Groundwater seepage through a gravel barrier: implications for coastal erosion, saline-freshwater mixing and nutrient dispersal

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Martin Austin and Gerd Masselink from the Coastal Processes Research Group at the University of Plymouth have been awarded £12k by the Seale-Hayne Educational Trust to monitor the seepage of groundwater through the Slapton Sands gravel barrier. This work assesses the implications of groundwater seepage for coastal erosion, saline-freshwater mixing and nutrient dispersal.

Groundwater seepage through a gravel barrier is thought to strongly influence whether the beachface is undergoing erosion or accretion. High rates of seepage toward the ocean promote a saturated beachface and bias swash-asymmetry offshore, resulting in erosion. However, when groundwater levels are low and seepage minimised, the beachface remains unsaturated, promoting onshore-directed swash-asymmetry and accretion. The groundwater level is also key in determining the mixing of freshwater from the lagoon (Slapton Ley) landward of the barrier and the saline ocean water. Finally, the groundwater flux provides a pathway for the exchange of agricultural runoff-derived nutrients from the Ley to be dispersed in the coastal ocean environment.

An array of six cased groundwater wells, penetrating up to 9 m deep, has been installed into the gravel barrier by rotary drilling. Each well is equipped with a self-logging pressure transducer sampling water-level and temperature every two minutes. In combination with additional pressure transducers recording the ocean tide and freshwater lagoon levels, these provide the profile of the groundwater through the barrier from which a groundwater flux can be derived.

In the latest phase of the monitoring, an INW Aquistar CT2X self-recording conductivity probe supplied by RSHYDRO has been installed into one of the most dynamic groundwater wells to provide high frequency measurements of the passage of the saline-freshwater mixing interface. The cross-barrier location and phase of this interface is principally controlled by the ocean tide level and thus is modulated at the semi-diurnal and spring-neap tidal frequencies.

The CT2X has also been used as a profiling CTD by manually lowering the sensor through the wells while logging at 1 Hz as recently demonstrated during the BBC Countryfile programme broadcast on 6 June 2010.

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