permafrost hazards**
Maintenance of a list of scientists and organisations **active in the field of glacier and permafrost hazards in high mountains**
Compilation of a bibliography **on glacier and permafrost hazards in high mountains**
Workshops **on glacier and permafrost hazards**
Special sessions **within international scientific conferences (e.g., AGU, EGU)**
Publications **(workshop proceedings, special journal issue or a joint review article)**
Lobbying **governmental departments, development banks and donor agencies to raise the awareness of key related issues**

Close ties are envisioned with other organisations and programmes such as the International Glaciological Society (IGS), the World Glacier Monitoring Service (WGMS), and the Global Land Ice Measurements from Space project (GLIMS). Especially close relations are planned with the **International Permafrost Association** (IPA).

27 June 2003

Andreas Kääb (University of Zurich, Switzerland)
John M. Reynolds (Reynolds Geo-Sciences, United Kingdom)
Jeffrey Kargel (U.S. Geological Survey)

The following persons support the present proposal:

John J. Clague (Simon Fraser University, Canada)
Stephen G. Evans (Geological Survey of Canada)
Martin Funk (Swiss Federal Institute of Technologies)
Wilfried Haeberli (University of Zurich, Switzerland)

Hermann Häusler (University of Vienna, Austria)
Jon Ove M. Hagen (University of Oslo)
Jörg Hanisch and Georg Delisle (National Institute of Geosciences and Resources, Germany)
Charles Harris (University of Cardiff, United Kingdom)
Gianni Mortara (National Research Council, Italy)
Cesar Portocarrero (Peru)
Andy Russell (Keele University, United Kingdom)
Jack Shroder and Michael Bishop (University of Omaha, U.S.A.)
Joseph S Walder (U.S. Geological Survey)