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# Using Information on Land-use and Capture Zones for non-Stationary State-Wide Interpolation of Groundwater Quality Parameters

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A novel approach for spatial non-stationary interpolation is presented. This approach takes censored measurements, secondary information in physically based neighbourhoods, and non-Gaussian spatial dependence structures into account. The impact of the improvements of the geostatistical model are evaluated using regional groundwater quality data.

Secondary information has an influence on the distribution of the concentration at each interpolation location. In this study, land-use and hydrogeological units are used as two types of secondary information.
The influence of the land-use composition of local neighbourhoods at an interpolation location is modelled by mixed distributions of concentrations. The mixture is derived from the distributions of concentrations within groups of similar land-uses. These pure distributions are jointly optimized for all groups of secondary information. Different geometries and sizes of the neighbourhood are used. Additionally, physically-based delineated capture zones are taken into account for evaluating the influence of the neighbourhood on the measurement distribution.

Censored measurements, such as measurements below some detection limit, are commonly ignored, but are incorporated in the presented approach both in the marginal distributions and the multivariate distributions via probabilities of non-exceedance. This is an important feature for emerging contaminants, which typically have a large portion of censored measurements.

Spatial copulas are multidimensional dependence models that are capable of incorporating not censored and censored measurements. The dependence can deviate from Gaussian dependence and is independent of the marginal distribution. The proposed model is used for estimation based on the measured parameters and for spatial interpolation purposes.

The improved quality of the interpolation is demonstrated by cross-validation results, also relating to the uncertainty of the interpolation. The result is a more realistic, heterogeneous, and non-stationary interpolation method.