

Hydrometeorology

Christopher G. Collier



Advancing Weather and Climate Science

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Dedication

This book is dedicated with love and gratitude to Cynthia for all the support she has given to me over many years.

Series Foreword

Advancing Weather and Climate Science

Meteorology is a rapidly moving science. New developments in weather forecasting, climate science and observing techniques are happening all the time, as shown by the wealth of papers published in the various meteorological journals. Often these developments take many years to make it into academic textbooks, by which time the science itself has moved on. At the same time, the underpinning principles of atmospheric science are well understood but could be brought up to date in the light of the ever increasing volume of new and exciting observations and the underlying patterns of climate change that may affect so many aspects of weather and the climate system.

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Preface

The Earth, referred to as the blue planet, has three-quarters of its surface covered by water, which is essential to life. However, excessive variations bring disasters in the form of floods and droughts. Water is unevenly distributed in both time and space, and its circulation within the global atmosphere and oceans, the hydrological cycle, is a vital component of the earth's energy system. Water is the medium through which the atmosphere has most influence on human wellbeing, and terrestrial surfaces have significant influence on the atmosphere. Early knowledge of water developed through local attempts to manage and control it.

Although atmospheric and hydrologic science and practice have largely developed separately, meteorological forecasts beyond a few days, and climate predictions, require numerical models that include realistic representations of surface hydrology and associated energy exchanges. Hence it is essential that hydrologists and meteorologists work together. Therefore the discipline of Hydrometeorology is important, and is addressed in this book. However, it is so wide ranging that this book cannot hope to cover everything, and at best I hope it stimulates the reader to investigate areas further.

Rainfall-runoff modelling at scales of interest (small to large catchments) is not able to reproduce all the details of flow processes that give rise to stream hydrology. Indeed it is essential to understand and articulate the uncertainties when addressing modelling problems. A wide range of numerical models have been developed to address river, surface and sewer flows. Also forecasts of rainfall and climate change are made using comprehensive models of the atmosphere at a range of grid scales depending upon the application from those appropriate to urban drainage systems to those appropriate to large continental river catchments. This work has been stimulated by the rapid advances in computer power over the last 30 years or so.

Remote sensing, both surface and space-based has been used for almost 80 years as a practical tool to aid mapping of river flood plain inundation areas and the earth's surface. For many years most of the work has been qualitative. However the growth of both meteorological and hydrological sciences has demanded more comprehensive quantitative measurements. A range of instrumentation from simple raingauges and sophisticated weather radar to satellite passive radiometers and active radars underpin operational systems I examine how these trends have led to advances in hydro-meteorological studies.

I have included a wide range of both recent and historical references. Many of the earlier references remain very relevant to modern applications. The access to a wide range of literature via the internet and electronic databases enables the reader of this book to develop the knowledge contained therein. The book contains 14 chapters with each chapter ending with a summary of the main points in the chapter, a list of problems which readers may wish to use to test their appreciation of the contents

and references. Each chapter also includes one or more appendices containing some additional information.

I wish to thank friends and colleagues who have encouraged me to work in the hydro-meteorological field. It is always difficult to engage with more than one discipline. However, I would highlight the scientific and practical benefits of the cross fertilization of ideas, and encourage young scientists in particular to accept the challenges that are offered by Hydrometeorology.

Chris G. Collier
Leeds

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About the Companion Website

This book is accompanied by a companion website

www.wiley.com/go/collierhydrometeorology

The website includes:

- Powerpoints of all figures from the book for downloading
- PDFs of tables from the book

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