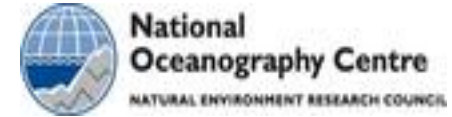




OceanFlux GHG is funded by:



and affiliated to:



The OceanFlux Greenhouse Gases project

David Woolf, Jamie Shutler, Bertrand Chapron, Margaret Yelland and many others
d.k.woolf@hw.ac.uk

International Centre for Island Technology
Heriot-Watt University



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

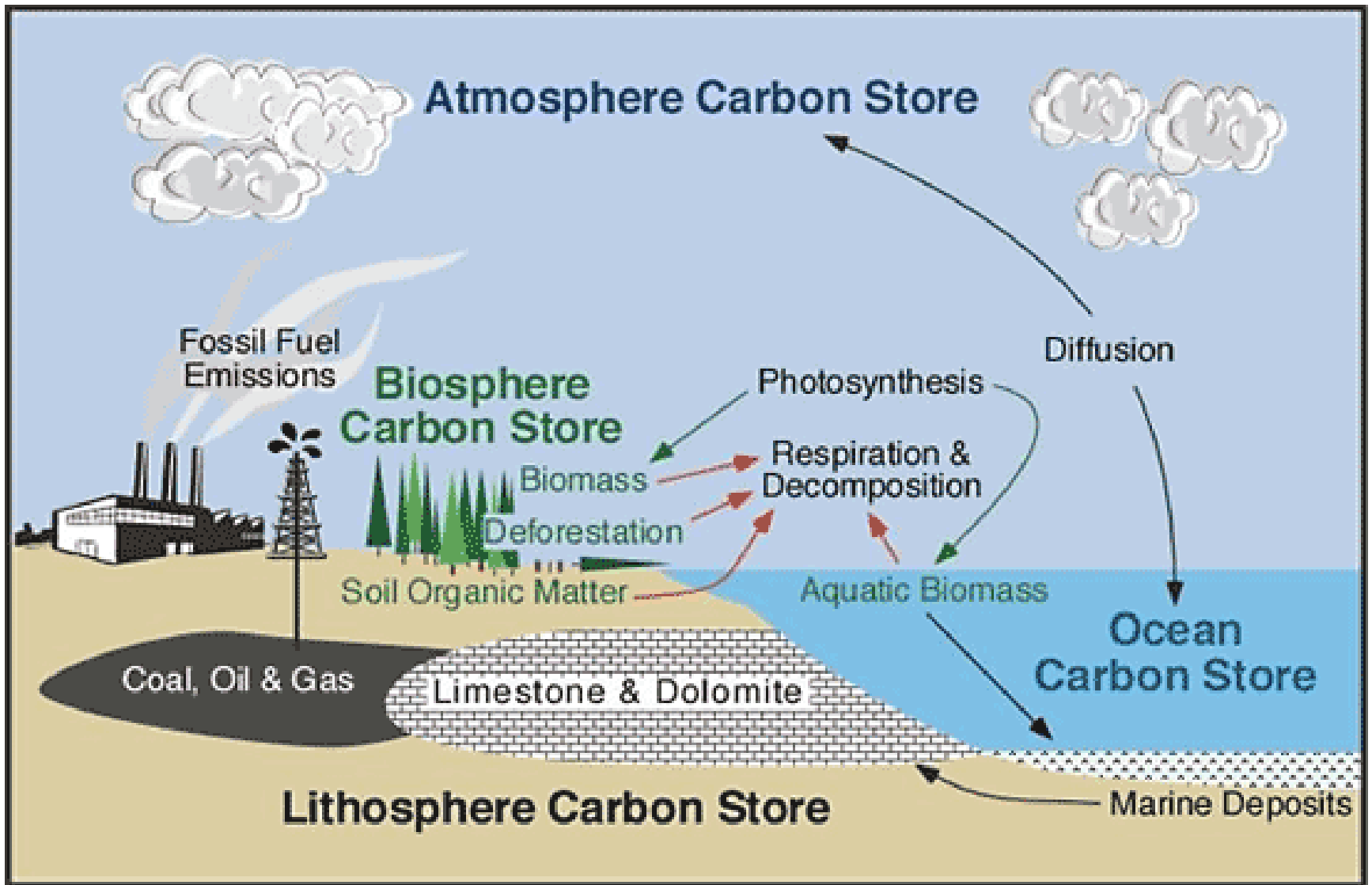
ESA and SOLAS: OceanFlux initiative has two generic aims:

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

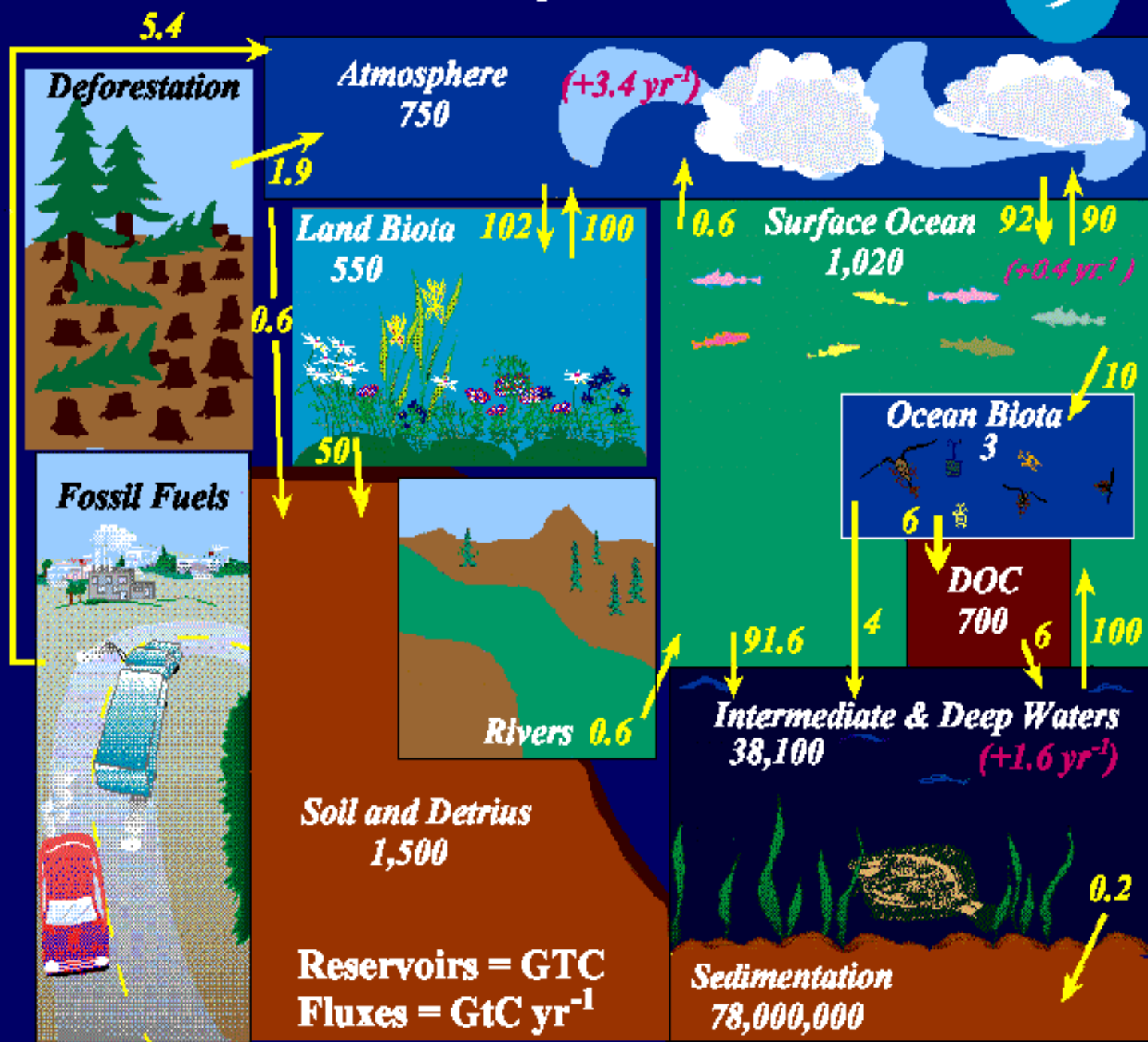
Following workshop in Toulouse in 2010, three *OceanFlux* projects:

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

Carbon cycle



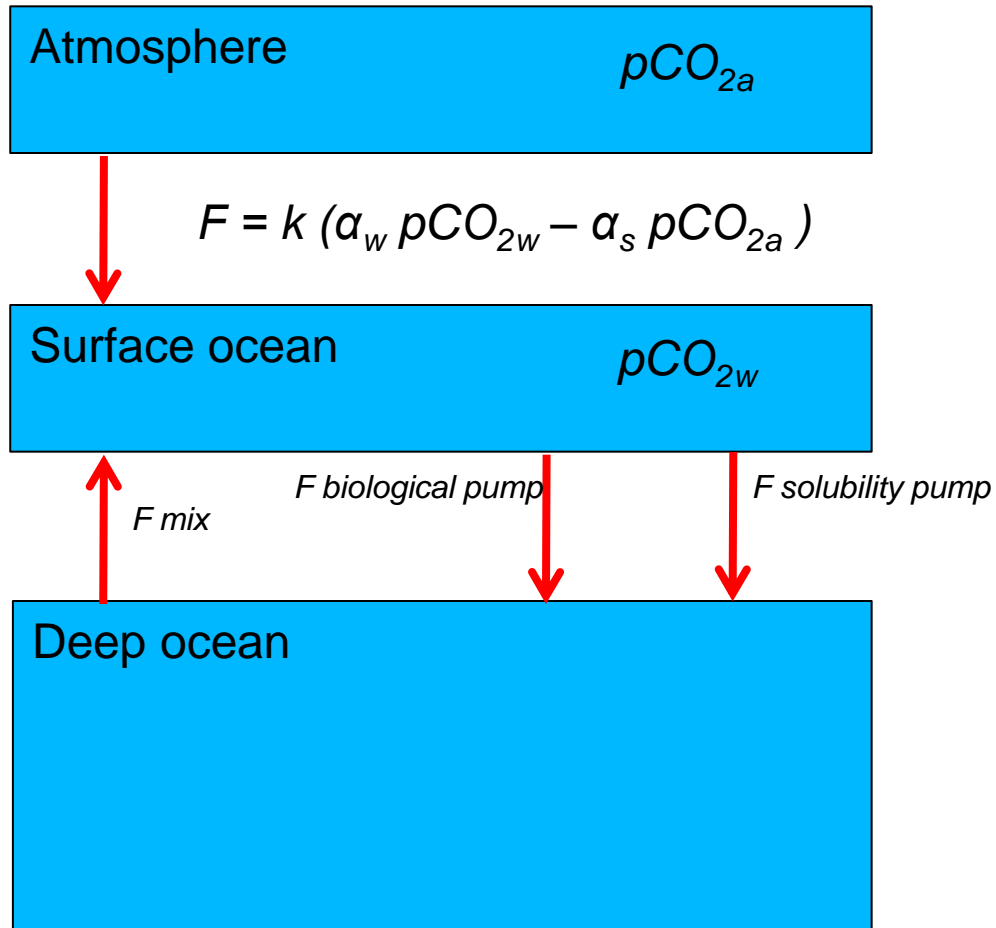
Global Carbon Cycle 1980-1989



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, S_c)

Other factors affecting k and flux

S_c , 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 $f\text{CO}_2$ from models

Data assimilation

Coastal CO_2 fluxes (Torres, Thursday pm)

“Cloud-based” processing system

Tasks I

Review (reference baseline documentation)

k

CO₂

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

$1^\circ \times 1^\circ$

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

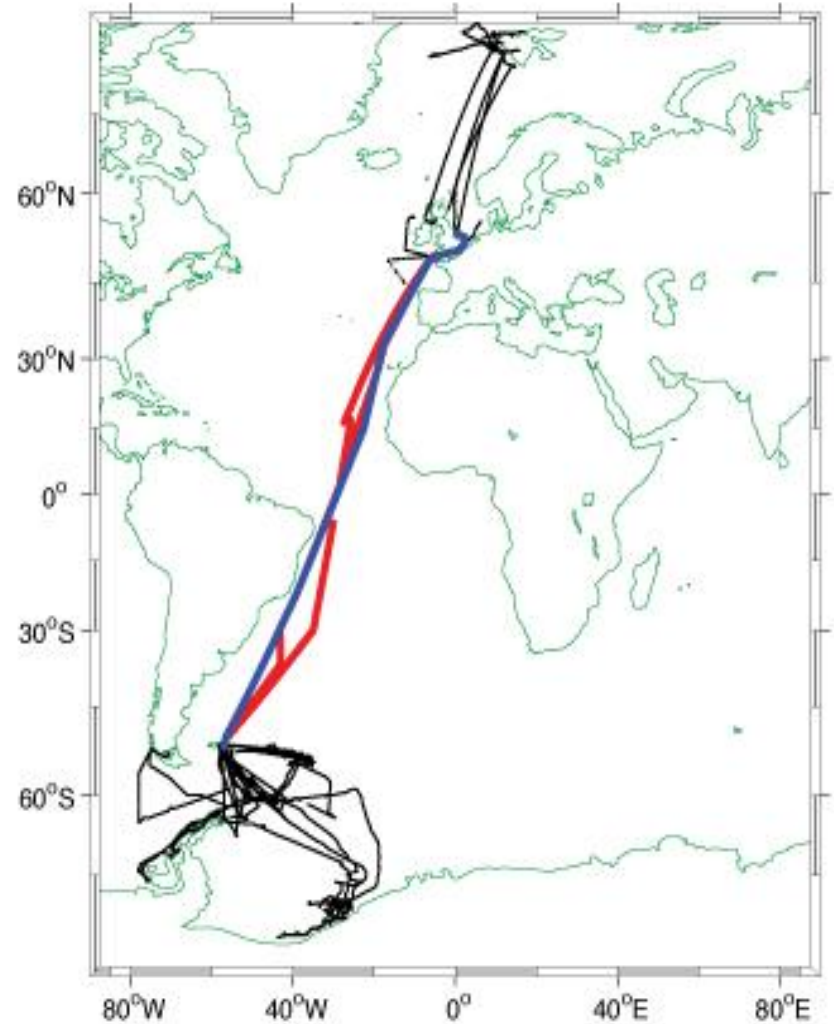
Papers from the project

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° x 1° climatology + processing tools

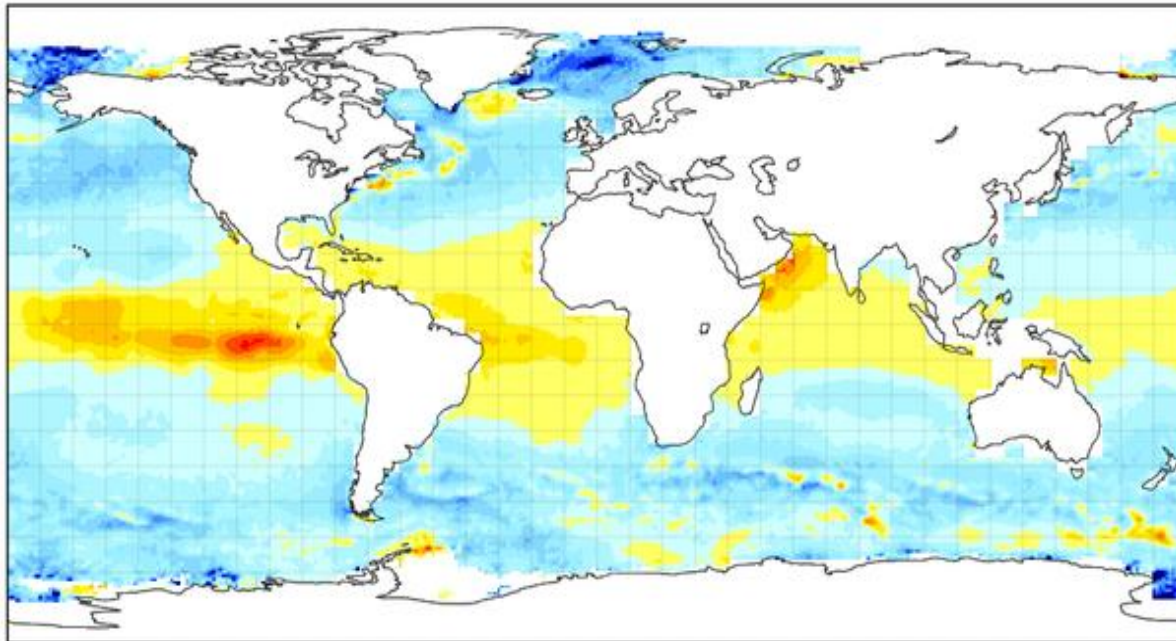
Uncertainty information

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

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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



Air-sea CO₂ flux using the kH06 Ho et al., 2006 gas transfer velocity (k) (g C m⁻² day⁻¹)



Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

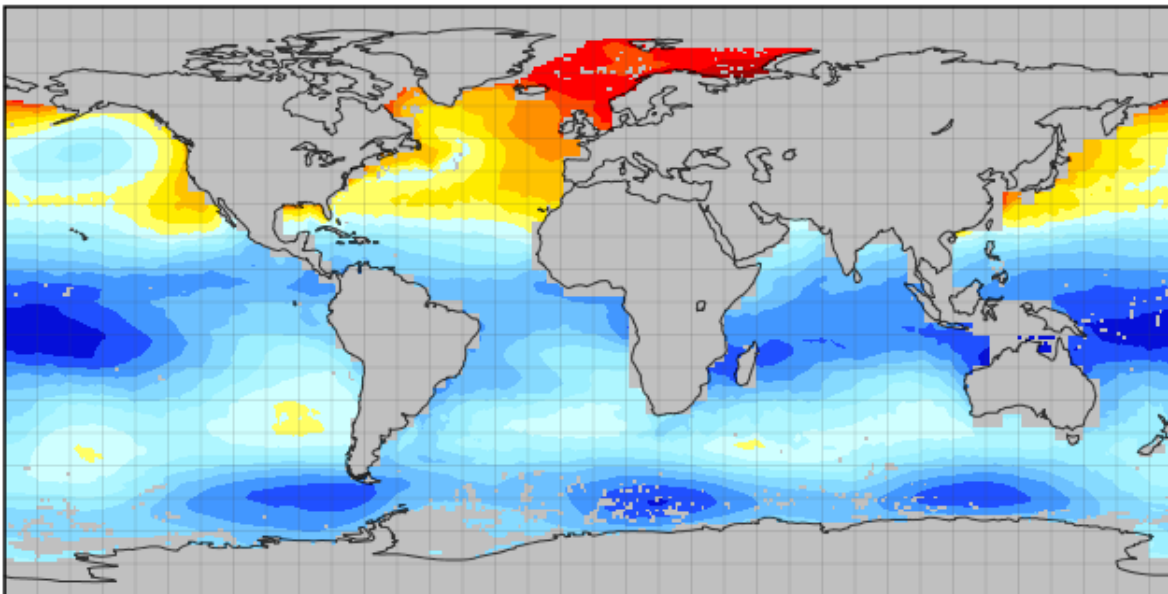
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

surface partial pressure (pCO₂) in air from climatology corrected using modelled sea level pressure



Water surface partial pressure (pCO₂) in air from climatology corrected using modelled sea level pressure (microatm)



Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

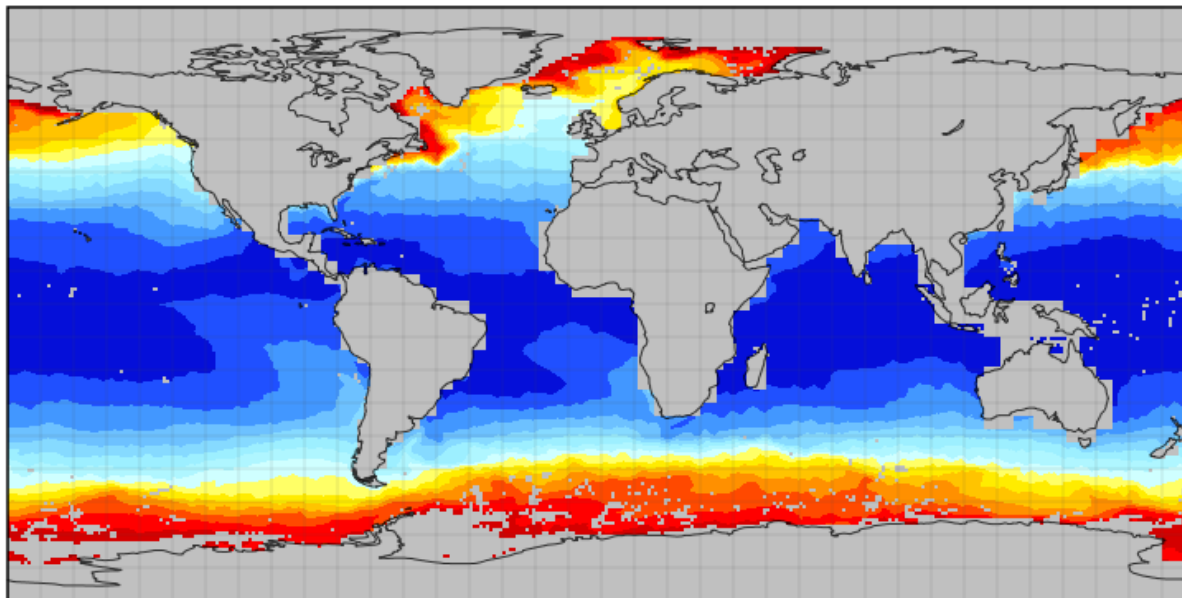
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

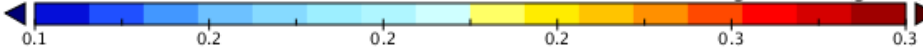
Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

Concentration of carbon dioxide at the sea water and air interface in g-C m⁻³



Concentration of carbon dioxide at the sea water and air interface in g-C m⁻³ (g m⁻³)



Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

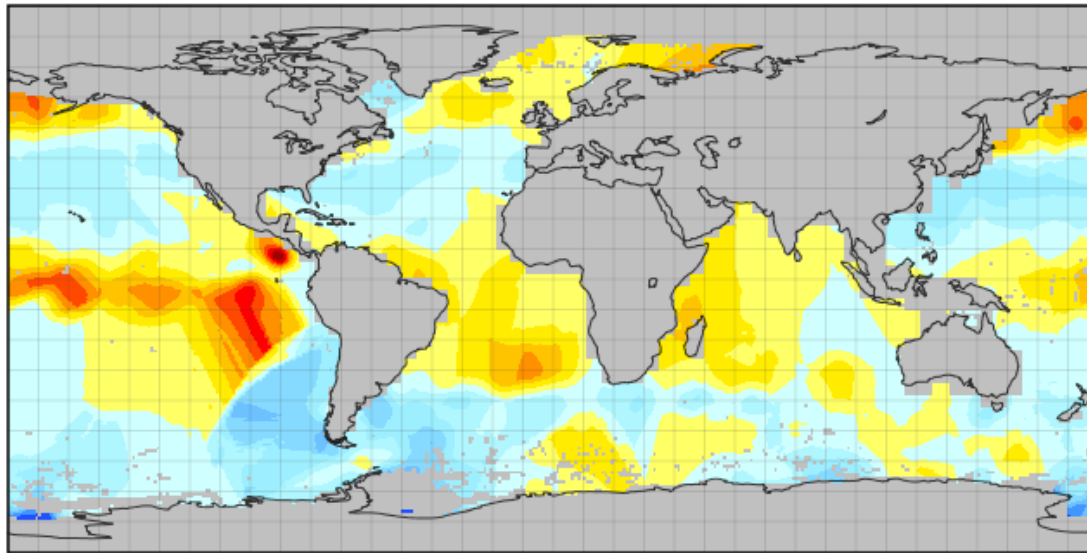
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

Sub skin partial pressure (pCO₂) of carbon dioxide



Sub skin partial pressure (pCO₂) of carbon dioxide (microatm)



Equiectional projection centered on 0.00°E

Data Min = 236.7, Max = 522.1

Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

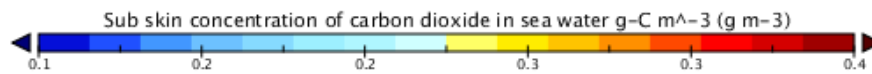
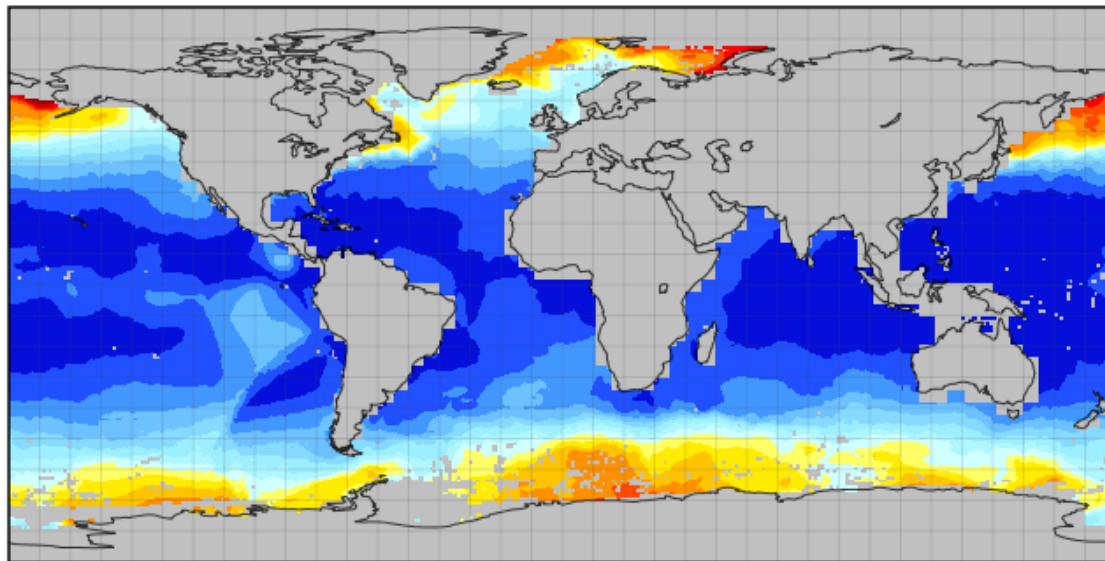
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

Sub skin concentration of carbon dioxide in sea water g-C m⁻³



Equiarectangular projection centered on 0.00°E

Data Min = 0.1, Max = 0.4

Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

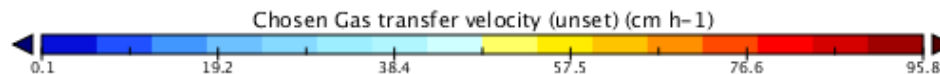
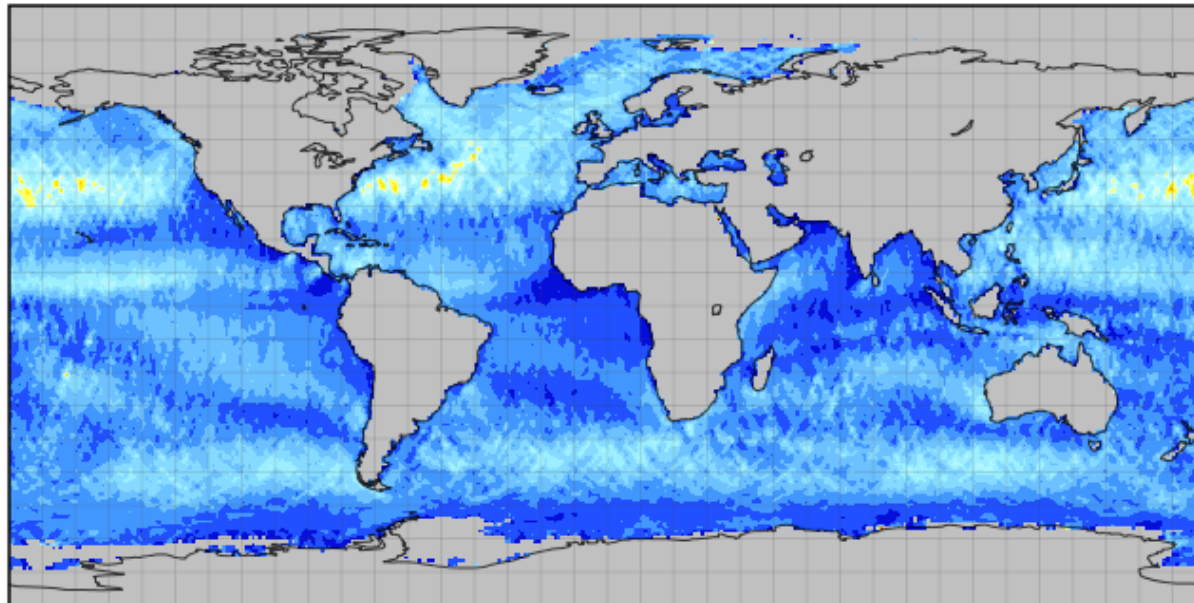
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

Chosen Gas transfer velocity (unset)



Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Global community data

Global regular grid 1° x 1° climatology + processing tools

Uncertainty information

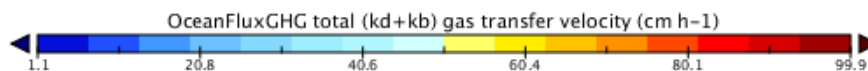
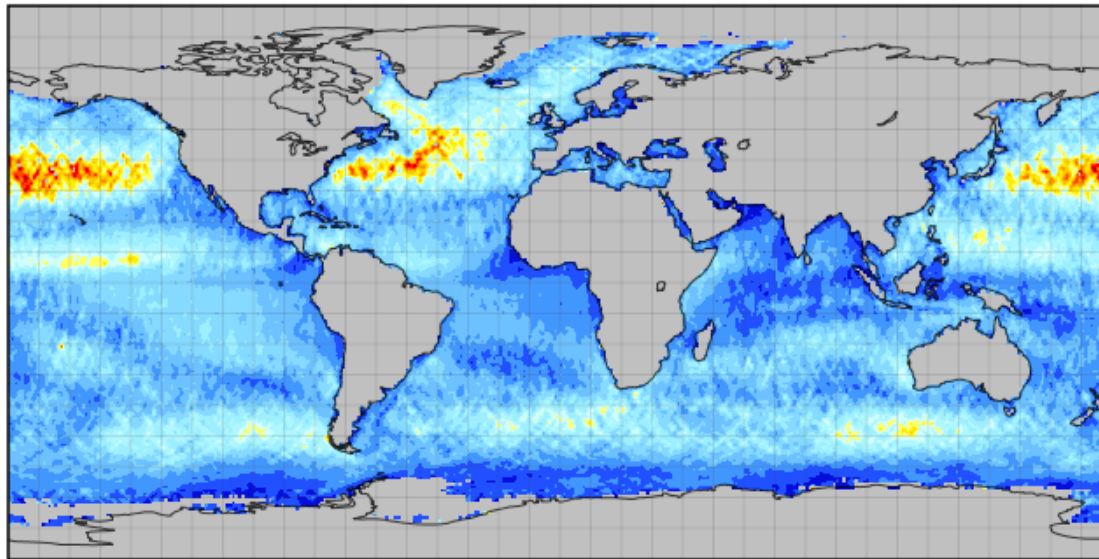
Attribute layers (inc surface biology, diurnal warming etc).

Normalised to 2010

Data at different depths (e.g. interfacial CO₂ concentrations, pCO₂ at base of micro-layer)

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

OceanFluxGHG total (kd+kb) gas transfer velocity



Equiarectangular projection centered on 0.00°E

Data Min = 1.1, Max = 99.9

Example
OceanFlux GHG
project output
Generated on the
Nephelae cloud.

OceanFlux GHG – Regional community data

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

Uncertainty estimates

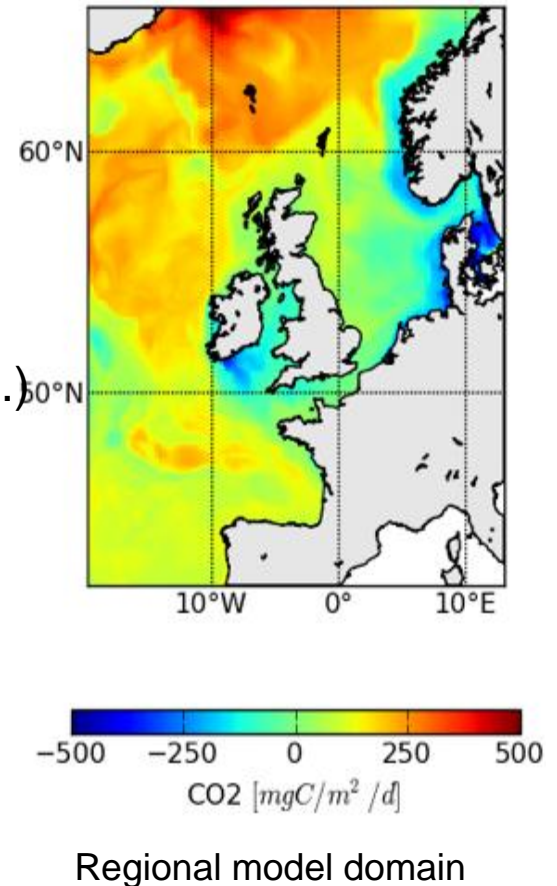
Data from ocean surface to floor (e.g. box data)

Normalised to 2010

Model includes EO data assimilation (biology)

Quantities: modelled pCO₂, salinity, solubility, SST + ..)

Towards being able to study fluxes in coastal regions.



OceanFlux GHG - Website

Site map | Contact

Oceanflux Greenhouse Gases

oceanflux ghg
support to science element

stse
esa

Ifremer | NHC | NOC | PML

The Project | Meetings & Events | Blog | News | Links | Contacts | Summary reports

Latest news

Zoom

Published on the 07/05/2012
From surf to satellite
About monitoring the whitecaps coverage
[Read the news](#) +

Published on the 29/03/2012
SMOS satellite data and high winds
The SMOS radiometer has the capability to provide quantitative and complementary surface wind information.
[Read the news](#) +

Published on the 27/02/2012
Progress report
The summary report of the first three months of the project is available.
[Read the news](#) +

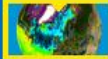
Partners

Ifremer [Access](#) +

National Oceanographic Center (NOC) [Access](#) +

North Highland College Environment Research Institute (NHC-ERI) [Access](#) +

The Project



Contact

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Mail : Fanny.Ardhuin@ifremer.fr

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User

Password

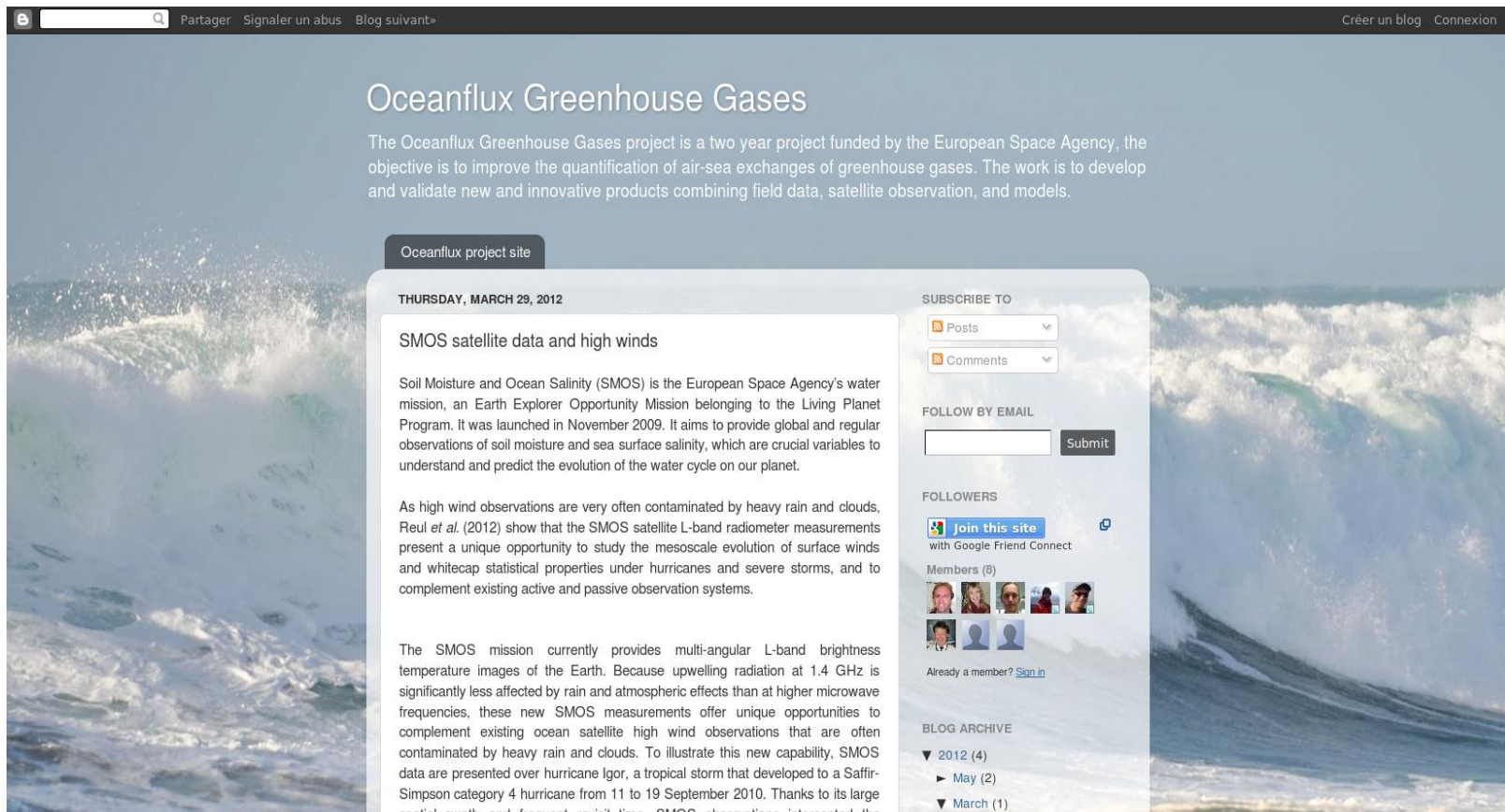
OK

OceanFlux GHG – community feedback

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

Reference User Group

Monthly summary reports



The screenshot shows a Blogger blog post from March 29, 2012. The post title is "SMOS satellite data and high winds". The main text discusses the SMOS mission and its capabilities in measuring soil moisture and sea surface salinity, particularly in high-wind conditions. The post includes a "SUBSCRIBE TO" section with dropdown menus for "Posts" and "Comments", a "FOLLOW BY EMAIL" section with a text input field and a "Submit" button, and a "FOLLOWERS" section with a "Join this site" button and a list of member avatars. A "BLOG ARCHIVE" section at the bottom shows a dropdown for the year "2012 (4)" and a list of months: "May (2)" and "March (1)". The background of the blog is a large image of a blue ocean with white-capped waves.

Partager Signaler un abus Blog suivant» Créer un blog Connexion

Oceanflux Greenhouse Gases

The Oceanflux Greenhouse Gases project is a two year project funded by the European Space Agency, the objective is to improve the quantification of air-sea exchanges of greenhouse gases. The work is to develop and validate new and innovative products combining field data, satellite observation, and models.

Oceanflux project site

THURSDAY, MARCH 29, 2012

SMOS satellite data and high winds

Soil Moisture and Ocean Salinity (SMOS) is the European Space Agency's water mission, an Earth Explorer Opportunity Mission belonging to the Living Planet Program. It was launched in November 2009. It aims to provide global and regular observations of soil moisture and sea surface salinity, which are crucial variables to understand and predict the evolution of the water cycle on our planet.

As high wind observations are very often contaminated by heavy rain and clouds, Reul *et al.* (2012) show that the SMOS satellite L-band radiometer measurements present a unique opportunity to study the mesoscale evolution of surface winds and whitecap statistical properties under hurricanes and severe storms, and to complement existing active and passive observation systems.

The SMOS mission currently provides multi-angular L-band brightness temperature images of the Earth. Because upwelling radiation at 1.4 GHz is significantly less affected by rain and atmospheric effects than at higher microwave frequencies, these new SMOS measurements offer unique opportunities to complement existing ocean satellite high wind observations that are often contaminated by heavy rain and clouds. To illustrate this new capability, SMOS data are presented over hurricane Igor, a tropical storm that developed to a Saffir-Simpson category 4 hurricane from 11 to 19 September 2010. Thanks to its large spatial swath and frequent revisit time, SMOS observations intercepted the

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BLOG ARCHIVE

▼ 2012 (4)

► May (2)

▼ March (1)

OceanFlux GHG - Brochure

