

WASTE WATER DIFFUSION IN THE GULF OF NAPLES

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R é s u m é - Dans les régions côtières urbaines et industrielles où la partie la plus importante de la pollution arrive à des points bien localisés, il est possible de suivre les procès de mélange par des mesures hydrologiques de courants marins.

Sur la base des données de plusieurs campagnes océanographiques accomplies par le Institut de Météorologie ed Océanographie à commencer de l'année 1977 à bord du navire de recherches "L.F.Marsili", project finalisé "Oceanographie et fonds marins", Sous-project Pollution marine, du Conseil National pour la Recherche, on discute la diffusion des eaux residuaires de la zone urbaine et industrielle de Naples, et de celles du fleuve Sarno près de Castellammare.

Marine pollution in the Gulf of Naples and its surrounding is mostly due to urban and industrial discharges, main outlet at Cuma and Sarno river, minor outlets scattered elsewhere ⁽¹⁾.

In order to study the diffusion of the pollutants we should carry out specific measures which usually are very complicate. It is possible to infer useful information about the passive pollutants distribution and their evolution from the mixing of waste waters and marine coastal waters by considering Salinity as a tracer.

For this it is necessary: a) to state the salinity distribution (S) of the area; and b) the salinity of the sea water unaffected by coastal polluted waters (\bar{S}); c) to locate and to track the mixed waters area starting from their origin in order to compute the correlation coefficient with the pollutants ⁽²⁾. So a small scale detailed hydrological survey as well as appropriate meteorological and current measurements are needed.

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In figure 1 we give the surface salinity distribution and in figure 2 we indicate the currents recorded at 10m depth and near the bottom in several stations. The data were collected from 15 through 19 April during the 8th. cruise in the Gulf of Naples ^(oo) (1980).



Figure 1 - Salinity (S‰ ,full lines) and depth (metres, dotted lines) of the homogeneous surface layer in the Gulf of Naples.

The T-S analysis allow us to locate the following water masses: a) northwards, close to the mouth of the Volturno, a plume of low salinity water (35.00‰), with strong vertical gradients in the first 2-3m; b) in the offshore waters of Ischia and south of Capri, unaffected tyrrhenian surface water by coastal waters, delimited by 37.80‰ isohaline and characterized by homogeneous structure in the first 5-10m;

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c) along the Sorrento peninsula, waters affected by Sarno river (37.00‰ isohaline) with a strong stratification in the upper 2-3m layer; d) in the middle area of the Gulf a large very homogeneous tyrrhenian surface water area, having thickness larger than 20m towards the shore (37.80‰ isohaline); e) a large area with less saline water than the tyrrhenian ones (37.70‰), homogeneous in the first metres between the shores of Vesuvio and Pozzuoli.

From the discussion of the above marine current records and of the meteorological data, the following results may be stated:

- a) the tyrrhenian waters came in the Gulf through the Bocca Grande on April 14th. and 15th. when a strong south wind was blowing;
- b) on the 16th., 17th. and 18th., during the hydrological survey (figure 2) an anticyclonic circulation, more active between the islands, and consequent movement of the tyrrhenian waters towards the Sorrento peninsula is evident.

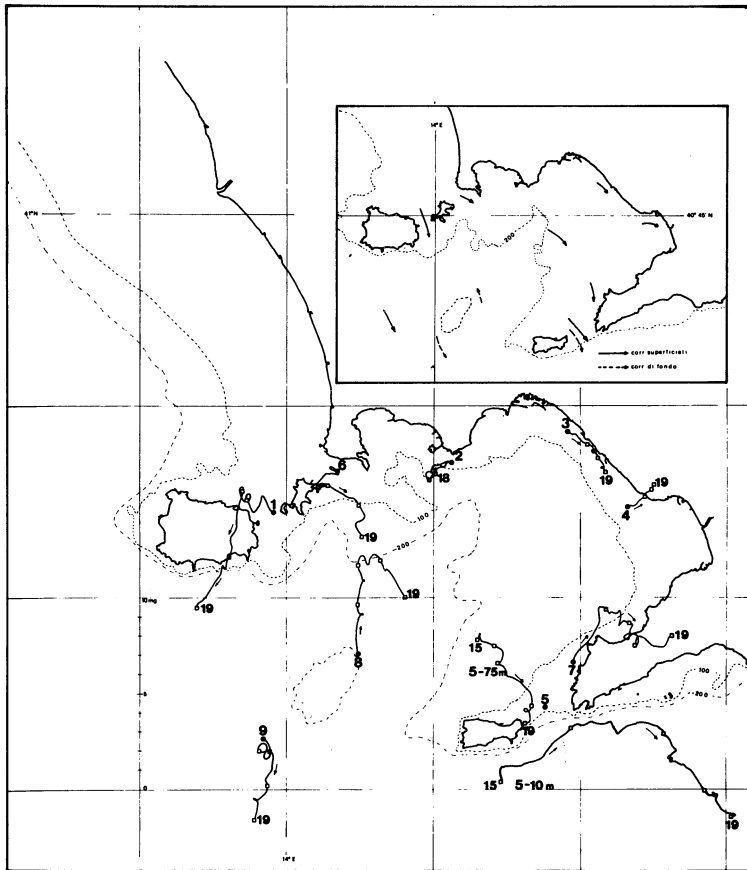


Figure 2 - Marine current records at 10m depth (Stations 1 through 7) and near the bottom (station no. 5 75m; station 8 196m; station 9 280m) and mean circulation pattern. The small squares along progressive vectors indicate the time 00 of each day (15,, 19).

Having specified the salinity of the tyrrhenian water ($S = 37.80\text{‰}$) and located the mixing area of the different sources, it is possible to evaluate their concentration by $m = 100 (1 - S/\bar{S})$.

For example the 35.00‰ isohaline in front of the Volturno river indicates a 7.4% fresh water content, the 37.00‰ isohaline, opposite the Sarno river a 2.1% content of its fresh water. Hence 7.4% or 2.1% are some measure of the amount in percent of passive pollutants present around the above isohalines.

Summary - In the urban and industrial coastal regions, where pollution largely arrives from localized waste water outlets, it is possible to follow the mixing processes through suitable hydrological and current measurements.

The Institute of Meteorology and Oceanography is carrying on an observational program aiming as its first step to provide time series of oceanographical data long enough to be useful for the best understanding of the physical phenomena which take place in the Gulf of Naples.

The research develops in the framework of the National Research Council project "Oceanography and Marine Bottoms" S.P. Marine Pollution.

Some of the collected data allow now the analysis of the diffusion of polluted waters of the neapolitan area and of the river Sarno, near Castellammare.

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