

## Preface

Around the globe, mountainous areas are some of the most sensitive to climate warming. These mountain regions, ranging from arctic to tropical, provide a source of water from orographic-induced rain and snow that can sustain ecosystems, agriculture, and urban and rural populations in regions that might otherwise be quite arid. Climate warming will alter patterns of mountain precipitation, changing the seasonal snow cover and mountain hydrology. It is critical that we understand how climate interacts with snow and mountain hydrology, how streamflow and ecosystems will be affected, and how these changes will translate into impacts on water supply for ecosystem, agriculture and human sustainability.

In July 2007, as part of the 14th General Assembly of the IUGG in Perugia, Italy, the International Commission on Snow and Ice Hydrology (ICSIH) convened a symposium *Hydrology in Mountain Regions: Observations, Processes and Dynamics* that brought scientists from around the world together to address these issues. From the 70 papers presented during the two days of the symposium, this Red Book presents 22 papers representing a broad spectrum of our understanding of this critical problem. These are sub-divided into five groupings:

- Precipitation distribution and mountain hydrological processes
- Hydrological, geochemical and ecohydrological modelling in mountain regions
- Soil and groundwater hydrology in mountain regions
- Large-scale analyses over mountainous regions
- Tropical mountain hydrology

This Symposium, along with one on *Climate–Permafrost–Hydrology Interactions: The Impact of Changing Climate on Cold Regions Hydrology and a workshop on Interactions between Snow, Vegetation and the Atmosphere* organized by Phil Marsh and Richard Essery, respectively, are the first scientific events ever convened by ICSIH. ICSIH is a new commission which was formally approved at the IAHS General Assembly in Perugia in 2007. ICSIH was created because water stored as snow and ice is a critical contribution to the world's available freshwater supply and is essential to the sustenance of natural ecosystems, agriculture and human societies. The formation, vaporisation and melting of snow, ice and soil frost are important and dynamic components of the hydrological cycle and hold an inordinately important role in runoff formation and streamflow generation. Snowmelt water and soil frost play major roles in runoff generation and soil moisture replenishment for both cold regions and mountains, and river flow from these source regions is extremely important to more temperate and often more arid downstream areas. River and lake ice affect water flow and may result in catastrophic flooding.

Snow and ice have been studied as core components of hydrology since its inception and their dynamics are key to hydrological functioning for much of the world. There is a community of snow and ice hydrologists who have a need for international scientific exchange and dialogue with the greater hydrological community; further there is great

value to be gained by international hydrology from advancing the level of understanding of, and expertise in, the dynamics of snow and ice in the hydrological cycle. The goal of the International Commission for Snow and Ice Hydrology is to promote the scientific study of the observation, processes and modelling of snow and ice hydrology and the influence of snow and ice on the environment, runoff generation, rivers and lakes, with an emphasis on the seasons and regions where the solid phase of water and its subsequent runoff are prevalent. The mountain environment is one of particular interest to ICSIH. This Symposium therefore made a significant contribution towards the goals of ICSIH and of international hydrological science and the presenters and authors are thanked for their contributions.

**John Pomeroy,**

*President ICSIH, University of Saskatchewan,  
Saskatchewan, Canada*

**Danny Marks,**

*Vice President, ICSIH, USDA-Agricultural Research Service  
Boise, Idaho, USA*