Stochastic differential equations for transport modeling

Project Aim

Stochastic particle models are developed for simulating transport processes in coastal waters. Higher order numerical methods for approximating the stochastic differential equation have been analysed and implemented to improve the performance of the model. Here attention has been concentrated on the treatment of the vertical dimension of the model. Furthermore, the variance reduction techniques control variates and importance sampling have been investigated to increase the efficiency of Monte Carlo applications of the particle model.

Progress

In the project we have focused on the concept of reverse time diffusion. Using this concept the efficiency of Monte Carlo methods for stochastic differential equations can be improved by generating both forward as reverse time realizations of the process. In corporation with prof. Delhez and prof. Deleersneider a general residence time theory have been developed using the adjoint formalism. The reverse time approach has been used to compute the residence time in coastal waters. Finally adaptive numerical schemes for stochastic differentiel equations have been developed and analysed too.

Dissertations

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Scientific Publications

1. Charles, WM, Berg, E. van den, Lin, HX, Heemink, AW & Verlaan, M (2008). Parallel and distributed simulation of sediment dynamics in shallow water using particle decomposition approach. Jounal of parallel and distributed computing, 68, 717-728. (TUD).

Project leaders

AW Heemink

Research theme

Mathematical and computational methods for fluid flow analysis

Participants

AW Heemink, HX Lin, E Deleersnijder

Cooperations

Deltares, Louvain-la-Neuve

Funded

Deltares, NUFFIC

1st 20% 2nd - 3rd 80%

Start of the project

2002

Information

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