

## Preface

The high latitude and lowland cold regions of the globe are experiencing some of the most rapid changes in climate. These regions include many of the most severely ungauged basins on Earth and suffer from sparse meteorological observations. Hydrology of these regions is dominated by snow and ice. Our understanding of the hydrological response to a changing climate over these cold regions is incomplete due to a lack of understanding of the controlling processes, and a paucity of hydrological and meteorological observations. Changes in hydrology related to changing frozen soils, snowfall/rainfall ratio, snow cover, river and lake ice, glacier cover and vegetation are not well known. In addition, our ability to model the effect of these changes on the fluxes of both energy and water between the land surface and the atmosphere, and soil and water bodies needs improvement. For example, a particular issue for modelling is the impracticability of model calibration due to the sparse gauge network and rapid climate change. There is also a lack of knowledge on process emergence with scale change across these regions.

To address the major issues and challenges in cold regions hydrology research and applications, a special symposium (H02) on *Cold Regions Hydrology in a Changing Climate* was organized by the IAHS International Commission on Snow and Ice Hydrology and the Predictions in Ungauged Basins (PUB) initiative at the 2011 IUGG Assembly. The emphasis of this symposium was on snow and ice hydrology, in particular, changes in the characteristics and functioning of rivers, lakes and wetlands in cold regions, and their interactions with changing human activities and ecosystems. This symposium also explored the biological, physical, and social impacts of hydrological and climatic change in the cold regions.

This book presents 28 papers from the symposium. These papers, coming from colleagues in 14 countries around the World, clearly demonstrate the international interest and attention on cold regions hydrology/climate research and applications. They cover a very broad domain, including snow cover, glaciers, permafrost, streamflow, temperature, precipitation, groundwater and ecosystems. They report new research results based on field observations, modelling and remote sensing in a great range of geographical regions from Chile to the Arctic. Collectively, these papers highlight recent progress in cold regions hydrology research and its linkage with climate change at various space and time scales. They also identify gaps and needs for future research.

As the editors and symposium conveners, we truly appreciate the contributions from our colleagues, and the interactions and communications with them regarding their papers and the publication of this book. Peer review of the manuscripts was critical to ensuring the quality of the papers in this session and book. The three editors shared this duty and work with several colleagues, and we are grateful to acknowledge the insightful reviews by Chris Spence, Yinsheng Zhang, Ross Brown, Thian Yew Gan and William Bolton.

**Daqing Yang**

*National Hydrology Research Center, Canada*

**Philip Marsh**

*National Hydrology Research Center, Canada*

**Alexander Gelfan**

*Water Problem Institute, Russia*

