

Preface

Monsoon systems are unique features of the climate of the Earth. While monsoons were historically defined as a “reversal in the surface winds accompanied by changes in precipitation” over the Bay of Bengal and Arabian Sea, modern studies in fact show that, except for the Polar Regions, monsoons occur in Africa, Asia, Indonesia, Australia, and the Americas. Driven primarily by the thermal contrast between large land masses and surrounding oceans, the monsoons exhibit a phenomenal range of spatial and temporal variability. The annual onset of the rainy season and its demise, for instance, show considerable changes from year to year in each monsoon system. Similarly, the intensity of the monsoons varies on subseasonal, inter-annual, decadal, and centennial time scales. It is, therefore, widely recognized that the monsoons play a vital role for humans and the environment. Often the occurrence of extreme events, such as heavy precipitation or droughts, can have significant impacts on millions of people who live in monsoon regions and rely on water for human consumption, agriculture, energy, and transportation.

Observational and theoretical evidence points to the undeniable fact that the Earth’s climate is changing rapidly, and anthropogenic activities have been an important component of this change. Climate variability and change pose significant challenges for humans to develop adaptation strategies that can minimize negative impacts. This is the case in particular when important uncertainties in projections of regional climate change exist. While the monsoons have been investigated for many decades and the understanding of the physical mechanisms associated with them has progressed steadily over the years, there are many unresolved questions of how the continual warming of the planet will affect the monsoons.

This book originated from the conference session entitled “The Global Monsoons and Climate Change: Observations, Models and Projections” held at the fall meeting of the American Geophysical Union (AGU) in 2012 in San Francisco, California. A significant portion of the material presented here includes results from the Coupled Model Intercomparison Project Phase 5 (CMIP5) model simulations, which contributed to the Fifth Assessment of the Intergovernmental Panel on

Climate Change (IPCC) finalized in 2013. Thus, the main goal of this book is to provide a concise and timely assessment of the monsoons and climate change.

The book has 11 chapters. Chapter 1 introduces the main intent of the book. A global view of the monsoons and its change are presented in Chap. 2. Chapters 3 and 4 discuss the Asian Monsoon variability and the projected changes in the twenty-first century. Chapter 5 covers the Australian summer monsoon and potential changes in upcoming decades, and the monsoon systems in South America and North America are discussed in Chaps. 6 and 7, respectively. Chapter 8 explores the seasonal variation of the Indo-Pacific monsoon circulation and interactions with the climate of East Africa. Connections between the North American and South American Monsoon systems are covered in Chap. 9. Since all monsoon systems exhibit significant variability on intra-seasonal time scales, Chap. 10 discusses future changes in the Madden-Julian Oscillation (MJO). Lastly, Chap. 11 analyzes the importance of the monsoon systems on glaciers in the central Andes and Himalayas.

The completion of this book was possible with the contributions of several authors who are experts in the research of monsoons and climate change. Their efforts and dedication are greatly appreciated, and we also thank Forest Cannon, Abheera Hazra, and Jesse Norris for their kind help in proofreading several sections of the book. Finally, we express our sincere appreciation for the support and professionalism of the editorial staff of Springer International Publishing.

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Observations and Modeling

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