

Application of spatial statistics to the evaluation of trend and spread of pollutants in soil: A case of an oil well in Niger delta area of Nigeria.

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Abstract

The study carried out to investigate the usefulness of the Multiple-Variable Indicator Kriging method in environmental impact studies of soils was done in the areas around an active oil well in the Niger Delta area of Nigeria. Soil samples were collected in grids at points and at various depths around the well-head and analysed for electrical conductivity (EC), total hydrocarbon, phenol, heavy metals, SO_4^{2-} , PO_4^{2-} , and other pollutants associated with petroleum industry. Preliminary statistical analyses of the data show the soil properties evaluated to be locally stationary. The data were subjected to semivariance analyses, and the semivariogram constructed show the evaluated soil properties to be spatially dependent, with evidence of high geometric anisotropy. Except for areas very close to the waste pit, the soil contents of the pollutants were generally lower than the critical limits. The semivariogram of the soil properties indicated the area of maximum influence of most of the pollutants not to be more 200m radius away from the wellhead area with highest intensity along the southern border of the field. Additional data points were interpolated by kriging technique, to ensure a smooth contour plot of the pollutants. The soil properties were aggregated into a single index "Pollution Indicator", using The Multivariate Indicator Kriging Technique (MVIK). The contour grid plots of the "pollution indicator" clearly indicate the source, intensity and the direction of the pollutants in the field.