X-Band Radar for Coastal Monitoring

Oceans2025 Theme 3 – Shelf & Coastal Processes
W.P. 3.5 – Coastal Morphodynamics & Bathymetric Evolution

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• LEACOAST2 Project, Sea Palling
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• Outputs – Wave patterns, timelapse, bathymetry, currents
• Subtidal Dune Fields
WAVE BREAKS UP at the beach when swell moves into water shallower than half the wavelength (1). The shallow bottom raises wave height and decreases length (2). At a water depth 1.3 times the wave height, water supply is reduced and the particles of water in the crest have no room to complete their cycles; the wave form breaks (3). A foam line forms and water particles, instead of just the wave form, move forward (4). The low remaining wave runs up the face of the beach as a gentle wash called the uprush (5).
X-Band Radar

- 9.8GHz (3cm) standard marine radar
- 2.4m Antenna rotating once every 2.4 seconds (High speed antenna 1.4secs)
- Short pulses (60ns)
- Radar cost ~ £10k-£15k
- PC Based recorder ~ £70k (Wamos, Miros) or make your own for about £5k
Wide Area Bathymetry inversion & UEA Survey
High Resolution Bathymetry Mapping
Bathymetry & Currents

Radar derived, current resolved water depth map, 01-Nov-2006 16:00:19

Radar derived, current resolved water depth map, 01-Nov-2006 10:00:19

Flood

Ebb
Current Validation

[Graph showing current validation with two lines representing ADCP and Radar data over the period of 2006/11/01 to 2006/11/03, with peaks and troughs indicated.]
Convergence & Divergence of Flow over Dunes

Figure 10.1. Schematic plot showing the relationship between radar image intensity, sea surface roughness, tidal flow, and underwater bottom topography.

Figure taken from NOAA SAR Marine User’s Manual, Ch. 10, “Underwater Topography” Alpers et al. 2004
Inferred subtidal dune field based on current-modulated sea surface radar signatures, 31/9/2006-02/10/2006
Summary

- Radar has wide area coverage
- Generally use up to 4km range, can do 8km under optimal conditions (storm)
- Bathymetry generally within 1m of survey
- Current maps under development
- Dune field maps under development
- Long time series
- Low maintenance

Commercial development: www.wamos.de