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Edited by Achim A. Beylich, John C. Dixon and Zbigniew Zwoliński
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SOURCE-TO-SINK FLUXES IN UNDISTURBED COLD ENVIRONMENTS

Amplified climate change and ecological sensitivity of polar and cold climate environments are key global environment issues. Understanding how projected climate change will alter surface environments in these regions is only possible when present-day source-to-sink fluxes can be quantified.

The book provides the first global synthesis and integrated analysis of environmental drivers and quantitative rates of solute and sedimentary fluxes in cold environments, and the likely impact of projected climate change. The focus on largely undisturbed cold environments allows ongoing climate change effects to be detected and, moreover, distinguished from anthropogenic impacts. A novel approach for coordinated and integrative process geomorphic research is introduced to enable better comparison between studies.

This highly topical and multidisciplinary book, which includes case studies covering Arctic, Antarctic, and alpine environments, will be of interest to graduate students and researchers in the fields of geomorphology, sedimentology, and global environmental change.

Achim A. Beylich is a senior research scientist at the Geological Survey of Norway, Trondheim. He has also held an Associate Professor position at the Norwegian University of Science and Technology (NTNU) in Trondheim. Dr. Beylich has more than 20 years of experience in field- and laboratory-based quantitative process geomorphic research in cold climate environments in Iceland, Sweden, Finland, Norway, Canada, Russia, and the German Alps. He initiated the SEDIBUD (Sediment Budgets in Cold Environments) working group of the International Association of Geomorphologists (IAG), which he has chaired and led since 2005.

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Source-to-Sink Fluxes in Undisturbed Cold Environments

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Preface

Amplified climate change and ecological sensitivity of largely undisturbed polar and high-altitude cold climate environments have been highlighted as key global environmental issues. The effects of projected climate change will change surface environments in cold regions and alter the fluxes of sediments, nutrients, and solutes, but the absence of quantitative data and coordinated geomorphic process monitoring, analysis, and modeling to understand the sensitivity of the Earth surface environment in these largely undisturbed environments is acute.

This book, *Source-to-Sink Fluxes in Undisturbed Cold Environments*, addresses this key knowledge gap and aims at an integrated analysis of environmental drivers and rates of contemporary solute and sedimentary fluxes in cold climate catchment geosystems. It summarizes and synthesizes achievements of the International Association of Geomorphologists' (I.A.G./A.I.G.) SEDIBUD (Sediment Budgets in Cold Environments) program which has been active over the last eleven years, since 2005. In the focus of the book are selected examples of natural and largely undisturbed catchment geosystems (SEDIBUD key test sites) from different characteristic cold climate environments worldwide. The book is not aiming at a geographical survey or inventory of these environments. The key focus is on the quantitative analysis and understanding of environmental controls and rates of contemporary solute and sedimentary fluxes in defined cold climate catchment geosystems. Referring to the issue of glacial environments versus cold environments both glacierized and nonglacierized catchment geosystems are investigated.

For reaching a global cover of different cold climate environments the book is, after providing an introductory part, "Solute and sedimentary fluxes and budgets in changing cold climate environments" (Part I) and a general part, "Climate change in cold environments and general implications for contemporary solute and sedimentary fluxes" (Part II), dealing in different defined book parts with "Solute and sedimentary fluxes in sub-Arctic and Arctic environments" (Part III), "Solute and sedimentary fluxes in sub-Antarctic and Antarctic environments" (Part IV), and "Solute and sedimentary fluxes in alpine/mountain environments" (Part V). In Part VI, "Quantitative analysis of solute and sedimentary fluxes in cold climate environments," the key findings from the previous book parts are summarized and main conclusions are drawn. In addition, comparable datasets on contemporary solute and sedimentary fluxes and yields generated during coordinated research efforts in different selected cold climate catchment geosystems are integrated with the key goals to (1) identify the main environmental drivers and rates of contemporary solute and sedimentary fluxes, (2) explain the spatial variability of contemporary solute and sedimentary fluxes and yields found across different cold climate environments, and (3) assess possible effects of projected climate change on solute and sedimentary fluxes in these cold climate environments.

All chapters of this SEDIBUD synthesis book went through a peer-review process, and the completion of this book would not have been possible without the valuable help of numerous peer reviewers. We would like to thank all these anonymous reviewers for their important work and contributions. In addition, we would like to express our special thanks to Professor Dr. Olav Slaymaker (Vancouver, Canada), who provided essential scientific advice throughout the duration of the SEDIFLUX and SEDIBUD programs and during the process of preparing this book.

Achim A. Beylich, John C. Dixon,
and Zbigniew Zwoliński