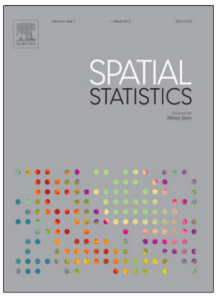

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Spatio-temporal statistical methods in environmental and biometrical problems

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Abstract

This is the editorial letter for the Special Issue dedicated to the VIII International Workshop on Spatio-temporal Modelling (METMAVIII) which took place in Valencia (Spain) from 1 to 3 June 2016, and to the second Galician-Portuguese meeting of Biometry, with applications to Health Sciences, Ecology and Environmental Sciences (BIOAPP2016) held in Santiago de Compostela (Spain), 30-2 July 2016.

This special issue summarises and discusses selected peer-reviewed contributions related to spatial and spatio-temporal statistical methodologies comprising both new methodological approaches and a wide range of applications related to environmental and biometrical problems. Point processes, lattice data and geostatistical methods are covered. These methods are illustrated with statistical analyses of animal or plant species in ecological studies, seismic data, temperatures and monthly precipitation, daily ozone concentration values, air pollution data, breast cancer incidence rates, mussels, wildfires, pore structures in pharmaceutical coatings, hake recruitment and cancer mortality data.

Keywords: Air pollution data, Breast cancer, Environmental applications, Hake recruitments, Mussels, Pore structures, Wildfires, Seismic data

1. Introduction

In recent years, spatio-temporal modelling has become one of the most interesting and, at the same time, challenging research areas of natural sciences. This has been largely fueled by the increased availability of inexpensive, high-speed computing. Such availability has enabled the collection and management of large spatial and spatio-temporal datasets across many fields, has facilitated the widespread usage of sophisticated geographic information systems (GIS) software to create attractive displays, and has endowed the ability to investigate challenging, evermore appropriate and realistic models (Gelfand *et al.*, 2010). The relevant literature is growing fast and along directions that range from theoretical works to methodological developments to real world applications. Spatio-temporal systems modelling involves the synthesis of a rich interdisciplinary body of knowledge for which it is necessary to establish a solid theoretical foundation and a science-based methodology with both researchers and practitioners in mind.

A spatial point process is a stochastic process each of whose realisations consists of a finite or countably infinite set of points in the plane. Spatio-temporal point processes are considered as being a hybrid of the spatial and temporal components, by extending the definition of spatial point processes to include time. Because the spatial location can always be considered as one component of a multi-dimensional mark, the evolution of spatial features with time is often of special interest. Despite such considerations, studies of spatio-temporal models have lagged well behind those of simple temporal models, and even those of purely spatial models. No doubt the reasons have been largely practical, notably the difficulty of compiling good spatio-temporal datasets and the heavy computations needed to analyse them. One way to observe these processes is to consider the spatial location itself viewed as a mark for a simple point process

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