

Jan van Riebeeck harbour and North Sea channel, Amsterdam

Geo Statistical analysis of dioxin-contaminated sediments

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Introduction: For nautical reasons, the brackish North Sea Channel between Amsterdam and IJmuiden has to be dredged. Parts of the channel and the adjoining harbours (Jan van Riebeeck harbour and other harbours) are contaminated by dioxins due to an accident in a pesticides factory more than 40 years ago. To assess the risks of the sediments, remaining after the dredging of the channel is completed and the surface layer of adjoining harbours, an intensive field study was carried out using state of art geo statistical analysis.

Methods: Because of the large area of the location the geo statistical analysis “nested sampling” is used to select the sampling locations. With this technique relations are been investigated between the distance of the sampling points and the differences in concentrations. The sampling points are chosen at random locations in different distance ranges.

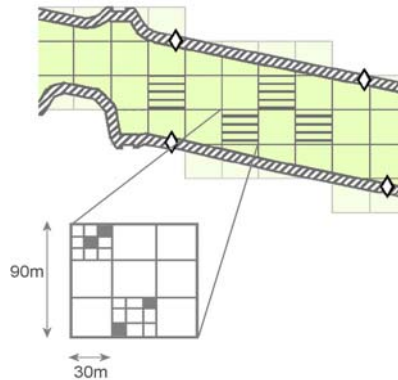


Fig. 1: Nested sampling network

After the first campaign (100 sampling locations) the results were evaluated by making variograms (relations between concentration and variance).

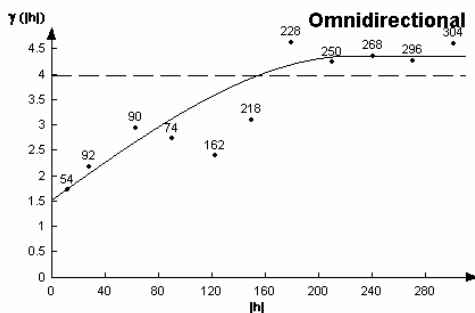


Fig. 2: Variogram of dioxin

After the first round samples were taken on fixed distances based on the results of the nested sampling.

Results:

The assumption of a (log) normal distribution of the concentrations was only be found for dioxin, probably caused by the fact of one known large source. The variogram fig 2 shows that below a range of app. 150 m the concentrations are correlated. After filling the white gaps (sampling campaign 2 and 3), based on this fixed distance an interpolation is made by kriging of the results (figure 3). Compared to standard sampling campaigns with fixed areas, nested sampling leads in this situation to reliable results with quantified variation.

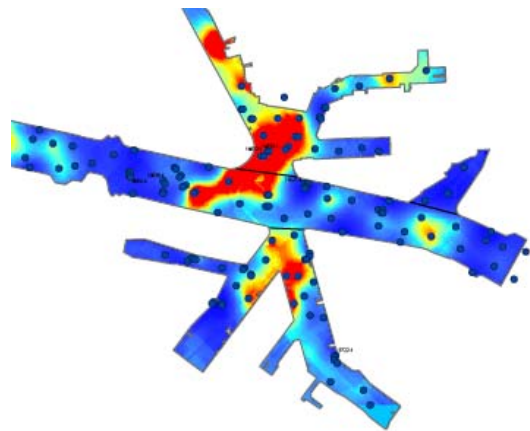


Fig. 3: Dioxin concentration red = high, blue = low.

Discussion:

In this situation a relation is found for dioxin. For other parameters the results were less reliable due to many different sources. In case with a well known source nested sampling in combination with interpolation could lead to more reliable results with probably less samples.

References:

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- Webster, R., Oliver, M.A. Statistical methods in soil and land recourse survey, Oxford, 1999.