

# Preface

Changes in the natural environment of the planet Earth, including its climate, have fascinated mankind all through the ages. The modern scientific understanding of natural processes that govern the functioning of the Earth system has provided sufficient knowledge to understand its present climate, including its evolution and future changes. The developments of the last few centuries have culminated into a system of monitoring and generation of global data sets, and enhancement in the basic theoretical understanding of complex processes involved in the science of Earth's climate. As a result of these efforts many holistic earth system models have evolved during the last few decades. These models have proven to be successful in generating plausible scenarios of future climates and highlighting the role of human interference in climate change. Realizing the role of anthropogenic influences on climate change, the last few decades have resulted in unprecedented activity and interest in the phenomenon of climate change in scientific, social, and political circles. This understanding and awareness has brought the issues of climate change impacts, mitigation, adaptability, and remedial measures at the forefront of all developmental activities with a focus on conserving the environment and the sustainability of natural resources. In spite of these accelerated developments, the major stakeholders with serious concern for their future as well as that of the generations ahead lack basic information and understanding on the subject to grasp and sensibly react to the issues in a broader perspective.

An academic career of almost half a century in the field of Earth system science has provided me an opportunity to be closer to many scientific ideas, deliberations, discussions, and differences of perceptions and goals at global and regional levels on climate change and other allied issues. It is, therefore, natural that the idea of writing a book as a basic source material on the subject suitable for a wide spectrum of scientifically oriented readers has always been in my mind. The opportunity to write this book acquired its renewed vigor after I joined the faculty at the Department of Atmospheric and Space Sciences at the Savitribai Phule Pune University. This has renewed my contacts with interested colleagues and students within and outside the university, and has created a sense of enthusiasm and confidence to take up this task as a joint effort. My coauthors, Dr. Pradeep Kumar, Dr. J.V. Revadekar, and

Dr. Narendra Singh have not only contributed in the subjects of their interest but also in every stage of the manuscript preparation. I may like to emphasize that in every sense this material is a joint contribution by all of us and this endeavor has enriched our joint research and teaching experiences.

Any writing in the subject with an intended wide spectrum of readership will not be able to fulfill its purpose unless it contains specific examples from a climate-sensitive target area. The authors have selected the region of Western Himalaya, possessing a unique weather system, large forest cover, extensive mountain ranges with rivers, glaciers, and snow cover as well as a highly fragile ecosystem for detailed discussion and illustrations. Western and Central Himalaya, the highest and largest mountain ranges of the world, are the major source of fresh water to many countries of the South Asian region. The weather and climate of Himalaya plays an important role in the atmospheric general circulation systems which affect the large population living in the region and its biodiversity and abundance of flora and fauna. Himalaya plays an important role in the establishment and sustainability of large-scale monsoon systems over South Asia. The book also very briefly discusses the monsoonal climate of the Indian region to illustrate the relevant features of regional climate with bearings on Himalayan weather and climate. The mountain ecosystem over the region is very delicate and highly susceptible to even minor changes in their complex environmental parameters, with a high degree of dependence on changes in global and local climate factors. Many scientific studies and reports, particularly the IPCC reports on mountain glaciers, have highlighted the irreversible nature of the impact of climate change on the mountain regions especially the melting of snow and an accelerated pace of retreating glaciers. The subject of Himalayan climate is very timely and of wider interest. It is expected that the topic will find general acceptance among climate scientists, meteorologists, water resource scientists, and wide a spectrum of social scientists and policy makers.

To fully incorporate certain recent studies and make the subject material more useful for understanding climate change impacts on a smaller region, we have downscaled our discussion to a subregion designated as Central Himalaya. Due to the limitations of specific long period station data to represent an inhomogeneous terrain, we depended on the data from few stations as well as the grid point data from global analysis sets for illustrations. The major part of Central Himalaya, mainly represented by the state of Uttarakhand, is considered and used in the discussion of climate change impacts, remedial measures, and adaptation policies. These sections are included primarily to provide some guidelines to policy makers for due consideration of climate change impact as one of the factors in their decision-making process. These sections specifically deal with core sectors such as water, agriculture, glaciers, forests, biodiversity, and natural disasters. In the process of writing on many facets of the subject, the information has been scrutinized from research papers, reports, documents, and electronic media on public domain.

We sincerely wish that the reader interested in the subject will find the contents of the book useful and informative. This is just a beginning as far as the Himalayas are concerned. The next generation of climate scientists will enlarge the climate change information base with an advantage of long period high resolution data over the Himalayas at their command, and further efforts will continue.

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