

Contents

Preface to the Third Edition	v
Preface to the Second Edition	vii
Preface to the First Edition	ix
List of Special Symbols	xviii
I Modeling and Data Analysis	1
1 Parametric Modeling	3
1.1 Applications of Extreme Value Analysis	3
1.2 Observing Exceedances and Maxima	7
1.3 Modeling by Extreme Value Distributions	14
1.4 Modeling by Generalized Pareto Distributions	23
1.5 Heavy and Fat-Tailed Distributions	30
1.6 Quantiles, Transformations and Simulations	35
2 Diagnostic Tools	39
2.1 Visualization of Data	39
2.2 Excess and Hazard Functions	49
2.3 Fitting Parametric Distributions to Data	56
2.4 Q–Q and P–P Plots	61
2.5 Trends, Seasonality and Autocorrelation	64
2.6 The Tail Dependence Parameter	74
2.7 Clustering of Exceedances	76
II Statistical Inference in Parametric Models	81
3 An Introduction to Parametric Inference	83
3.1 Estimation in Exponential and Gaussian Models	84
3.2 Confidence Intervals	90
3.3 Test Procedures and p -Values	93
3.4 Inference in Poisson and Mixed Poisson Models	96

3.5	The Bayesian Estimation Principle	102
4	Extreme Value Models	107
4.1	Estimation in Extremes Value Models	107
4.2	Testing within Extreme Value Models	118
4.3	Extended Extreme Value Models and Related Models	120
5	Generalized Pareto Models	127
5.1	Estimation in Generalized Pareto Models	127
5.2	Testing Within Generalized Pareto Models	143
5.3	Testing Extreme Value Conditions with Applications (co-authored by J. Hüsler and D. Li)	144
5.4	Statistics in Poisson–GP Models	152
5.5	The Log–Pareto Model and Other Pareto–Extensions	154
6	Advanced Statistical Analysis	159
6.1	Non–Random and Random Censoring	159
6.2	Models of Time Series, the Extremal Index	164
6.3	Statistics for Student Distributions	170
6.4	Statistics for Sum–Stable Distributions (co-authored by J.P. Nolan)	172
6.5	Ultimate and Penultimate GP Approximation (co-authored by E. Kaufmann)	182
6.6	An Overview of Reduced–Bias Estimation (co-authored by M.I. Gomes)	190
7	Statistics of Dependent Variables	207
	(coauthored by H. Drees)	207
7.1	The Impact of Serial Dependence	208
7.2	Estimating the Extreme Value Index	209
7.3	Extreme Quantile Estimation	215
7.4	A Time Series Approach	219
8	Conditional Extremal Analysis	227
8.1	Interpretations and Technical Preparations	227
8.2	Conditional Extremes: a Nonparametric Approach	238
8.3	Maxima Under Covariate Information	240
8.4	The Bayesian Estimation Principle, Revisited	242
9	Statistical Models for Exceedance Processes	247
9.1	Modeling Exceedances by Poisson Processes: the Homogeneous Case	247
9.2	Mean and Median T –Year Return Levels	250
9.3	ML and Bayesian Estimation in Models of Poisson Processes	252
9.4	GP Process Approximations (co-authored by E. Kaufmann)	256

9.5 Inhomogeneous Poisson Processes, Exceedances Under Covariate Information	258
III Elements of Multivariate Statistical Analysis	263
10 Basic Multivariate Concepts and Visualization	265
10.1 An Introduction to Basic Multivariate Concepts	265
10.2 Visualizing Multivariate Data	270
10.3 Decompositions of Multivariate Distributions	275
11 Elliptical and Related Distributions	279
11.1 Multivariate Gaussian Models	279
11.2 Spherical and Elliptical Distributions	281
11.3 Multivariate Student Distributions	283
11.4 Multivariate Sum-Stable Distributions (co-authored by J.P. Nolan)	285
12 Multivariate Maxima	291
12.1 Nonparametric and Parametric Extreme Value Models	291
12.2 The Gumbel–McFadden Model	301
12.3 Estimation in Extreme Value Models	305
12.4 A Spectral Decomposition Methodology	309
13 Multivariate Peaks Over Threshold (co-authored by M. Falk)	313
13.1 Nonparametric and Parametric Generalized Pareto Models	313
13.2 Estimation of the Canonical Dependence Function	318
13.3 About Tail Independence (co-authored by M. Frick)	321
13.4 The Point Process Approach to the Multivariate POT Method	333
IV Topics in Hydrology and Environmental Sciences	335
14 Flood Frequency Analysis (co-authored by J.R.M. Hosking)	337
14.1 Analyzing Annual Flood Series	337
14.2 Analyzing Partial Duration Series	338
14.3 Regional Flood Frequency Analysis	343
14.4 The L -Moment Estimation Method	345
14.5 A Bayesian Approach to Regional Estimation	349

15 Environmental Sciences	
(co-authored by R.W. Katz)	353
15.1 Environmental Extremes	353
15.2 Inclusion of Covariates	356
15.3 Example of Trend	359
15.4 Example of Cycle	361
15.5 Example of Covariate	364
15.6 Numerical Methods and Software	367
V Topics in Finance and Insurance	369
16 Extreme Returns in Asset Prices	
(co-authored by C.G. de Vries and S. Caserta)	371
16.1 Stylized Facts and Historical Remarks	372
16.2 Empirical Evidence in Returns Series	375
16.3 Parametric Estimation of the Tails of Returns	378
16.4 The Profit/Loss Variable and Risk Parameters	382
16.5 Evaluating the Value-at-Risk (VaR)	386
16.6 The VaR for a Single Derivative Contract	392
16.7 GARCH and Stochastic Volatility Structures	395
16.8 Predicting the Serial Conditional VaR (co-authored by A. Kozek and C.S. Wehn)	401
17 The Impact of Large Claims on Actuarial Decisions	
(co-authored by M. Radtke)	411
17.1 Numbers of Claims and the Total Claim Amount	412
17.2 Estimation of the Net Premium	415
17.3 Segmentation According to the Probable Maximum Loss	419
17.4 The Risk Process and the T -Year Initial Reserve	426
17.5 Elements of Ruin Theory	432
17.6 Credibility (Bayesian) Estimation of the Net Premium	434
VI Topics in Material and Life Sciences	439
18 Material Sciences	441
18.1 Extremal Corrosion Engineering	441
18.2 Stereology of Extremes (co-authored by E. Kaufmann)	445
19 Life Science	
(co-authored by E. Kaufmann)	453
19.1 About the Longevity of Humans	453

<i>Contents</i>	xvii
19.2 Extrapolating Life Tables To Extreme Life Spans: A Regression Approach	458
Appendix: First Steps towards Xtremes and StatPascal	465
A The Menu System	467
A.1 Installation	467
A.2 Overview and the Hierarchy	467
A.3 Becoming Acquainted with the Menu System	470
A.4 Technical Aspects of Xtremes	476
A.5 The UserFormula (UFO) Facilities	481
B The StatPascal Programming Language	485
B.1 Programming with StatPascal: First Steps	486
B.2 Plotting Curves	490
B.3 Generating and Accessing Data	492
Author Index	495
Subject Index	501
Bibliography	509