



Modelling the transport of nutrients and carbon from catchment to coast – the SPEAR project

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The SPEAR project – Sustainable Options for People, Catchments and Aquatic Resources – www.bioqiang.org – is developing an innovative approach integrating physical and ecological modelling to estimate the fate of nutrients and carbon from their sources in the catchment to their final export to the ocean. The approach focuses on the complex processes occurring in Regions of Restricted Exchange – RREs – where terrestrial and marine systems meet.

This approach was applied for Huangdun bay, China, a medium-sized estuary south of Shanghai. The main catchments draining to the bay were characterized using remote sensing tools, and the SWAT catchment model was then applied to these watersheds in order to estimate the relationships between agricultural fertilisation, human pollution and the export of nutrients and carbon to streams, rivers and subsequently into the bay. The hydrodynamic circulation of the bay was simulated in detail using the Delft 3D model, to estimate the variability of transport rates for dissolved and suspended substances with currents and tidal situations.

Finally, the EcoWin 2000 ecological model was coupled to Delft3D in order to study the impact of human activities – especially aquaculture – on the fate of nutrients and carbon inside Huangdun bay, at a multi-year scale. Processes studied included carbon exchange with the sediments and atmosphere via respiration and CO₂ uptake by phytoplankton and seaweeds, the uptake of carbon by humans through aquaculture of both shellfish and finfish, and the export of carbon and nutrients to the ocean. The model was calibrated and validated for this system, illustrating its applicability as a tool to study the significant impacts of RREs in the transport of riverine matter to ocean environments.