



Liverpool Bay: a coastal seas' responses to winds, waves, tides and freshwater.

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Liverpool Bay, in the eastern Irish Sea, is a Region of Freshwater Influence (ROFI) fed by the rivers Dee, Mersey and Ribble. Current theories regarding the vertical structure of the region, mainly based on short datasets, have been tested against continuous Coastal Observatory mooring measurements from late 2005 to 2007. Horizontal and vertical density gradients have been compared with changes to river flow, wind power, tidal stirring and wave mixing. Whilst, on occasion, the theories correctly predict haline stratification, there are many occurrences when the hypothesised stratification or mixing fails to occur in reality.

A potential energy model, using Simpson and Bowers' (1981) potential energy anomaly, has been used to investigate the changes, due to inputs of buoyancy and mixing, to the stratification of Liverpool Bay. This potential energy model incorporates terms that will enhance stratification, such as solar heating and estuarine circulation, and those that will destroy it, such as wave mixing and tidal stirring. Initial results indicate that interchangeable mixing and stratifying processes act to alter the potential energy of the system on short-time scales. Winds gusts, for example, may temporarily act to reduce stratification. The relative importance of buoyancy inputs and mixing processes in the competition to create and destroy stratification is temporally significant, with processes such as tidal mixing, although varying significantly over a spring-neap cycle, acting to continuously stir the water column and intermittent events, such as a wave mixing, having a short-term impact on the potential energy.