TOPOGRAPHIC RIP CURRENTS AROUND COASTAL GROYNE STRUCTURES

Location: Bournemouth, UK
Project Dates: October 2012
Clients: Royal National Lifeboat Institution and the UK MetOffice

Scope of Work:
- 10-day field experiment
- Observation from both fixed instruments (wave, tide and current meters) and GPS-drifters
- Quantification of topographic rip currents and rip circulation patterns
- Calibration and validation of an numerical model (XBeach).

PROJECT DESCRIPTION
Topographic rip currents are strong seaward-flowing currents that are generated in the surf zone and occur around permanent structural or geological features (e.g., groynes, breakwaters or rock outcrops) and present a hazard to water users worldwide.

In the UK, topographic rip currents are potentially implicated in at least 13 accidental coastal drownings per year. The aim of this research was to gain new quantitative scientific understanding of the dynamics of topographic rip currents that occur around coastal structures, specifically those located in fetch-limited seas. A 10-day field experiment at Boscombe beach on the south coast of England measured rip currents and nearshore hydrodynamics around a groyne field. A calibrated and validated numerical model (XBeach) was then used, in support of measured data, to identify the key environmental controls on topographic rip behaviour. This work has gone on to inform practical beach safety management and guidance.

Opposite: Mean Lagrangian circulation (2-hour deployment) measured with GPS-tracked surf zone drifters. Average wave height was $H_s = 1.1$ m and direction $D_p = 145^\circ$. Contours are measured bathymetry (0.25 m interval) and shading is residual morphology. Bold black lines are groynes and red contours are mean tidal levels.

Below: Vectors and shading show flow speed ($uv$) and direction (5 x 5m spacing). Black lines are impermeable groynes, red line is still water shoreline and blue line is the outer edge of the surf zone where computed wave dissipation is 10% of the cross-shore maximum.