Possibilities of Reducing Nutrients under Support of Models

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The North Sea, including its harbours and enclosed seas (and bays), is continuously loaded by nutrients, heavy-metals and halogenated hydrocarbons. In the past several numeric models have been used which detect the appearance and behaviour of different organic compounds. They are used as basic tools and decision-bases for measures which can reduce those loads, for example, by wastewater treatment. Excluding the loads from East Germany, the waste-water-treatment strategics have been accomplished. Furthermore nutrients and heavy metals from catchment areas and former mines are responsible for eutrophication and special contamination problems.

For three case studies, different types of models were developed to estimate and at least reduce the nutrient and heavy metal loads. One case-study investigates the loads of nutrients in the river "Vechte" up to the "Ijsselmeer"-Sea (Netherlands), which is an enclosed part of the North Sea. For the evaluation of different land use possibilities, groundwater and wastewater treatment, including their influence on water quantity and quality special numeric models were developed, which simulate the whole catchment-areas (including surface waters) in North-Rhine-Westphalia, Lower Saxony (Germany) and the Netherlands. The modelling of those areas has proceeded over several years in timesteps of two weeks. Measurements in surface- and groundwater, only for this response, were carried out over one year in the recent area by five Dutch and German water authorities coordinated by the authors. This project is also based on experiences with a land-use and surface-water quality-model for the system of river "Hunte" and lake "Dümmer" which both pour at least into the North Sea, too.

The results are showing that a relatively small part of the area is responsible for high amounts of nutrients. The simulated influence of different catchment areas, and possible strategies to reduce the loads from there can be used for the calculation of resulting eutrophication effects.