

**XAVIER SANCHEZ-VILA, JESUS CARRERA and
JOSÉ JAIME GÓMEZ-HERNÁNDEZ, Editors**

geoENV IV – Geostatistics for Environmental Applications



QUANTITATIVE GEOLOGY AND GEOSTATISTICS

KLUWER ACADEMIC PUBLISHERS

geoENV IV – GEOSTATISTICS FOR ENVIRONMENTAL APPLICATIONS

Proceedings of the Fourth European Conference on
Geostatistics for Environmental Applications held in
Barcelona, Spain, November 27–29, 2002

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KLUWER ACADEMIC PUBLISHERS

DORDRECHT / BOSTON / LONDON

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 1-4020-2007-4

ISBN 1-4020-2115-1 (e-book)

Published by Kluwer Academic Publishers,
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

Sold and distributed in North, Central and South America
by Kluwer Academic Publishers,
101 Philip Drive, Norwell, MA 02061, U.S.A.

In all other countries, sold and distributed
by Kluwer Academic Publishers,
P.O. Box 322, 3300 AH Dordrecht, The Netherlands.

Printed on acid-free paper

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Printed in the Netherlands.

Foreword

The fourth edition of the European Conference on Geostatistics for Environmental Applications (geoENV IV) took place in Barcelona, November 27-29, 2002. As a proof that there is an increasing interest in environmental issues in the geostatistical community, the conference attracted over 100 participants, mostly Europeans (up to 10 European countries were represented), but also from other countries in the world. Only 46 contributions, selected out of around 100 submitted papers, were invited to be presented orally during the conference. Additionally 30 authors were invited to present their work in poster format during a special session.

All oral and poster contributors were invited to submit their work to be considered for publication in this Kluwer series. All papers underwent a reviewing process, which consisted on two reviewers for oral presentations and one reviewer for posters. The book opens with one keynote paper by Philippe Naveau. It is followed by 40 papers that correspond to those presented orally during the conference and accepted by the reviewers. These papers are classified according to their main topic. The list of topics show the diversity of the contributions and the fields of application. At the end of the book, summaries of up to 19 poster presentations are added.

The geoENV conferences stress two issues, namely geostatistics and environmental applications. Thus, papers can be classified into two groups. The reader will find a number of papers dedicated to the most recent methodological developments, with examples predominantly in environmental sciences. The remaining ones provide a good indication of the wide variety of environmental applications in which geostatistics plays its role.

The fourth volume in the geoENV conference series proves how dynamic the geostatistical community is, and confirms the relevance of geostatistics as a tool to be included as a standard procedure in environmental sciences. We now look forward to geoENV 2004 for new applications and new methodological advances.

Barcelona, November 2002

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TWO STATISTICAL METHODS FOR IMPROVING THE ANALYSIS OF LARGE CLIMATIC DATA SETS: GENERAL SKEWED KALMAN FILTERS AND DISTRIBUTIONS OF DISTRIBUTIONS

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Abstract: This research focuses on two original statistical methods for analyzing large data sets in the context of climate studies. First, we propose a new way to introduce skewness to state-space models without losing the computational advantages of the Kalman filter operations. The motivation stems from the popularity of state-space models and statistical data assimilation techniques in geophysics, specially for forecasting purposes in real time. The added skewness comes from the extension of the multivariate normal distribution to the *general multivariate skew-normal distribution*. A new specific state-space model for which the Kalman Filtering operations are carefully described is derived. The second part of this work is dedicated to the extension of clustering methods into the *distributions of distributions* framework. This concept allows us to cluster distributions, instead of simple observations. To illustrate the applicability of such a method, we analyze the distributions of 16200 temperature and humidity vertical profiles. Different levels of dependencies between these distributions are modeled by copulas. The distributions of distributions are decomposed as mixtures and the algorithm to estimate the parameters of such mixtures is presented. Besides providing realistic climatic classes, this clustering method allows atmospheric scientists to explore large climate data sets into a more meaningful and global framework.