Computer Visualization System for Sediment Pollution in Japan

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Investigation and analysis on sediment pollution have been performed at individual municipal organizations, and there is yet no comprehensive study to understand the sediment pollution on national scale. The present study attempts to visualize data on sediment pollution throughout Japan and prepare computer graphics for each prefecture and sea area as a comprehensive and direct approach to understanding the sediment pollution. Our study demonstrates that the analysis of sediment data by the present method is highly effective.

It is well known that the sediment is one of the significant factors in elucidating the mechanism of water pollution. However, highly complicated mechanism of pollutant movements in the sediment has made it difficult to grasp the mechanism of sediment pollution over a wide area. In the present study, data collected by individual investigative organizations were compiled and subjected to an analysis as outlined below to obtain overall understanding of the sediment pollution.

Data for Analysis

Altogether, 20,306 sets of data counting 69 items such as oxidation–reduction potential (ORP), cadmium, total mercury and PCB as one set were collected from all 47 prefectures for the period of 12 years between 1972 and 1983. In particular, there are 8,572 sets of data which are collected from 28 prefectures covering 344 sea areas. These data were given code numbers identifying the prefecture, water area and monitoring point by the Atlas of Water Quality Monitoring Points in Public–Use Water Areas in Japan, and are stored in a hard disk(40 M bytes) for computers as the original data. Most of data represent the measurements on the concentration of pollutants in the surface of sediment layer. Core samples which would give information on plural layers are also included in the original data. The time interval between samplings varied depending on the sampling points ranging from one month to one year. Data precision somewhat differs depending

on the investigative organizations and on the time of samplings.

Analysis Method and Result

As for time and place, changes in the sediment concentration are more gradual and subtle than those in the water quality. Biased distribution of monitoring points and time interval is therefore corrected by taking average values within an area and within one year. Data classified by areas and by years thus obtained are recorded in the numerical data file to be used for display.

In order to visualize the contents of the numerical data file, mapping data file is prepared on a computer. This file is a map of monitoring points for each sea area, and the data are inputted in a computer using an image scanner and a mouse. The mapping data thus obtained by graphical processing are stored as the mapping data file.

A final database is formulated by combining these two kinds of data file on the Municipal Information Management System. By referring to the data by item such as the sea area, year, and components of sediment pollution from the final database, a map showing the chronological changes in the sediment concentration for each sea area and prefecture can be displayed on CRT or printer.

Figures 1 and 2 show a portion of the results obtained by the analysis method of the present study. The blank portions in the maps are the areas where no measurement data are available. Fig. 1 shows the distribution of cadmium concentration in sediment measured in different prefectures at an interval of 3 years from 1977. Figs. 2(a) and 2(b) show two representative enclosed sea areas in Japan similarly at an interval of 3 years. It is seen from these figures that whereas the cadmium concentration in Tokyo Bay decreases gradually from the center toward the coast of the bay over the years, cadmium in Osaka Bay is concentrated at the center with sudden changes in the surrounding areas.

Conclusion

There has been no attempt to visualize the voluminous data obtained from field observations to clarify the overall situation of the sediment pollution. Analysis of sediment data on wider areas by the present method is considered highly effective in comparing and analyzing the situation of pollution as a comprehensive and direct approach.

Reference

1) Committee on Atlas of Water Quality Monitoring Points in Public-Use Water Areas in Japan 1982; Research Data, The National Institute for Environmental Studies, Japan, No. 23 B-23-83, 1988
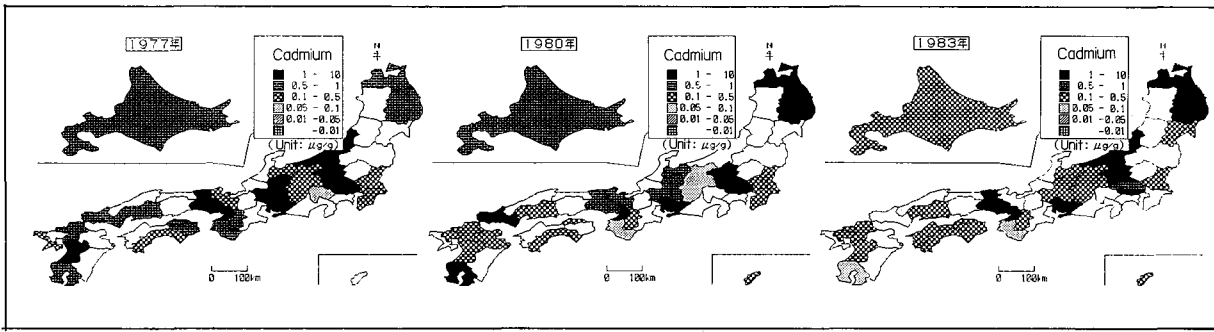
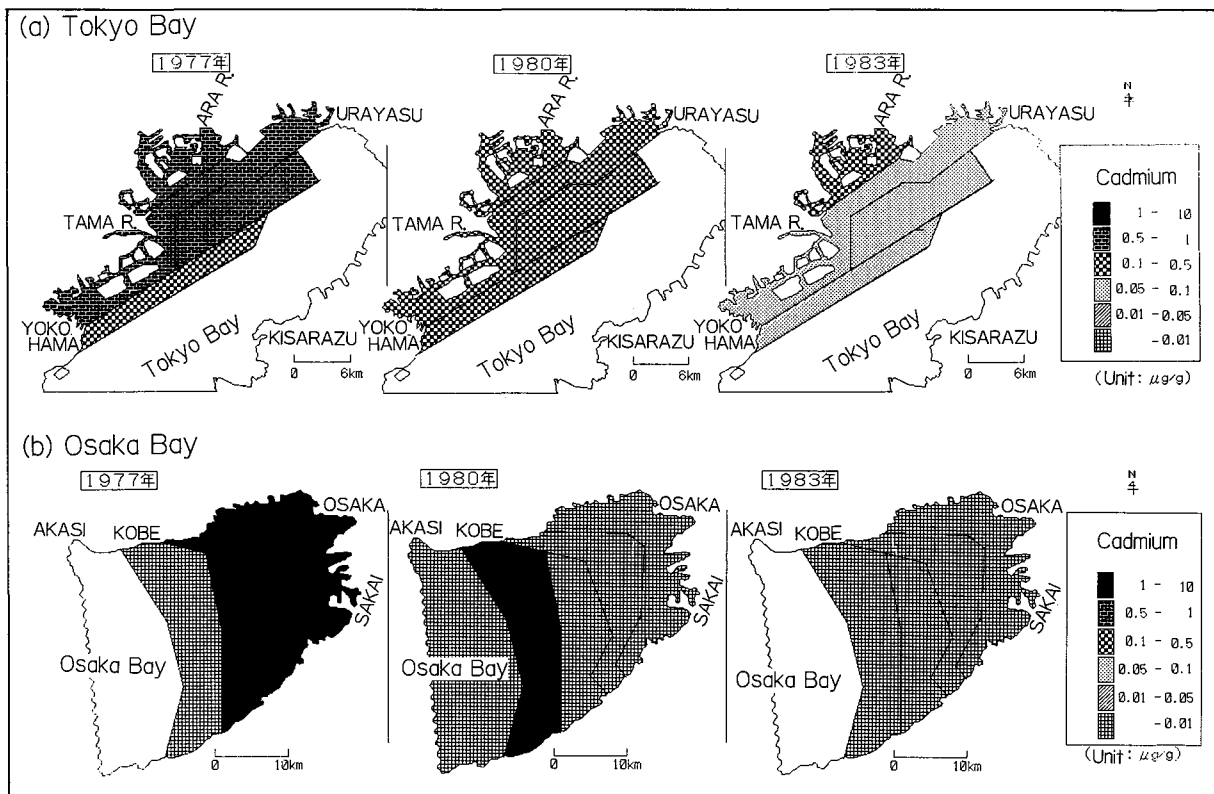Fig. 1 Concentration of Sediment Pollution Divided by Each Prefecture

Fig. 2 Concentration of Sediment Pollution in Enclosed Sea Areas