Geophysical Research Abstracts
Vol. 16, EGU2014-14693, 2014
EGU General Assembly 2014

Two-stage-six-objective calibration of a hydrodynamic-based sediment transport model for the Mekong Delta

Nguyen Viet Dung (1,2), Nguyen Van Manh (1), Bruno Merz (1), and Heiko Apel (1)

(1) Germany Research Center for Geosciences, 5.4 Hydrology, Potsdam, Germany (dung-viet.nguyen@gfz-potsdam.de), (2) Southern Institute of Water Resources Research SIWRR, Ho Chi Minh City, Vietnam

An advection-dispersive (AD) module for cohesive sediment transport modelling is built up based on a quasi-2D hydrodynamic model (HD) for the whole Mekong Delta which has been recently developed by Dung et al. (2011) using the modelling software DHI MIKE 11. As parameter uncertainty is one main epistemic uncertainty source of modelling work, it needs to be reduced via a calibration-validation process in order to improve the modelling skill of the simulation tool. In this large scale two-component (HD-AD) model, many parameters need to be properly estimated. These parameters include the flow resistance coefficient (Manning's roughness coefficient), longitudinal dispersion coefficient, the free settling velocity and the critical shear stress for deposition. It should be noted that they are spatially distributed over the modelling domain which consists of more than 4000 branches and 26000 computational nodes used to model real channels and floodplains for the vast area in the Mekong Delta. We aim at developing a suitable framework for optimizing these parameters automatically. As the model included a real 1D illustration of river and channel networks and quasi-2D presentation of floodplains being able to represent both main flow and inundation processes, the calibration is, hence, seen from a multi-objective viewpoint using in parallel high-temporal, low-spatial resolution data (gauge data) and low-temporal, high spatial resolution data (remote sensing data). The calibration (and validation) data utilized in this study comprise of gauged time series data along the main channel (water level, flow discharge and suspended sediment concentration), satellite-based flood extent maps and monitored sedimentation deposition rates in several locations. In total, six objective functions as calibration criteria are defined based on these data. Learning from the feature that AD module can be simulated using finer computational time step after HD results are computed, we propose to formulate a two-stage calibration by firstly estimating parameters for the HD module to fit the three objective functions and then estimating the parameters for the AD module the fit the remaining three objective functions. We developed a wrapper code implementing the parallel version of NSGA II, controlling the whole calibration process of both stages. This reduces the computational time significantly and facilitates the calibration in due time. The calibration results imply that the proposed two-stage-six-objective calibration procedure provides meaningful parameter sets fulfilling the different objectives in a Pareto sense, even for such a large scale 2D quasi hydrodynamic-based sediment transport model within a highly complex study domain like the Mekong Delta.