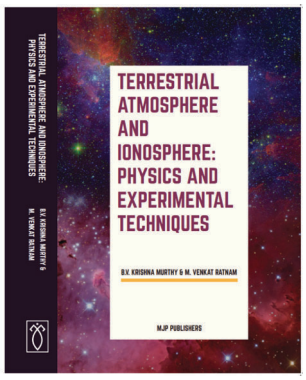

Terrestrial Atmosphere and Ionosphere: Physics and Experimental Techniques. B. V. Krishna Murthy and M. Venkat Ratnam, MJP Publishers, Chennai, India. 2021. 696 pages. Price: Rs 2400.

In dealing with problems in the science of the terrestrial atmosphere (neutral and ionized), one often comes across situations that call for knowledge (physical as well as analytical) on certain fundamental aspects, which often would be too fundamental to ask someone, yet quite important in understanding and solving some of the research questions. This is true irrespective of the stature of the individuals, whether a graduate student, research scholar, early or mid-career researcher or even a senior researcher. While the parameter or process is important and fundamental in nature, its actual definition, representation and application may be incomplete without the fundamental knowledge regarding it; but often one would feel delicate to ask a colleague. It is equally applicable when early career researchers plan to develop dedicated experimental set-ups to measure atmospheric/ionospheric parameters; either *in situ* or through remote sensing (active or passive) methods. So, often information is sought from the internet, which calls for ascertaining the authenticity and at times may not provide the exact details one is looking for in designing an experiment. This is more so in the present era, mainly due to the tremendous advancement in the understanding of the Earth's near-space environment on the one hand, and the large advancement of experimental techniques to probe the region, which include ground-based as well as balloon-borne, rocket-borne and satellite-borne instruments, for measurements of various parameters using *in situ* and remote sensing techniques on the other.

This book provides a one-stop solution to all these problems, by providing all important information (fundamentals, processes and experimental techniques) under one umbrella, even though the authors have mainly targetted graduate and undergraduate students pursuing courses in atmospheric and ionospheric sciences. Despite the dire need, no such books are available dealing with the entire near-space environment of the Earth, after the one by S. K. Mitra in 1950 (*The Upper Atmosphere*, University of Calcutta (Published by the Royal Asiatic Society of Bengal, Calcutta (Kolkatta)), p. 616). The authors have also pointed out this in the Preface. This book has 12 chapters, organized under three sections, running over 650 pages.

The first section focuses on the structure, composition, chemistry, aerosols and greenhouse gases (GHGs) of the neutral atmosphere, spanning over five chapters. It gives a glimpse of the evolution of the Earth's atmosphere and the various constituents in it. Thereafter it takes the reader through the vertical structure and composition of the neutral atmosphere, basic equations and processes governing its state and thermodynamics, the energetics, radiative and dynamical coupling, and experimental techniques to measure the basic parameters of the neutral atmosphere. After providing the basic foundation, it dwells with interaction of the atmosphere with solar radiation, basic radiative transfer and photo-chemical processes, involving radiatively active trace and minor constituents such as aerosols and GHGs. Aerosol microphysical processes are described and the importance of these in perturbing the radiative balance of the Earth atmosphere system is delineated. Finally, the section ends with an account on chemical processes in the troposphere and stratosphere, the role of ozone, and a brief account of experimental techniques to measure aerosols and trace gases.

The second section, organized again in five chapters (6–10), is dedicated to the dynamics of the neutral atmosphere; from the boundary layer to the mesosphere through the middle atmosphere. The authors have provided details of the various forcings controlling the dynamics of the atmosphere, and different experimental techniques to measure these directly or infer these through remote sensing of the effects they produce in the neutral atmosphere.

The last two chapters (10 and 11) are dedicated entirely to the upper atmosphere – the ionosphere and the magnetosphere – and are included under section 3. It gives an account of the historical background of ionospheric research followed by the theory and processes leading to the formation of the ionosphere through interaction with solar X-ray and EUV radiation, competing effects of photoionization and loss processes leading to the formation of different layers of the atmosphere, and the role of the Earth's magnetic field in controlling the electrodynamical processes in the lower ionosphere. An account of the instability mechanisms leading to the formation of ionospheric irregularities and their manifestations on trans-ionospheric radio propagation is highly thoughtful and provides a comprehensive picture of the ionosphere in communication-related applications and the processes that would affect such communication. A short account of different techniques used for measurement of ionospheric parameters is useful. Proceeding further higher into the magnetosphere, the region being mostly under the influence of the Earth's magnetic field, the authors discuss the important aspects of the magnetosphere and the plasmasphere. They have added a useful section as appendix, which raises several questions that prove useful for the students to check their understanding of the subject.

This book has several positive aspects as mentioned below:

(i) It is one of the rare books that has put together in one place the wide-ranging topics of the Earth's near-space environment, from the lowest part of the atmospehre that is in contact with the Earth's surface (the atmospheric boundary layer) to the magnetosphere, where the plasma is entirely controlled by the terrestrial magnetic field.

(ii) It describes the important processes taking place in each region of the atmosphere, both in terms of the physics and also analytically.

(iii) A useful inclusion is of aerosols and GHGs and their radiative interactions and climate implications.

(iv) Dynamical processes in the lower and middle atmosphere as well as electrodynamics of the upper atmosphere.

(v) Experimental technique to measure most of the important parameters of the atmosphere.

This excellent and concise book is well brought out by the publishers, as a hardbound copy. It is recommended for general reading as well as a textbook for those pursuing graduate and doctoral studies of the terrestrial atmosphere.

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