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Impact of intertidal biota on hydrodynamics and sediment dynamics

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Flume and field studies have quantified the functional role of a wide range of biota as sediment stabilisers and destabilisers on intertidal mudflats. These ecosystem engineers influence sediment erodability through a range of different mechanisms. The effects of biota on turbulence, bed shear stress and sediment erodability are size and density dependent. Increased sediment erodability, measured in terms of critical erosion threshold, sediment mass eroded and erosion rate, can occur as a result of direct physical disturbance of the sediments, as well as changes in bed shear stress due to changes in bed roughness. Organisms within the size range from micro-organisms up to small animals (mm scale, e.g. *Hydrobia ulvae*) have little effect on bed shear stress, but can significantly modify sediment stability. Both field and flume based Acoustic Doppler Velocimeter (ADV) measurements of the relationships between currents and bed shear stress show that near-bed flow over smooth sediments (dominated by small organism up to mm scale) is consistent with smooth turbulent flow. Larger organisms (cm scale), such as burrowing bivalves (e.g. cockles, *Cerastoderma edule*) and salt marsh vegetation (e.g. *Spartina anglica*) can increase turbulence and bed shear stress and thus significantly increase sediment erodability ($>$10-fold). The density dependent effects of *Cerastoderma* and *Spartina* are examined. The process of physically disturbing the surface sediments by *Cerastoderma* increases sediment bed roughness / bed shear stress, but in so doing may also loosen the surface sediments thus reducing its cohesiveness. Examination of the relative contribution of these two processes demonstrates that the increase in bed shear stress is the dominant factor determining increased sediment erodability by *Cerastoderma*. This is in contrast to the smaller mollusc (*Hydrobia*) which enhances sediment erodability primarily by loosening of the surface sediments, but with little effect on bed shear stress.