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title: **Geostatistics tools for characterizing the spatial variability of groundwater temperature in Veneto region**

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INTRODUCTION

The principal tool of most geostatistical analyses is the variogram, a function that relates the average squared difference between paired data values to the distance (and direction, where anisotropy is considered) by which they are separated. A theoretical variogram may be fitted to the experimental variogram. The model variogram obtained allows to assign the weights in the ordinary kriging prediction (Isaaks, Srivastava, 1989; Goovaerts, 1997). Kriging provides at every grid node the value prediction and the prediction error variance. In particular the use of indicator kriging in most earth science applications, and from the main reasons for its introduction, is both because is a non-parametric method and is a technique which allows to use together populations and qualitative data (Andrew et al., 2000).

METHODS

The dataset consists of 145 temperatures of groundwater measured in Veneto (NE, Italy) region until 100 m in depth. The software used in this geostatistical analysis is R (R Developed core team, 2009), and in particular its "gstat" package, which provides a flexible suite of prediction tools.

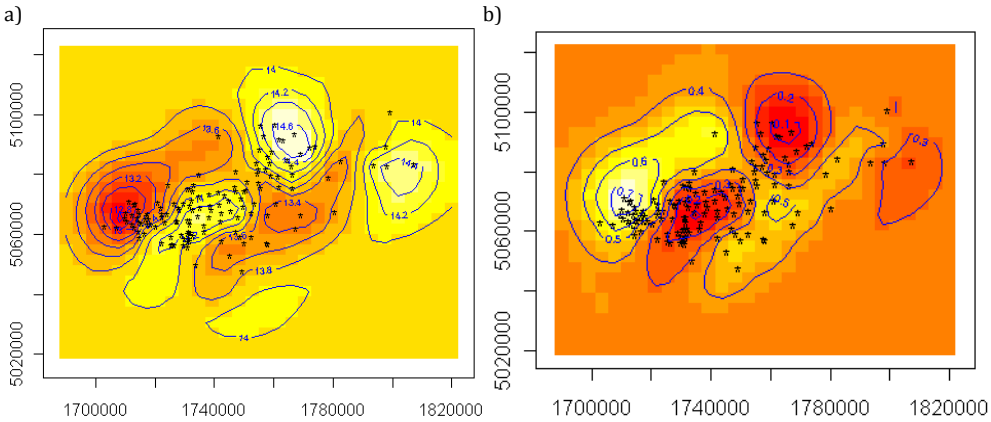

Figure 1. Prediction map of groundwater temperature distribution in Veneto region: a) Ordinary kriging; b) Indicator Kriging for the first quartile (< 13°C).

Using indicator kriging: three thresholds were selected as follow: (first quartile) is 13°C, (median) is 14°C and (third quartile) is 15°C, of the qualitative distribution function (c.d.f) of the temperature data. At every cutoff experimental variogram was calculated and then a theoretical variogram was fitted. Moreover the theoretical variogram of temperature was fitted based on the experimental one.

RESULTS

Figure (1a) shows the Ordinary Kriging results with a high groundwater temperatures concentrated in North eastern and in the middle part of the study region (14.1–14.5°C), but most of the highest values were found in the center of the region. The lowest values of temperature were found in the West part of the studied area (13–12.5°C). According to figure (1b) for indicator kriging, the groundwater temperature values are lower than 13°C in the North western Veneto, where the probability is close to 1.

REFERENCES

Lister A.J., Rachel, R., Michael H., 2000: *A nonparametric geostatistical method for estimating species importance*. In Second Annual Forest Inventory and Analysis (FIA) Symposium, Salt Lake City, UT, October 17–18.

Goovaerts P., 1997: *Geostatistics for Natural Resources Evaluation*. New York: Oxford University Press.

Isaaks E.H., Srivastava R.M., 1989: *An Introduction to Applied Geostatistics*. New York: Oxford University Press.

R Development Core Team, 2009: *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, www.R-project.org.

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