CAMBRIDGE

Cambridge University Press
978-1-107-00936-3 - Understanding the Earth System: Global Change Science for Application
Edited by Sarah E. Cornell, I. Colin Prentice, Joanna I. House and Catherine J. Downy
Table of Contents
More information

Contents

List of editors *page* vii
List of scientific editorial team members viii
List of contributing authors x
Foreword Professor Sir John Lawton xiii
Preface xv
Acknowledgements xxiii
List of units xxv

1 Earth system science and society: a focus on the anthroposphere 1
Sarah E. Cornell, Catherine J. Downy, Evan D. G. Fraser and Emily Boyd

1.1 The Earth system and the 'problematic human' 1
1.2 Conceptualizing the 'human dimension' from an Earth system perspective 6
1.3 Social science perspectives on the Earth system 16
1.4 Creating usable and useful integrated research about the Earth system 30

2 Fundamentals of climate change science 39
I. Colin Prentice, Peter G. Baines, Marko Scholze and Martin J. Wooster

2.1 Observing and studying climate 39
2.2 Fundamentals of climatology 42
2.3 Fundamentals of terrestrial ecosystem science 53
2.4 The global carbon cycle 60
2.5 Prognosis 64

3 How has climate responded to natural perturbations? 72
Eric W. Wolff, Sandy P. Harrison, Reto Knutti, Maria Fernanda Sanchez-Goñi, Oliver Wild, Anne-Laure Daniau, Valérie Masson-Delmotte, I. Colin Prentice and Renato Spahni

3.1 Introduction 72
3.2 Climate perturbations 72
3.3 Methods for observing and understanding the past 74
3.4 How climate has altered in the past 78
3.5 Response of climate change to forcing 79
3.6 Case studies of climate perturbations and responses 85
3.7 Natural perturbations as a guide to the future behaviour of the Earth system 94

4 The Earth system feedbacks that matter for contemporary climate 102
Pierre Friedlingstein, Angela V. Gallego-Sala, Eleanor M. Blyth, Fiona E. Hewer, Sonia I. Seneviratne, Allan Spessa, Parvadha Suntharalingam and Marko Scholze

4.1 Introduction 102
4.2 Land–atmosphere biogeophysical feedbacks 105
4.3 Carbon-cycle feedbacks 108
4.4 Nitrous oxide feedbacks 110
4.5 Methane feedbacks 111
4.6 Fire feedbacks 115
4.7 Human feedbacks 119

5 Earth system models: a tool to understand changes in the Earth system 129
Marko Scholze, J. Icarus Allen, William J. Collins, Sarah E. Cornell, Chris Huntingford, Manoj M. Joshi, Jason A. Lowe, Robin S. Smith and Oliver Wild

5.1 Introduction 129
5.2 Horses for courses: no model is 'best' 132

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00936-3 - Understanding the Earth System: Global Change Science for Application
Edited by Sarah E. Cornell, I. Colin Prentice, Joanna I. House and Catherine J. Downy
Table of Contents
More information

5.3 Understanding observations 139
5.4 Predicting future global change 145
5.5 A perspective on future model developments 151
5.6 The outlook for Earth system science 153

6 Climate change impacts and adaptation: an Earth system view 160
Richard A. Betts, Nigel W. Arnell, Penelope M. Boorman, Sarah E. Cornell, Joanna I. House, Neil R. Kaye, Mark P. McCarthy, Douglas J. McNeall, Michael G. Sanderson and Andrew J. Wiltshire

6.1 Introduction 160
6.2 Measuring and modelling potential impacts of climate change 163
6.3 Evidence for impacts of climate change in the recent past 180
6.4 Global-scale impacts of future climate change 184
6.5 Adaptation in practice 192
6.6 Key messages 194

7 The role of the land biosphere in climate change mitigation 202
Joanna I. House, Jessica Bellarby, Hannes Böttcher, Matthew Brander, Nicole Kalas, Pete Smith, Richard Tipper and Jeremy Woods

7.1 Introduction: from human perturbation to biosphere management 202
7.2 How big a mitigation effort is required? 204
7.3 How has the biosphere influenced climate change in the recent past? 209
7.4 Mitigation potential in the forest sector 214
7.5 Mitigation potential in the agricultural sector 217
7.6 Mitigation in the bioenergy sector 219
7.7 Critical issues in land-based mitigation 225
7.8 Opportunities and priorities for action 235

8 Society's responses and knowledge gaps 245
Sarah E. Cornell and I. Colin Prentice

8.1 Introduction 245
8.2 Some unresolved issues 245
8.3 Envisioning the future 250
8.4 Concluding remarks 254

List of acronyms 257
Glossary 261
Index 263

© in this web service Cambridge University Press www.cambridge.org