

P1.15**Coastal acid sulfate soil acidification in a heated future: What are the risk factors for estuaries?**

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Abstract

Extreme prolonged drought over southern and eastern Australia a decade ago (the Millennium Drought, 1996–2010) triggered extensive coastal acid sulfate soil (CASS) oxidation and associated acidification in the River Murray Estuary (RME), South Australia. Substantial release of metal-enriched acidic drainage was also documented during this event. We use this event as a test case for how climate change and anthropogenic impacts can enhance the vulnerability of estuaries to CASS acidification.

Surficial sediment samples (n=43) and sediment cores (n=5) were collected from the RME's central basin environment and analysed using a suite of geochemical, radiometric dating, and sedimentological methods, to trace the impact of metal-enriched acidic drainage and reconstruct changes in the system's structure and function.

Metals mobilised from oxidised CASS accumulated in the sediments of the RME, with their transport and accumulation controlled by hydrodynamic and geomorphic processes in the estuary. These processes have, however, changed during the history of the RME in response to sea-level and anthropogenic impacts. Significantly, artificially raised water levels and the installation of tidal barrages are identified to have intensified the extremity of the Millennium Drought acidification event.

We demonstrate that many acidification risk factors are extant within the boundary conditions of wave-dominated estuaries, and these systems can be major depositional sinks for acid-mobilised contaminants. The potential disconnection of these estuaries to marine influence, either by tidal barraging or subaerial berm formation greatly exacerbates the likelihood of severe acidification. We also demonstrate that due to complexity in estuarine systems, CASS acidification will often exhibit non-linear behaviour in response to changing boundary conditions, complicating the assessment of risk. Increases in future water extraction and diversion, the construction of tidal barrages, and drier climates, will shift estuarine systems closer to thresholds where severe acidification can be expected.

Keywords

Heavy metals, Acid Sulfate Soils, Climate change, Wave-dominated estuaries