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Physical Processes in Earth and Environmental Sciences, by Mike Leeder & Marta Pérez-Arlucea, 2006. Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, United Kingdom. Paperback, 336 pages. Price GBP 24.99; US$ 49.95. ISBN 1-4051-0173-3.

Recently, the British Geophysical Association expressed trepidation about the falling number of undergraduate students reading Geophysics at UK Universities. This piggybacks on a wider, nationwide concern over declining numbers of students doing school and university courses in the physical sciences. This trend is certainly not unique to the UK, and, if no cure is found fairly quickly, its long-term consequences will be felt by all earth and environmental scientific disciplines that rely on mathematical and physical laws.

One way of tackling the problem is to make physical sciences more attractive to those young people who have the ability and dormant interest in physical sciences, but who are apprehensive of working with numbers due to its complexity. Waking up the right students is a challenge, which should start at an early age and continue into academia. Mike Leeder and Marta Pérez-Arlucea have written a book that may well fit this purpose. 'Physical Processes in Earth and Environmental Sciences' uses a pleasant and transparent format to explain complex processes in earth-system science. The text reads like a knife cuts through butter, it contains relevant historical information, anecdotes and side steps, and it is accompanied by a large number of explanatory line drawings and photographs. Particularly appealing is the use of a limited number of fundamental physical laws by means of which many of the processes acting in the atmosphere, on the earth surface and within the solid earth can be dealt with. This approach will appeal to a wide readership, as it provides a strong handle to sort out the chaos.

In only 336 pages, Leeds and Pérez-Arlucea touch upon an incredibly wide range of physical processes in the outer part of the Earth, which they define as the area between the 660 km deep mantle discontinuity and the 12 km high troposphere boundary. And amazingly, they get away with it. Chapter 1, in which the properties of 'system Earth' are described in general terms, sets the scene for five more chapters in which matters of state and motion (Chapter 2), forces and dynamics (Chapter 3), and flow, deformation and transport (Chapter 4) are explained and subsequently applied to the interior Earth (Chapter 5) and the exterior Earth (Chapter 6). A brief mathematical refresher and 21 cookies (defined as derivations for the intellectually challenged) complete 'Physical Processes in Earth and Environmental Sciences'.

In Chapter 2, the static and kinematic properties of gases, liquids and solids are described, and the role of temperature and heat transfer is explained. Chapter 3 deals with Newton's laws, thermal energy, hydrostatic pressure, various forces (e.g., gravity, inertia, buoyancy, centripetal/centrifugal forces, the Coriolis force, viscous and turbulent forces), rheology, and solid stress and strain. Arguably the best chapter is Chapter 4, because it contains a wealth of information on the flow of gases and liquids, and the deformation of solids, set in a historical scientific context and illustrated with natural examples. Key subjects include laminar versus turbulent fluid flow, stratified flow, vertical and horizontal particle transport, particle-laden

density flow, short- and long-period water-surface and internal fluid waves, and flow through porous media. The same chapter also discusses folding, fracturing and faulting of solids, seismic waves and heat transport by radiation and convection.

Chapter 5 contains a short overview of physical processes within the solid Earth. Rock-melting processes and melt-material properties are described before the flow behavior and recrystallization of melts as well as volcanic eruptions are discussed in some detail. A separate section is devoted to the role of mantle convection and mantle plumes in the kinematics of plate tectonics. The final chapter applies physical laws to Earth exterior processes, such as atmospheric circulation and climate, exchange of heat, gases and particulate matter at atmosphere/ocean and atmosphere/land interfaces, and thermohaline circulation within deep oceans. Complex physical processes in shelf seas and in coastal environments are explained in simplified terms, and finally the movement of water (or ice) and sediment in lacustrine, alluvial, aeolian and glacial environments is summarized. Noteworthy cookies are those that explain the 'law of the wall' for steady, turbulent fluids, derive the Airy wave theory for shallow-water waves and explain stereographic projection methods.

Leeder and Pérez-Arlucea's book has been written with undergraduate courses in mind, which is not only expressed in the content but also in the attractive pricing. I have little doubt that this book will be popular amongst lecturers and students. The print quality is generally very good, although the photographs tend to be on the dark side. Unfortunately, text editing has been below standard. Grammar and syntax are excellent, as can be expected from the track record of the authors, but it is disappointing that the index refers to an entirely different set of chapter and section numbers than used in the main text.* Some references within the text also suffer from the same problem. An erratum should be made available, preferably as a download from the Blackwell web site. Despite this flaw, 'Physical Processes in Earth and Environmental Sciences' occupies a significant niche in Earth and Environmental Sciences. I am confident that this book will stimulate undergraduate students to embrace more of those dreaded mathematics and physics.

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***ADDENDUM**: Blackwell Publishing Ltd have corrected the errors in the index by rebinding the entire stock of the book. The keywords in the index should now refer to the correct chapter and section numbers, thus providing a valuable means of finding specific information.

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