25th International Congress on Modelling and Simulation, Darwin, NT, Australia, 9 to 14 July 2023
mssanz.org.au/modsim2023

Black ooze and algae: Modelling the response and restoration of the Coorong

C. Sims [a], M. Hipsey [b], P. Huang [b], D. Paraska [b] and S. Zhai [b]

[a] *South Australian Government Department for Environment and Water, Adelaide, Australia*
[b] *Aquatic Ecodynamics, School of Agriculture and Environment, The University of Western Australia, Perth*
Email: claire.sims@sa.gov.au

Abstract: The Coorong is a wetland of local, national, and international importance and one of the most significant waterbird habitats in the Murray–Darling system. The condition and value of the Coorong has suffered long-term decline, exacerbated by the Millennium Drought. This decline, coupled with frequent low water levels over late spring and summer has resulted in the long-term accumulation of salt and nutrients, prohibiting the recovery of the system to a recognisable healthy state (DEW, 2022).

Consequently, the Coorong has been the focus of numerous studies, research, and monitoring for several decades. In response to several key knowledge gaps identified in previous Coorong studies and subsequent model applications, dedicated modelling activities were established within the Healthy Coorong Healthy Basin (HCHB) Trials and Investigations (T&I) Integration project. This modelling effort, in collaboration with the University of Western Australia (UWA), has progressed concurrently with the substantial body of research and data collection undertaken as part of T&I components since 2020. Collectively, this body of work has resulted in significant updates to both the Department for Environment and Water's (DEW) original Coorong TUFLOW Finite Volume (FV) fine resolution hydrodynamic model and UWA's Aquatic EcoDynamics (AED) model.

Together these models are referred to as the Coorong Dynamics Model (CDM) and comprise a library of modules and algorithms for simulation of hydrodynamics, water quality, aquatic biogeochemistry, biotic habitat, and aquatic ecosystem dynamics. The significant improvements made to both DEW's TUFLOW-FV model and UWA's AED model have extended the CDM's functionality and ability to represent complex and dynamic water quality, sediment biochemistry, and ecological habitat processes. These improvements have been followed by extensive model calibration and validation, confirming that the model accurately captures both the temporal and spatial variability in the hydrodynamics of the Coorong and the resulting changes in water, sediment, and habitat quality (Hipsey et al., 2022).

The individual models can be configured, coupled, and applied in various ways to address a range of questions. To date, application of the CDM by DEW has dynamically linked the AED water quality model with TUFLOW-FV for a set of hindcast scenarios focusing on changes to the key environmental management levers of barrage and Salt Creek releases, and to assess the impact of a range of large-scale infrastructure options. The expansion of outputs from key hydrodynamic and water quality parameters to include sediment biogeochemistry and improved habitat suitability prediction have demonstrated the enhanced functionality and predictive capability of the CDM for application to a wide range of assessments (DEW, 2022).

The CDM is a sophisticated, flexible, and powerful tool for quantitatively assessing the response of the Coorong system to management options and changing environmental conditions over varying spatial and temporal scales. This enhancement represents the first step in operationalising the significantly enhanced modelling capability and toolkit developed under HCHB. Continuing development and future applications will help to further reduce uncertainties, fill critical knowledge gaps, and facilitate the assessment of strategies to restore the Southern Coorong to the desired state.

REFERENCES

DEW (2022). Application of the Coorong Dynamics Model, DEW Technical report 2022/02, Government of South Australia, Department for Environment and Water, Adelaide.

Hipsey, M.R., Huang, P., Zhai, S., Busch, B., Paraska, D., Sims, C., (2022). The Coorong Dynamics Model. Zenodo: DOI: 10.5281/zenodo.xxpendingxx.

Keywords: *Coorong, hydrodynamic modelling, nutrients, water quality, habitat suitability*