

Preliminary Results of Modelled Carbon Fluxes

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and the rest of the WP4 team that developed NEMO-ERSEM and
produced the hindcasts)

SSB WP4-Modelling

A summary

Hydrodynamics

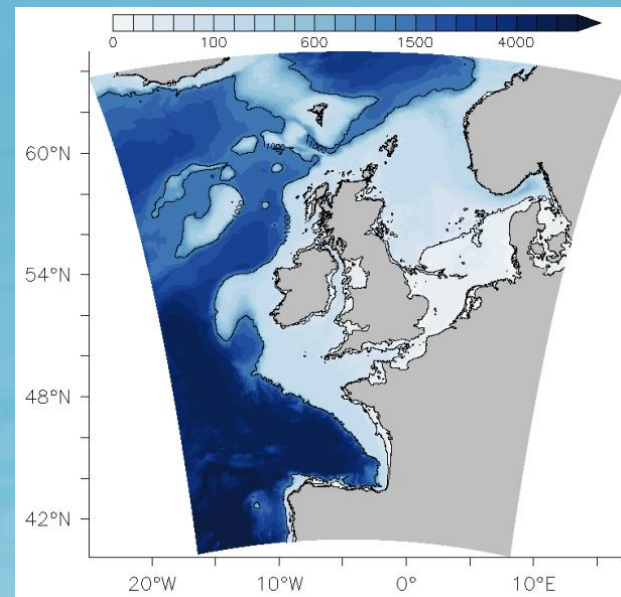
NEMO Atlantic Margin Model 7 km

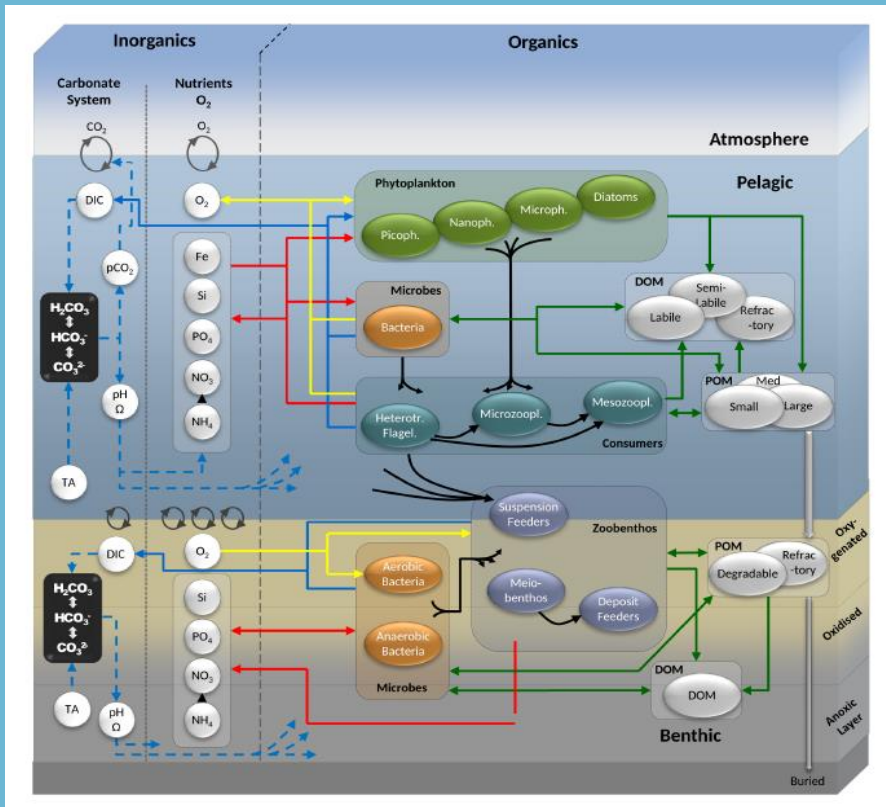
Biogeochemistry

ERSEM PML branch (Blackford et al., 2004) further developed in SSB (Butenschon et al. 2016)

Coupling using FABM

Agnostic coupler with bindings for GOTM, NEMO, GETM, MOM4, MOM5, etc...





V0 Baseline	V1 Safe	V2 Progressive
PML version with FABM coupling	e.g. TEP - Transparent Exopolymer Particles Benthic redox Permeable sediments	e.g. Archea Filter feeders and Rouse profiles Iron cycle Sediment resuspension Upgrading N cycle Benthic predator

Butenschon et al. 2016. Geo. Model Devel.

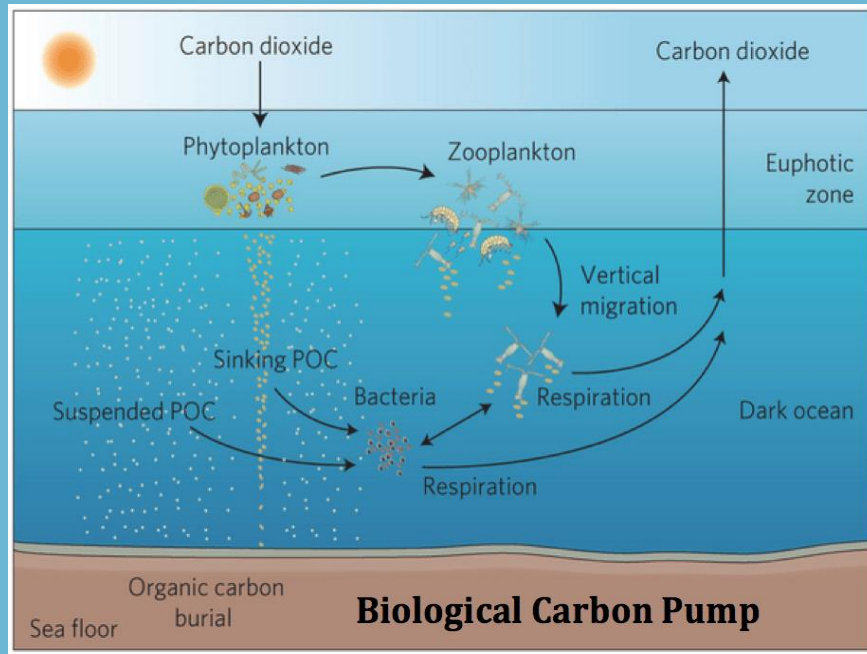
Model runs

- V0 Hindcast 1981-2015 ✓
- V1 Hindcast 1981-2015 ✓
- Climate change scenario RCP8.5 1980-2050
- Trawling scenarios - 20 yrs (2 runs) ✓
- Climate + trawling (2 runs)
- Reduction of riverine discharge of N and P - 20 yrs (3 runs)

First Results for Carbon Flux Calculations

- NEMO-ERSEM SSB v0 1981-2015
- V0 hindcast still being rerun at writing time
- Analysed the period 1986-1995 and 1986-2004 for time series

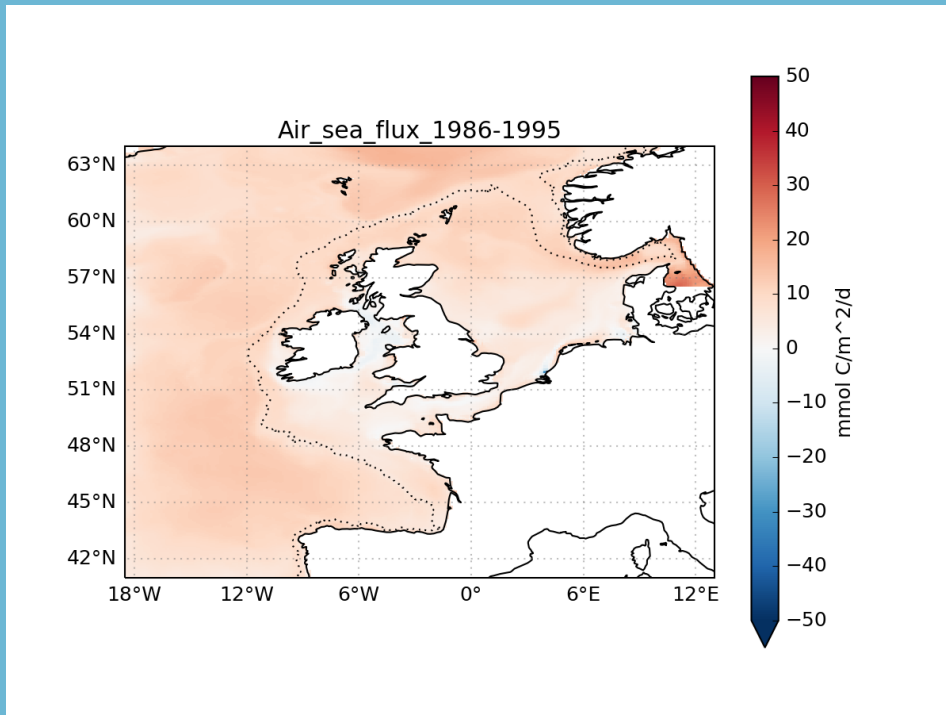
Marine Carbon Cycle



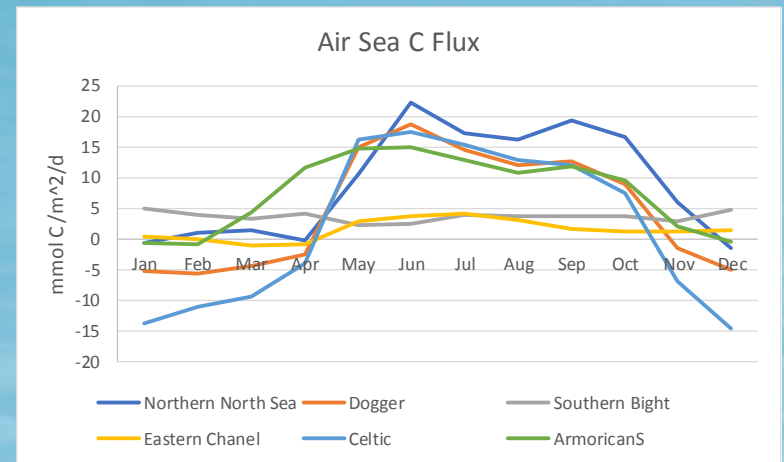
Emma Cavan-Southampton

- Air-sea flux
- Net advection
 - Organic/Inorganic
- Production-Respiration
- Benthic-Pelagic
 - Organic/Inorganic

Air-sea C flux

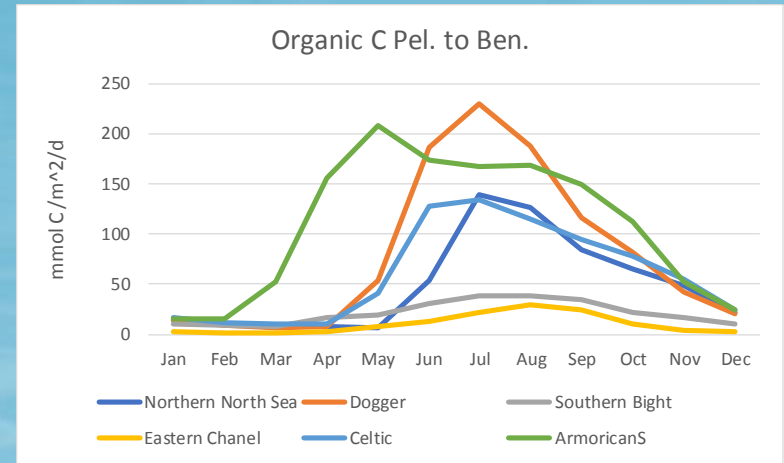
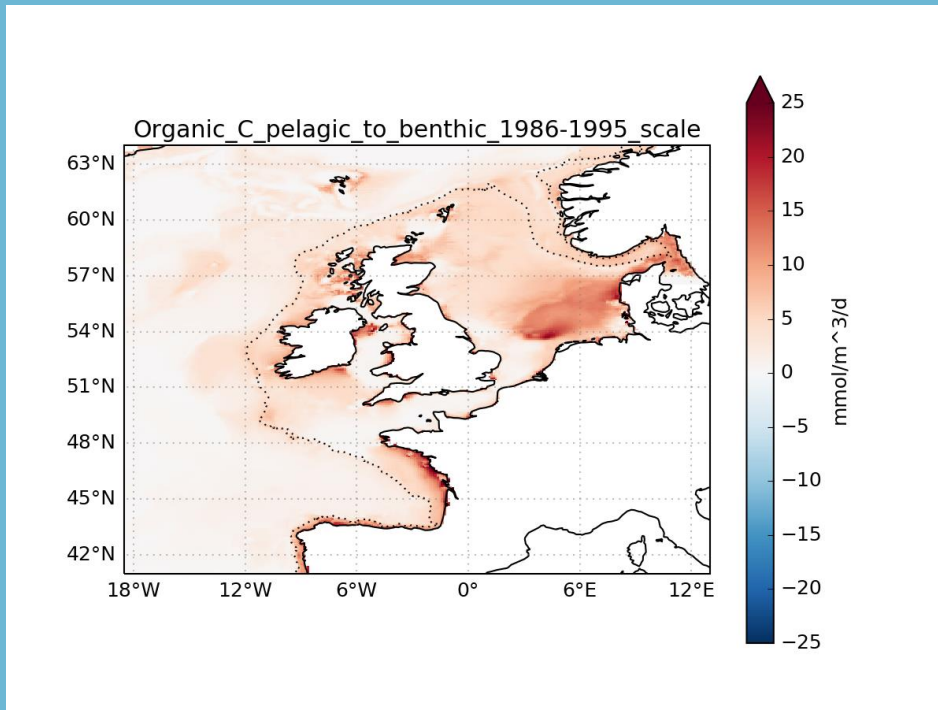


- Net uptake by ocean
- Higher uptake values over deep areas
- Shelf budget ~30 Tg C/y (Yuri)

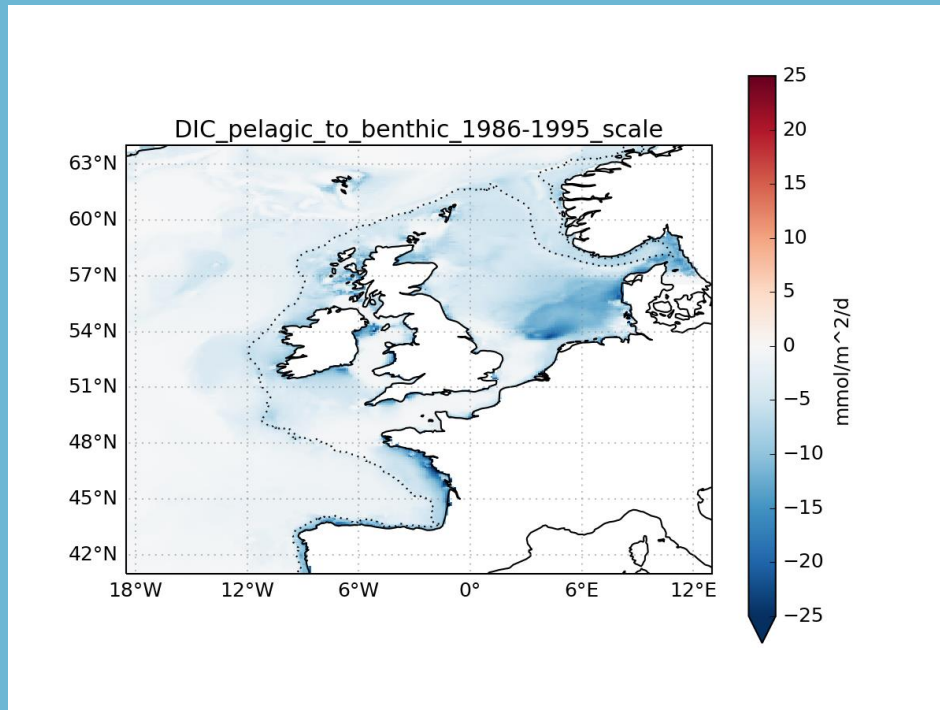


Organic C Pelagic to Benthic

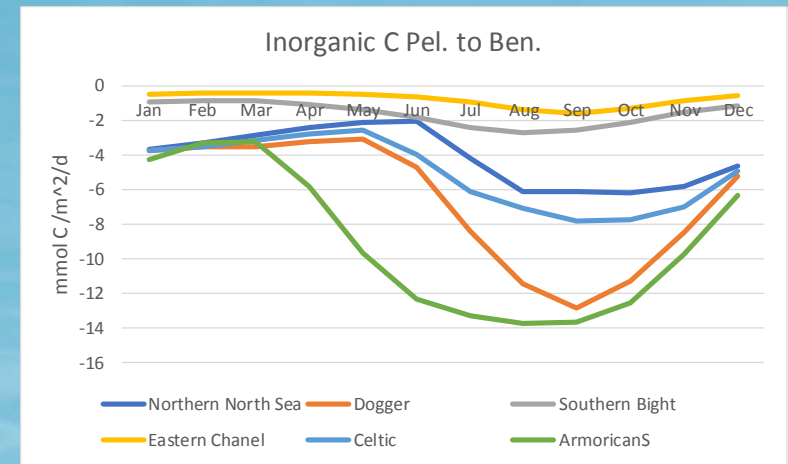
- Deposition + Benthic feeding
- Erosion



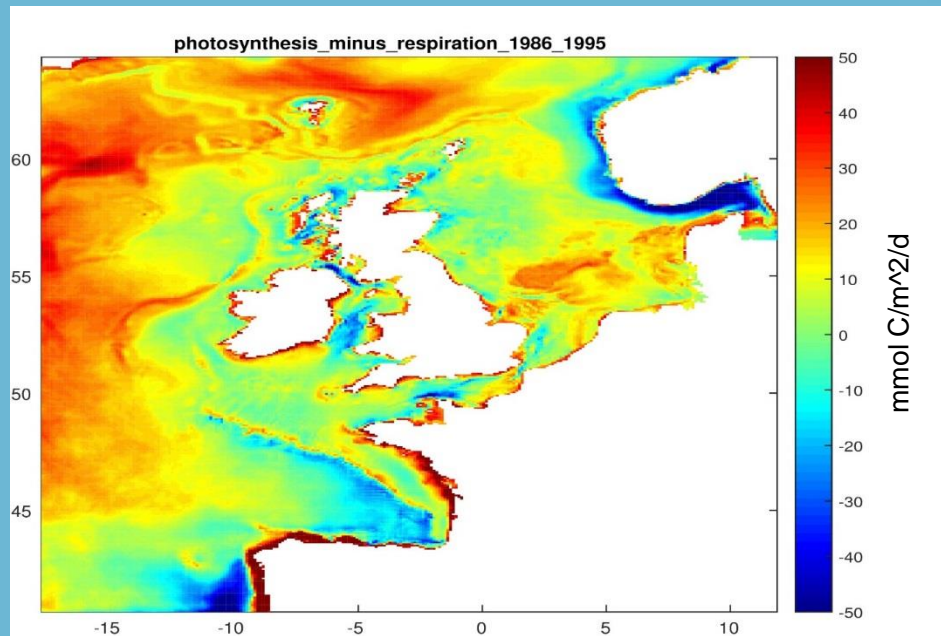
Inorganic C Pelagic to Benthic



- Diffusion of DIC to pelagic



Photosynthesis - Respiration



Photosynthesis
(4 groups)

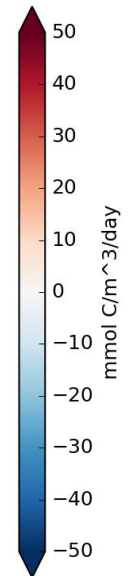
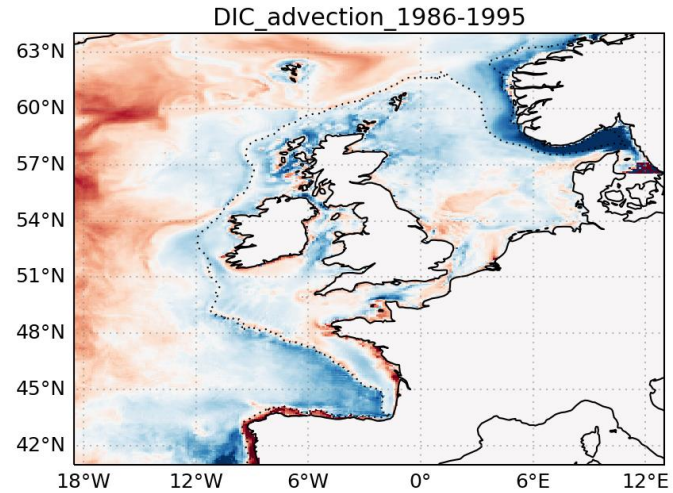
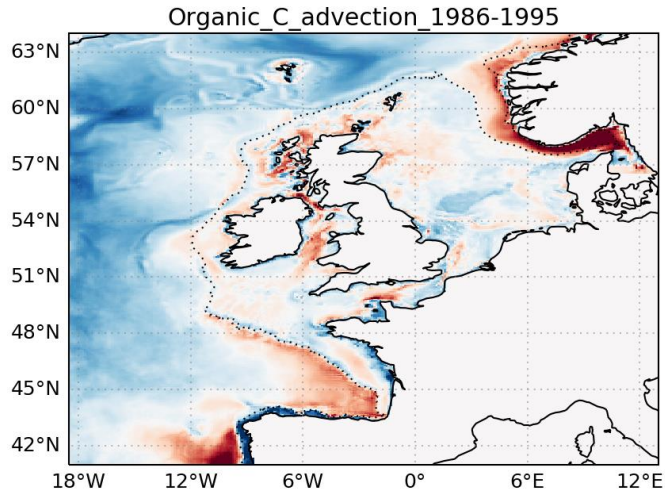
minus

Respiration

- Phytoplankton
- Zooplankton
- Bacteria

- Pelagic only

Advection of Carbon

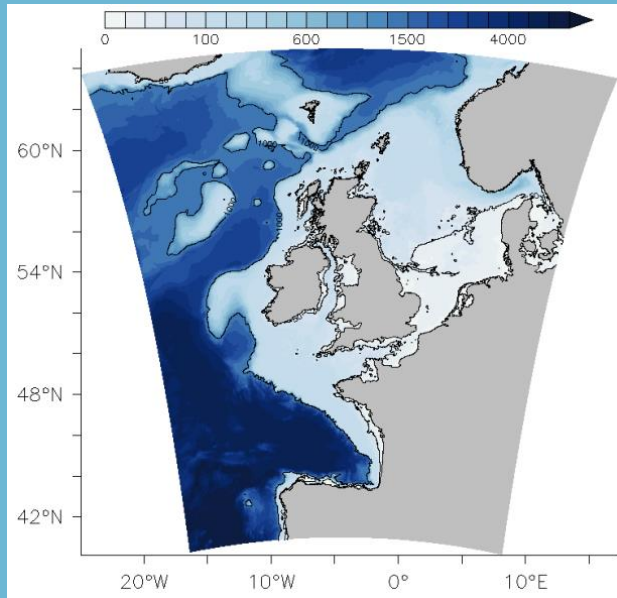


Next Steps - Comparison with Observations

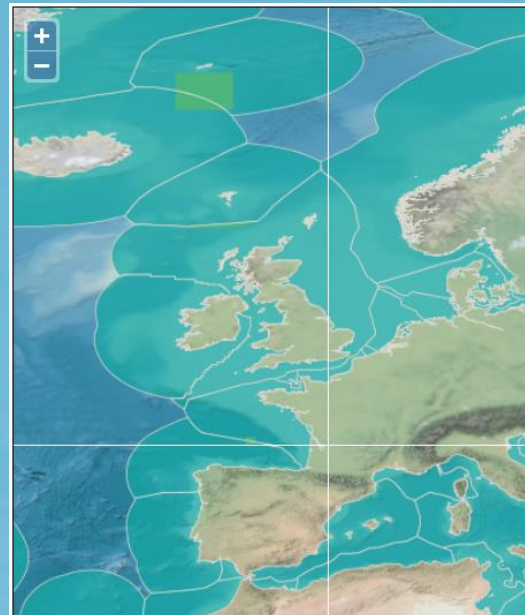
- Regional budgets (e.g. Thomas et al. 2004, CANDYFLOSS)
- DIC/TA concentrations
- $p\text{CO}_2$ (SOCAT)
- Different Models (e.g. Wakelin et al 2012)

Choice of Regions

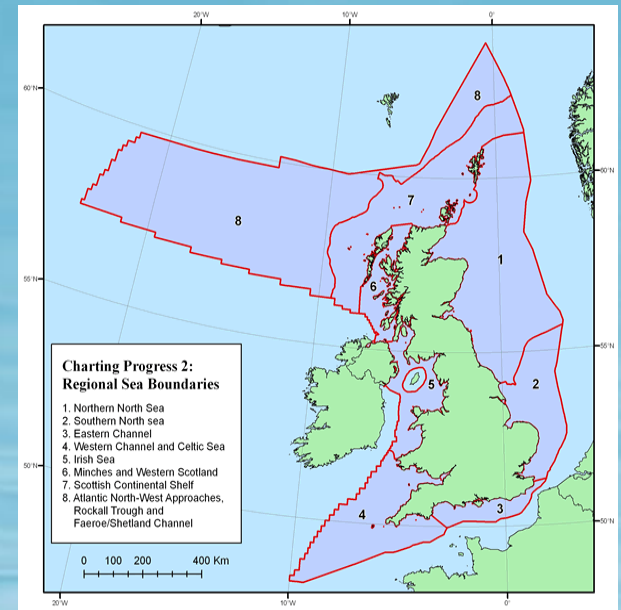
Shelf-Open ocean



Regional Seas or
National (EEZ)
ICES regions



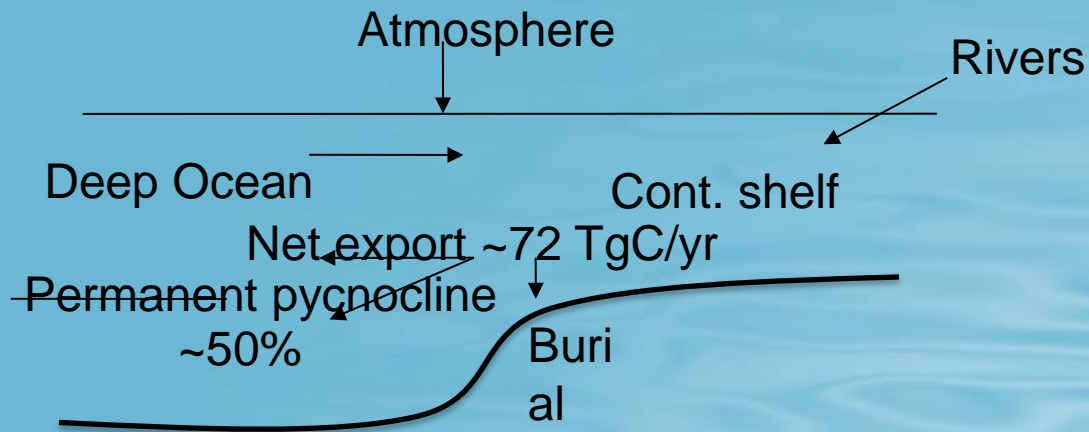
Defra Charting Progress 2



www.marineregions.org

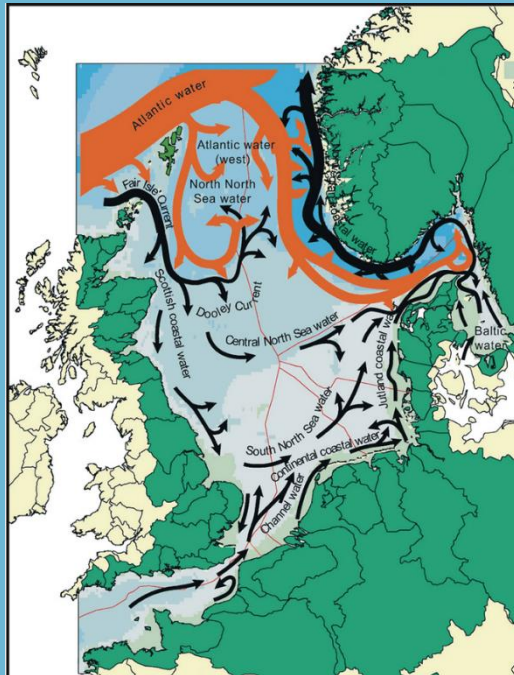
jncc.defra.gov.uk

Pathways for Carbon Storage



values from Wakelin et al 2012

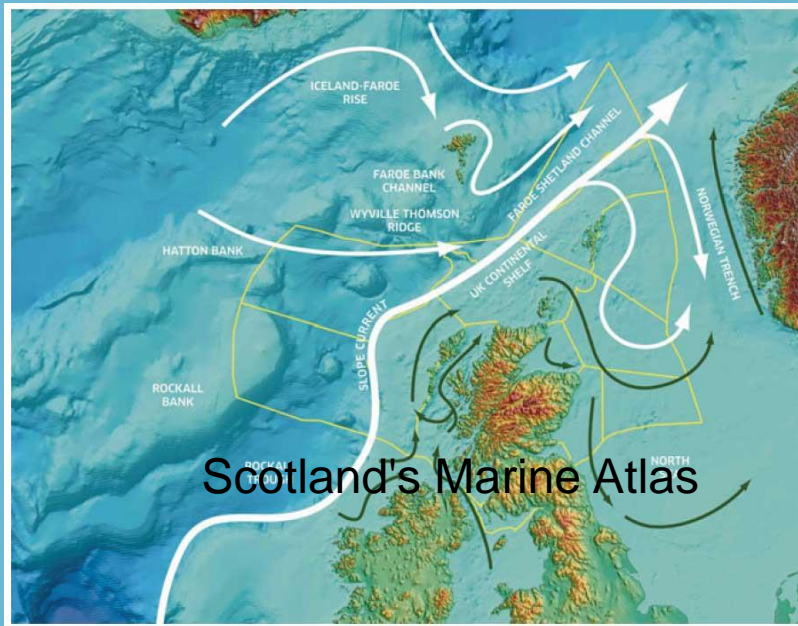
Routes for Carbon Storage



After Turrell 1992

- Local burial of sediments?
- Advection off the shelf below the pycnocline
 - Main pathway is a surface current

The Effect of the Slope Current on the Carbon Pump



- Replenishes on-shelf nutrients
- Removes DIC

