Title: Unraveling the Essential Effects of Flocculation on Large-Scale Sediment Transport Patterns in a Tide-Dominated Estuary

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Sediment transport in estuaries and the formation of estuarine turbidity maxima (ETM) highly depend on the ability of suspended particulate matter (SPM) to flocculate into larger aggregates. While most literature focuses on the small-scale impact of biological flocculants on the formation of larger aggregates, the influence of the flocculation process on large-scale estuarine SPM profiles is still largely unknown. In this presentation, we study the impact of flocculation of SPM on the formation of ETM. For this, a semianalytical width-integrated model called iFlow is utilized and extended by a flocculation model. Starting from a complex one-class flocculation model, we show that flocculation may be described as a linear relation between settling velocity and suspended sediment concentration to capture its leading-order effect on the ETM formation. The model is applied to a winter case in the Scheldt estuary (Belgium, Netherlands) and calibrated to a unique, long-term, two-dimensional set of turbidity (cf. SPM) observations. First, model results with and without the effect of flocculation are compared, showing that the spatial and temporal variations of the settling velocity due to flocculation are essential to reproduce the observed magnitude of the suspended sediment concentrations and its dependence on river discharge. Second, flocculation results in tidally averaged land-inward sediment transport. Third, we conduct a sensitivity analysis of the freshwater discharge and floc breakup parameter, which shows that flocculation can cause additional estuarine turbidity maxima and can prevent flushing of the ETM for high freshwater inflow.