

## QUADRENNIAL REPORTS OF THE ASSOCIATIONS

### QUADRENNIAL REPORT OF THE INTERNATIONAL ASSOCIATION OF CRYOSPHERIC SCIENCES

#### INTRODUCTION

The International Association for Cryospheric Sciences (IACS) is the eighth and youngest Association of the International Union of Geodesy and Geophysics (IUGG). IACS is concerned with snow and ice science and provides expert advice on cryospheric issues to governmental and non-governmental organisations. Most snow and ice research within IUGG was previously covered within the International Commission on Snow and Ice (ICSI), a commission of the International Association of Hydrological Sciences (IAHS). In 2004 the then ICSI board put forward a proposal to the IUGG board to enhance the study of the Cryosphere within IUGG through the formation of a new independent Association for the Cryospheric Sciences. In response to this proposal, IUGG established an interim commission to replace ICSI called the Union Commission for the Cryospheric Sciences (UCCS), organized directly under IUGG. The IUGG Council voted to establish IACS at the IUGG General Assembly in Perugia, Italy in 2007. This is hence the first Quadrennial report of IACS as an independent Association.

The objectives of IACS are to:

- promote studies of cryospheric subsystems of the Earth solar systems,
- encourage research in the above subjects by members of the cryospheric community, national and international institutions and programmes, and individual countries through collaboration and international co-ordination,
- provide an opportunity on an international basis for discussion and publication of the results of the above research,
- promote education and public awareness on the cryosphere, and
- facilitate the standardisation of measurement or collection of data on cryospheric systems and of the analysis, archiving and publication of such data.

#### ADMINISTRATION

The business of IACS is managed by a Bureau of elected officers. Membership of the Bureau has remained stable over the first four years, consisting of President (Georg Kaser, Austria – until July 2009 whence he became immediate Past-President), President-Elect (Ian Allison, Australia – until July 2009 whence he became President),

Secretary General (Manfred Lange, Cyprus) three Vice-Presidents (Kumiko Goto-Azuma, Japan; Gino Casassa, Chile; Peter Jansson, Sweden) and the heads of five disciplinary Divisions (Glaciers and Ice Sheets, Julian Dowdeswell, UK; Snow and Avalanches, Charles Fierz, Switzerland; Marine and Freshwater Ice, Claude Duguay, Canada; Planetary and Other Ices of the Solar System, Ralf Greve, Japan; and Cryosphere, Atmosphere and Climate, Valérie Masson-Delmotte, France).

Most internal business of the Association and interaction with other scientific agencies is conducted by email. The Bureau does however meet at least once each year. The First Bureau meeting was held in Perugia, Italy in July 2007 immediately after the Association was formed, and the Second was held in Vienna in April 2008. Two Bureau meetings were held in Montreal in July 2009 in conjunction with the Joint Scientific Assembly of IAMAS/IAPSO/IACS (MOCA09, “Our Warming Planet”). In 2010 a sub-set of the Bureau met in Stockholm University, Sweden on 22-23 November. The main purpose of this meeting was to prepare information on issues related to the funding and profile of the Association that were then decided on at the Fifth formal Bureau meeting held by tele-conference on 21 December. Minutes of these meetings are available on the IACS website, [www.cryosphericosciences.org](http://www.cryosphericosciences.org). Plenary Administrative meetings with the IACS stakeholders, the cryospheric science community, were held in Perugia, Italy in July 2007 and in Montréal, Canada, on July 23, 2009.

The President and the Secretary General of IACS participated actively in the IUGG Executive Committee meeting in Karlsruhe, Germany on 5 and 6 August 2008, and the President participated in the IUGG EC meeting in Melbourne, 9-11 October 2009.

The current four-year term of most Bureau members finishes in July 2011, and a “nominating panel” of members independent of the Bureau (Jon-Ove Hagen – Norway; Konrad Steffen – USA; Qin Dahe – China) was established in June 2010 to identify suitable candidates for election to the Bureau. The nominating panel’s role is to ensure that candidates for the IACS Bureau provide a good coverage of world regions and cryospheric disciplines.

IACS facilitates the transfer of research methods and explores new avenues in cryospheric science through Standing Groups and Working Groups devoted to a theme or subject and composed of experts in the particular field of study. The activities of these Groups are given in the next section.

The historical records of the International Commission on Snow and Ice have been catalogued and will be transferred to the National Snow and Ice Data Center, Boulder, for permanent archiving. A new process has been established to formalize requests for financial support from IACS for conferences and other activities.

## ACTIVITIES

### Publications and WG activities

The work of a former WG of the IACS predecessors, ICSI and UCCS, was published as the book *Snow and Climate: Physical Processes, Surface Energy Exchange and Modeling* by Cambridge University Press. Details of this work, edited by Richard L. Armstrong and Eric Brun, are available from the IACS website

Working Groups of IACS completed two further significant reference publications during 2010. *The International Classification for Seasonal Snow on the Ground*, edited by Charles Fierz and members of a now disbanded WG, was published as Technical Documents in Hydrology 83 (IACS Contribution No. 1) by the International Hydrological Programme of UNESCO. The *Glossary of Glacier and Mass Balance Terms*, edited by Graham Cogley and members of the WG on Glacier Mass Balance Terminology and Methods, was completed and will also be published by IHP/UNESCO as IACS Contribution No. 2.

A number of papers (26 total) presented during the IUGG General Assembly in Perugia, Italy on July 2-14, 2007 were published by the International Glaciological Society's *Annals of Glaciology*, Volume 48 in 2008. The volume was edited by the Chief Editor for the *Journal of Glaciology*, T.H. Jacka. More details are at: <http://www.ingentaconnect.com/content/igsoc/agl/2008/00000048/00000001>. The proceedings of the workshop on Mass Balance Modelling (see below) were also published as *Annals of Glaciology* Volume 50.

The currently active Working Groups (WG) of IACS are the WG on Glacier Mass Balance Terminology and Methods and the WG on Glacier and Permafrost Hazards in Mountains (GAPHAZ, a joint WG with the International Permafrost Association). The current Standing Groups (SG) are the Joint commission on Volcano-Ice Interactions (with the International Association of

Volcanology and Chemistry of the Earth's Interior - IAVCEI) and a newly formed Standing Group (December 2010) that is the Steering Committee of the Global Terrestrial Network for Glaciers (see below).

### Conferences and Symposia

The workshop on Mass Balance Modelling took place in Skeikampen, Norway on March 26 to 28, 2008 and was devoted to advancing numerical methodologies aimed at quantifying mass balance processes of Cryospheric entities. The workshop was jointly organized by the Norwegian Water Resources and Energy Directorate, the International Glaciological Society (IGS) in Cambridge, UK, and the World Glacier Monitoring Service (WGMS) in Zurich, Switzerland. Convenors were Liss Andreassen, Peter Jansson and Jon-Ove Hagen. During the workshop, the IACS Working Group on Mass Balance Terminology commenced its activities.

IACS was a partner with IAMAS and IAPSO in the Joint Assembly MOCA09 "Our Warming Planet" held in Montreal, Canada from July 19 to 29, 2009 (IACS Symposia were limited to July 19 to 24). The topic of the Assembly ("Our Warming Planet") attracted 1339 delegates, of whom 129 were registered as IACS delegates. As somewhat of an innovative element of the Assembly, most of the symposia were organized jointly between the three Associations. A total of 21 joint symposia on topics from embracing "Tropical Cyclones" to "Ice-cores in Paleoclimate" were held. In addition, IACS organized five symposia that were specifically geared towards the Cryospheric community. During the Assembly, 1871 papers were presented of which 1061 (62) were oral presentations, 586 (339) were poster presentations and 221 (25) were invited presentations (numbers in parentheses represent IACS presentations).

During 2010 IACS cosponsored, with funding support from IUGG Small Grants, meetings on *Southern Hemisphere Cryospheric Change*, in Valdivia, Chile and on *Cryospheric Change and its Influences in Regional Sustainable Development* in Lijiang, China and an international summer school/workshop in glaciology at the Wrangell Mountain Center, McCarthy, Alaska. IACS officers also played lead roles in the organization of the *International Polar Year Conference* in Oslo.

All IACS officers, and particularly the Secretary-General and President, have been involved in planning scientific sessions for the IUGG General Assembly in Melbourne in June/July 2011.

### Interaction with other scientific organisations

The role of IACS in providing scientific advice and oversight to the World Glacier Monitoring Service

(WGMS) has been further formalised. The WGMS, based in Zurich, collects and publishes standardized information about ongoing glacier changes under the auspices of IACS, the Federation of Astronomical and Geophysical Data Analysis Services (FAGS/ICSU), UNEP, UNESCO and WMO. The Global Terrestrial Network – Glaciers (GTN-G), a component of the Terrestrial Observation Panel for Climate of GCOS/GTOS, links WGMS with other bodies involved with observations of glacier systems and their fluctuations: the US National Snow and Ice Data Center (NSIDC) in Boulder, and the Global Land Ice Measurements from Space (GLIMS) initiative. A GTN-G Steering Group was formed in 2010 and established as a Standing Group of IACS, with the IACS Division Head for Glaciers and Ice Sheets as the chair of its Advisory Board. The WGMS has succeeded in securing long-term funding from the Swiss government, and the IACS Past-President served as a member of the selection committee for a new director of WGMS.

A Memorandum Agreement between IACS and the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Council (IASC) was signed on July 8, 2008. This MoU outlines procedures to be followed by IASC, SCAR and IACS that are intended to “...combine their efforts in cryospheric activities (to be decided by mutual agreement) so as to raise the level of impact of all three organizations in terms of making scientific advances and of advising policy makers, as well as to avoid duplication...”. Georg Kaser (President 2007-2009) attended the SCAR Delegate Meeting in Moscow, Russia, July 2008 as an observer. Ian Allison (President 2009-2011) was subsequently appointed as the formal IUGG Delegate to SCAR and participated in their Delegate Meeting in Buenos Aires, Argentina in July 14-16, 2008.

A number of IACS officers submitted a proposal to the Chairs of Working Group I of the Intergovernmental Panel on Climate Change (IPCC) on the treatment of the cryosphere in the IPCC Fifth Assessment Report: this was welcomed by the chairs. Several IACS officers, and many others from our scientific community, are now active as lead authors in the Fifth Assessment Report.

Georg Kaser (IACS, President 2007-09) was invited to participate in the meeting of the Scientific Steering Group of the Climate and Cryosphere (CliC) project in Geneva, December 2008, and to present IACS to its delegates. CliC is a major research project of the World Climate Research program (WCRP) aimed to “...understand and represent the role of the cryosphere in Earth’s climate system and to assess and quantify the impacts that climate variability and change have on

components of the cryosphere and its overall stability, and the consequences of these impacts for the climate system...” and thus close to IACS’ goals and objectives.

Charles Fierz (Division Head) represented IACS at regular telephone conferences among “Cryospheric Managers” in order to coordinate activities among the leading organisations (IACS, CliC, IGS, EGU, AGU) dealing with ice and snow issues and scientific meetings. Although these coordinating meetings have now stopped, there are plans to reinstate them.

### **Other activities**

Georg Kaser (President 2007-2009) participated in an UNESCO led mission to Nepal. This was to commence organization of a glacier mass balance training course in Nepal in the framework of the *Hindu Kush Himalayan - Flow Regimes from International Experimental and Network Data* (HKH-FRIEND) project. IACS offered to coordinate the trainers' group as well as the content and the background material to be used. The latter was based on the publication: *A manual for monitoring the mass balance of mountain glaciers*, Kaser et al. (eds.), 2003, which was produced in the framework of an earlier course

Georg Kaser also played the unique role of officially ending the *Expédition Glaciologique Internationale au Groenland* (EGIG), nearly 60 years after it was initiated. EGIG was started in the early 1950s as a pioneering initiative under the auspices of IACS’ predecessor ICSI. Its objective was to regain momentum in polar research after World War II. In the course of the 1950s and 1960s, under the leadership of Dr. Paul-Emile Victor, a number of expeditions to the Greenland Ice Sheet were undertaken and provided the foundation for many later investigations. The project had never been formally finished until Kaser wrote to the former members and declared EGIG to be officially ended.

### **PLANNED FUTURE ACTIVITIES**

A new WG on *Flow law for polycrystalline ice* has been approved and will be established in 2011. An improved constitutive relationship for ice is particularly important in developing better models of the response of ice sheet systems to anthropogenic climate change. New WGs on *Quantitative Snow Stratigraphy* and on *Polar Surface Features* are also under consideration. The GAPHAZ WG is to be reconstituted as a Standing Group which will provide liaison to the IUGG Commission on Geophysical Risk and Sustainability (GeoRisk).

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IACS, with its partners the Scientific Committee on Antarctic Research and the International Arctic Science Committee, is planning a two day symposium prior to the ICSU General Assembly in Rome in September 2011. This will address all aspects of polar science, with a focus on the functioning of the Earth System in the Arctic and Antarctic, the major drivers of pervasive change and the as yet unaddressed research issues in these regions. These global issues will be considered in the polar regions within the context of the ICSU Grand Challenges and as a legacy of the International Polar Year 2007-2008.

Planning has also commenced for a Joint IAMAS/IACS Assembly in Davos, Switzerland in 2013 (DACA-13, the Davos Atmosphere and Cryosphere Assembly 2013). The theme of the conference will be *Ice and Air: Process Interactions*. A Swiss National Organizing Committee has been established and a logo and web-site are in preparation and should be ready for release at IUGG 2011 in Melbourne.

Ian Allison, IACS President  
Manfred Lange, IACS Secretary General