

1. Record Nr.	UNINA9910806919403321
Autore	Montero Jose Maria
Titolo	Spatial and spatio-temporal geostatistical modeling and kriging // Jose-Maria Montero, Department of Statistics, University of Castilla-La Mancha, Spain, Gema Fernandez-Aviles, Department of Statistics, University of Castilla-La Mancha, Spain, Jorge Mateu, Department of Mathematics, University Jaume I of Castellon, Spain
Pubbl/distr/stampa	Chichester, West Sussex, UK : , : John Wiley and Sons, Inc., , 2015
ISBN	1-118-76238-X 1-118-76243-6 1-118-76242-8
Edizione	[1st ed.]
Descrizione fisica	1 online resource
Collana	Wiley Series in Probability and Statistics
Altri autori (Persone)	Fernandez-AvilesGema MateuJorge
Disciplina	551.01/5195
Soggetti	Geology - Statistical methods Kriging
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright -- Dedication -- Contents -- Foreword by Abdel H. El-Shaarawi -- Foreword by Hao Zhang -- List of figures -- List of tables -- About the companion website -- Chapter 1 From classical statistics to geostatistics -- 1.1 Not all spatial data are geostatistical data -- 1.2 The limits of classical statistics -- 1.3 A real geostatistical dataset: data on carbon monoxide in Madrid, Spain -- Chapter 2 Geostatistics: preliminaries -- 2.1 Regionalized variables -- 2.2 Random functions -- 2.3 Stationary and intrinsic hypotheses -- 2.3.1 Stationarity -- 2.3.2 Stationary random functions in the strict sense -- 2.3.3 Second-order stationary random functions -- 2.3.4 Intrinsically stationary random functions -- 2.3.5 Non-stationary random functions -- 2.4 Support -- Chapter 3 Structural analysis -- 3.1 Introduction -- 3.2 Covariance function -- 3.2.1 Definition and properties -- 3.2.2 Some theoretical isotropic covariance functions -- 3.3 Empirical covariogram -- 3.4 Semivariogram -- 3.4.1 Definition and properties -- 3.4.2 Behavior at intermediate and large distances --

3.4.3 Behavior near the origin -- 3.4.4 A discontinuity at the origin --  
3.5 Theoretical semivariogram models -- 3.5.1 Semivariograms with a sill -- 3.5.2 Semivariograms with a hole effect -- 3.5.3 Semivariograms without a sill -- 3.5.4 Combining semivariogram models -- 3.6 Empirical semivariogram -- 3.7 Anisotropy -- 3.8 Fitting a semivariogram model -- 3.8.1 Manual fitting -- 3.8.2 Automatic fitting -- Chapter 4 Spatial prediction and kriging -- 4.1 Introduction -- 4.2 Neighborhood -- 4.3 Ordinary kriging -- 4.3.1 Point observation support and point predictor -- 4.3.2 Effects of a change in the model parameters -- 4.3.3 Point observation support and block predictor -- 4.3.4 Block observation support and block predictor.  
4.4 Simple kriging: the special case of known mean -- 4.5 Simple kriging with an estimated mean -- 4.6 Universal kriging -- 4.6.1 Point observation support and point predictor -- 4.6.2 Point observation support and block predictor -- 4.6.3 Block observation support and block predictor -- 4.6.4 Kriging and exact interpolation -- 4.7 Residual kriging -- 4.7.1 Direct residual kriging -- 4.7.2 Iterative residual kriging -- 4.7.3 Modified iterative residual kriging -- 4.8 Median-Polish kriging -- 4.9 Cross-validation -- 4.10 Non-linear kriging -- 4.10.1 Disjunctive kriging -- 4.10.2 Indicator kriging -- Chapter 5 Geostatistics and spatio-temporal random functions -- 5.1 Spatio-temporal geostatistics -- 5.2 Spatio-temporal continuity -- 5.3 Relevant spatio-temporal concepts -- 5.4 Properties of the spatio-temporal covariance and semivariogram -- Chapter 6 Spatio-temporal structural analysis (I): empirical semivariogram and covariogram estimation and model fitting -- 6.1 Introduction -- 6.2 The empirical spatio-temporal semivariogram and covariogram -- 6.3 Fitting spatio-temporal semivariogram and covariogram models -- 6.4 Validation and comparison of spatio-temporal semivariogram and covariogram models -- Chapter 7 Spatio-temporal structural analysis (II): theoretical covariance models -- 7.1 Introduction -- 7.2 Combined distance or metric model -- 7.3 Sum model -- 7.4 Combined metric-sum model -- 7.5 Product model -- 7.6 Product-sum model -- 7.7 Porcu and Mateu mixture-based models -- 7.8 General product-sum model -- 7.9 Integrated product and product-sum models -- 7.10 Models proposed by Cressie and Huang -- 7.11 Models proposed by Gneiting -- 7.12 Mixture models proposed by Ma -- 7.12.1 Covariance functions generated by scale mixtures -- 7.12.2 Covariance functions generated by positive power mixtures.  
7.13 Models generated by linear combinations proposed by Ma -- 7.14 Models proposed by Stein -- 7.15 Construction of covariance functions using copulas and completely monotonic functions -- 7.16 Generalized product-sum model -- 7.17 Models that are not fully symmetric -- 7.18 Mixture-based Bernstein zonally anisotropic covariance functions -- 7.19 Non-stationary models -- 7.19.1 Mixture of locally orthogonal stationary processes -- 7.19.2 Non-stationary models proposed by Ma -- 7.19.3 Non-stationary models proposed by Porcu and Mateu -- 7.20 Anisotropic covariance functions by Porcu and Mateu -- 7.20.1 Constructing temporally symmetric and spatially anisotropic covariance functions -- 7.20.2 Generalizing the class of spatio-temporal covariance functions proposed by Gneiting -- 7.20.3 Differentiation and integration operators acting on classes of anisotropic covariance functions on the basis of isotropic components: 'La descente etendue' -- 7.21 Spatio-temporal constructions based on quasi-arithmetic means of covariance functions -- 7.21.1 Multivariate quasi-arithmetic compositions -- 7.21.2 Permissibility criteria for quasi-arithmetic means of covariance functions on  $R^d$  -- 7.21.3 The use of quasi-arithmetic functionals to build non-separable, stationary, spatio-

temporal covariance functions -- 7.21.4 Quasi-arithmeticity and non-stationarity in space -- Chapter 8 Spatio-temporal prediction and kriging -- 8.1 Spatio-temporal kriging -- 8.2 Spatio-temporal kriging equations -- Chapter 9 An introduction to functional geostatistics -- 9.1 Functional data analysis -- 9.2 Functional geostatistics: The parametric vs. the non-parametric approach -- 9.3 Functional ordinary kriging -- 9.3.1 Preliminaries -- 9.3.2 Functional ordinary kriging equations -- 9.3.3 Estimating the trace-semivariogram -- 9.3.4 Functional cross-validation -- Appendices.

Appendix A Spectral representations -- A.1 Spectral representation of the covariogram -- A.2 Spectral representation of the semivariogram -- Appendix B Probabilistic aspects of  $U_{ij}=Z(s_i)-Z(s_j)$  -- Appendix C Basic theory on restricted maximum likelihood -- C.1 Restricted Maximum Likelihood equation -- Appendix D Most relevant proofs -- D.1 Product model: Peculiarity (ii) (Rodriguez-Iturbe and Mejia 1974 -- De Cesare et al. 1997) -- D.2 Product model: Peculiarity (iv) (Rodriguez-Iturbe and Mejia 1974 -- De Cesare et al. 1997) -- D.3 Product-sum model: Semivariogram expression (7.29) (De Iaco et al. 2001) -- D.4 General product-sum model: Obtaining the constant  $k$  (De Iaco et al. 2001) -- D.5 General product-sum model: Theorem 7.8.1 (De Iaco et al. 2001) -- D.6 General product-sum model: Theorem 7.8.2. (De Iaco et al. 2001) -- D.7 Generalized product-sum model. Proposition 1 1 (Gregori et al. 2008) -- D.8 Generalized product-sum model. Proposition 1 2 for  $n = 2$  (Gregori et al. 2008) -- D.9 Generalized product-sum model. Corollary 1 3 of Proposition 2 (Gregori et al. 2008) -- D.10 Generalized product-sum model. Range of  $\rho$ . Case 1: The Gaussian case 4 (Gregori et al. 2008) -- D.11 Generalized product-sum model. Range of  $\rho$ . Case 2: The Matern case 5 (Gregori et al. 2008) -- D.12 Generalized product-sum model. Range of  $\rho$ . Case 3: The Gaussian-Matern case 6 (Gregori et al. 2008) -- D.13 Mixture-based Bernstein zonally anisotropic covariance functions. Theorem 7.18.1 (Ma 2003b) -- D.14 Construction of non-stationary spatio-temporal covariance functions using spatio-temporal stationary covariances and intrinsically stationary semivariograms. Equation (7.159) (Ma 2003c).

D.15 Construction of non-stationary spatio-temporal covariance functions using spatio-temporal stationary covariances and intrinsically stationary semivariograms. Equation (7.161) is a valid covariance function (Ma 2003c) -- D.16 Construction of non-stationary spatio-temporal covariance functions using spatio-temporal stationary covariances and intrinsically stationary semivariograms. Equation (7.163) Ma (2003c) -- D.17 Permissibility criteria for quasi-arithmetic means of covariance functions. Proposition 1 (Porcu et al. 2009b) -- Bibliography and further reading -- Index -- Supplemental Images -- Wiley Series in Probability and Statistics -- EULA.

---

## Sommario/riassunto

Statistical Methods for Spatial and Spatio-Temporal Data Analysis provides a complete range of spatio-temporal covariance functions and discusses ways of constructing them. This book is a unified approach to modeling spatial and spatio-temporal data together with significant developments in statistical methodology with applications in R. This book includes: Methods for selecting valid covariance functions from the empirical counterparts that overcome the existing limitations of the traditional methods. The most innovative developments in the different steps of the kriging process. An up-to-date account of strategies for dealing with data evolving in space and time. An accompanying website featuring R code and examples.

---