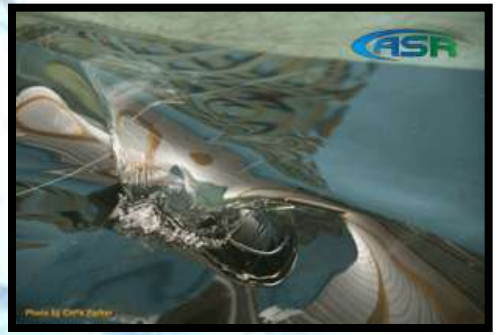
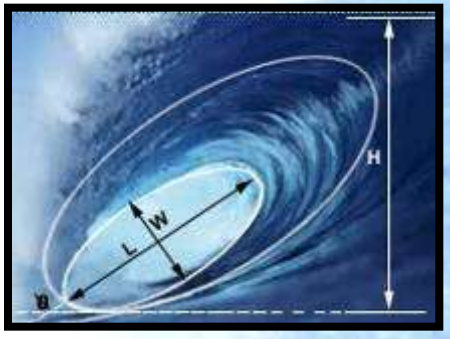
ASR Limited

Marine Consulting and Research

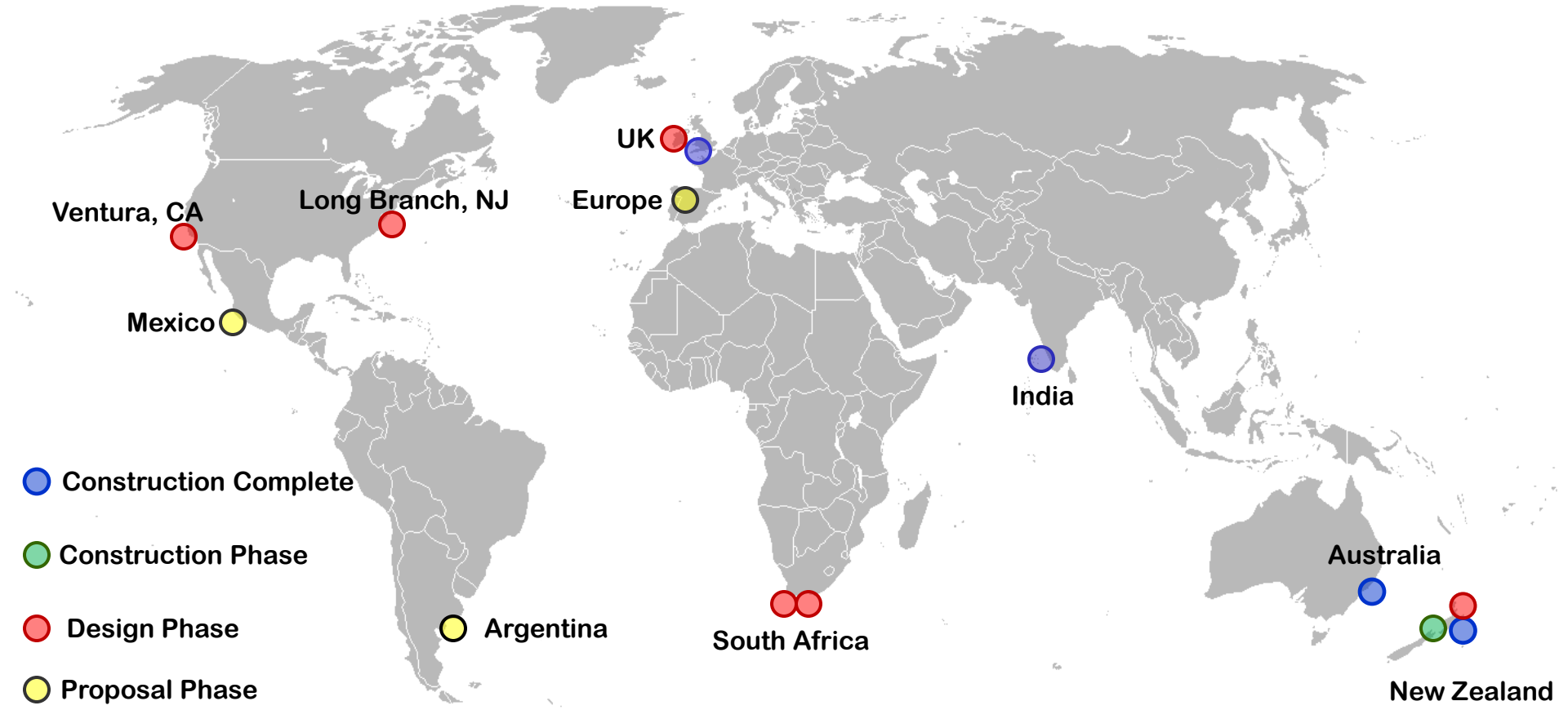
Cocoa Beach, Florida

- Innovative and patented **beach protection solutions**
- Cutting edge **simulations of hydrodynamic** processes
- Leaders in **ecological monitoring and protection**
- Recognized global leaders in **surf science** and **artificial reefs**.

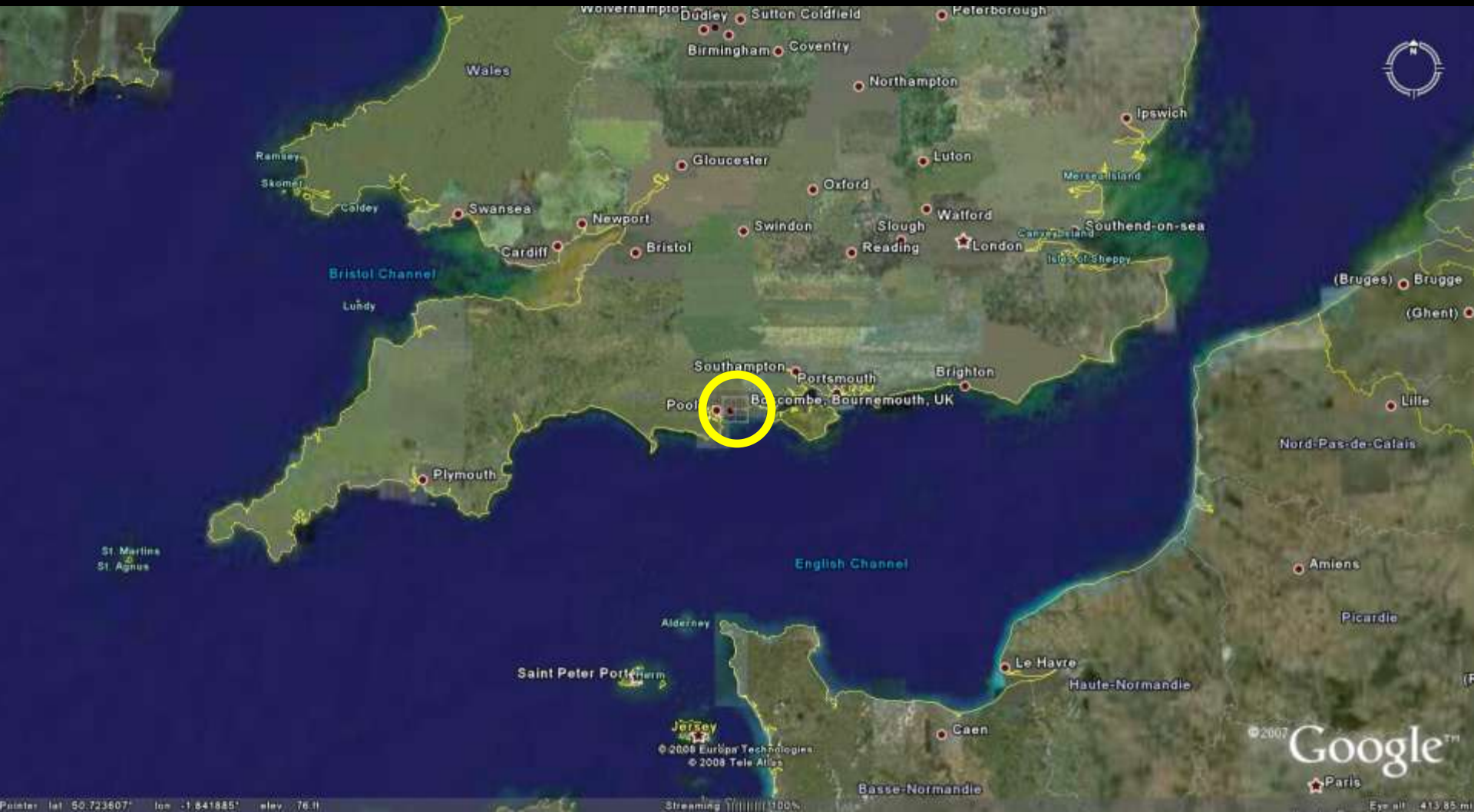


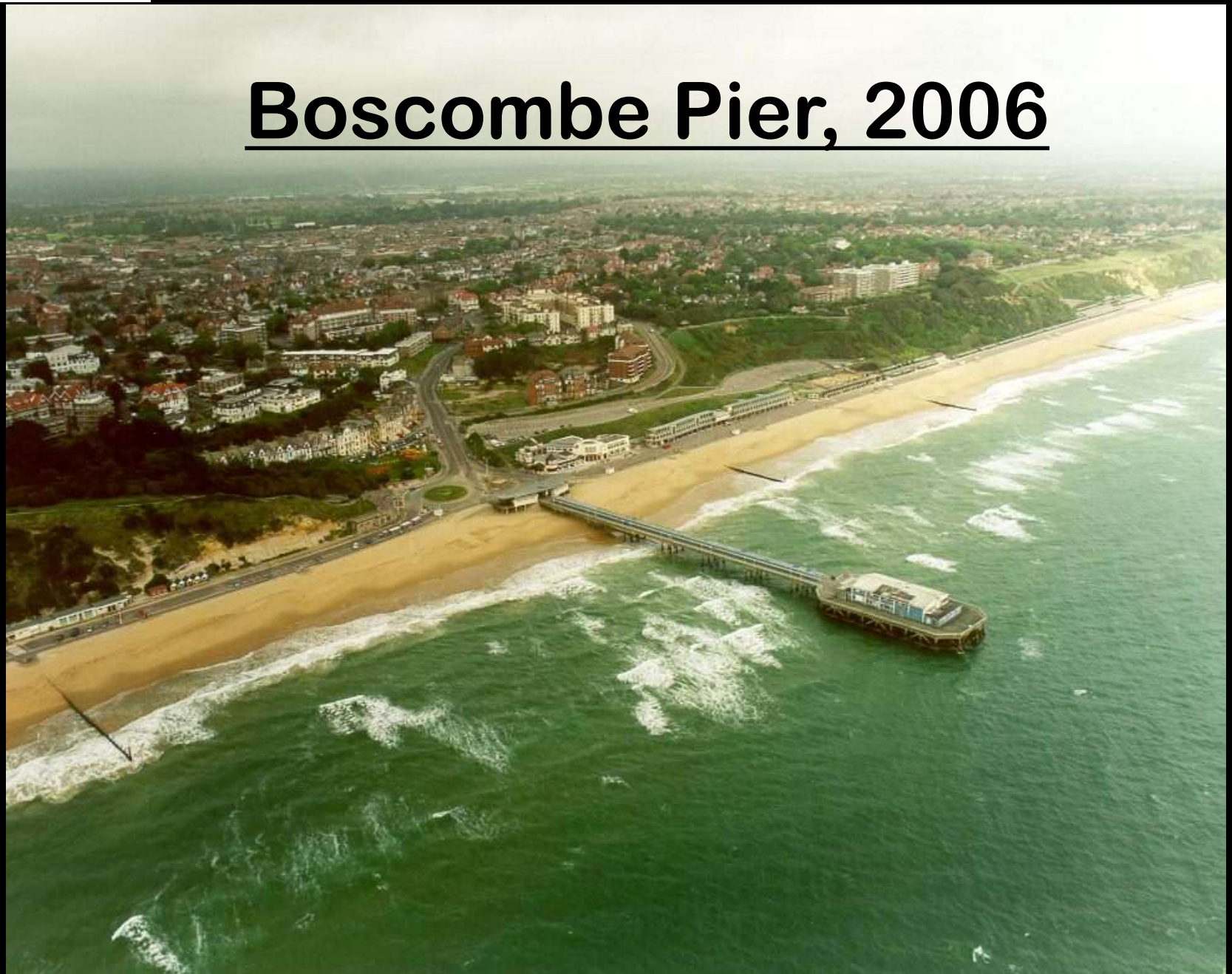


Multi-Purpose Reef Projects:



Boscombe Multi-Purpose Reef, UK

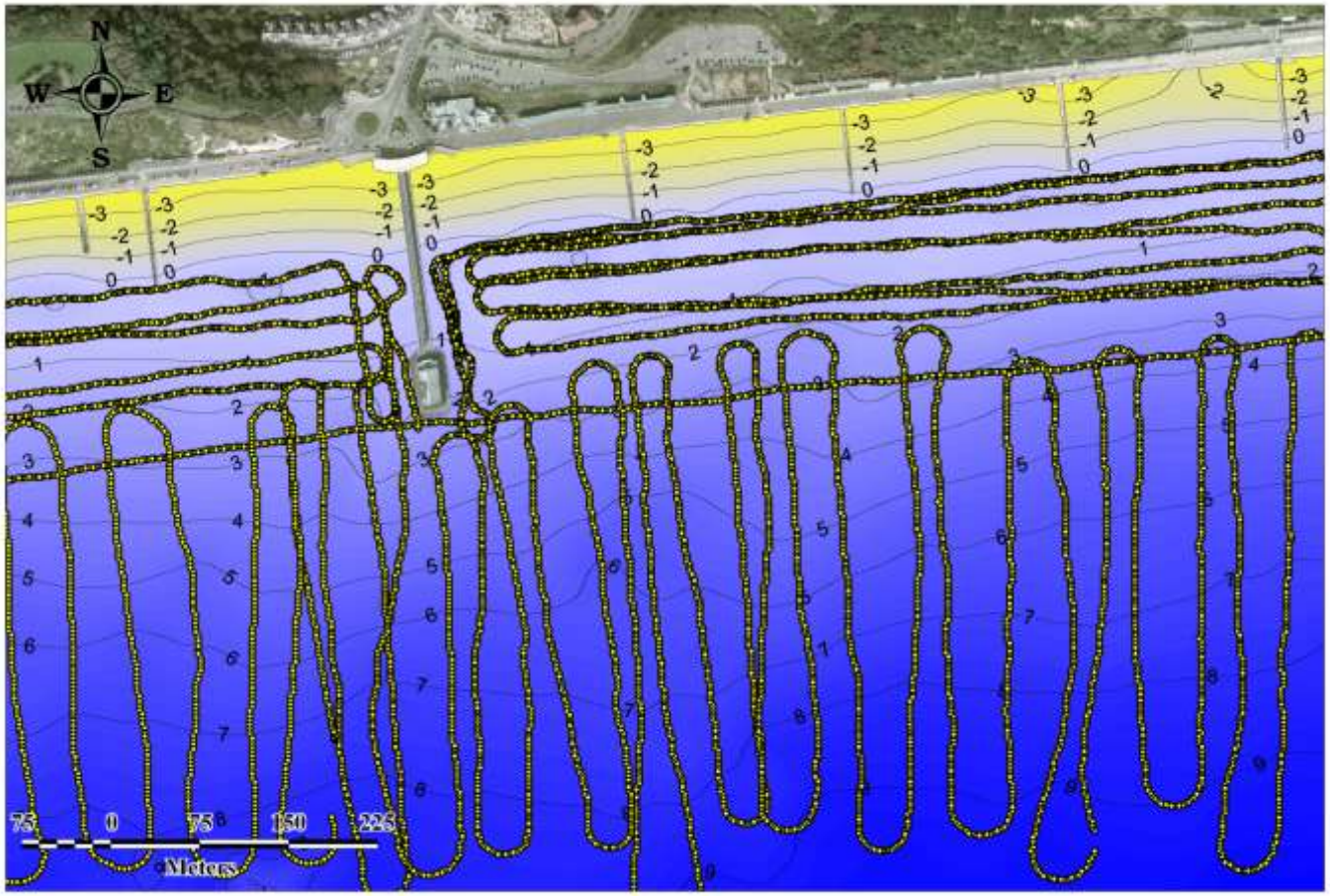



Boscombe Pier, 2006

Boscombe Multi-Purpose Reef

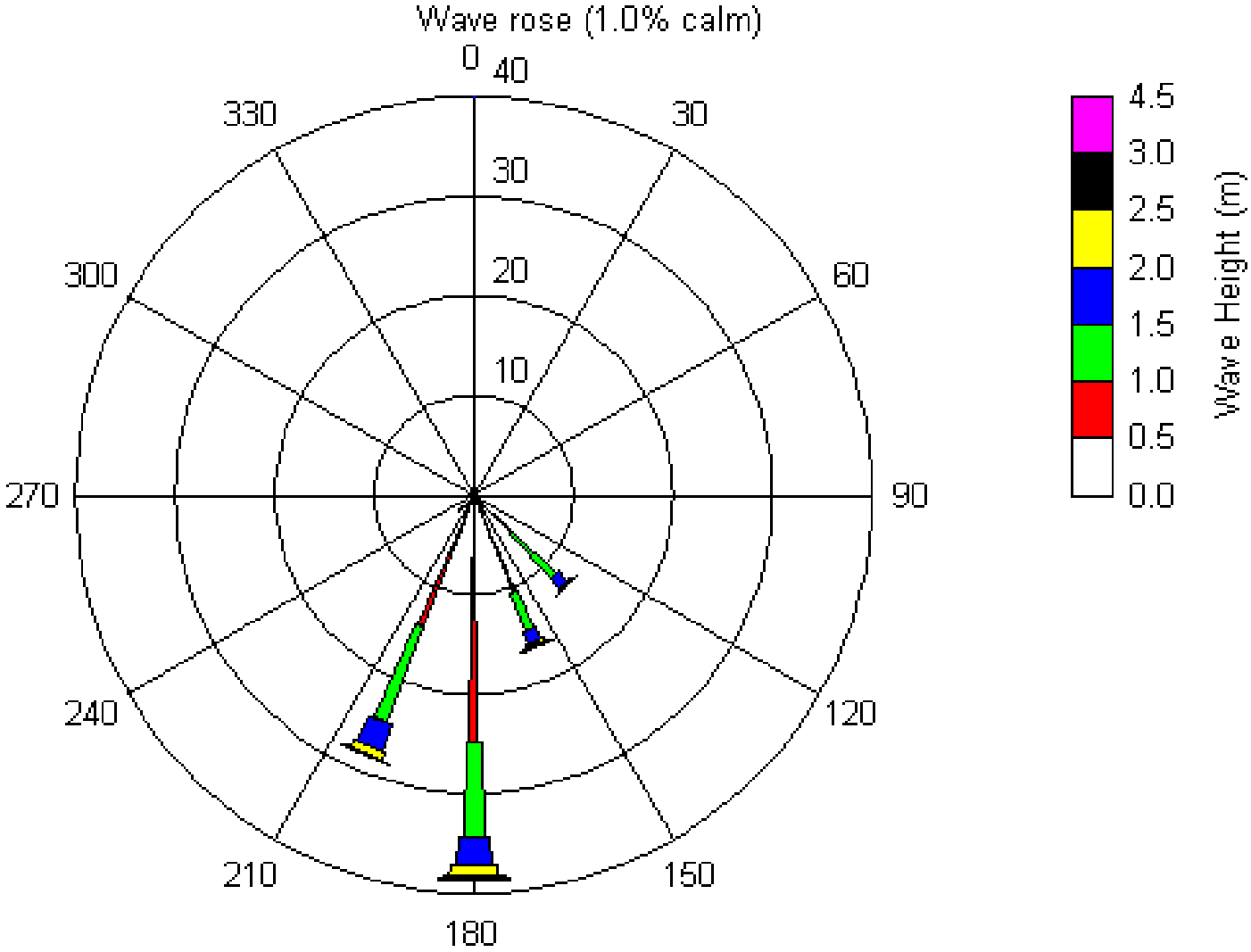
1. Surfing Enhancement
2. Coastal Protection
3. Economic Enhancement
4. Ecological Enhancement

Boscombe Bathymetry



Sandy Bottom, Parallel Contours
Sea Bed Slope 1:60

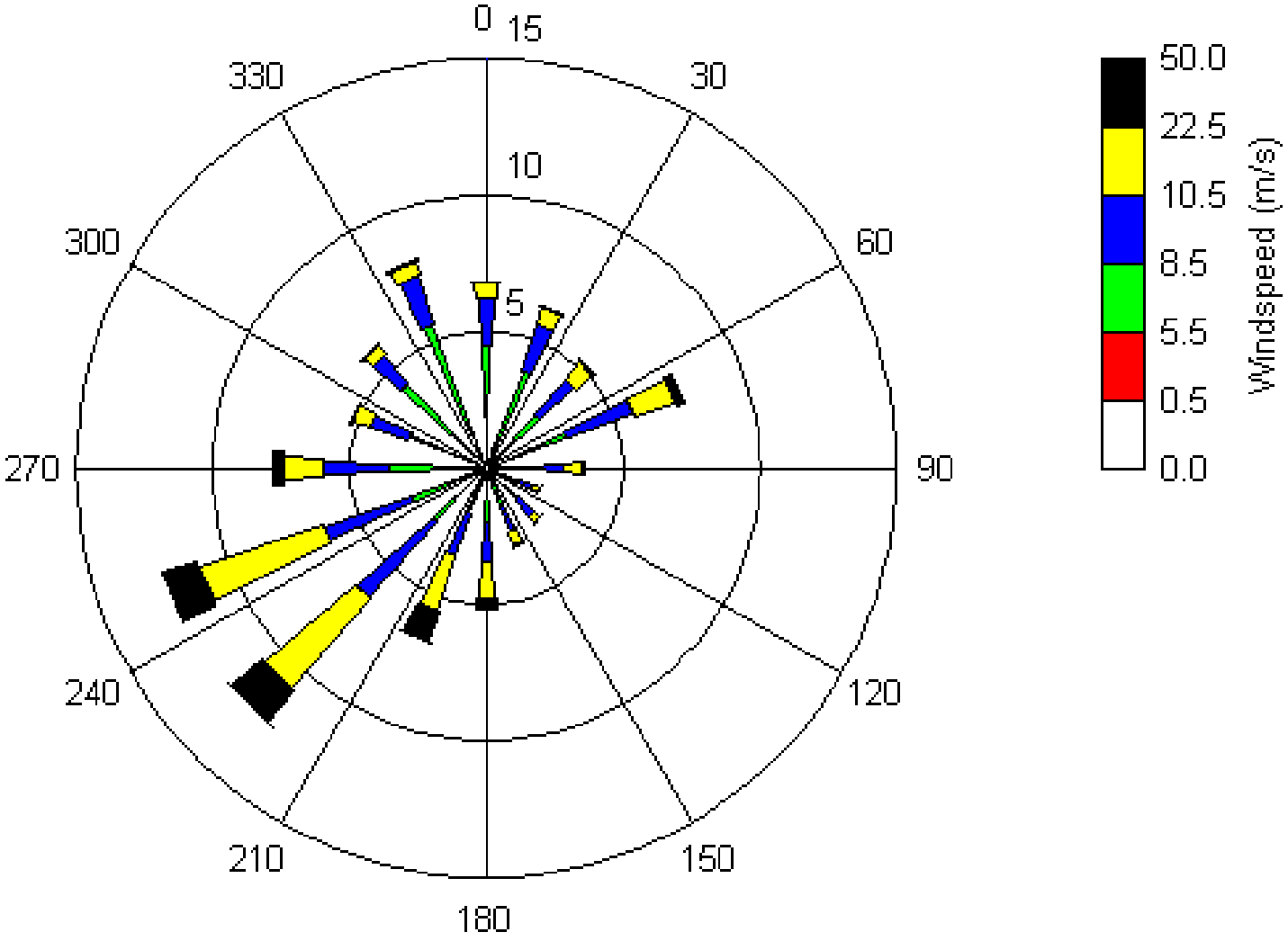
Boscombe Wave Climate



Predominate Wave Heights: 0.5 - 1.5 meters

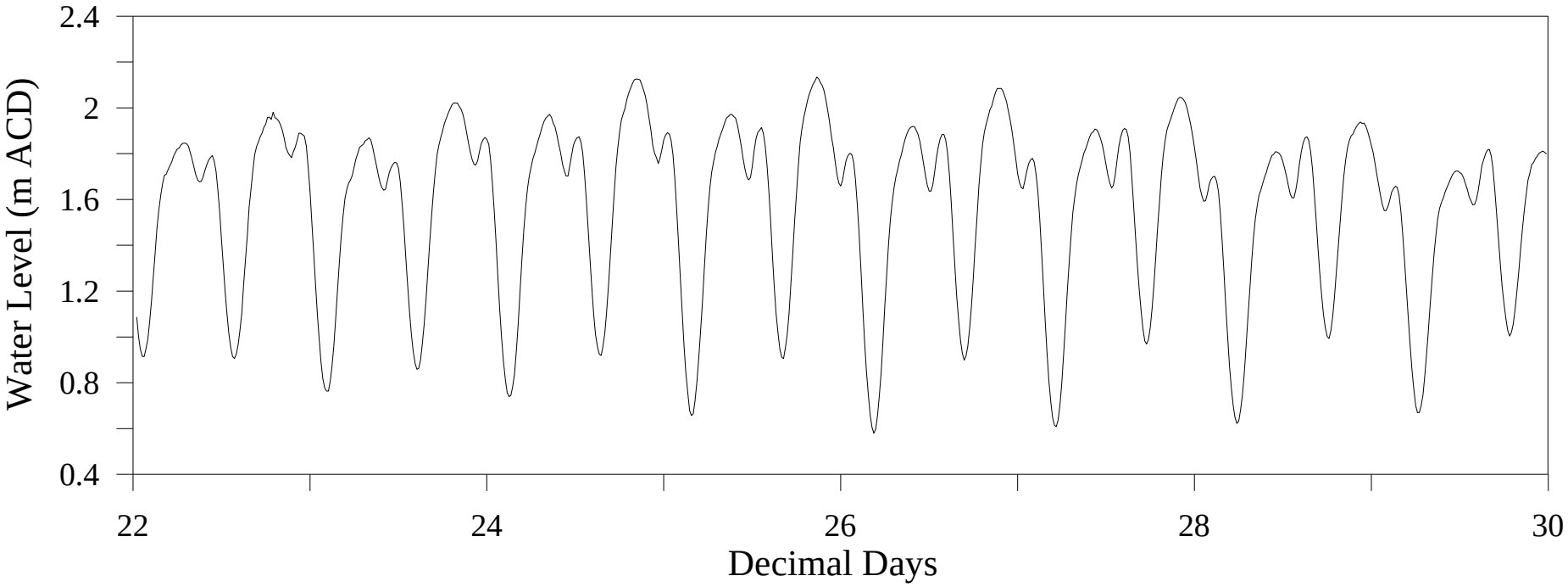
Predominate Wave Periods: 5 - 9 seconds

Boscombe Wind Climate



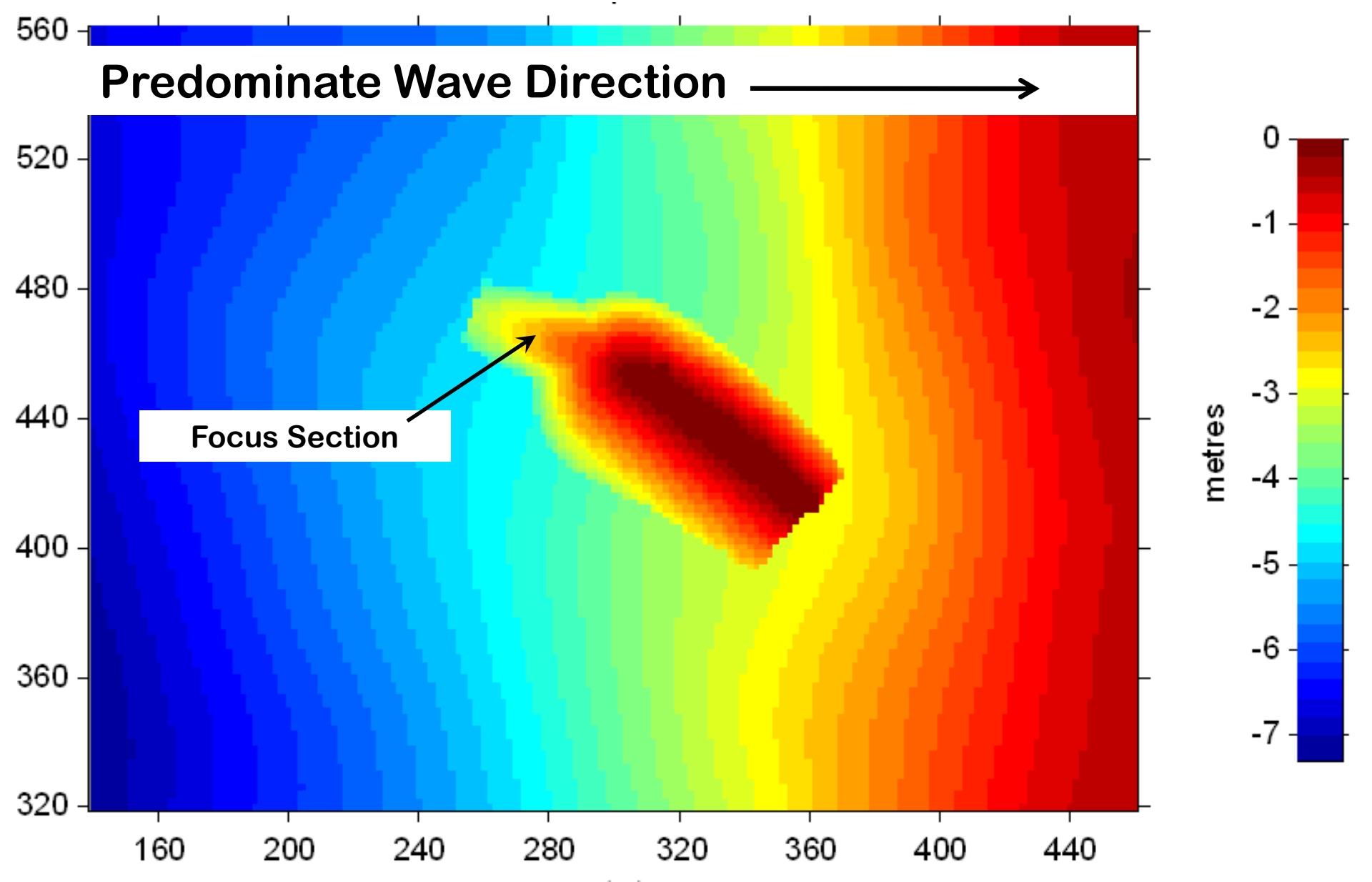
Predominate Cross Shore > 8.5 m/s (19mph)

Boscombe Tide Cycle

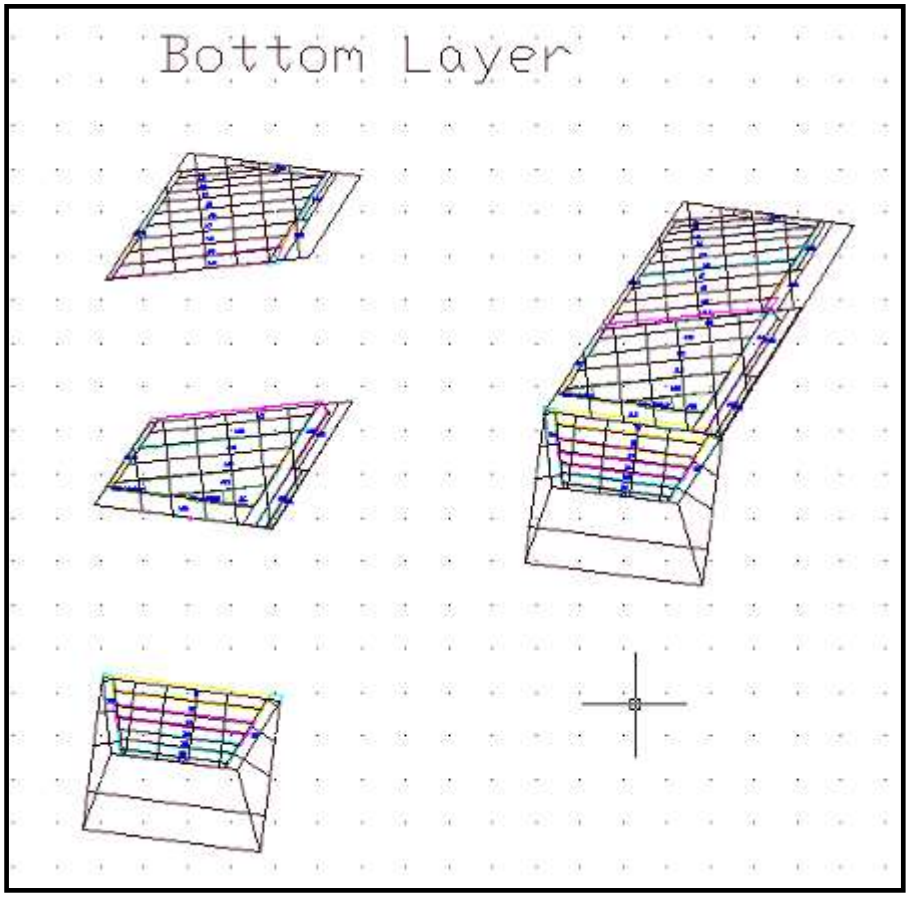


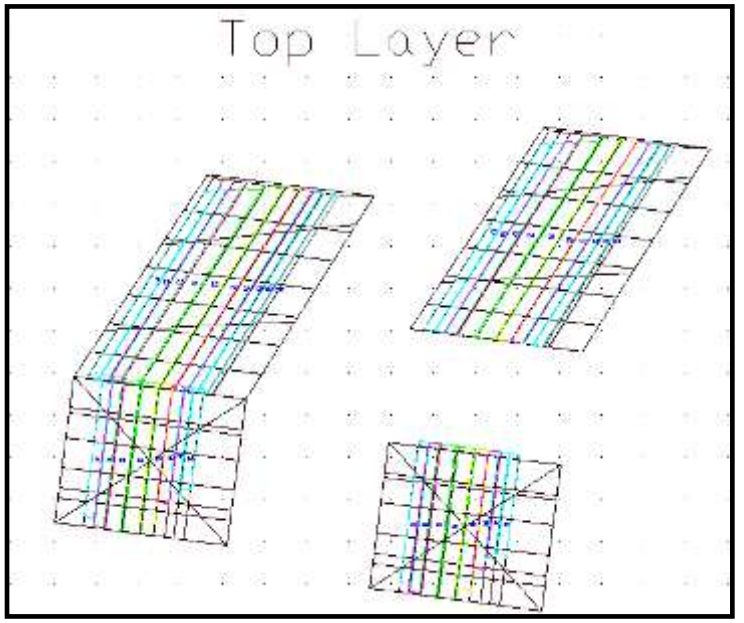
Asymmetric Double High Tide Peak
Range: 1.76 meters

Boscombe Reef Design



Boscombe Reef Design





Geotextile Sand Filled Container Layout

54 Containers - 2 Layers - 5 Sections Total

Boscombe Reef Construction

Boscombe Reef Construction

Boscombe Reef Construction

Boscombe Reef Construction

Boscombe Reef, UK

Completed Summer 2009

Wave Breaking on Laboratory Model

Wave Breaking on Reef

Surfing Enhancement

Boscombe Reef, UK

Boscombe Reef – Coastal Protection

Boscombe Reef – Coastal Protection

Boscombe Reef: Coastal Protection

Boscombe Reef: Economic Enhancement

Predicted Benefit to Cost Ratio 20:1

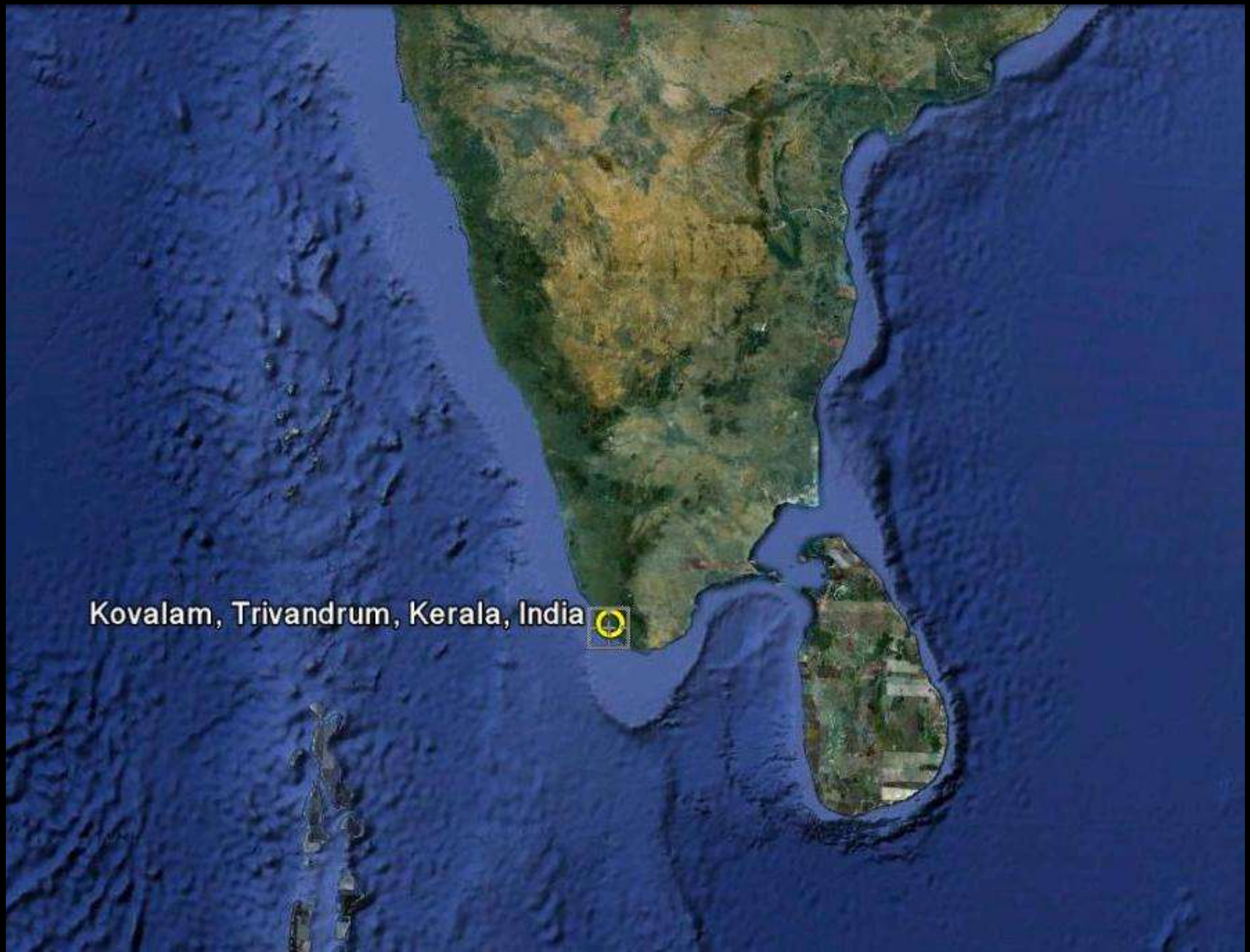
Media coverage of the Boscombe Reef Project generated over (US $20 million) in free publicity for the region.

(Bournemouth Borough Council, UK, 2009)

Boscombe Reef: Ecological Enhancement

Hard stable substrates promote greater biodiversity than sandy bottom

Kovalam Reef, India

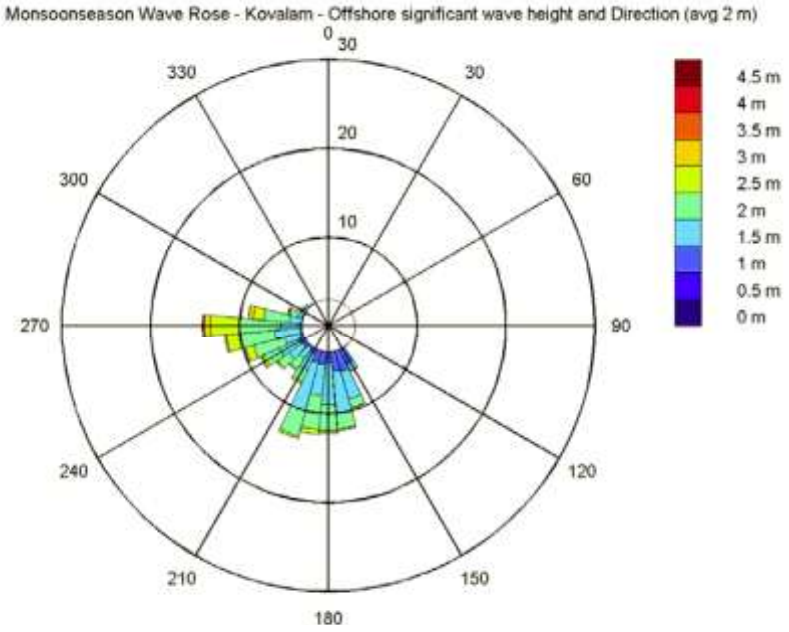


Kovalam Beach 2009

Kovalam Multi-Purpose Reef

1. Coastal Protection
2. Surfing Enhancement
3. Economic Enhancement
4. Ecological Enhancement

Kovalam Wave Climate Analysis



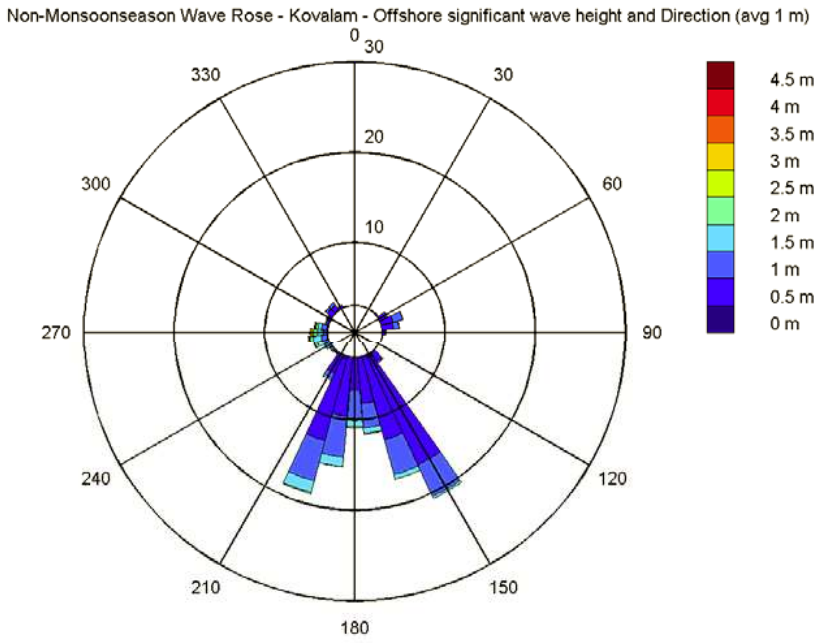
Two swell directions in the monsoon

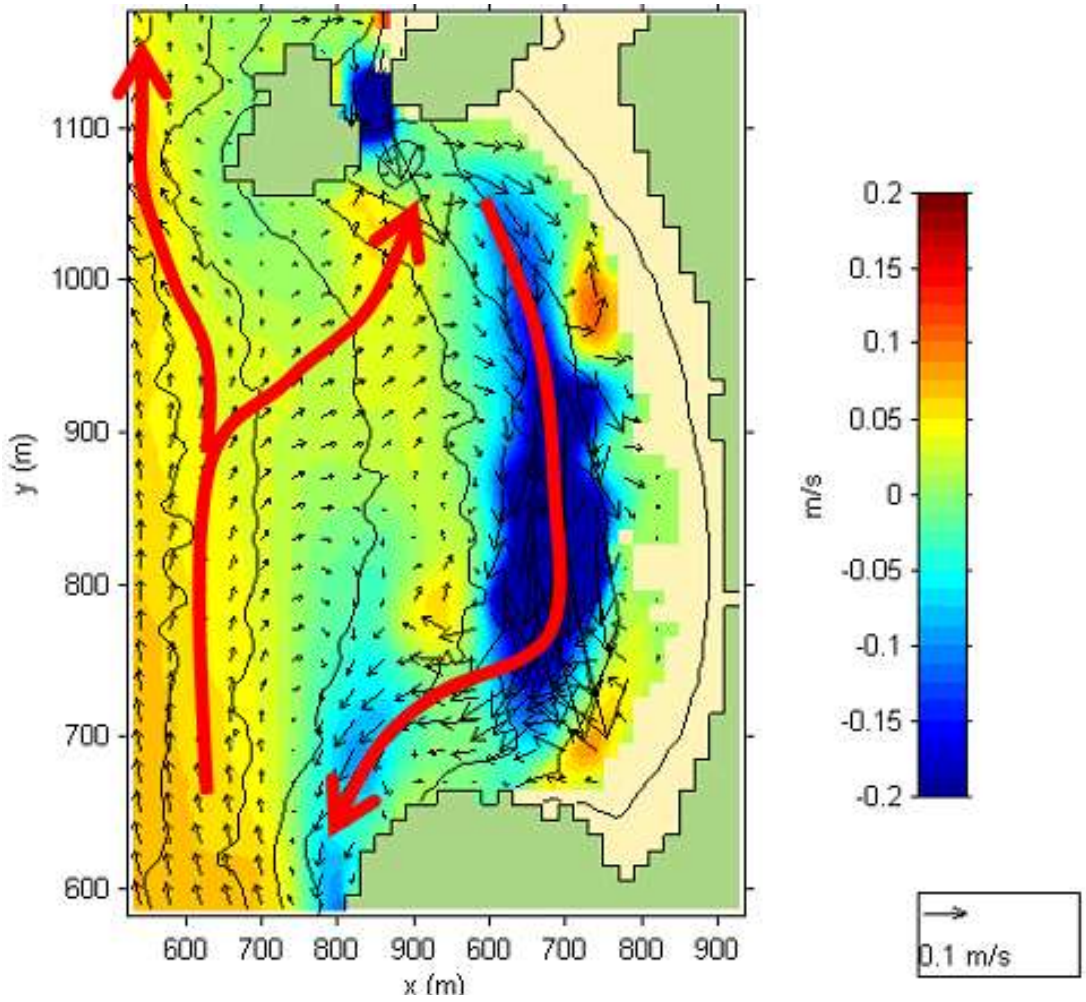
Predominate Conditions

Wave Heights: 1 – 2.5 meters

Wave Periods: 11-15 seconds

Non-Monsoon

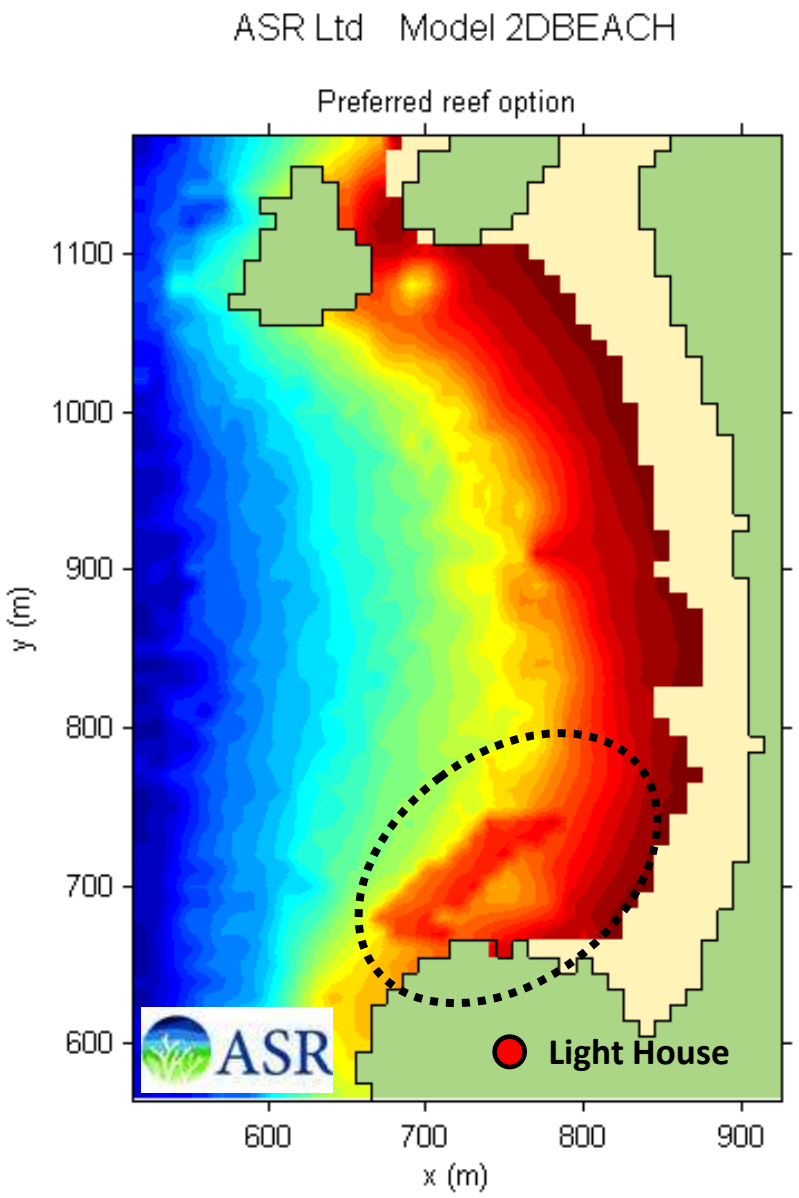




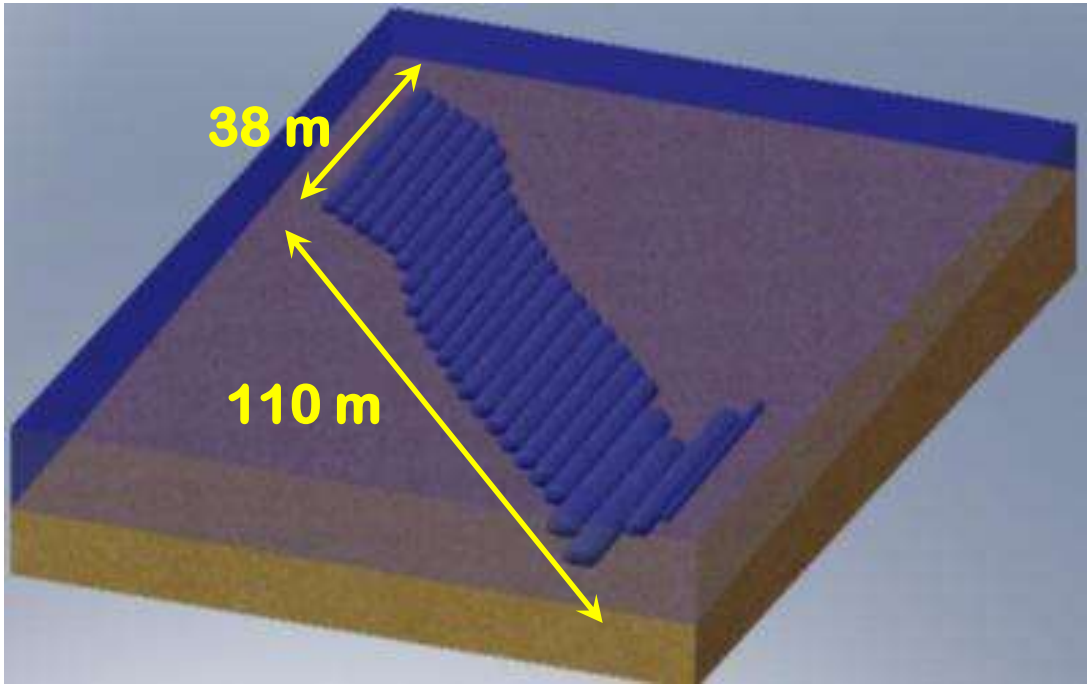
Velocity in the longshore direction with the current vectors for the monsoon.

The red arrows show sediment pathways.

Kovalam Reef – Site Specific Solution



Multi-Purpose Reef attached to the Southern Headland



Single Layer of 28 Geotextile Sand Filled Containers

Kovalam Reef: Completed February 2010

Kovalam Reef: Shoreline Response

September 2009

August 2010