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Estuarine beach stability during storms and recovery pathways

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Beaches are a primary coastal defence, and provide significant economic and ecological benefits. Beach stability depends on the balance between erosion and recovery processes. Erosion is relatively well understood, however, recovery has been largely overlooked. In particular, low-wave energy estuarine beaches are highly vulnerable as they tend to be narrow, low-lying, prone to coastal flooding, and are sensitive to even small changes in wave climate. They are widespread globally, and often densely populated. Fundamental data of erosion and recovery pathways and rates are needed from estuarine beaches to reduce uncertainties in planning and management. This research focuses on the erosive impacts of storms on estuarine beaches, and recovery rates after an extreme storm event, relative to the geomorphic setting. This is a key missing parameter for determining the vulnerability of estuarine coasts to climate change. We focus on 8 estuarine beaches in Sydney (Australia), with various levels of exposure to ocean swells/ prevailing winds, and relationships to flood tidal deltas. We track erosion and recovery after a severe East Coast Low in June 2016, where peak waves (up to 17.7 m offshore maximum wave height) coincided with spring tides, and waves came from an unusual direction (NE). The worst erosion (0.88 m3/m) occurred at one of the most sheltered beaches with a westerly aspect, while accretion occurred on the eastern shore beaches. Simultaneously, the storm had negligible impact on the most exposed beaches. Recovery rates on the eroded beaches have been very slow (∼0.07–0.2 m3/m/month), and largely below mean sea level. Almost one year after the erosive event, the upper beach and dune remain severely eroded. Preliminary analysis suggests ebb dominance, and the significantly stronger tidal current at the bottom suggest an important role of tidal currents in beach recovery.