

→ ATLANTIC FROM SPACE WORKSHOP

23–25 January 2019
National Oceanography Centre
Southampton, UK

Marine Biogeochemistry and Bio-Optics around the Irish continental shelf

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Catherine
Jordan
PhD student
(Cullen)
Hyperspectral



Monica
Mullins
PhD student
(iCRAG)
SAR & slicks



Ciaran O'Donnell



Allan
Grassie
PhD student
CDOM &
Light



Sarah
Nicholas
Post-Doc
Marine
Biogeochem
(Now at
BNL)



Caroline Cusack

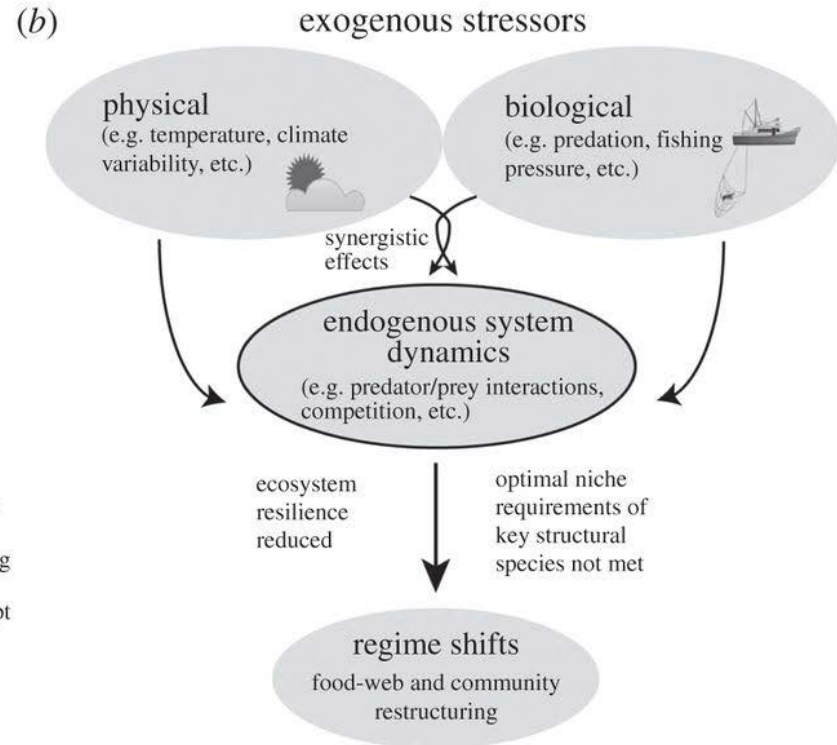
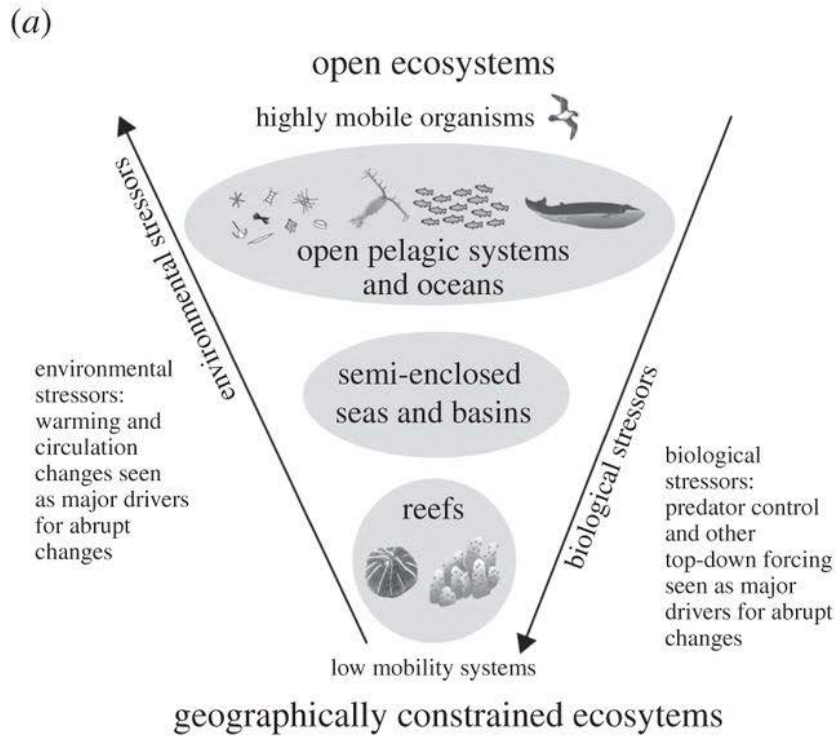
Funding Acknowledgments



The University of Dublin



Research Motivation: Understanding the Impact of Multiple Stressors on Marine Ecosystem Services



Conversi et al (2015)



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”



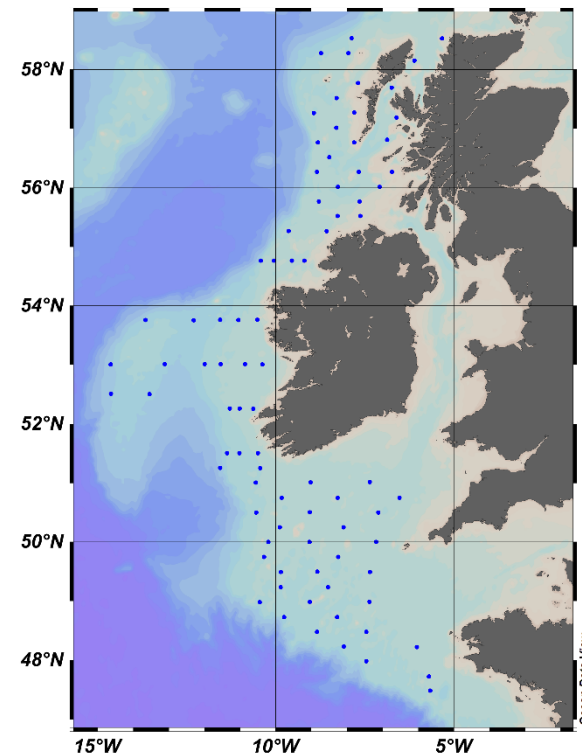
June 4, 2007. The bloom emanates from the mouth of the River Shannon and tapers off to the north.

MODIS
(TERRA)



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

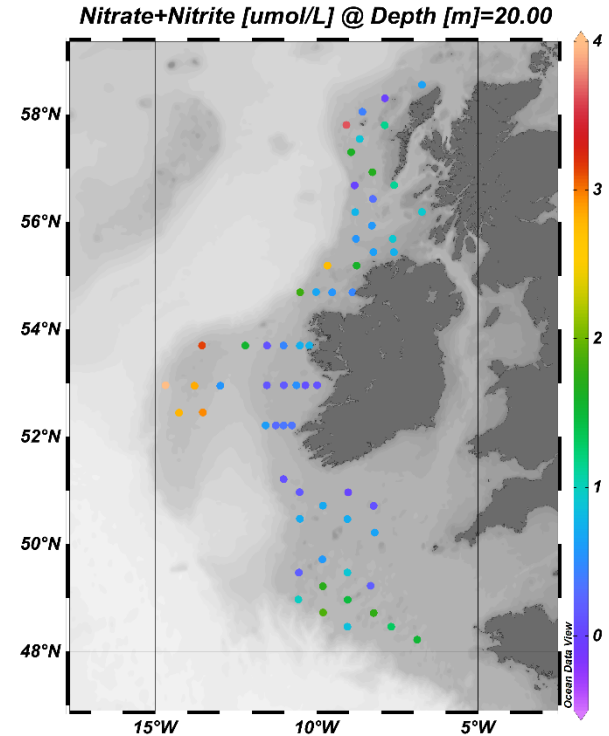


WESPAS sampled since 2016

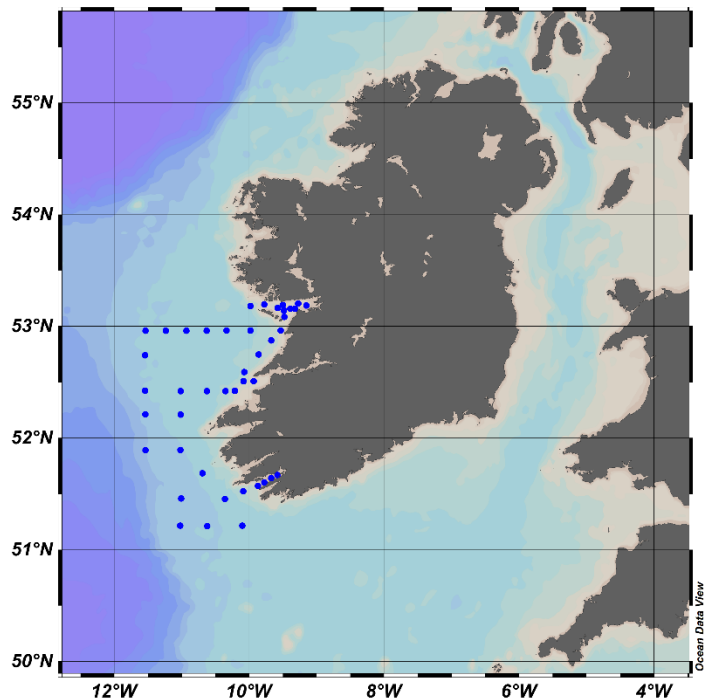
Biogeochemistry: Vertical and Horizontal Distribution of Nitrite, Nitrate, Urea (since 2018), Phosphate and Silicate. Radium isotopes in 2016 for shelf mixing processes.

Pico and nanoplankton by flow cytometry

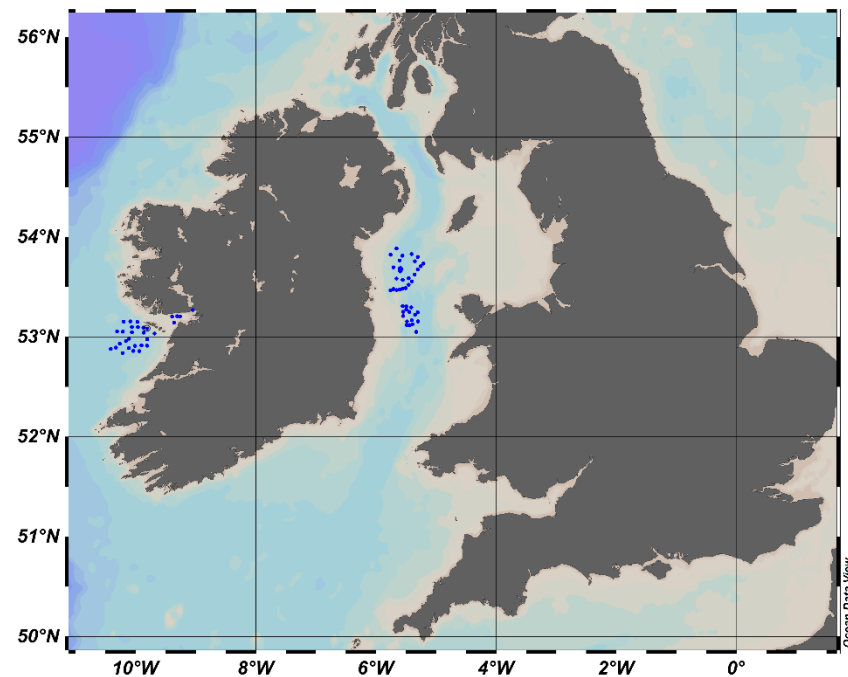
Bio-Optics: Particle absorption, Chlorophyll and reflectance measurements (since 2018)



Celtic Voyager Surveys: Hyperspectral Profiles



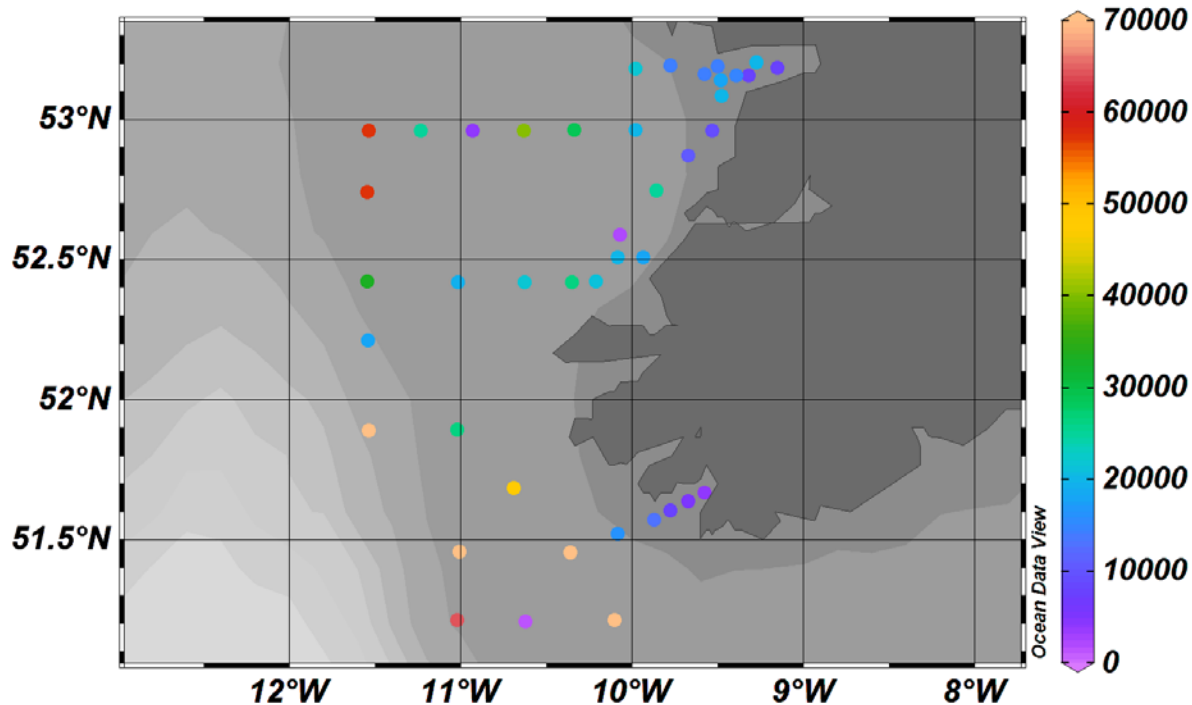
CV16035 SW Ireland



CV18012 Nephrops Survey

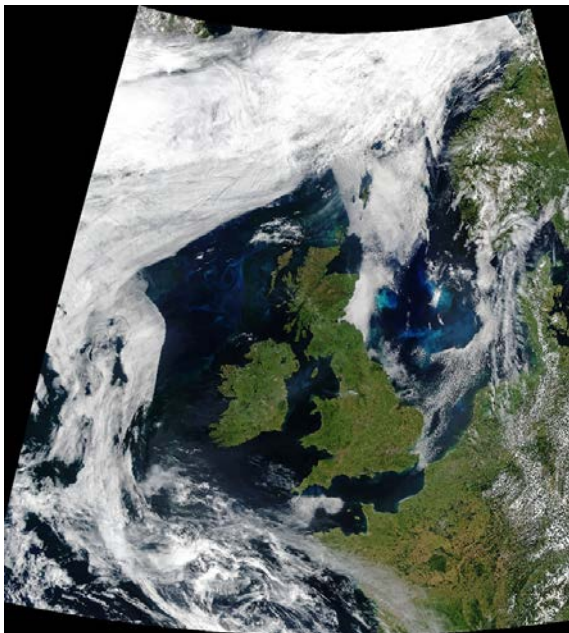


Synechococcus [cell/ml] @ Depth [m]=first



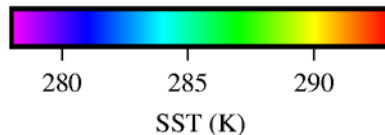
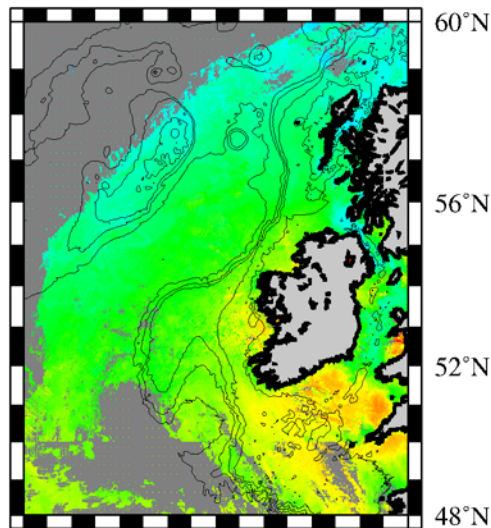
Aedin McAleer
CV16035

June 27

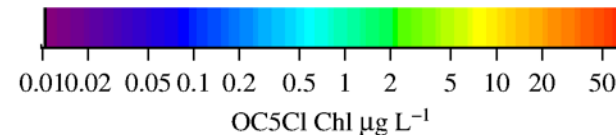
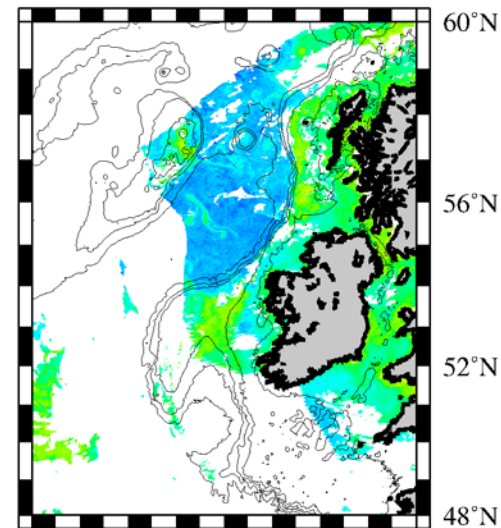


MODIS image: Rare fair skies over Ireland & UK, 27TH June 2018

20°W 16°W 12°W 8°W 4°W



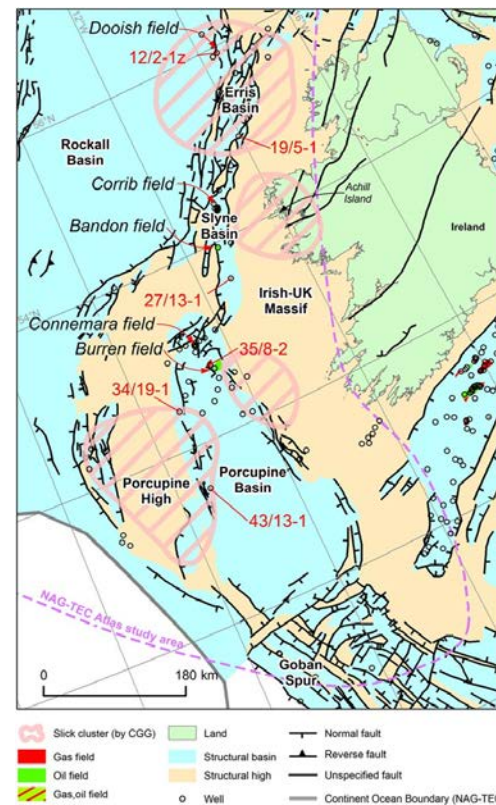
20°W 16°W 12°W 8°W 4°W



Surface Slicks: Bio-Optics & Sentinel Satellites



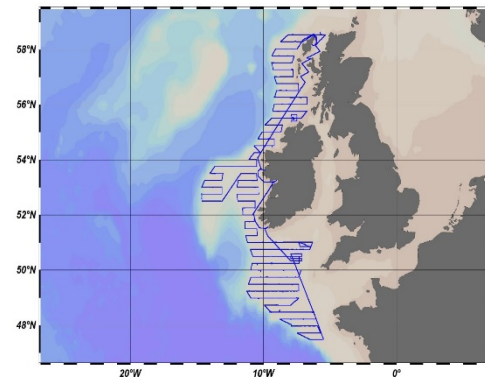
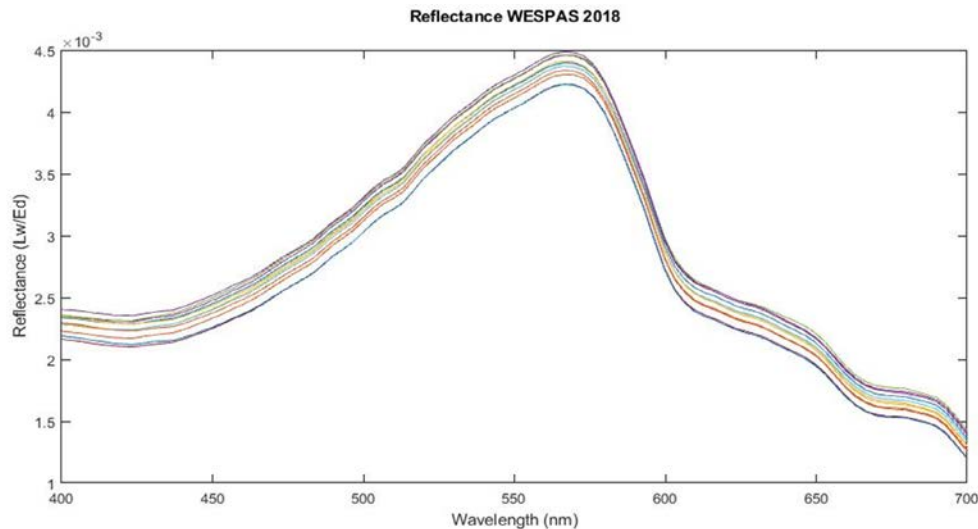
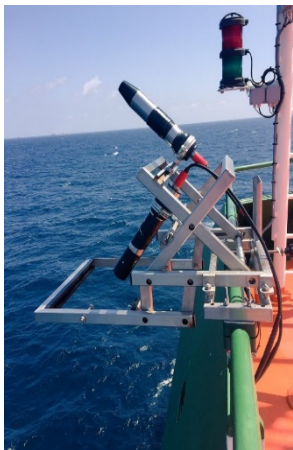
- ▲ Baseline studies of CDOM from phytoplankton and other natural sources along the west coast of Ireland.
- ▲ Satellite along with airborne hyperspectral observations of surface slicks along the Irish coast.
- ▲ Validation of the Irish Atlantic Margin oil slick map, showing the regional structural basins (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

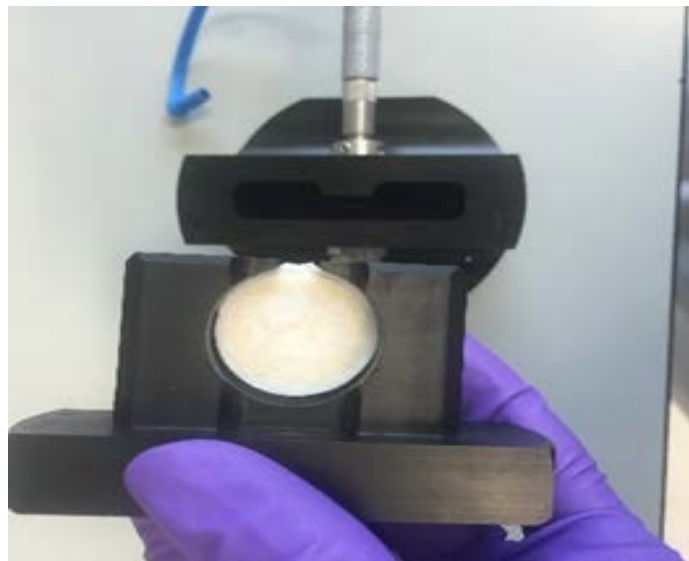


Shipboard Reflectance Spectra: Trios RAMSES



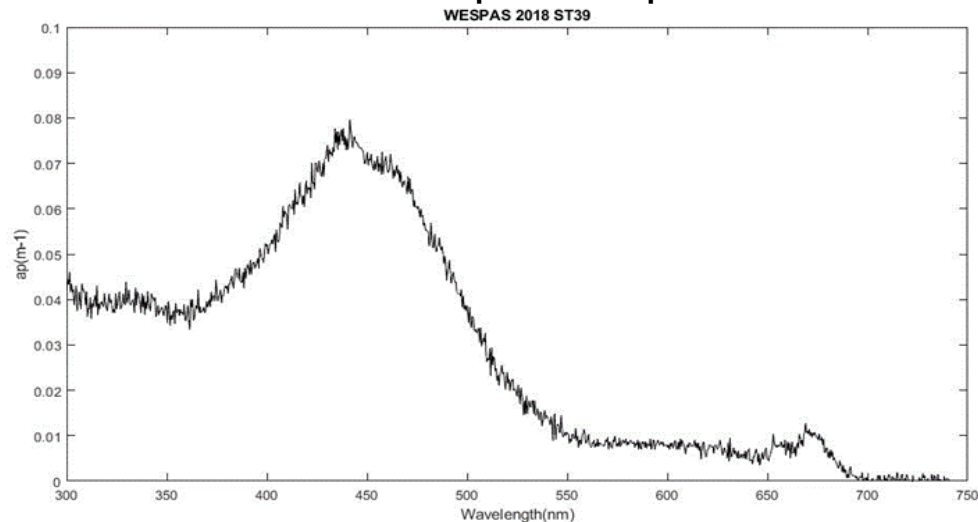
Data: Catherine Jordan

Future work: Comparison to Sentinel 3 reflectance data



QFT1 filter holder with GF/F filter

Particulate Absorption Spectrum

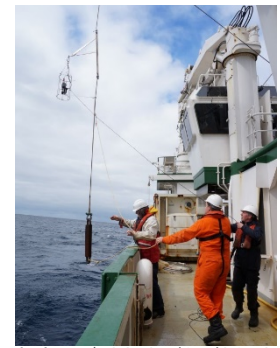
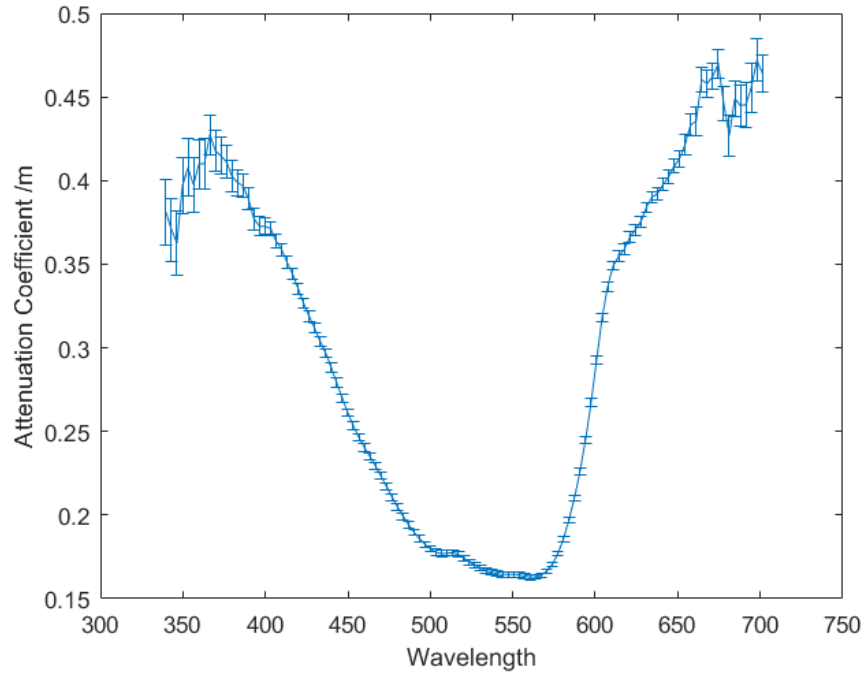


Data: Catherine Jordan

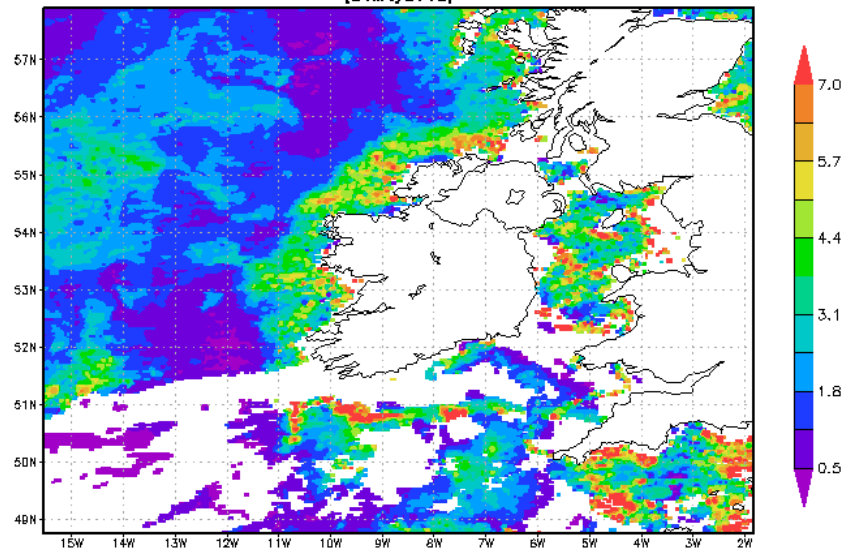
Hyperspectral data from the water column



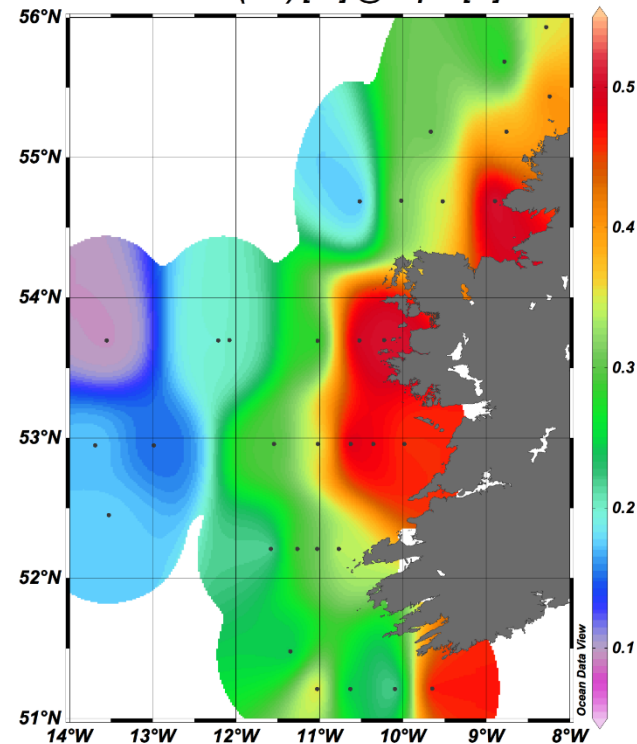
Analysis of in situ light data obtained from the NUI Galway Trios RAMSES SAMIP during CV16035 along the Irish west coast. Data results from an exponential fit to the light profile data in the top 25 m of the water column – data only shown to 700 nm.

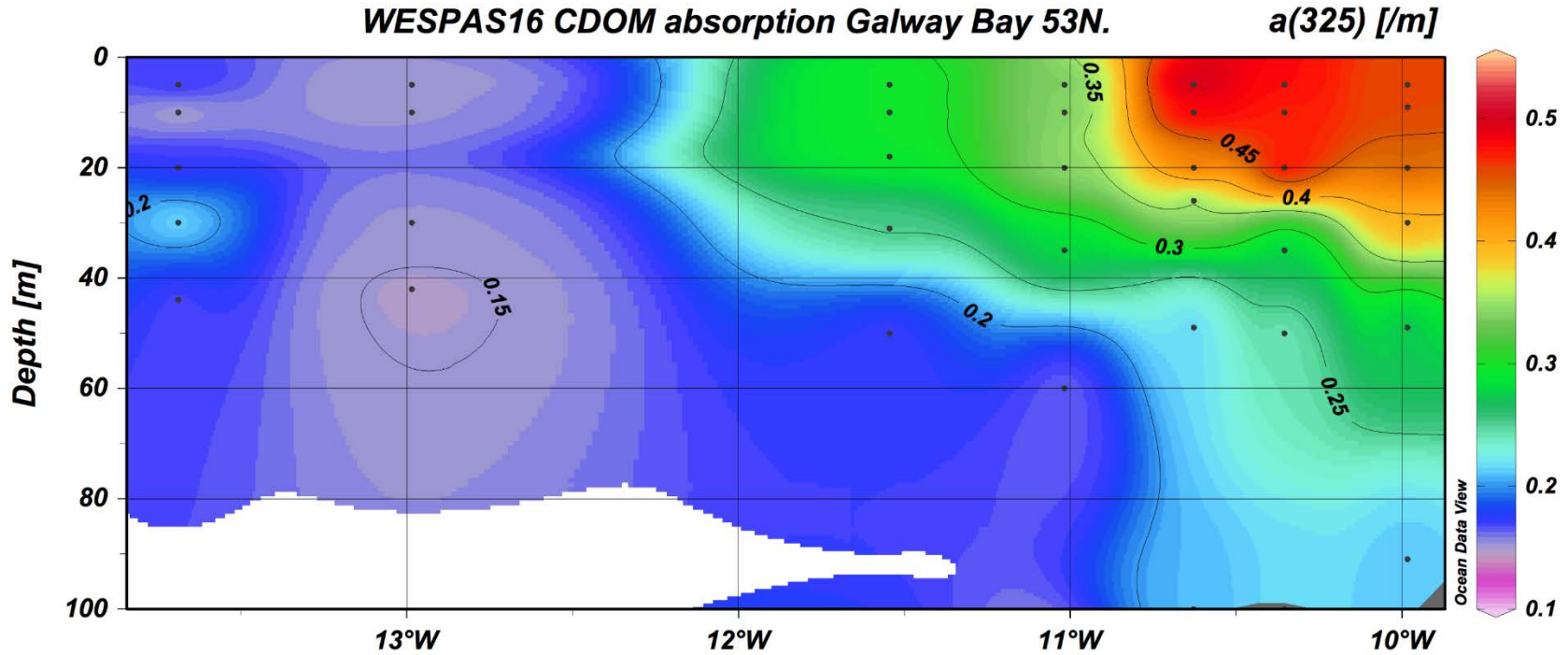


MABD_CDOM_4km.CR Colored Dissolved Organic Matter (CDOM) Index 4km, 8-day [unitless]
(24May2012)



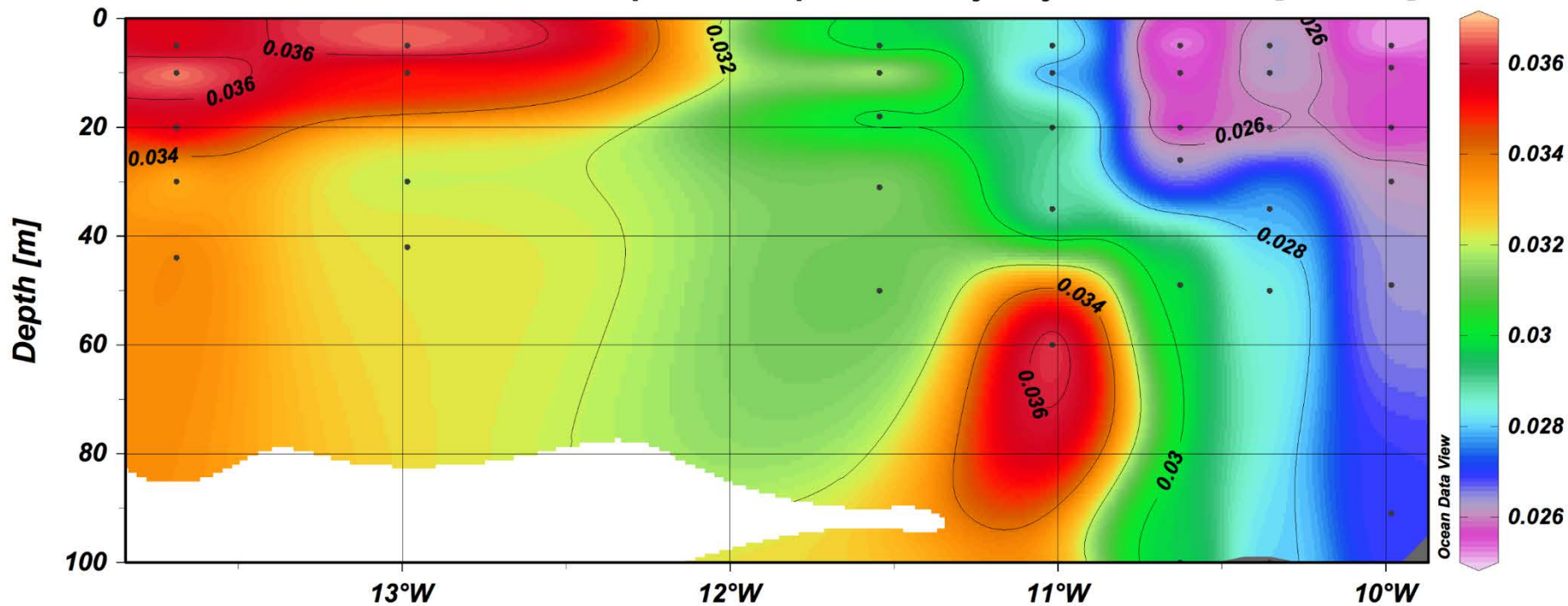
$a(325)$ [1/m] @ Depth [m]=first





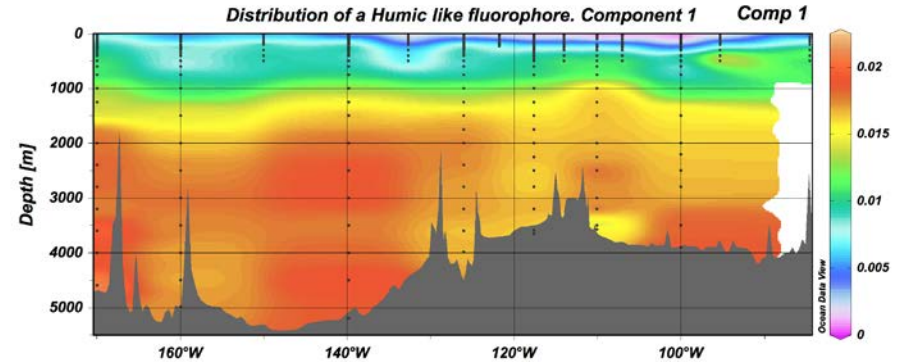
WESPAS16 CDOM spectral slope S Galway Bay 53N.

S [275-295]

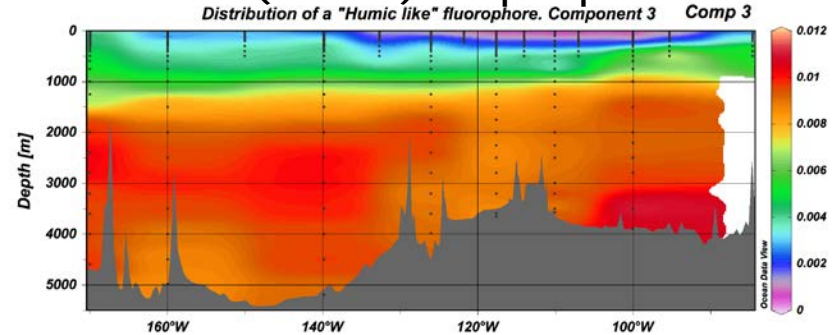


Blue waters of the South Pacific Gyre (SPG) – purest ocean water – important for salt water contribution to reflectance spectra for separating CDOM and Chl a components.

Highlight: 1st FDOM survey of SPG



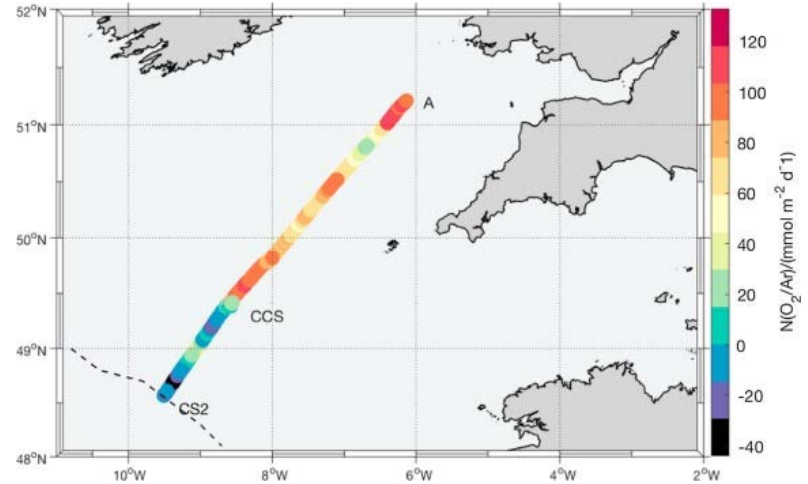
Data: Allan Grassie (NUIG) in preparation





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_2O



UK example: Zonal variations of **net community oxygen production** ($N(O_2/Ar)$) along the Celtic Sea. Seguro et al. (2018)

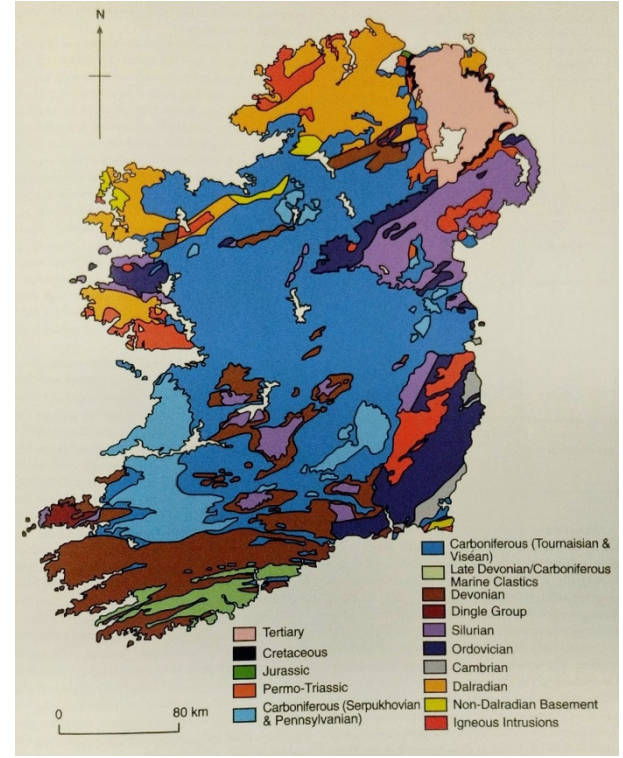
Sources: Weathering from Irish Rivers (Peatbogs)



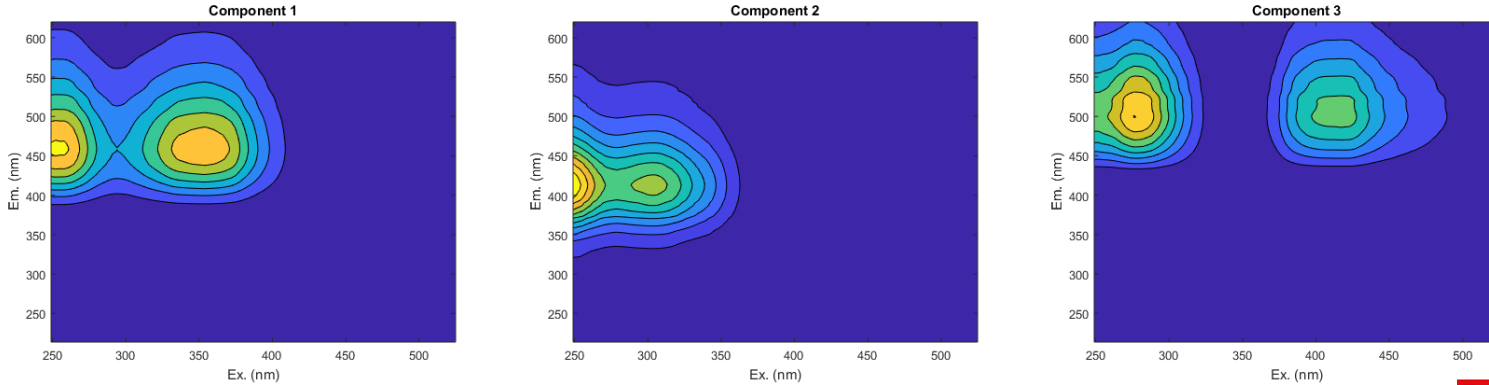
Peatland Soils



Rivers



3 humic components dominate the riverine FDOM signature



Project:
Trace
FDOM/CDOM
from River
to Sea



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

THANKS FOR YOUR ATTENTION

