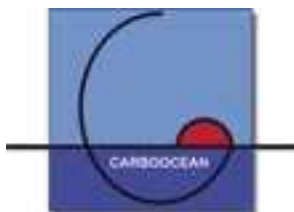


CARBOOCEAN “Marine carbon sources and sinks assessment”:



Sustained carbon observations in combination with cutting edge biogeochemical climate modelling are fundamental to provide guardrails for informed decisions on climate mitigation and adaptation.

Since starting industrialisation around 1750, mankind has increasingly released carbon dioxide (CO₂) to the atmosphere which significantly contributed to human induced climate change. The atmospheric CO₂ content would even be higher if it was not for that at present about 25% of annual CO₂ emissions are absorbed by the ocean. However, since temporal and spatial details of this sink are not yet accurately quantified, the EU-funded FP6 Integrated Project CARBOOCEAN (contract no. 511176 GOCE) is dedicated to an improved quantification of the oceanic uptake of anthropogenic CO₂.

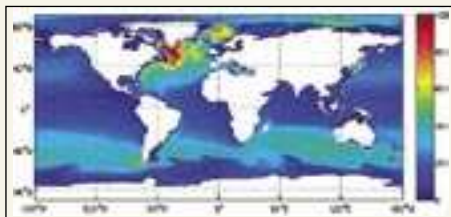


Figure 1: Anthropogenic carbon in the water column (in mole-C/m²) as a result of the coupled physical biogeochemical ocean model MICOM-HAMOCC (University of Bergen, Bjerknes Centre for Climate Research). The North Atlantic and the Southern Ocean show high inventories of anthropogenic carbon. (Source: Karen Assmann)

CARBOOCEAN is highly policy relevant, as the source/sink distribution for CO₂ has to be accurately known in order to frame policies aiming at CO₂ emission reductions and measures to enforce such policies. In the recent IPCC 4th Assessment Report of Working Group I, mostly physical climate models have been used for the climate change scenarios until 2100. The next generation of future climate scenarios needs to fully include the carbon cycle feedback to climate change which CARBOOCEAN will help to develop.

From the CARBOOCEAN project, three major issues emerge:

1) Decrease of the ocean carbon sink

There is evidence from observations (Fig. 2a+b) and modelling that the ocean carbon sink at high latitudes has been weakening over the past years. If this trend continuous, the CO₂ content in the atmosphere could rise more quickly than formerly expected, implying that human CO₂ emissions would need to be cut down even further to make the EU-target of maximal 2 degrees global temperature realistic.

2) Increase of “ocean acidification”

Increased CO₂ uptake by the oceans results in a decrease of the pH-value. This affects not only the organic and inorganic carbon cycling but also marine organisms with calcareous shells because the water masses become more acidic. Especially in the Arctic region, the surface water might be undersaturated with respect to aragonite by 2050, being a threat for e.g. marine snails.



Figure 2a: Several VOS-lines equipped with automatic instruments for measuring carbon dioxide in the water have been successfully used by the CARBOOCEAN project. The MV Santa Maria, a container ship chartered by Geest, has generated more than 90,000 measurements of CO₂ on its way from the West Indies carrying bananas to the UK (Source: Ute Schuster, UEA).

3) Intensifying feedback mechanisms

The integrated marine carbon cycle feedback to global warming and higher CO₂ concentrations in the atmosphere is positive, i.e. it is reinforcing climate change.

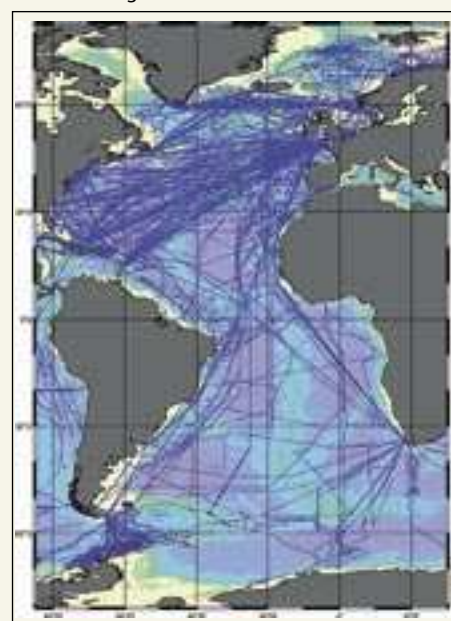


Figure 2b: Cruise tracks from voluntary observing ships (VOS) and research vessels which provide semi-continuous measurements of the ocean surface CO₂ content. This map includes data collected before and during the CARBOOCEAN project (Source: Benjamin Pfeil, University of Bergen).

CARBOOCEAN

- is the European contribution to the global observation network on marine carbon
- combines the key European experts of 47 groups from 15 countries (Europe, Morocco, USA, and Canada)
- is funded by the European Commission over a five year period (2005-2009)

www.carboocean.org

CarboSchools

CARBOOCEAN's educational outreach component is “CarboSchools”. As a European network of regional projects for school partnerships on climate change research, it enables teachers and students to understand current research in carbon cycling. An introductory booklet and a teacher-scientists partnership guide can be downloaded from the CarboSchools homepage (www.carboschools.org).



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