## Index

Aarhus Convention 153
absolute priority concept 109
academic research projects 160
accelerated learning 263
ACSL 333
adaptive community learning 181–2, 201–3
adaptive management 15–16, 220, 263, 265–6, 283, 284–5
Africa
approaches to IWRM 11–12
water pollution/scarcity 31–2
wildlife parks 299–300
Agenda 21 4, 72, 74–5
agent based modelling/models (ABM) 193, 194, 197, 271, 293, 307
Agreement on Government Procurement (AGP), GATS 28, 34
agriculture
contamination of crops 302
expansion of 281–2
pollution from 31–2, 119
algae problems 135–42
allocation
alternatives for 120–21
case study 208–13
optimal 303–4
policies 304
process, France 29
allocation policies, Gwydir/Namoi river basins 208–9
participatory management tasks
209
participatory methods 209–13
alternatives, definition of 136
analyses, ISM 275–6
Analysis Matrix (AM) 85–6
analysis methods/tools 79–81
modelling/evaluation 85–6
Analytic Hierarchy Process (AHP) 110, 112, 118, 122
application development systems 327, 343
application domain specialists 236, 258
application programming interface (API) 329, 331
archiving functions 334
Army Corps lake projects, Australia 198
artificial water bodies, WFD 57–9
artificial watercourses 48–50
Asia
approaches to IWRM 12, 20
water pollution 32
assessment methods/tools 81–3
dynamic and integrated DPSIR-DSS tool 86–8
see also integrated assessment
attributes, definition of 101
Australia
allocation 190–92, 208–13
approaches to IWRM 10–11, 20
TIME initiative 336–9
automatic data loggers 243
averaged system outcomes 293
base models 207–9
Basin Development Plan, Mekong River Commission 12
Bayes, Thomas 313
Bayesian belief networks 313–17
behaviour definitions 201–3
bias 15, 220–21
bid-auction system 36–7, 41
biodiversity impact assessment (BIA) 81
biogeochemical cycle 48–9
models 300–301
biological indices/surveys 61–2
Borda technique 94–5
boundary conditions 238, 274–5
Bruntland Report 4, 5
Buenos Aires Water Concession 39
<table>
<thead>
<tr>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build, Own, Operate, Transfer (BOOT) system 29</td>
</tr>
<tr>
<td>built-in functionality 250, 251</td>
</tr>
<tr>
<td>C++ 248, 341-2</td>
</tr>
<tr>
<td>calibration 259, 295</td>
</tr>
<tr>
<td>calibrators 341</td>
</tr>
<tr>
<td>California, water project management agencies 29</td>
</tr>
<tr>
<td>Candellara Canal, Italy 91, 93</td>
</tr>
<tr>
<td>capacity building workshops 184, 211, 213</td>
</tr>
<tr>
<td>card sorting 184</td>
</tr>
<tr>
<td>cardinal ranking 115-16</td>
</tr>
<tr>
<td>case studies</td>
</tr>
<tr>
<td>algae problems 135-42</td>
</tr>
<tr>
<td>integrated scenario modelling 279-80</td>
</tr>
<tr>
<td>irrigation management 189-98</td>
</tr>
<tr>
<td>OPENMI modelling 339-40</td>
</tr>
<tr>
<td>overview of 20-21</td>
</tr>
<tr>
<td>sharing visions 189-93, 198-203</td>
</tr>
<tr>
<td>TIME modelling 336-9</td>
</tr>
<tr>
<td>transboundary management 189-93,</td>
</tr>
<tr>
<td>213-16</td>
</tr>
<tr>
<td>TWOLE 340-43</td>
</tr>
<tr>
<td>urban water management 189-93,</td>
</tr>
<tr>
<td>203-8</td>
</tr>
<tr>
<td>water allocation 189-93, 208-13</td>
</tr>
<tr>
<td>water management 143-8</td>
</tr>
<tr>
<td>catchment boundaries 288</td>
</tr>
<tr>
<td>Catchment Management Boards 212</td>
</tr>
<tr>
<td>catchment modelling toolkit 336-9</td>
</tr>
<tr>
<td>catchment scale hydrological models 296</td>
</tr>
<tr>
<td>catchment systems, sustainability in 263-4</td>
</tr>
<tr>
<td>causal modelling 185</td>
</tr>
<tr>
<td>centralised management 29-30</td>
</tr>
<tr>
<td>Chile, Maipo River Basin 311</td>
</tr>
<tr>
<td>choice models 305-6</td>
</tr>
<tr>
<td>choice phase 92-5</td>
</tr>
<tr>
<td>circulatory systems 48</td>
</tr>
<tr>
<td>climate variability 274-5</td>
</tr>
<tr>
<td>closed-loop control 268, 273</td>
</tr>
<tr>
<td>cognitive mapping 185, 205-8, 217</td>
</tr>
<tr>
<td>collective skills 183</td>
</tr>
<tr>
<td>communication 218, 283</td>
</tr>
<tr>
<td>compartmentalism 263</td>
</tr>
<tr>
<td>competition</td>
</tr>
<tr>
<td>introduction of 28</td>
</tr>
<tr>
<td>under GATS rules 40-41</td>
</tr>
<tr>
<td>competitive pressure 37</td>
</tr>
<tr>
<td>complete ranking 115-16</td>
</tr>
<tr>
<td>complex models 310-12</td>
</tr>
<tr>
<td>component-based software 327-8</td>
</tr>
<tr>
<td>components, software</td>
</tr>
<tr>
<td>data storage/manipulation components 331-2</td>
</tr>
<tr>
<td>decomposition of software into</td>
</tr>
<tr>
<td>328-31</td>
</tr>
<tr>
<td>in existing models 247</td>
</tr>
<tr>
<td>knowledge representation components 332</td>
</tr>
<tr>
<td>modelling components 332-4</td>
</tr>
<tr>
<td>operational components 334-5</td>
</tr>
<tr>
<td>re-use of 20</td>
</tr>
<tr>
<td>user interface components 335-6</td>
</tr>
<tr>
<td>compromise 264-5</td>
</tr>
<tr>
<td>compromise programming (CP) 104,</td>
</tr>
<tr>
<td>106-7, 121, 122, 272</td>
</tr>
<tr>
<td>conceptual frameworks 74, 76-9, 84-5</td>
</tr>
<tr>
<td>conceptual models 296, 325-6</td>
</tr>
<tr>
<td>concession of water management 40</td>
</tr>
<tr>
<td>concordance index 114-15</td>
</tr>
<tr>
<td>concrete processes 325-6</td>
</tr>
<tr>
<td>conditional probability tables (CPTs) 313, 315-16</td>
</tr>
<tr>
<td>conditioning see data-assimilation</td>
</tr>
<tr>
<td>confidentiality 168</td>
</tr>
<tr>
<td>conflict, potential for 265</td>
</tr>
<tr>
<td>Consent Decree Orders, US Federal</td>
</tr>
<tr>
<td>District Court 199</td>
</tr>
<tr>
<td>constraints, method multi-objective programming 105</td>
</tr>
<tr>
<td>construction processes 326</td>
</tr>
<tr>
<td>consultation processes 154</td>
</tr>
<tr>
<td>contamination 119, 301-2</td>
</tr>
<tr>
<td>continuous methods 120</td>
</tr>
<tr>
<td>multi-criteria objectives 132</td>
</tr>
<tr>
<td>problems 121</td>
</tr>
<tr>
<td>controllable drivers 7</td>
</tr>
<tr>
<td>controllable influencing variables 273-4</td>
</tr>
<tr>
<td>Cooperative Research Centre for</td>
</tr>
<tr>
<td>Catchment Hydrology (CRCCH) 337</td>
</tr>
<tr>
<td>Cooperative Research Centre for</td>
</tr>
<tr>
<td>Cotton 211</td>
</tr>
<tr>
<td>cost-benefit monitoring/analysis 189</td>
</tr>
<tr>
<td>Council of Australian Governments (COAG) 10-11</td>
</tr>
</tbody>
</table>
coupled complex models 310
coupling mechanisms, existing models 244, 247
Cour des Comptes, France 38
criteria, selection/definition of 137
Criterium DecisionPlus 3.0 134
crops, water consumption of 120
cross-model compatibility 333
culture 201, 217
cumulative effects assessment (CEA) 81
curve number approach 294
Danube, River 158
data exchange difficulties 250–51
harmonisation/interoperability 332
processing techniques 236–7
social surveys 284
data quality, maintenance of 244
data storage/manipulation components 331–2
data warehouses 326
data-assimilation 259
data-based models 291, 294, 295–6, 306
Decision Explorer 3.2 134
decision making, IWRM 12–14, 71–3
methodology for 84–8
modelling for 290
objectives 131–2
supports for 73–83
see also multi-criteria decision making
decision support systems (DSS) 16, 83, 86–8, 95, 209, 211–12, 217, 290, 318
decision variables, definition of 101
decisions, ownership of 156
declarative modelling 333–4
decomposition 112–13
DEFINITE
Jisperveld case study 143–8
multi-criteria decision making 133–42
overview 19
DellWLS 244
demand models 306–7
demand nodes 311
Department of Statistics, Ministry of
Agriculture, France 36
descriptive indicators 75, 79
design phase 89–92
design processes 326
Destra Piave Reclamation Board, Italy 88
deterministic models 239
developing countries
public participation 170
water pollution/scarcity 31, 119
digital mapping tablets 243
disciplines, integration of 7, 12–14, 308
discordance index 114–15
discrete choice problems/solutions 120, 121, 133–4
discrete multi-criteria methods 132
displaced ideal method, compromise
programming 107
diversity, respect for 162
DLLs 337
documenting functions 334
domain objects 341
dominance index 117
double-loop learning 161, 162
down-scaling routines 257–8
downstream use/users 171, 303
DRASTIC 245
drivers, integration of 7
Drivers-State-Response (DSR) system 77
driving force indicators 90
Driving Force-Pressure-State-Impact-
Response (DPSIR) framework
52–3, 76–9, 84–92, 95
Dublin Core ontology 332
Dublin Statement (1992) 153
Duero, River 190–92, 213–16
dynamic environmental models 251
dynamic modelling scripts 251–6
dynamic models 292, 295–7, 299–300, 304, 305
dynamic spatial models 237–40, 249
dynamic validation 196
Earth Summit (1992) 4, 72, 74–5
eco-efficiency indicators 75–6, 79
EcoBas 334
ecological criticisms, EU policy 58–9
ecological modelling approaches 297–8
biogeochemical models 300–301
ecotoxicological models 301–2
modelling population dynamics
299–300
trophic networks 298
ecological perspective, water management 52–4
ecological status, WFD 57–8, 59–60, 61, 62, 63–4
ecological-economic system, privatisation/interaction in 37–8
ecology of surface water 48–52
economic-ecological system, privatisation/interaction in 37–8
ECOPATH 298
Ecosystem Management Decision Support (EMDS) 134
ecosystem models 301
Ecosystem Services Database 334
ecotoxicological models 301–2
effect models 301–2
efficiency 35–7
efficient solutions 104–5, 106–7
ELECTRE 114–16, 118, 122, 134, 142, 272
element-based spatial models 292
Emission Limit Value (ELV), EU River Basin Management Plan 57
empirical data, application of 243
England, River Tyne Catchment 312
environmental aims 37–8
environmental data 326
environmental engineering projects 91
environmental health impact assessment (EHIA) 81
environmental impact assessment (EIA) 81–2
environmental modelling languages 247–8, 250–51
Environmental Protection Agency, USA 10
environmental quality, changes in 305–6
EPIC model 312
equity 35–7, 39
error accumulation 275, 278
ESRI 251
MapObjects 332
ethics 15
Europe
privatisation 35
water pollution 31
European Commission
5th Framework Programme 339
INSPIRE initiative 332
European Environmental Agency (EEA) 75–6, 77, 78–9
European Union
assessment of water status 60–62
ecological criticisms 58–9
history of water management 54–5
plans/programmes 59–60
regulations 150, 302
see also Water Framework Directive
eutrophication models 301
evaluation 85–6
of participatory approaches 14, 167, 219–20
research 15
Evaluation Matrix (EM) 85–6
evaluation techniques, stakeholder participation 187–8
cost-benefit monitoring/analysis 189
experimental observation/comparison 189
innovation assessment 188
participant surveys/interviews 188–9
project documentation 189
sustainability matrix 188
EValue procedure 140
Evanix method 142
excretory systems 48
experimental observation 189
exploratory data analysis (EDA) techniques 244
Exploratory Modelling 247, 252
exploratory power of models 235
exploratory simulation/optimisation 271–3
external evaluation 189
external process managers 165
fairness 35–7
fate models 301–2
fen meadow areas 143–4, 145, 148
field data
model inputs for 256–9
model structure for 240–41
software tools for 243–4
fish migration 121
FLEUR 312
flood control/protection 119, 171
flow-control structures 333–4
Flumen Monegros irrigation area, Spain 121
Index

focus groups 184, 185, 214–16, 217
forecasting 289–90
Foresight for Lanier workshops 200–203
formal meetings 166
Fortran 248
forward models see dynamic models
France
   outranking methods 114
   price equity 36
   privatisation 29, 30, 38
   urban water management 35
   functional management concept 59
   functionality of software 236
   fuzzy sets 117–18, 121
gender analysis 164
General Agreement on Trade and Services (GATS) 28
   commitments under 37–9
   general features 32–3
   ongoing processes 33–5
   rules 40–42
General Algebraic Modelling System (GAMS) 333, 335
Generale des Eaux 35
generic purpose scripting languages 249
Geoffrion 333
Geographical Information Systems (GIS)
   in multi-criteria decision making 119, 133
geological layers 245
Geostatistical interpolation routines 243–4, 257
Germany
   river bank maintenance 171
   urban water management 35
global models 302
GMS 245
goal programming (GP) 104, 107–9, 118, 122
goals
   definition of 101
   reflection on 161–2
   government decision making 154
government procurement 33–5
GPS 243
Grand Anse, Grenada, algae problem 135
   multi-criteria analysis 137–42
   problem definition 136–7
   report 142
   sensitivity analysis 142
   graphical modelling languages/systems 249–50
   graphical user interface (GUI) 256, 329, 335–6, 337, 338
   GRASS 251
   Grenada, Grand Anse 135–42
   Grid 344
   grid-based models 292, 296–7, 312
groundwater contamination 119
   groundwater management 9, 121
groundwater protection programs 244–5
   group decision making 124
   group model building 181
group systems 133–4
   GSLIB 257
   Guardiana, River 190, 213–16
   Gwydir, River 190–92, 208–13
Haeckel, Ernst 297
Harmoni/COP project 183
Hengelo, groundwater quality mapping 245
   heterogeneous information retrieval 13–14
   hexagon method 185
   hierarchic analysis 112–14
   hierarchical data format (HDF) 331
   high level policy-making bodies 84
   HIPRE 134
   Hiview 134
   Hodgson’s approach, cognitive mapping 207
   Hofstede’s theory 159–60
   house building 314, 316
   hydrocommons 288
   hydrological modelling approaches
      IHACRES 295–6
      NRCS curve number approach 294
      overview 20
   TOPOG 296–7
   hydrological modelling software tools 235–7
dynamic spatial models 237–40
   estimation of inputs/parameters 256–9
existing models 244–7
high volume tools 243–4
model construction inside GIS 250–56
model construction outside GIS
247–50
model development cycle 240–43
hydrological models 117, 296
linking of 339–40
IBERAQUA project 213–16
ideal solutions 106–7
IDRISI/IDRISI 3.1 134, 243, 251, 257
IHACRES model 295–6
ILWIS 134, 243
image processing software 243
impact assessments 81–3
indicators 74–6
assessment/measurement of 326
definition process 329–30
management of 84–5
individual-based models see agent-based models
individualism 158
inflows 98–9
informal participation 154
Infrastructure for Spatial Information in Europe (INSPIRE) 332
infrastructure investments 49
initiation phase, public participation 167
innovation assessment 188
input-output models 267–70, 304
Input-Output-Outcome-Impact framework 76
inputs
probability distributions 277
software for estimation of 256–9
Institute for the Environment (IFEN), France 36
Institute of Ecosystem Studies (IES) 298
institutional changes 32–5
institutional frameworks 29
institutional pressures 4–5
institutions 15
instream uses 311
integrated assessment (IA) 185, 215–16, 264, 265–7, 279, 283, 284–5
integrated assessment modelling (IAM) 53, 80, 85–6, 87–8, 95
model integration 267–71
Integrated Catchment Management, Australia 11
integrated decision making/knowledge
12–14
integrated modelling 263–4
assessment/scenario modelling 265–71
benefits/difficulties of ISM 280–83
differing treatment of ISM 279–80
enhancing prospects for IWRM 283–5
key considerations for ISM 271–9
practical approach to identification of sustainability 264–5
problems of 287–8
Integrated Modelling Toolkit 336
integrated models 307–17, 324–5
integrated process models 267–70, 271
integrated reservoir management tools 340–43
Integrated Scenario Modelling 16, 20, 263–4
broad objectives of 274
differing treatment of 279–80
exploratory simulation and/or optimisation 271–3
insights 281–2
interpersonal matters 282–3
involvement in modelling 281
key modelling considerations 274–5
miscellaneous considerations 278–9
scales/nodes of analyses/outputs 275–6
software 282
stakeholder involvement 281
types of scenarios/indicators 273–4
uncertainty/sensitivity needs 276–8
integrated water resources management approaches/tools for 15–16
by doing 17
challenges in 12–17
decision making in 71–3
definition of 8
ecological perspective 52–3
enhancing prospects for 283–5
Europe 54–62
international approaches 8–12
methods for integration of models 307–17
nature of 5–8
principles 71–2
Index

integration 6–8
issues 17–18
methods for IWRM 307–19
intensive agriculture, role of 31–2
Interactive Component Modelling System (ICMS) 337
interactive software 132–3
interdisciplinary research 12–14
interface specification problems 333
interlinked data 313–17
internal process managers 165
internal software architecture 328
internal waters, Italy 62–3
international approaches to IWRM
Africa 11–12
Asia 12
Australia 10–11
Europe 9
US 9–10
International Centre for Living Aquatic Resources Management (ICLARM) 298
international level public participation 167–9
International Standards Organisation 62
international trade in services, GATS commitments 32–5
internationalisation of markets 55
interpersonal matters, ISM 282–3
interpolation routines 257–8
interviews 186, 188–9, 210, 213
inverse modelling procedure 257, 258–9
irrigation management, Senegal participatory management task 193–4
participatory methods 194–5
strengths/weaknesses 195–8
irrigation schemes 170–71
issues, integrated treatment of 308
Italy application of EU Water Framework Directive 63–4
environmental reporting 78
quality management of internal waters 62–3
see also Venice Lagoon watershed study

Java 340, 342
Java 2 Enterprise Edition 336
Java Beans 335
Jisperveld, Netherlands, water management 143–8
Jordan strategic planning 122
water scarcity 119
key modelling considerations, ISM 274–5
knowledge representation components 332
kriging 257
Lakemaker 336
Land Development Department, Thailand 281
Land Reclamation Boards, Italy 88–9
landscape models 301–2
language building blocks 251
Lake Lanier 190–92, 198–203
Law 139/76 (Legge Merli), Italy 62
Law 152/99, Italy 63
Law 183/89 (Legge Galli), Italy 62–3
leadership, public participation 162
learning by modelling 182
lexicographic goal programming (LGP) 108–9
linear programming model 103–4
linear standardisation 138
local decision makers 84
local management water systems, changes to 30–31
Logical Decisions 5.1 134
loose coupling 244, 247
low-level programming languages 248–50
lumped spatial models 250, 291, 294, 295–6, 298, 306
lumped temporal models 292, 294, 298, 304, 305, 306
MacBeth 134
MacKay type models 301
Mac Chaem catchment study 279, 280
Maggiore (Verbano), Lake 342
mailouts 211
Maipo River Basin, Chile 311
multi-attribute utility theory 142, 272
multi-criteria analysis (MCA) 266, 272
methodology 80–81, 95
ranking 140–42
standardisation 137–40
techniques 86
weighting 140
multi-criteria decision making (MCDM) 85, 98–118, 123–4, 129–30
applications 118–22
see also software tools
multi-criteria preference index 116–17
multi-objective decision approach (MODM) 101–4, 121–2
compromise programming (CP) 106–7
goal programming (GP) 107–9
multi-objective programming (MOP) 104–5
multi-purpose water use 98–9
MURMUR 332
Murray-Darling Basin, Australia 208
Namoi, River 190–92, 208–13
national culture 156–9
national level public participation 168
nationalisation 40–41
natural equilibrium 53
natural monopolies 36, 40, 41
natural watercourses 48–50
nearest neighbour interpolation 257
NELUP (NERC/ESRC Land-use Programme) 312
Netherlands
flood protection 171
groundwater quality mapping 245
water users’ associations 156
see also Jisperveld
new models, programming 247–50
Nile River Strategic Action Program 11–12
Nitrate Directive (91/676/EEC) 55
node-link systems 310–12
non-government organisations (NGOs) 160, 163, 166, 167, 168, 169
non-inferior set estimation model (NISE) 105
non-linear standardisation 138–9
non-model-based assessment methods 267
non-spatial models 237–9, 250, 291, 305, 306
non-temporal models 292, 306
normalisation procedure 86, 108–9
NRCS curve number approach 294
numerical behaviour definitions 201–3
numerical environmental models 235–40, 242
numerical integration routine 333–4
numerical models 298
numerical recipes 249
Object Modelling System 336
object-oriented technology 341
objective function 258–9
objectives, definition of 101
observer status 169
off-the-shelf models 242, 245–7
Office of the National Water Resources Committee, Thailand 281, 336
offstream uses 311
one-dimensional dynamic models see non-spatial models
Ontoknowledge project 332
Ontoweb project 332
Open Modelling Engine (OME) 337
open spaces 166
open-loop control 268
optimisation 273
OPENMI (Open Modelling Interface and Environment) 339–40, 343
operational components 334–5
operational decision making 119–21
operational processes 326–7
optimal allocation 303–4
optimal solutions 107–8, 120
Optimal Territorial Areas, Italy 63
optimisation 271–3, 277
optimisation algorithms 305
optimisation-based models 102, 290, 311
optimisers 341
Order Weighting Average (OWA) method 93
Organisation for Economic Cooperation and Development (OECD) 77, 78
Our Common Future 4
outcomes, differentiation of 16, 284
outflows 98–9
privatisation 28, 29–31, 34–9, 53–4
problem definition, multi-criteria decision making
assessment of scores 137
definition of alternatives 136
selection/definition of criteria 137
problem formulation 89
problem structuring 133–4
problematic information 162
process design, public participation 167
process managers, public participation 165
process-based models 291, 296–7, 304, 305
process-oriented logic 75
process-oriented models 267–70, 271
production models 303–4
programming
model construction inside GIS 250–56
model construction outside GIS 247–50
use of existing models 244–7
programming languages 247–50
programming tools 327
project documentation 189
project organisation 165
Prolog 333
PROMETHEE 116–17, 122, 272
Protégé project 332
public consultation, Australia 10–11
public good, water as 27–8
public participation, IWRM 7, 14–15
choice of methods 166
goals 155–6
organisation of 163–7
overview 19
process managers/project organisation 165
purpose 163–4
in research 159–60
roles/rules 165
scale issue 167–70
scope 165–6
social learning 160–63
stakeholder analysis 164
timing 166
see also water users’ associations 170–71
public representation 162–3
public sector 29–30
purification 49–50, 51–2
qualitative data 120
quality assurance 16–17
quality indices 64
quality issues 119
surface water 48–52
quality management, Italy 62–3
quality monitoring 60–62
quality safeguards 53–4
quality standards 55
quantity regulation 38
quasi-criteria 116
questionnaires 184, 188–9, 200–203, 215
rainfall run-off modelling 251–6, 297
ranking 140–48
reciprocal determinism 182–3
reciprocity 162
Red Bluff diversion dam, Spain 121
reference environments, WFD 58, 59–60, 63–4
Regime method 142
region-based production models 303–4, 305
region-based spatial models 291–2, 296
regional economy, impact of changes 303–4
Regional Watershed Coordination teams, US 10
regional-scale production models 303–4, 305
remote sensing techniques 243
reports 16–17, 142
representative farm models 304–5
research
constraints 278–9
current/future 341–2
evaluation of 15
public participation in 159–60
research models 290–91
reservoir management 119, 120, 121
tools for 340–43
resource constraints 278–9
response exercises 183–4
response options 85

Rhine, River 168
riparian zones 51–2
risk attitude 274
risk-based optimisation 272
river bank maintenance 171
River Basin Authorities, Italy 62–3
river basin districts, EU 56–7, 169–70
River Basin Management Plans, WFD 9, 57, 60
river basin organisations 168
river basin planning 119
river basins
integration of 6–7
public participation in 167–70
rivers, WFD categorisation of 57–60
role-playing games 186–7, 194–8, 205–8, 217
roles, public participation 165
rule-based function 238
rules, public participation 165
rural water provision, Australia 10
scale
choice of 288
integration of 308–9
public participation 167–70
selection of 275–6
transfer 258
scaling up 297
scarcity 31–2, 119, 121
scenarios 273–4, 324–5
science 12–14, 15
scripting languages 249
SCS curve number approach see NRCS
curve number approach
security of supply 203–4
self-organising integration frameworks 271
self-purification 49–50, 51–2
self-regulation, watercourses 51–2
Semantic Web 334
semi-distributed modelling approaches 310–12
semi-structured interviews 186, 210
Senegal, irrigation management 190–98, 217, 220
Senegal, River 190–92, 193–8
sensitivity analysis 142–3
sensitivity needs, ISM 276–8
service sector, GATS commitments 32–5
sewage systems 135
shared watercourses, Africa 11
sharing visions, Lake Lantier/Chattahoochee watershed 198–9
participatory management tasks 199–200
participatory methods 200–203
SHE model 312
Sicily 122
Simple Additive Weighting (SAW) method 93
Simscript 333
simulation 271–3
errors 276–8
simulation-based models 290
simulators 341
single organism models 301
single sector approach to quality standards 55
single-loop learning 161
ski pistes 251–6
social equity 35–6
social impact assessment (SIA) 81
social learning
concept of 160–61
contribution of research 160
definition of 156
leadership/facilitation 162
modelling for 290
principles 161–2
promotion of 171
representation 162–3
stakeholder participation 182–3
Social Learning Group 178–9
social sciences 267, 284, 287–8
social-relational activities 161
socioeconomic drivers 89
socioeconomic issues 87–8
socioeconomic modelling approaches 302–3
agent-based models 307
choice models 305–6
impact of changes on regional economy 304
impacts of change on industries/producers 303–4
representative farm (household) models 304–5
urban water demand models 306–7
software
classification of components 331–6
decomposition in components 328–31
role of 325–7
software applications 328
software development 282
software engineers 236, 249
software tools for IWRM management 324–5
case studies 336–43
classification of components 331–6
current/future research 341–2
decomposition into components 328–31
development of applications 336
monolithic software 327–8
role of 325–7
time modelling environment 336–9
software tools for multi-criteria decision making 131–4
presentation of results 143–8
problem definition to report 135–42
see also hydrological modelling software tools
software workshops 211
South America, water pollution 32
Southern African Development Community (SADC) 11
space, treatment of 291–2
Spain
reservoir management 121
transboundary management 190–92, 213–16
urban water management 35
spatial database systems 243
spatial decision support systems 133–4
spatial functions 251–6
spatial lumps 310–11
spatial models 237–40, 250, 251, 291–2, 294, 295–6, 298–9, 306
spatial planning 245
spatial trade-offs 304
spatially lumped models 295–6
spatio-temporal data 243
stakeholder analysis 80, 164, 165, 167
stakeholder participation 177–8
case studies 189–216
ISM 281
lessons from case studies 217–21
overview 19
participatory methods 178–80
participatory processes/methods/evaluation 181–9
versus public participation 155
stakeholders
identification of 163–4
integration with 309
views of 282–3
standard algorithms 249
standardisation 137–40
standardisation procedure 86
state indicators 90
state-space models 270–71
steering committees 187, 210
STELLA 249, 299, 302
sticky-dot exercises 202
stochastic models 239, 271, 343
strategic decision making 119–20, 122
strategic environmental assessment (SEA) 81, 82–3
structural changes 32–5
structured interviews 186
structured modelling 333
sub-catchments 279–80, 303
subjectivity 263, 264–5
Suez Lyonnaise des Eaux 35
Sun Microsystems J2EE 328, 333
supply nodes 311
surface water, ecology/quality issues 48–52
surrogate worth trade-off method 118
surveys 184, 188–9, 200–203, 305–6
sustainability
concepts of 264
practical approach to identification of 264–5
sustainability assessment (SA) 82
sustainability matrix 188
sustainable development
decision making 71–3
decision making tools 73–83
methodology 84–8
pilot study 88–95
three pillars of 5–6, 18–19
Sustainable Development Strategies 80
Switzerland
Lake Maggiore 342–3
urban water management 190–92, 203–8, 218–19
system identification 196
system learning 283
system monitoring 326
system representation 275
system understanding, modelling for 290–91
System-Wide Initiative on Water Management (SWIM) 311
systems analysis 329–30
Tajo, River 190–92, 213–16
targets
definition of 101
selection of 264–5
Tarsier 337
Team Expert Choice 134
technical computing language 250
technocratic management 29–30
technological monopolies 40
temporal data 251–6
temporal models 298–9, 304, 305, 306
territorial aspects, WFD 56–7
Thailand, catchment studies 279–82
Thames Water 35
Ticino, River 342
tight coupling 244, 247
time
discrete representation of 238
leads/lags 275, 278–9
modelling case studies 336–9
of models 275, 278
quantification of 274
uncontrollable drivers 7
uncontrollable influencing variables 273–4
unilateral control/protection 162
United Nations Commission on Sustainable Development 76, 77
Millennium Development Declaration (2000) 5, 48
World Commission for the Environment and Development 4
unstructured interviews 186
up-scaling routines 257–8
Upper Chattahoochee River, Australia 198–203
upstream use/users 171, 303
urban water demand models 306–7
urban water management, Switzerland 203–4
participatory management tasks 204
participatory methods used 204–8
urban water use 28
US
approaches to IWRM 9–10
culture 159
Lake Lanier 190–92, 198–203
privatisation 35
US Federal District Court 199
user interface components 335–6
utility maximisation 306

transparency 14
trophic networks 298
true criteria 116
TWOLE 336, 340–43
Tyne, River 312

UK, privatisation 30
uncertainty
avoidance of 158
ISM 263, 265, 276–8
management 16–17
of models 275, 278
quantification of 274
uncontrollable drivers 7
uncontrollable influencing variables 273–4

Sustainable Management of Water Resources

Carlo Giupponi, Anthony J. Jakeman, Derek Karssenberg and Matt P. Hare - 9780857937117
Downloaded from Elgar Online at 02/13/2019 01:19:37AM via free access
Index

validation processes 195–7
Valloio, River 89, 91
value functions methods 110–12, 122
Vela Catchment, Italy 89–95
Venice Lagoon
   Palude della Rosa 298
   watershed study 88–95
VISA/VISA Groupware 134
Visual Basic 335
Vivendi SA 35
wastewater planning 119
water bodies
   classification of 57–8
   reclamation of 59–60
water cycle 48–50
Water Framework Directive, EU 5, 9, 18, 47–8, 54–8, 339
compliance with 87
criticisms of 58–9
implementation of 65, 213, 214, 215
Italy’s application of 63–4
monitoring water status 60–62
new plans/programmes under 59–60
public participation in 169–70, 179–80
water project management agencies, US 29
Water Quality Objective (WQO), EU River Basin Management Plan 57
water reclamation, EU 59–60
water resources, principles for safeguarding 53–4
Water Sharing Plans 212
water status assessment, EU 60–62, 169
water users’ associations 154, 156, 170–71
waterborne disease 36
watercourse management, Africa 11
watercourses
   as open ecosystems 50
   self-regulation/self-purification processes 51–2
watershed management 313
US 9–10
weak dominance approach, outranking 115
web site provision 184, 215
Web-HIPRE 134
weighted goal programming (WGP) 108–10
weighted summation 140–42, 145–6, 272
weighting 92–5, 111, 140–42
weights method, multi-objective programming 105
welfare indicators 76, 79
wetlands
   protection of 59
   use of 54
wildebeest model 299–300
workshops 184, 200–203, 205–8, 211, 213, 214–16, 217
World Bank 37
World Summit on Sustainable Development (WSSD) (2002) 4–5, 48
commitments of scientists 73
World Trade Organisation (WTO) 28, 35, 37
World Water Council (WWC) 71
worst-case planning 203–4
XML 332
Yass catchment study 279, 280