**Project title:** Monitoring, forecasting and remediating sediment in estuary zones  
*(Ref: OP20266)*

**One Planet Research Theme:**  
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☒

**Lead Supervisor:**  
Luke Smith

**Key Research Gaps and Questions:**  
Can continuous monitoring aid the development of a conceptual model for sediment in an estuary environment, under future climate scenarios?  
How can a satisfactory level of contaminated sediment remediation be under those scenarios?  
Can sediment loads be forecast for 15-20 years from now?

**Project Description:**  
Rivers are crucial for a range of economic, social and environmental reasons. However, there is a need to balance competing pressures in these complex ecosystems linking the terrestrial and aquatic environments. Sediment fluxes, wave action dynamics, modifications for shipping, and high-low extreme flows can mobilise, deposit, and result in stagnant polluted sediments. These sediments can degrade habitats and biota, and adversely affecting navigability. Polluted sediments are thus dredged for shipping, but there are quotas on sea disposal. Sea level rise and climate-induced changes in river flows will influence the system and remobilisation of sediments. There are significant gaps in our ability to model deposition and remobilisation with accuracy at fine scales (Robins et al., 2016); quotas have led to trials in alternative methods of remediation and disposal, but the long-term viability and impacts unknown. A huge source of uncertainty in assessing the viability of remediation over coming decades, is future river flows and sea level rise under more extreme rainfall, which risks exacerbating and remobilising sediments that compromise economic activity.

This project will focus on the River Tyne, a representative industrial river that suffers from contaminated sediment. It will develop a conceptual model of the estuary system to represent the dynamic nature of its sediment regime, taking into account the quantity of sediment being transported via internal entrainment and introduced from the land (see French et al., 2016). The project will design a monitoring campaign and methodology to record dynamic sediment accumulation and sample for sediment and water quality variables. Sampling will take place at bioremediation sites being constructed by the Environment Agency, and considered with respect to navigability, industrial activity, sediment discharge limits, and safe disposal of contaminated sediment, with assistance from the Port of Tyne. A continuous monitoring approach will improve upon the usual one-off sampling and provide a spring board for future studies and advanced modelling and simulation capabilities. Newcastle’s Urban Observatory and National Green Infrastructure Facility will contribute sensors and lab facilities for sediment and water quality analysis.

French et al. (2016) Appropriate complexity for the prediction of coastal and estuarine geomorphic behaviour at decadal to centennial scales, *Geomorphology*, 256:3-16.

**Prerequisites:**  
Knowledge of hydrology, geomorphology, statistical modelling and experience in field work would be desirable.

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