Marine Biogeochemistry and Bio-Optics around the Irish continental shelf

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Geotraces

IMBER

Surface Ocean \ Solas
Lower Atmosphere Study

Croot | Atlantic from Space Workshop | 23-25/01/2019 | Slide 3
Research Motivation: Understanding the Impact of Multiple Stressors on Marine Ecosystem Services

What controls phytoplankton production on the western Irish shelf?

May 22, 2010 MODIS Terra

“The phytoplankton may have benefited from iron and nutrients in the ash dumped onto the ocean surface for weeks by Iceland’s Eyjafjallajökull Volcano”
Focus on Coastal Blooms and HABs

June 4, 2007. The bloom emanates from the mouth of the River Shannon and tapers off to the north.

MODIS (TERRA)
Western European Shelf Pelagic Acoustic Survey

WESPAS - RV Celtic Explorer survey over 6 weeks providing synoptic coverage of shelf waters from 47°N northwards to 58°30’N

Fisheries focused but allows CTD work and opportunity to collect water samples for biogeochemistry, phytoplankton and zooplankton analyses
Western European Shelf Pelagic Acoustic Survey

WESPAS sampled since 2016
Biogeochemistry: Vertical and Horizontal Distribution of Nitrite, Nitrate, Urea (since 2018), Phosphate and Silicate. Radium isotopes in 2016 for shelf mixing processes.
Pico and nanoplankton by flow cytometry
Bio-Optics: Particle absorption, Chlorophyll and reflectance measurements (since 2018)
Celtic Voyager Surveys: Hyperspectral Profiles

CV16035 SW Ireland

CV18012 Nephrops Survey
Picoplankton along the Western Irish Shelf

Synechococcus [cell/ml] @ Depth [m] = first

Aedin McAleer
CV16035
June 27

**MODIS image: Rare fair skies over Ireland & UK, 27\textsuperscript{th} June 2018**
Baseline studies of CDOM from phytoplankton and other natural sources along the west coast of Ireland.

Satellite along with airborne hyperspectral observations of surface slicks along the Irish coast.

Validation of the Irish Atlantic Margin oil slick map, showing the regional structural basins (Funck et al. 2014), and the areas where oil slicks have been observed (oil-slick data provided by CGG: GOSD 2014).

Using combination of Sentinel 1 SAR and Sentinel 3 Ocean Colour
Shipboard Reflectance Spectra: Trios RAMSES

Data: Catherine Jordan

Future work: Comparison to Sentinel 3 reflectance data
WESPAS 2018 – Particulate Absorption

Data: Catherine Jordan

QFT1 filter holder with GF/F filter

Particulate Absorption Spectrum
Hyperspectral data from the water column

Analysis of in situ light data obtained from the NUI Galway Trios RAMSES SAMIP during CV16035 along the Irish west coast. Data results from an exponential fit to the light profile data in the top 25 m of the water column – data only shown to 700 nm.
CDOM/FDOM WESPAS 2016 (Data: Allan Grassie)
WESPAS16 CDOM absorption Galway Bay 53°N.

Depth [m]

100 90 80 70 60 50 40 30 20 10 0

WESPAS2018 CDOM
WESPAS2016 Spectral Slope of CDOM
Blue waters of the South Pacific Gyre (SPG) – purest ocean water – important for salt water contribution to reflectance spectra for separating CDOM and Chl a components.

Highlight: 1\textsuperscript{st} FDOM survey of SPG

Data: Allan Grassie (NUIG) in preparation
Membrane Inlet Mass Spectrometry

Hiden HPR-40 DSA

Measure climate relevant gases in seawater

$O_2 / Ar$ for net community oxygen production

DMS, CO$_2$, N$_2$, CH$_4$, N$_2$O

UK example: Zonal variations of net community oxygen production ($N(O_2/Ar)$) along the Celtic Sea. Seguro et al. (2018)
Sources: Weathering from Irish Rivers (Peatbogs)

Peatland Soils  Rivers
3 humic components dominate the riverine FDOM signature

Project:
Trace FDOM/CDOM from River to Sea
Recommendations

- More of the same
- Ocean Metrology - intercomparisons
- Improve/extend CDOM products
- Develop separate tools for the Open Ocean, Coastal Zone & Submarine Groundwater