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Numerical simulation of flocculation behaviour during storm events

Peihung Chen [1], Michael Fettweis [2], Federico Maggi[3], Jason C.S. Yu [1*]

[1] National Sun Yat-Sen University, Department of Marine Environment and Engineering, Lien-Hai Road 70, 80424 Kaohsiung, Taiwan (*E-mail: jasonyu@mail.nsysu.edu.tw)

[2] Royal Belgian Institute of Natural Science, Management Unit of the North Sea Mathematical Models, Gulledelle 100, 1200 Brussels, Belgium

[3.] The University of Sydney, School of Civil Engineering J05, Sydney NSW 2006, Australia

ABSTRACT

The flocculation of cohesive sediment (floc formation and break-up) depends on biological, chemical and physical processes, causing a highly nonlinear behaviour. Suspended Particulate Matter (SPM) consists of clay- and silt-sized mineral particles and biogenic components, which due to their cohesive characteristics, forms flocs and aggregates. SPM transport and settling of mud flocs is controlled by the floc size, hence by the abovementioned flocculation processes. The settling velocity is a function of the particle size and excess density, and it varies strongly in natural environments as the SPM consists a population of flocs.

Natural SPM comprises many different substances with concentrations that are generally site specific and time varying. The flocculation model (BFLOC) proposed by Maggi (2009) incorporates the coupling of mineral and micro-organism dynamics to predict the median floc size. The aim of this study is to simulate the floc dynamics during storm events using Maggi's model. The results will be validated using in-situ data collected from the Belgian coastal waters (southern North Sea) obtained with a tripod. The flocculation model has been calibrated using a set of shipboard full tidal cycle (13 hours) measurements and associated sampling data from the Belgian North Sea. Data collected from the mounted instruments on the tripod, including a SonTek 3 MHz ADP, a SonTek 5 MHz ADV Ocean, a Sea-Bird SBE37 CT system, two OBS and a LISST 100X, have been used to study the mud behaviour during these storm events. Modeled flocculation dynamics during storm conditions will be compared and validated with particle size measurements using a LISST 100X.