Nonparametric approaches for estimating risk maps

P. García-Soidán[1] and R. Menezes[2,*]

[1] *Dept. of Statistics and Operations Research, University of Vigo, Spain; pgarcia@uvigo.es*
[2] *Center of Mathematics, University of Minho, Portugal; rmenezes@math.uminho.pt*
[*] *Corresponding author*

Abstract. *Assessment of environmental contamination is increasingly a concern in nowadays society. The maximum levels for pollutants are heavily regulated, being necessary to ensure compliance. Consequently, it becomes important to construct probability maps of the observation region, showing the complementary value of the distribution function of the variable involved at regulatory thresholds. These are usually called risk maps in the environmental setting.*
In this work, two kernel-type estimators of the spatial distribution function are constructed, which depart from approximating the distribution at the sampled sites and then obtaining a weighted average of the resulting values, to derive a valid estimator at any random location. Consistency of both approaches is proved under rather general conditions, such as local stationarity and the existence of a number of derivatives of the distribution function. Unlike other alternatives, the new proposals provide non-decreasing functions and do not require a previous estimation of the indicator variogram or the trend function. However, appropriate bandwidths parameters are needed and selection of them in practice needs to be addressed.
Numerical studies are carried out, aiming at comparing the current proposal with more usual methods, such as those based on the sill estimation or the indicator kriging, described in Journel (1983) or Goovaerts (1997), respectively, and redesigned in García-Soidán and Menezes (2012). Finally, the new proposal is applied to arsenic data from Portugal, so that pollution risk maps of the referred region are constructed. Moreover, accuracy maps of the probability estimates might be constructed based on bootstrap replicas, as described in García-Soidán, Menezes and Rubiños (2014).

Keywords. *Spatial data; Distribution function; Kernel function; Stationarity*

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