



Oxygen dynamics in highly turbid estuaries, an idealised model

H.E. de Swart (1), S.A. Talke (2), and V.N. de Jonge (3)

(1) University of Utrecht, Inst. of Marine and Atmospheric Research, Utrecht, Netherlands (h.e.deswart@uu.nl), (2) University of Washington, Civil & Environmental Engineering Department, Seattle, USA, (3) University of Hull, Institute of Estuarine Coastal Studies, Hull, UK

Field data collected in the highly turbid Ems estuary reveal that dissolved oxygen (DO) concentrations are strongly anticorrelated with suspended sediment concentrations (SSC). Hypoxic conditions (DO concentrations < 2 mg/l) occur in the turbidity maximum (SSC > 10 kg/m³) during periods of low freshwater discharge and summertime water temperatures (15-25 degrees C). A simple model is discussed to gain fundamental understanding about the sensitivity of oxygen concentrations in turbid estuaries to freshwater discharge, water depth and sediment availability. The model describes tidally averaged circulation and SSC, which are both input into an advection-diffusion-sink module to calculate the spatial distribution of DO. The model is calibrated to the observed variation of DO with SSC and temperature. Modelled DO closely tracks changes to the magnitude and distribution of SSC: increased channel depth, decreased freshwater discharge, and decreased mixing move the turbidity zone upstream, amplify SSC and decrease DO. Summertime temperatures produces lower DO than cooler periods. Model results are consistent with historical measurements, which indicate that summertime hypoxic events have occurred more frequently after deepening the shipping channel from 5 m to 7 m.