The hydrocarbon concentration distribution in the contaminated site using geospatial analysis

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Abstract

The volatile organic compounds exposure is governed by the source distance and dispersion of the pollutant into air and groundwater. The purpose of this study was to validate suggested models for the prediction of concentration distributions. The study design was organized into different methods to simulate industry site. The distribution models generally showed a fair agreement with measured data. For graphical representation of concentration of volatile hydrocarbon, it has to obtain a continuous representation of the contamination of the site. Therefore, the used interpolative methods examined for this project are the IDW(inverse Distance Weighting) and kriging method. In the results, in summary, all two different methods can be used to quantify exposures at a particular source area, and thus provide, a solid foundation for making risk-based decisions. All the calculations can be performed using Excel's built-in functions, and the capabilities of geospatial analysis allow the results to be displayed visually. However, anyone who uses these methods should understand all of the assumptions and limitation

Key words: volatile organic compounds exposure, concentration distribution, Kriging, IDW

1. Introduction

The various geostastical mehods can create predictable benzene concentration from spatially sparse monitoring well data. Three techniques are used for this study: Inverse Distance Weighting(IDW), Spline, and Kriging. This study shows which interpolation methods are more precise through making a comparing among them. Of these methods, this study shows that spline are not suitable for prediction of creating benzene concentration. Also, this result falls into Cressie's and Ju Young Lee's results which kring(Cressie, 1991 and Ju Young Lee, 2005) is the best suitable method.

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2. Materials and Methods

Above mentioned that, this study describes the application and comparing of three geostatistical methods. Three methods such as IDW, Spline and Kriging are used for this study. Kriging defines that it assigns all of weights from monitoring data to predict data at unmeaused data. Kriging method depends on mathematical and statistical aspects. Its basic concept is autocorrelation and distance. Spatial benzene monitoring wells simulate their distance and their benzene data are computed as autocorrelation response to a function of distance.

Before creating predicting data in unmeasured region, the exploratory spatial data analysis is performed whether observed benzene data are necessary transformation for normal distribution to analysis or not. Methodology is histogram, QQ plot, skewness-kurtosis analysis. If observed data require transformation, observed dataset are manipulated by using Box-Cox, arcsine, or log transformations. In next step, detrending work is necessary to creating dataset. Also, before three interpolation methods are applied, trend analysis is essential to remove trend. In the geostatistics, the removing trend provides the modeling of random variation to obtain precise prediction. Therefore, the spatial neighbors benzene data analysis should be based on geological aspects. In general, the oil refinery site has anisotropic formation. For example, its elevation ranges from 43m to 57m.

3. Results

In this study, spatial analysis using interpolation techniques were evaluated for precise prediction of benzene concentration data which is used for impact of environmental risk assessment. Kriging interpolation method are suitable to generate precise benzene concentration data in oil refinery site but this study is not shown about results of IDW and Spline. Kriging method calculate autocorrelation of the measured data from Monitoring well stations and prediction values in unmeasured region from measured data. Therefore, it is used and the best interpolation technique is chosen through validation tests. After all, validation and cross-validation tests in kriging would be much of help for proof to obtain precise results.

Reference

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