Developments in Atmospheric Science, 16

New Perspectives in Climate Modelling

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INTRODUCTION

The 9th General Assembly of the European Geophysical Society was held in Leeds, Great Britain on August 23-28, 1982. Within the framework of this manifestation a two-day symposium devoted to problems of climatic change was convened. The present volume contains the proceedings of the lectures presented at this Symposium.

The objective of the Editors is to stress the need for a multidisciplinary approach to climate modelling which, in addition to data analysis of climatic variability and to detailed quantitative deterministic models, focuses on the qualitative aspects of climate as well. The motivation for adopting this point of view is twofold. First, it is widely recognized that the earth-atmosphere--cryosphere system is capable of existing in many possible states and of performing transitions between them in response to various disturbances of external or internal origin. And second, the complexity and diversity of the phenomena going on at various scales, from the molecular to the global is such that it is desirable to sort out some general trends underlying climate dynamics.

The volume is divided into four parts dealing successively, with data on climatic variations, global climate models, general circulation models, and nonlinear or stochastic problems in climate dynamics.All papers have been refereed.

In the first part a general survey of climatic variability as it appears today from glaciological data, deep sea sediment data, and historical record is provided. Recent and paleoclimatic data

are discussed in view of reconstructing how the climate is changing along different time scales. In this respect, of special interest is the conclusion that according to paleoceanographic indices two distinct climatic regimes have presumably occurred within the Quaternary era.

Global climate models referring to the effect of both internal mechanisms (cloudiness, sea ice, radiative effects) and external ones (orbital variations, man's impact) are presented in the second part. They bring out the need for a better understanding of the interaction between oceans, atmosphere and cryosphere and provide information on the values of parameters that are to be used in more detailed descriptions.

The third part of the volume deals with the detailed description of climatic phenomena based on general circulation models. The potential usefulness of these models to predict local changes in climate over several years, and to assess the sensitivity of the climate system to various external forcings is discussed.

In the final part of the volume some facets of a more qualitative approach to climate are covered. The analysis of nonlinear balance equations for simplified models reveals the possibility of multiple simultaneously stable climatic states. This suggests that stochastic effects, which are always present in the climatic system, should play an important role. Much of the fourth part deals with the tools and techniques needed for the stochastic description, the basic spatio-temporal characteristics of the fluctuations, and the enhancement of the sensitivity of simple climate models to external forcings induced by stochastic effects.

We hope that this volume will bring out the beauty and complexity of the field of climatology, as well as the fact that we still are at the very beginning of an understanding of the mechanisms of climatic change. Climatology is a young, open discipline where the most exciting discoveries are ahead of us !

In conclusion, we wish to thank all scientists who attended this first European Symposium on climate modelling, and especially those who contributed their papers to this book and made this experience promising.

Thanks to the European Geophysical Society, the Local Organizing Committee and its chairman, Prof. J.C. Briden (Leeds) for hosting the symposium and Dr. J. Lemaire (IAS, Brussels), chairman of the Scientific Programme Committee, for his support. We wish also to recognize the assistance of Mr.Jean-Louis Marcotte for helping to compose the final draft and of Mrs N. Materne-Depoorter who ensured the entire typing of these proceedings.

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TABLE OF CONTENTS