Model integrations for a real-time and forecasting estuary water quality management system: the Swan-Canning estuary virtual observatory

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Abstract: Coastal embayments and estuaries are under increasing threat from nutrient enrichment and ecosystem degradation. There is a need to develop a fast-responding and quantitative management system that provides useful information of current and predictable future conditions of the aquatic system. With this aim, a software package SCEVO (the Swan-Canning estuary virtual observatory) is developed as a tool for sustainable management of the Swan-Canning River. SCEVO is a good example of integration of environmental models across multiple disciplines. It integrates weather conditions from a downscaled WRF model, coastal forcing from a local coastal ocean model, and real-time log flow data at incoming rivers from government resources. All the external data is then processed to force a well-calibrated 3D estuary model TUFLOW-AED2 which provides 5-day hindcast and 5-day forecast of water conditions. The key environmental parameters delivered by the water quality model include water temperature, salinity, N/P nutrients, dissolved oxygen, and phytoplankton growth potential. The model domain has a high-resolution mesh grid with the upstream extending 42km inland. The model well reproduced the estuary conditions across the freshwater-ocean continuum especially the salt-wedge and the hypoxic condition in the upstream. These information are critical for the estuary management such as oxygenation plant operation and flooding event response. The system operates on daily basis, updating the results to a website that is accessible by public to view and download the model outputs. This paper provides an overview of the structure and components of the system, the model performance, and its implementation in Western Australia. An application example of the system in the 2017 flooding events is included.