Facies reconstruction through the exploitation of a locally adaptive kernel regression: implications in risk evaluations

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Facies delineation or reconstruction is defined as the separation of geological units with distinct intrinsic characteristics (i.e. grain size, hydraulic conductivity, mineralogical composition, etc.). It is a major challenge (for scientists, technicians, stake holders, among others) when just a few scattered pieces of information are available. Several studies have tried to find a method that can be used to achieve this task, from nearest neighbor classification to support vector machine and indicator kriging.

We present the results obtained for facies reconstruction when using a data-adapted kernel regression. This non-parametric methodology, created for a different field (image processing), outperforms the previously cited methods. A nice feature of the kernel regression method is that it provides uncertainty assessment, allowing the use of gradients to generate more realistic facies maps.

The fate of reactive pollutants is directly related to facies mapping, and this can be translated into connectivity maps by means of existing methodologies based on Frechet derivatives. If facies are further associated to less-mobile domains, it may have additional implications in solute transport and eventually in risk evaluations.