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Sequential gaussian simulations for indoor radon risk mapping using declustering and constrained nets

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Spatial clustering of measurements is a frequent condition for environmental data and could represent a problem during interpolations. The location of indoor radon values is conditioned to the disposition of dwellings: an irregular arrangement following the urban areas. Declustering weights can be calculated by different methods; depending on the pertinence for the dataset at hand. First a characterization of the information is required in terms of preferential sampling and topology. The purpose of this research is to characterize spatial clustering of an indoor radon dataset and to propose proper methods for declustering when using constrained nets for sequential gaussian simulations.

The dataset was first divided into training and validation subsets. Spatial clustering was revealed by index of fractality and by comparison of histograms of polygons areas when considering the training data and randomly distributed data over the area of interpolation. Quantile mapping was used to analyze conditions of preferential sampling. A relation with scale of variability and topology was identified. In comparison to radon distribution, the histogram of polygons for the training data presented much more small polygons, which reveals the state of clustering. Nevertheless a slight bias to the presence of smaller polygons in the random disposition was due to border effect and convexity. The use of different nets was then proposed to deal with influence of topology in simulations.

The polygons sizes were used as declustering weights for sequential gaussian simulations. A variogram with two structures was used as a model and different shapes

were considered as simulation nets. Two kinds of nets were built: one constrained to the boundaries of survey and another with a bounding box configuration. The reproduction of the variogram model after simulation changed according to the simulation net used and the application or not of polygonal declustering. The short range structure was better reproduced using a constrained net while the long range had better fit when the bounding box net was used. Using the polygonal weights together with the constrained net a fit of both structures was attained. The validation error was reduced when tuning the neighborhood parameters, the polygonal weights and the simulation nets together. The many factors that influence histogram reproduction, variogram reproduction and validation error were analyzed as well as the pertinence of declustering methods for the indoor radon risk mapping.