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HYDROLOGICAL PROCESSES
Hydrol. Process. **20**, 0–0 (2006)
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hyp.6206

Preface

Contribution from glaciers and snow cover to runoff from mountains in different climates

Special Issue

Melt water from mountain snow and glaciers contributes significantly to river flow and water resources in many parts of the world. An estimated one-sixth of the world's population depends on snow- and ice-melt for their water supply. Evidence of accelerated melting in most mountain systems, coupled with globally increasing demands for fresh water, has highlighted the importance of this vital source and the vulnerability of downstream communities to the potential impacts of climate change. Understanding, and reliably predicting, the quantity, timing and variability of runoff from mountains is essential to safeguard the lives and future livelihoods of many millions of people around the world.

Interactions between the processes that control the snow- and ice-melt contribution to runoff vary considerably between different climatic regions. In mid- and high-latitude mountain ranges, for example, seasonal snow cover exerts a strong influence on runoff variability, whereas glaciers are the dominant source of water during the dry season at low latitudes. Consequently, climate change is expected to trigger different responses in different regions.

A symposium on the *Contribution from Glaciers and Snow Cover to Runoff from Mountains in Different Climates* was held to address these issues during the 7th Scientific Assembly of the International Association of Hydrological Sciences (IAHS) in Foz do Iguaçu, Brazil (4–9 April 2005). The symposium was convened by the former International Commission on Snow and Ice (ICSI), which now has become the Union Commission of Cryospheric Sciences (CCS). Snow and ice hydrology as a research emphasis continues in the IAHS as the new International Commission on Snow and Ice Hydrology (ICSIH), with strong links to CCS. Selected papers from the symposium have been compiled for this Special Issue. The papers address the influence of present climate, and the potential effects of climate change, on snow- and ice-melt runoff in several different parts of the world, ranging from analyses of historical data to future predictions, driven by climate model output. It is apparent that severe consequences of enhanced melting may be expected on a decadal time-scale and that further quantitative predictions of the effects of snow- and ice-melt on runoff are needed. Much uncertainty remains owing to the lack of data of sufficient length, and quality, for trend analyses, model input and model validation, particularly in the Andes, Himalaya and Arctic.

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Glaciers and seasonal snow cover are expected to change their water storage capacity under the ongoing warming of the global climate with major consequences for downriver water supply (1â€“4). Despite reliable observations and model results of projected changes in runoff from individual highly glacierized basins (5â€“13), a severe lack of appropriate data records and inadequately resolved model results (14â€“16) leave us with only vague ideas of the importance of glaciers and seasonal snow cover on regional scales.Â The monthly water availability from precipitation and glacier runoff above the elevation zi in a basin (light blue lines in Fig. 1, right) is then given by the mean precipitation in the basin above that elevation (dark blue lines in Fig. Regional differences in response of flow in glacierâ€fed Himalayan rivers to climatic warming. HG Rees, DN Collins. Hydrological Processes: An International Journal 20 (10), 2157-2169, 2006. 278. 2006. Large-scale river flow archives: importance, current status and future needs. DM Hannah, S Demuth, HAJ van Lanen, U Looser, C Prudhomme, Hydrological Processes 25 (7), 1191-1200, 2011.Â Contribution from glaciers and snow cover to runoff from mountains in different climates. R Hock, G Rees, MW Williams, E Ramirez. HyPr 20 (10), 2089-2090, 2006. High mountain glaciers and climate change. Challenges to human livelihoods and adaptation. Kaltenborn, B. P., Nellemann, C., Vistnes, I. I. (Eds). 2010. High mountain glaciers and climate change â€“ Challenges to hu-man livelihoods and adaptation. United Nations Environment Programme, GRID-Arendal, www.grida.no ISBN: 978-82-7701-087-8 Printed by Birkeland Trykkeri AS, Norway.Â Changes in glacier regimes and runoff from snow and ice, combined with changes in precipitation timing and intensity will most likely increase human vulnerability in many areas. Livelihoods are affected as climate variability and water stress affect agriculture, forestry, health conditions and tourism. Differentiating Snow and Glacier Melt Contribution to Runoff in the Gilgit River Basin via Degree-Day Modelling Approach. by. Yasir Latif.Â The Upper Indus Basin (UIB) combines the high mountain ranges of the Hindukush, Karakoram, and Himalaya (HKH) [1]. Snow and glacier meltwater from this region is the main contributor to 10 major river basins downstream.Â These studies focused on the climatic and snow cover trends for both the present and future, without considering glacier coverage (clean ice/debris-covered) [35] for the selected basins. Snow cover in the mountains is the principal driver of spring runoff.Â According to Pomeroy, more than half of humanity relies on runoff from mountain snow for drinking, power generation, and irrigation. "We can finally predict the development of mountain snowpack," said Pomeroy. "This is a big achievement, which allow water management agencies to better assess our mountain snow water resources."Â As part of their validation, the team was able to toggle on and off the different physical factors in their modelâ€”a process called model falsificationâ€”to determine how large an influence each had on the accuracy of the information generated. "We turned off the wind redistribution, we turned off the avalanching," said Vionnet.