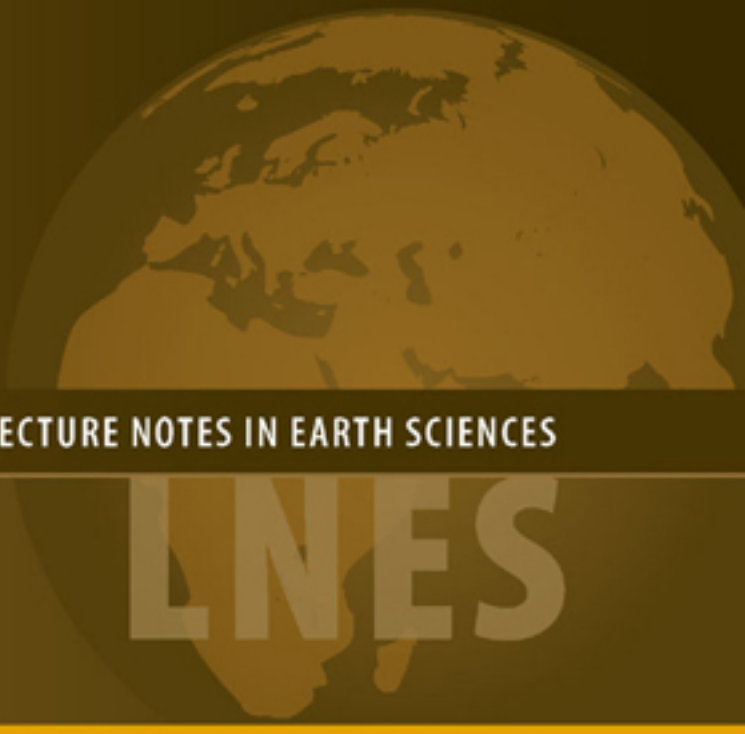
Huilin Xing



LECTURE NOTES IN EARTH SCIENCES

119 LNES

Advances in Geocomputing

Springer

Lecture Notes in Earth Sciences 119

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For all Lecture Notes in Earth Sciences published till now please see final pages of the book

ISBN: 978-3-540-85877-5 e-ISBN: 978-3-540-85879-9

DOI 10.1007/978-3-540-85879-9

Lecture Notes in Earth Sciences ISSN: 0930-0317

Library of Congress Control Number: 2008936483

Cover design: deblik, Berlin

Printed on acid-free paper

9 8 7 6 5 4 3 2 1

springer.com

Preface

Numerical modelling is being an advanced tool in geoscience and geoengineering. Idealized experiments and field observations have been the main pillars of geoscience for decades, while the rapid development of supercomputers leads to a paradigm shift towards geocomputing. High-performance computing based simulations offer outstanding opportunities to get insights into increasingly complex geoscience and geoengineering problems.

Several new institutes and initiatives with special emphasis on high-performance geocomputing have been established around the world, such as ACcESS MNRF (Australian Computational Earth System Simulator, Major National Research Facility, http://www.access.edu.au) and AuScope (an organisation for a National Earth Science Infrastructure Program, http://www.auscope.org.au) in Australia; GEON (GEOscience Network, http://www.geongrid.org/), PRAGMA (Pacific Rim Applications and Grid Middleware Assembly, http://www.pragma-grid.net/), SERVO (Solid Earth Virtual Research Observatory, http://www.servogrid.org/), PetaSHA (Petascale Cyberfacility for Physics-based Seismic Hazard Analysis from Southern California Earthquake Center, including TeraShake etc. platforms, http://scecdata.usc.edu/petasha/) and CIG (Computational Infrastructure for Geodynamics, http://www.geodynamics.org) in the United States; GeoFEM (http://geofem.tokyo.rist.or.jp) and CHIKAKU system (http://www.riken.go.jp/lab-www/CHIKAKU/index-e.html), and the Earth Simulator Center (www.es.jamstec.go.jp/) in Japan; the Laboratory of Computational Geodynamics of Chinese Academy of Sciences in China; and the iSERVO seed project (iSERVO-international Solid Earth Virtual Research Observatory, http://www.iservo.edu.au) aims to foster ongoing international cooperation on simulation of solid earth phenomena. iSERVO is the natural follow-on to ACES (APEC Cooperation for Earthquake Simulation, http://www.aces.org.au).

This book provides a concise overview of the recent developments in geocomputing, covering model construction, advanced computational theory, visualization of the results, and high-performance software development on supercomputers. We present applications spanning the different temporal and spatial scales of geoscience. Those exemplary

simulations focus on topics from geodynamics, crustal dynamics, earthquakes, tsunami and rock physics. The book is composed of 8 chapters written by 35 authors from 6 countries – Australia, China, Germany, Japan, Switzerland and the Unites States, which reflected the current state-of-the-art achievements and the future research direction in the field. All mention of colour in the legends can be seen only in the enclosed DVD-ROM and in the online version in addition to the animation files of the amazing simulation results.

The collection of topics aims to reflect the diversity of recent advances in geocomputing. Such a broad perspective may be useful for scientists as well as for graduate students in geophysics, geology, geochemistry, computational science, environmental and mining engineering, and software engineering. I hope this book will be relevant and valuable to the whole geoscience community and serve to both define and advance the state of geocomputing.

The last but not the least, I would like to express my deep appreciation to all the authors and reviewers for their outstanding contribution to this book, and to Professor Dave Yuen of University of Minnesota, Dr. Chris Bendall and Janet Sterritt-Brunner of Springer for their kind encouragement and help to have such diverse topics on geocomputing published as a book.

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