Preface

Floods are among the natural extreme events that occur after intensive storm rainfall events as excessive water volumes over the earth surface more than the capacity of surface natural or artificial conveyance systems (stream and river basins, creeks, estuaries, wadis, valleys, canals, channels, culverts, dams, cities). Apart from the rainfall causative floods, there are others as consequences of snowmelt, sea surge and tides, tsunamis, ground water level rise, urban sewer capacity overflow, dam breaks in addition to confined aquifer overflows.

Since the start of human history, societies have been exposed to the danger of natural events such as earthquakes, droughts, and floods that could not be avoided completely even with the modern-day scientific and technological facilities, preparedness, mitigation, and early warning systems. The most hazardous extreme natural event is the flood occurrence not only due to the intensive rainfall effects, but more significantly due to human settlement along flood dangerous areas such as floodplains, adjacent to riverbanks, and valleys. The floods are extremely beneficial events in arid regions, because they are the main source of groundwater recharge along drainage basins (wadis), where there are no human settlements or urban area exposed to flood danger. For this purpose, there are even runoff harvesting works in many arid regions of the world. However, flood beneficial aspects are outside the scope of this book, which is concentrated on floods and flash floods.

In order to achieve successful works to reduce flood danger and hazard, it is necessary to know scientific fundamental aspects of flood definition and generation processes, which pave way for methodological procedures to predict their future behaviors and to take precautions by means of hardware through the engineering water structures and software by means of early warning systems and also public awareness through educative training.

The main purpose of this book is to bring together all the layman, technicians', engineers', and scientists' methodological procedures that have been developed for flood peak discharge prediction during the last 150 years. Early approaches are rather logical and empirical, but later on, more systematic and analytical approaches are developed on the basis of rational, probabilistic, statistical, and stochastic

uncertain methodologies in a better objective manner. Empirical formulations are location dependent and cannot be applied to other parts of the world with satisfaction. Their old versions, prior to the rainfall recording, are dependent on the drainage basin area, but later versions include the rainfall amount or intensity. Today, the evolution of the flood peak discharge calculation methodology has reached to the employment of remote sensing and satellite image procedures coupled with digital elevation model (DEM) in the electronic media as for the surface morphological feature description, which is an essential ingredient in flood discharge prediction.

This book after the introductory chapter explaining the flood definition, types, physical causes, relationship to the overall hydrological cycle, and hazard types enters the domain of methodological procedures starting with the precipitation characteristics that take role in flood occurrence in addition to the surface features of drainage basin in terms of geomorphological variables. In two of the chapters, the hydrographs and flood discharge estimation empirical methodologies are presented with basic and fundamental explanations. The uncertainty aspects are presented through the probabilistic and statistical procedures including risk concept and return periods, which correspond to life of an engineering water structure. In the mean time, the sedimentation and debris expositions of various engineering structures are presented with some innovative recommendations for the first time in this book. In the last two chapters, climate change impact relationship to floods and also the flood hazard and mitigation procedures and approaches are exposed with the latest developments. In each chapter, some criticism and new suggestions are proposed for future better methodological advancements.

The content of this book is based on the vast experience of the author especially in arid region of the Arabian Peninsula through his academic work at the King Abdulaziz University, Faculty of Earth Sciences, Kingdom of Saudi Arabia; at the application establishment of the Saudi Geological Survey, Jeddah; and also at the Meteorology and Civil Engineering Faculties at the Istanbul Technical University, Istanbul, Turkey.

I hope that this book will support to those interested in flood discharge estimation with risk attachments, climate change relationships, hazard and mitigation aspects, and their applications in flood prevention works. I thank my colleagues who have encouraged me to write a book on floods and especially my wife Mr. Fatma Şen, who had kept silence, endurance, and patience during my extensive hourly, daily, monthly, and yearly works for the preparation of this book.

Çubuklu, Istanbul, Turkey   Zekâi Şen
2016