RESEARCH ACTIVITIES IN OCEANOGRAPHY (1987-1990) AT THE LABORATORY OF HYDRAULICS, KATHOLIEKE UNIVERSITEIT LEUVEN, BELGIUM (de Croylaan 2, 3001 Heverlee)

1. Numerical modelling of tides and wind induced currents

1.1. 2D Models

The depth averaged shallow water equations have been solved using finite differences. Different schemes have been used to describe the solution in the time and space domain (ADI, FADI, explicit). The following application have been worked out.

- Tidal computations in the North Seas and English Channel region, ranging from a Belgian coastal model with a gridsize of 300 m to a coarse grid (24 km) continental shelf model.
- Calculation of wind induced surface currents and tides in the Wedell Sea.
- Tidal computations in the lagoon of Venice.

1.2. 2,5 D - 3 D Models

For the simulation of water movements outside the well-mixed continental shelfs 3D baroclinic models are necessary. The 2,5 D model is a simplified vertical plane version of the fully 3D model. The models have been applied to ice edge upwelling and shelf break upwelling. An important item is verification and comparison of the model results with analytical solutions or other model results.

2. 2D modelling of dispersion of pollutants

The discharge of highly polluted waste waters into the sea causes ecological problems not only at the disposal place but also at the regions to where the water is flowing. The pollutant transport is described by the advection diffusion equation. Research has be done concerning numerical techniques to solve the equations, i.e. advection schemes and mixed Eulerian Lagrarngian models.

3. Analysis and prediction of ocean tides along a coast

A procedure has been proposed to constitute the optimum model based on harmonic analysis of observed time series of water level recordings for three Belgian coastal stations. A method for determinating the optimum number of constituents which should be included in a model has been developed.

4. Wind sea and swell prediction

4.1. Air-water interaction

The influence of the wind on the sea surface and the influence of the waves on the atmospheric boundary layer are studied. Emphasis is on the relation between parameters describing the saturation range of the sea surface elevation spectrum and parameter describing the atmospheric boundary layer.

4.2. The energy transport equation

An explicit and an implicit integration scheme are implemented for the dimensional wave energy transport equation.
The wave model used is the 1D - WAM model from the Max Planck Institut für Meteorologie in Hamburg (Hasselmann). It solves the energy transport equation for fetch and duration limited conditions.

4.3. Souce term sensitivity

The generation, interaction and dissipation of waves is described by the source terms in the energy transport equation.
The source terms contain a number of parameters which can be optimized to obtain an optimal fit with fetch- and duration limited wind seas.
Use is made of standard optimization routines on the IBM 3090 from the University Computer Centre to look at the sensitivity of source term parameters. Special emphasis is put on obtaining optimal parameter values for different wind input terms.

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