

Progress in Physical Geography 29, 1 (2005) pp. 123–137

Book reviews

Liang, S. 2004: *Quantitative remote sensing of land surfaces*. Hoboken NJ: Wiley-Interscience. xxvi + 534 pp. + CD-ROM. £82.50 cloth. ISBN 0 471 28166 2.

Shunlin Liang is an Associate Professor of Geography at the University of Maryland. His research interests centre on the topic of

radiative transfer modelling, and this book represents his largely successful attempt to describe the development and use of physically based models to recover estimates of the values of Earth surface variables from remotely sensed data. Reliable estimates of these variables, which are used for the purposes of environmental prediction, can only be achieved, the author believes, through the use of physical dynamic models. He therefore focuses on two main themes – the theory underlying the models and the algorithms required to write operational computer code. He does not cover the use of remotely sensed images to generate thematic maps of, for example, land cover; rather, he explains how remotely sensed data can be calibrated to physical values (radiance), how the effects of the atmosphere can be removed from the signal received at the sensor, and how these calibrated and atmospherically corrected data can be related to the magnitudes of physical phenomena such as soil moisture content and vegetation canopy properties. The approach is rigorously theoretical rather than empirical, though some of the models that are described include empirical relationships. Most of the book is concerned with calibration, modelling and validation issues, but the final chapter provides details of the practical use of modelling in ecology, agriculture, studies of the global carbon cycle and climatology.

The first chapter is a concise and well-illustrated introduction to quantitative remote sensing, concentrating on the definition of radiometric variables, and on the components of a remote sensing modelling system (e.g., atmospheric radiative transfer models, sensor models). Chapters 2–4 provide in-depth treatments of atmospheric short-wave radiative transfer modelling canopy reflectance modelling, and modelling snow and soil reflectance. Chapter 5 then deals with the radiometric calibration of sensors, with specific details of Landsat TM and NOAA AVHRR calibration procedures. A review of atmospheric correction methods (Chapter 6) is followed by a detailed review of topographic

correction procedures (Chapter 7). Next, the estimation of land surface biophysical variables from multispectral and hyperspectral data sets is considered in some detail (Chapter 8). Chapters 9 and 10 cover the topic of estimation of the surface radiation budget, with Chapters 8 and 9 covering broadband and longwave albedo estimation, respectively. Four-dimensional data assimilation is treated in chapter 11, and chapter 12 covers validation and spatial scaling. The remaining chapter (13) is devoted to applications in ecological modelling, agriculture, climatology and carbon cycle studies. Each chapter ends with an extensive bibliography. The index is reasonably detailed.

A CD accompanies the book. Its contents are divided into two parts, data and software, each of which is arranged in chapter order. Data sets include extra-terrestrial solar irradiance derived using MODTRAN4, and a set of sensor spectral response functions for Landsat TM and ETM, AVIRIS and other sensors. The software provided on the CD is mainly written in Fortran, with some C code. Source code is provided for a number of atmospheric and canopy reflectance models, including DISORT and GeoSAIL.

The level of physics and mathematics required to understand and appreciate the content of this book – described as ‘a good working knowledge of statistics, calculus and linear algebra on an undergraduate level’ – is well above that achieved by the majority of geographers, and it is therefore likely that the main readership of the book will consist of postgraduate-level environmental physicists. It will find its main use as a reference book rather than as a course text. There are a number of unimportant typographic errors, plus some mistakes that should have been picked up at the proofreading stage (for example, the use of the term ‘generic algorithm’ rather than ‘genetic algorithm’). Such quibbles apart, this is a well-researched book that the environmental modelling community will find an indispensable reference.

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