

PML

Plymouth Marine
Laboratory

Marine Matters

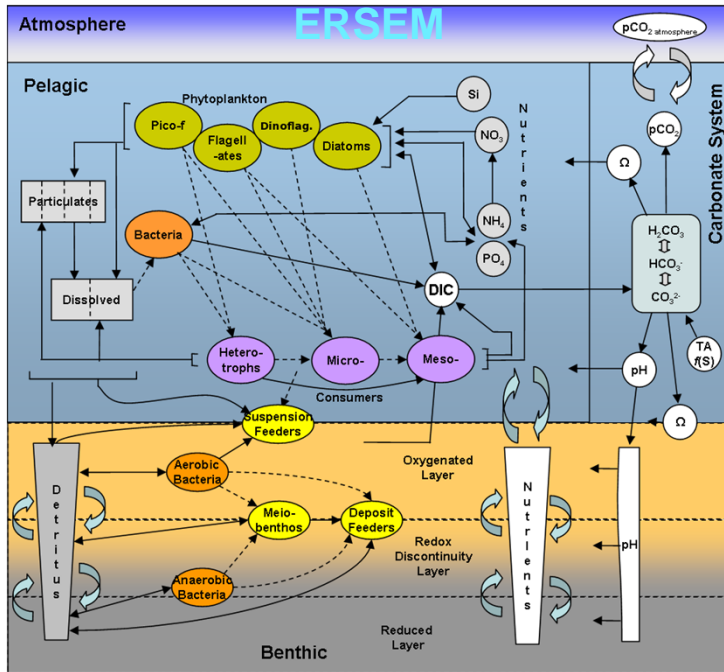
Regional ecosystem impacts: the NW European shelf

Y. Artioli, M. Butenschön, J. Holt, S. Wakelin, J. Blackford

Outline

- Model set-up
- Recent trends of Ocean Acidification
- Future scenarios
- OA impacts on the NW European Shelf
- Future work

Model set-up

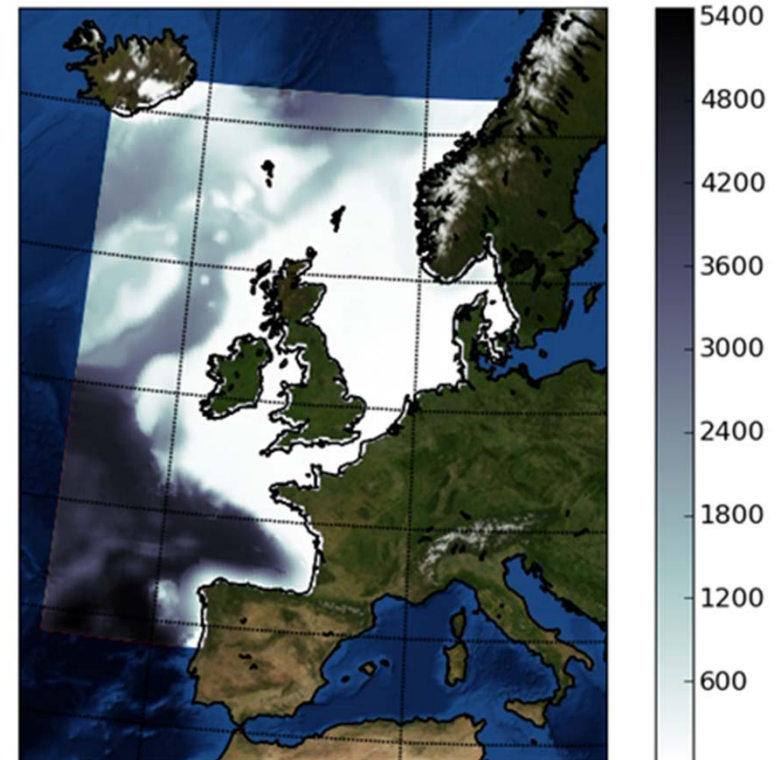


Hindcast (1960-2004):

- atmospheric forcing from ERA40
- b.c. from ORCA reanalysis, WOA and GLODAP

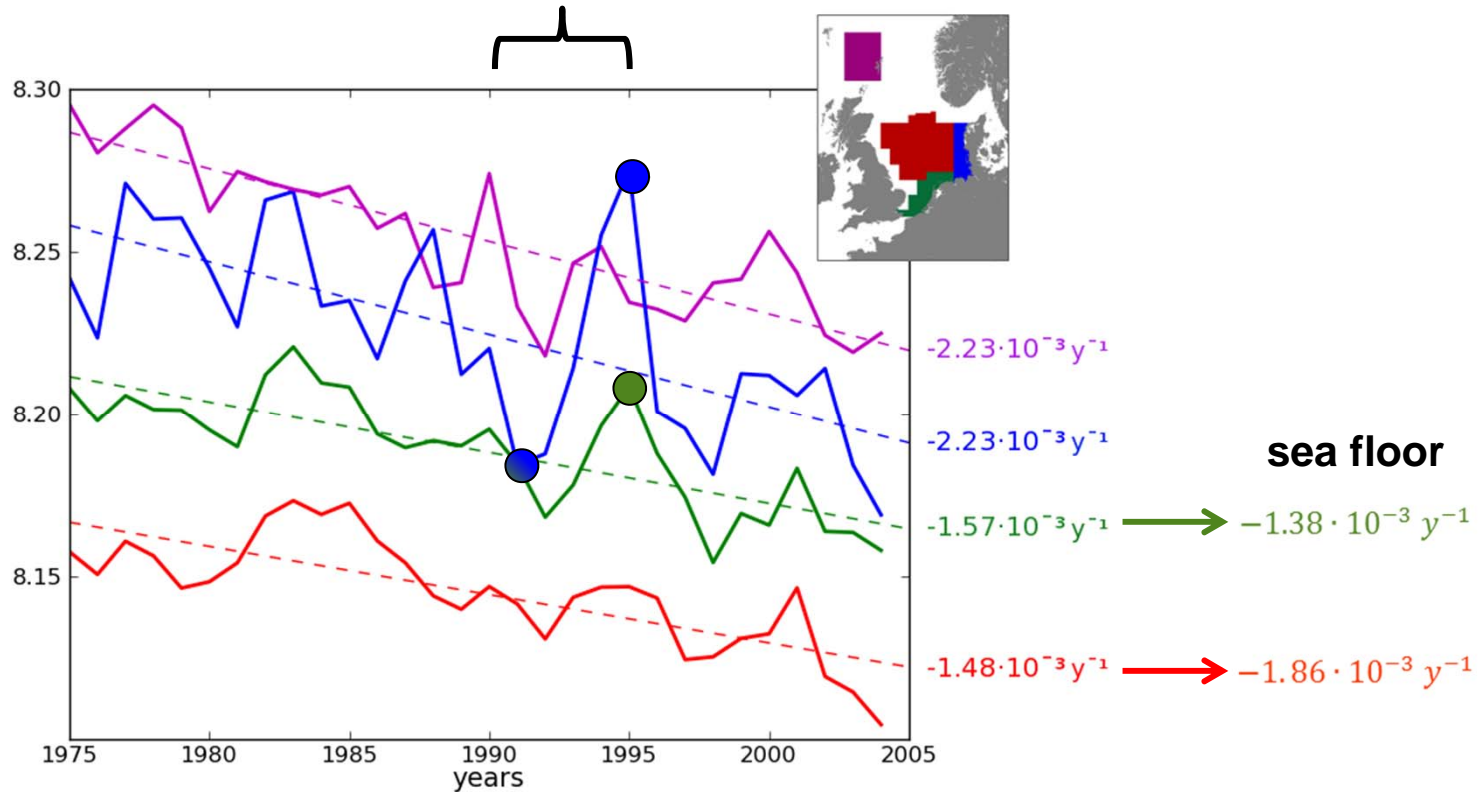
Climate forced (1981-2000;2080-2099):

- a.f. from IPSL climate model
- b.c. from IPSL (T,S bias corrected)
- river flows updated

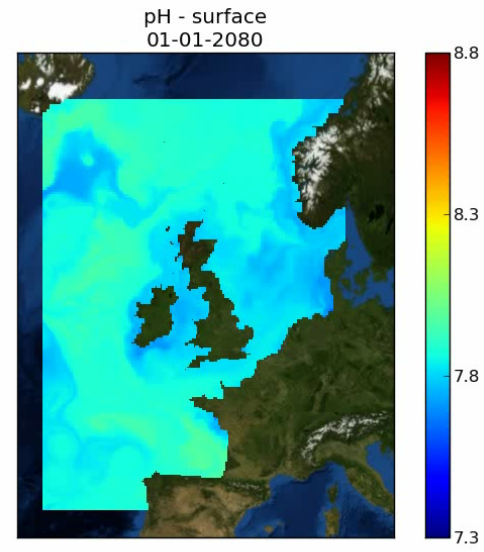
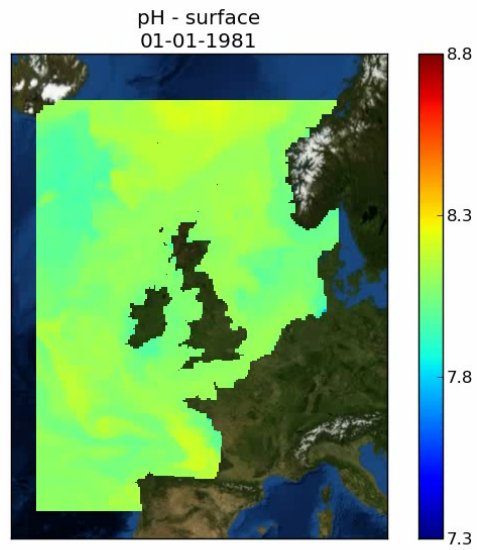


Recent OA trends

$\Delta nPP = 75 \text{ mgC/m}^2$
 $\Delta nPP = 45 \text{ mgC/m}^2$

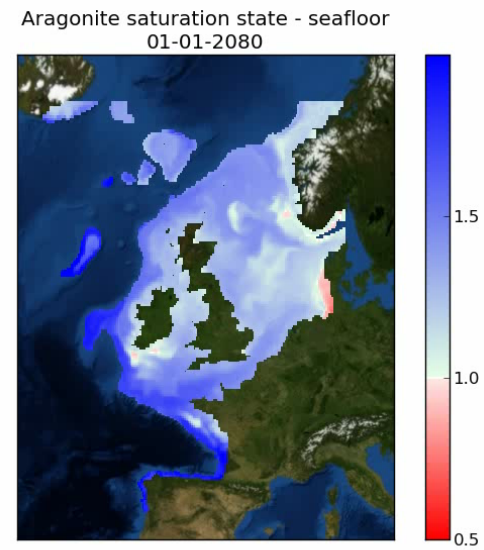
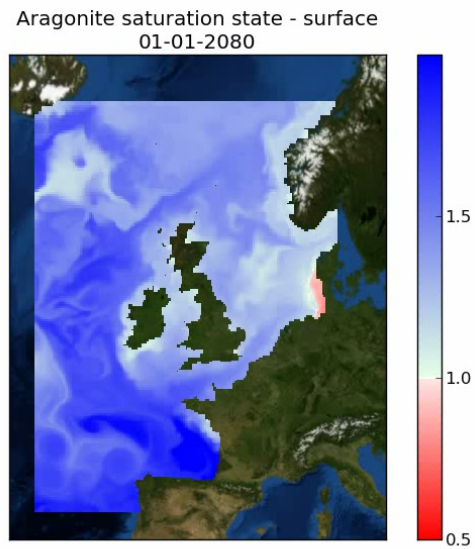


present



future

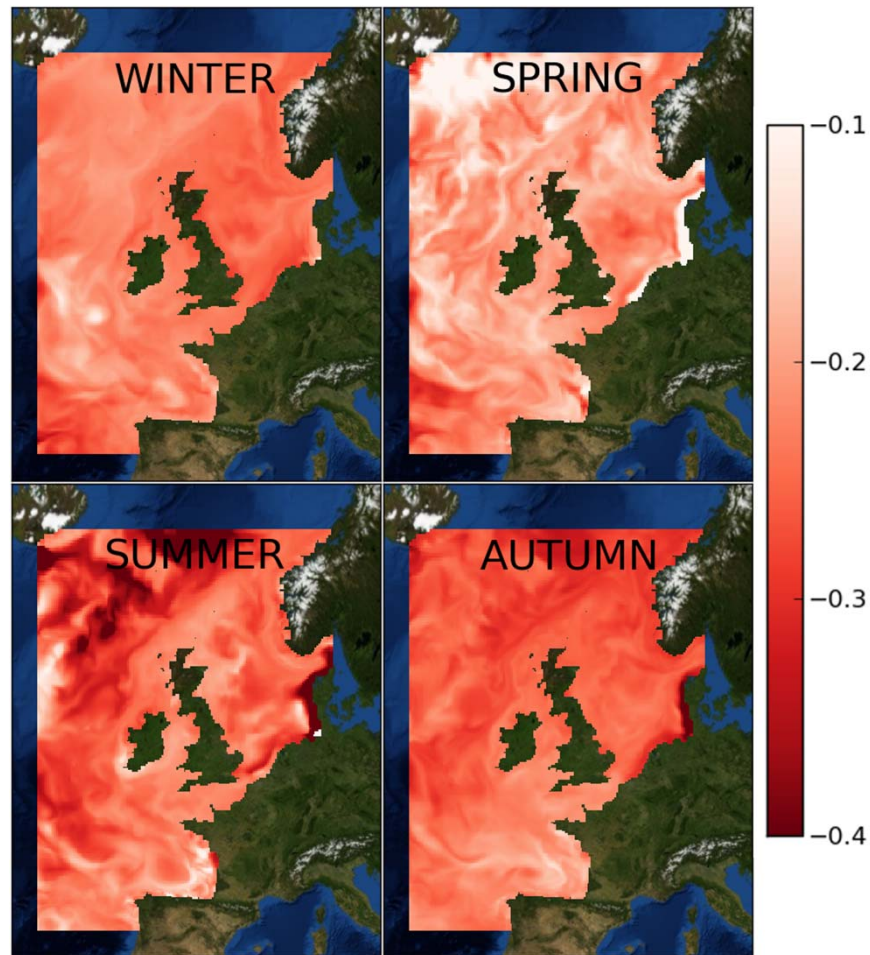
future



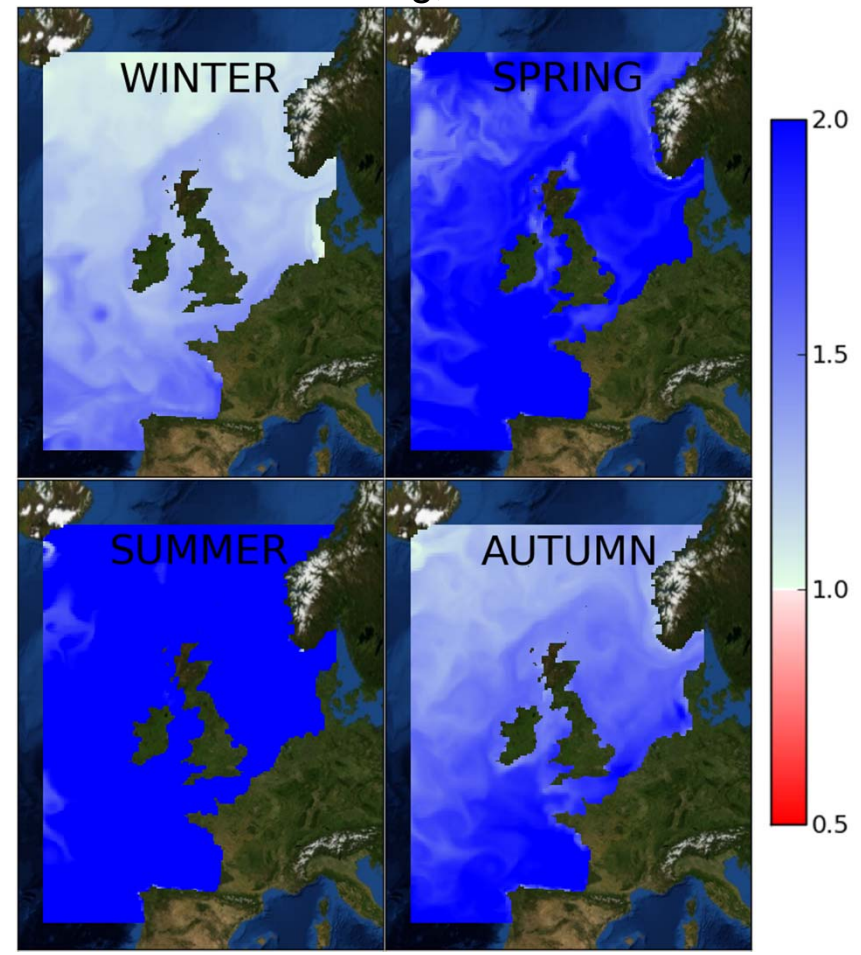
future

Ocean Acidification signal

ΔpH



Ω_{arg} , 2080-2100



OA impacts on Primary Production

From metanalysis of PEECE III db (similarly to Oschlies, 2008):

$$Cenh = 1 + 0.0005 \cdot (pCO_{2,a} - pCO_{2,a}|_{2005})$$

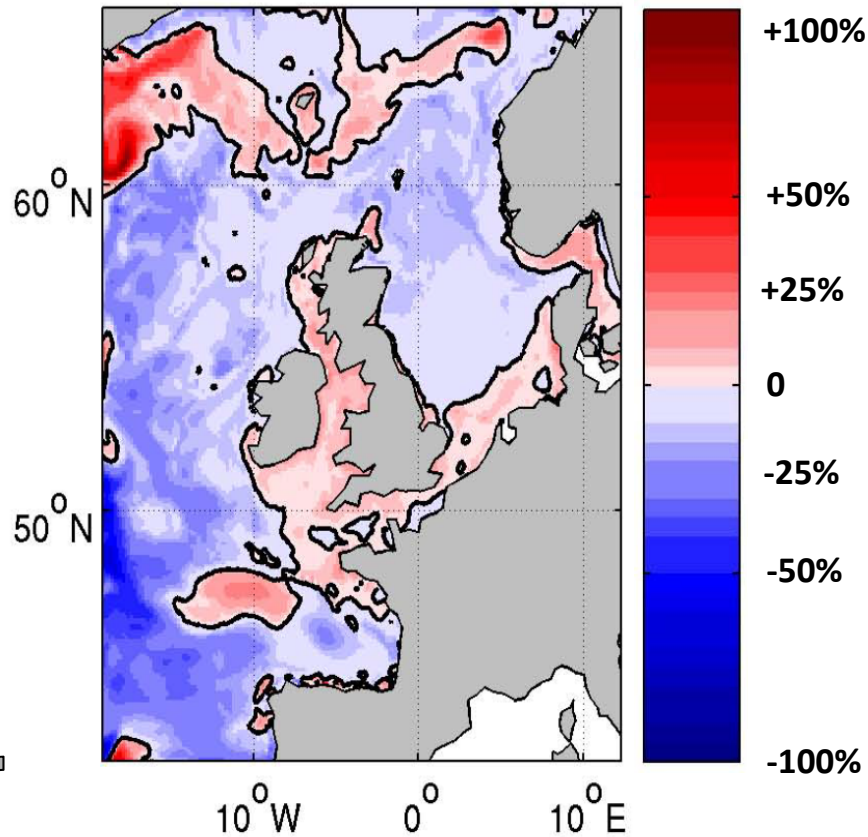
This factor is applied to

- GPP: $\mu = \mu(T, I) \cdot Cenh$
 - Activity respiration: $resp = srs(T) + sra(\mu, Nut)$
- rest resp. activity resp.
-

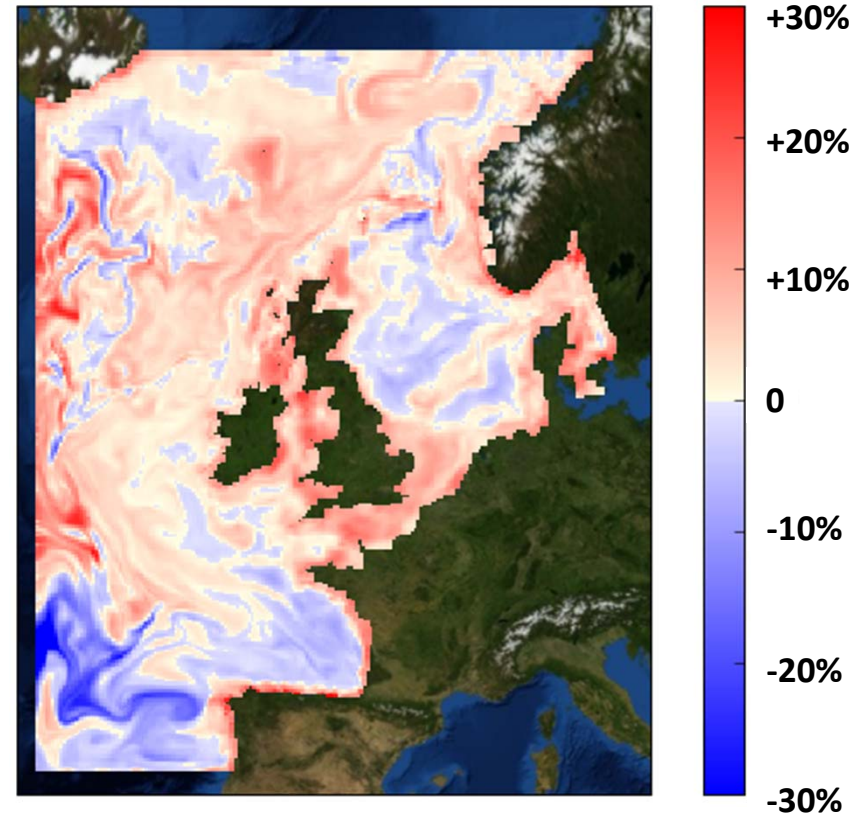
Impacts on PP in the NW European Shelf

Relative change in netPP

due to CC



due to OA

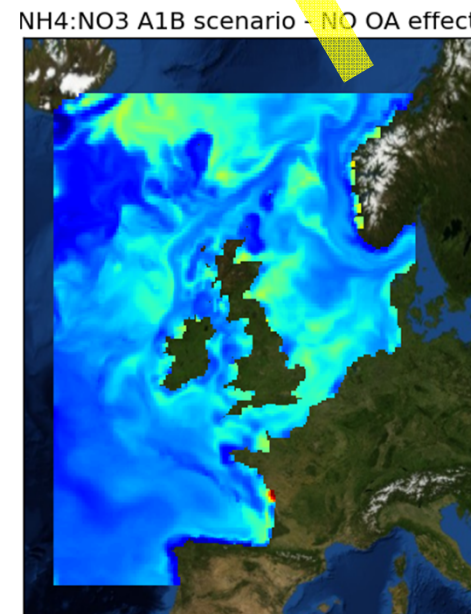
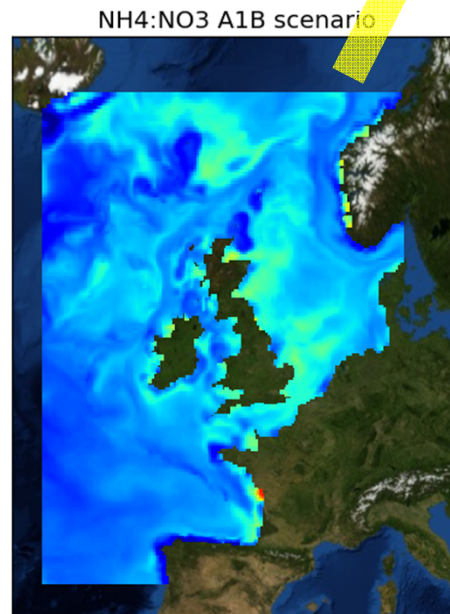
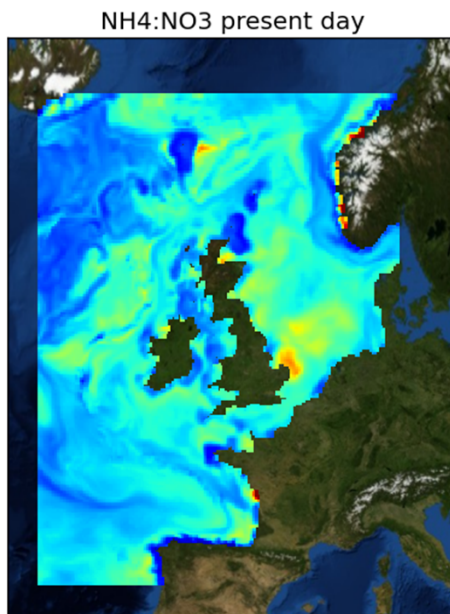
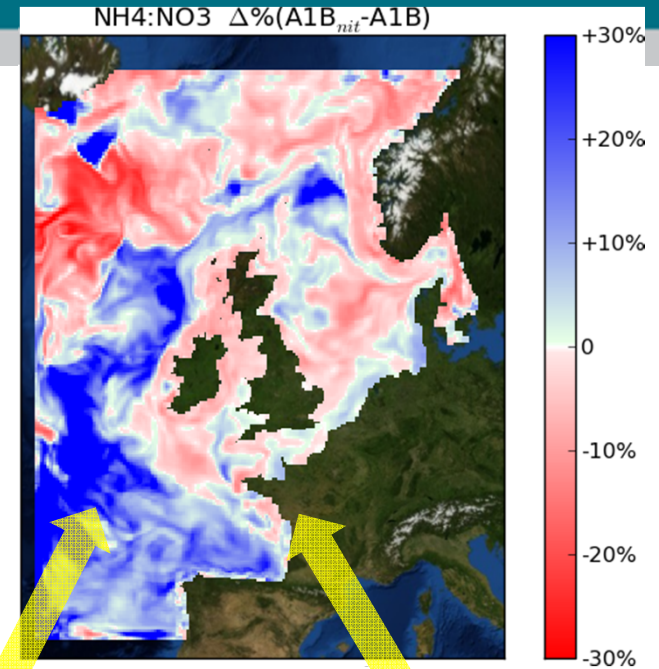


from Holt et al., biogeosciences, 2012

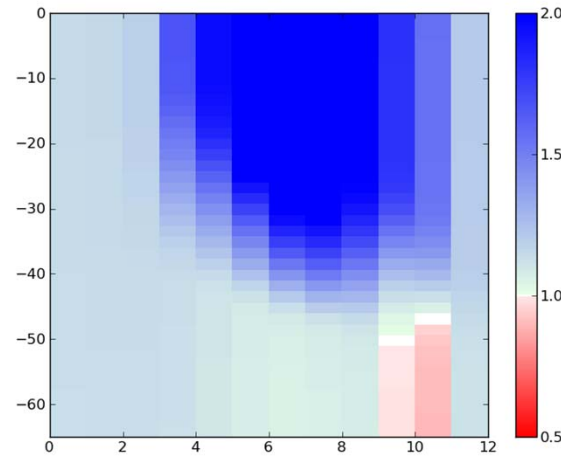
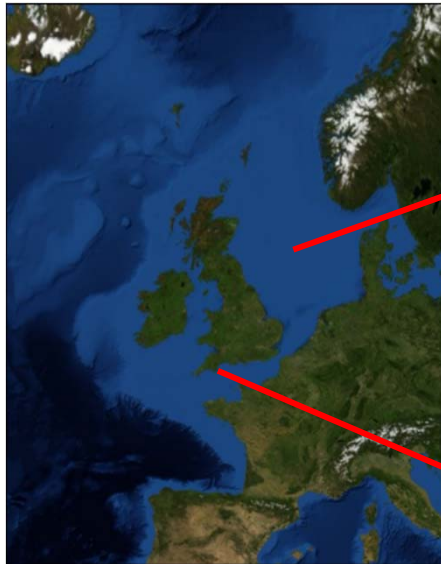
OA impacts on nitrification

$$nit_{pH} = nit(0.6111pH - 3.8889)$$

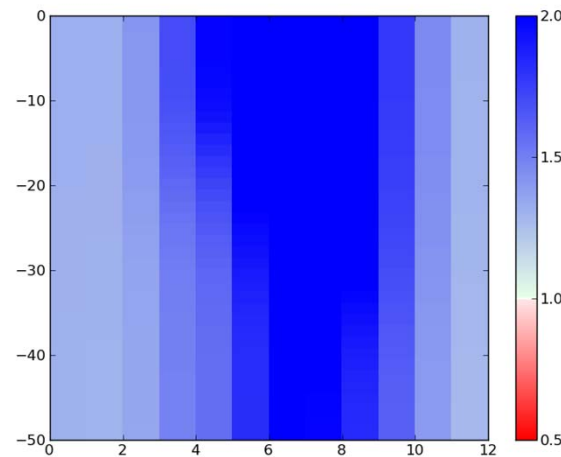
from Huesmann et al., Mar. Poll. Bull., 2002



Variability and impacts on biota (Echinoderm larvae)



Better for early
spawners



Better for late
spawners

Next steps

- Included calcification, now OA impact on calcification (following Ridgwell et al., biogeosciences 2007,2009)
- Transition to NemoShelf-Ersem
- Full transitional run: present day → 2100