

# Présentation du Global Carbon Atlas

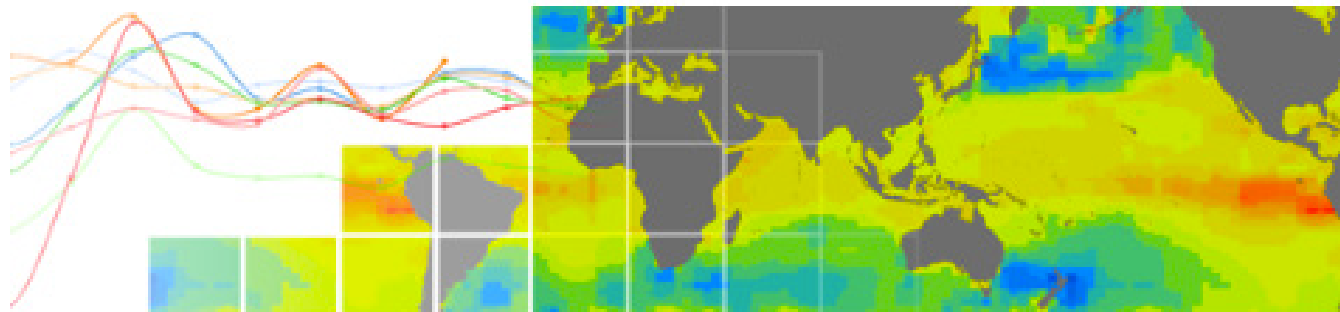
Publié conjointement avec le bilan du CO<sub>2</sub>

# 2013

# Pourquoi un Atlas Global du Carbone ?

- L'augmentation du CO<sub>2</sub> est la première cause du dérèglement climatique
- Les émissions de CO<sub>2</sub> sont en forte croissance
- Besoin de données fiables, publiques et publiées
- Besoin d'informations simples, pour différents utilisateurs

**Avec le soutien financier de la fondation BNP-Paribas, le Global Carbon Project a mobilisé les laboratoires de recherche du monde entier pour mettre en ligne des données scientifiques récentes sur le cycle du carbone**



Earth Syst. Sci. Data Discuss., 6, 689–760, 2013  
 www.earth-syst-sci-data-discuss.net/6/689/2013/  
 doi:10.5194/essdd-6-689-2013  
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Open Access  
 Earth System  
 Science  
 Data  
 Discussions

This discussion paper is/has been under review for the journal Earth System Science Data (ESSD). Please refer to the corresponding final paper in ESSD if available.

## Global carbon budget 2013

C. Le Quéré<sup>1</sup>, G. P. Peters<sup>2</sup>, R. J. Andres<sup>3</sup>, R. M. Andrew<sup>2</sup>, T. Boden<sup>3</sup>, P. Ciais<sup>4</sup>, P. Friedlingstein<sup>5</sup>, R. A. Houghton<sup>6</sup>, G. Marland<sup>7</sup>, R. Moriarty<sup>1</sup>, S. Sitch<sup>8</sup>, P. Tans<sup>9</sup>, A. Arneth<sup>10</sup>, A. Arvanitis<sup>10</sup>, D. C. E. Bakker<sup>11</sup>, L. Bopp<sup>4</sup>, J. G. Canadell<sup>12</sup>, L. P. Chini<sup>13</sup>, S. C. Doney<sup>14</sup>, A. Harper<sup>15</sup>, I. Harris<sup>16</sup>, J. I. House<sup>17</sup>, A. K. Jain<sup>18</sup>, S. D. Jones<sup>1</sup>, E. Kato<sup>19</sup>, R. F. Keeling<sup>20</sup>, K. Klein Goldewijk<sup>21</sup>, A. Körtzinger<sup>22</sup>, C. Koven<sup>23</sup>, N. Lefèvre<sup>24</sup>, A. Omar<sup>25</sup>, T. Ono<sup>26</sup>, G.-H. Park<sup>27</sup>, B. Pfeil<sup>25,28</sup>, B. Poulter<sup>4</sup>, M. R. Raupach<sup>12</sup>, P. Regnier<sup>29</sup>, C. Rödenbeck<sup>30</sup>, S. Saito<sup>31</sup>, J. Schwinger<sup>25,28</sup>, J. Segsneider<sup>32</sup>, B. D. Stocker<sup>33</sup>, B. Tilbrook<sup>34</sup>, S. van Heuven<sup>35</sup>, N. Viovy<sup>4</sup>, R. Wanninkhof<sup>36</sup>, A. Wiltshire<sup>37</sup>, S. Zaehle<sup>30</sup>, and C. Yue<sup>4</sup>

Corinne Le Quéré  
[c.lequere@uea.ac.uk](mailto:c.lequere@uea.ac.uk)

More information, data sources and data files at  
[www.globalcarbonproject.org](http://www.globalcarbonproject.org)

## GLOBAL CARBON ATLAS

The Global Carbon Atlas is a platform to explore and visualize the most up-to-date data on carbon fluxes resulting from human activities and natural processes.

Human impacts on the carbon cycle are the most important cause of climate change.

### OUTREACH

Take a journey through the history and future of human development and carbon

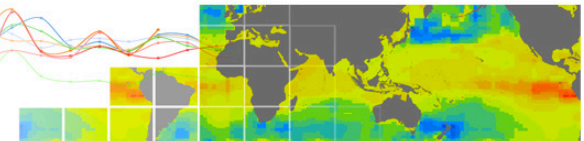


### EMISSIONS

Explore and download global and country level carbon emissions from human activity.

### RESEARCH

Explore and visualize research carbon data, and get access through data providers



Philippe Ciais  
[philippe.ciais@lscce.ipsl.fr](mailto:philippe.ciais@lscce.ipsl.fr)

More information, data sources and data files at  
[www.globalcarbonatlas.org](http://www.globalcarbonatlas.org)

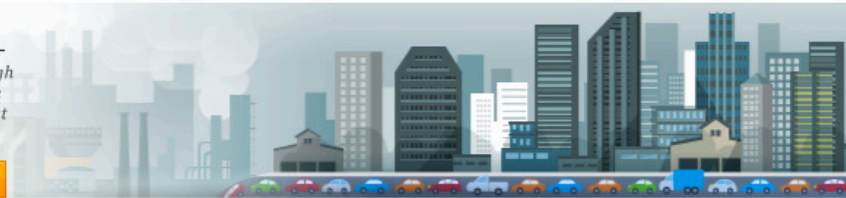


## GLOBAL CARBON ATLAS

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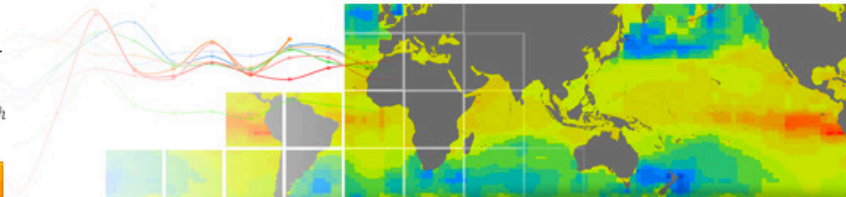
### EMISSIONS

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### RESEARCH

Explore and visualize research carbon data, and get access through data providers



**Grand public :**  
l'évolution du CO2 et le changement climatique pour les scénarios IPCC

**Scientifiques :**  
visualisation des cartes de flux naturels, avec les résultats de plus de 50 modèles

**Experts :**  
visualisation interactive des émissions de CO<sub>2</sub> fossile, jusqu'en 2012

## Des données transparentes et vérifiables, publiées le 19 Novembre pour le bilan de CO<sub>2</sub> de l'année 2012

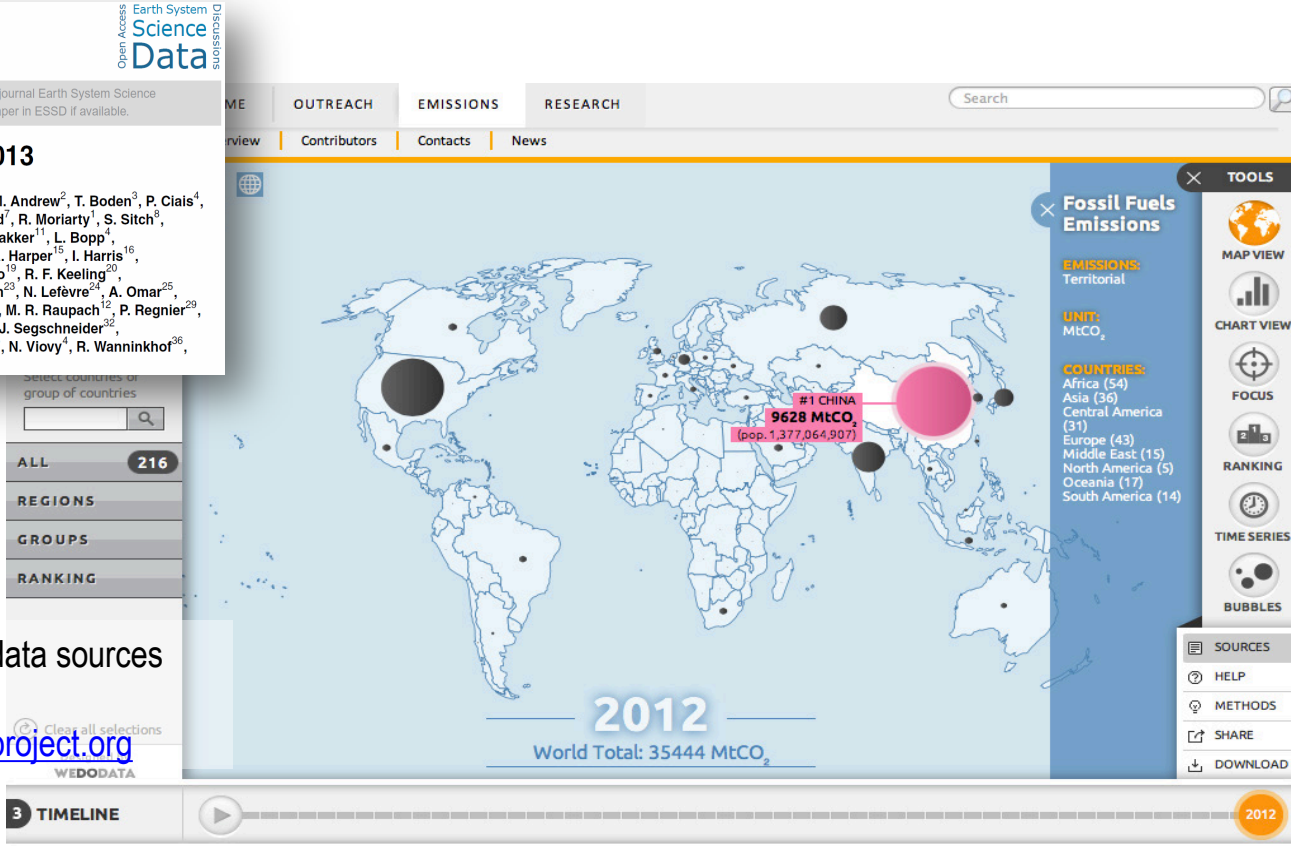
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 Science  
 Data

This discussion paper is/has been under review for the Journal Earth System Science Data (ESSD). Please refer to the corresponding final paper in ESSD if available.

### Global carbon budget 2013

C. Le Quéré<sup>1</sup>, G. P. Peters<sup>2</sup>, R. J. Andres<sup>3</sup>, R. M. Andrew<sup>2</sup>, T. Boden<sup>3</sup>, P. Ciais<sup>4</sup>, P. Friedlingstein<sup>5</sup>, R. A. Houghton<sup>6</sup>, G. Marland<sup>7</sup>, R. Moriarty<sup>1</sup>, S. Stith<sup>8</sup>, P. Tans<sup>9</sup>, A. Arnett<sup>10</sup>, A. Arvanitis<sup>10</sup>, D. C. E. Bakker<sup>11</sup>, L. Bopp<sup>4</sup>, J. G. Canadell<sup>12</sup>, L. P. Chini<sup>13</sup>, S. C. Doney<sup>14</sup>, A. Harper<sup>15</sup>, I. Harris<sup>16</sup>, J. I. House<sup>17</sup>, A. K. Jain<sup>18</sup>, S. D. Jones<sup>1</sup>, E. Kato<sup>19</sup>, R. F. Keeling<sup>20</sup>, K. Klein Goldewijk<sup>21</sup>, A. Körtzinger<sup>22</sup>, C. Koven<sup>23</sup>, N. Lefèvre<sup>24</sup>, A. Omar<sup>25</sup>, T. Ono<sup>26</sup>, G.-H. Park<sup>27</sup>, B. Pfeil<sup>25,28</sup>, B. Poulter<sup>4</sup>, M. R. Raupach<sup>12</sup>, P. Regnier<sup>29</sup>, C. Rödenbeck<sup>30</sup>, S. Saito<sup>31</sup>, J. Schwinger<sup>25,28</sup>, J. Segsneider<sup>32</sup>, B. D. Stocker<sup>33</sup>, B. Tilbrook<sup>34</sup>, S. van Heuven<sup>35</sup>, N. Viovy<sup>4</sup>, R. Wanninkhof<sup>36</sup>, A. Wiltshire<sup>37</sup>, S. Zaehle<sup>30</sup>, and C. Yue<sup>4</sup>



More information, data sources and data files at [www.globalcarbonproject.org](http://www.globalcarbonproject.org)

**Boden, TA, G Marland, and RJ Andres. 2013.** Global, Regional, and National Fossil-Fuel CO<sub>2</sub> Emissions. Carbon Dioxide Information Analysis Center (CDIAC), Oak Ridge National Laboratory, US Department of Energy, Oak Ridge, Tenn., USA doi:10.3334/CDIAC/00001\_V2013

**1 COUNTRIES**  
Select one country for detail  
Select two countries for comparison

**ALL** **1**

**REGIONS**

**GROUPS**

**2 EMISSIONS**  
Click on emission type below to see the graphics

Territorial **1**

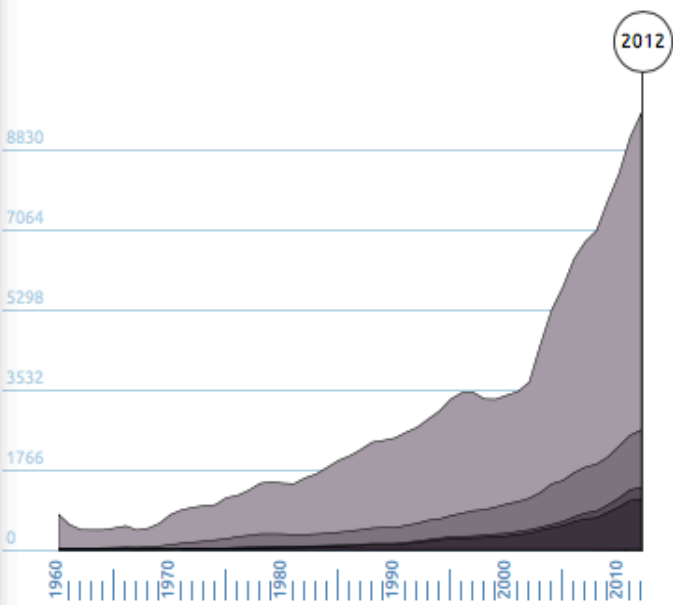
Consumption **2**

Per GDP **3**

Per capita **4**

## CHINA Territorial emissions

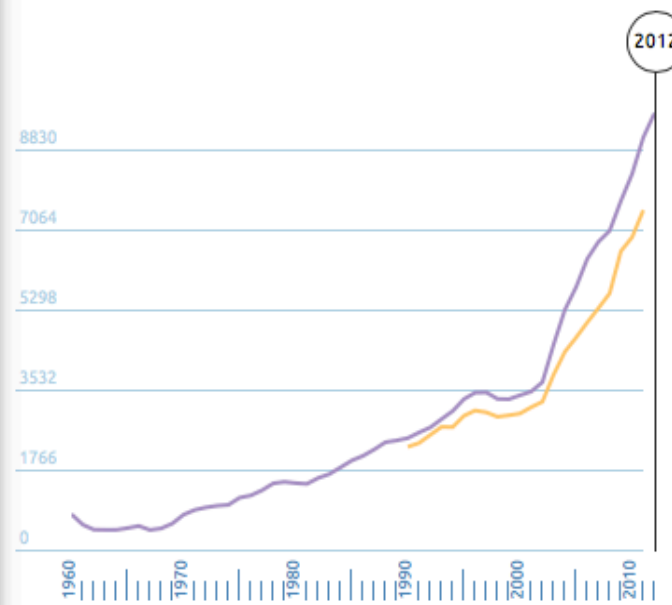
Territorial   
 1990 - 2012   
 Growth Index per year  6.2%  2011 - 2012  5.9%



Emissions	MtCO <sub>2</sub> (2012)
Coal	6990
Oil	1265
Gas	265
Flaring	No data for selected year
Cement	1108

## CHINA Consumption emissions

Territorial   
 1990 - 2012   
 Growth Index per year  6.2%  2011 - 2012  5.9%



Emissions	MtCO <sub>2</sub> (2012)
Consumption	No data for selected year
Territorial	9628

**TOOLS**



MAP VIEW



CHART VIEW



FOCUS



RANKING



TIME SERIES



BUBBLES

SOURCES

HELP

METHODS

SHARE

DOWNLOAD



**1 COUNTRIES**  
 Select one country for detail  
 Select two countries for comparison

**ALL** 1

**REGIONS**

**GROUPS**

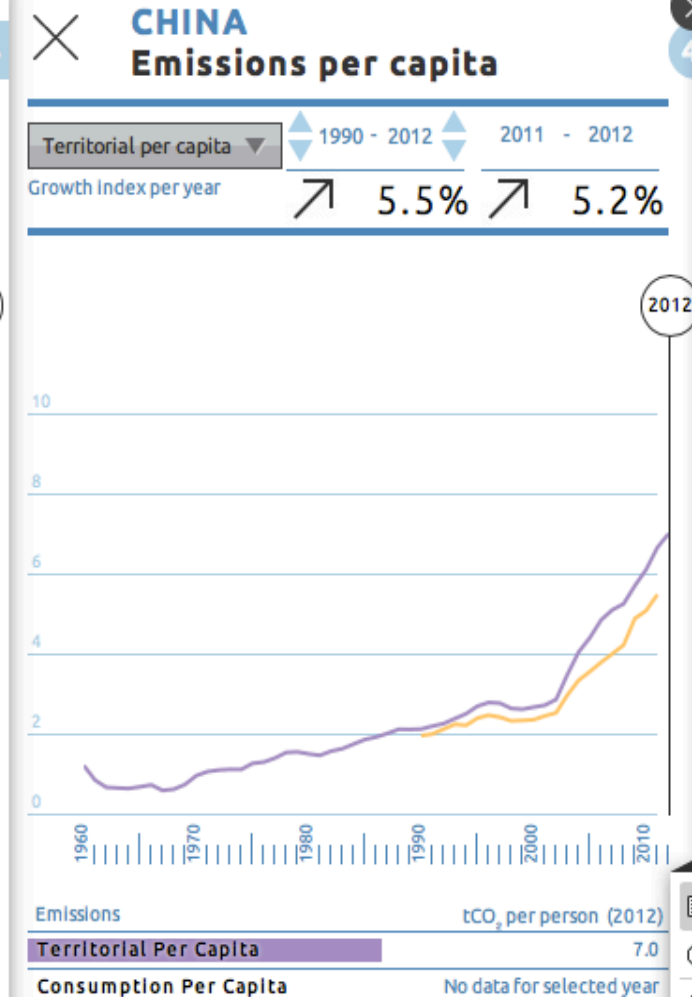
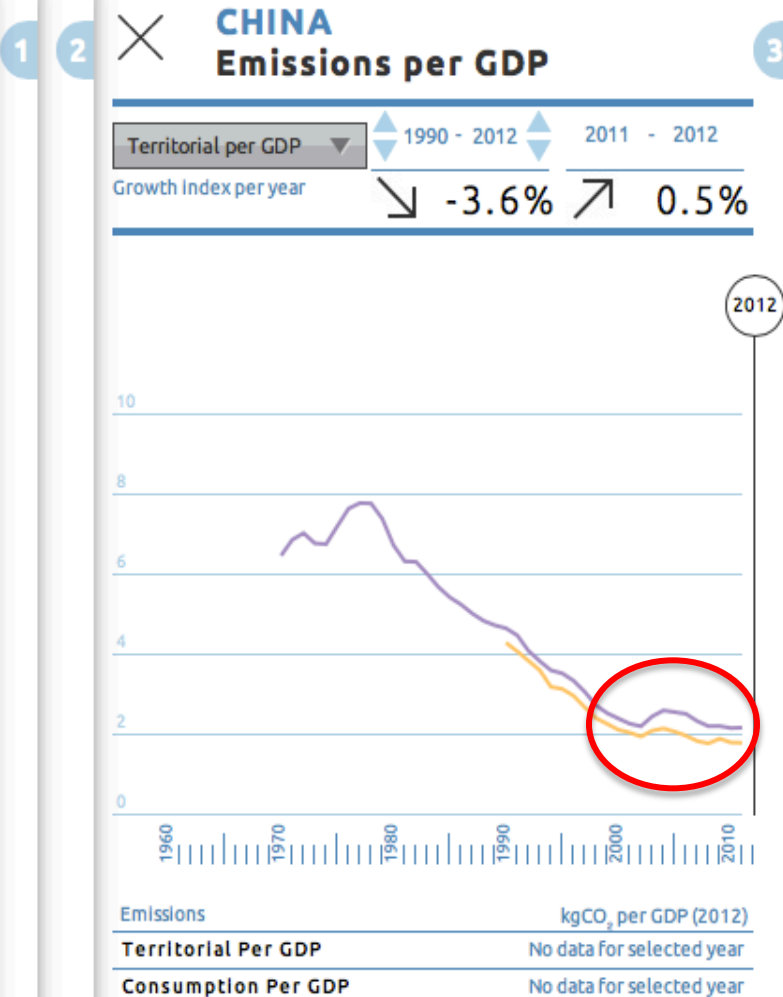
**2 EMISSIONS**  
 Click on emission type below to see the graphics

Territorial 1

Consumption 2

Per GDP 3

Per capita 4



**TOOLS**

MAP VIEW

CHART VIEW

FOCUS

RANKING

TIME SERIES

BUBBLES

---

SOURCES

HELP

METHODS

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DOWNLOAD

**1 COUNTRIES**

Select up to 10 countries

**ALL** **7**

**REGIONS**

**GROUPS**

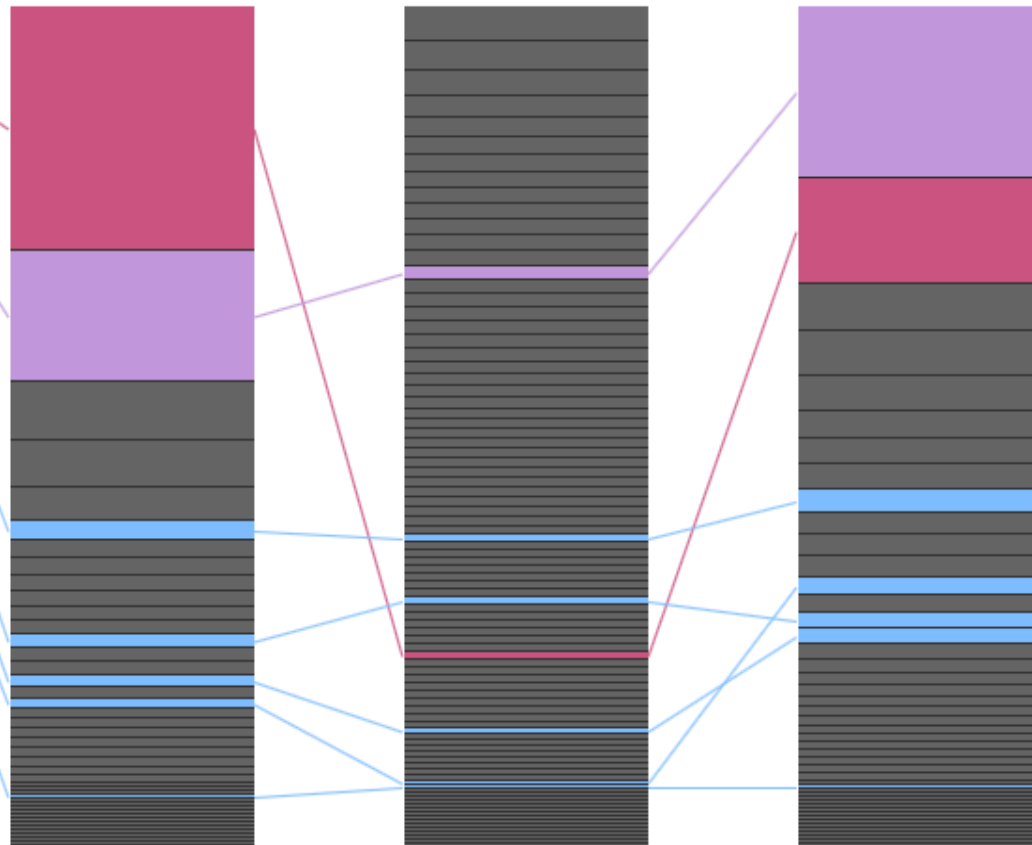
**HIGHLIGHT**

- China X
- USA X
- Germany X
- United Kingdom X
- Italy X
- France X
- Sweden X

Territorial  MtCO<sub>2</sub>

Territorial  tCO<sub>2</sub> / person

Oil  MtCO<sub>2</sub>



**TOOLS**

- 
- 
- 
- 
- 
- 

- 
- 
- 
- 
- 

Designed by **WEDODATA**



**1 COUNTRIES**

Select one country for detail  
Select two countries for comparison

**ALL** 1

**REGIONS**

**GROUPS**

**2 EMISSIONS**

Click on emission type below to see the graphics

Territorial 1

Consumption 2

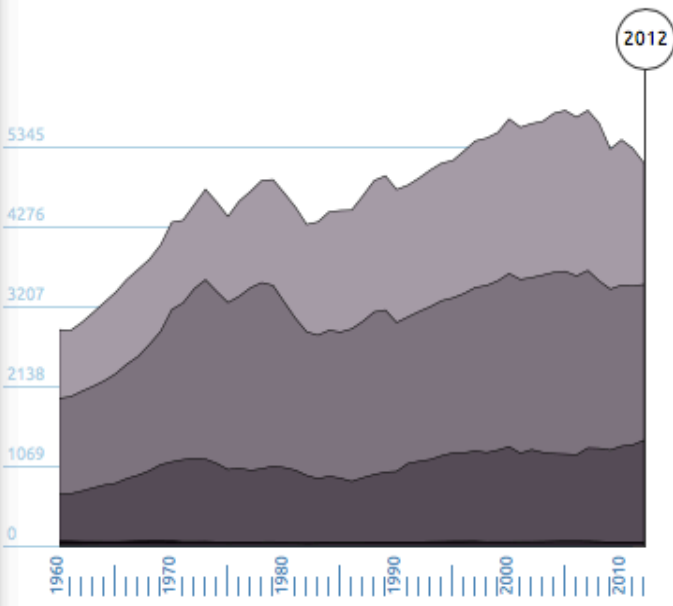
Per GDP 3

Per capita 4

## UNITED STATES OF AMERICA Territorial emissions

Territorial 1990 - 2012 2011 - 2012

Growth Index per year ↗ 0.5% ↘ -3.7%

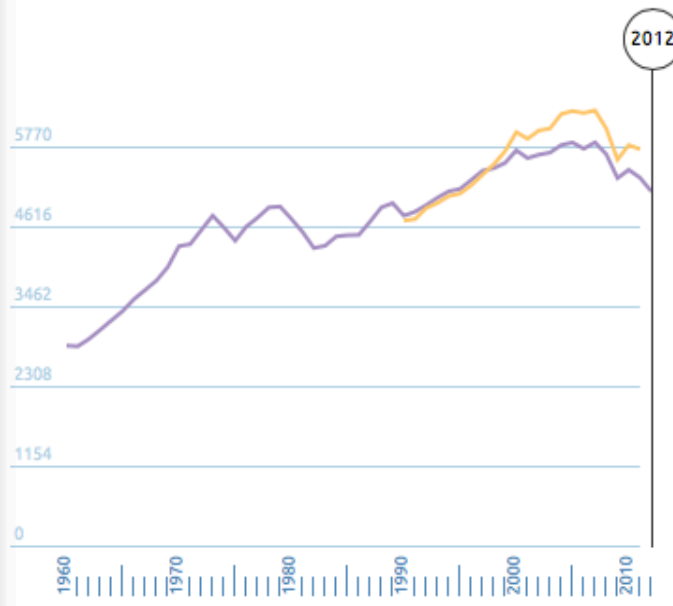


Emissions	MtCO <sub>2</sub> (2012)
Coal	1626
Oil	2086
Gas	1364
Flaring	8.9
Cement	37

## UNITED STATES OF AMERICA Consumption emissions

Territorial 1990 - 2012 2011 - 2012

Growth Index per year ↗ 0.5% ↘ -3.7%



Emissions	MtCO <sub>2</sub> (2012)
Consumption	No data for selected year
Territorial	5122

**TOOLS**

MAP VIEW

CHART VIEW

FOCUS

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HELP

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SHARE

DOWNLOAD

**1 MODE**  
Visualize 1 emission for several countries

**COUNTRIES**

**2 EMISSIONS**  
Select one emission type and a unit

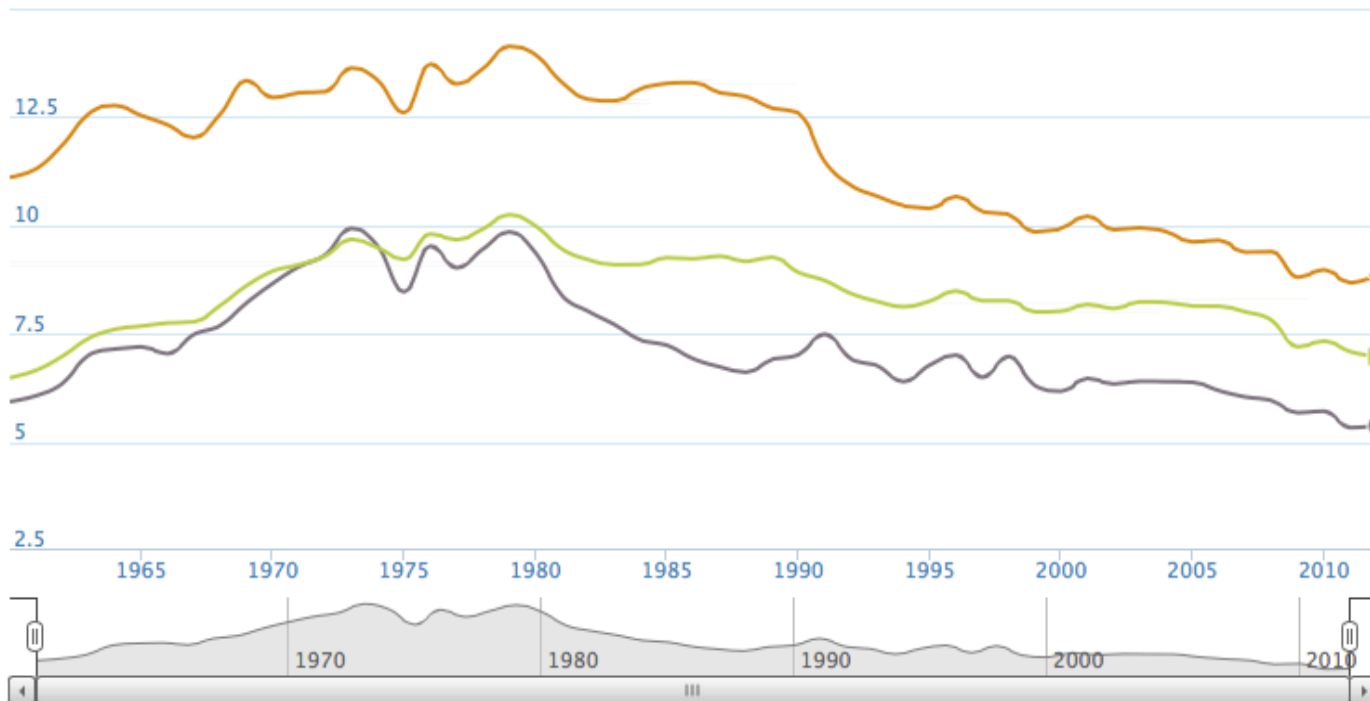
**TYPE**

**UNITS**

**3 COUNTRIES**  
Select up to 10 countries

## Territorial emission Per capita (tCO<sub>2</sub>/person)



2012

X France	5.4
X Germany	8.8
X EU28	7.0

TOOLS

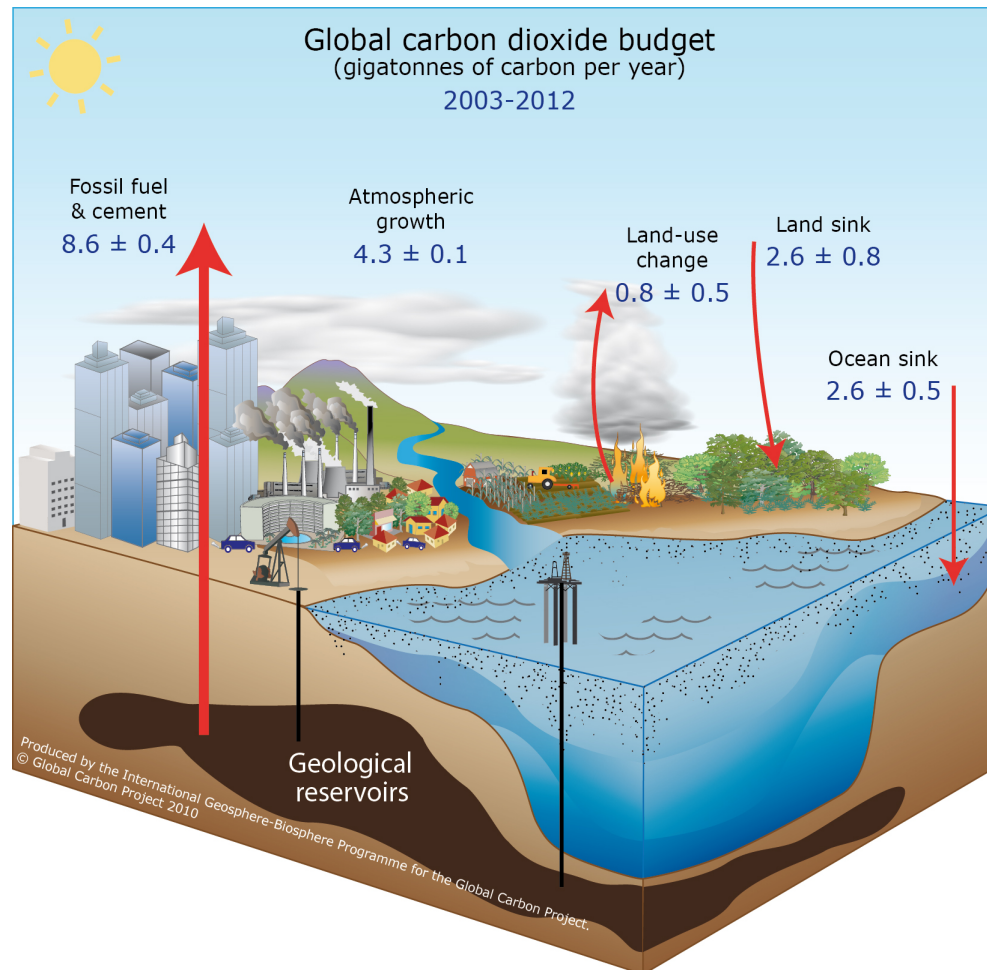
- MAP VIEW
- CHART VIEW
- FOCUS
- RANKING
- TIME SERIES
- BUBBLES

- SOURCES
- HELP
- METHODS
- SHARE
- DOWNLOAD

Clear all selections

# Le bilan global du CO<sub>2</sub> émis par l'Homme

Une fraction des émissions sont absorbées par les puits de carbone naturels



# Emissions et puits - moyenne de 2003 à 2012

8.6 ± 0.4 GtC/yr 92%



0.8 ± 0.5 GtC/yr 8%



4.3 ± 0.1 GtC/yr 45%



2.6 ± 0.8 GtC/yr 27%

Calculated as the residual of all other flux components



2.6 ± 0.5 GtC/yr 27%



+

## CARBON STORY

## Visualizing human impact

SO FAR  IN 2012

PAST

PRESENT >

FUTURE

SOURCES

SHARE

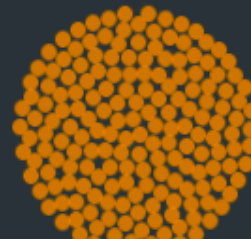
WHERE DOES IT COME FROM?

WHO PRODUCED IT?

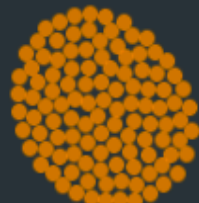
WHERE DOES IT GO?

WHEN WAS IT EMITTED?

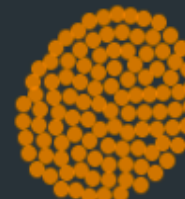
● = 100 Mt of CO<sub>2</sub> (human emissions in 2012)



IN THE ATMOSPHERE



ON LAND



IN THE OCEAN

Both the ocean and land are continuing to remove emissions. Year-to-year variations are the largest on land, with some years being the most important cleaner of atmospheric carbon dioxide while others contributing little.

WHAT'S NEXT?

Take a look at the future >

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## CARBON STORY

### 2000s

**Urbanization and energy**  
 Over half of the global population lives in urban areas with an associated consumption of about 70% of the world primary energy. An additional 2.8 billion people, largely from developing countries, are to join the urban world with its higher energy consumption, by 2050. >Fifth assessment of IPCC says: 'It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century'.

**HUMAN IMPACT SO FAR**  
 1,465 GtCO<sub>2</sub>

**WHAT NOW?**  
 Analyse the present

**Concentration of CO<sub>2</sub> in the atmosphere (ppm)**

Year	CO <sub>2</sub> Concentration (ppm)
800,000 BC	~200
400,000 BC	~200
100,000 BC	~200
1800	~280
1860	~290
1900	~300
1920	~310
1955	~320
1965	~330
1995	~350
2013	~390

← PAST | PRESENT | FUTURE | SOURCES | SHARE

← | WHAT NOW? | →

← Pre-Industrial Era

YOU ARE HERE

Designed by WEDODATA



- Il est important de pouvoir échanger les résultats des modèles et de les comparer pour quantifier et comprendre les incertitudes
- Pour la sortie du Global Carbon Atlas, plus de 25 laboratoires de recherche ont accepté de partager les sorties:



Des modèles du carbone  
océanique



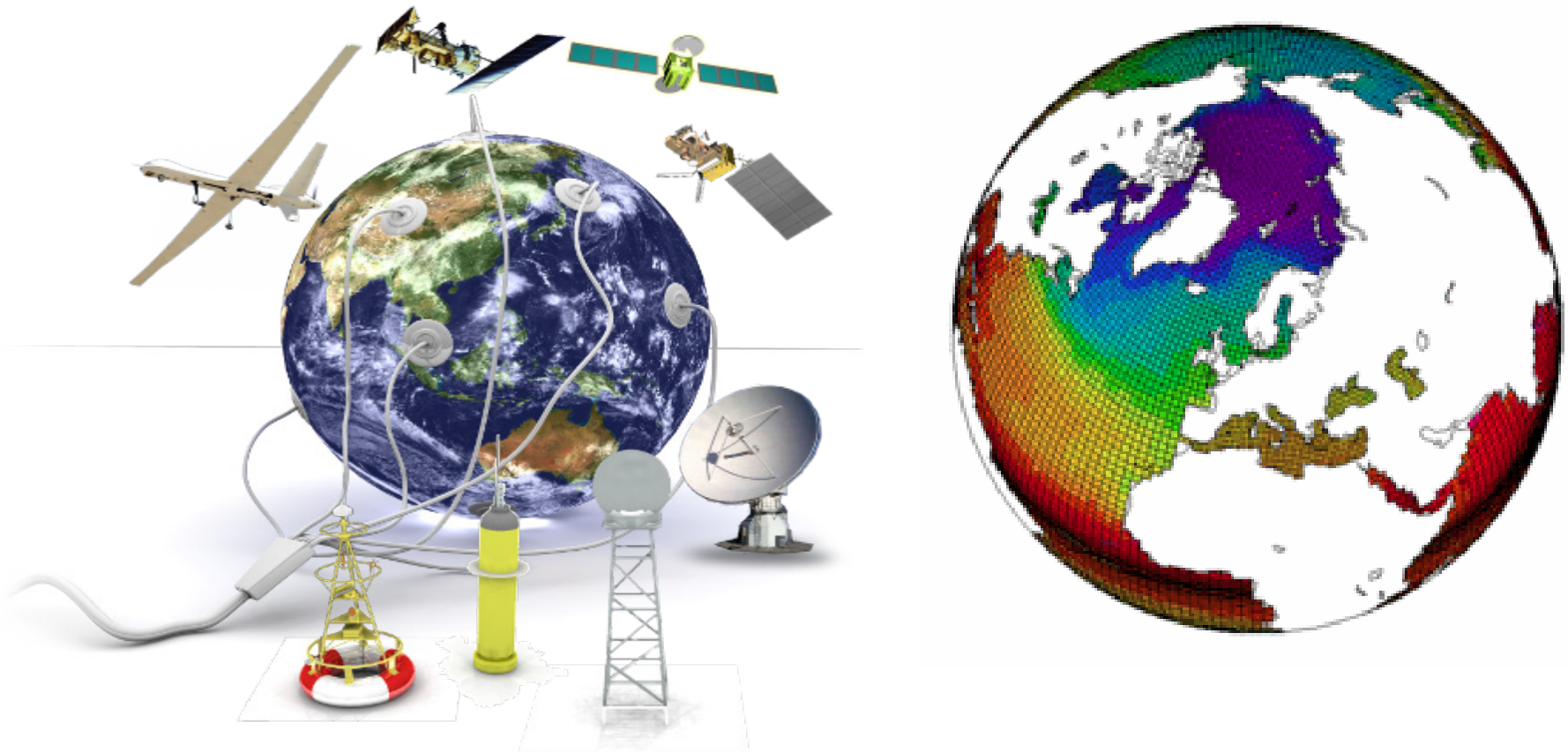
Des inversions  
atmosphériques



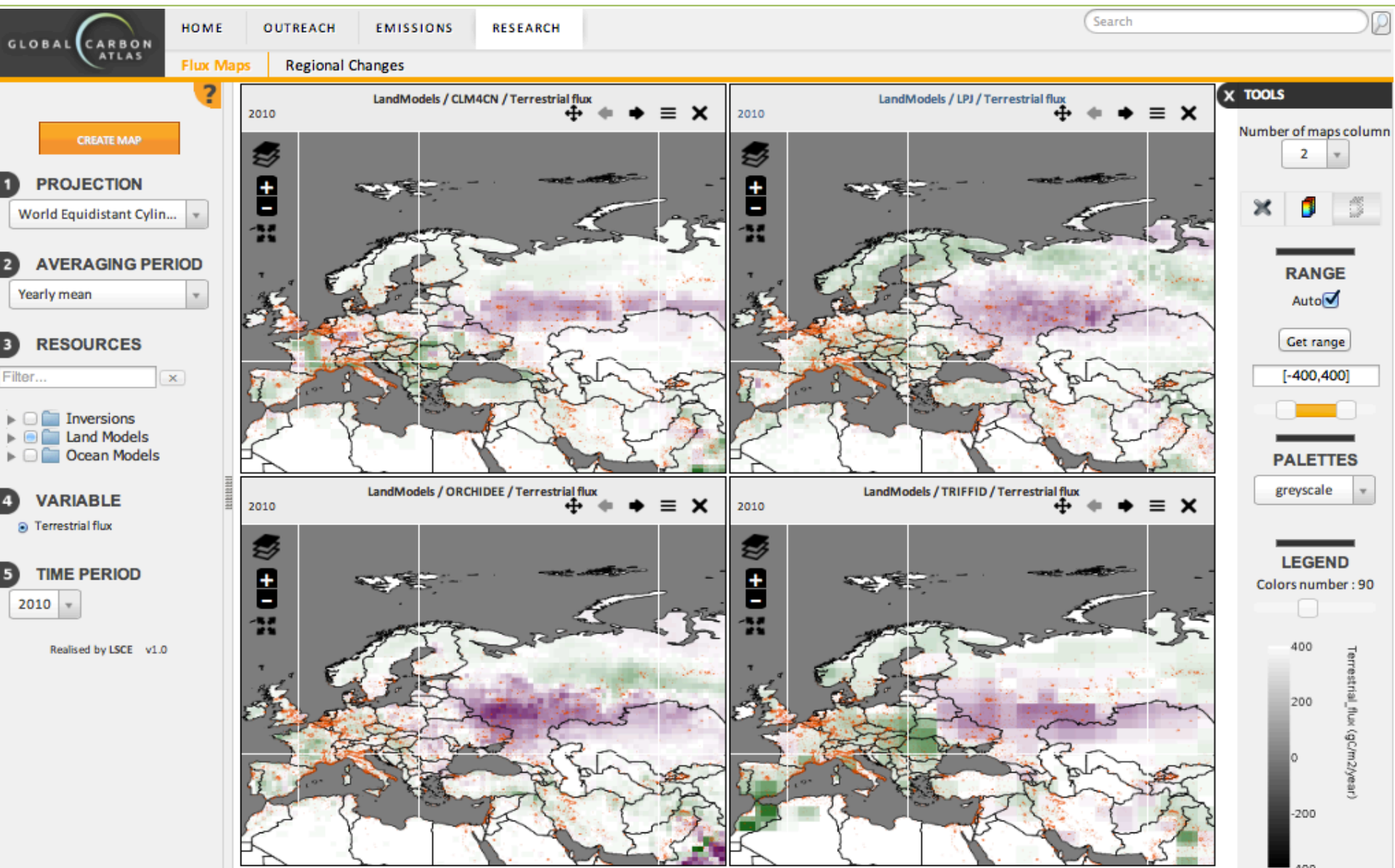
Des modèles de  
végétation

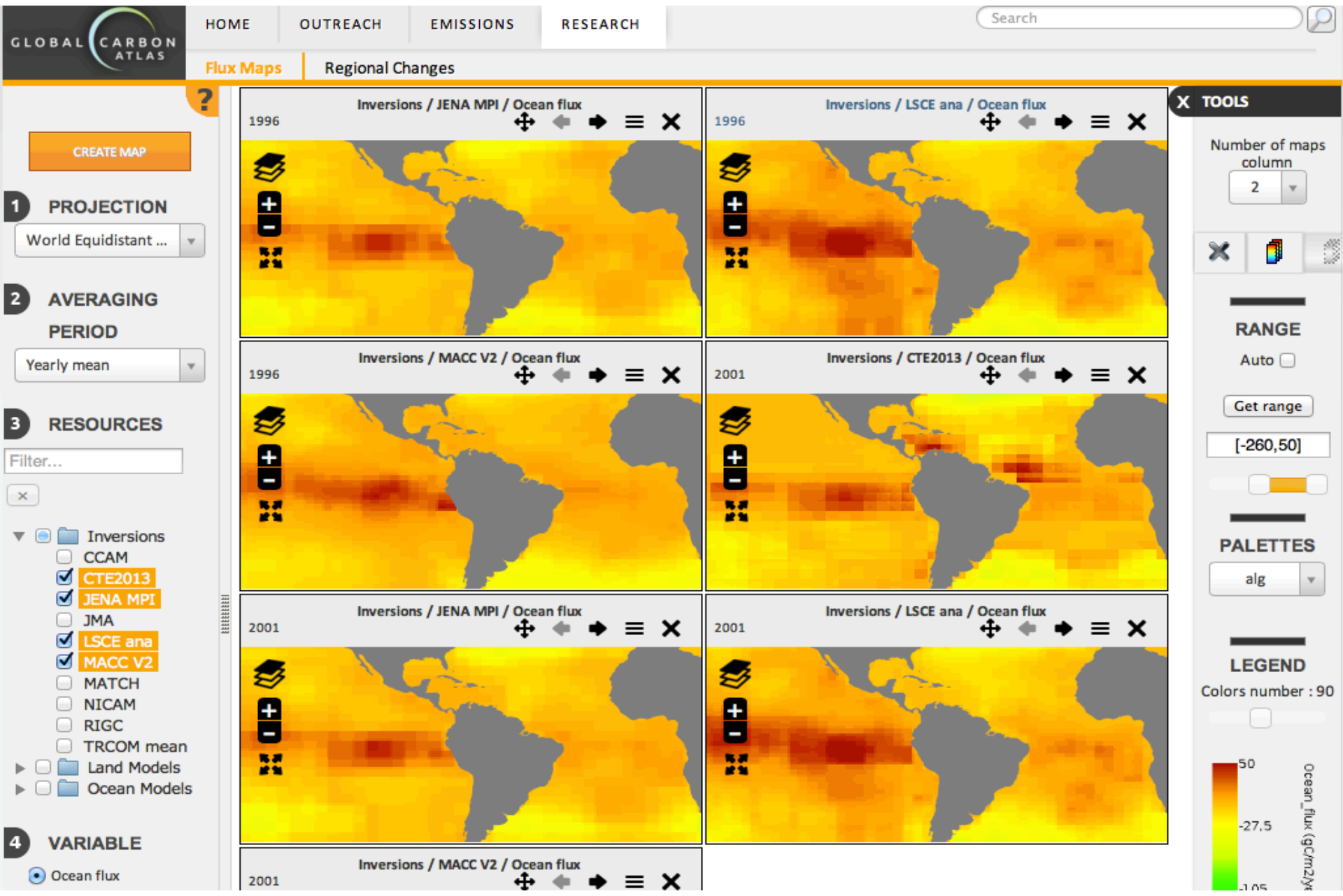
# Une technologie innovante

Pour visualiser de gros volumes de données



Deux exemples sont présentés ci après







[globalcarbonatlas.org](http://globalcarbonatlas.org)

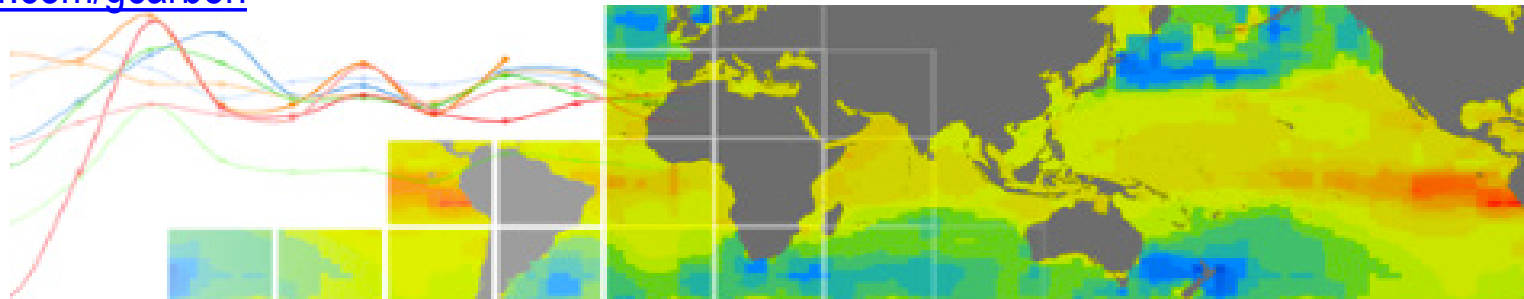


**Merci de votre attention !**

Questions : [philippe.ciais@cea.fr](mailto:philippe.ciais@cea.fr) ou [contact@globalcarbonatlas.org](mailto:contact@globalcarbonatlas.org)

Facebook: <https://www.facebook.com/globalcarbonproject>

Twitter: <https://twitter.com/gcarbon>





## Philippe Ciais

Dr. Philippe Ciais is the head of the Atmospheric Composition Department at the Laboratoire des Sciences du Climat et de l'Environnement. He is an expert in carbon cycle research and has authored more than 300 articles in A-ranking scientific journals, and was lead author of the IPCC 4th assessment report - for which he was one of the co-recipient of the Nobel Peace Prize in 2007 - and of the IPCC 5th assessment report. Philippe Ciais co-chaired the Global Carbon Project from 2007 to 2013; he helped to design and coordinate the implementation of the Global Carbon Atlas"



## Pep Canadell

Dr. Pep Canadell is Executive Director of the Global Carbon Project and Research Group Leader at the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia. His work involves internationally coordinated research on the human perturbation of the carbon cycle, global and regional carbon sources, sinks, and pools, and the mitigation requirements for climate stabilization. He has contributed to the 4th and 5th Assessment Reports of the IPCC, and holds a number of advisory roles in national and international research committees



## Corinne Le Quéré

Corinne Le Quéré is Professor of Climate Change Science and Policy at the University of East Anglia and Director of the Tyndall Centre for Climate Change Research. She conducts research on the interactions between climate change and the carbon cycle. Prof Le Quéré was author of the 3rd, 4th and 5th Assessments Reports of the IPCC, co-Chair of the Global Carbon Project (2007-2013), and is now a member of the science committee of Future Earth. She has overseen the design and implementation of the Emissions component of the Carbon Atlas, and is leading the GCP effort to update the Global Carbon Budget on an annual basis.



## Philippe Peylin

Dr. Philippe Peylin is a research scientist working on the carbon cycle with a strong expertise in atmospheric CO<sub>2</sub> inversions and the use of ecosystem land surface models to diagnose the terrestrial carbon balance. He is responsible for the development of the ORCHIDEE land surface model and he coordinated or participated to several large international projects. He helped to design the Global Carbon Atlas and was specifically responsible for collecting the different carbon flux products displayed under the research application of the portal.



## Robert Andres

Dr. Robert Andres works for the Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory (ORNL) in the United States. He has worked on fossil fuel carbon dioxide emission inventories since 1992. Recent efforts have concentrated on improving temporal and spatial resolutions of the inventories as well as better quantifying their uncertainty. The Global Carbon Atlas combines this effort with that of others to describe the anthropogenic portion of the global carbon cycle.



## Glen Peters

Dr. Glen Peters is a Senior Research Fellow at the Center for International Climate and Environmental Research - Oslo (CICERO) in Norway. He conducts research on the development and assessment of effective global climate policy. His most active areas of research are emissions accounting, the role of international trade in climate policy, carbon leakage, competitiveness concerns, and carbon footprints. Other areas of research include emission metrics and the annual updates of the global carbon budget.



## Robbie Andrew

Robbie Andrew is a Senior Research Fellow at the Center for International Climate and Environment Research - Oslo (CICERO). His research focusses on the analysis of international climate policy, in particular the effects of and consequences for international trade of policy implementation. He also conducts research on future scenarios, carbon footprint methodologies, and ecosystem services, along with assisting in the Global Carbon Project's annual releases.



## Shilong Piao

Dr. Shilong Piao is Cheung Kong Professor of Peking University. His current research focuses on the data-model integration to improve our ability for predicting terrestrial carbon cycle responses to global change. He has contributed to the 5th Assessment Reports of the IPCC. He is now on the Editorial Advisory board of Global Change Biology and also serves on editorial board of Agricultural and Forest Meteorology.



## Anna Peregón

Dr. Anna Peregón is researcher at the Laboratoire des Sciences du Climat et de l'Environnement (LSCE), France. She conducted research on various aspects of the carbon cycle in the Northern Eurasia, and was served as Scientific Assistant in the 5th Assessment Report of the IPCC. Dr. Peregón is now assist coordination and provides liaison to potential contributors to the Global Carbon Atlas.



## Róisín Moriarty

Dr. Róisín Moriarty is a Senior Research Associate at the Tyndall Centre for Climate Change Research and the University of East Anglia. She participates in the publication of the GCP's annual Global Carbon Budget update and the Emissions component of the Global Carbon Atlas. She has a background in ocean biogeochemical and ecosystem research with a primary focus on the ocean carbon cycle.





## Patrick Brockmann

Patrick Brockmann is a scientific software engineer who has worked at LSCE (Laboratory of Sciences of the Climate and Environment) since 1998. He has master degrees in both computer science and remote sensing. He has worked extensively on model intercomparison projects and on earth system model infrastructure in climate modelling research. His research interests include data visualization, geo-spatial web applications, geo-services architectures and data processing in high performance computing environments. He coordinates the project and the technical architecture of the research applications developed for the Global Carbon Atlas.



## Vanessa Maigné

Vanessa Maigné is a development engineer who has worked at LSCE (Laboratory of Sciences of the Climate and Environment) since 2013 after 5 years at the IPSL (Pierre Simon Laplace Institute). She has a master degrees in computer science and physics and is an expert in Java/J2EE development and front-end new technologies. She is a developer of the research applications for the Global Carbon Atlas.



## Pascal Evano

Pascal Evano is an assistant researcher at CEA-LSCE (Laboratory of Sciences of the Climate and Environment) since 2012. He has a degree in Geography and a MSc in Remote Sensing and GIS. He's working in relation with the GeoViQua (GEOSS Quality Visualization) project which is a European project which intends to introduce in GEOSS quality visualization tools. Pascal Evano assisted in development of scientific applications of the Global Carbon Atlas (Web Map Service protocol to compare carbon data models).

**Franck Corsini and Philippe Weill** (ISIS, Informatique fédérative IPSL - Services et Infrastructures) for network and servers infrastructure.

## WeDoData

WEDODATA is a data visualization agency based in Paris specialized in print infographics, web and mobile applications with a strong data input. At WEDODATA, journalists, graphic designers and web developers work as a team to deliver the most creative and accurate visualizations to their clients such as OECD, FranceTV, Radio France or French WIPO branch. WEDODATA assisted the Carbon Atlas team in the design (conception and development) of the Outreach and Emissions applications.

Karen Bastien : Director

Brice Terdjman : Responsible of Outreach application

Vincent Le Jeune : Development of Emission application

Anthony Vessière : Development of Emission application

Website : <http://wedodata.fr/>

## ClimMod Engineering

CLIMMOD is a scientific engineering company involved in the field of numerical modeling and simulation for climate and environment. The team consists of engineers with extensive research experience in the development and validation of scientific software. CLIMMOD was responsible for development and integration of the web platform for the Global Carbon Atlas.

Contact information: Dr. Jacques Zegbeu POUSSI, C.E.O. [Zegbeu.Poussi@climmod.com](mailto:Zegbeu.Poussi@climmod.com)

The Editorial Board is made up of experts in the subject area that the Global Carbon Atlas including data providers, research user community, broader user community (NGOs, civil society, industry, higher education), and science communicators. They provide advice on content and appropriateness, review content and links to user community, and advice on communication content and strategies for the multiple audiences.

<b>Laurent Bopp</b>	Laboratoire des Sciences du Climat et de l'Environnement (IPSL/LSCE; CEA-CNRS-UVSQ), France
<b>Owen Gaffney</b>	International Geosphere-Biosphere Programme (IGBP), Sweden
<b>Jean-Jacques Goron</b>	Foundation BNP Paribas, France
<b>Jay Sterling Gregg</b>	Technical University of Denmark, Denmark
<b>Kevin Gurney</b>	Arizona State University, USA
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## All the data is shown in GtC

1 Gigatonne (Gt) = 1 billion tonnes =  $1 \times 10^{15}$ g = 1 Petagram (Pg)

1 kg carbon (C) = 3.664 kg carbon dioxide (CO<sub>2</sub>)

1 GtC = 3.664 billion tonnes CO<sub>2</sub> = 3.664 PgCO<sub>2</sub>

## Disclaimer

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