

Index

- abandoned mine workings, 74, 132, 144, 145, 271,
see also mining subsidence; quarries
- Abbeystead (England) 150
- Aberfan (Wales) 65, 160, 265
- abrasiveness testing 196
- accidents, industrial 149–150
- acid waters, 34, *see also* mining waste
- aerial photography 37, 38, 131
- aerial reconnaissance 252–253, 254
- Agenda 21 282, 285
- aggregate resources 26, 34, 37, 40, 257–263
- agricultural changes 29, 30, 50, 72
- aid agencies 43
- air quality 50
- alabaster working (Nottingham, UK) 10
- Alaska (USA) 150
- alluvium 1, 3, 6, 15, 72, 144
- Alpine orogeny 6
- Amsterdam (Netherlands) 28, 139
- anchoring
 slope stabilization (South Korea) 172
 underground railways 225, 227, 230, 233, 240
- Andean landslides 89
- Ankara (Turkey) 193, 195, 196
- aquifers 2, 11, 22
 and landfill site location (Brazil) 163
 river-aquifer interaction modelling 57, 60
 vulnerability 35
 see also groundwater
- archaeological records and data, 131, 134, *see also*
 historical information
- archaeological remains 136–137, 143, 144, 201, 204,
 216, 217, 222–223, 244–245
- architectural heritage structures 144, 215–241,
 244–245, 271
- Argentina 101
- armour stone 271
- arsenic-contaminated soils 163
- artificial deposits, 6, 15–18, 37, *see also* fill; made ground
- Arun, River (Sussex, UK) 78
- Association of Geotechnical and Geoenvironmental
 Specialists 125, 138, 153
- Athens (Greece) 35, 118, 191
- atmospheric gases 66, 70, 75–76
- Auckland (New Zealand) 117
- Australia 25, 189, 193, 287
- Austria 154, 291, 293
- Azerbaijan 115
- backfill, 16–18, 22, 169, *see also* fill; made ground
- Baihetan Power Station (China) 196
- Bangladesh 115, 267
- bearing capacity, 26, 36, 37, 69, 128, 171, 192, *see also*
 strength
- bedrock ground conditions (Nottingham, UK) 11–14
- bedrock resources for sustainable concrete production
 257–263
- Beijing (China) 25
- Belgium 116, 153, 291
- Bhopal (India) 150
- biodegradation of contaminants 162
- biodiversity 29, 39–40, 42
- BIONICS project 73
- Bolivia 101, 107, 108
- boreholes
 databases 131, 138, 210
 information for London Clay model 56
 use of older data 43, 44
- brainstorming 131
- Brasilia (Brazil) 210, 266
- Brazil, 42, 72, 78, 101, 116, 117, 163, 210, 267, *see also*
 Diadema; Pará; Rio de Janeiro; Sao José do Rio
 Preto; Sao Paulo
- breccias 1, 3, 20–22, 34
- brick clays 1, 3, 10, 18
- bricks, reuse as aggregate 271
- bridges 172, 241–242, 243
- Bristol (UK) 132
- British Geological Survey
 GeoIndex database 131, 138, 210
 ground source heat pump data 75
 hazard maps and models 50–55
 linked 3D model (Glasgow, UK) 211
 regional change modelling 50–55
 world digital map 30
- brownfield sites, 153–154, 159, 169, 298, *see also*
 derelict sites
- Bucharest (Romania) 36, 37
- building damage database (Italy) 37
- building demolition v. reuse 154
- building materials, durability 144, 145
- building stone resources and assessment 271
- building stone weathering 172, 271
- buildings, high-rise 30, 33, 202–203
- buildings, historic *see* architectural heritage
- buried channels and valleys 34, 35, 38, 210
- cadmium-contaminated soils 163
- California (USA) 193
- cambering 13
- Canada 30, 40, 89, 182, 186
- canal tunnel refurbishment 191–192
- Canary Islands 27
- carbon dioxide
 and climate change 26, 66, 67
 reduction 179–180, 282
 sequestration/storage 28, 75–77, 267, 286
- Caribbean 72, 87, 101–112, 116–117
- case study methods 119
- caves and cavities
 catacombs 201–202
 near tunnel line in Naples (Italy) 225
 in Nottingham (UK) 1, 3, 20–22
 as underground structures 201–202
 see also subsidence; underground space
- cementitious hydration systems 257, 261, 262
- Central Africa 89
- Central America 89, 101–112

- Cerchar abrasiveness index 196
 Chalk 57–58, 191–192
 Chartered Institution of Water and Environmental Management 153
 chemical stabilization techniques 171–172
 chemical waste storage 28
 chemically damaged land 149, 150, 155–157, 160–164
 Chernobyl (Ukraine) 150
 Chile 101, 115
 China, 39, 89, 116, 117, 144, 171, 189, 194, 210, 242–243, 267, *see also* Baihetan; Beijing; Gong; Kunming; Lanchang; Nanjing; Neijiang; Nuozadu; Shanghai; Suzhou; Three Gorges; Tianjin; Ya-an; Yalong; Yangtze; Zhegu Mount
 city, definition, 152, *see also* urban
 civil engineering
 role of professionals 127, 178, 186
 scale of works in UK 277, 279–280
 classifications
 classification projects in Europe 293
 Coastal Landslide Hazard Assessment System (UK) 55–56
 concretionary soils 144
 ‘intelligent’ classification of tunnel wall rock 212
 rock mass 193–194, 196
 slope instability (Turkey) 35
 soils 293
 and underground space 189
 weathering 144
 clays and clay rocks
 characterization 168–169
 fabric, clay shales 145
 geotechnical data 40, 139
 indurated, for aggregates 34
 lacustrine, testing 145
 in Nottingham (UK) 1, 3, 6, 10, 13, 15, 18
 reinforcement 171
 shrink-swell 37, 40, 56, 74, 144, 145
 shrinkage potential model 55
 spalling and fissuring in karst 116
 unconsolidated, thickness mapping 40
 weathering 14
 see also soils
 clients *see* decision-makers
 ‘CLIFFS’ monitoring network for landslide processes 61
 climate change 27, 30, 39–41, 43, 113, 251
 causes and evidence 66
 implications for engineering geology 59, 65–82
 models 50, 65, 67, 73, 79
 and rising groundwater 34, 145
 scenarios 39–41, 66–67, 68
 coal mining, 1, 2, 8–10, 16–19, 23, 118,
 see also mining
 coastal erosion 27, 28, 38, 49, 55–56
 and climate change 72
 regional modelling 55, 58, 59
 coastal zone 27, 28, 36, 38, 39
 and climate change 72
 coastal management strategies 38, 49
 see also coastal erosion
 collaborative working, 43, 286, *see also* datasharing
 collapses
 caves, Nottingham (UK) 20–22
 historic railway infrastructure (UK) 247–248
 mine-related 74
 risk 26
 see also soils, collapsible
 colluvium 3, 15, 18
 Colombia 101, 287
 Colorado (USA) 35
 combined heat and power 195
 communication, effective, 41, 43, 61, 62, 119, *see also* information dissemination
 compaction, degree of 144
 compaction techniques 119, 171
 competencies of engineering geologists 289–290, 298
 competitive tendering 126–127
 compressibility, Thames Estuary clays (UK) 40
 concrete
 aggregates for 257–263, 271
 mineral reactions 12, 14, 16, 178
 new types 257, 260, 261
 proportioning 257, 258
 sustainable use of bedrock resources 257–263
 tunnel linings 191
 cone penetration tests 145, 210, 244
 Connecticut (USA) 153
 conservation and biodiversity 40
 conservation geology 283
 Construction Industry Research and Information Association 125
 contaminated land
 and biodiversity 39–40
 environmental urban geotechnics 169
 modelling (Thames Estuary, UK) 40
 remediation (Nottingham, UK) 22–23
 risk assessment and management 149–165, 212
 role of engineering geologist 152–153, 159–165
 and underground construction 31
 urban site investigation 37, 132, 134, 137, 138, 143
 see also gases and fluids; groundwater contamination; pollution
 continental slope instability 70
 contingency measures 41, 43
 continued professional development 299
 contract procurement methods 126–127
 Coordinating Committee for Geoscience Programs in East and South East Asia 28
 Costa Rica 101, 109
 costs
 of decommissioning and disposal 180
 of disasters 101–104, 108–111, 113–114
 environmental 178, 180
 of geohazards 27
 of infrastructure construction 178
 of integrated assessment of water management 35
 of land 30, 33
 of remedial measures and repairs 39
 of resources 271
 and risk management 109–111
 of site investigation 126–127, 138
 of travel 180
 of underground expansion 30, 178
 of urban development 33, 38–39, 42
 crown holes 21, 35
 crushing plant for aggregate from bedrock 258
 cryoturbation 6, 14

- cultural barriers in modelling 61–62
- cyclones 89, 97
- Cyprus 145
- Czech Republic 154, 169, 189, 191

- Dakar (Senegal) 35, 144
- damage prevention policies 163
- damage registers 119
- dams 138, 242
- Danish Hydraulics Institute 56, 60
- databases/datasets 37, 40, 43, 118, 201–213
 - boreholes 43, 44, 56, 131, 138, 210
 - climate and climate change 67
 - cone penetration test data 210
 - data management systems 210, 245, 251
 - datasharing 40, 43, 44, 119
 - digital data 40, 44, 204, 210
 - ease of use and credibility 205
 - future geodata requirements 204–206
 - geohazards 50, 210, 211
 - with GIS and maps, for city of Oporto (Portugal) 210
 - Global Precipitation Climatology Centre 93–94
 - history of geodata collection 201–203
 - importance of data collection and management 40, 62, 210, 212
 - landslide fatality data 84, 86–98
 - need for maintenance and updating 40
 - rates of change datasets 61
 - for site investigation 131–137, 138, 140, 210, 211–212
 - spatial database development 209–210
 - stability of cut slopes and retaining structures 172
 - standards and procedures for 212
 - translation to 3D models 43–44
 - UK national geohazard databases 50
 - UK National Land Use Database 154
 - underground infrastructure 185, 204
 - understanding of *see* decision-makers
- debris flows 61, 101, 111–112, 251
- decision-makers
 - effective communication with 41, 43, 44, 49–50, 118, 119–120, 153, 299–301
 - site investigation philosophy in UK 126–127, 138
 - understanding of models and data by 43, 49–50, 52, 55, 62, 111, 205, 212
- decision-making process
 - in risk management 101–112
 - and sustainable development 153
 - tool development 171, 211–212
- decommissioning and disposal costs 180
- deforestation 38
- deformation phases 38
- deformation in tunnels 212, 242
- Delft (Netherlands) 39, 202, 298
- delta environments, and climate change 72
- Denmark 56, 60, 182
- derelict sites, 37, 153–154, 159–165, *see also* brownfield sites
- design
 - empirical approaches used in past 69–70
 - geotechnical design 139
 - shortcomings 242
 - of underground spaces 180, 181, 182, 183
 - design charts 118
 - design life 180, 181, 182, 191
 - desk studies 73, 127, 128–132, 138, 140, 144, 204, 244
 - developing countries' resources 33–35, 43
 - development control 114
 - Devon (UK) 253–254
 - Diadema (Brazil) 41
 - diaphragm walls for underground railways 225–227, 230, 233–234, 239–240, 244
 - diffuse reflectance infra-red spectroscopy 261
 - digital databases *see* databases/datasets
 - digital elevation models 35–36, 40
 - digital imaging 145
 - digital mapping *see* mapping
 - digital measurement 145
 - digital photogrammetry, cliffed coastline (UK) 55
 - digital terrain models 37, 40, 41
 - disasters 265
 - accidental industrial contamination 149–150
 - disaster potential 41
 - economic impact of 103–104, 108–109
 - hazard and risk planning for 113–123
 - management 286
 - response to 298, 300
 - risk management 101–112
 - scenarios 119
 - discontinuity orientation mapping 145
 - disease control, regional change modelling 50
 - displacement
 - modelling 195–196, 215–222, 226–232, 237–240
 - monitoring 194
 - dissolution 13, 20, 35, 74–75
 - disturbed land, and biodiversity 39–40
 - dolomitic rocks 3, 5, 10, 18, 191
 - domestic (municipal) waste disposal 15–16, 28, 29, 37
 - Dominican Republic 101
 - drainage
 - and climate change 70, 72–73
 - drainage basin landscapes 72–73
 - and fatal landslides 97
 - sustainable urban drainage systems 77–78
 - drains, vertical 171
 - drilling, 138–139, 140, 145, 190, 193, *see also* tunnelling
 - drought 27
 - durability of building materials 144, 145
 - dust, health risks of 27
 - dynamic penetration testing 138–139

 - earthquakes 23, 27, 35, 36, 101
 - and climate change 70
 - hazard and risk planning 115, 118, 120
 - regional modelling 58
 - risk management in susceptible areas 101–112
 - and substructures 181, 183, 191
 - trigger for landslides 87, 88
 - vulnerability index 117
 - see also* seismicity
 - earthwork infrastructure assets protection 251–254
 - economic geology 274
 - economic growth 29
 - economics
 - impact of disasters 103–104, 108–109
 - and sustainability 178, 180
 - ecosystems and climate change 39–40, 281

- ecotoxicology 35
 Ecuador 101
 education and training in engineering geology 277–278, 279, 283, 284, 285, 286, 292–293, 297–301
 education and training for general public 118, 298
 Egypt 34, 39
 El Niño 89, 101, 104
 El Salvador 101
 electrokinetic remediation techniques 162
 electronic transducer system 145
 embankments 6, 171, 252–253, 254
 end-users *see* decision-makers
 energy resources 26
 engineering geological mapping *see* mapping
 engineering geology
 core attributes and role 273–302
 education and training 277–278, 279, 283, 284, 285, 286, 292–293, 297–301
 interaction triangle 288–289
 professional practice 273–275, 278, 279, 293–294, 298, 299–300, 301
 research and development 284, 285, 286, 298, 299, 301
 role in land contamination management 152–153, 159–165
 skills shortage in UK 277–278, 279, 280, 297–298
 environmental awareness 29, 301
 environmental change 39–40, 43, 60, 281–282, 299
 environmental costs 178
 environmental degradation 160
 environmental geology 66
 environmental geotechnics 167–176
 environmental hazards 27, 28–29
 environmental impact assessment 28, 36, 42
 environmental impact of different concretes 257
 environmental impact reduction in quarrying 271
 environmental issues 28, 178, 180, 281–282, 283, 301
 see also sustainability
 environmental legislation 33, 38
 environmental management in Malaysia 29–30
 environmental urban geotechnics 167–176
 environmentally sensitive areas 30
 erosion 18, 27, 38, 73
 hazard and risk planning 115–116, 118, 120
 potential 41
 regional modelling 55
 susceptibility mapping 40
 see also coastal erosion
 Europe
 engineering geology perspectives 287–295
 Joint European Working Group 287–290, 294, 298, 300
 European Environment Agency 26
 European Union
 geotechnical design/Eurocode 79, 289, 293
 groundwater legislation 35, 56, 60, 61
 risk-based modelling 60
 sustainable brownfield regeneration 153
 evaporation increase 70
 evapotranspiration 39, 73
 excavations
 backfilled (Nottingham, UK) 16–18
 dewatering (New York, USA) 34
 techniques for underground space use 30
 underground railways systems 215, 222, 225–240
 expert knowledge
 and geodata requirements 206, 211
 and geohazard modelling 59, 60
 in hazard and risk planning 119
 and site investigation 130–131, 143
 failure 18, 20–22, 36, 44
 consequences in urban areas 138
 see also dams; embankments; highways;
 remediation; slopes; tunnels
 fatalities, in urban landsliding 83–99
 faults 18, 20, 23, 115
 interpretation from digital data 44
 laboratory analysis of fault gouge materials 170
 reactivation during carbon storage 77
 reactivation following mining subsidence 19
 Federation of International Geo-Engineering Societies
 287, 290
 Fengjie (China) 172
 fertilizers 11, 22
 field studies, 254, 271, *see also* walkover surveys
 fill 6, 15–18, 22, 36
 cause of urban landslides 85
 characterization strategy 144
 numerical analysis of behaviour 85
 urban site investigations 132, 134, 136
 see also artificial deposits; made ground
 finance *see* costs
 Finland 37, 40
 fires 38, 204–205
 fissuring and spalling in karst 116
 Flanders (Belgium) 153
 flooding 1, 18, 21–22, 27, 28, 34, 36, 38, 101
 after groundwater abstraction 28, 34
 back analysis of flood bund 170–171
 and climate change 70, 72–73, 77–78
 defences 72
 due to ageing infrastructure assets 245
 flood potential modelling (Thames Estuary, UK) 40
 from leaking water supply pipes 117
 hazard zonation 41
 impact on infrastructure 251
 insurance claims 50
 mitigation using SUDs 77–78
 regional modelling 50, 56, 57–58, 60–61
 risk management in susceptible areas
 101–112, 245
 and UK planning system 50, 73
 vulnerability of Asian countries 282–283, 286
 see also coastal erosion; water flows
 fluvial environments and climate change 39, 72
 fluvial geomorphology 37
 fossil fuels, 26, 179–180, *see also* oil
 foundations 69–70
 and design of sustainable urban drainage systems 78
 developments in design 202–203
 on loessic soils 168–169
 probabilistic maps for depth of 211
 urban foundation conditions 37–38, 40
 urban site investigation for 127–128, 131–140
 fracturing
 permeability model 170

- site investigation 144, 145
 - tunnels 242
- France 25, 40, 153, 202, 211
- Fujairah Emirate (UAE) 115
- future climate scenario datasets 67
- future of engineering geology 273–302
- future urban trends and prospects 29–31, 180
- gas hydrates 70, 74
- gases, hazardous gases (and fluids), 14, 15, 16, 19, 23, 38, 72, 149–150, 162, *see also* contaminated land; leachates; pollution
- gases, atmospheric, 66, 70, 75–76, 286, *see also* carbon dioxide; methane
- geo-composites 171–172
- Geo-Dome concept 30
- geo-energy, data requirements for 204, 206
- geo-engineering 287–289, 299, 301
- geo-environmental modelling and prediction 43
- geo-grid reinforcement 171
- geocities 33–48
- geodata *see* databases/datasets
- geographical information systems 35, 37, 38, 40, 41, 115, 271
 - new developments 118, 209, 210–211, 252
 - see also* databases; mapping; modelling
- geohydraulic testing 293
- geoindicators 42
- geoinformatics 210
- geological model, site-specific 288–289, 299
- Geological Society of London 153
- geomechanics 287, 288
- geophysical site investigation techniques 145, 163, 192–193, 242
- geostatistics 211
- GeoSure hazard maps 50, 55
- geotechnical advisers 127, 143
- geotechnical engineering 127, 278, 300
- geotechnical investigations, European standardization 293
- geotechnical properties 12, 13, 14, 37
 - of bedrock, for concrete production 258–260
 - and climate change 69–73
 - linked 3D model 211
 - National Geotechnical Database (UK) 50
 - site investigation developments 139, 144–145
 - site investigations for tunnels (Italy) 219, 226, 230
 - see also* laboratory testing
- geotechnical subsurface and near surface behaviour 169
- geotechnical zoning 210
- geotechnics
 - environmental 167–176
 - and sustainability 174
- geothermal energy 267
- Germany 28, 37, 150, 154, 186, 189, 211, 287–295
 - engineering geology perspectives 287–295
 - see also* Munich
- GIS *see* geographical information systems
- glacial deposits 1, 6, 14, 74, 145
- glacial earthquakes 70
- glacier melt 68, 70
- Glasgow (Scotland) 42, 211
- global circulation models 67, 73, 79
- global environment *see* environmental issues
- global positioning systems 252
- Global Precipitation Climatology Centre 93–94
- global warming, 66, 281, 282, *see also* climate change
- Gong Tunnel (China) 195
- gravels, 18, 36, 217, *see also* sands and gravels
- Greece 35, 38, 116, 118–119, 144, 149, 191, 195
- green belts 33
- green revolution 30
- greenhouse gases, 28, 66, 286, *see also* carbon dioxide; methane
- Greenland 70
- greywackes 37
- ground characterization/investigation 125–141
 - Bucharest (Romania) 37
 - and climate change 69–70, 73–74
 - of contaminated land 150, 152
 - mis-reporting of 241–242
 - seismic hazards 36
 - site investigation techniques 143–145
- ground compaction evaluation 144
- ground conditions
 - Nottingham (UK) 2–3, 11–18
 - suitable for construction 36–37
 - and sustainable urban drainage systems 78
 - and UK planning system 50
 - for underground railway construction 217, 223–224, 225–226
 - in urban areas 132–136, 143–144
- ground deformation *see* displacement; settlement
- ground engineering 287, 300
 - risk-based 298
- ground freezing 225, 232–233, 235, 240
- ground improvement 119, 171
- ground models 36, 128, 288–289
- ground penetrating radar 242
- ground response to climate change 67–75
- ground source heat pumps 74, 75
- ground stabilization techniques 171–172
- ground-penetrating radar 144, 145
- ground-structure interactions 181–182
- groundwater, and climate change 27, 34, 72, 73
- groundwater abstraction 28, 34, 35
 - and flooding 34
 - and subsidence 28, 39, 116, 117, 144, 145
- groundwater basin recovery 34
- groundwater contamination 16, 22, 23, 28–29, 34, 75, 78, 162
- groundwater flow, and climate change 72, 73
- groundwater modelling 56–58, 60, 162, 170, 195
- groundwater protection legislation 22, 34, 35, 56, 60, 61
- groundwater recharge 34, 70
- groundwater resources 11, 26, 42, 78
- groundwater, rising 34, 168, 170
- groundwater sampling and measurements
 - standardization 293
- groundwater vulnerability 35, 78
- Guatemala 88, 90, 101
- Gulf Stream 67
- gypsum 3, 5, 10, 14, 20, 36, 74–75
- habitat changes 39–40, 42, 72
- Haiti 87, 101
- happiness 30
- harmony with nature 28, 42, 285
- hazard assessment for railway route selection 242–243

- hazard databases 50, 210
hazard impact assessment 112
hazard and risk identification 131
hazard susceptibility maps 210, 211
hazard zonation 22, 35, 36, 38, 41, 115, 116, 118
hazard-vulnerability-consequence framework 114
hazards
 geotechnical assessment 168–169
 planning and regulation for 265, 266, 271
 see also legislation, planning, and specific types of hazard
head deposits 6, 15, 18, 38
health risks in cities 27, 28–29
heavy metals
 pollution 149, 162, 163
 in pulverized fuel ash 15
helium 38
Helsinki (Finland) 37, 40
highways
 affected by landslide 85
 contract cost over-runs (UK) 126
 ground stabilization 172
 risk mitigation framework 243
 site investigation 144, 145
 slope stabilization 171
 tunnel serviceability failure 253
Himalaya 35, 87, 88–89, 92–93, 193, 282
historical information, records and data 131, 132–136, 243, 244, 248, 249–250, 254
historical railway assets, management and protection 245–254
historical structures *see* architectural heritage structures
Hong Kong 85, 138, 145, 182, 193, 265
household waste *see* domestic waste
housing
 increased needs 29
 insurance claims 50
 in loessic area 169
 mineral resources for 34
 preliminary studies 39
 site investigation 145
 and water supply 34
Huascarán (Peru) 85
human resources 26
humidity, underground space 31, 183
Hungary 116
hurricanes, 87, 101, 103, *see also* cyclones; storm activity
hydrocarbons 28, 150, 162
 and collapsibility of loess 169
 underground storage 183, 193, 267
 see also oil
hydrogeological cycle, impact of climate change on 39
hydrogeologists in Germany 292
hydrogeology
 strategic studies 34–35
 and sustainable urban drainage systems 78
hydrological cycle model 57, 60
hydrological engineering 29
hydrology, and sustainability, 34–35, *see also* groundwater
hydropower, underground construction 183, 193, 194
ice cores 66
India 35, 42, 87, 88, 89, 116, 144, 150, 266, 267
Indian Ocean islands 72
Indonesia 27, 28, 34, 36, 38, 42, 85, 117
industry
 and carbon sequestration 76, 77
 effects on urban environment 28
 expansion of 29, 33
 and land contamination 149–150
 and made ground, Nottingham (UK) 6
 waste disposal 29
 wastes used as fill 15–18, 22–23
 see also contaminated land; derelict sites
information dissemination, 41, 43, 298, 299, 300,
 see also communication; decision-makers
information exchange, 43, 286, *see also* datasharing
infra-red techniques 145, 261
infrastructure 241–256, 266
 affected by landslides 85–86
 Asian issues 283, 284
 costs 178
 management and protection of historical railway assets (UK) 245–254
 operators, and regional modelling 52, 55
 pre-existing on neighbouring land 134–136, 138, 143
 project feasibility 242–244
 underground 182, 185, 185–186, 189, 192, 267
 see also specific services
Institute of Environmental Management and Assessment 153
Institution of Civil Engineers 153
insurance industry 38, 50, 52, 56, 60, 109, 110
integrated assessment, in water management 35
integrated modelling 57, 60, 61, 62
intellectual property rights 60, 61, 62
‘intelligent’ classification of tunnel wall rock 212
intelligent design 183, 184
Intergovernmental Panel on Climate Change 66, 67
International Association for Engineering Geology and the Environment 157, 159, 287, 297
 Action Plan 299
International Association of Hydrologists 34
International Decade for Natural Disaster Reduction 119
International Groundwater Resources Assessment Committee 26
International Society for Rock Mechanics 287
International Society for Soil Mechanics and Geotechnical Engineering 287
Internet, 41, 43, 62, 119, 204, 205, *see also* websites
Iran 35, 36, 89, 115, 117, 189, 192, 193, 196, 242
Istanbul (Turkey) 34, 37
Italy, 37, 85, 115, 117, 163, 191, 245, *see also* Naples; Pisa; Rome; Venice
Jakarta (Indonesia) 28, 85
Japan 34, 117, 169, 182, 189, 267, 281–286
 engineering geology perspectives 281–286
 see also Minamata; Shikoku; Takamatsu
Japan Geotechnical Consultants Association 283
Japanese Society of Civil Engineers 283
Japanese Society for Engineering Geology 281, 282, 283, 284–286
Joint European Working Group 287–290, 294, 298, 300
joints 18, 20, 145, 163

- karst 13, 35, 38, 50
 - hazard and risk planning 116, 117, 118, 120, 145
 - National Karst Database 50
 - tunnelling in 116
- Kashmir 87, 88
- Kathmandu (Nepal) 85
- knowledge-based tool development 211–212
- Kunming (China) 118, 190, 242–243
- Kyoto Protocol Pact 282
- laboratory testing
 - techniques 30, 145, 169–170
 - underground railway construction 219, 230
 - underground site investigation 189, 196
- lacustrine deposits 6, 15, 44, 145
- lacustrine environment, modelling 50
- lagoons, infilled 38
- lahar deposits, for aggregates 34, 36
- Lancaster (UK) 252
- Lanchang River (China) 194
- land availability 26, 33
- land classification 35, 36
- Land Condition Record 153
- land costs 30, 33
- land degradation 29, 33, 160
- land management, 149–158, 285, *see also*
 - contaminated land
- land re-use, 132–136, 153–154, *see also*
 - brownfield sites
- land reclamation 28, 30
- land suitability 35–38, 41, 119
- land use
 - potentially contaminating 149
 - previous use 132–136, 160
- land use changes 117
 - and historic railway infrastructure 250–251
- land use cycle 153
- land use modelling 128
- land use planning, in Asia 28
- landfills 2, 16–18, 163, 180, 267
- landslides 18, 19, 35, 36, 38, 41, 101, 244
 - ‘CLIFFS’ monitoring network 61
 - and climate change 73
 - Coastal Landslide Hazard Assessment System (UK)
 - 55–56
 - hazard and risk planning 115–116, 118, 120
 - hazard zonation 41
 - and historic railway infrastructure (UK) 247
 - impact forecasting 39
 - impact of urban landslides 83–99
 - National Landslide Database (UK) 50
 - and pore water pressure 170
 - potential reactivation 115–116
 - regional modelling 58–59, 60, 61
 - risk management 101–112, 251–254
 - risk mitigation framework systems 251–252
 - risk mitigation, railway route selection 242–243
 - site investigation 144, 145
 - susceptibility mapping 40
- Las Vegas (Nevada) 25
- laser scanning 145, 170, 194, 211, 254
- Latin America 101–112
- latitude, and fatal landslides 90–91, 96–98
- leachates *see* groundwater contamination
- lead levels in schoolchildren 149
- legislation 33, 43, 73, 153, 265
 - environmental 33, 38, 42, 72, 78
 - groundwater 35, 56, 61, 69
 - see also* planning; safety
- Licensed Site Professional 153
- lignite mine reuse 271
- Lima (Peru) 27
- limestones 5, 11, 13
 - for aggregates 34
 - and climate change 74–75
 - quarried, deterioration assessment 145
 - tunnelling in 116, 191
 - see also* karst
- liquefaction strength, and micropiles 192
- literature search 191
- Lithuania 169
- litigation 143
- loess 74, 144, 168–169, 171–172
- London (UK) 28, 132–136, 137, 138, 182, 190, 195
- London Clay Formation 56, 139, 171, 189, 190
- made ground 6, 37, 143, 169
 - tunnelling in 217, 226
 - see also* artificial deposits; fill
- Malaysia 28, 29–30, 35, 37, 145, 283
- mangrove swamps 39
- Manila (Philippines) 85
- manmade deposits *see* artificial deposits
- mapping
 - 3D 36, 40, 118
 - digital 30, 50–55, 210
 - discontinuity orientation 145
 - engineering geological 36, 37, 44, 117, 210, 271
 - erosion and landslide susceptibility 37, 40
 - infrastructure 185
 - probabilistic 211
 - risk 111, 116, 118
 - rupture zones 115
 - seismic hazards 36
 - site investigation 131
 - slope maps 36, 41
 - soil expansion potential 37
 - subsurface and underground 185, 193, 194
 - of superficial deposits 40
 - thematic maps 118, 211
 - thickness of unconsolidated clays 40
 - see also* geographical information systems
- Maputo (Mozambique) 34, 37, 38
- masonry stone, weathering 172, 271
- Massachusetts (USA) 150, 153
- medical geology 27
- Mediterranean countries 27, 72
- megacities 29, 33–48
- Melbourne (Australia) 193
- metamorphic rocks, weathering effects 144
- methane 16, 66, 70, 150
- methane hydrates 70, 74
- Mexico 101, 145
- microzonation 115, 118, 119
- military use of underground space 183
- Milton Keynes (UK) 266
- Minamata (Japan) 149
- mineral resources 1–2, 26, 28, 34, 42

- mining
 - acid mine drainage 12, 19, 22
 - opencast 9, 16–18, 169
 - waste 16, 37, 65, 160, 265
 - see also* abandoned mine workings; quarries
- mining subsidence 35, 118
 - 3D modelling of mined ground 35
 - investigation and remediation 19, 22
 - reactivation due to rising groundwater 170
 - see also* abandoned mine workings
- mission statements 274, 275
- Moçambique 34, 37, 38
- modelling 37, 40, 43
 - 3D 35, 40–41, 42, 43, 55–56, 116, 140, 209, 211
 - 4D 56–58
 - ground models 36, 128, 288–289
 - groundwater 56–58, 60, 162, 170, 195
 - regional geohazard change 49–63
 - river catchments 57–58
 - for site investigation 36, 37, 128, 138, 139, 140
 - see also* climate change models; digital elevation models; digital terrain models; integrated modelling; probabilistic models; risk analysis and modelling; spatial modelling
- molasse deposits 36
- Mongolia 73
- monitoring
 - climate change and monitoring techniques 65, 73–74
 - of ground deformation 194
 - intelligent 184
 - land contamination 152
 - landslides 145
 - road cut 144
 - settlement, in organic soils 171
 - soil-tunnel-structure interactions 226–228, 235, 240
 - of urban development 114
- monsoons 89, 92, 93, 282–283
- Montevideo (Uruguay) 37
- Montreal (Canada) 30
- Montserrat 116–117
- Moscow (Russia) 35, 38, 43–44, 116, 117, 169, 210
- mudflows 38
- mudstones and mudrocks 3, 5, 6, 10, 11–14, 34, 144, 145
- multi-disciplinary supervisory teams 245
- multi-utility sustainable tunnel (MUST) 185–186, 195
- Mumbai (India) 144
- Munich (Germany) 36, 190, 191, 192
- municipal (domestic) waste 15–16, 28, 29, 37
- Nanjing (China) 117, 118, 171, 195
- Naples (Italy) 215–216, 222–240, 244–245
- National Land Use Database (UK) 154
- natural disasters
 - hazard and risk planning for 113–123
 - natural disaster potential 41
 - risk management 101–112, 113–115
- Natural Environment Research Council (UK) 57
- natural resources *see* resources
- nature, building in harmony with 28, 42, 285
- Neijiang-Kunming Railway (China) 242–243
- Nepal 84, 85, 92–98, 189, 193
- Netherlands 30, 38, 39, 44, 150, 210, 243, 244
 - engineering geology perspectives 291, 298
 - subsurface use 30, 31, 38, 186, 189, 194–195, 210
 - see also* Amsterdam; Delft
- neural network techniques 36, 192, 194
- Nevada (USA) 25
- New Hampshire (USA) 153
- New York City (USA) 34, 37–38, 43, 139, 190, 202–203
- New York State (USA) 153
- New Zealand 117
- Nicaragua 101
- nitrate in groundwater 11, 22
- nitrous oxide, atmospheric 66
- North Korea 87–88
- Norway 70, 182–184
- Norwegian Tunnelling Society 182
- Nottingham area (UK), engineering geology of 1–24
- nuclear radiation 27, 150
- nuclear waste storage 28, 181
- numerical analysis and modelling 30, 85, 169–171
 - substructures and underground space 189, 190, 191, 192, 194, 195–196
 - underground railway construction 219–222, 228–232, 235, 237–240
- Nuozadu (China) 193
- obstructions, on-site 131, 143, 244–245
- Ocean Drilling Program 74
- offshore (continental slope) instability 70
- offshore site investigation 144
- Ohio (USA) 35, 143
- oil, underground storage 183, 267
- oil contamination 150, 161, 162, 163, 169
- oil and gas extraction 11, 28, 163
- opencast mining 9, 16–18, 169
- ordnance, undiscovered 132, 138, 143
- ozone layer depletion 66, 281
- Pacific Ocean islands 72
- Pacific Rim volcanism 27, 89
- Pakistan 87, 88
- Pará (Brazil) 39
- parking, underground 267
- Particle Flow Code 190
- particle packing and concrete rheology 260–261
- Patras (Greece) 36
- paving, urban 74
- peat 6, 15, 242, 243
- peripheral settlement growth 33
- permafrost degradation 160
- permeability 78, 170
- Peru 27, 85, 101
- pesticides 28
- Philippines 27, 85, 87
- piedmont fan deposits 37
- Pietermaritzburg (South Africa) 34, 35–36, 37, 39
- piezocone tests 145
- pile load capacity 127–128
- piling 143, 172, 189, 192
- pipelines
 - affected by landslide 85
 - flooding from leaks 117
 - subsurface geotechnics 169, 180, 182
 - trenchless technology 180, 185

- Pisa (Italy) 202
- planning
 and geohazards 113–123, 265, 266, 271
 of infrastructure projects 242–244
 response to climate change 78–79
see also decision-makers; legislation
- plate boundaries, 36, 70, *see also* tectonically active areas
- Poland 72, 168–169, 171
- politics *see* social-political environment
- pollution 27, 28–29, 33, 150, 281
 and climate change 72
 issues in Asia 282, 283
 prevention 163
 and sustainable urban drainage systems 78
 and UK planning system 50
see also contaminated land; gases; groundwater contamination
- ponding 70, 75
- population, growing urbanization of 29, 132, 167, 189
- population growth 25, 33, 113, 180
 regional modelling 50
- pore water pressure 170, 225–226
- Portugal 37, 40, 41, 169, 210
- poverty 29, 33, 106, 283
- powder swelling test 145
- power station waste 15, 75
- powerhouses, underground construction 183, 193, 194
- pozzolana, tunnelling in 223–224
- Prague (Czech Republic) 191
- pre-loading with vertical drains 171
- precipitation, and climate change, 39, 67, 68, 69, 70–75, 77–78, *see also* rainfall
- predictive models 35, 36, 43, 61, 194, 215–241
- prioritization, of infrastructure repairs 245
- probabilistic maps 211
- probabilistic models 35, 58–59, 61, 62, 170
- property industry 50
- public health issues, 167, *see also* contaminated land; pollution
- public policy making, *see* decision-makers
- public understanding of geohazards and engineering geology 118, 298, 299, 300
- pulverized fuel ash 15
- pyrite 12, 16, 34, 145
- quality assurance 43, 44
- quality of urban life 27, 29
- quantum chemistry 261
- quarries 18, 22
 deterioration assessment of quarried limestone 145
 environmental impact reduction 271
 reuse of waste 162, 271
 rockfall susceptibility 118–119
 structural effects of quarrying 37
- radar interferometry 28, 65, 74, 145
- radiation risk 27, 150
- radioactive waste storage 28
- radon gas 38, 117, 120
- Railroad Commission (USA) 185
- railways
 landslide risk mitigation 251–254
see also tunnels; underground transport systems
- rainfall
 data for predictive modelling 61
 impact of intense events 61, 87–91, 95–96, 251
 vulnerability of Asian countries 282–283, 286
see also flooding; precipitation
- reclaimed land (Nottingham, UK) 6
- reclamation project (Singapore) 171
- recycling, 30, 77, 168, 271, *see also* reuse
- reflectometry, time-domain 145
- regional modelling of geohazard change 49–63
- remediation 39, 242
 of contaminated land 150, 152, 157, 162–163
 of infrastructure 241–242
- remote sensing 30, 33, 88, 145, 254, 271
- reports, engineering 118, 189, 205, 241–242
- research and development in engineering geology 284, 285, 286, 298, 299, 301
- reservoir-triggered seismicity 242
- resources 26, 33, 178, 179, 180, 181, 257–272
 impact of urbanization on 42
 increased demands on 29, 33
see also recycling; sustainability
- reuse 168, 180
 of contaminated materials 162
 of resources 30, 271
 of urban land 153–154
see also brownfield sites; recycling; sustainability
- Rhode Island (USA) 153
- Rio de Janeiro (Brazil) 89, 172
- risk analysis and modelling 35, 59–60, 112, 115, 117, 119, 128, 131, 139–140
- risk assessment 38–39, 42, 143, 212, 245, 251, 298
- risk of hidden obstacles, 244–245, 131, 143, 132, 138,
see also archaeological remains
- risk impact ranking 131
- risk management 101–112, 113–115, 168
 infrastructure systems 241–256
 land contamination 149–158, 160–161
 subsurface and underground space 189, 192–195
- risk mapping 111, 116, 118
- risk mitigation, railway infrastructure 242–243, 245–254
- risk mitigation frameworks 243–244, 251–252
- risk profiles 244
- risk registers 131, 139
- risk scenarios 111
- risk workshops 131
- risk zonation 117
- river catchments 35, 57–58, 72–73
- river-aquifer interaction modelling 57, 60
- robotic vehicles 186
- rock burst potential 194
- rock classification projects in Europe 293
- rock mass characterization 211
- rock mass classification 193–194, 196
- rock mass deformation, numerical modelling 195–196
- rock mass rating 144
- rock mechanics 203, 287, 288, 289
- rock quality for crushed rock aggregate production 258
- rock slopes 36, 170, 252
- rock strength 36, 40, 145
- rockfalls 18, 36, 244
 historic railway infrastructure (UK) 247, 248, 251
 susceptibility in abandoned limestone quarries 118–119

- Romania 36, 37
 Rome (Italy) 215–222, 237–240, 244–245
 roughness of discontinuity surface 170, 211
 Royal Institution of Chemistry 153
 runway development, China 171
 rupture zones 115, 144
 rural decline 33
 Russia, 35, 39, 117, 168, 169, 172, *see also* Moscow
- safety
 and climate change 70
 and geodata requirements 204–205
 of railway infrastructure 254
 safest locations for cities 27
 in tunnelling 30, 204–205
 urban legislation aspects 26, 28, 266
- Sahara dust 27
 saline intrusion 34, 78, 191
 salt domes 242
 San Francisco (California, USA) 193
 sands and gravels 1, 6, 10, 14–15, 18
 replacement resources 257, 271
 settlement of foundation on 127, 128
see also gravels
 sandstones 1, 3, 5, 10, 12–14, 18, 20–22, 169–170
 Santiago (Chile) 115
 Sao José do Rio Preto (Brazil) 211
 Sao Paulo (Brazil) 37, 89, 117
 Sarawak 28
 satellite technology 30, 33, 88, 145, 254, 271
 satinspar mining (Nottingham, UK) 20
 Saudi Arabia 36, 42, 171
 scaling down from global circulation models 67, 79
 scaling for regional modelling 57, 60, 61
 Scandinavia 182–184, 186, 257
 Scotland 42, 61, 211, 242, 243, 244, 251, 252–253
 scour hollows 132
 sea level rise 27, 39, 68, 72, 78
 sea-bed profiling 144
 Seaford Chalk 191–192
 seasonality 68, 73–74, 96–98
 sediment mobilization 70, 73, 83
 seismic techniques 36, 115, 193, 242
 seismicity 23, 26, 28, 36, 265
 hazard mapping 36
 hazard and risk planning 115, 116
 and hydrocarbon caverns 193
 monitoring 145
 reservoir-triggered 242
 trigger for landslides 87
 vulnerability of Asian countries 282
 vulnerability exacerbated by coal mining 118
see also earthquakes
- Senegal 35, 144
 sensitivity analysis 243
- settlement
 associated with backfilled excavations 17, 22
 associated with landfills 16
 of foundations on sand 127, 128
 hazard and risk planning 116
 micropiles and 192
 numerical modelling 195–196, 215–222, 226–232, 237–240
 on organic soils 171
 prediction 243, 244
 tunnelling-induced 215–222, 226–232, 237–240
- Shanghai (China) 28, 116
 Shikoku (Japan) 193
 Singapore 171, 182, 231
 sinkholes 116
 site investigation 28, 42–43, 125–148, 243
 developments in techniques and methods 138–139, 143–148
 effect of climate change on 69–70, 73–74
 and existing neighbouring infrastructure 134–136, 138, 143
 geophysical surveys for landfill site location 163
 hazard and risk planning 113–123, 143
 mis-reporting 241–242
 on smaller urban sites 145
 underground construction 192–193
 wind farm on peatland terrain 242, 243
- site-specific characterization 143–144, 275, 287, 299
 site-specific geological model 288–289, 299
 skills shortage in UK engineering geology 277–278, 279, 280, 297–298
- Sleipner West gas field, carbon sequestration 77
 slope instability/failure 18, 19, 26, 28, 35–36, 138, 170, 265
 hazard and risk planning 116
 index appraisal systems for soil slopes 252
 infrastructure 242
 land classification (Turkey) 35
 modelling 36, 55
 site investigation 144
 slope maps 36, 41
 stabilization 171, 172
see also coastal erosion; collapses; debris flows; landslides; rockfalls
- social-political environment
 and engineering geology 273–274, 278, 300, 301
 and sustainability 178, 180, 183
- soft ground, densification 171
 soft rocks 144, 189, 193, 195
 soil mechanics 20, 203, 287, 289
 soils 26–27, 42
 attenuation and decontamination 23, 28–29, 162, 163
 classification projects 293
 and climate change 69–70, 74
 collapsible 74, 116, 117, 120, 144, 169
 concreterious 144
 expansive 37
 index appraisal systems for soil slopes 252
 organic 72, 171
 productivity loss 39
 reinforcement 171
 residual 144, 169
 shrinkage and compressibility 35, 74
 stabilization 171–172
 testing 36, 37, 139, 189, 196
 tropical 37, 144
 weak 39, 115
see also clays and clay rocks; glacial deposits; loess; soft rocks
- solar energy radiation 66
 solution *see* dissolution
 Somerset (UK) 251
 Soumagne Tunnel (Belgium) 116

- South Africa, 42, 118, 138, 145, *see also* Pietermaritzburg
- South America 89, 101–112
- South Korea 30, 150, 172, 189, 191
- Spain 36, 37, 73, 241–242, 243
- spatial analysis and modelling 111–112, 210–211
- spatial data management system 210
- Specialist in Land Condition 153
- spontaneous combustion 16
- stability prediction 194
- standard of living 29, 106, 180
- standards and standardization projects 293, 299
- stewardship concept 274, 299
- storm activity
- and climate change 67, 68
 - trigger for fatal landslides 88, 89, 97
 - vulnerability of Asian countries 282, 286
 - see also* cyclones; hurricanes; monsoons
- strategic hydrogeological studies 34–35
- strength
- of granular materials 171
 - ground-substructure interactions 181
 - liquefaction 192
 - rock mass 36, 40, 145
 - sandstones from USA 169–170
 - see also* bearing capacity
- stress conditions, and climate change 69–70
- stress path testing, tunnels 196
- stress testing of glacial soils 145
- submarine instability 70
- subsidence 26, 27, 28, 35
- hazard and risk planning 116, 118, 120
 - insurance claims 50
 - investigation and remediation 22
 - in Nottingham (UK) 18–22
 - worst-case prediction of subsidence-strain 35
 - see also* groundwater abstraction
- substructures 189–199
- design life 180, 181, 182
 - geodata history 201–202
 - and sustainability 177–188
 - see also* infrastructure; underground space
- subsurface
- geodata requirements 204, 205, 206
 - geotechnical behaviour 169, 181–182
 - risk analysis procedures in Russia 35
 - site investigation 192–193
 - see also* displacement; ground movement; settlement
- sulphate attack on concrete 12, 14, 16
- sunspot activity 95
- superficial deposits 1, 6, 14–15
- creep and failures of gravels 36
 - investigation in Russia 35
 - mapping and DEM 40
- susceptibility zoning 36
- sustainability 30, 31, 41–42, 152, 153–154, 159, 280
- and climate change 72
 - concrete from bedrock resources 257–263
 - and hydrology 34–35, 40
 - infrastructure projects 243, 244
 - key aspects of 42
 - management of oil and gas reserves 163
 - models incorporating 153, 174, 178–179, 180
 - subsurface and underground space 177–188, 189, 195
- sustainable urban drainage systems 77–78
- Suzhou (China) 116
- Sweden 27, 257–263
- Switzerland 38, 44, 70, 194, 291
- SWOT analysis 118
- Sydney (Australia) 25
- Tajikistan 86
- Takamatsu (Japan) 115
- tectonically active areas, 36, 70, 89, 93, 94, 115,
see also seismicity
- Tehran (Iran) 36, 193
- telecommunications, underground centre 183
- temperature and climate change 39, 67, 68, 70–72, 74
- temperature in underground space 31
- Thailand 28
- Thames River and Estuary (UK) 40–41, 134
- thermohaline circulation 67
- Three Gorges Project (China) 115–116, 118, 172
- Tianjin (China) 116
- tills 1, 6, 14, 74, 145
- time-domain reflectometry 145
- time-series data 56, 58–59, 206
- Toronto (Canada) 30
- training *see* education and training
- trenchless technology 180, 185
- Trent River (UK) 1, 3, 6, 10, 14–15, 18
- tropical regions, fatal landslides in 88, 89, 92, 93,
96–98
- tsunamis 27, 28, 36, 38, 70, 282, 286
- tuffs, tunnelling in 223–224, 225, 232, 235, 245
- tunnelling 28, 131, 181, 185, 189, 190–192, 194
- bedrock problems 34, 37
 - decision-making tool 211–212
 - dewatering (New York) 34
 - effect of swelling in soft rock 144
 - environmental impact assessment 36
 - in karst 116
 - monitoring 194
 - for railway construction (Italy) 215–241
 - safety 30, 204–205
 - for sustainable underground structures 181, 183, 184,
185–186
 - in tuffs 223–224, 225, 232, 235, 245
- tunnels
- failure and risk mitigation 138, 143, 242, 243,
245–251
 - linings 191–192, 194, 205, 242
 - remedial measures 242
- Turkey, 35, 36, 115, 117, 144, 189, *see also* Ankara;
Istanbul
- typhoons 87–88
- Ukraine 150
- ultrasonic testing methods 271
- uncertainties
- site investigation 127–130
 - underground working 180, 192, 215
 - see also* risk of hidden obstacles
- underground space 26, 28, 30–31, 33, 177–199, 267, 271
- geodata requirements 204, 205, 206
 - interaction with existing substructures 38,
194–195, 271
 - and sustainability 177–188, 195

- underground space (*Continued*)
 uses 30–31, 38, 178, 183–184, 195, 267
see also caves and cavities; substructures; subsurface
- underground storage 28, 76–77, 184, 267, 286
- underground transport systems 181, 185–186, 190, 191–193, 195, 215–241, 267
- United Arab Emirates 115
- United Kingdom
 Coastal Landslide Hazard Assessment System 55–56
 development planning system 50
 engineering geology in 277–280
 Engineering and Physical Sciences Research Council 39, 61, 179, 185
 flood risk assessment legislation 73
 Foresight Initiative 180
 hazard susceptibility maps (GeoHazarD) 210, 211
 Highways Agency Geotechnical Data Management System 245, 251
 management of historic railway infrastructure 245–254
 maps and mapping 50, 131, 132, 134, 185
 national geological databases 50
 National Land Use Database 154
 planning and policies on climate change 78–79
 planning and policies on coastal management 49–50
 planning and policies on contaminated land 150, 153, 163
 planning and policies on land instability 265
 sustainability initiatives and programmes 178, 179, 180
 Tyndall Centre for Climate Change Research 59
 UK Climate Impacts Programme 67
 UK Site Investigation Steering Group 125
see also Abbeystead; Arun; Bristol; Devon; Lancaster; London; Milton Keynes; Nottingham; Scotland; Somerset; Thames; Trent; Wales
- United Nations Environment Programme 78
- United Nations Population Division 29
- United States
 contaminated land policies 150, 153, 161, 163
 engineering geology perspectives 273–276
 strength of sandstone samples 169
 US Geological Survey (USGS) 56
see also Alaska; California; Colorado; Connecticut; Massachusetts; Nevada; New Hampshire; New York; Ohio; Rhode Island
- universities *see* education and training; research and development
- unsaturated zone and climate change 70–72
- upland areas and climate change 39
- uranium 27
- 'urban', definition of term 84
- urban environment 132–140
- urban equity 29
- urban expansion 119, 266
- urban planning and zoning 27
- urban population growth 29, 132, 167, 189
- urban regeneration 298
- urban shrinkage 33
- urbanization 25–27, 27, 39, 42, 117–118
- Uruguay 37
- vacant land, 33, *see also* brownfield sites
- Variscan orogeny 3, 5–6
- vegetation changes 38, 39–40, 73, 74, 97
- vegetation for slope stabilization 171
- velocity density model (Iran) 36
- Venezuela 101
- Venice (Italy) 28
- vertical electrical sounding, for landfill site location 163
- volcanism 27, 36, 101
 and climate change 70
 hazard and risk planning 111–112, 116–117, 119–120
 monitoring 145
 regional modelling 58
- vulnerability
 of Asian countries to hazards 282–283, 298
 earthquake vulnerability index 117
 planning and assessment 30, 59–60, 113, 119, 265
 and risk management 102, 103, 104–108
- wadis 36
- Wales, 150, 163, 244, 251, 253, *see also* Aberfan
- walkover surveys 127, 130, 131, 144, 254, 271
- warning measures/systems 41, 114
- waste disposal 28, 29, 33, 168, 265, 267, 271
 colliery waste 16, 65, 160, 265
 contaminated waste, 149–150, 161, 162, *see also* contaminated land; pollution
 underground storage 28, 76–77, 184, 267
 use as fill 15–18, 22
- wastewater treatment, underground plants 184
- water balance studies 34
- water flows
 historic railway infrastructure (UK) 247, 248–249
 in tunnels 190–191, 195, 224–226, 239–240, 242
- water leakage detection 145
- water management, integrated assessment 35
- water quality, effect on construction materials 34
- water resources 26, 34–35, 36, 37, 42
 Asian monsoon area 282–283
 and climate change 68, 78
 in developing countries 34–35, 43
- water table
 level fluctuation 75
 lowering 116, 132, 138
 modelling rise of 58
 perched 37
 and tunnelling 225–226, 239–240
see also ground freezing; groundwater
- water-ground interaction in urban environment 171
- waterlogging 38
- weak rocks 144, 190
- wealth 29
- weathering
 of building stones 172, 271
 impact of climate change 69, 70–72
 influence on geotechnical properties 144–145, 169
 and landslide susceptibility 97–98
 and Nottingham (UK) deposits 13, 14
- websites
 climate change scenario information 66
 ground source heat pump data 75
 site investigation resources 131, 138, 210
see also Internet

wetland habitats, and climate change 72
wind farm site investigation 242, 243
winds, and climate change 67, 68

Ya-an (China) 242

Yalong River (China) 194

Yangdok (North Korea) 87–88

Yangtze River (China) 115–116, 118, 191

Yemen 36

Yogyakarta (Indonesia) 34, 36, 38, 42

Zhangjiu River (China) 190

Zhegu Mount (China) 211–212