

## Book reviews

**Everybody talks about it ...** by A. Wiin Nielsen (The Royal Danish Academy of Science and Letters, 1997). ISBN 87-7304-288-9. DK 150

A more descriptive title for this little book would have been 'A short history of numerical weather prediction (NWP)'. But the enigmatic and less pretentious title chosen should attract more readers.

The stated aim of the book is 'to describe the development of weather forecasting in the latter half of the present century in a mostly untechnical (sic.) way'. The author also promises early that, '...no equations will be presented in the following chapters. It will rather be attempted to describe the physical and mathematical principles involved and to show their relevance to the prediction problem.'

The book achieves its modestly stated aim, and does more besides. The whole book is written in anecdotal style, which I for one found attractive, but may not be to everyone's taste. In almost every chapter, famous and not so famous names in meteorology and NWP are introduced or reappear, not always in a scientific context, but always in a way that enhances the overall account. Much of the book is written from the author's personal experience, so it tends to be US and (western) Eurocentric.

Probably because the publisher is non-commercial, there is no accompanying promotional material about who the book is intended for. Given the author's decision to keep the book equation-free, while at the same time explaining the mathematical and physical principles of NWP, I expect his intended audience was mainly the informed non-specialist. Nevertheless, as a NWP specialist, I thoroughly enjoyed the book too, for its excellent historical perspective, presented in the individual style previously alluded to. I must confess, though, that I often found myself turning some of the words back into equations!

A good idea of the scope of the book may be gained from the chapter titles. After some scene setting, chapters 3 to 5 are 'A general attempt: L.F. Richardson' (the famous experiment, with instructive commentary), 'A new foundation of dynamic meteorology' (featuring Rossby, Charney, Eliassen et al.), and 'From the complicated to the simple' (the early days of rudimentary computers and filtered models). Then follow 'The project at the institute for advanced studies' (in Princeton, US, headed by Von Neumann), 'The project at the international institute' (in Stockholm, Sweden, headed by Rossby), and 'From experiments to operational predic-

tions' (the pioneering operations of the Joint Numerical Weather Prediction (JNWP) unit, a cooperative effort by the US Weather Bureau and the three major US military services). Then, 'Back to Richardson's general approach' (the resurgence of primitive equations models), and the chapter I enjoyed most, 'Limited predictability'. Moving to more recent times there is 'The medium-range problem: The European Centre'. The author was the inaugural Head of the Centre and this chapter is more anecdotal than most. Then comes 'Problems of long range predictions', followed by concluding remarks.

How well does the author succeed in his attempt to provide an insight into the principles of NWP, without writing a single equation? Given my background, I'm certainly not in the best position to judge. I do think that a reader would already need some background in basic physics, and in dynamical and physical meteorology, to gain the most insight. But there is still something for everybody, as is appropriate, because the promise of an equation-free book should ensure a larger and more diverse readership than would otherwise have been the case.

In summary, regardless of how much or little you learn about the science of NWP from reading this book, if you are anything like me you should enjoy the experience, because the author not only informs but also entertains.

**Bob Seaman**

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**TARGETS (Tool to Assess Regional and Global Environmental and health Targets for Sustainability), Version 1.0 (CD-ROM, ESIAM, Electronic Series on Integrated Assessment Modelling, Volume 1)** by H.B.M. Hilderink et al. (Baltzer Science Publishers, 1998). ISSN 1385-7495. US\$235.

ESIAM is a new electronic journal dedicated to the exploration and publication of Integrated Assessment Models (IAMs). In the words of the journal itself, 'integrated assessment can be described as an interdiscipli-

nary process that involves combining, interpreting and communicating knowledge from diverse scientific disciplines.' It does so in a policy context, where public policy and formal science are combined to allow the assessment of various policy objectives.

In placing these models inside a user-friendly communication shell and making them available in a journal, *ESIAM* intends to:

- make IAMs as transparent as possible;
- make the underlying assumptions and theories as clear as possible; and
- display uncertainties and complexity of system behaviour comprehensibly.

The first issue describes the *TARGETS* model. This model was constructed as part of the interdisciplinary research program 'Global Dynamics and Sustainable Development' which commenced at the Dutch National Institute of Public Health and the Environment (RIVM) in 1992. The aim of the model is not to predict the future but is to experiment with new concepts and techniques. The model has two over-arching frameworks: the world view and the management styles. Within these, a policy and response system drives economic models coupled to the human and environmental systems. Within the human system lie human health, population and energy systems. Global cycles, food and fresh water are contained within the environmental system.

These subsystems are considered as a series of reservoirs linked by fluxes in cause-effect chains. The Pressure-State-Impact-Response (PSIR) approach is used to conceptualise this framework. Pressure represents social, economic and ecological forces; State represents changes in the biosphere and in population, capital and resource stocks; Impacts respond to various disturbances; and Response is the human intervention following impacts. The PSIR system is not a strictly hierarchical system in the model but is interwoven, both vertically and horizontally across sectors.

The communication shell is viewed on a Netscape or Explorer WWW browser. It consists of two parts: a problem description, and a decision support and model description. The problem description is constructed in a similar way to the model, where the topics of human health, population, energy systems, global cycles, food and fresh water are all discussed separately.

Both the communication shell and the model are arranged in a hierarchical structure. The model is displayed as a series of graphs, affecting both the Pressure-State-Impact aspects of the human and environmental systems, and the economic and policy-related inputs in the response system. It is possible to open all graphs on the screen at once but if one wants to see individual graphs clearly, it is necessary to use a zoom function to open that graph on the full screen.

When comparing electronic publications to books, information retrieval is very different for educational, research or even reviewing purposes. An experienced user can easily and rapidly locate information in a good book. Electronic publications, however, require the user to invest some time in becoming familiar with their style and operation. This is partly because the medium is new and the conventions dictating its structure are still fluid. The electronic medium is also very flexible, so there are many structures possible.

It took a couple of hours to familiarise myself with the *TARGETS* system. At first I found the hierarchical structure of both the model and supporting information unwieldy. It was quite easy to get lost following links into the problem description pages. Because of this, it was also easy to miss information. Once I became familiar with the structure this became less of a problem. However, the lack of an index, structural overview, or a word search function meant that later on, when prompted by a result that the model produced, I would search for more information on a concept by clicking through various pages at random, not knowing whether it was included in the documentation or not.

The presentation is good, with attractive graphics and a user-friendly layout on individual pages. Most of the controversies and uncertainties are explained in a clear and concise manner but errors have crept into the text in a number of places. For instance, the natural greenhouse effect is referred to as the 'enhanced greenhouse effect' which is actually the term for the anthropogenic forcing of the natural greenhouse effect. There were a number of references cited in the text for which I was unable to locate the full references. Several links were missing.

The *TARGETS* model is run by applying world view and management styles according to three different perspectives: hierarchical, egalitarian and individualist. This is where I disagree most with the approach of the model authors, who use belief structures to influence physical uncertainties within the model.

'Traditional' science and neo-classical economics have both viewed their disciplines as being separate from the human sphere, where objective truths can be studied in isolation from the subjective influences of humans. This led to a management style where scientists or economists study a problem, predict an outcome, then pass their conclusions on to policymakers for implementation — a classic prediction-response system.

The model authors explicitly recognise that these divisions between science and policy cannot be maintained and that they influence each other. However, I believe they have gone too far in the other direction. An example that will be familiar to readers of this journal is based on the outputs of the global cycles model within *TARGETS*:

When the hierarchist (H), egalitarian (E) and individualist (I) emissions of CO<sub>2</sub> are integrated for 2100, the atmospheric concentration goes from highest to lowest in the order of H, I, E. However, the global temperature rise at 2100 proceeds from highest to lowest in the order of E, H, I. So egalitarian management produces the lowest CO<sub>2</sub> emissions but the egalitarian world view produces the highest temperature change (see Table 1).

As the supporting information states, the main uncertainties in the climate system are related to geophysical feedbacks. It is well known that the sensitivities of these feedbacks are independent of human opinion and not tightly bound to human behaviour. However, the egalitarian and individualist scenarios that approximately represent roughly the IS92c and IS92d scenarios produce a similar net greenhouse gas forcing of 4 W/m<sup>2</sup> for very different warmings of 3.7 and 1.1°C, both lying outside the IPCC ranges given by forcing feedbacks and climate sensitivity.

Being convinced that science and policy need to be integrated in order to understand how the world might change over the next century, I really wanted to like this model. However, by allowing simulated belief structures to affect how the TARGETS model represents physical process without the option of changing those processes independently is, in my opinion, a real mistake.

There are a number of books and reports based on the TARGETS project that can be used to explain the outcomes of various experiments—this level of detail is not included in the ESIAM edition of the model. I cannot recommend this version as a stand-alone product and refer the reader back to the more conventional scientific references\* which discuss a more detailed version.

Lastly, there was one area where the model worked admirably. When run with an individualist world view and an egalitarian management style, the model crashed. This was, I believe, the correct response.

System requirements: Pentium PC, 24 MB RAM, Windows 95 or NT 4. Will run on a Pentium 133 MHz with 16 MB RAM, but a Pentium II with >32MB RAM is recommended. The ESIAM series has a number of other IAMs forthcoming. <http://ns.baltzer.nl/targets/>

**Roger Jones**

*Dr Roger Jones is an environmental scientist with a broad range of experience covering palaeoclimate research, climate impacts research, environmental education and habitat reconstruction. He also has experience in electronic publishing, including interactive CD-ROMs.*

\*Rotmans, J. and de Vries, B. 1997. Perspectives on Global Change: The TARGETS Approach. Cambridge University Press, 479 pp.

**Table 1. Output from the TARGETS 1.0 global cycles model for 2100 based on different world views and management styles.**

<i>World view and management style</i>	<i>Carbon emissions (Gt C/yr)</i>	<i>Nitrogen emissions (Tg N/yr)</i>	<i>Sulphur emissions (Tg SO<sub>2</sub>/yr)</i>	<i>Atmospheric CO<sub>2</sub> concentration (ppmv)</i>	<i>Greenhouse gas forcing (W/m<sup>2</sup>)</i>	<i>Negative forcing (W/m<sup>2</sup>)</i>	<i>Global warming (°C)</i>
Egalitarian	4	15	15	497	5	-1	3.7
Hierarchical	21	71	126	729	8	-2	2.7
Individualist	12	54	59	638	7	-3	1.1

