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Leeside aeolian sediment transport on a sandy beach under offshore winds

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This study examines aeolian sediment transport patterns across a beach at Magilligan Strand, Northern Ireland, under offshore wind conditions. Traditionally the offshore component of local wind regimes has been ignored when quantifying beach-dune sediment budgets, with the sheltering effect of the foredune assumed to prohibit grain entrainment on the adjoining beach. Recent investigations of secondary airflow patterns over coastal dunes have shown this is not the case. Field studies that have recorded transport on 'sheltered' beaches under offshore winds suggest a complex transport system exists in which sediment may be moved counter to the primary airflow direction. This may aid in understanding the dynamics of aeolian dunes on coasts where the dominant wind direction is offshore.

The present study investigates aeolian sediment transport patterns under an offshore wind event. Data were collected during an 8-hour directly offshore wind event on 25/04/2010. Continuously weighing horizontal sediment traps were co-located with ultrasonic anemometers. The instruments were deployed in a grid covering an area of 65 m cross-shore x 90 m alongshore. Extra traps were used on a central line. Results confirm that sediment transport occurred in the 'sheltered' area under offshore winds. There are clearly identifiable cross-shore trends in both magnitude of transport and the direction of sediment movement. These patterns vary depending on the alongshore position of a trap providing evidence of the three dimensional nature of aeolian sediment transport under these conditions. Alongshore spatial heterogeneity of sediment transport seems to show a relationship to undulations in the dune crest, while temporal and spatial variations may also be related to the position of the airflow reattachment zone. These results highlight the important feedbacks between flow characteristics and transport in a complex three dimensional surface.