oceanflux ghg
support to science element

OceanFlux GHG is funded by: esa and affiliated to: solas

eri environmental research institute | PML Plymouth Marine Laboratory | HERIOT WATT UNIVERSITY | Ifremer | National Oceanography Centre NATURAL ENVIRONMENT RESEARCH COUNCIL | stse support to science element

The OceanFlux Greenhouse Gases project

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International Centre for Island Technology
Heriot-Watt University

HERIOT WATT UNIVERSITY

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OceanFlux GHG Project Overview

NORTH HIGHLAND COLLEGE - University of the Highlands and Islands (NHC-UHI)

PLYMOUTH MARINE LABORATORY (PML)

INSTITUT FRANCAIS RESERCHE POUR L'EXPLOITATION DE LA MER (IFREMER)

NATIONAL OCEANOGRAPHY CENTRE (NOC)

for European Space Agency, STSE

Overview

- Context
- Scientific Drivers
- Satellite Capabilities
- Other Capabilities
- The Project - Tasks
- Legacy

Context: ESA, STSE and SOLAS

ESA and STSE

- Reinforce scientific collaboration between ESA and international programmes
- Fostering collaboration between different scientific communities
- Developed in close collaboration with international programmes

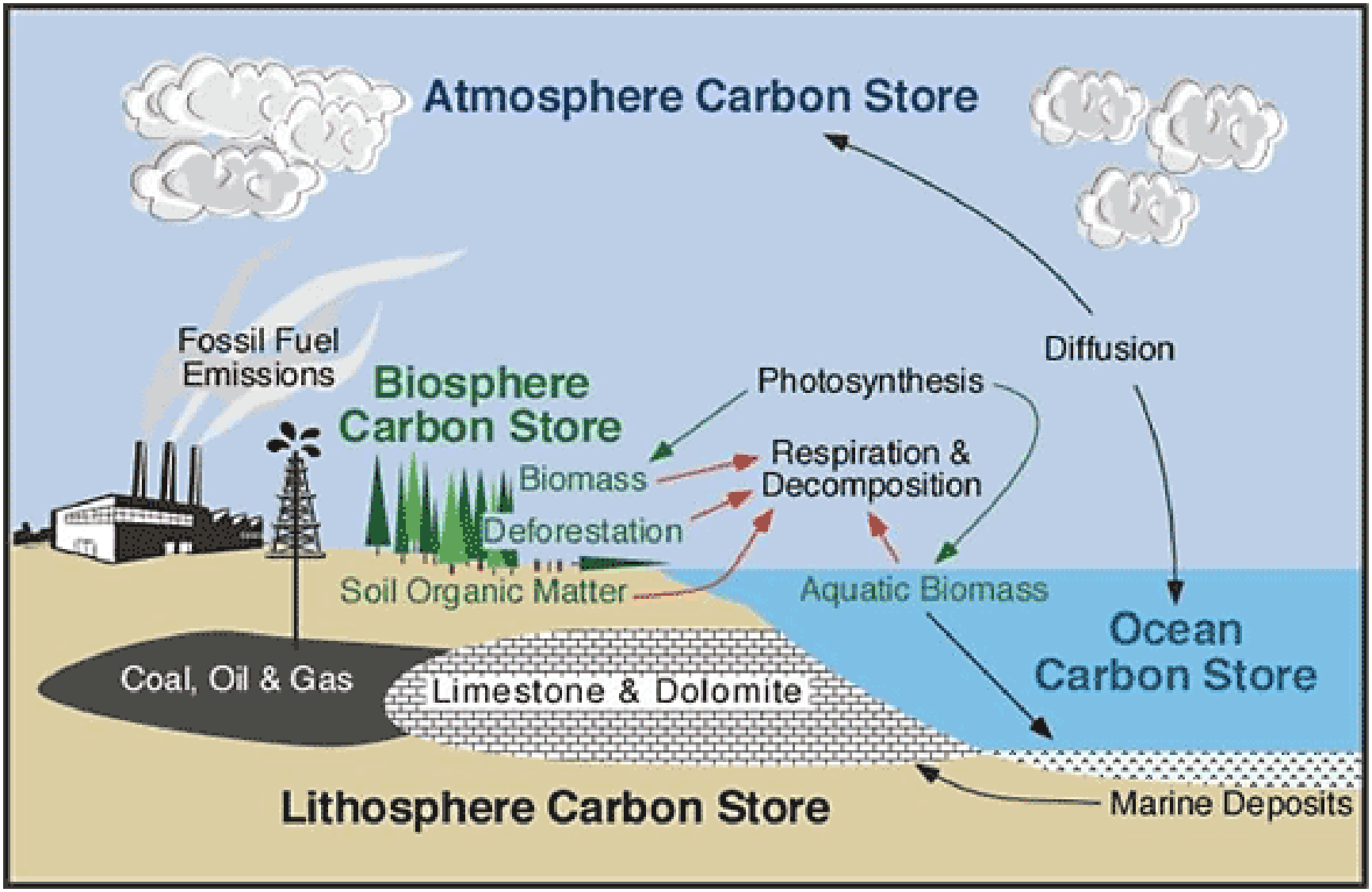
ESA and SOLAS: OceanFlux initiative has two generic aims:

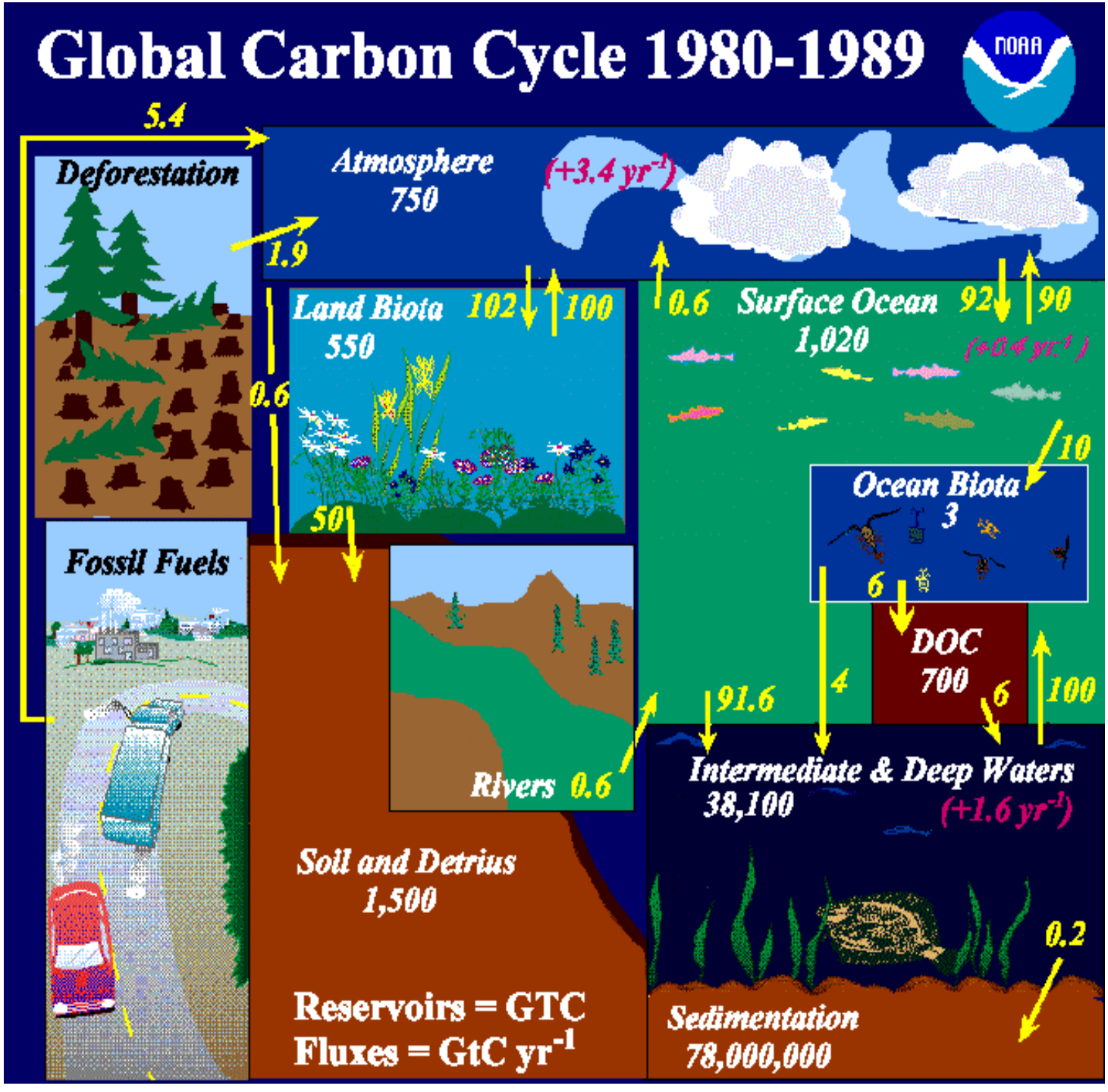
- Support development of novel products
- Facilitate and advance integration of EO data into SOLAS process studies

Following workshop in Toulouse in 2010, three *OceanFlux* projects:

1. **OceanFlux Sea spray and aerosols**
2. **OceanFlux Greenhouse Gases**
3. **OceanFlux Upwelling (feasibility study)**

Carbon cycle

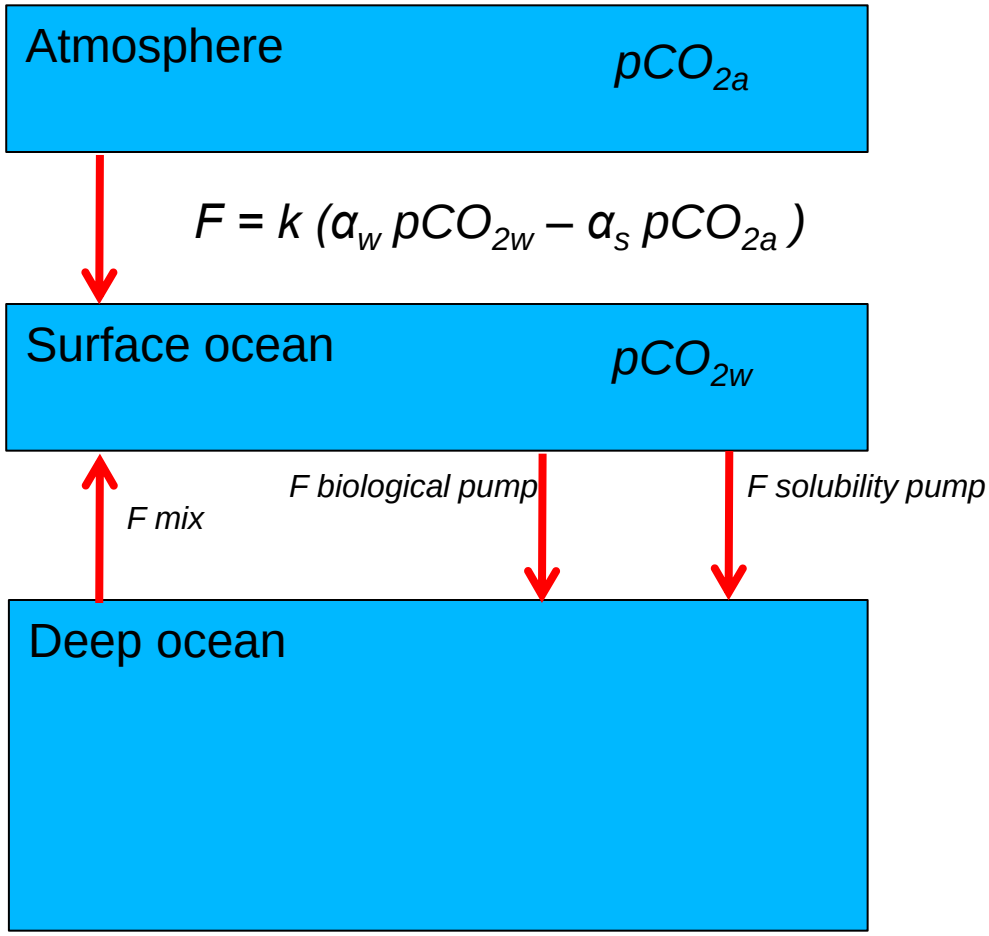




Source: NOAA-PMEL

Carbon export to the deep ocean

Basic box model



OceanFlux Greenhouse Gases (GHG)

Towards better air-sea fluxes of greenhouse gases

- Originally focus on transfer velocity, *k*, and its drivers
- Agreed in negotiation that climatology was endpoint

Multi-disciplinary team, expertise in:

- EO scientists and experts (near-infrared, optical, radar, microwave)
- In situ scientists
- Members of the SOLAS community
- Wave modellers
- Hydrodynamic ecosystem modelling
- Expertise in efficient processing of large datasets

Scientific Drivers

"*k* Conundrum", k (U, Sc)

Other factors affecting k and flux

- Sc, solubility
- Temperature
- Sea State
- Rain
- Slicks
- Currents and Fronts

Dissolved Gas Measurements

- SOCAT

Satellite Capabilities

A wide range of instruments and sampling from space

Wind speed and sea state

- Multi-sensor wind speed sampling
- Sea State from altimeter and SAR

Temperature and Salinity

- SMOS
- CCI SST and other improved temperature products

Rain, Slicks etc.

Other Capabilities

Wave Modelling

- Energy dissipation
- Breaking wave and Whitecap characteristics
- (Ardhuin, Wednesday pm)

Ocean Carbon Modelling

- Generation of fCO2 from models
- Data assimilation
- Coastal CO_2 fluxes (Torres, Thursday pm)

“Cloud-based” processing system

Tasks I

Review (reference baseline documentation)

- *k*
- CO_2
- Temperature and salinity
- Satellite capability

Choices (Technical baseline and specification)

- Data sets
- Algorithms
- Processing System

Outcomes from Tasks I

Ambiguity in *k*

Other factors affecting *k*

Specification of Climatology

- 1^o x 1^o
- Referenced to 2010
- SOCAT
- Ensemble
- Attribute Layers

Open Access

Outcomes from Tasks I continued

Temperature and Salinity

Multiple data sets

Strict separation of skin and sub-skin temperature; upward and downward flux

Wind speed and sea state

Multi-sensor wind speed (PDF of wind speed)

Altimeter and wave model products

Simple geospatial optimal interpolation

Tasks II

Realization of the climatology and the processing system

Validation

Promotion and facilitating access to the processing system

Workshop

Scientific Impact Assessment Report

Publication

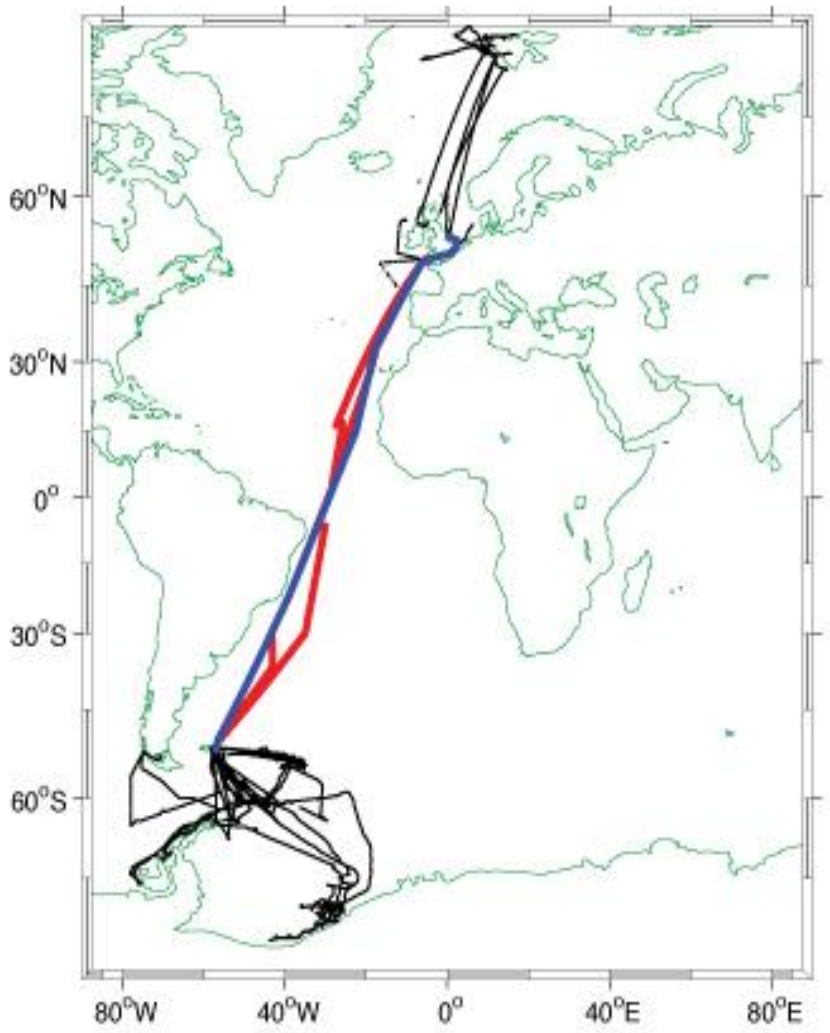
- Papers from the project
- Special Issue (EGU journals)

OceanFlux GHG – Scientific studies

Exploit cloud processing and Multi-year global EO datasets for:

1. EO algorithm development and validation
 - gas transfer velocity
 - whitecapping (model vs EO vs in situ)

2. Studying the impact on air-sea fluxes of:
    - Surface biology
    - Diurnal warming
    - Intense rain events
    - Wave breaking (whitecapping)



In situ data collection cruise tracks

OceanFlux GHG – Global community data

Global regular grid 1^o x 1^o climatology + processing tools

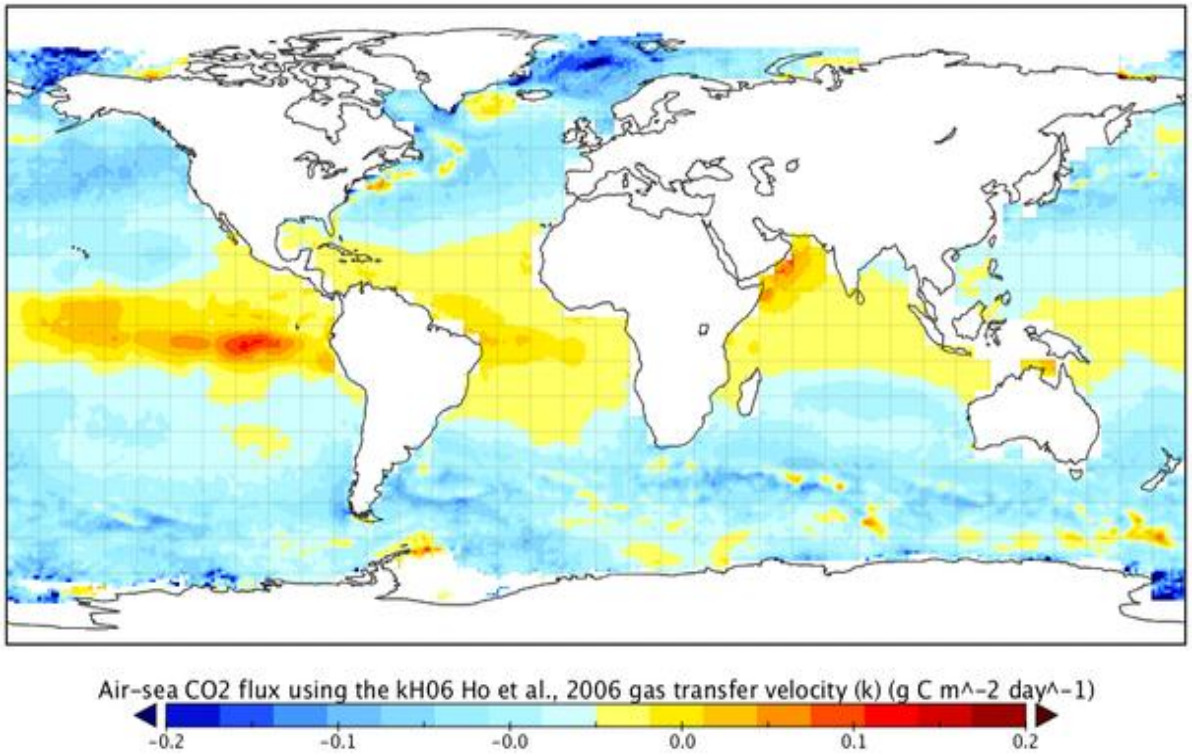
Uncertainty information

Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO_2 concentrations, pCO2 at base of micro-layer)

Quantities: SST_{skin}, SST_{fnd}, salinity, whitecap coverage, solubility, fugacity, k_{total}, k_{rain} +..)



Example OceanFlux GHG project output Generated on the Nephalae cloud.

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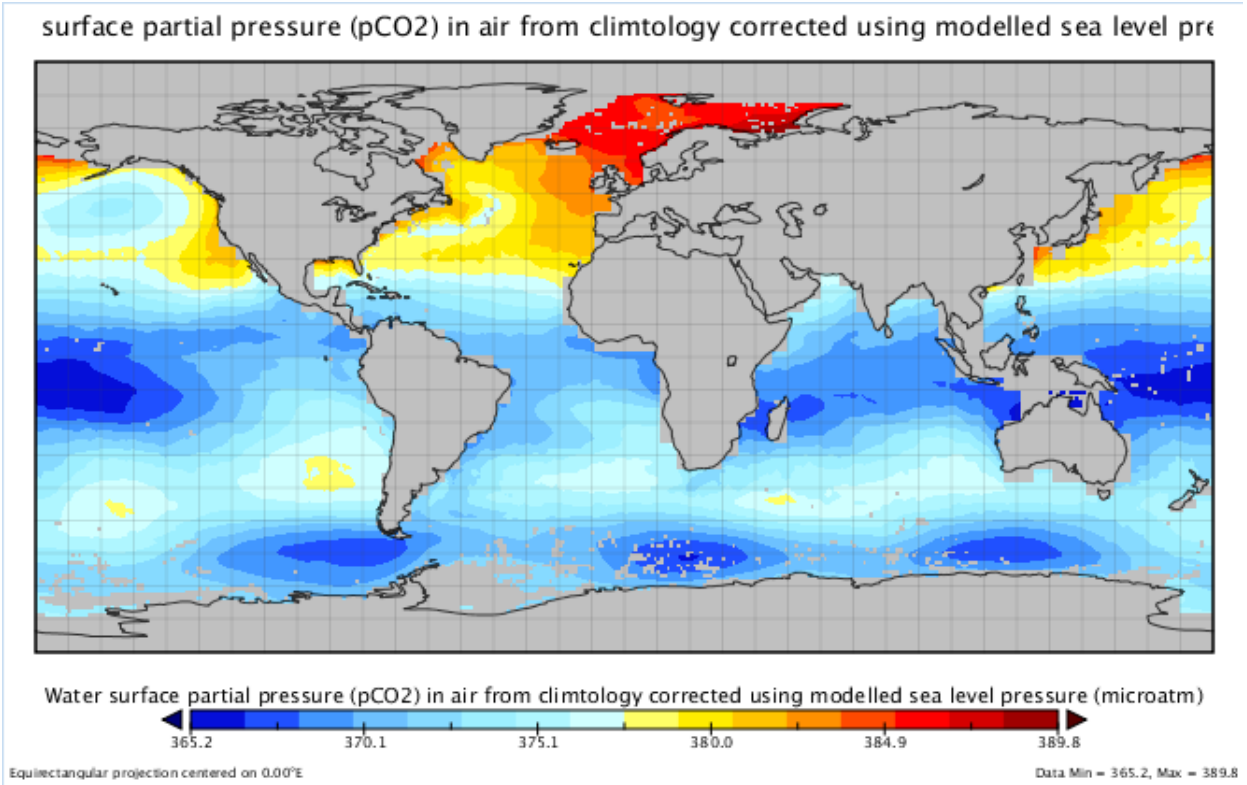

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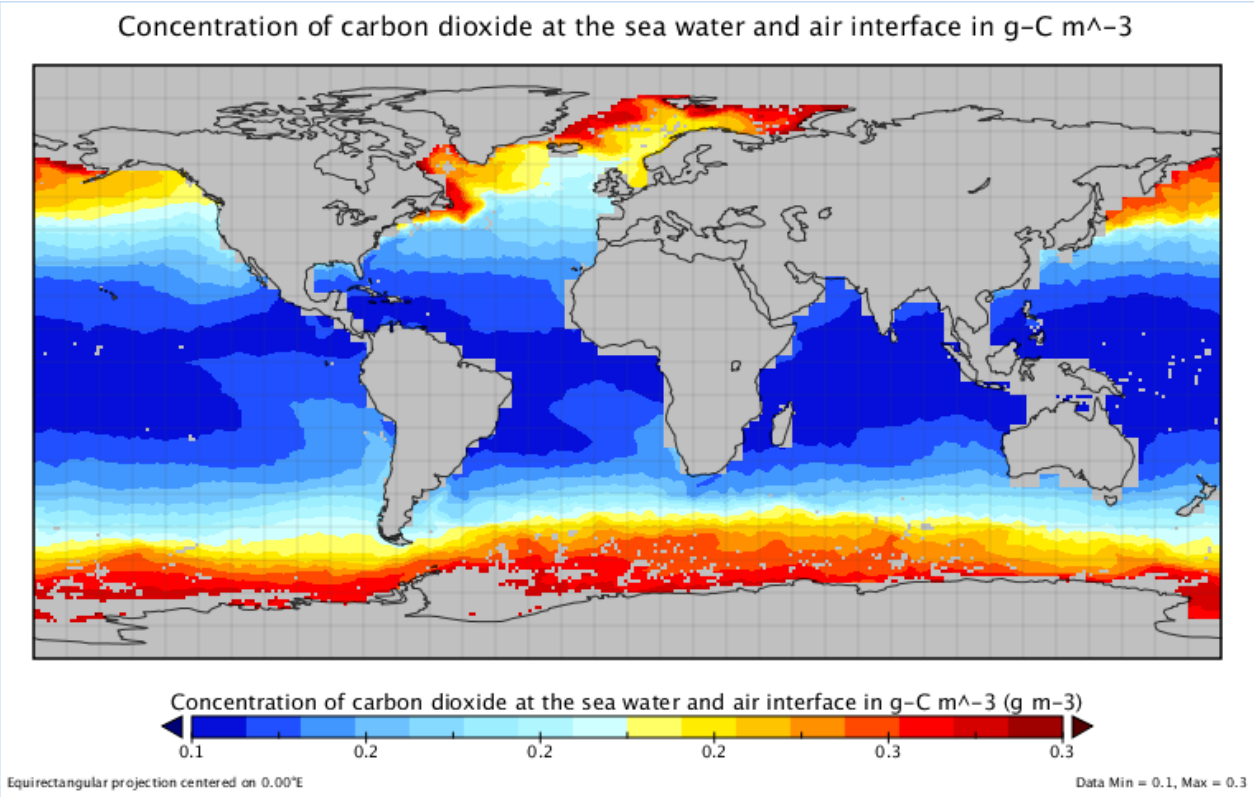

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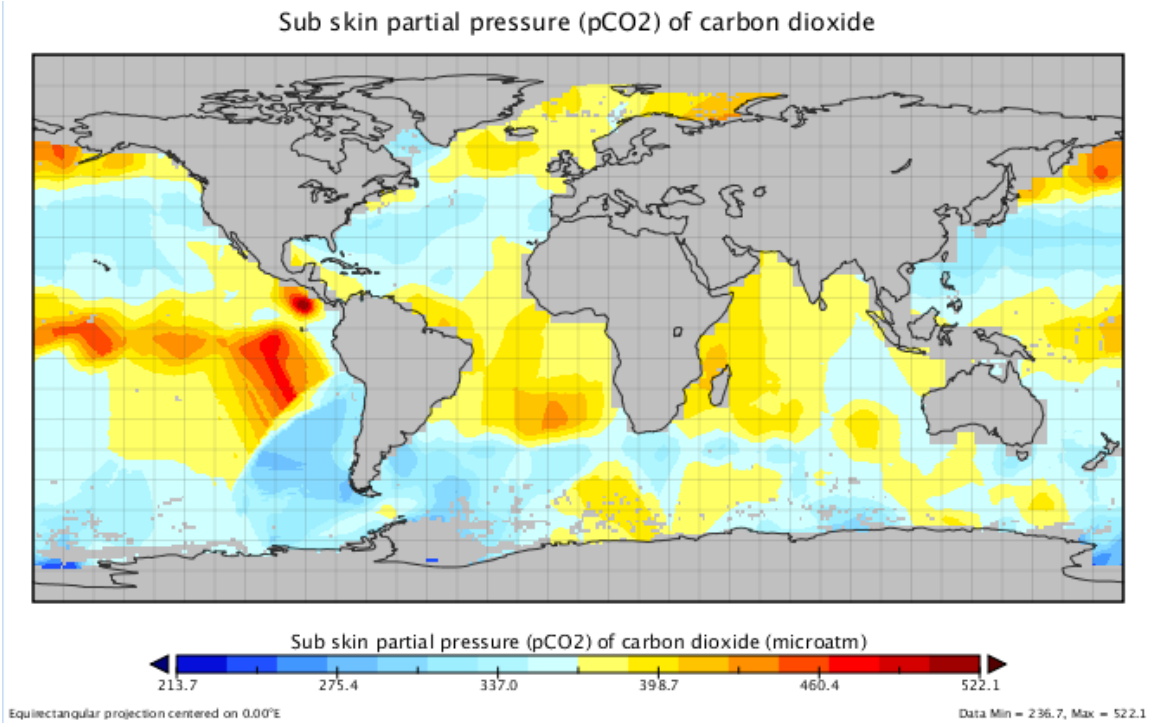

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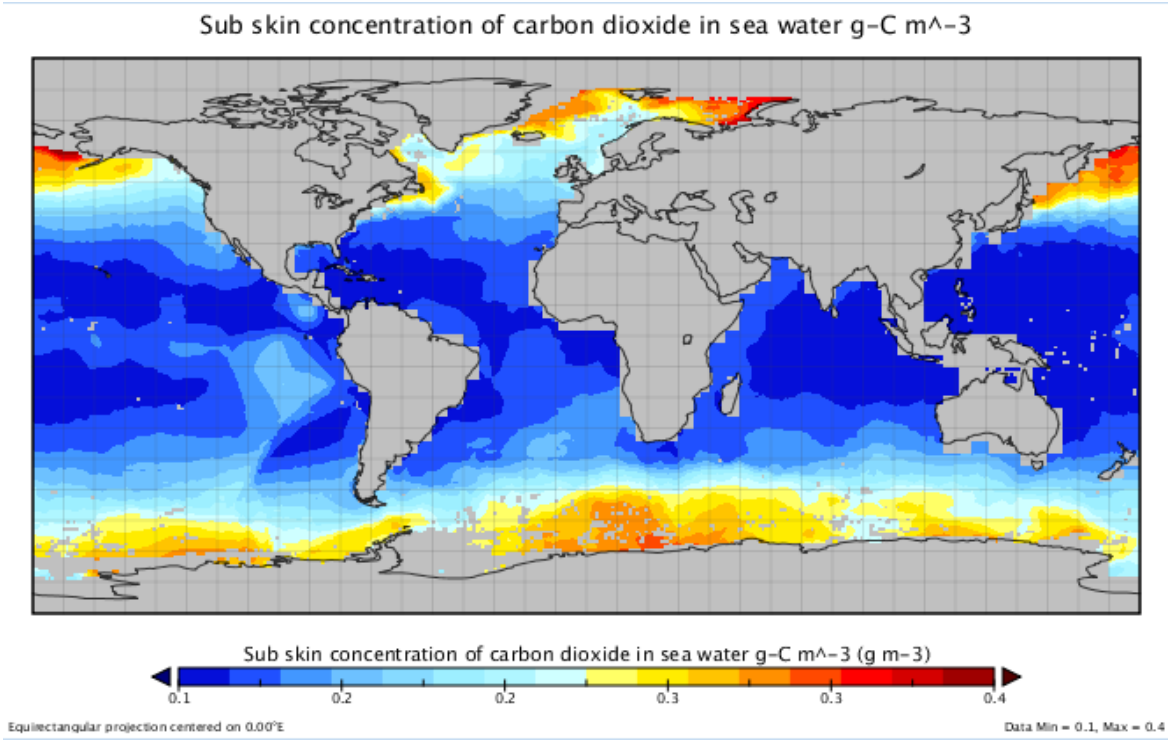

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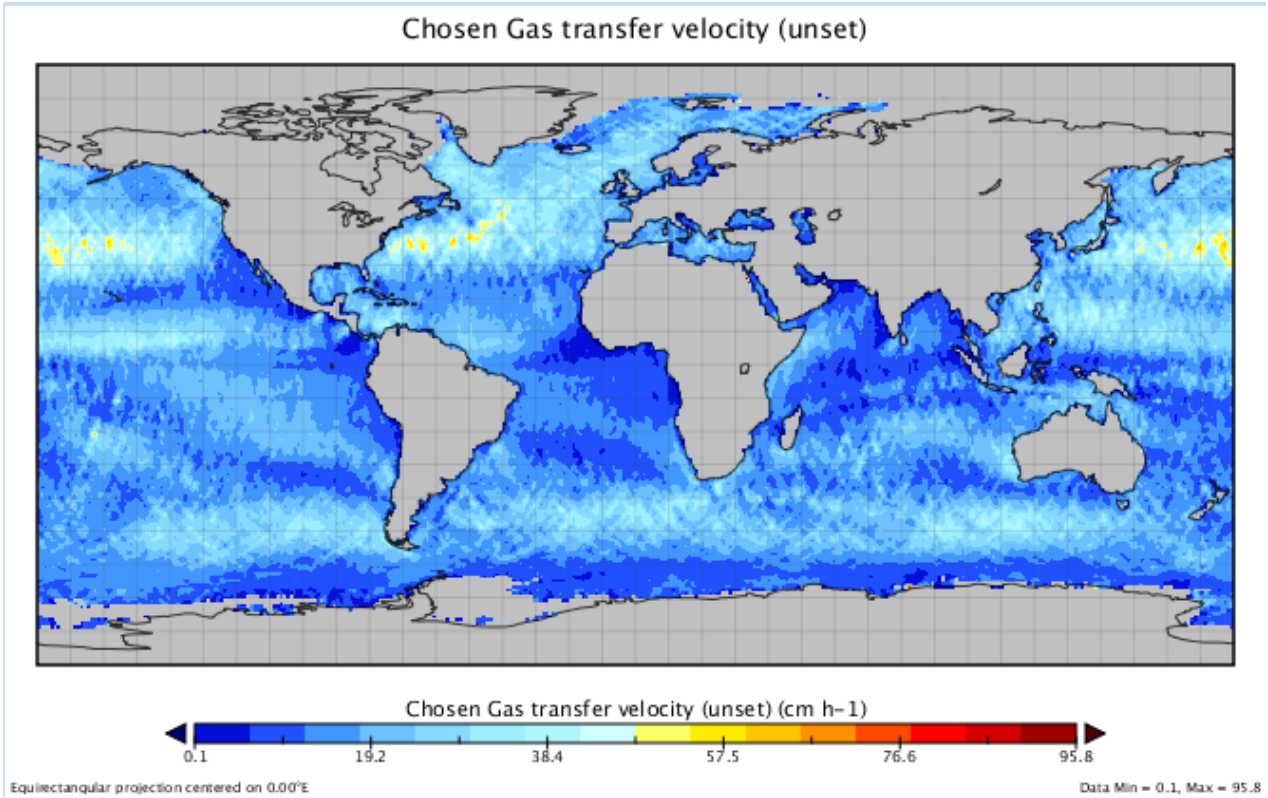

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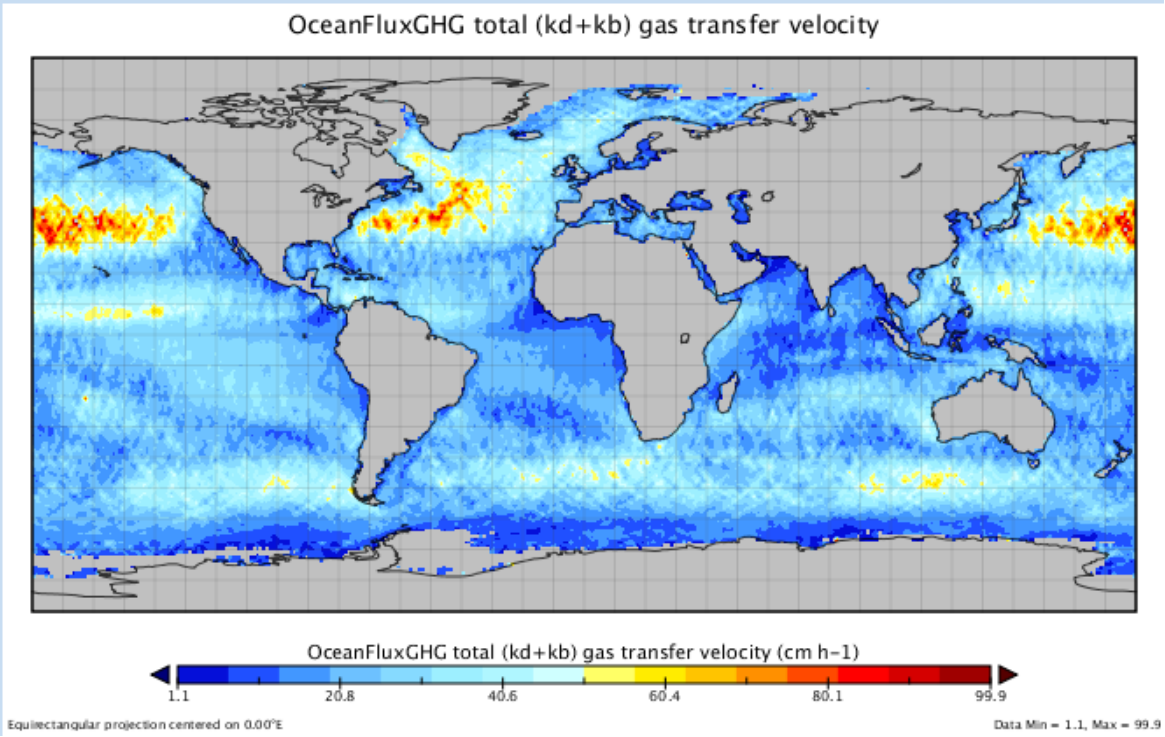


Example OceanFlux GHG project output Generated on the Nephalae cloud.

OceanFlux GHG – Regional community data

Regional European shelf 1/9º x 1/6º data

Uncertainty estimates

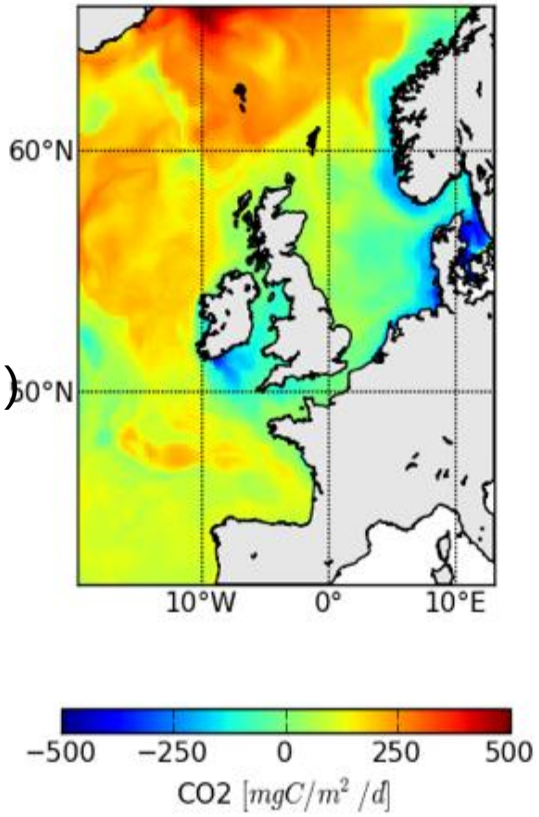
Data from ocean surface to floor (e.g. box data)

Normalised to 2010

Model includes EO data assimilation (biology)

Quantities: modelled pCO_2, salinity, solubility, SST + ..)

Towards being able to study fluxes in coastal regions.



Regional model domain

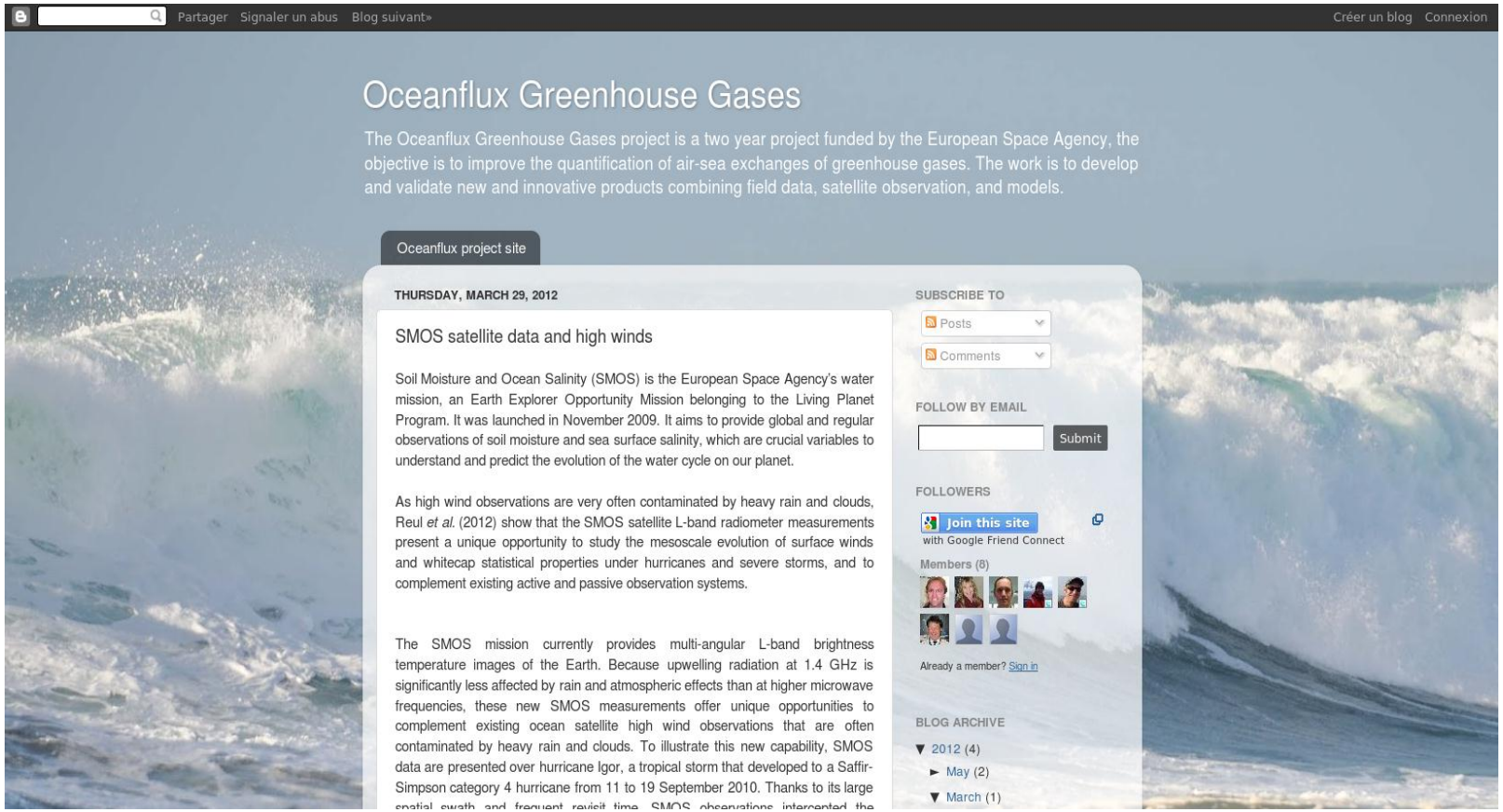
OceanFlux GHG - Website

OceanFlux GHG – community feedback

Project blog – www.oceanflux-org.blogspot.fr

Reference User Group

Monthly summary reports



OceanFlux GHG - Brochure