

CARBOOCEAN

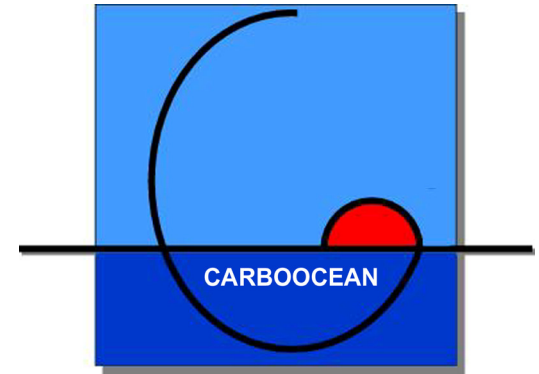
Marine carbon sources and sinks assessment

"Integrated Project", European Commission

Contract no. 511176 GOCE



CARBOOCEAN aims at:

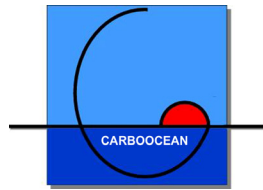


An accurate scientific assessment of the marine carbon sources and sinks within space and time.

Focus on:

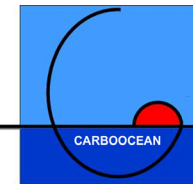
The Atlantic and Southern Oceans and a time interval of -200 to +200 years from now.

FIVE CARBOOCEAN CORE THEMES:



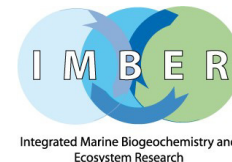
- 1. Detection of decadal-to-centennial Atlantic and Southern Ocean carbon inventory changes. (Doug Wallace)**
- 2. North Atlantic and Southern Ocean CO₂ air-sea exchange on a seasonal-to-interannual scale. (Andy Watson)**
- 3. Carbon uptake and release at European regional scale. (Helmuth Thomas)**
- 4. Biogeochemical feedbacks on the oceanic carbon sink. (Marion Gehlen)**
- 5. Future scenarios for marine carbon sources and sinks. (Christoph Heinze)**

CARBOOCEAN TASKS AND FACTS



Data management
Dissemination
Consortium management
Training
Demonstration

ENDORSEMENTS:



50 participating groups (partners, associated collaborators, 15 nations)

1 US contractor, 7 associated collaborators from US and Canada

1 Jan 2005 – 31 Dec 2009

14.5 million EUR from EU, at least 14.5 million EUR national co-funding

Coordination: University of Bergen, Bjerknes Centre for Climate Research
C. Heinze



Three overarching (all partners involved) work packages:

- WP1 “Prediction towards sustainable development”
- WP2 “Assessment on interannual time scales”
- WP3 “Long term assessment”

CT 1 "North Atlantic and Southern Ocean CO₂ air-sea exchange on a seasonal-to-interannual scale"

(CT leader: Andy Watson)

-WP4 "Atlantic observing system, VOS, time series"

-WP5 "Southern ocean observation and processes"

-WP6 "Model-based flux assessment"

-WP7 "Mooring development" (currently inactive)

Monitoring of the North Atlantic CO₂ sink:

- The North Atlantic CO₂ sink was lower in 2002/05 than 1994/95.
- The North Atlantic CO₂ observing network needs to be maintained.



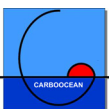
Thanks to...

North Atlantic: U. Schuster, A. Watson, M. Telszewski, T. Johannesen, A. Olsen, A. Omar, A. Körtzinger, T. Steinhoff, J. Olafsson, A. Corbière, N. Metzl, Nathalie Lefèvre, A. Rios, F. Perez, X.A. Padin, N. Bates, H. Lüger, R. Wanninkhof, N. Bates, D. Wallace, J.M. Santana Casiano, M Gonzales-Davila,and many others

General: Captains, Officers and Crew of VOS and research ships

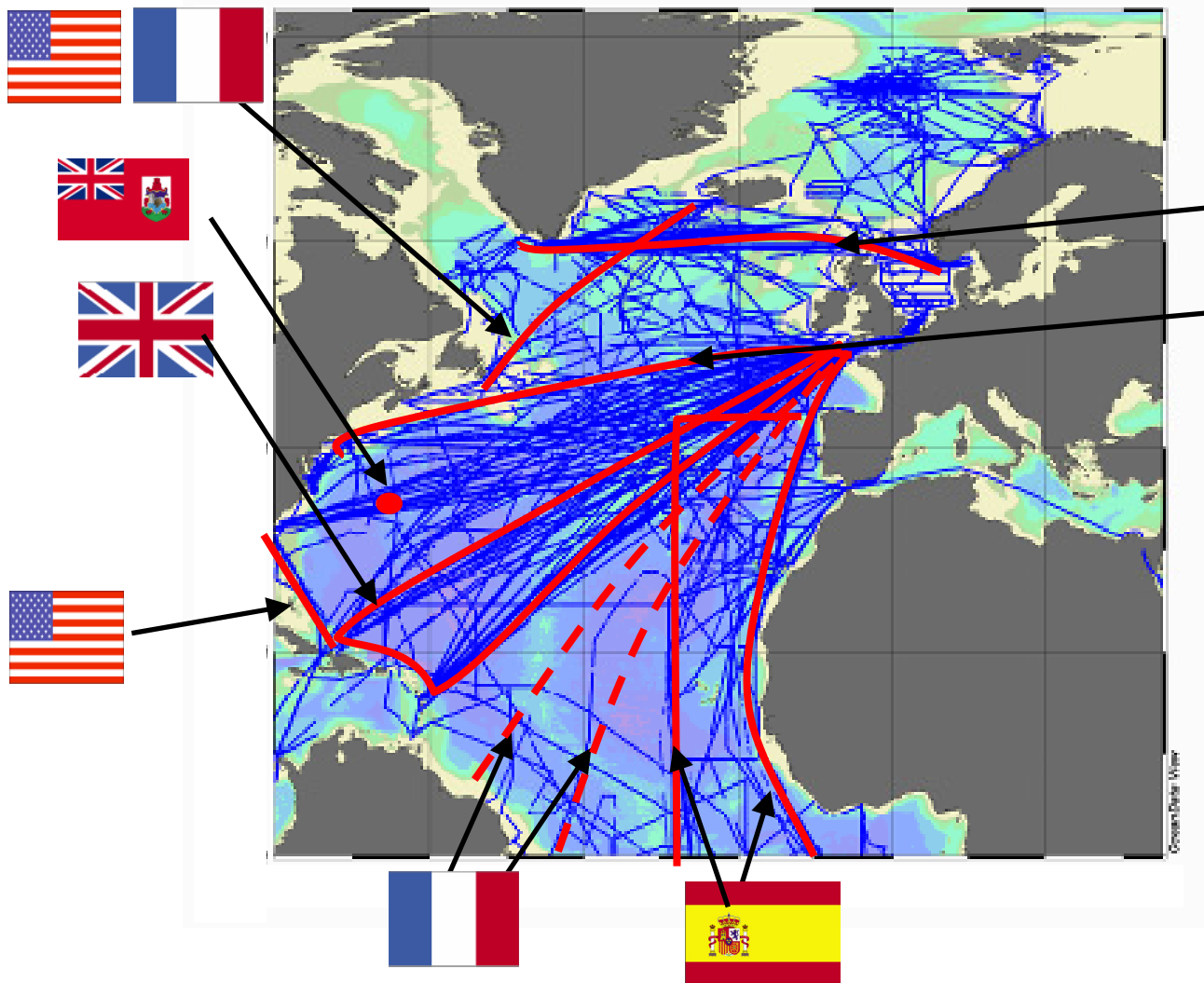
Funding by: European Commission, national funding agencies





WP 4: Atlantic observing system

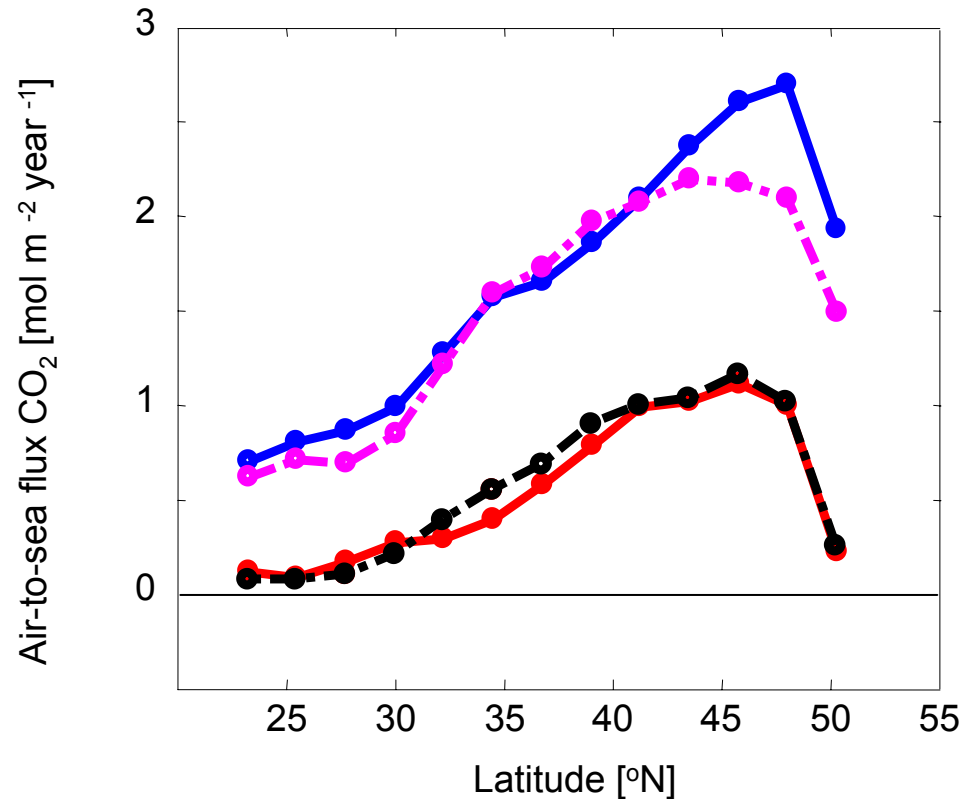
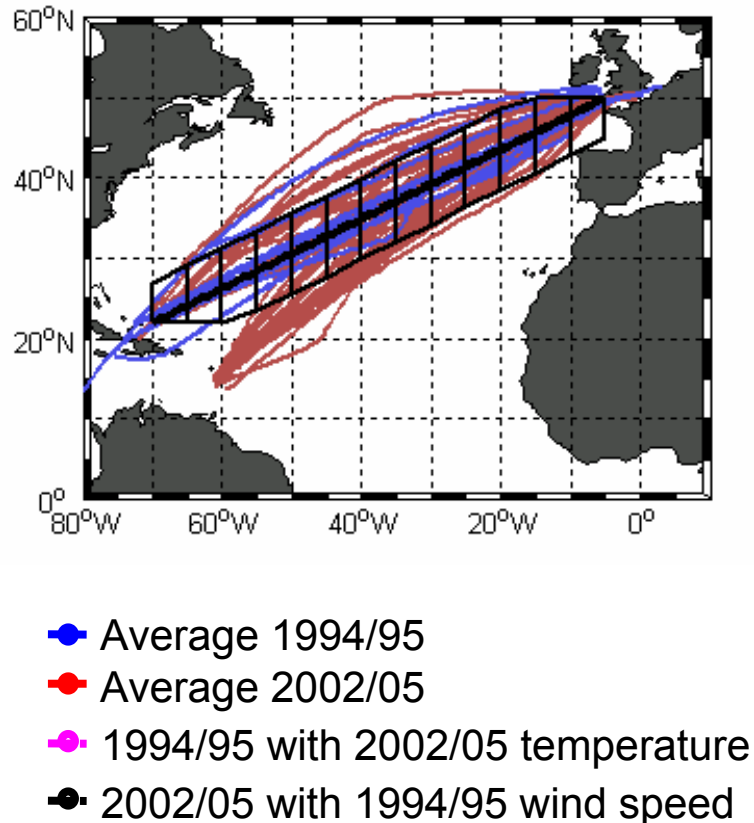
North Atlantic CO₂ observing network



Started 2002 (CAVASSOO), operational 2005 onwards

A decrease in the CO₂ air-sea flux from 1994/95 to 2002/05

Decadal variation or a long term trend?



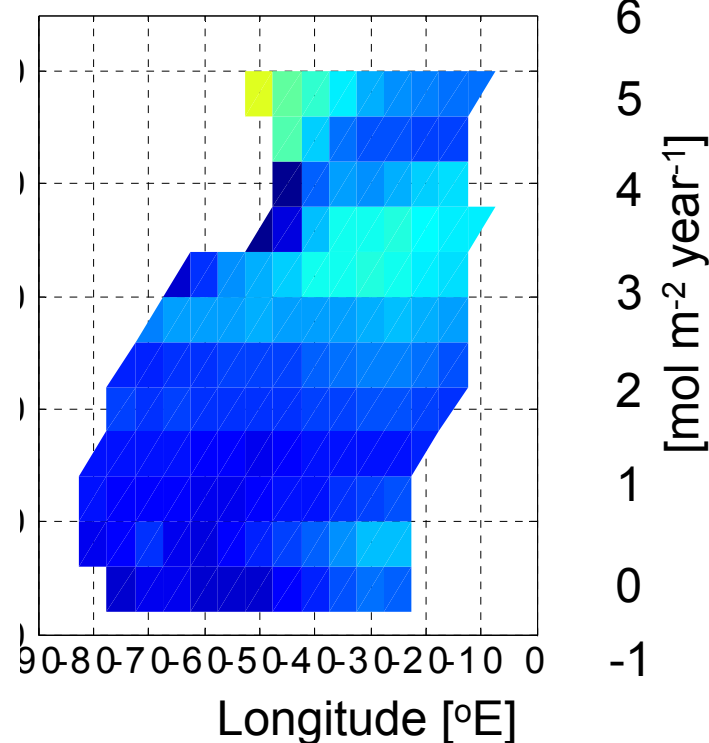
(Schuster and Watson, *JGR*, *in review*, 2007)

Change of the N. Atlantic CO₂ air-sea flux

0.43 Gt C year⁻¹ 1995

2005

0.30 to 0.37 Gt C year⁻¹



Longitude [°E]

Recalculation of the Takahashi et al. (2002) climatology

@T. Takahashi, S.C. Sutherland, C. Sweeney, A. Poisson, N. Metzl, B. Tilbrook, N. Bates, R. Wanninkhof, R.A. Feely, C. Sabine, J. Olafsson, Y. Nojiri

CARBOOCEAN data from 2005.

@U. Schuster, M. Telszewski, A.J. Watson, T. Johannesen, A. Olsen, A. Omar, A. Körtzinger, T. Steinhoff, J. Olafsson, A. Corbière, N. Metzl, N. Lefèvre, A. Rios, X.A. Padin, F. Perez, H. Lüger, D. Wallace

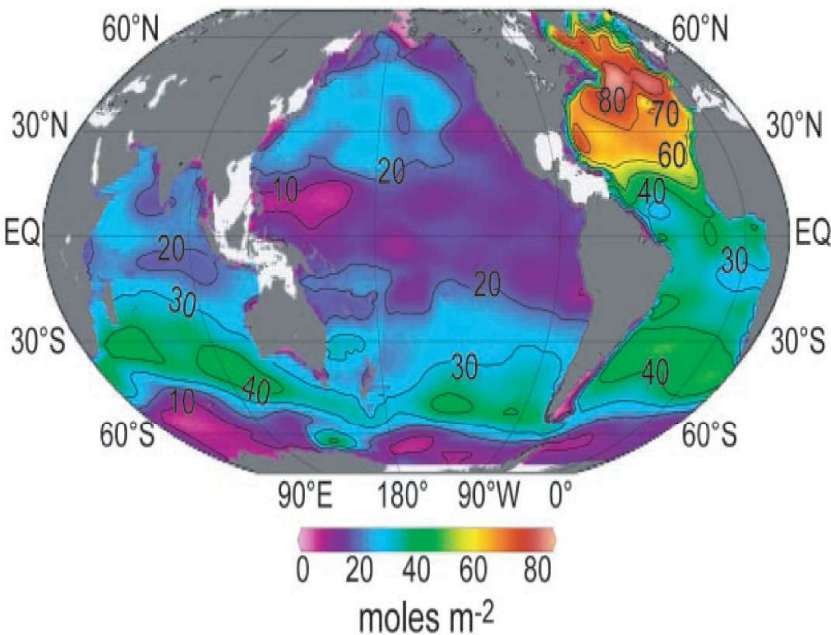
CT 2 "Detection of decadal-to-centennial ocean carbon inventory changes"

(CT leader: Doug Wallace)

- WP8 "Ocean interior data collection and documentation"
- WP9 " C_{ant} quantification and decadal changes in carbon inventory"
- WP10 "Oxygen and carbon profiling floats"
- WP11 "Model performance assessment and initial fields for scenarios"**

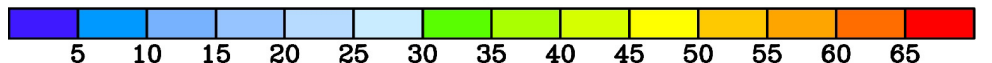
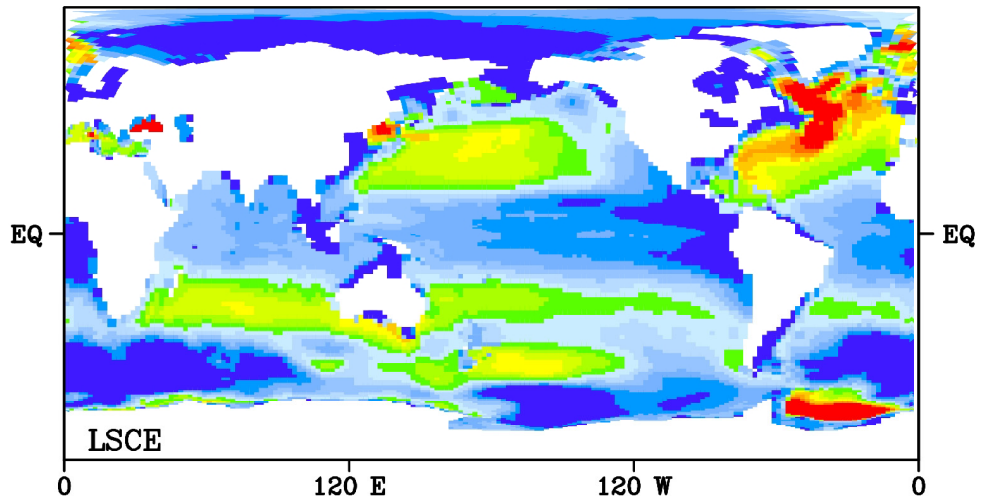
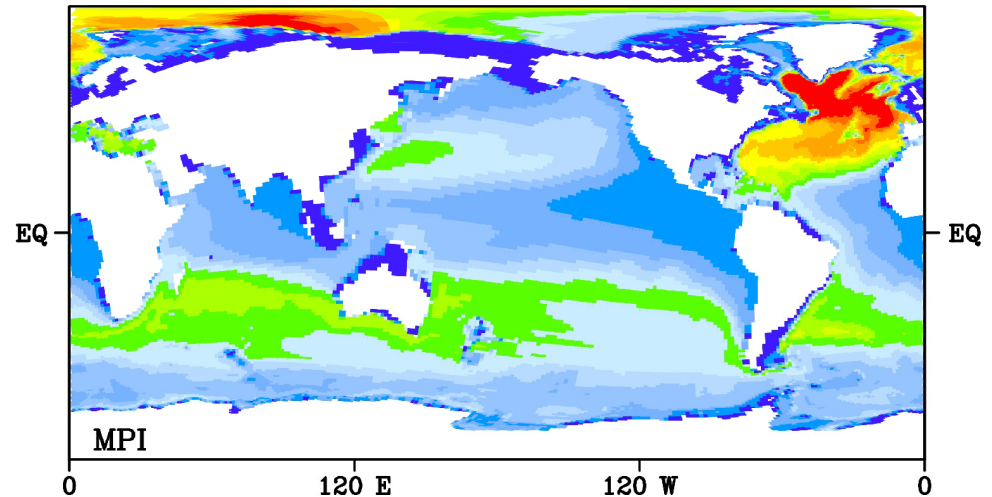
Anthropogenic carbon (C_{ant}) water column inventory

Observation derived:



Following Sabine et al., 2004, based on measurement analysis

Model results CARBOOCEAN



CT 3 ” Carbon uptake and release at European regional scale”

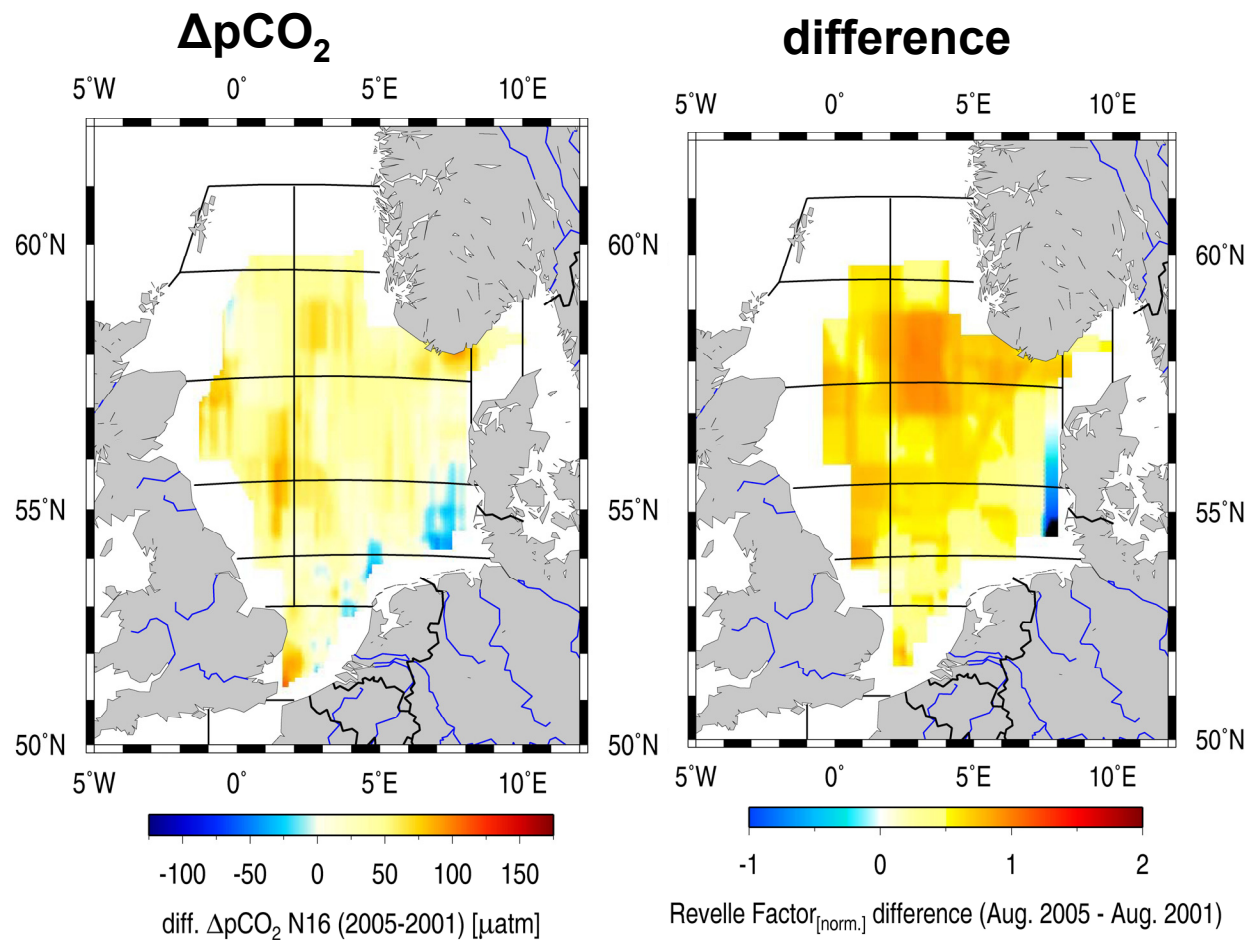
(CT leader: Helmuth Thomas)

-WP12 “Regional assessment for the North Sea”

-WP13 “Regional assessment for the West-Mediterranean”

-WP14 “European integration” (year 5)

Observations in the North Sea 2001 and 2005



• **Identical** period of cruises:
16.8.-13.9.2001 and **17.8.-6.9.2005**.

• 90 identical CTD stations during both cruises
• >40,000 underway measurements of $p\text{CO}_2$



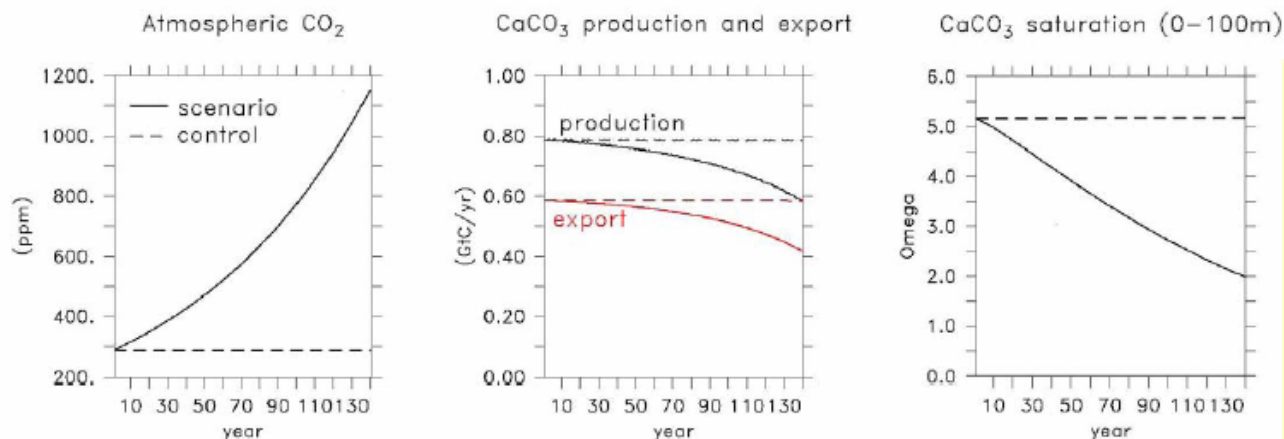
CT 4 ” Biogeochemical feedbacks on the oceanic carbon sink”

(CT leader: Marion Gehlen)

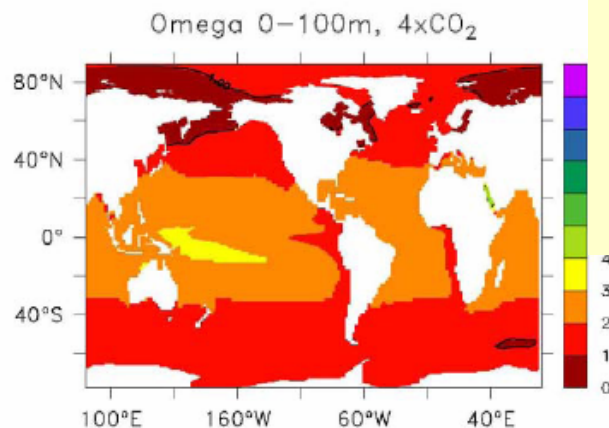
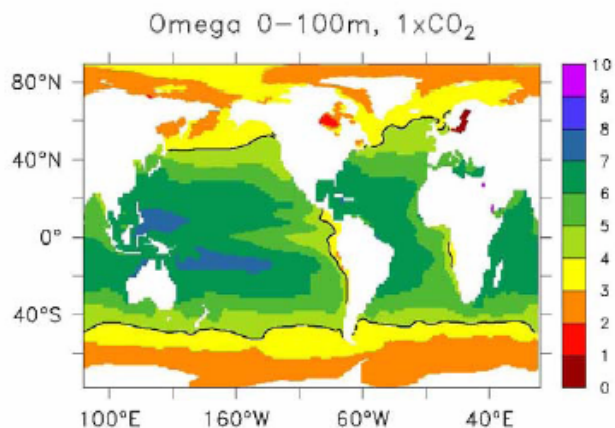
-WP15 “Physical-chemical feedbacks at high latitudes”

-WP16 “Biological feedbacks”

Impact of ocean acidification on pelagic calcification

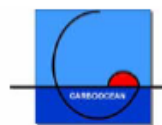


CaCO₃
production
decreased
by - 26 %
⇒ Large
impact on
ecosystems



Model: Nemo-PISCES (IPSL)

Gehlen et al., 2007, Biogeosciences Discussion and CarboOcean deliverable D16.4



CT 5 "Future scenarios for marine carbon sources and sinks"

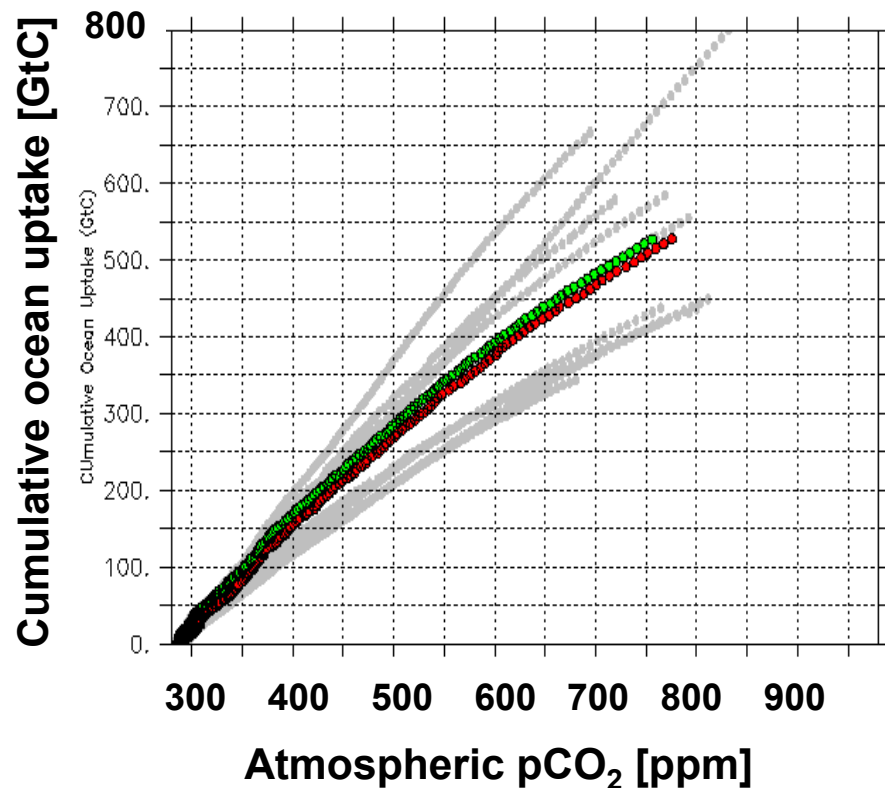
(CT leader: Christoph Heinze)

-WP17 "Coupled climate carbon cycle simulations"

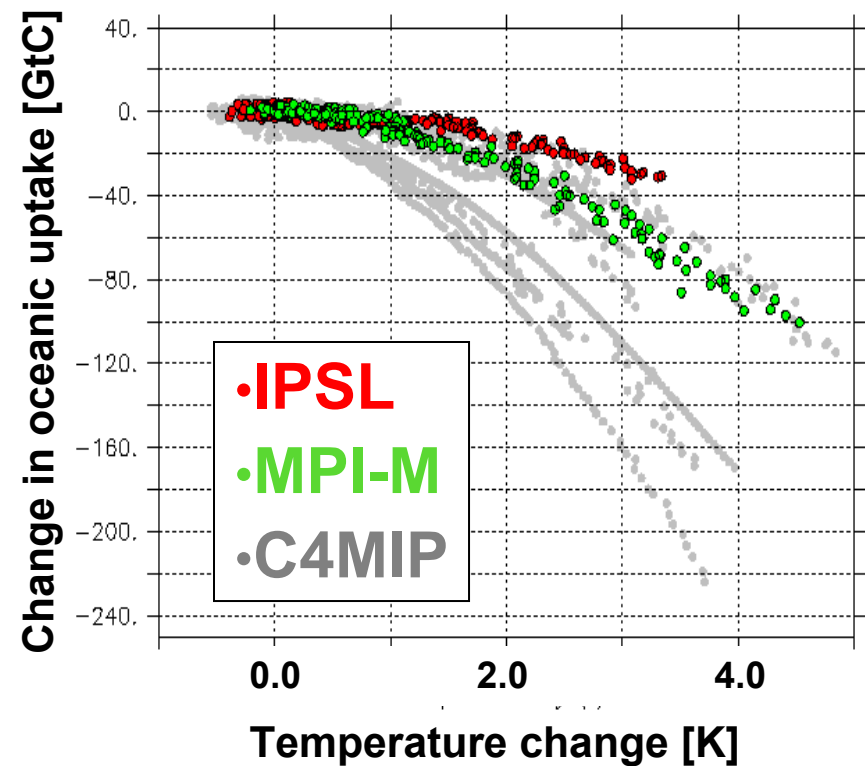
-WP18 "Feasibility study on purposeful carbon storage"

Quantifying climate sensitivity: New results from CarboOcean

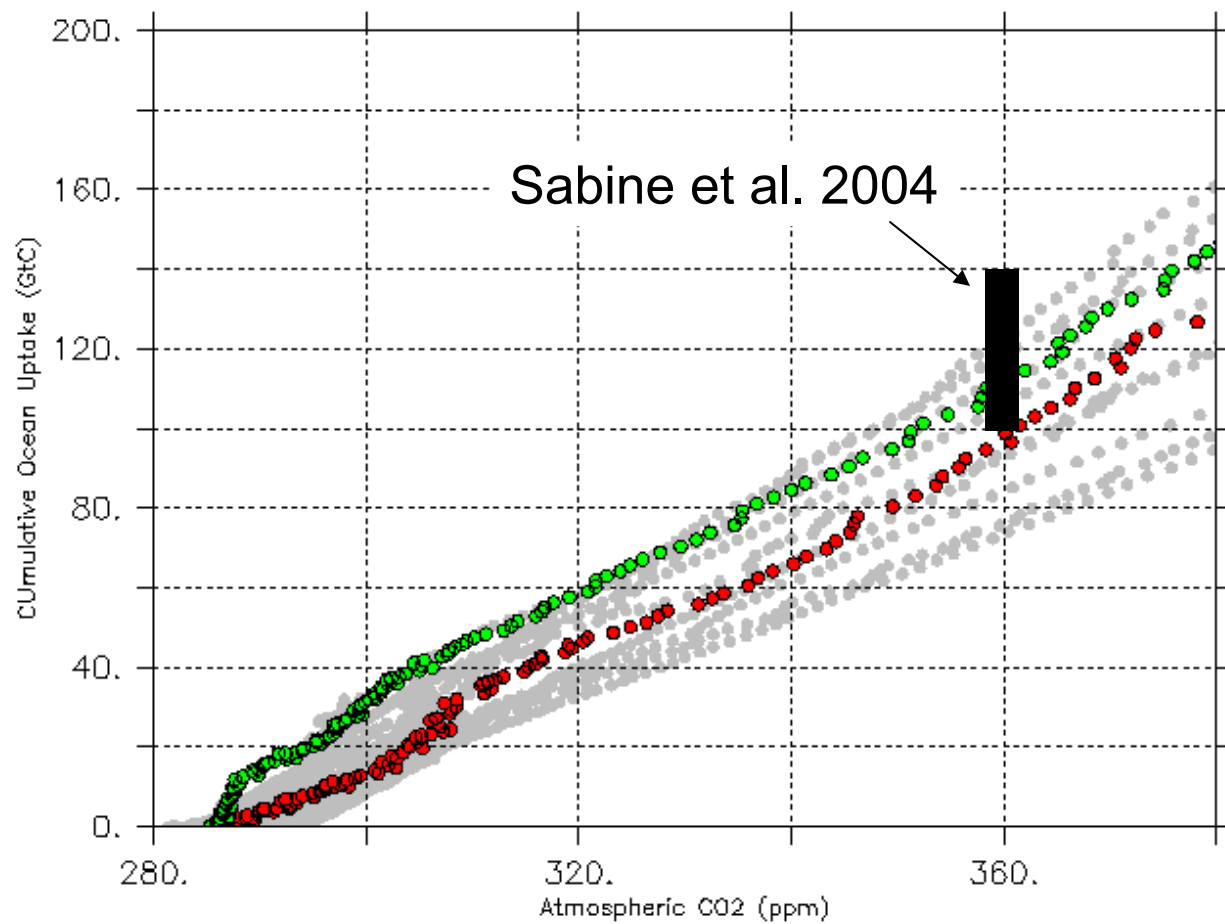
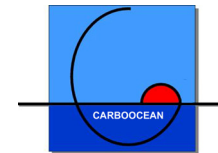
β ocean



γ ocean



Anthropogenic DIC



MPI
IPSL

-WP19 “Data and information management”

-WP20 “Management of the project”

-WP21 “Training”

-WP22 “Dissemination, exploitation and management
of knowledge”

-WP23 “Review and assessment of progress and
results”

CARBOOCEAN data management

- Gives access to historic and recent data
- Uses international standards for archiving data
- Provides assistent for scientists (data compilations, discussions forums, etc)
- Works on an international basis with partners in the USA, France, Germany and Norway

All data is

- quality controlled, standardized and archived in a World Data Center
- available through the CARBOOCEAN data portal, a state-of-the-art Distributed Networked Database
<http://dataportal.carboocean.org/>
- Approx. 1.200.000 measurements have been made and archived within CARBOOCEAN

