



“Physics in Canada”
Book Review

“La Physique au Canada”
Critique de livre

CLIMATE AND ECOSYSTEMS by David Schimel, Princeton University Press (2013), ISBN: 978-0-691-15196-0 (pbk.), price 30.21.

This is the fourth book in the Princeton Primers in Climate series. Its objective is to provide a brief introduction to the role of ecosystems in the climate system. The author has evolved from a herbivore biologist into a generalist and has played a leading role in developing the field of earth systems science. He has chaired one of the Intergovernmental Panel on Climate Change committees. In 1971, the famous American biologist and pioneer ecologist, Barry Commoner, introduced his First Law of Ecology “Everything is connected to everything else”. This book makes this dictum abundantly clear. Physicists reading this book will marvel at how much more complex the study and modelling of the natural world is than modelling physical world phenomena.

The Preface and Introduction give the flavour and objectives of this book. The Climate System covers the basics of climate and energy balance from the organism’s eye-view and provides critical physical concepts that underpin the remainder of the book, Climate Controls over Ecosystems addresses the effects of climate on ecosystems, including geographic patterns and the physiological and behavioural responses of organisms, Ecosystem Feedback and Interactions with Climate focuses on ecosystem effects on climate through control of atmospheric chemistry, the carbon cycle, and the surface energy balance, Modelling the Future discusses challenges and progress in modelling the future of ecosystems as the climate changes and the interactions between ecosystem change and the climate, and Summary and Concluding Thoughts discusses climate change and some of the scientific frontier issues that form a basis for informing society about risk and opportunity. A useful Glossary is appended.

This reviewer felt overwhelmed by the enormity of the task the author and his colleagues have embarked on in attempting to model an Earth System consisting of the atmosphere, oceans, cryosphere, lithosphere and biosphere. Modelling planet Earth interaction problems is much more difficult than modelling even the most complex physical phenomena. Modelling climate change is also easier since, fortunately, many long time data sequences exist to assist in fitting the evolution of carbon dioxide content in glacier ice cores, tree ring analysis, isotopic analysis of various indicator elements, etc.. This reviewer felt that the author frequently got lost in the maze of interactions that he was attempting to summarize because untangling these interactions is extremely difficult. One can recognise that it is very easy to get lost particularly when one is trying to present a balanced presentation and cover a large number of interactions in agreement with Commoner.

This book is a valuable introduction to the problems researchers face in modelling even simple biological systems. It would be easy to conclude from some of the discussion that the author thinks global warming might be minimized if such modelling was successful. Recent

research has found that many species cannot absorb as much carbon dioxide as is available because the soils do not have sufficient nitrogen available. This means that many climate models are too optimistic about how much carbon can be absorbed in estimating future global temperatures. Unfortunately, the increasing global combustion of fossil fuels is strongly correlated with rising temperatures. Biological systems only play a complex role in determining the time scales for the observed increase. For example, the slow mixing of ocean layers has delayed the expected temperature increase during recent years but the latest data shows that this time lag is no longer playing an effective role.

Physicists interested in broadening their understanding of the impact of global warming due to climate change on planet Earth's biosphere should read this book. This reviewer found it a fascinating and refreshing change from the physical science literature.

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