ICSIH Annual Report to IAHS Bureau

19 October 2012 John Pomeroy, ICSIH President

1. **Introduction.**

ICSIH, the International Commission on Snow and Ice Hydrology, continues its work in promoting and developing an exciting and growing area of hydrology – that which occurs at the triple phase change from snow and ice to water and water vapour and is dominant at the high altitude and high latitude cold regions and in cold seasons over much of the Earth's surface. Snow and ice hydrology has an inordinately effective role in generating runoff that is important outside of the cold regions and seasons and can form an important water source for temperate and tropical regions downstream. Snow and ice hydrological systems are relatively ungauged, difficult to predict and highly sensitive to the impacts of climate change. ICSIH has a special role within IAHS by fostering a connection between IAHS and the International Association of Cryospheric Sciences.

2. **Organisation**

ICSIH Bureau 2011-2012.

President: Professor John Pomeroy, University of Saskatchewan, Canada & Aberystwyth University, Aberystwyth, Wales

President Elect: Dr. Daniel Marks, Agricultural Research Service, Dept. of Agriculture, USA

Vice-President: Dr. Alexander Gelfan, Russian Academy of Sciences, Moscow, Russia

Vice-President: Dr. Tobias Jonas, Swiss Snow and Avalanche Institute, Davos, Switzerland

Vice-President: Dr. Tetsuya Hiyama, Research Institute for Humanity and Nature, Kyoto, Japan

Secretary: Dr. Regine Hock, Uppsala University, Sweden & University of Alaska, Fairbanks, USA

3. **ICSIH Activities 2011-2012**

ICSIH has been preparing its symposia and workshops for Gothenburg and Davos scientific assemblies for 2013. In Gothenburg ICSIH is convening a symposium (with ICCLAS) on cold region and mountain hydrology under climate change and co-convening a symposium with various associations and commissions on deltas for the International Year of Deltas. In DACA13 ICSIH is convening a session on changing mountain snow and ice hydrology and a session on distributed modelling of snow, ice and hydrology in mountains.

ICSIH has signed a memorandum of understanding to coordinate activities of organisations with meetings in the cryospheric sciences to avoid temporal conflicts in the future with the following organisations:
Association of Polar Early Career Scientists, APECS
Climate and Cryosphere, CliC, a project of the World Climate Research Programme (WCRP), the International Arctic Science Committee (IASC), and the Scientific Committee on Antarctic Research (SCAR)
Cryosphere Research Focus Group, American Geophysical Union, AGU
Division on Cryospheric Sciences, European Geosciences Union, EGU
International Association of Cryospheric Sciences, IACS
International Glaciological Society, IGS
International Permafrost Association, IPA
Permafrost Young Researchers Network, PYRN
Scientific Committee on Antarctic Research, SCAR
Working Group on Cryosphere of the International Arctic Science Committee, IASC

4. **ICSIH Sessions at Gothenburg 2013**

Cold and mountain region hydrological systems under climate change: towards improved projections

Commissions
ICSIH, ICCLAS

Convener and co-conveners
Alexander Gelfan (Russia); Eugene Gusev (Russia), Harald Kunstmann (Germany), Daqing Yang (Canada)

Description text
Cold- and mountain regions are the areas of the Earth where some of the earliest and most profound climate-induced changes of hydrological systems are expected, probably because of the dominant contribution of snow and ice to hydrological processes. Our ability to understand changes in hydrological responses to a changing climate needs to be improved through enhancement of the modeling tools (hydrological and land surface models) and observation techniques used for future projections. This symposium will address major issues both in modeling cold- and mountain regions hydrological processes

(with an emphasis on snow and ice hydrology) and in adapting these models to changing climatic conditions. Among the issues related to cold region modeling *per se*, deepening the processes understanding and physical foundation of models, adapting models to new data sources, and PUB-related cold region issues will be addressed. Among the issues related to model adaptability, problems of model parameterization, calibration and validation taking into account changing climate conditions, and the demonstration of a model's readiness for use in these environmental conditions will be examined. Also, this session will bring together experimental and modeling experts to address a broad range of issues related to understanding specific features of cold region hydrological systems which are responsible for their visible sensitivity to climate change.

5. ICSIH Sessions at DACA13, Davos 2013

Changing snow and ice hydrology in mountain watersheds

In mountain watersheds, snow and ice melt constitutes a critical component of the annual hydrological cycle. Climate warming is changing the dynamics of this meltwater generation throughout the world. Being able to predict the amount and timing of meltwater is important for managing water resources and preventing natural hazards, not only in the mountains but also for large areas downstream.

This session will focus on advances in mountain snow and ice hydrology, including process understanding, observational advances, model development and validation and projections of future snow and ice hydrology under a changing climate. Ecohydrological implications of changing snow and ice are also welcome.

Session conveners

Lead convener: Dany Marks (ars.danny@gmail.com)

Co-conveners: Alexander Gelfan, Tetsuya Hiyama, Regine Hock, Tobias Jonas, John Pomeroy

Meteorological forcing data and distributed modelling of snow, ice and hydrology in mountain watersheds

A primary constraint to spatially-explicit modelling in mountain basins is limited forcing data. Distributed snow, ice, and hydrological models have become a valuable tool for water resources and ecosystems research in alpine regions. But while the capabilities of such models have made significant progress in recent years, it remains challenging to provide the models with accurate meteorological forcing fields. This session will cover all aspects of distributing forcing data over complex mountain topography, including

innovative mapping methods for precipitation, temperature, and wind, model sensitivity to different approaches, distributed sensing experiments, and scaling issues

Session conveners

Lead convener: Tobias Jonas (jonas@slf.ch)

Co-conveners: Danny Marks, Richard Essery

6. ICSIH Statement on New IAHS Hydrological Decade.

The snowy and cold regions of the world have extreme and variable climates and are experiencing rapid development and environmental change. Changing climate has resulted in altered patterns of snowfall and snowmelt, conversion of snowfall to rainfall, loss of glaciated area and thawing of permafrost. Human alterations of cold and snowy environments have also directly changed snow and ice hydrology through mining, forestry, urbanization, agriculture, reclamation and oil and gas development. Contaminants from power plants, biomass burning, oil processing, and mines affects snowpacks and glaciers by reducing albedo and accelerating melt and by increasing acidity and toxic chemical load. Effects of these changes include changing alpine and arctic treelines, forest conversion to wetlands in areas of permafrost loss, increased glacier melt, increased shrub height and coverage in arctic tundra and alpine systems, forest loss or gain, frozen ground disturbance, and vegetation management in steppes/prairies, with associated impacts on snow, frozen ground and ice accumulation and melt including chemistry. These climate, cryospheric, chemical and land surface changes have produced changes to water storage and cycling with earlier and more variable streamflow from many mountain, forest and steppe environments, substantially earlier and sometimes higher streamflows with greater winter baseflows in Polar environments, pH depressions in the spring freshet and indications of changes in extreme precipitation events throughout the cold and snowy regions. Deforested areas often generate greater streamflow from snowmelt, strip-mined areas exhibit utterly modified hydrology and severely degraded water quality. Some glacial streams are showing declining streamflow and higher variability. The implications of these complex and interconnected changes on snow and ice hydrology are poorly understood, and the rate of change due to altered atmospheric temperature, chemistry and moisture dynamics is so high that there are important concerns that current hydrological models, developed on historical data and an assumption of stationarity, have reduced predictive capability where snow and ice dominate streamflows. Recent years have seen the failure of cold regions water management systems with high economic, environmental and social consequences. Future failures to manage water in the changing snow and ice environments are virtually certain unless understanding and prediction are rapidly improved. Such improvements will provide better planning and management for water supply, transportation, disaster management, energy, food security and ecosystem sustainability.

To meet this challenge, we propose that the new IAHS research decade include the objective: **to enhance capability for prediction and adaptive management of environmental change for the cold and snowy regions through improved understanding and modelling of rapidly changing atmospheric, hydrological, chemical and terrestrial processes at multiple scales.** This objective can be met by improving our understanding and hydrological modelling of changing cold environments at small scales, and then upscaling this to larger river basins whose headwaters are often dominated by snow and ice hydrology. We also note that the continuity of IAHS research decades should be maintained through extending of the PUB decade achievements for prediction in changed, but often virtually ungauged, basins.

ICSIH Bureau, May 2012.