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HIGH-RESOLUTION LONG-TERM MONITORING OF WAVE RUNUP AND MORPHOLOGY CHANGE ON GRAVEL BEACHES USING AN OFF-GRID LIDAR SYSTEM

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Gravel beaches are known to respond very rapidly to changes in wave conditions and water levels, with substantial morphology change occurring within a few hours. Traditional beach monitoring programmes which survey beaches on timescales of months are unable to capture these changes. The use of continuously scanning 2D Lidar to measure morphology and swash processes in field and large-scale laboratory experiments has been gaining popularity in recent years. Using this approach, a single sensor is able to capture time-varying bed or water surface elevation data at hundreds of points in the cross-shore, and can be used to measure parameters including swash flow velocity, swash depths, wave-by-wave bed elevation change, wave runup statistics and overtopping volumes. To date, the use of Lidar on gravel beaches has been restricted to short, storm-focussed deployments due to the requirement to mount on a fixed structure directly overlooking the beachface and the relatively high power consumption, requiring mains power. Here we report on the development and winter 24/25 deployment of a remote solar-powered Lidar coastal monitoring system capable of capturing beach profile data every low tide and high-resolution wave runup data during high-tide at 3 UK gravel beaches. These systems enable hydro and morphodynamic data to be captured day and night throughout storm events and enable new insight into wave runup, overtopping and the dynamic stability of gravel beaches.