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Hydrodynamics, vegetation transition and geomorphology coevolution in a semi-arid floodplain wetland.

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The Macquarie Marshes is a complex system of marshes, swamps and lagoons interconnected by a network of streams in the semi-arid region in north western NSW, Australia. The low-gradient topography of the site leads to channel breakdown processes where the river network becomes practically non-existent. As a result, the flow extends over large areas of wetland that later re-join and reform channels exiting the system. Vegetation in semiarid wetlands are often water dependent and flood tolerant species that rely on periodical floods in order to maintain healthy conditions.
The detrimental state of vegetation in the Macquarie Marshes over the past few decades has been linked to decreasing inundation frequencies. Spatial distribution of flood tolerant overstory species such as River Red Gum and Black Box has not greatly changed since early 1990's, however; the condition of the vegetation patches shows a clear deterioration evidenced by terrestrial species encroachment on the wetland understory. On the other hand, areas of flood dependent species such as Water Couch and Common Reed have undergone complete succession to terrestrial species and dryland.
In order to simulate the complex dynamics of the marshes we have developed an ecogeomorphological modelling framework that combines hydrodynamic, vegetation and channel evolution modules and in this presentation we provide an update on the status of the model. The hydrodynamic simulation provides spatially distributed values of inundation extent, duration, depth and recurrence to drive a vegetation model based on species preference to hydraulic conditions. It also provides velocities and shear stresses to assess geomorphological changes. Regular updates of stream network, floodplain surface elevations and vegetation coverage provide feedbacks to the hydrodynamic model. We presents also the development and assessment of transitional rules to determine if the water conditions have been met for different vegetation associations in the patches known to have undergone succession to terrestrial species and dry-land.