



**Geofysisk institutt**  
Universitetet i Bergen

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Bjerknes Centre  
for Climate Research



# Changes in carbon uptake and emissions by oceans in a changing climate - CARBOCHANGE

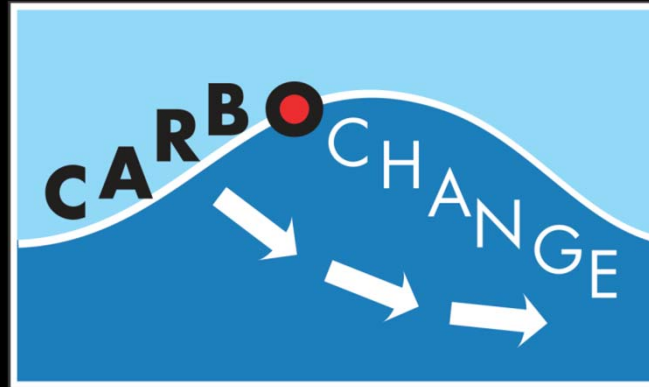
Christoph Heinze, Friederike Hoffmann, Benjamin Pfeil  
(University of Bergen)

and the

**CARBOCHANGE consortium**



# EU FP7 Collaborative Project – Large-Scale Integrating Project



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

March 2011 – February 2015

Budget: 7 Mio €

29 partner institutions from 15 countries

> 100 scientists involved





CarboChange - Windows Internet Explorer  
http://carbochange.b.uib.no/

**CARBOCHANGE**  
CHANGES IN CARBON UPTAKE AND EMISSIONS BY OCEANS IN A CHANGING CLIMATE

HOME WHO WHAT DATA MEDIA CENTRE RESTRICTED AREA LINKS JOBS CONTACT

### UPCOMING EVENTS

7 May, 2012  
Liege Colloq on Ocean Dynamics all day  
SOLAS Open Science Conference all day

13 May, 2012  
Effect of Climate Change on... all day

23 July, 2012  
ClimECO3 IMBER summer school at 0:00

### NEWS

April 2012  
New CARBOCHANGE publication:  
Global Biogeochem. Cycles, Contribution of tropical cyclones to the air-sea CO<sub>2</sub> flux: A global view

March 2012  
CARBOCHANGE information brochure is released  
CARBOCHANGE Annual Meeting takes place in Galway, Ireland.

## Home

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

March 2011 – February 2015

The EU FP7 project CARBOCHANGE brings together over 100 scientists from 28 partner institutions in 15 countries.

The diagram illustrates the CARBOCHANGE project structure. At the top, 'CHANGING CLIMATE' is shown with a red arrow pointing right. Below this, a box contains 'International coordination, GEO, GEOSS, GMES'. The main body is a blue box labeled 'CARBOOCEAN integrated project' on the left and 'FP6' on the top left. It contains three pink ovals: 'Core Theme 3 - Data model integration', 'Core Theme 2 - Observing systems (Towards ICOS)', and 'Core Theme 1 - Key processes, feedbacks, future scenarios, vulnerabilities'. A vertical pink oval on the right side of the main box is labeled 'Global and regional synthesis and synergies with international projects'. At the bottom of the main box is a box for 'Projects on ocean acidification, impacts, ecosystems'. To the right of the main box is a green box labeled 'Guard rails for policies, mitigation', 'IPCC assessments 5 and 6', 'ICOS', 'global & regional monitoring & prediction systems', 'FP6', 'Emerging knowledge gaps to be closed', and 'Securing our sustainable future'. Arrows indicate interactions between the main project and the guard rails.

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# The problem:

more CO<sub>2</sub> ....



...more global warming!

Illustration: Colourbox



# The solution: the ocean takes it all?

CO<sub>2</sub>



chemical reactions



biological activity

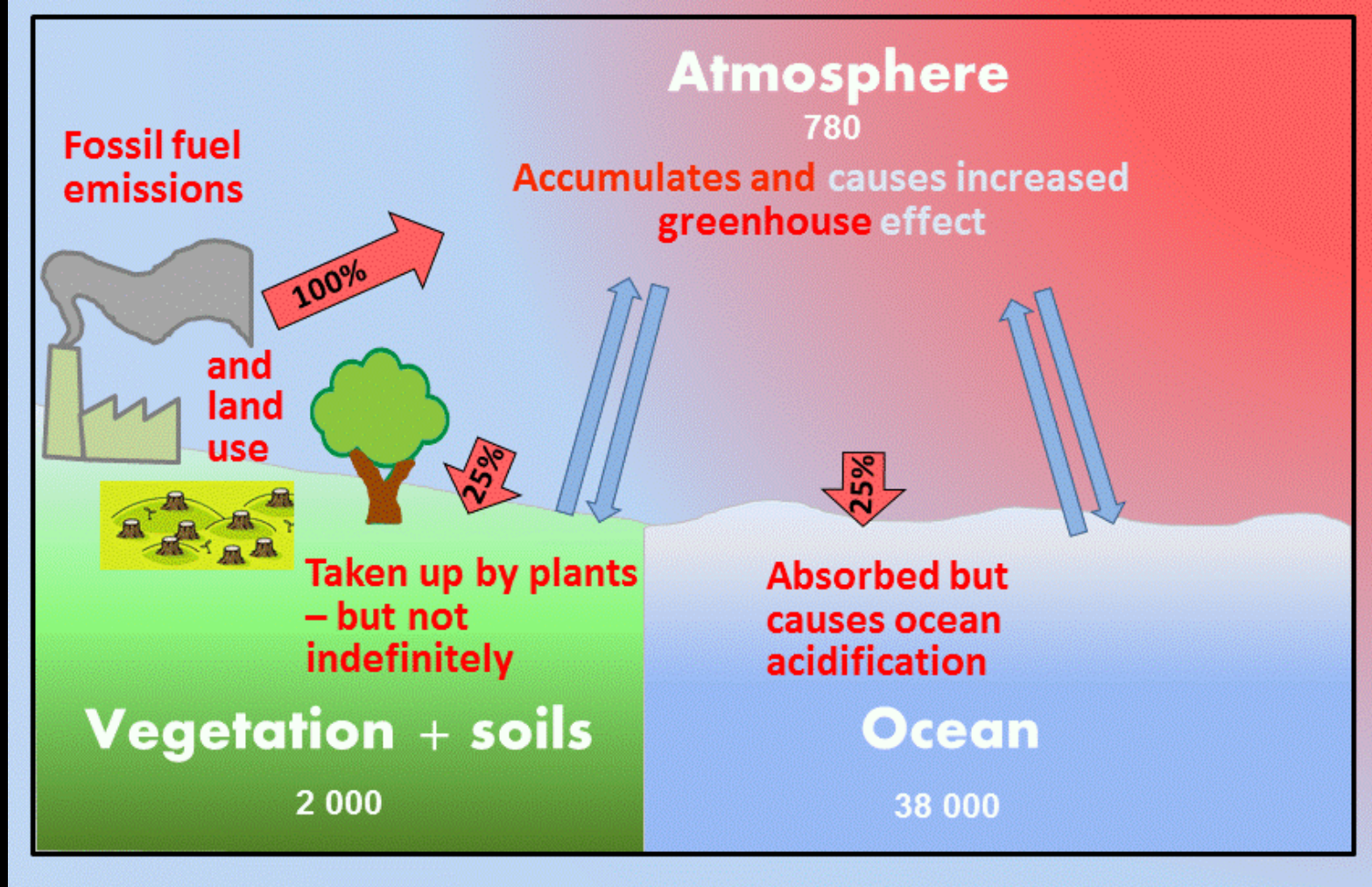


physical transport



Fig. by le Quéré, modified

# Not all – but a lot!



- The ocean takes up about 25% of the human-produced CO<sub>2</sub>
- It is also the largest carbon reservoir on earth

→ How do carbon fluxes change with time?

# CARBOCHANGE key questions:

















**How much CO<sub>2</sub> 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?**



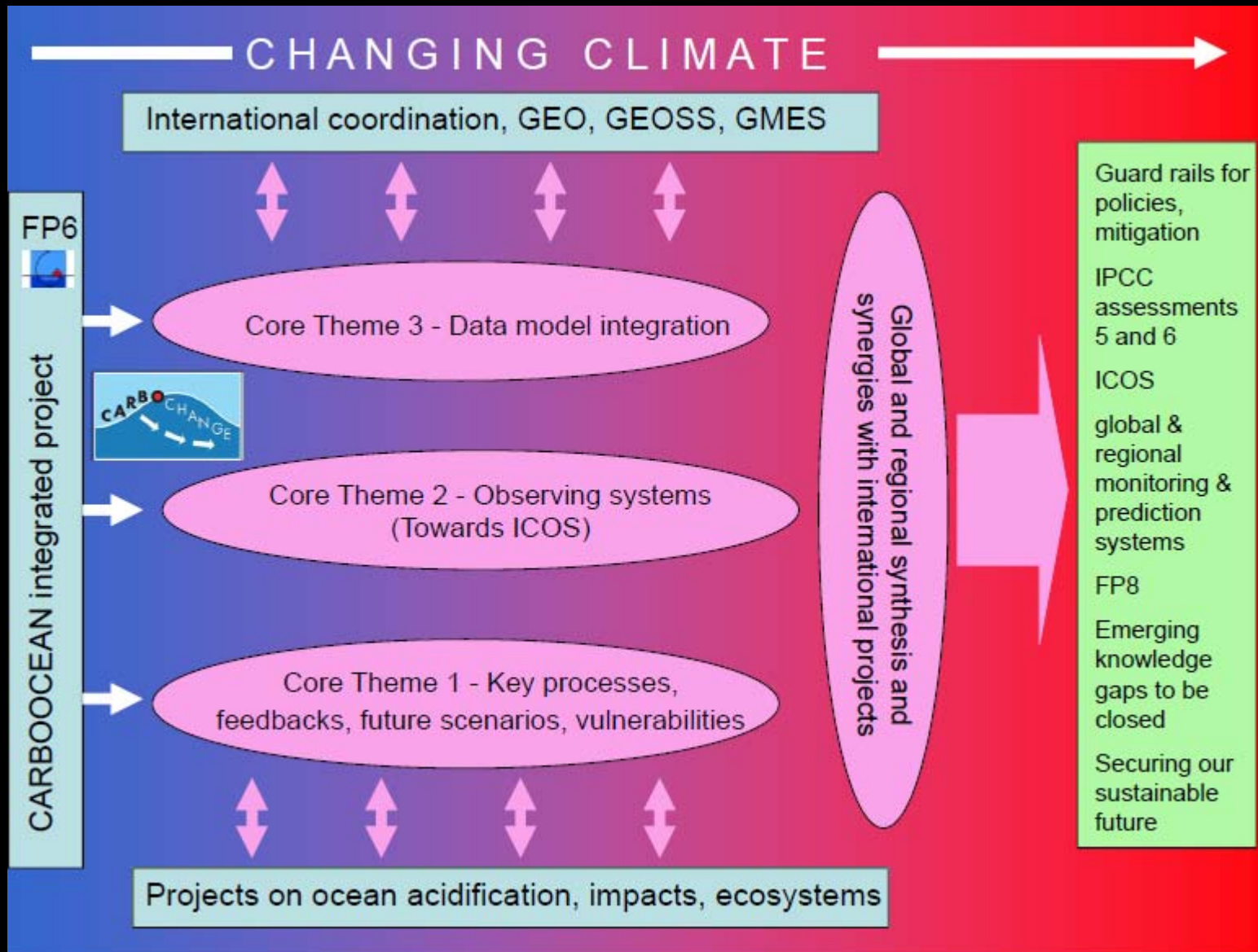
# CARBOCHANGE gathers international expertise:

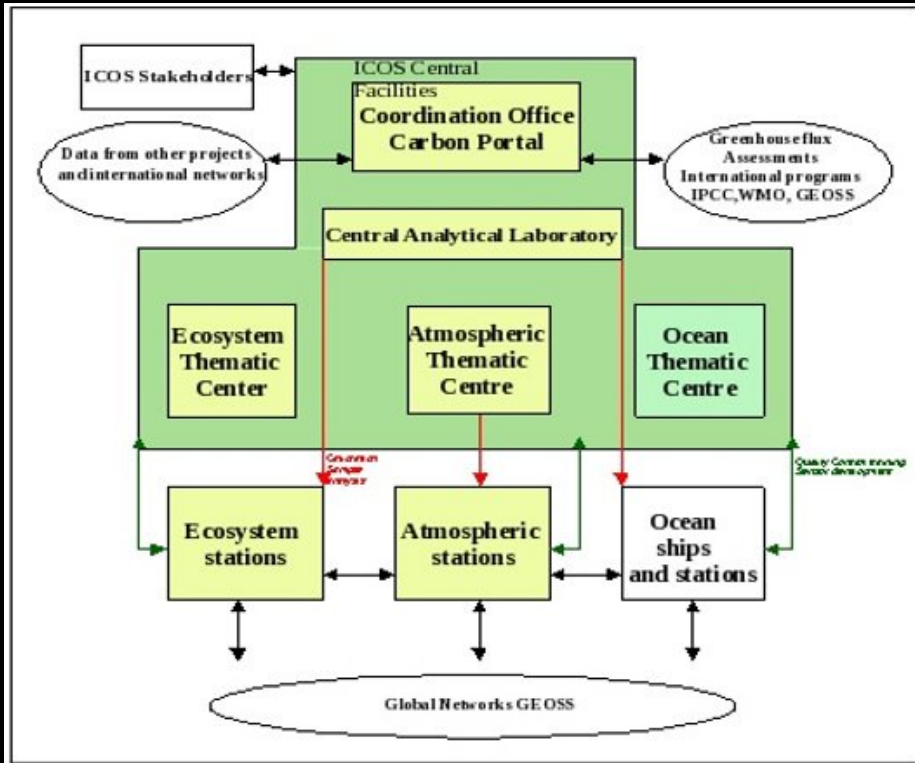
|                                                                                     |            |                                                                             |             |
|-------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------|-------------|
|    | UiB        | Coordinator: University of Bergen                                           | Norway      |
|    | VitusLab   | VitusLab Copenhagen, Denmark                                                | Denmark     |
|    | IFREMER    | Institut Français de Recherche pour l'Exploitation de la Mer                | France      |
|    | CEA        | Commissariat à l'Energie Atomique/Laboratoire des Sciences du Climat        | France      |
|    | UPMC       | Université Pierre et Marie Curie, Paris                                     | France      |
|    | AWI        | Alfred Wegener Institute for Polar and Marine Research                      | Germany     |
|    | IFM-GEOMAR | Leibniz Institute of Marine Sciences                                        | Germany     |
|    | MPG        | Max-Planck-Society, Institute for Meteorology                               | Germany     |
|    | UniHB      | University of Bremen                                                        | Germany     |
|   | MRI-UI     | Hafrannsóknastofnunin - Marine Research Institute and University of Iceland | Iceland     |
|  | NUIG       | National University of Ireland, Galway                                      | Ireland     |
|  | INRH       | Institut National de Recherche Halieutique, Casablanca                      | Morocco     |
|  | NIOZ       | Netherlands Institute for Sea Research                                      | Netherlands |
|  | NERSC      | Nansen Environmental and Remote Sensing Center                              | Norway      |

|                                                                                       |             |                                                                                |                |
|---------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------|----------------|
|    | UNIRESEARCH | Bjerknes Centre for Climate Research, UniResearch AS                           | Norway         |
|    | CSIC        | Agencia Estatal Consejo Superior de Investigaciones Científicas                | Spain          |
|    | ULPGC       | University of Las Palmas de Gran Canaria, QUIMA group                          | Spain          |
|    | UGOT        | University of Gothenburg                                                       | Sweden         |
|    | ETH Zürich  | Eidgenössische Technische Hochschule, Zürich                                   | Switzerland    |
|    | UBERN       | University of Bern                                                             | Switzerland    |
|    | MetO        | The Met Office, Hadley Centre for Climate Prediction and Research              | United Kingdom |
|    | NERC        | National Oceanography Centre Southampton, Natural Environment Research Council | United Kingdom |
|    | PML         | Plymouth Marine Laboratory                                                     | United Kingdom |
|    | UNIVBRIS    | University of Bristol                                                          | United Kingdom |
|   | UEA         | University of East Anglia                                                      | United Kingdom |
|  | CSIR        | Council for Scientific and Industrial Research                                 | South Africa   |
|  | PU-AOS      | Princeton University                                                           | USA            |
|  | DU          | Dalhousie University                                                           | Canada         |
|  | CLIMMOD     | CLIMMOD Engineering SARL                                                       | France         |



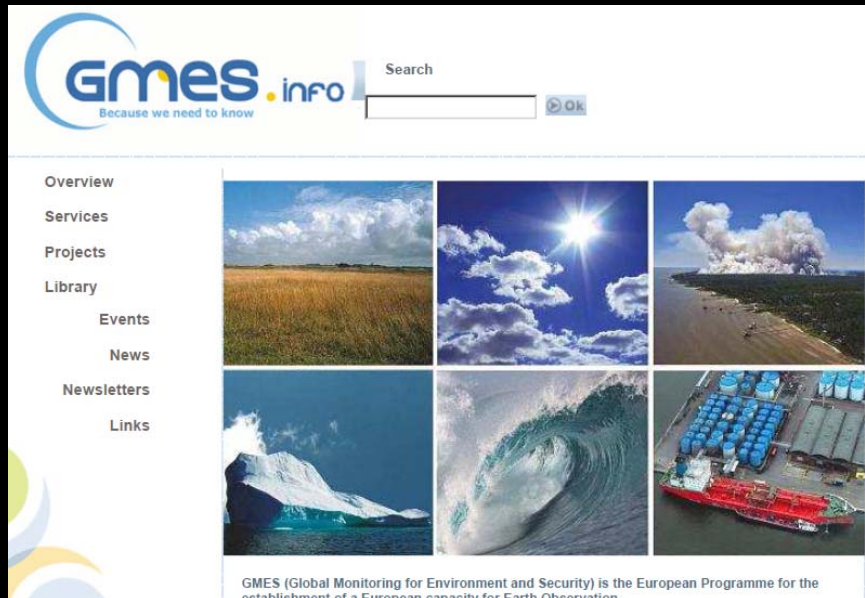
# The CARBOCHANGE concept:





The European ocean carbon data streams will feed into the **global observing system GEOS** under the Group on Earth Observations (**GEO**), and into the related European **GMES** (Global Monitoring for Environment and Security) programme.

CARBOCHANGE will also synergistically work with the emerging European Research Infrastructure **ICOS** (Integrated Carbon Observing System) to establish a functioning **long-term carbon observing capability** in Europe to watch the evolution of carbon sources and sinks on land and in the ocean and their vulnerabilities.



# CARBOCHANGE achievements so far:



Data Portals  
[\(click here\)](#)

Publications  
[\(click here\)](#)

Surface Ocean Carbon  
websites  
[\(click here\)](#)

# We would like to thank...



## Funding



## Endorsing

## Cooperation and company

