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Large scale mapping of radioactively contaminated territories. Chernobyl case study.

M. Kanevski, M. Maignan

Institute of Geomatics and Analysis of Risk, University of Lausanne, Switzerland
(Mikhail.Kanevski@unil.ch)

The paper presents a review of different approaches, from simple interpolations via geostatistical and bayesian maximum entropy predictors, up to machine learning algorithms applied to analyze, to model and to make spatial predictions on radioactive contamination after Chernobyl accident. Spatial patterns of the contamination after the Chernobyl accident are very complicated and highly variable at different geographical scales from small scale in populated sites up to European continental scale. Analysis and mapping of such data demands a wide range of models and tools to be used at different stages. In the present study, which is based on more than 15 years experience with Chernobyl data modeling, the main attention is paid to the following questions: 1) Analysis and quantification of monitoring networks; 2) Power and limits of geostatistics; 3) Automatic mapping with machine learning algorithms; 4) Predictive mapping using science based and spatial statistics models; 5) Bayesian maximum entropy approach to data modeling and integration taking into account uncertainties, repetitive measurements and soft information (expert knowledge).

The uniqueness and complementarities of different approaches is considered in detail. The practical side of the paper is oriented towards decision-oriented mapping using GIS as an important tool.