Y-IV2

Modeling the sewage assimilative capacity of coastal waters in the Mediterranean

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A B S T R A C T

The marine environment can assimilate to a certain degree pollutant substances of domestic origin. For organic loads this assimilation is doing through three main processes: (a) transport from marine environment to sediments, atmosphere and organisms (sedimentation, sorption, aerosol formation, interaction with biota), (b) transport within the water body (convection by currents and waves, turbulent diffusion and dispersion) and (c) transformation (biodegradation, chemical and photochemical degradation). For the proper design of the environmental engineering works, such as submarine outfalls and sewage treatment plants, it is very useful to analyse and model the assimilative capacity of a coastal environment to organic pollutants. Modeling the involved processes is the most important step following the description of the marine system and preceeding the management and decision phase. In view of the complexity of the various processes, complete modeling is almost impossible so that simplifications and assumptions are to be introduced. Before using spatially distributed models, assessment of the relative importance of the involved mechanisms can be done from the data series and evaluation of the input - output relations can lead to a definition of various water quality areas of the coastal system.

This methodology is illustrated for the case of Thessaloniki bay. Seasonal fluctuations of water quality parameters such as pH, dissolved oxygen and nutrients have been recorded in nine stations during the period 1984-1987. Measurements have been performed for every station at three points: surface, mean depth and bottom. As for example, in Fig. 1 the time evolution of the dissolved oxygen is shown at station 1 near the city. Oxygen deficiency below 5 ppm can be seen for relatively long periods especially in summer and close to the bottom. The observation of the irregular fluctuations of the nutrients (NO_2^-, NO_3^-, PO_4^{3-}, SiO_4),

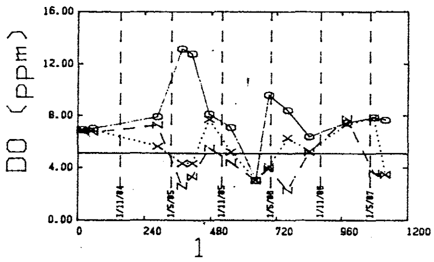

Fig. 1 Dissolved oxygen fluctuation at station 1 -o- surface, -x- mean depth, -z- bottom.

together with the results of current measurements shows that transport and turbulent dispersion mechanisms in the bay are relatively more important than biogedradation. Furthermore, the assimilative capacity is evaluated using the following input - output modeling. The coastal area is divided in three parts: the inner, central and outer bay. For every part, pollutant loads are evaluated in terms of COD (kg/year). From the current measurements and the hydrodynamic models the cycling-time of water is estimated at 4 days in the inner and 15 days in the central parts. Using the value 0.2 g/m^3/day of COD as the maximum load which can be discharged in a confined sea-water body (Laporte et al., 1982) the assimilative capacity found is in agreement with the measurements and the available historical data.

Selected References

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Y-IV3

Concentration field in an area of a sunken ship loaded with a toxic substance

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ABSTRACT

Traffic of ships loaded with large quantities of liquid toxic substances is being increased due to greater need and production. When such ships sink they present a potential local (or an international) ecological catastrophy. In case the ship sunk in a deeper water, the unloading procedure may be very dangerous itself, the planning of operations lenghty and the possibilities range from leaving the ship to leak slowly, to releasing the substance all at once.

A modelling case study of vinyl chloride is presented to help evaluate the impact of several strategies. After the leackage has been detected or a test leaking performed, the first step is to estimate parameters of a stationary and a nonstationary distribution. The parameters may include the intensity of the source, the mean sea current vector, an extinction coefficient and the dispersion coefficent (1). The estimation procedure is neccessary since the complete behaviour of the substance in real conditions is not known . Upon the completion of the estimation procedure, simulation of several cases may be attempted (2). First, the results concerning transient concentration field following momentary release are presented. Second, the results of several stationary distributions following different rates of release are compared.

Finally, a monitoring procedure is proposed for measurements that are neccessary to obtain the essential parameters.

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