

Contents

<i>List of contributors</i>	<i>page x</i>
I Introduction	1
ANDREW S. GOUDIE	
Part I Processes	3
2 Regional seismic shaking hazards in mountains	5
WILLIAM B. BULL	
2.1 Introduction	5
2.2 Lichenometry site characteristics	5
2.3 Regional seismic shaking	8
2.4 Conclusions	11
3 Volcanic hazards and risks: a geomorphological perspective	13
JEAN-CLAUDE THOURET	
3.1 Introduction	13
3.2 Direct volcanic hazards around active volcanoes	14
3.3 Indirect volcanic hazards and geomorphic impact	20
3.4 Post-eruption geomorphic impacts and responses	22
3.5 Long-term geomorphic hazards around inactive volcanoes	24
3.6 Methods and goals of volcano hazard and risk assessment	25
3.7 Concluding remarks and perspectives	28
4 Mountain hazards	33
OLAV SLAYMAKER	
4.1 Introduction to mountain geomorphic hazards	33
4.2 Site scale	34
4.3 Drainage basin scale	35
4.4 Global scale	40
4.5 Conclusion in light of accelerating environmental change	43
4.6 Conclusions	44

5 Review and future challenges in snow avalanche risk analysis	49
MICHAEL BRÜNDL, PERRY BARTELT, JÜRIG SCHWEIZER, MARGRETH KEILER AND THOMAS GLADE	
5.1 Background	49
5.2 Review and recent trends in hazard analysis	51
5.3 Methods of risk analysis	54
5.4 Change in avalanche risk, influence of different risk factors	56
5.5 Conclusions: where to go from here; future challenges	58
6 Landslide hazards	63
DAVID PETLEY	
6.1 Introduction	63
6.2 Landslide causes and triggers	64
6.3 The role of geomorphology in landslide hazard management	66
6.4 Terrain mapping	66
6.5 Susceptibility analysis	67
6.6 Hazard and stability analyses	68
6.7 Monitoring, behaviour prediction and warning systems	69
6.8 Secondary hazards and sediment production	70
6.9 Conclusions	72
7 Catastrophic landslides and sedimentary budgets	75
MONIQUE FORT, ETIENNE COSSART AND GILLES ARNAUD-FASSETTA	
7.1 Catastrophic landslides: definition, modes of emplacement and geomorphic significance	75
7.2 Geomorphic impacts of catastrophic landslides	78
7.3 Forecasting and preventing	82
7.4 Conclusions	83
8 Landslides and climatic change	87
LISA BORGATTI AND MAURO SOLDATI	
8.1 Introduction	87
8.2 Conceptual framework	88
8.3 Landslides and climate: state of the art	90
8.4 Conclusions: landslides in a changing environment; issues and perspectives	91
9 The hazardousness of high-magnitude floods	97
AVIJIT GUPTA	
9.1 Introduction	97
9.2 Flood climate	98
9.3 Non-meteorological floods	100
9.4 Flood physiography	101
9.5 Floods and geographical locations	102
9.6 Water and sediment transfer in floods	102
9.7 Source-to-sink passage of a flood	103

Contents

vii

9.8 Types of flood hazard and their location	105
9.9 Conclusions: flood hazards and climate change	107
10 Flood hazards: the context of fluvial geomorphology	111
GERARDO BENITO AND PAUL F. HUDSON	
10.1 Introduction	111
10.2 Fluvial geomorphology in flood hazard assessment	112
10.3 Flood hazards in the context of global climate change	119
10.4 Geomorphological adjustment to flood management	120
10.5 Flood hazard management: an integrated approach	122
10.6 Conclusions	123
11 Geomorphology and coastal hazards	129
HARLEY J. WALKER AND MOLLY MCGRAW	
11.1 Introduction	129
11.2 Earthquakes, volcanic eruptions, and tsunami	133
11.3 Landslides	137
11.4 Meteorological events and coastal disaster	138
11.5 Other coastal hazards/disasters	139
11.6 Conclusions	142
12 Weathering hazards	145
ANDREW S. GOUDIE AND HEATHER VILES	
12.1 Introduction	145
12.2 Salt weathering	146
12.3 Changing dimensions of the salt weathering hazard	148
12.4 Atmospheric pollution and weathering	149
12.5 Changing dimensions of the air pollution-induced weathering hazard	151
12.6 Fire, lightning and thermal fatigue	152
12.7 Mitigation	152
12.8 Conclusions	154
13 Hazards associated with karst	161
FRANCISCO GUTIÉRREZ	
13.1 Introduction: why are hazards associated with karst important?	161
13.2 Sinkhole hazard	162
13.3 Other hazards associated with karst	170
13.4 Conclusions	173
14 Soil erosion	177
ANDREW S. GOUDIE AND JOHN BOARDMAN	
14.1 Introduction: the nature of the problem	177
14.2 Forms of erosion	177
14.3 Rates of erosion: natural and anthropogenic	178
14.4 Assessment of current erosion	178
14.5 Consequences of erosion	179
14.6 Causation: soil erosion associated with deforestation and agriculture	180
14.7 Soil erosion produced by fire	180

viii Contents

14.8	Soil erosion associated with construction and urbanization	181
14.9	Humans or nature?	181
14.10	Soil erosion by wind	182
14.11	Global hotspots of erosion	183
14.12	Soil conservation: water erosion	183
14.13	Soil conservation: wind erosion	184
14.14	Conclusions	184
15 Desertification and land degradation in arid and semi-arid regions		189
YANG XIAOPING		
15.1	Introduction	189
15.2	Regional-scale hazards and causes	190
15.3	Global-scale hazards	194
15.4	Conclusions	196
16 Dune migration and encroachment		199
ANDREW S. GOUDIE		
16.1	Introduction	199
16.2	Methods of study	199
16.3	Rates of dune movement	199
16.4	Control	200
16.5	Conclusions	201
Part II Processes and applications of geomorphology to risk assessment and management		203
17 GIS for the assessment of risk from geomorphological hazards		205
CEES J. VAN WESTEN		
17.1	Introduction	205
17.2	Spatial data requirements for risk assessment	206
17.3	Hazard assessment	212
17.4	Vulnerability and risk assessment	214
17.5	Risk management	216
17.6	Conclusions	218
18 Hazard assessment for risk analysis and risk management		221
MICHAEL CROZIER AND THOMAS GLADE		
18.1	Approach	221
18.2	Basic concepts and issues	221
18.3	The contribution of geomorphology to hazard assessment	224
18.4	Conclusions and perspectives	229

19 Vulnerability analysis in geomorphic risk assessment	233
GABI HUFSCHMIDT AND THOMAS GLADE	
19.1 Rationale	233
19.2 Different vulnerability approaches towards risk reduction	233
19.3 Science and technology	233
19.4 The human ecology approach	234
19.5 Vulnerability and the applied sciences	236
19.6 Vulnerability and the structuralist paradigm	237
19.7 Summary and perspectives	239
20 Geomorphological hazards and global climate change	245
ANDREW S. GOUDIE	
20.1 Introduction	245
20.2 Coastal hazards	246
20.3 Hydrological hazards	248
20.4 Mass movement and soil erosion hazards	250
20.5 Glacial and permafrost hazards	250
20.6 Aeolian hazards	251
20.7 Conclusions	252
21 Geomorphic hazards and sustainable development	257
DAVID HIGGITT	
21.1 Introduction	257
21.2 Challenges to the dominant paradigm of natural hazards	258
21.3 Vulnerability and resilience: Asian earthquakes	259
21.4 Geomorphology, hazards and sustainability	262
21.5 Flood hazards in Southeast Asia: links with sustainable management	265
21.6 Conclusions	266
22 Geomorphology and disaster prevention	269
IRASEMA ALCÁNTARA-AYALA	
22.1 Geomorphological hazards	269
22.2 Disasters: the international framework	270
22.3 1900–2000: beyond a century of disasters	272
22.4 Geomorphology: a brief account of contributing research, methodologies and techniques	275
22.5 Conclusions: the future agenda	276
23 Geomorphology and the international agenda: concluding remarks	279
IRASEMA ALCÁNTARA-AYALA	
<i>Index</i>	282