

XXXVIII IAH Congress

**Groundwater Quality Sustainability
Krakow, 12–17 September 2010**

Extended Abstracts

**Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmieciak**



**University
of Silesia
Press 2010**



IAH 2010
Krakow

abstract id: **309**

topic: **1**

Groundwater quality sustainability

1.4

Groundwater quality and agriculture

title: **Application of disjunctive kriging to nitrate risk assessment in the northern aquifer alluvial system of the river Tagus (Portugal)**

author(s): **Maria Paula Mendes**

CVRM — Instituto Superior Tecnico, Portugal, mpaulamendes@gmail.com

Luis Ribeiro

CVRM — Instituto Superior Tecnico, Portugal, luis.ribeiro@ist.utl.pt

keywords: nitrates, contamination, probability maps, geostatistics, disjunctive kriging

The Water Framework Directive and its daughter directives recognize the urgent need to adopt specific measures against the contamination of water by individual pollutants or a group of pollutants that present a significant risk to the quality of water. Probability maps that the nitrate concentrations exceed a legal threshold value in any location of the aquifer are used to assess risk of groundwater quality degradation from intensive agricultural activity in aquifers.

In this paper we use Disjunctive Kriging (DK) to map the probability that the Nitrates Directive limit (91/676/EEC) is exceeded for the Nitrate Vulnerable Zone of the River Tagus ALLUVIUM AQUIFER.

Now more than ever there is a need to apply robust statistical methodologies to ensure the proper evaluation of the risk of groundwater contamination through agricultural activities. Of these geostatistical methods, the DK technique is less popular because its application is not straightforward. However this method has considerable advantages over Indicator Kriging (IK) because it uses all the information about the Probability Distribution Function of the variable, whereas IK applies a binarized variable.

An initial exploratory data analysis shows that generally the statistical distributions of NO_3 concentrations are tend to be positively skewed and in some cases highly asymmetric, for the period of the three campaigns on both banks of the Tagus alluvium aquifer.

The variographic analysis of the normalized standard transformed variable reveals an increase in the magnitude of the variogram ranges on the right bank through the three summers which is clearly associated to the increased extent of groundwater contamination areas. These areas with a higher probability of groundwater contamination by nitrates can be explained by inter-annual climate variation and by the used fertilization regime. On the left bank the relation between the increasing of variograms range cannot be assess, since the agricultural areas of the left bank are more heterogeneous than the right bank.

Furthermore, the study reveals that the right bank has more areas with higher probability of nitrates concentrations exceeding the 50 mg/L than the left bank.

The probability maps are very useful tools for the decision-makers, because they can reinforce the implementation of agri-environmental measures in vulnerable areas, so as to ensure good compliance with the Nitrate and Groundwater Directives in the EU zone. They can also be used in the areas of land use planning and for the protection of groundwater for public supply.



International Association of Hydrogeologists



AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0