

COUPLING OF A NEW IN-SITU MEASUREMENT TECHNIQUE WITH A NEW MODELLING APPROACH FOR THE DETERMINATION OF THE EFFECTIVE SETTLING VELOCITY OF FLOCCULATING SEDIMENTS IN ESTUARIES

Chen Margaret ¹, Erik Toorman², Frank Mostaert³, Pierre Van den Winkel⁴, Koenraad Muylaert⁵, Patric Jacobs⁶, Elin Vanlierde⁶, Patrick Meire⁷, Andre Cattrijsse⁸ and Florimond de Smedt¹

¹ Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel, Pleinlaan 2, 1050, Belgium
E-mail: Margaret.Chen@vub.ac.be

² Hydraulics Laboratory, Katholieke Universiteit Leuven, Kasteelpark Arenberg 40, 3001 Heverlee, Belgium

³ Flanders Hydraulics Research, Berchemlei 115 | B-2140 Borgerhout, Belgium

⁴ Department of Applied Physics, Cyclotron Laboratory, Vrije Universiteit Brussel, Laarbeeklaan 103, 1090 Brussel, Belgium

⁵ Laboratory Aquatic Biology, Katholieke Universiteit Leuven, KULeuven Campus Kortrijk, E. Sabbelaan 53, 8500 Kortrijk, Belgium

⁶ Department of Geology and Soil, Universiteit Gent, Krijgslaan 281 S8, 9000 Gent, Belgium

⁷ Ecosystem Management Research Group, Universiteit Antwerpen, Universiteitsplein 1, 2610 Wilrijk, Belgium

⁸ Flanders Marine Institute (VLIZ), InnovOcean site, Wandelaarkaai 7, 8400 Oostende, Belgium

This research project is funded by Research Foundation Flanders (FWO-Vlaanderen) and led by VUB partnered with other three Flemish universities (KULeuven, UGent and UA) and two Flemish institutions, Flanders Hydraulics Research (WL) and Flanders Marine Institute (VLIZ). It is a four-year project involving field measurements with an innovative in-situ system, comparative laboratory experiments in a water tank and the development of a new modelling approach. Estuarine particles are largely flocculated and their size and density may vary significantly over time scales of minutes. Knowledge of flocculation and accurate in-situ measurements of floc are essential for understanding particle aggregation mechanisms and the resulting settling velocity and the entire sediment transport process. One of the most crucial parameters, which remains an unresolved problem known to the hydraulic research domain, is the determination of in-situ settling velocity and related floc properties as well as particle-turbulence interactions. This research is aimed to develop a new and reliable system for the in-situ real-time measurement of particle movement along with simultaneous measurement of turbulence and size and shape of settling particles; to use the aforementioned new measurement system to investigate in-situ particle settling velocity and particle-turbulence interaction on meso-scale in the laboratory experiments and on macro-scale in the Scheldt Estuary; and to bridge the gap between the measurements and the simulation and prediction of flocculation by numerical models. This involves feed-back from the model to the interpretation of the measurements with the new system. Consequently the complementary nature of this project will lead to the characterisation of the relation between flow and particle-turbulence interactions, and to the development of a new modelling approach for the determination of the effective settling velocity of flocculating sediments in estuaries.

Project promoter: Florimond de Smedt

Project coordinator: Margaret Chen

Project participants:

Margaret Chen, Florimond de Smedt and Stanislas Wartel
Vrije Universiteit Brussel, Hydrology and Hydraulic Engineering

Pierre Van den Winkel, Ludo de Vis and Rene Waegeneer
Vrije Universiteit Brussel, Department of Applied Physics, Cyclotron Laboratory

Erik Toorman, Byung Joon Lee and Jian Wang
Katholieke Universiteit Leuven, Hydraulics Laboratory

Frank Mostaert, Jan de Schutter and Stijn Claeys
Flanders Hydraulics Research

Andre Cattrijsse
Flanders Marine Institute

Koenraad Muylaert
Katholieke Universiteit Leuven, Laboratory Aquatic Biology, KULeuven-Kortrijk

Patric Jacobs and Elin Vanlierde
Universiteit Gent, Department of Geology and Soil

Patrick Meire and Stefan Van Damme
Universiteit Antwerpen, Ecosystem Management Research Group