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MODELING OF SEDIMENT TRANSPORT AND TURBIDITY MAXIMUM IN THE GIRONDE ESTUARIES (FRANCE) BY SINGLE- AND TWO- PHASE APPROACHES

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Nowadays, there exist two approaches for modeling sediment transport in estuaries: classical (single- phase) and two-phase ones. Almost all existing sediment transport models are based on the single- phase approach, in which a hypothesis on "passive scalar" is adopted. Solid particles are considered as a simple tracer that moves at the same velocity as fluid particles. A numerical study for sediment transport and turbidity maximum in the Gironde Estuary was done by Li et al. (1994) using single- phase approach

The second, two-phase approach is first used in particle-gas domain, in particular, for fluidized bed problems. In this approach, all interactions such as fluid-particles, particle-particle and particles-walls are taken into computation. Since the consolidation of solid particles could be taken into computation in the two-phase models, no fictive definition for the bed is necessary as the case of mono-phase models. Fluid-bed interaction, which is in fact the exchange on the water-sediment interface near the bottom, as well as falling velocity of the solid particles are evaluated naturally in solving two-phase Navier-Stokes equations. Therefore, the two-phase approach is a promising one for modeling sediment transport (Barbry 2000, Chauchat 2007 and Nguyen et al 2009).

The purpose of this article is to present a two-phase model, and to show the perspectives in developing and improving this model for sediment transport modeling. The Eulerian approach is used. The model is based on solving Navier-Stokes' equations for the solid and fluid phases by using a finite-volume method, coupled with a projection technique. The attention is paid to ensure that all numerical schemes used in the model must be strictly conservative.

The model is used to simulate the fine-grained sediment transport in the Gironde estuary (France). The estuary with three branches (Garonne, Dordogne and Gironde) has been discretised by a computing of dx=300 m and of 21 points over the vertical. A coupling technique for three branches has been proposed and realized on a PALM Plate-form.

The numerical results obtained from modeling of sediment transport and turbidity maximum in the Gironde estuary (France) using two-phase approach are presented. A comparison of the results obtained by both single- and two-phase approaches has been done to illustrate the advantages of two-phase approach over single-phase one.

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