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CHANGING ESTUARY RESIDENCE TIMES

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Many important environmental services and unique ecosystems provided by estuaries are impacted by water quality, whereby estuary residence time is a controlling factor – being an indicator of the time in which pollution and high nutrient concentrations can remain within estuaries. For the UK government and its environmental agencies, there is an evidence gap on how and where water quality will change in estuaries in the future, limiting their ability to implement effective climate change adaptation and assess environmental impacts of catchment and coastal developments. We developed high-resolution hydrodynamic and water quality climate impact models for the majority (53) estuaries in England. By applying the present-day and future projected stressors to our estuary models, we have predicted the behaviour, natural variability, and expected 21st century changes in estuary residence times. We have assessed which estuaries are most vulnerable to changes in residence times, regarding the potential for water quality degradation. Our approach builds a foundational modelling tool from which future modelling work can assess a wide range of pollution events and water quality scenarios, such as the development of harmful algal blooms, health risks associated with sewage discharges, or habitat changes resulting from increased erosion or warming. This information provides coastal statutory advisors and regulators with the essential and robust evidence base that is needed to make informed decisions about the long-term resilience, management, and adaptation of estuarine ecosystems.