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Hydrography Committee

Questions regarding the assessment of the fluxes of  
suspended matter in the sea

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Summary

The question is raised how to obtain reliable figures on the transport of suspended matter in the sea, taking into account the variability at various time scales.

Questions regarding the assessment of the fluxes of suspended matter in the sea.

Introduction.

In September 1979 an ICES workshop on pollutants and sediments was held at Texel (see C.M. 1979/E:71). At this workshop plans were proposed for pilot surveys. These plans subsequently were considered by a coordinating group (according to C. Res. 1979/2:8) which met at Texel on 25-26 Febr. 1980. One of the points raised there was the measurement of sediment fluxes in the sea. It was considered important that the Hydrography Committee should investigate what are the possibilities for such measurements.

Transport as Bed Load and in Suspension.

One may discriminate between the transport of sedimentary particles as bed load (involving rolling and saltation) and transport in suspension. As fine particles are primarily considered in the above-mentioned proposals, we here concentrate on the transport in suspension. For all practical purposes suspended matter can be regarded as material smaller than 60-70  $\mu$ m. Usually a limit of 63  $\mu$ m is used.

Present knowledge.

Estimates have been made on the suspended matter or "mud" budget of the North Sea by McCave (1973) and recently by Eisma (in press). These estimates are based upon mean water fluxes, mean suspended matter concentrations and sedimentological evidence.

Sediment transport as a hydrographic problem.

As a first approach the product of mean concentration of suspended matter and the mean residual water flux gives a figure for the sediment flux, but further consideration of the transport process indicates that such estimates may be altogether wrong. Not only the current but also the concentration of suspended matter is variable in time and these variations are likely to be correlated. Also the vertical deviations from the mean of both current and suspended matter concentration should be considered.

As an example we may, for instance, consider the effect of storms. The concentration of suspended matter may then be strongly increased, whereas the current pattern may significantly differ from the mean. The resulting sediment transport may be quite different from that at more quiet conditions, and the average for all weather conditions could be different from the product mean water flux times mean concentration.

Apart from such a storm-induced transport (1) and apart from the effect of vertical variations (2) one may consider the possibility of additional transport by turbulent variations (3), tidal variations (4) and topographical variations such as in ebb- and flood channels (5). Such variations have been studied in coastal and estuarine waters, but their significance in open sea is not clear. Some idea on the long-periodic variability may be gained from an inspection of the JONSDAP-73 data for the Southern Bight on currents (Ramster, Medler and Jones, 1976) and on suspended particles (Eisma and Gieskes, 1977). Although the timing of the data sets does not permit actual computations, it is suggested that the effect needs further investigation. The tidal effect is illustrated by the observations by Joseph (1954), where the concentration of the suspension (here: fine sand) is strongly correlated with the tidal current.

#### Measurement problems.

The problem outlined above may be partly approached by theoretical studies and experiments in hydraulic models. We may refer to a review article by Bowden (1978) on the problems of the benthic boundary layer. However, field measurements are desirable, if not necessary, to supplement these studies. This especially is the case when mud deposition is considered in areas where tidal current velocities are relatively high, as in the German Bight and off the Belgian-Dutch coast. However, for the measurement of sediment concentration and its variation at different time scales there is no generally applicable technique available, as there is for current measurements. It is probable that a solution can be found in optical sediment measurements, but here information is scarce and the variability in composition and size of the sedimentary particles (including plankton and detritus) poses a serious problem. A solution is to carry out measurements in the absence of living plankton, i.e. during the winter or below the thermocline (Eisma and Kalf 1979), and to calibrate optical measurements with results from the determination of particle size and of total content of suspended matter.

#### Questions.

The above problem appears to become more and more important. It is therefore desirable that within the ICES Hydrography Committee some consideration is given to this point. The following questions may be specified:

- a) Can we, on the basis of present knowledge, indicate the relative importance of the different possible mechanisms for the sediment transport problem?
- b) What are the instrumental possibilities for measuring suspended matter transport and determining suspended matter fluxes in the sea?

- c) Can research groups be identified that are active in this field and can they consider further the proposals made by the Texel Workshop?
- d) If there is not sufficient activity, should ICES, and especially the Hydrography Committee, take steps to promote the work in this field?

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