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Nuclear Technologies Applied to Sediment Transport in River, Estuarine and Coastal Zones to Validate CFD Codes

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Siltation in harbour is a longstanding problem which could generate important costs for maintenance program to secure nautical conditions. This paper reports different studies on sediments in France (Le Havre, Bordeaux, Saint-Michel and Fort-de-France) aiming to characterise the rheological properties of sediment, analyse sedimentation-consolidation processes and propose a numerical model for simulating sediment dumping and water injection dredging. Two non-intrusive techniques are used to measure the time evolution of the vertical profile of concentration during batch settling test. The first one is a Magnetic Resonant Imaging (MRI) vertical prototype used on Gironde estuary. The second is an X-ray 'home-made' prototype used on Seine estuary. Both are used to observe the sedimentation and the consolidation processes of natural cohesive sediments that was sampled close to Ports. They provide both movements of the supernatant/suspension interface and the isoconcentration lines of the process. A space-time based method is proposed to close the governing equation. Two different computational fluid dynamic (CFD) codes are used to simulate observations in well controlled laboratory conditions. The one is an open source and industrial 2D code (Telemac) while the other is a research and modern 3D code (NSMP). Both are considered to reproduce sedimentation consolidation of very fine sediments from sites of studies with an analysis of what happens when cohesive and non cohesive sediment are presents. Even through the results are satisfying, there are many questions arising from these exercices. More experiments (using nuclear technologies) are therefore essential to confirm interpretations of processes and further improve their modelling. Since the CRP F22066 is formed, there is a new hope to tackle this longstanding challenge.

Country/Organization invited to participate

France

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