Foreword

It is with great pleasure and admiration for the author, Professor A. Chandrasekar, that I undertake this task of writing the Foreword to his second book, entitled *Numerical Methods for Atmospheric and Oceanic Sciences* published by Cambridge University Press. After completing his PhD in Applied Mathematics from the Indian Institute of Science, Bangalore, India in 1988, his journey into the vast landscape of atmospheric and oceanic sciences began with a faculty assignment in the Department of Physics and Meteorology, Indian Institute of Technology, Kharagpur, India, where he was a member of the faculty for a little over two decades. Soon, he was called on to direct the newly created Center for Oceans, Rivers, Atmosphere and Land Sciences at the Indian Institute of Technology, Kharagpur, India, a position he held for a year. Over the recent past twelve years he has been on the faculty at the Indian Institute of Space Science and Technology, Tiruvananthapuram, India, where he has held numerous teaching and administrative positions. Despite the demands of administration at various levels at different institutions of higher learning in India, he never lost sight of the fact he was a teacher first and has taught a two-level system of graduate courses – basics of atmospheric and ocean dynamics and numerical methods for solving the atmospheric model equations – on a continuous basis for over three decades. It is these years of experience in classroom teaching that resulted in his first book on basic dynamics and now this second book on the latter topic. For an aspiring graduate student this book represents a one stop shopping option. The style is very engaging, and it is as though he is talking directly to the students. The opening two chapters provide a broad overview of the standard models of interest in atmospheric and ocean sciences. A detailed account of various grid configurations, attendant discretization schemes and the associated error and stability analyses are covered in the next two chapters. Examples of discretization of equations for damped oscillators, linear advection, shallow water barotropic, and baroclinic models along with the use of staggered grids are systematically and thoroughly covered in the next set of seven chapters. Extensive discussion of the ways to handle the boundary conditions along with Lagrangian and semi-Lagrangian methods are contained in the following two chapters. Then there are two chapters dealing with topics of great importance – the spectral methods, finite element, and finite volume methods. The last chapter contains a comprehensive discussion of the ocean models. A short appendix describes an algorithm for solving tridiagonal system that often arise in discretization using implicit methods and there is a good collection of references for further reading. Simultaneous coverage of finite-difference, finite-element, finite volume, and spectral methods and illustrating their use using different classes of models of interest in atmospheric and ocean sciences under one cover is a welcome and unique feature of this book. My own interests are in Dynamic Data Assimilation (DDA) where we assume that we have a model code that can run forward in time. The vast discipline of DDA rests solidly on the foundation laid by the work described in this book. I am confident that aspiring graduate students and those working in the field will greatly benefit from this comprehensive work for years to come. Congratulations on a project well accomplished.

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