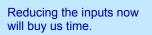
Building our sustainable future

How much more CO₂ will the ocean be able to take up in a given time period?

The ocean could take up more but not so much all at once.





How efficient will the ocean carbon sink be in the future?

Which factors cause changes in this sink?

What implications does this have for actions to mitigate climate change?

CARBOCHANGE gives answers through:

- Comprehensive <u>observations</u> of the ocean-climate system
- In-depth <u>understanding</u> of key processes
- Improved <u>prediction</u> of expected changes

CARBOCHANGE provides the knowledge base for sustainable climate policies

CARBO CHANGE consortium

University of Bergen	Norway
VitusLab	Denmark
IFREMER	France
LSCE / CEA	France
University Pierre and Marie Curie	France
CLIMMOD	France
AWI Bremerhaven	Germany
GEOMAR	Germany
MPI for Meteorology	Germany
University of Bremen	Germany
Marine Research Institute	Iceland
NUI Galway	Ireland
INRH	Morocco
NIOZ	The Netherlar
NERSC - Nansen Center	Norway
UniResearch, Bjerknes Centre	Norway
CSIC	Spain
University of Las Palmas de Gran Canaria	Spain
University of Gothenburg	Sweden
ETH Zürich	Switzerland
University of Bern	Switzerland
Met Office	UK
National Oceanography Centre	UK
Plymouth Marine Laboratory	UK
University of Bristol	UK
University of East Anglia	UK
CSIR	South Africa
Princeton University	USA



Canada

ordination and Project Office:
University of Bergen, Geophysical Institute and Bjerknes
Centre for Climate Research
Christoph Heinze, Project Director
Christoph.Heinze@gfi.uib.no
Friederike Hoffmann, Scientific Project Manager
Friederike.Hoffmann@gfi.uib.no
Tel. 0047–55582088
www.carbochange.eu

Dalhousie University, Halifax







CARBOCHANGE

Changes in carbon uptake and emissions by oceans in a changing climate

www.carbochange.eu

EU FP7 Collaborative Project Large-Scale Integrating Project Grant Agreement Number 264879

March 2011- February 2015

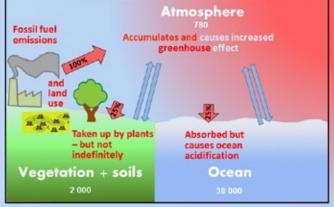




Facing the challenges

- Carbon dioxide (CO₂) from fossil fuel burning and land-use changes is the main driver for human-induced climate change
- · Currently, the ocean takes up about 25% of the carbon dioxide emitted annually by human activities
- The uptake rate is changing

HOW DO CARBON FLUXES CHANGE WITH TIME?



Human-produced carbon fluxes (changing); 50% remains in the atmosphere Natural carbon fluxes (quasi-equilibrium; arrows have no quantitative meaning)

White numbers give present carbon reservoirs in 1015 g C

Understanding the problem: how much, where, when?

How much CO₂ have the world oceans taken up so far?

How much will they take up in the future?

What are the interactions with progressing climate change?

Observe the changes

The amount of CO₂ taken up by the ocean is not the same everywhere. To obtain a complete picture of global carbon uptake and emissions by the oceans, CARBOCHANGE uses a comprehensive network of buoys, floats, and research vessels, including commercial ships (as voluntary observing ships, "VOS

lines"). While these ships cross the oceans, scientific equipment installed onboard continuously measures relevant variables. All incoming data are quality-controlled, standardized and archived. The data are made available for scientists all over the world via the data portal at our project website.





A lot happens to the CO₂ after it is taken up by the ocean. It can be transported by water masses. precipitated as carbonates, transformed into organic carbon by planktonic algae, released again to the atmosphere or buried forever in the sedi-

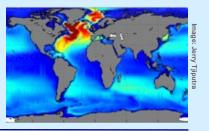
Quantify the processes

ments. CarboChange will quantify these key physical, chemical and biogeochemical processes through a combination of field observations, process studies, and modelling.

Predict the future

CARBOCHANGE is establishing model systems that will contribute to predicting the future climate. Observational data from the project will be used to calibrate and improve existing models. Using these models, we are quantifying the carbon sources and

sinks of the ocean of the past and present. We are also predicting future changes in the ocean carbon cycling with respect to ongoing and future CO2 emissions and associated climate change.



Summarize the results and inform policy makers



Project results are summarized in regular synthesis reports and outreach papers. These documents provide information on how much CO2 the ocean takes up on a regional and global level and what drives associated changes. They further give synthesized information on the state of the carbon cycle in the ocean, and on the vulnerability of the oceanic carbon sink. These results are shared with

the scientific community, the general public, and are communicated directly to policy makers. Several CARBOCHANGE scientists are co-authors of international assessments such as the reports of the Intergovernmental Panel on Climate Change (IPCC). The project results represent an important contribution to international synthesis publications.

CARBOCHANGE closely cooperates internationally with other institutions and projects in the field of marine carbon cycle research such as the International Geosphere-Biosphere Programme IGBP, Integrated Marine Biogeochemistry and Ecosystem Research IMBER, Surface Ocean Lower Atmosphere Study SOLAS, the Global Carbon Project GCP, and the Regional Carbon Cycle Assessment and Processes RECCAP.