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Multidisciplinary study to highlight interaction between anthropogenic disturbance and natural coastal sedimentary processes. Complementarity of geochemical and granulometric methods and proposal of a new spatial geostatistical approach

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Abstract

Traditional geochemistry studies use mapping techniques and multivariate analyzes to highlight spatial distribution of chemical concentration parameters. Granulometric parameters are used to study sedimentary transport, especially through Grain Size Trend Analysis (GSTA) approach integrating mean, sorting and skewness parameters. Within the increasing pressure of human activities on marine coastal ecosystems, the study of sedimentary disturbances remains a challenge. The Bay of Seine is highly anthropized by harbour activities and dredging sediments from The Havre Harbour and their deposition on subtidal area. To understand sedimentary mechanism, a geochemical and sedimentological study was conducted at the beginning of 2016. Sediments from 179 subtidal stations and 16 stations in the harbour basins and in the Seine, estuary were studied. Geochemical elemental composition (18 calibrated elements) was obtained through X-Ray Fluorescence spectrometry and infrared spectrometry (TOC). On this dataset, multi-treatments were applied and the results compared: mapping spatial distribution of the concentrations of each chemical element; PCA analyzes and selection of the information-bearing parameters and mapping of the PCA results; application of the "classical" GSTA approach on the granulometric parameters, "Innovative" integration of the chemical parameters and PCA results in the GSTA approach. The results show the need of multidisciplinary research and the interest of geochemical tracers to study coastal sediment dynamics and to highlight the impact generated by anthropogenic activities. The geochemical GSTA approach confirms the sedimentary dynamics and appears more robust than the methods conventionally used. To generalize this approach, an adaptation of the concepts is currently being developed: The MSTA.