A Coastal Observatory - tomorrows oceanology today

Proudman Oceanographic Laboratory
NATURAL ENVIRONMENT RESEARCH COUNCIL

Objective

To understand a coastal sea's response both to natural forcing and to the consequences of human activity.

● Instrumented moorings
● Shore based tide gauges
⊚ SMART buoys from CEFAS
- - - Instrumented ferries
✈ Airborne Imaging
🛰 Satellite remote sensing
◣ HF radar

(Map showing the Irish Sea region with PM, Port Erin Line, Prince Madog Line, Cypris, Bayrnàgh, University of Wales Bangor, Proudman Oceanographic Laboratory)
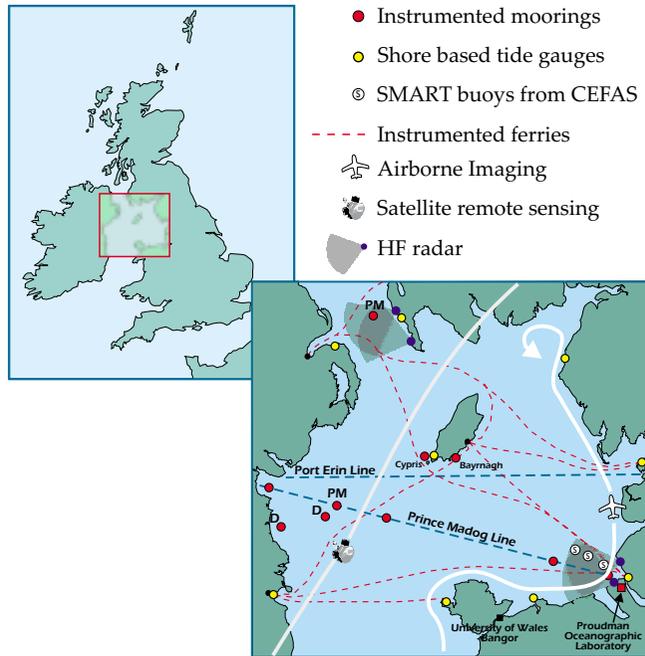
Introduction

The Observatory will integrate (near) real-time measurements with coupled models into a pre-operational coastal prediction system whose results will be displayed on the Web.

The concept is founded on obtaining data in (near) real time, using telemetry, from underwater to the sea surface to land to POL to a web site (armchair oceanography). This, the aspiration of every oceanographer, is now feasible.

It will grow and evolve as resources and technology allow, all the while building up long time series. The foci are the impacts of storms, variations in river discharge (especially the Mersey), seasonality, and blooms in Liverpool Bay.

Measurements

i)   In situ time series of current, temperature and salinity profiles and of waves and weather. A second site and measurements of turbidity and chlorophyll are eventually planned.

ii) The CEFAS SMART buoy for surface properties including nutrients and chlorophyll. www.cefas.co.uk/Products/smartbuoy.htm

iii) RV Prince Madog to service moorings and for spatial surveys. www.vtplc.com/madog/

iv) Instrumented ferries for near surface temperature, salinity, turbidity, chlorophyll and later nutrients. The first route will be Liverpool to Douglas.
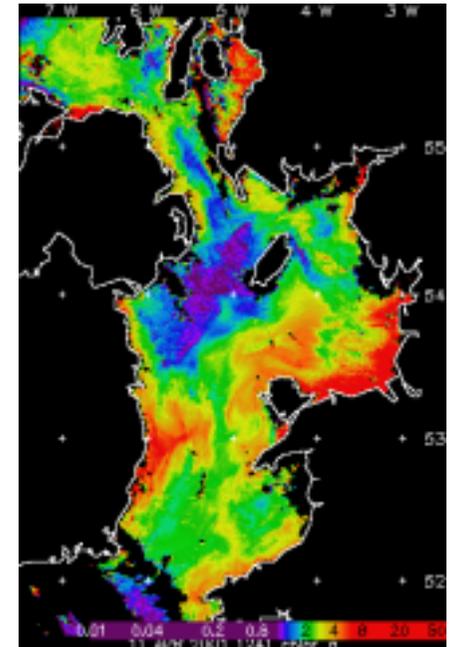
v)   Drifters, measuring surface currents and properties such as temperature and salinity.

vi) Tide gauges, with sensors for met, waves, temperature and salinity, where appropriate.

vii) Met data from Bidston Observatory and HF radar, tide gauge sites and in situ.

viii) Shore-based HF radar measuring waves and surface currents out to a range of 50 km.

ix) Satellite data - infra-red (for sea surface temperature) and visible (for chlorophyll and suspended sediment).

Prince Madog, the University of Wales research vessel, leaves Birkenhead for the Irish Sea

Partners

Proudman Oceanographic Laboratory
British Oceanographic Data Centre
Met Office
Centre for Environment, Fisheries and Aquaculture Science
Environment Agency
Liverpool University and Port Erin Marine Laboratory
School of Ocean Sciences, Bangor
Southampton Oceanography Centre
Department of Agriculture and Rural development, Northern Ireland

Satellite image of chlorophyll in the Irish Sea

Modelling

The Coastal Observatory will use POLCOMS (Proudman Oceanographic Laboratory Coastal Ocean Modelling System).

Visualisation, data banking (community products) & high performance computing
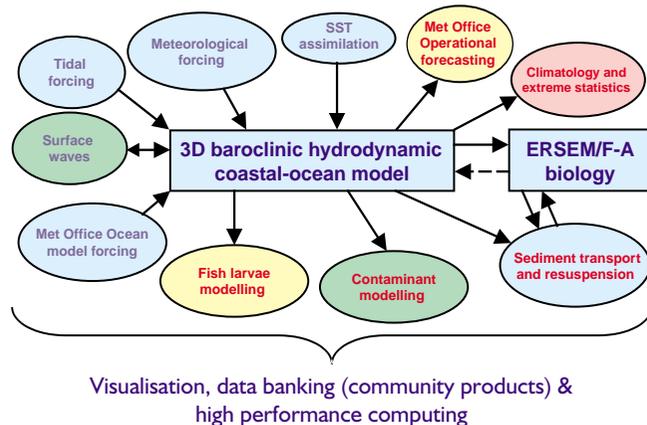
Nested 3-dimensional models covering the ocean/shelf of northwest Europe (12 km resolution), Irish Sea (1 km) will focus on Liverpool Bay (100-300m resolution).
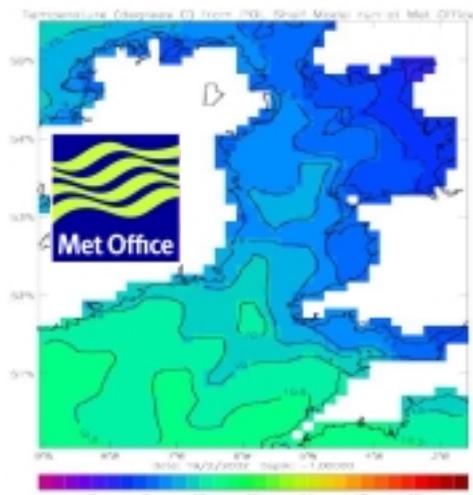
Sea surface temperature from a POL operational model run at the Met Office

At the Met Office POLCOMS on an ocean/shelf domain, forced by NWP mesoscale meteorology and ocean forcing from FOAM (Forecast Ocean Atmosphere Model), provides the boundary conditions for the Irish Sea model, which in turn provides boundary conditions for the Liverpool Bay model. Local river discharges will be included through a link-up to the Environment Agency river-flow network.

Initial implementation will be hydrodynamic with 3-dimensional wave-current interaction provided by 2-way linking between wave (WAM) and current models with performance checked against the in-situ and coastal sea-level measurements. Methods of data assimilation will be explored.
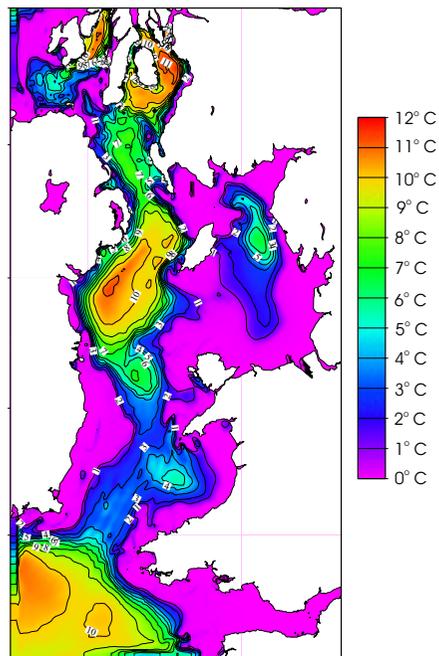
The temperature difference between the sea surface and sea bed predicted by a 1.5km grid Irish Sea model, highlighting the stratified region to the west of the Isle of Man

POLCOMS also includes a sediment transport module for estimating concentrations of suspended particulate matter, an important influence on light attenuation and hence biological processes.
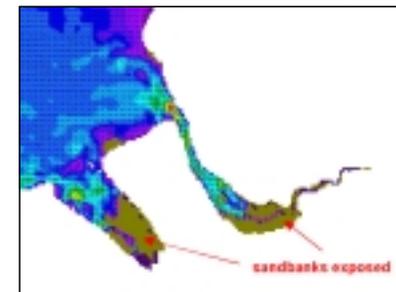
Predicted tidal currents from a subset of the 300m Liverpool Bay model

Nutrients and plankton dynamics will be simulated by coupling to the ERSEM (European Seas Regional Ecosystem Model) component of POLCOMS. CEFAS SMART buoys and the SeaWifs satellite ocean colour sensor will provide validation data.

Models will run daily in near-real time. All results (e.g. daily mean sea surface and sea bed temperature, currents, waves and sea surface height) will be displayed on the Coastal Observatory web-site.

Schedule

2002
First real-time met and tide gauge data.
Pilot in situ measurements.
Deploy SMART buoy.
Pilot measurements of Lady of Mann ferry.
Models - current, temperature salinity.
Irish Sea / Liverpool Bay models wave / current interaction.

2003
Start of HF radar operation.
Start first in situ site.
Models - nutrients and plankton dynamics.

2004
Drifting buoys.

2005
Second in situ site.

Further information is available from Roger Proctor:
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