

Preface

Historically, policy makers, scientific investigators and water resources managers have considered surface water and groundwater as separate, essentially unconnected components of the hydrological system. This separation has traditionally led to the development of very different approaches to modelling and observing surface- and groundwater systems. Today we appreciate the fact that groundwater and surface water are not isolated, but instead interact in almost all physiographic and climatic landscapes. The integrated management of water resources for human use and to sustain ecosystem services at the watershed or regional scale is not possible without an understanding of the connected surface–subsurface hydrological system. Therefore, a better understanding of the complex processes at the groundwater–surface water interface, including the mechanisms of water and chemical exchange across this interface, is essential for effective management and for the protection of associated environments (e.g. riparian zones, wetlands, flood plain). These landscape elements, linking terrestrial and aquatic ecosystems, may well be the most important components of the catchment system.

At present, the interactions of groundwater and surface water are only poorly understood, physically as well chemically, and process understanding is often based on a few site-specific and small scale studies. Furthermore, water management in many countries is by no means integrated, and risk assessments for surface water bodies, for example, often only focus on the water column or sediments, paying little or no attention to contaminated groundwater discharges and their impacts on riparian, hyporheic and/or wetland ecosystems. Consequently, the extent of pollution and impacts of contaminated groundwater on surface waters may not yet have been fully recognised. Hence, there is a pressing need to identify and develop methods that provide an appropriate framework for the integrated investigation, conceptualisation and modelling of these surface–subsurface systems and their interfaces. The increasing focus on understanding the impacts of climate variability and change on water resources and ecosystems further requires a close connection of these systems to atmospheric variables.

The ultimate goal of such a framework is to improve the conceptual understanding of groundwater–surface water interactions in different landscapes and at different scales, ultimately leading to, and the development of, robust algorithms for simulating the effects of management strategies on surface water/groundwater systems. To address these issues, a symposium on *A New Focus on Integrated Analysis of Groundwater/Surface Water Systems* was held during the International Union of Geodesy and Geophysics (IUGG) XXIV General Assembly in Perugia, Italy, 11–13 July 2007. The symposium was organised jointly by the IAHS International Commission on Groundwater (ICGW) and the IAHS International Commission on Coupled Atmosphere–Land Systems (ICCLAS) and provided a forum for scientists from a wide range of disciplines, including hydrology, hydrogeology, ecology and meteorology, to advance the integrated analysis of groundwater/surface water systems. A total number of 89

abstracts were accepted for presentation at the symposium including contributions from 6 continents and 18 countries.

This publication comprises 26 selected, peer-reviewed papers from the symposium. The papers include studies from a wide range of geographical locations (many different countries and continents) and environments (lowlands and uplands), which have been organised into three parts; the first part focuses on process-based field studies and the improvement of process understanding and conceptualisation; the second part concentrates on the modelling of surface water–groundwater interactions in different geographical and climatic environments, as well as at different scales; and the third part presents case studies of specific problems associated with anthropogenic impacts/activities and their solutions to accomplish sustainable water resource management.

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