Geostatistics for environmental applications

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This special issue of Spatial Statistics contains six selected papers that sprang from six presentations at geoENV2012, the IX Conference on Geostatistics for Environmental Applications that took place in Valencia (Spain) in September 2012. The geoENV conference series started in 1996 in Lisbon as a biennial encounter of researchers and practitioners applying geostatistics in an environmental context. At that time, the introduction of geostatistics in the environment was still at its early stages in some disciplines, prove of which was that some of the papers presented did not go further than a simple application of variography for trend detection. Eighteen years have passed since then, the concept of geostatistics has evolved to cope with different environmental challenges, new data acquisition technologies and larger datasets. The framework to process spatial data has also become more flexible, depending on the dataset characteristics and giving rise to new quantification approaches that fall in the broader classification of spatial statistics. The versatility brought by these approaches was evident in geoENV2012. This special issue will be able to give you a glimpse of the latest research in geostatistics for environmental applications spanning from theory to application in the topics of soil sciences, remote sensing, air quality, climate change, and forestry.

The first paper by Romary discusses a recurrent issue nowadays which is how to deal with very large data sets; computer power keeps increasing, but also the amount of data that needs to be processed, therefore finding efficient ways to solve very large kriging systems is important. The paper proposes the use of an incomplete Cholesky decomposition of the covariance matrix in the left hand side of the kriging system.

The second paper by Keaney, McKinley, Graham, Robinson and Ruffell, addresses a problem of spatial estimation of peat thickness in Northern Ireland in relation with the Kyoto Protocol for the reduction of greenhouse gas emissions. Peat has a high proportion of soil carbon, and it is important to model how it evolves in order to facilitate the management of carbon changes over time. The paper proposes the use of non-destructive geophysical measurements, more precisely airborne radiometric data, for the purposes of such estimation.

The third paper by Tang, Atkinson, Wardrop and Zhang applies multiple point geostatistics in the context of land cover classification from remotely sensed images. As it has already been

shown in the application of multiple point geostatistics, one of its advantages is the possibility of characterizing curvilinear features; this is also its major strength in land cover classification.

The fourth paper by Cameletti, Ignaccolo and Sylvan is the only one in this issue dealing with a spatial and temporal framework: modeling threshold probabilities of exceeding of particulate matter contamination at the Piemonte region in Italy. Their method is based in a kernel smoothing in the time domain plus a spatial interpolation followed by a block bootstrap technique.

The fifth paper by McKinley, Ofterdinger, Young, Barsby, and Gavin straddles medicine and environment since it looks at the local relationships between trace elements in soils and cancer data. The authors analyze a comprehensive geochemical dataset collected in Northern Ireland recently and the epidemiological data on cancer provided by the Northern Ireland cancer registry to identify relationships between potentially toxic elements present in soils and different types of cancer occurrence.

The sixth paper by Allard, López-Lozano and Baret addresses the complex problem of estimating the leaf area index, a key biophysical variable of vegetated surfaces. The authors propose a novel Boolean approach to model tree canopy in a realistic way, overcoming the common and unrealistic assumption that leaves are uniformly distributed in the canopy.

Environmental scientists and engineers know the importance of spatial statistics in their analyses. This issue proves it.