

Preface

Water resources management has to deal with incomplete knowledge of the current dynamics and the future evolution of water resource systems. Risk is a concept that helps in making management decisions under incomplete and/or incorrect knowledge by relating water-related hazards and their consequences. A variety of risks exist in water resources management – risks related to floods and droughts, risks related to environment and health, as well as economic and financial risks. Changes in the boundary conditions (e.g. water uses, hydrological conditions, legal framework) can significantly affect the risk and hence the performance of projects.

While many disciplines face the issues of risk, they face them in different ways. In hydrogeology, the difficulty lies in accurately estimating flow and transport paths. Health-related risks have to deal with a broad range of chemical and microbial agents in water bodies. It is a very challenging task to estimate health risk with high confidence taking exposure to a mixture of chemical and microbial hazards into account. In surface hydrology, the stochasticity of rainfall is one of the main sources of uncertainty. Finally, when operating a water infrastructure project, uncertainty of the inflows, demands and the system state (e.g. conditions in the downstream areas during flooding) are of critical importance. In many cases, the specification of consequences, e.g. by damage assessments, provides a major challenge. In water resource systems dominated by water supply issues, optimisation and the development of robust management systems is a major goal. In all instances, it is wise to integrate the various levels of uncertainty in the management decisions and strategies.

During the XXV General Assembly of the International Union of Geodesy and Geophysics, 28 June–7 July 2011, in Melbourne, a symposium was held entitled *Risk in Water Resources Management*. The symposium was organised by the International Commission on Water Resources Systems (ICWRS) together with the International Commissions on Surface Water (ICSW) and on Water Quality (ICWQ) of the International Association of Hydrological Sciences (IAHS). The importance of risk in water resources management is reflected in the large number of contributions to the symposium drawn from a range of disciplines. Out of these contributions, 41 papers were selected for this volume.

The purpose of this symposium was to bring together the various concepts of risk, tools and methodologies to specify them, and new approaches to address risk in water resource systems. The contributors were asked to address aspects of water-related risks in a broad way in order to integrate across the disciplines and/or sectors and thus contribute in a pro-active way to water resources management. The papers were grouped pragmatically into three themes: (1) Flood and Drought Hazards, (2) Uncertainty and Climate, and (3) Water Use and Risk, notwithstanding the many interactions between these aspects of water resources management.

The volume starts with the keynote presentation of the symposium, which deals with the conjunctive use of surface water and groundwater, and the management of multi-objective storage systems. The following set of five papers is concerned with increasing the accuracy of flood hazard estimates in terms of flood discharge. The papers propose new methods based on flood data, rainfall and hydrogeological information. Six papers present examples from case studies around the world, including effects of floods on groundwater supply, and inundation mapping. Drought hazards are discussed in two papers. The section on uncertainty and climate related to risk starts with four papers on the uncertainty of runoff measurements and runoff modelling. Five papers deal with uncertainty in water resources assessment and allocation, and

four papers analyse the effects of climate variability and change on future water resources and the associated risks. The final section is introduced by five papers on water resources optimisation to minimise supply risks, followed by two papers on groundwater assessment and use. Case studies of integrated water resources management with a focus on risk are presented in six papers, including one paper that maps the feedbacks between the components of a water resources system relating demand and supply. The final paper provides a global perspective on water availability and the potential sources of conflict in water resources management.

It is sometimes argued that risk assessment and uncertainty are central to decision making. Without uncertainty, decision making would be rather simple and straightforward. Obviously, it is not possible to completely eliminate uncertainty, but better understanding of the sources and magnitude of the uncertainties involved in a particular project will clearly lead to improved decisions. It is hoped that the present volume will be a step towards that end.

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