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3D modelling of the transport and fate of riverine fine sediment exported to a semi-enclosed system

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Understanding the transport and fate of suspended sediment exported by rivers is crucial for the management of sensitive marine ecosystems. Sediment transport and fate can vary considerably depending on the geophysical characteristics of the offshore environment (i.e. open, semi-enclosed and enclosed systems and the nature of the continental shelf).

In this presentation, we focus on a semi-enclosed setting in the Great Barrier Reef, NE Australia. In this system, the large tropical Burdekin River discharges to a long and narrow continental shelf containing numerous headlands and embayments. Using a new 3D sediment model we developed and SLIM 3D, a Finite Element 3D model for coastal flows, we highlight the key processes of sediment transport for such a system. We validate the model with available measured data from the region.

Wind direction and speed during the high river flows are showed to largely control the dynamics and final fate of the sediments. Most (71%) of the sediment load delivered by the river is deposited and retained near the river mouth. The remaining sediment is transported further afield in riverine freshwater plumes. The suspended sediment transported longer distances in the freshwater plumes can reach sensitive marine ecosystems. These results are compared to previous studies on the Burdekin River sediment fate and differences are analysed. The model suggests that wind-driven resuspension events will redistribute sediments within an embayment but have little influence on transporting sediments from bay to bay.