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Coevolution of hydraulic, soil and vegetation processes in estuarine wetlands

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Estuarine wetlands of south eastern Australia, typically display a vegetation zonation with a sequence mudflats - mangrove forest - saltmarsh plains from the seaward margin and up the topographic gradient. Estuarine wetlands are among the most productive ecosystems in the world, providing unique habitats for fish and many terrestrial species. They also have a carbon sequestration capacity that surpasess terrestrial forest.
Estuarine wetlands respond to sea-level rise by vertical accretion and horizontal landward migration, in order to maintain their position in the tidal frame. In situations in which buffer areas for landward migration are not available, saltmarsh can be lost due to mangrove encroachment. As a result of mangrove invasion associated in part with raising estuary water levels and urbanisation, coastal saltmarsh in parts of south-eastern Australia has been declared an endangered ecological community.
Predicting estuarine wetlands response to sea-level rise requires modelling the coevolving dynamics of water flow, soil and vegetation. This paper presents preliminary results of our recently developed numerical model for wetland dynamics in wetlands of the Hunter estuary of NSW. The model simulates continuous tidal inflow into the wetland, and accounts for the effect of varying vegetation types on flow resistance. Coevolution effects appear as vegetation types are updated based on their preference to prevailing hydrodynamic conditions. The model also considers that accretion values vary with vegetation type. Simulations are driven using local information collected over several years, which includes estuary water levels, accretion rates, soil carbon content, flow resistance and vegetation preference to hydraulic conditions. Model results predict further saltmarsh loss under current conditions of moderate increase of estuary water levels.