

## BOOK REVIEWS

Berdowski, J.; Guicherit, R. & Heij, B. 2001. **The Climate System**. vi + 178 pp. A.A. Balkema Publishers, Lisse, The Netherlands. ISBN 90 5809 255 0 (hard-bound). Price: USD 54.00.

'The Climate System' is a deceptively thin volume containing a mass of detailed, interesting, and important information. The volume represents an attempt at a synthesis of a number of projects of the Dutch National Research Program on Global Air Pollution and Climate Change. This work has contributed to many international programs in the field of climate change. The majority of the work reported in the volume is organized into four chapters entitled 'Global emission sources and sinks', 'The land component in the climate system', 'Global energy balance and radiative forcing', and 'Climate variability'. Each chapter has a useful summary of the principal findings. The authors claim that target readers for this book include climatologists, 'generalists' in the field of climate research, and interested 'outsiders'.

The volume commences with a useful Executive Summary outlining the principal research findings of the program. The summary is densely packed with information. These findings address aspects of climate change, global warming potential, global emission sources and sinks, quality of emission inventories, land-atmosphere interactions, global energy balance and radiative forcing, climate variability, and the cross-cutting issues of UV-B radiation and tropospheric ozone. Within the Executive Summary and elsewhere in the book, the authors repeatedly criticize the concept of 'global warming potential' (GWP) (p. 25). Global warming potential is "The time-integrated radiative forcing from the instantaneous release of 1 kg of a trace gas expressed to that of 1 kg of a reference gas" (p. 2). In climate change science carbon dioxide (CO<sub>2</sub>) is used as the reference gas. The authors criticize the GWP concept because of its dependence on CO<sub>2</sub> that has an ill-defined atmospheric residence time and non-linear infrared absorption behavior. In addition, some substances exhibit an indirect GWP because of secondary chemical reactions.

Chapter 2, on global emission sources and sinks, clearly describes the huge difficulties of making an emission inventory. Almost everything is uncertain including often the distinction between anthropogenic and natural sources. The chapter concentrates on the results from the Emission Database for Global Atmospheric Research (EDGAR). It is clear that the Dutch scientists have made an important contribution to world climate science in the establishment and continual improvement of this database. The results and trend diagrams of greenhouse gas emissions from different sources in this chapter are very interesting.

The third chapter addresses the land component of the climate system and the complex topic of biosphere-atmosphere interaction. Within this broad field the Dutch scientists have made contributions in the following areas: representing the annual cycle of vegetation, the relation between vegetation and the carbon cycle, snow parameterization, and soil physical

parameterization. This reviewer was most interested in the role of snow and the role of the seasonal cycle of vegetation. It was found that parameterizations of snow play a major role in the hydrological cycle at high latitudes in Europe. This reflects the delicate equilibrium between snow sublimation and melt. This equilibrium, or lack thereof, affects the spring melt peak. The role of the seasonal cycle of vegetation in enhancing the flow of water vapor to the atmosphere was found to be very important in the drier, Mediterranean areas of Europe.

Chapter 4 describes some studies of the global energy balance and radiative forcing. The chapter provides good examples of temporal and spatial variations of anthropogenic and sulfate forcing over the globe. A surprising finding is that the indirect atmospheric cooling effect of sulfate in the atmosphere over The Netherlands may exceed the warming effect by well-mixed greenhouse gases by a factor of almost 4 (p. 127). Another finding is that tropospheric ozone is identified as being second to carbon dioxide is acting as a greenhouse gas over the European sector.

The last chapter deals with climate variability with particular attention to the El Niño - Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO), the Antarctic Circumpolar Wave (ACW), and the exchange of warm and salty Indian Ocean water into the South Atlantic via a phenomenon known as the Agulhas Rings. The authors use a numerical model of ocean and atmosphere to good effect to suggest an explanation of NAO and ACW decadal-scale variations. Their simulation support ideas that atmospheric circulation anomalies force typical patterns of sea-surface temperature anomalies. The ocean response to these anomalies gives rise to a preferred time scale that is reprinted back onto the atmosphere as a signal primarily present in surface air temperature.

The content of the book represents a report of high quality science performed by the Dutch investigators. This having been said, we should turn our attention to some of the shortcomings of the volume. First, there are number of minor typographic and grammatical errors. These become a little annoying after a while. Better proof reading would have helped the volume. Second, the authors should be more careful of their use of the term 'chaotic' (e.g. p. 27) and to specify whether they are using the term in the true mathematical/systems analytical sense or a sense related to random activity. Next, occasionally the authors provide only brief considerations of some topics. For example, there is a frustratingly short section on the possibility of 'superstorms' (p. 170). Another, relatively small annoyance is the absence of an index. This absence makes the book rather difficult to use as a reference book.

More important, the book is perhaps misnamed because it does not deal with the 'Climate System' in a comprehensive way. Almost the entire field of dynamic climatology and coupled general atmospheric circulation modeling is absent. Even within the topics of the four main chapters, the text naturally concentrates on the parts of the sub-field in which the Dutch authors contributed and does not give a comprehensive overview of the sub-field. The genesis of the book explains the uneven coverage of the complete climate system. According