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EDITORIAL

Editorial to the topical collection INTERCOH 2015

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The 13th edition of the International Conference on Cohesive Sediment Transport Processes (INTERCOH 2015) has been held from 7 to 14 September 2015 at the University of Leuven (KU Leuven) in Leuven, Belgium. INTERCOH provides an international forum for scientists and engineers facing challenges posed by the presence of cohesive sediments ("mud") in the aquatic environment.

Even though for the first time organized in Belgium, it was not the first international meeting of this kind in Belgium. Twenty-five years earlier, in November 1990, an International Workshop on Cohesive Sediments, entitled *Towards a definition of* "*mud*," was organized by the Royal Belgian Institute for Natural Sciences in Brussels, in collaboration with many national partners, under the chair of Prof. Stanislas Wartel. This very likely triggered the further internationalization of Prof. Ashish Mehta's workshops in the USA (started in 1981), resulting in the first edition under the title INTERCOH, which was organized in 1994 for the first time outside the US by HR Wallingford in the UK.

For further information on INTERCOH, visit the website www.intercoh.org.

Belgium, located at the heart of Europe, is small, but the occurrence of mud in the coastal zone and in the ports of Antwerp and Zeebrugge and their access channels has initiated applied and fundamental research as early as the end of the nineteenth century. The characterization of marine deposits in the Belgian coastal zone was initiated by hydrographers from the Ministry of Public Works, i.e., Stessels (1866), for hydrographical mapping and Van Mierlo (1899, 1908) during the construction of the port of Zeebrugge between 1899 and 1903, and by Gilson (Royal Belgian Institute of Natural Sciences) in the framework of marine ecosystem research (Gilson 1900, 1928). A revival of sediment research came with the studies on mud dynamics in the Scheldt Estuary by Peters at the Hydraulics Research Laboratory (now Flanders Hydraulics Research) since 1964 (e.g., Peters et al. 1965; see potamology.com), and occurred during the large-scale "Project Sea" (1970–1976), when also SPM dynamics was investigated in the southern bight of the North Sea using numerical models and in situ measurements (Nihoul and Gullentops 1976). The major extensions of the ports Zeebrugge in the 1980s have triggered the most recent cohesive sediment research line in Belgium, a challenge taken up by Prof. Berlamont of the KU Leuven (e.g., Berlamont 1989). This work resulted in the establishment of a dedicated research unit on fundamental and applied sediment mechanics. The engineering challenges associated with marine construction and dredging operations and their impact on the marine and estuarine environment has led to further development of cohesive sediment related research at the Royal Belgian Institute of Natural Sciences (RBINS) and at Flanders Hydraulics Research (FHR), a division of the Flemish Ministry of Public Works. At RBINS, the Directorate Natural Environment (comprising the former Management Unit of the Mathematical Model of the North Sea) is responsible for the monitoring and modeling of the Belgian part of the North Sea. They developed the modeling system COHERENS (http://odnature.naturalsciences.be/coherens/), which has a wide international users group, and have gained a lot of expertise in in situ measurements and their analysis. FHR contributes to model improvements for their applications to waterway and harbor management (especially the Scheldt Estuary and the Belgian Coast) and is one of the forerunners in research on defining and measuring the nautical depth in muddy areas. Belgium is also the home to two of the largest

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dredging companies in the world. This explains why the small cohesive sediments research community in Belgium has evolved to one of the major contributors to advances in cohesive sediments science.

The Topical Collection INTERCOH 2015 comprises 11 articles which cover a wide variety of topics.

The first paper, entitled "Monitoring and characterisation of sand-mud sedimentation processes" by Cuthbertson et al. (2016), describes a series of settling column tests which are conducted to investigate the hindered settling and initial bed consolidation phases of a range of sand-clay mixtures to determine the parametric conditions under which bed segregation occurs. A new, non-invasive, electrical resistivity measurement technique is employed to capture both temporal and spatial changes in the density, porosity, and composition of the evolving sand-clay bed deposits, complimented by time-lapsed images of the sedimentation process within the column. The results show that the formation of segregated (sand-clay) bed layers with bed deposits is largely controlled by the initial fractional composition. A polydisperse hindered settling model is successfully validated with the experimental data, providing new insights into mixed (sand-clay) sedimentation processes.

"Influence of bottom trawling on sediment resuspension in the "Grande-Vasière" area (Bay of Biscay, France)" by Mengual et al. (2016) analyzes optical and acoustic measurements made in the water column in an intensively trawled coastal area. Results show that trawling resuspension (mainly due to the scraping action of doors) can become dominant during the fishing high season (i.e., up to several times the natural one in summer). In addition, the contribution of trawling-induced resuspension is shown to increase with water depth, because of the rapid decay of wave effects. The seasonal evolution of the respective contributions for erosion (mainly trawling and waves) could be mapped for the whole study area.

"Floc size distributions of suspended kaolinite in an advection transport dominated tank: measurements and modeling" by Shen and Maa (2017) describes a one-dimensional longitudinal (1-DL) flocculation model along a streamtube, based on solving the population balance equation to find the floc size distributions (FSD) by using the quadrature method of moments. The model is validated with a laboratory experiment of pump-driven recirculating flow in a cylindrical tank. The flow field is measured with ADV and the flocs sizes determined from camera image processing. The FSDs as well as their representative sizes are efficiently and reasonably simulated by this 1-DL model.

"The impact of disposal of fine-grained sediments from maintenance dredging works on SPM concentration and fluid mud in and outside the harbor of Zeebrugge" by Fettweis et al. (2016) investigates the hypothesis that a significant part of disposed sediments recirculates back to the dredging places and that a relocation of the disposal site to another location at equal distance to the dredging area would reduce this recirculation. The conclusion from a 1-year field study is that the SPM concentration decreases after relocation of the disposal site but indicate stronger (first half of field experiment) or weaker (second half of field experiment) effects that are, however, strongly influenced by the environmental conditions.

"Surface suspended particulate matter concentration in the Taiwan Strait during summer and winter monsoons" by Yu et al. (2016) aims at using MODIS satellite images to investigate how local sediment sources in addition to the seasonality in wind, oceanographic currents, and waves influence the suspended particulate matter (SPM) dynamics in the Taiwan Strait. The data analysis reveals a seasonal pattern of high SPM concentrations in winter, low in summer, and only short-term effects of typhoons.

"Uncertainty in complex three-dimensional sediment transport models: equifinality in a model application of the Ems Estuary, the Netherlands" by van Maren and Cronin (2016) investigates the effect of equifinality (i.e., different combinations of model input parameters leading to the same result) on predictive model capabilities with a complex three-dimensional sediment transport model of a turbid estuary which is subject to several human interventions. The computed effect of two human interventions (offshore dredged material disposal and tidal channel profile restoration) was found to be only weakly influenced by the various equifinal model settings that were tested, strengthening confidence in the numerical model predictions.

"A parameter model for dredge plume sediment source terms," by Decrop et al. (2017), describes a new gray-box model which allows for fast simulations of the near-field behavior of overflow dredging plumes. A new source term of fine sediments is implemented in a hydrodynamic model to simulate the fine sediment dispersion in large-scale applications. To allow for correct representation of overflow plume dispersion in a real-time forecasting model, a fast assessment of the nearfield behavior is needed. A semi-analytical parameter model has been developed that reproduces the near-field sediment dispersion obtained with a detailed fine-scale CFD model in a relatively accurate way.

"A regression approach to the mapping of bio-physical characteristics of surface sediment using in situ and airborne hyperspectral acquisitions" by Ibrahim et al. (2017) investigates the use of two regression models to quantify sediment properties instead of classifying them. Multiple regression and support vector regression (SVR) are used in this study for the retrieval of bio-physical variables of intertidal surface sediment of the IJzermonding, a Belgian nature reserve. Sediment property maps are successfully obtained using the models and hyperspectral imagery where SVR is used with all bands achieves the best performance.

"On the hindered settling of sand-mud suspensions" by Spearman and Manning (2017) examines the hindered settling behavior of monodisperse suspensions in order to create a framework for polydisperse hindered settling that works for both non-cohesive and cohesive suspensions. The model is shown to reproduce the hindered settling of a variety of different sediment mixtures whilst reducing the extent of empiricism often associated with the modeling of polydisperse hindered settling of mud/sand mixtures.

"An examination of the rheology of flocculated clay suspensions" by Spearman (2017) is concerned with establishing a rheological framework for the range of sediment concentrations from the yield point to Newtonian flow. An equation is proposed which has the ability to match the equilibrium and time-dependent viscous rheology of a wide range of suspensions of different concentration and mineralogy.

The last paper, entitled "Erosion characteristics and horizontal variability for small erosion depths in the Sacramento-San Joaquin River Delta, California, USA" by Schoellhamer et al. (2017), tests the hypothesis that observed erosion rates in microcosm experiments indicate horizontal heterogeneity. The authors develop a simple numerical model that includes horizontal heterogeneity, use it to develop an artificial time series of suspended-sediment concentration in an erosion microcosm, and then analyze that time series assuming horizontal homogeneity. The latter analysis reproduced the original profile of critical shear stress, but the erosion rate coefficient increased with eroded mass, similar to the empirical data, confirming the small-depth erosion hypothesis. A linear model of critical shear stress and eroded mass is proposed to simulate small-depth erosion, assuming that the applied and critical shear stresses quickly reach equilibrium.

Many more topics were presented during the conference. The program of INTERCOH 2015 consisted of 70 oral presentations and 36 posters. The **INTERCOH 2015 Book of Abstracts** is available online at the website of the Flanders Marine Institute (VLIZ) at http://www.vliz.be/en/imis?module=ref&refid=249519, and can be downloaded in full or by individual abstract. It gives an impression of the scientific questions and practical problems that are faced by scientists and engineers today. Sediment research is difficult; cohesive sediments behave even more complex. Some of the questions are (very) old and have not found adequate solutions for many years.

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