Chapter 1
Introduction

Meteorology belongs among the oldest scientific disciplines. It has a long-lasting history that reaches back to the distant past of the human civilization. From the beginnings of life, people have been trying to adapt to the atmospheric behaviour, to create a more comfortable life, and to control those conditions that endanger or make life uncomfortable. There is no doubt that today meteorological science has a tremendous importance around the world. Every day, people are faced with various manifestations of weather. Depending on weather conditions, they adapt their planned activities. Weather manifestation is closely related to the status of the atmosphere, which has a wave nature. The scientific discipline that examines atmospheric phenomena, atmospheric structure, composition, atmospheric features and phenomena, and the important processes that occur in a thin surrounding layer of the atmosphere-troposphere, water, and air including the future state of the atmosphere is referred to us as *"meteorology"*. Basically, meteorology examines the physical processes that occur in the atmosphere. Hence, this scientific discipline is often referred to as the *"Physics of the Atmosphere"* (see Spiridonov 2010; Spiridonov and Ćurić 2011; Andrews 2010; Salby 1996). Meteorology as an interdisciplinary science cuts across a various number of natural disciplines. Thus, there is a great interest in meteorology, especially in the last two to three decades, when the global community is facing with global warming and climate change with extreme weather events. During this period many comprehensive textbooks, scientific publications, and studies were dedicated to this contemporary and interdisciplinary science (e.g. Andrews 2010; Ackerman and Knox 2007; Ćurić 2006; Lutgens and Tarbuck 2009; Salby 1996; Anthes 1996).

The key motivation for writing this contemporary textbook arrives from the need for comprehensive and systematic way of describing all the important atmospheric phenomena and processes that constitute the modern concept of meteorology. The purpose is to offer an advanced understanding and significant knowledge of the important topics relating to these natural environmental processes. Standard, theoretical, and experimental approach gradually adapts the reader into the subject and introduces the problems which emerge. Furthermore, the essential elements of

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mathematics are used, in order to easily present certain phenomena and processes in the atmosphere. We have tried to incorporate all important topics in the modern concept of the physics of atmosphere meteorology. The writing is primarily intended for students of the atmospheric and environmental sciences and physics of the atmosphere meteorology or those who attend the general course in meteorology. Yet again, this book is designed for a wider circle of readers, starting from primary, secondary, and higher education to all those interested in meteorology who want to find useful information, content, and interpretation of certain global phenomena and processes occurring in the atmosphere of our planet. With an exceptionally readable, comprehensive, and extensive illustrative and interesting approach with the standard appropriate mathematical concept, it describes the basic characteristics of the atmosphere, including weather, climate, and climate change. The book begins with the definition of the subject and the tasks of meteorology, methods of research, classification of meteorology, and the relation between meteorology and other sciences. It also contains chapters on the historical overview, structure and chemical composition of the atmosphere, energy and radiation in the atmosphere, the energy budget of the Earth, the basis of the thermodynamics of the atmosphere, air temperature, and its variations. The book covers all the major topics of atmospheric moisture processes (e.g. air humidity, condensation and formation of clouds, their classification as well as an explanation of the process of formation of precipitation). It also deals with chapters devoted to air pressure and winds, atmospheric statics, planetary boundary layer, atmospheric dynamics, turbulence, the global atmospheric circulation, air masses and fronts, cyclones, anticyclones, and tropical cyclones. The book also contains basic information about natural disasters related to weather, water and climate, atmospheric optical phenomena (photometers), and atmospheric electricity. Climate and climate change, complexity of climate system, climate models, the modern watching of climate change, greenhouse effect, and global warming are considered with a special attention. A chapter in this book is especially devoted to the methods and techniques of analysis and weather forecasting development and application of numerical weather prediction. The 25th novel chapter briefly introduces the readers in atmospheric chemistry, aerosols, and the factors affecting the pollution source of atmospheric gases and aerosols. The last chapter describes the meteorological measurements and observations, modern instruments and devices used to measure atmospheric phenomena, radar and satellite measurements, and observations of the atmosphere.

References

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