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Asymmetric Strained Stratification on currents turbulence and sediment transport

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Liverpool Bay is macro-tidal shelf sea and, with four adjacent large estuaries (Conwy, Dee, Mersey and Ribble), Which generate a complex region of freshwater influence (ROFI). Strong tidal currents in the bay are predominantly in an east-west direction, while density driven flows is a dominant factors controlling the weaker, variable residual circulation. With Tidal Asymmetric Strained Stratification being an important factor controlling the dynamics of the region.

Here we investigate the effects of Asymmetric Strained Stratification on flow, turbulence and sediment transport, during a spring-neap and within a tidal cycle. We use a combination of high frequency 3-D fine resolution numerical model (POLCOMS, the Proudman Oceanographic Laboratory Coastal Ocean Modelling System), and moored data to study the turbulence and hydrodynamics of this ROFI.

The observations show that contrary to previous studies stratification happens near high water when turbulence dissipation is maximum, this suggest that the Asymmetric Strained Stratification processes are happening near the bottom, similar to a salt wedge estuary. Results from 3-D modelling show that the dynamics in the ROFI are 3-dimensional and any previous simplifications cannot really be applied.

We also investigate the effects of freshwater on the sediment transport, by carrying simulations with and without river input. The no rivers simulation shows that sediment as well as being advected east-west, they are generally disperse slowly northwards (away from the Mersey and Dee). The presence of freshwater causes periodic stratification and tidal currents to be less rectilinear; sediments tend to spread faster and move southwards.