Biogeochemistry model developments in the "green ocean" project

Collaborations between

University of East Anglia (Corinne Le Quéré, Erik Buitenhuis, Meike Vogt, Manfredi Manizza, Tanja Pangerc)

British Antarctic Survey (Roisin Moriarty, Clare Entright)

Max Planck Institute for Biogeochemistry (**Nick Stephens**, Leticia Cotrim da Cunha)

and

Laurent Bopp and Olivier Aumont

our goal is to

build global biogeochemistry models based on

Plankton Functional Types

to understand and quantify the feedbacks
between marine ecosystems and climate

latest developments are done with NEMO, running on a linux cluster at the Univ. of East Anglia

some developments done with OPA8.1, running on the German DKRZ super-computer

we do mostly interannual simulations with NCEP forcing
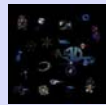we focus on CO_2, O_2, and marine ecosystems

large parallel data synthesis

1. current and planned model developments
2. some results from climate simulations

1. current and planned model developments

2. some results from climate simulations

• limitation by Fe, P, and Si

• Meso-zooplankton parameterisation based on global data compilation (difference to Olivier Aumont's PISCES model)
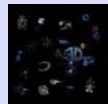
phyto-
plankton

mixed

silicifiers

zoo-
plankton

proto

meso

- limitation by Fe, P, and Si

- Meso-zooplankton parameterisation based on global data compilation

- Micro-zooplankton parameterisation based on global data compilation (work with Richard Rivkin)

- Ballast effect based on Stokes law

- adjusted grazing preferences
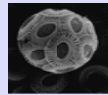
phyto-plankton

 calcifiers

 mixed

 silicifiers

zoo-plankton

 proto

 meso

bacteria

 pico-heterotrophs

 pico-autotrophs

 N_2-fixers

phyto-
plankton
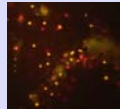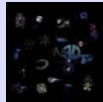
 calcifiers

 DMS-producers

 mixed

 silicifiers

zoo-
plankton

 proto

 meso

PlankTOM 9
(under development)

PlankTOM 10
(planned for 2007)

bacteria

pico-heterotrophs

pico-autotrophs

N_2-fixers
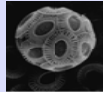
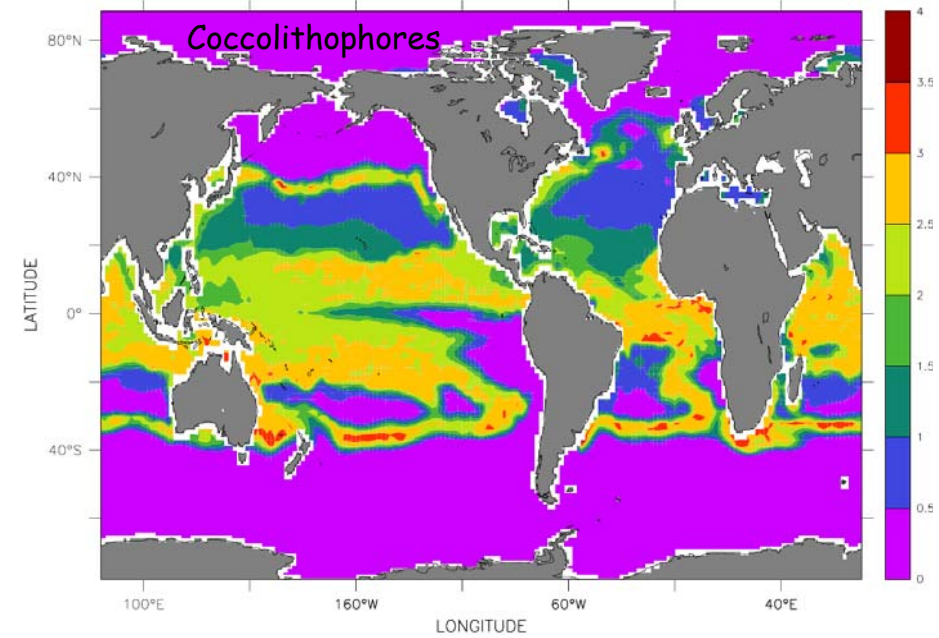*phyto-plankton*
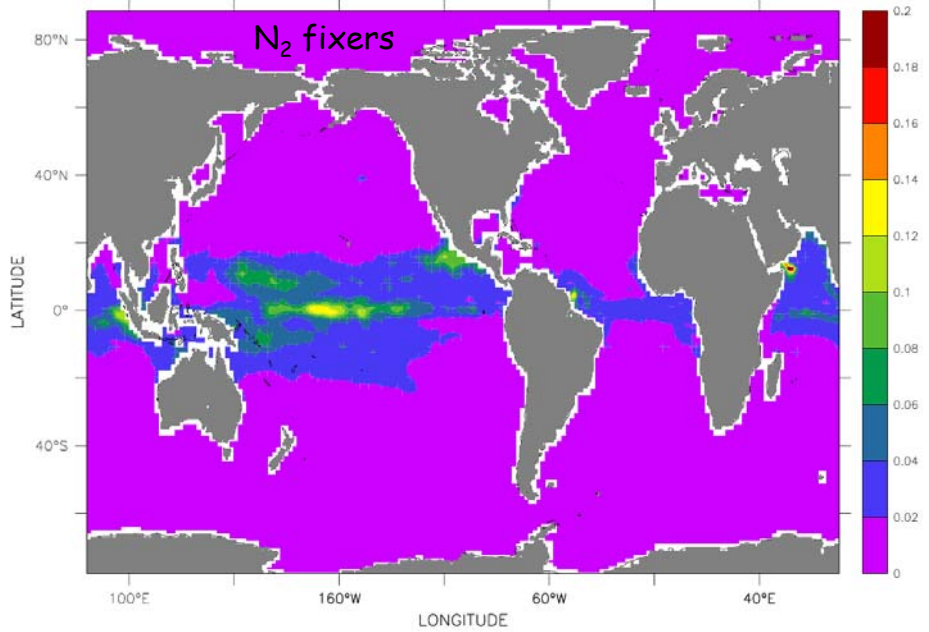
calcifiers

DMS-producers

mixed

silicifiers

zoo-plankton

proto

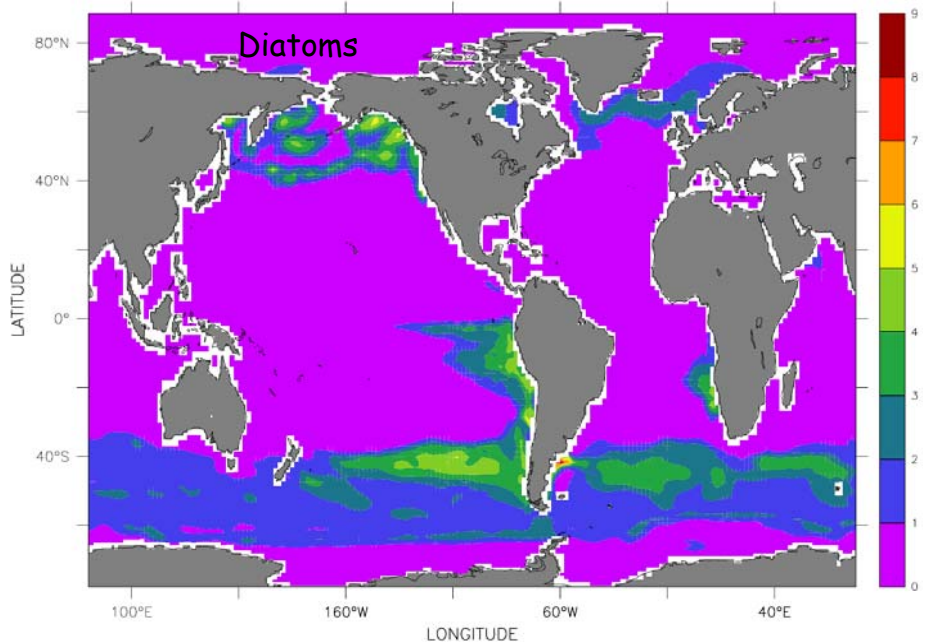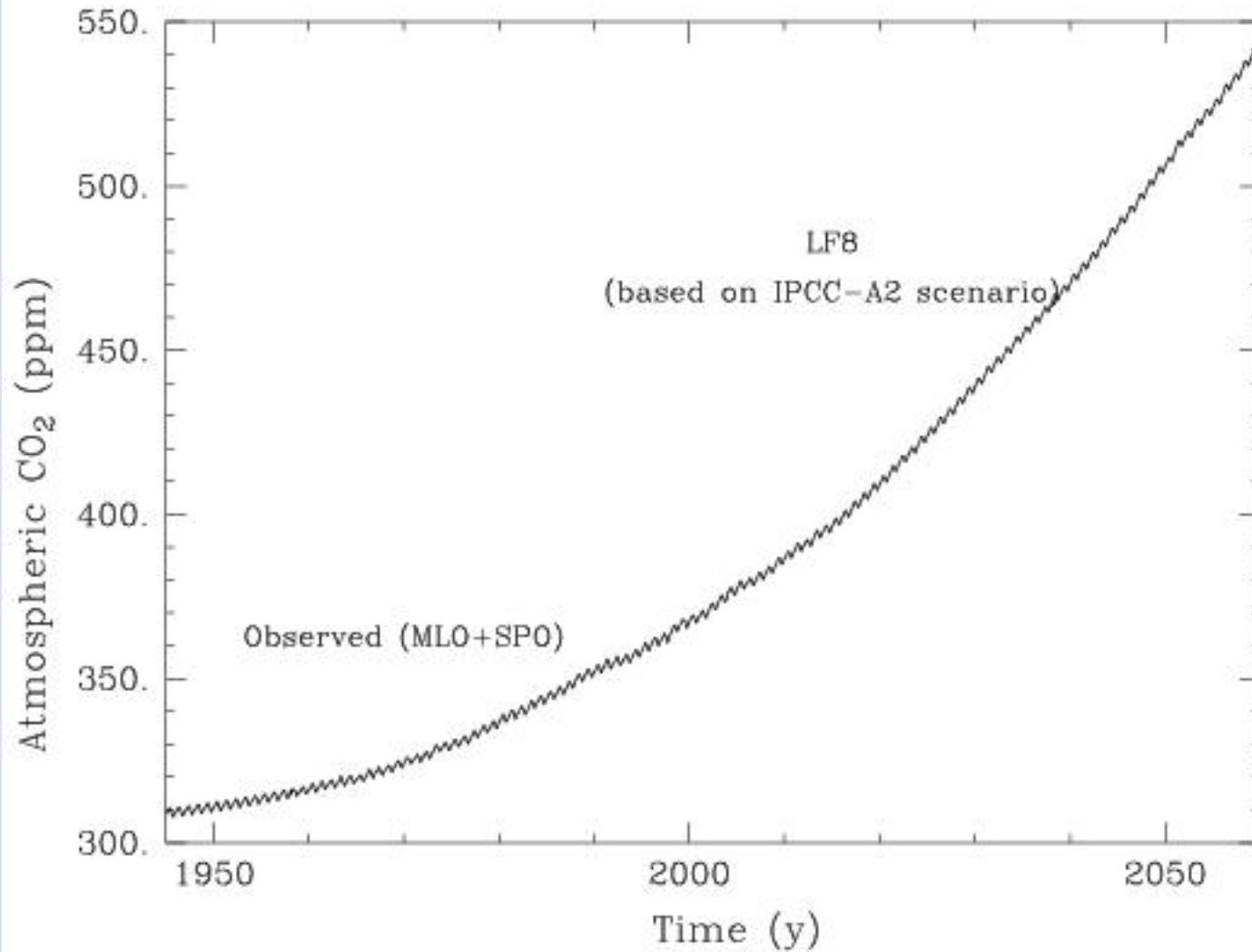meso

macro

PlankTOM 6.0 simulation for 1st October 2005

N2 fixers

Coccolithophores

N$_2$ fixed = 0.171 PgN yr^{-1}, Primary Productivity = 96.60 PgC yr^{-1}, Export to 100m depth = 16.27 PgC yr^{-1}
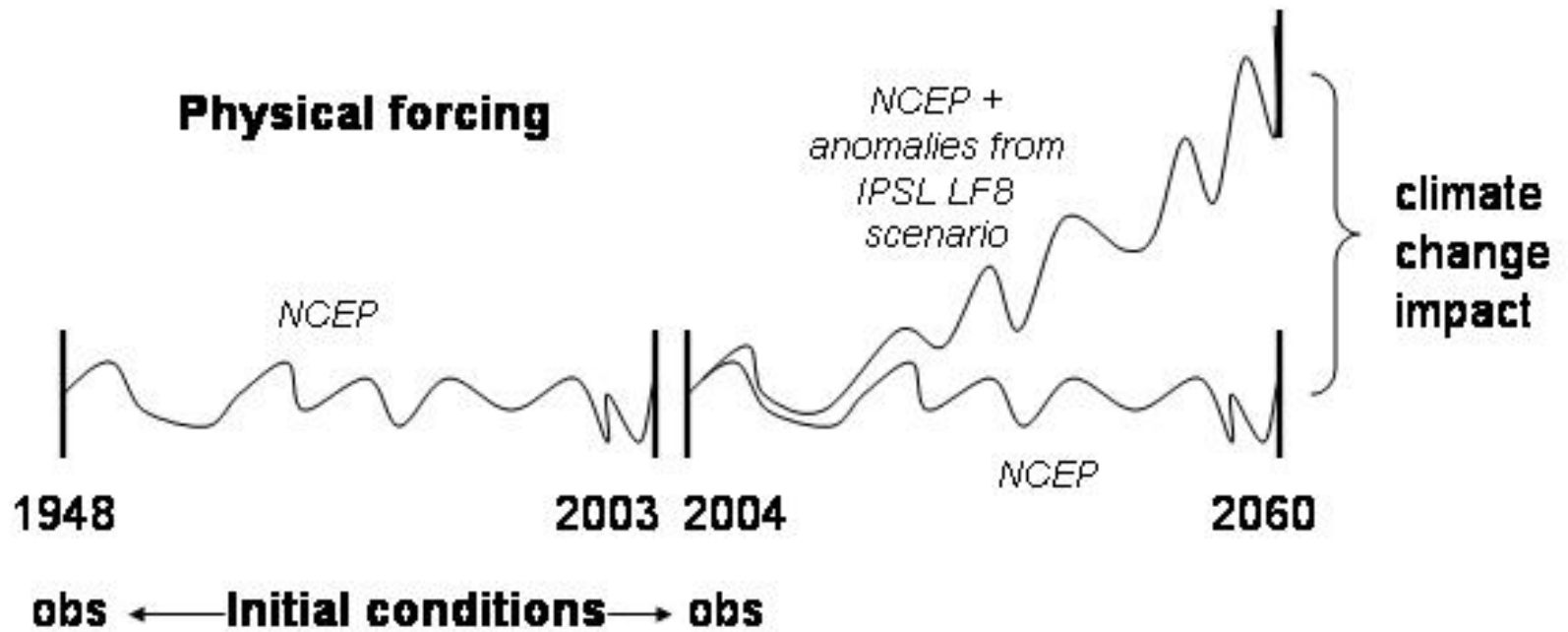
Diatoms

Mixed phytoplankton
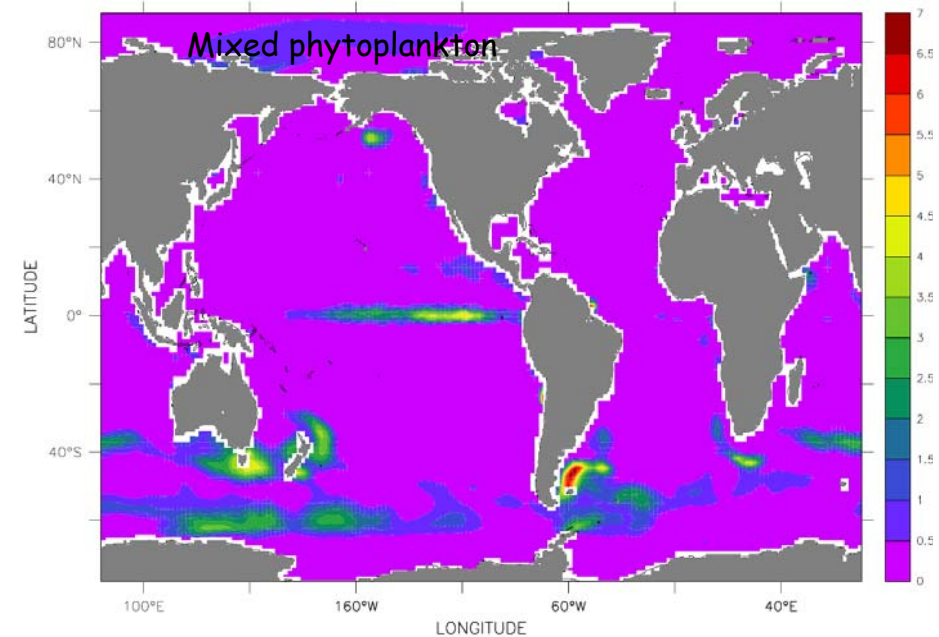
1. current and planned model developments
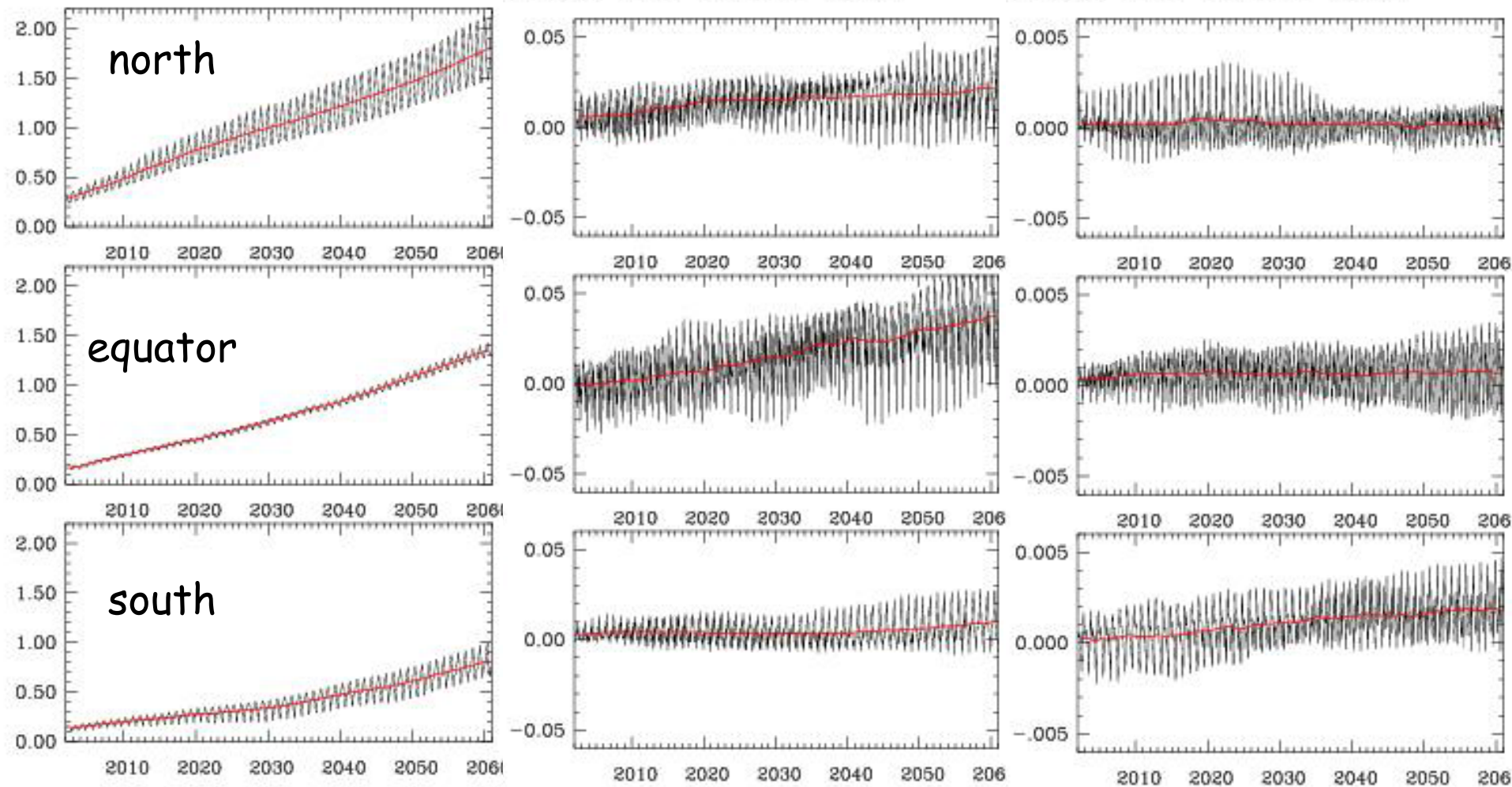
2. some results from climate simulations

Projection of atmospheric CO_2 up to 2060

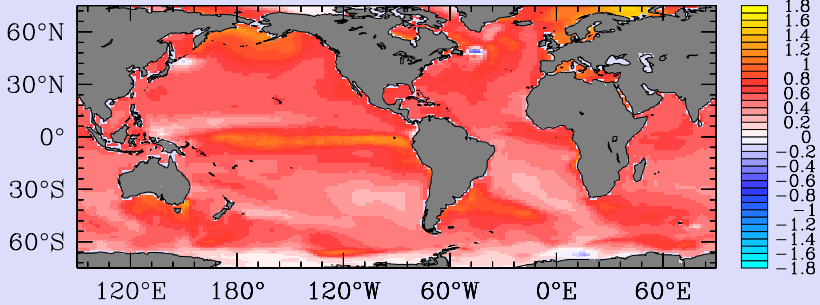# strategy for **forced** atmospheric conditions
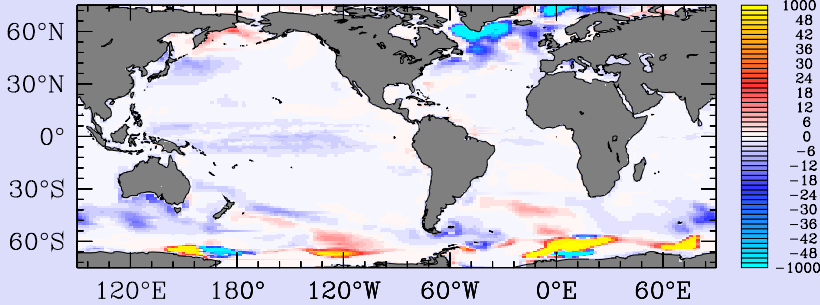
anomalies in atmospheric forcing
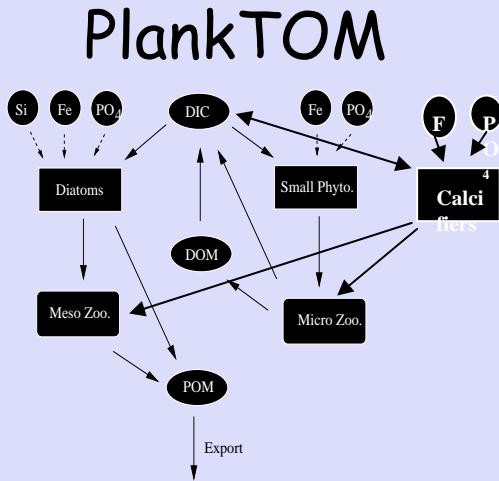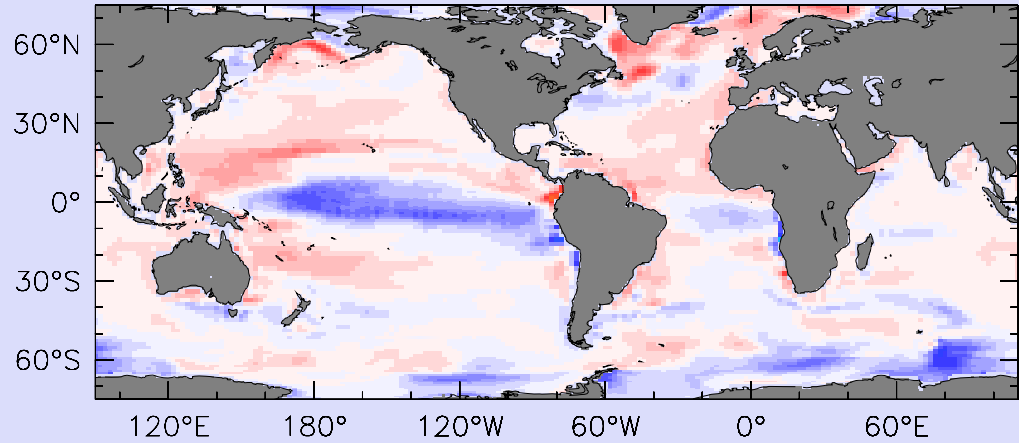
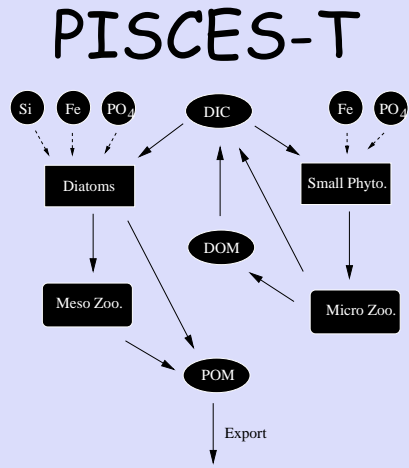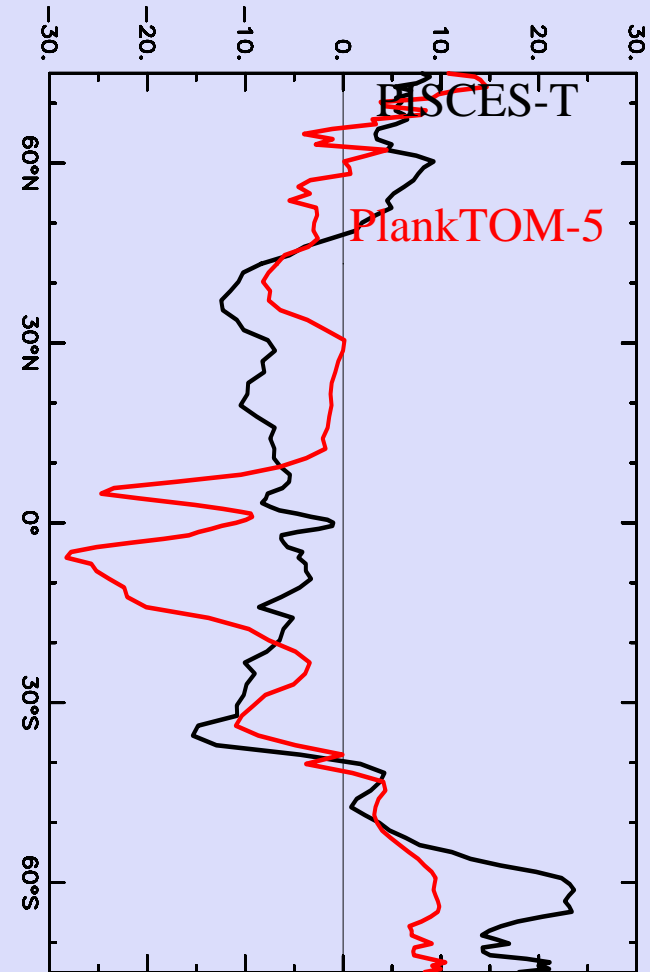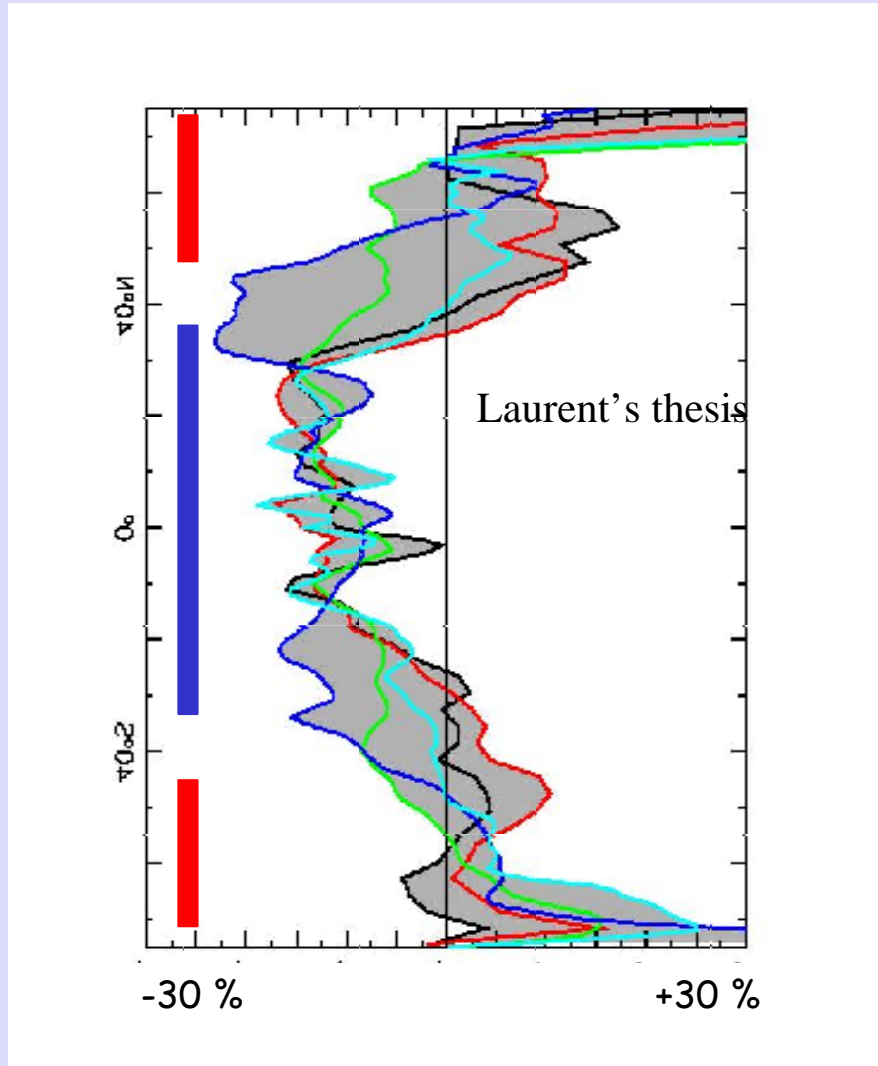# model projection of climate change in 2060

temperature

mixed layer depth

ice cover
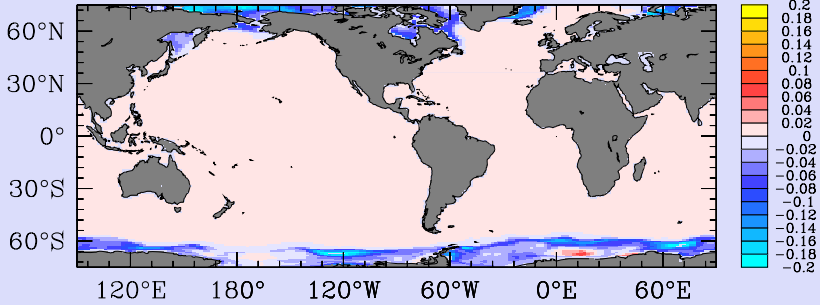
change in the CO_2 sink in 2060 (mol/m^2/y)
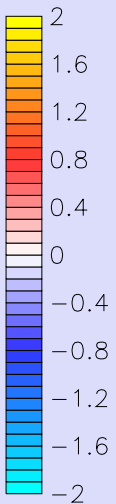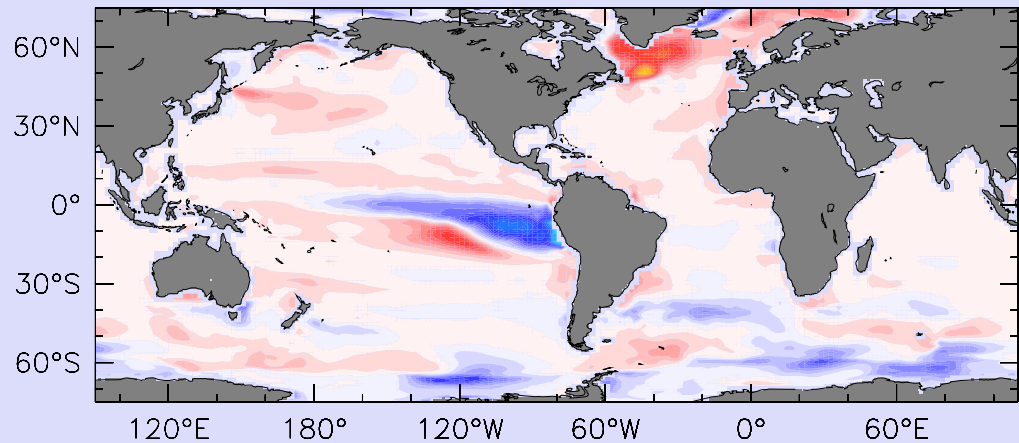
Comparison to results from the thesis of Laurent Bopp
export production at 100 m for $2 \times CO_2$

other information:

the PlankTOM code is open access, PlankTOM 5.0 is available on our web site (lgmacweb.env.uea.ac.uk/green_ocean)

PlankTOM will be coupled to the Hadley climate model in about 1.5 years time

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