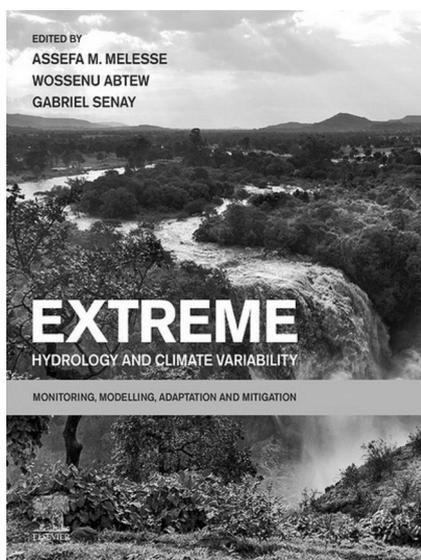


Book reviews

Extreme hydrology and climate variability, monitoring, modelling, adaptation and mitigation, by A. Melesse, W. Abteu & G. Senay (Eds.), 2019. Elsevier Inc., Amsterdam. 580 pages. Paperback: price \$170.00, ISBN 9780128159989.



There is an increasingly greater interest in extreme hydrological phenomena due to the higher frequencies of occurrence of sudden freshets, floods and severe droughts in various parts of the world. Phenomena observed occur both on regional and local scales; for the latter, their course is marked by considerable dynamics and an often unpredictable direction of development which leads to extensive damage. Historically, many regions and states are highly susceptible to floods and droughts during various time intervals and of different magnitudes, durations and area extents afflicted. They may also intensify under the influence of a range of driving factors, such as climate and changes in land use.

Being an extreme hydrological phenomenon of varying origins, floods rank amongst the most dangerous natural hazards, resulting in loss of lives, material damage to infrastructure and general environmental destruction. Presently, both the frequency of flood hazards and the number of factors leading to occurrences are on the up due to increased building activities and spatial management of areas susceptible to flooding. Extreme hydrological inci-

dents brought about by torrential precipitation are usually modified by various processes that occur within catchment areas, and also by anthropogenic factors. Drought is a complex natural phenomenon with far-reaching connotations for the entire water cycle. It is one of the most destructive natural hazards, and is characterised by prolonged periods of dry and hot weather conditions which have a significant impact on both social and economic activities. The propagation of drought in the hydrological year and extended periods of high temperature result in enormous losses to agriculture, ecosystems and society, and may also lead to other natural disasters, such as fires, thereby further endangering the natural environment and human life. To provide societies that exist under diverse environmental conditions (climatic, hydrological and economic), which frequently have a negative impact on health and standard of living, with efficient protection against the effects of extreme events, including floods and drought and secure access to drinking water, is presently a priority in strategies of sustainable development; not only on a global scale, but also on regional and local ones.

Issues concerning hydrologically extreme events, from their description through a historical approach and with reference to contemporary changing climate, through the monitoring of hydrometeorological characteristics and the assessment of the variability of hydrological conditions and change tendencies, presented against the backdrop of landscape dynamics and regional weather patterns, to an indication of actions facilitating the management of extreme events by their mitigation and adaptation of society to climate change. All of these form the focus of the present tome. The broad spectrum of issues is presented in six thematic parts, and 39 topical chapters, each of which constitutes a separate representation of issues, complete with introductions to specific topics and brief descriptions of the area of research, duely accompanied by a presentation of source materials, methodology,

research results, a discussion and a list of literature. Individual chapters are in fact separate case studies, which readers may use to conduct a detailed analysis and review of the issues presented, while at the same time adapting methods of research to their own purposes or engaging in a discussion of the results obtained by the authors of the study. The authors of individual chapters are researchers from prestigious universities whose scholarly interests focus on issues of climate change and hazards caused, on extreme hydrology, economic and water engineering, and also on water resource management. An additional advantage of the book consists in the addition of four separate sections – the Contents and Contributors and Preface at the beginning, and the Author Index and Subject Index at the end; both considerably facilitate navigating the study on the basis of geographical location or topic. The work has been professionally edited, while the arrangement of texts and figures ensures excellent clarity and legibility.

A society with a limited capability of coping with extreme hydrological situations, restricted strategies for managing risks connected with natural disasters and insufficient preparation for the occurrence thereof is highly susceptible to socio-economic effects. In order to be able to face these challenges, it is necessary to develop a clear understanding of the causes and effects of floods and drought at any given location, with due consideration to local determinants. Thus, readers will find chapters in which the problem of hydrological extremes within the context of climate change has been analysed on the basis of reference locations or regional weather models, as well as case studies devoted to various spatial approaches – regional (physico-geographical regions or specific landscape forms, and even individual states), but also local, such as catchment areas and river valleys or lake drainage basins. The majority of topics discussed in this present book refer to Ethiopia, Iran and the USA, although individual descriptions and analyses have been devoted to Qatar, Sudan, Australia and China – countries that are, to variable degrees, exposed and susceptible to occurrences of extreme hydrological events, and which cope with the hazards posed by floods and drought and with the management of concomitant risk factors with differing degrees of efficiency.

Especially in Africa, many regions are forced to struggle with shortages of information and a lack of hydrometeorological data bases, which are the direct consequence of limited monitoring capabilities. A key role in analyses of the risk of occurrence of floods and drought and in the future management of these risk factors is played by methods of

monitoring and mapping extreme events, as well as by the results of modelling and forecasting of phenomena, which are elaborated taking scenarios of climate change into consideration. In numerous chapters of the book this problem is touched upon within the context of the significance and the broader applicability of various hydrometeorological monitoring techniques. The informational scope of the climatic and hydrological data bases presented and discussed in individual chapters, which function as references for specific regions and catchment areas, allows their utilisation as study materials for the purposes of research into both extreme hydrology and climatic hazards, particularly with regard to uncontrolled areas. Research presented by the authors points to the possibility of utilising satellite data and data obtained from various types of global climatic models. Emphasis has also been placed on the significance of remote sensing techniques for research, because these allow us to obtain, and subsequently process and interpret, data on extreme hydrological and climatic phenomena.

Readers may also acquaint themselves with a broad spectrum of research methods used by the authors, from statistical methods and models through methods of climatic data scaling, meteorological reanalysis, estimating atmospheric precipitation and extracting maximums, to hydrological modelling, which is used for simulating and forecasting the course of extreme events taking into consideration climate variability and scenarios of changes thereof. Equally noteworthy is the presentation of numerous graphical studies, especially in the form of maps of the territorial distribution of elements of hydrological balance, as well as integrated indices that are the end product of compilations of spatial data. These will familiarise readers with the degree of exposure, susceptibility or resistance of any given area to the occurrence of floods or drought, or indeed other extreme events, for example hurricanes or storms, depending on climatic and hydrological determinants and the degree of resistance of society and individual sectors of economy to events of such type.

The problem of access to drinking water within the context of negative climate change and various forms of environmental degradation, and also the process of globalisation and conflicts of various origin, including conflicts over water, require the implementation of integrated solutions which promote transparent methods of monitoring and mitigating hazards. Research into water circulation and studies of the hydrological balance on various temporal and spatial scales necessitate taking into consideration a whole spectrum of issues connected

with climate change and the nature of catchment areas and their management. These issues are touched upon throughout the book. The results of these analyses, as we can read in successive chapters, translate into strategies for water resource management, also in extreme hydrological situations in which the social and ecological aspect is of considerable – or even paramount – importance. The level of knowledge of the abundance of water in catchment areas, the limits of their natural resistance to external factors and the ability of the hydrological system to self-regulate and renew itself, as well as a determination of the nature and needs of users of water resources constitute integral elements of a strategy of integrated and sustainable management and protection of water resources, and also of adaptation in a changing climate. Irrespective of the environmental and economic circumstances of the countries to which the topics touched upon in the book refer, emphasis has been squarely placed on the fact that the management of extreme hydrological phenomena is a prerequisite for the sustainable development of these countries.

Particularly noteworthy in chapters devoted to issues of access to water resources and their management in extreme situations are analyses of adaptations to climate change in developing countries. As opposed to highly developed countries, and especially the large municipal systems, where the effects of climate change are a common problem, developing countries are only now facing the complexities introduced by urban growth and the effects of climate change, particularly in large municipal agglomerations. The effective adaptation of

society to the hydrological effects of urbanisation through the mitigation of hazards and the integration of best practices of city management is an indispensable condition for and the required path of adapting to climate change in the future; this is stressed in numerous topics presented in the book.

The broad spectrum of issues concerning *Extreme Hydrology and Climate Variability*, within the context of their *Monitoring, Modelling, Adaptation and Mitigation* – all matters of great currency and importance – in the global, regional and local approaches, irrespective of natural determinants and the degree of resistance of societies or their adaptation to change, makes me recommend it to a wider audience of scientists and practitioners. It will doubtlessly find many readers interested in a scientific approach to these issues, among others due to the considerable opportunities for practical application of research results presented. This holds particularly true for activities in the fields of economy, water engineering and resource management, which are primarily intended to prevent negative effects of extreme phenomena, and not the phenomena themselves. In light of the subject matter touched upon in the book and its considerable informational potential, the book is definitely worthy of recommendation, irrespective of where in the world we live and to what degree we are impacted by the problem of extreme hydrological events and concomitant risk management.

Renata Graf
Adam Mickiewicz University, Poznań, Poland
e-mail: rengraf@amu.edu.pl