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INTEGRATED GLOBAL CARBON OBSERVATIONS

CL-09-03: Global Carbon Observations and Analysis

- Quick review
- Overlaps with the Forest CoP
- Current status of the global carbon observing system

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Objectives of an integrated carbon observing system

- **Provide** long-term observations required to improve the understanding of the present state and future behaviour of the global carbon cycle
- **Monitor** and **assess** the effectiveness of carbon sequestration and/or emission reduction activities on global atmospheric CO_2 levels

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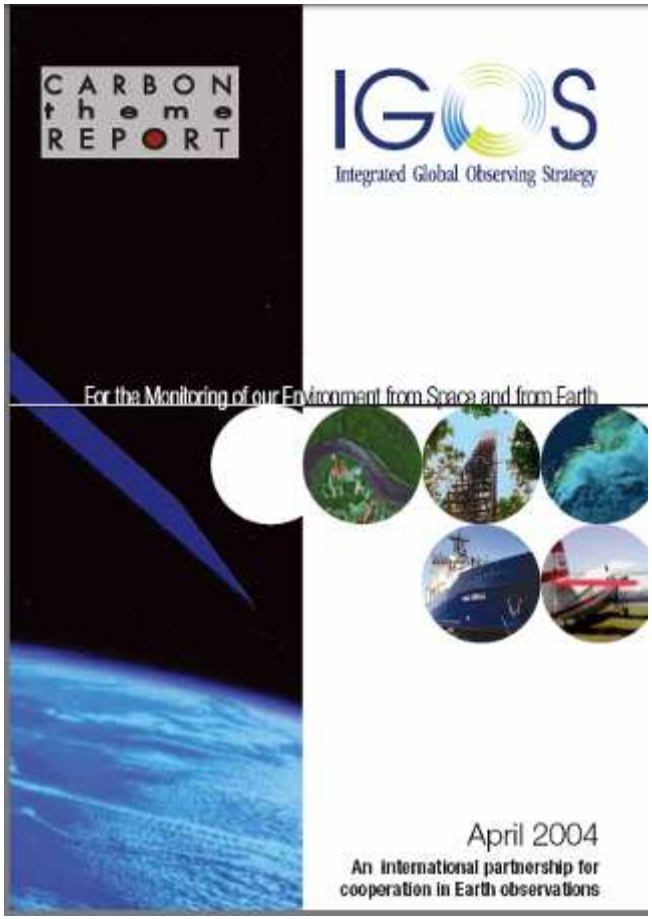
GEO Carbon Report

- Key driver of current Carbon CoP activities
- Update of the IGOS-P Carbon Report
- Goal to evaluate the progress and remaining gaps in the carbon observing system
- Draft 0 complete
- Draft 1 (review by Carbon CoP) due end of October
- Final document published December



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GEO Carbon sub-tasks

- Integrated Global Carbon Observations
  - Develop carbon observing and synthesis system to answer key carbon cycle questions
- Monitoring Greenhouse Gases From Space
  - Develop and deploy remote sensing technology to measure CO_2, CH_4 etc.
- Forest Carbon Tracking
  - Develop observations and synthesis for regional and global forest carbon measurements

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Forest Observation User Communities

Membership determined by range of uses for forest observations and information

(1) Global Change Science

(2) Timber, Fuel and Fiber

(3) Watershed Protection

(4) Biodiversity and Conservation

(5) FCCC and other Environmental Agreements

(6) Recreation and Tourism

(7) Sustainable Forest Management

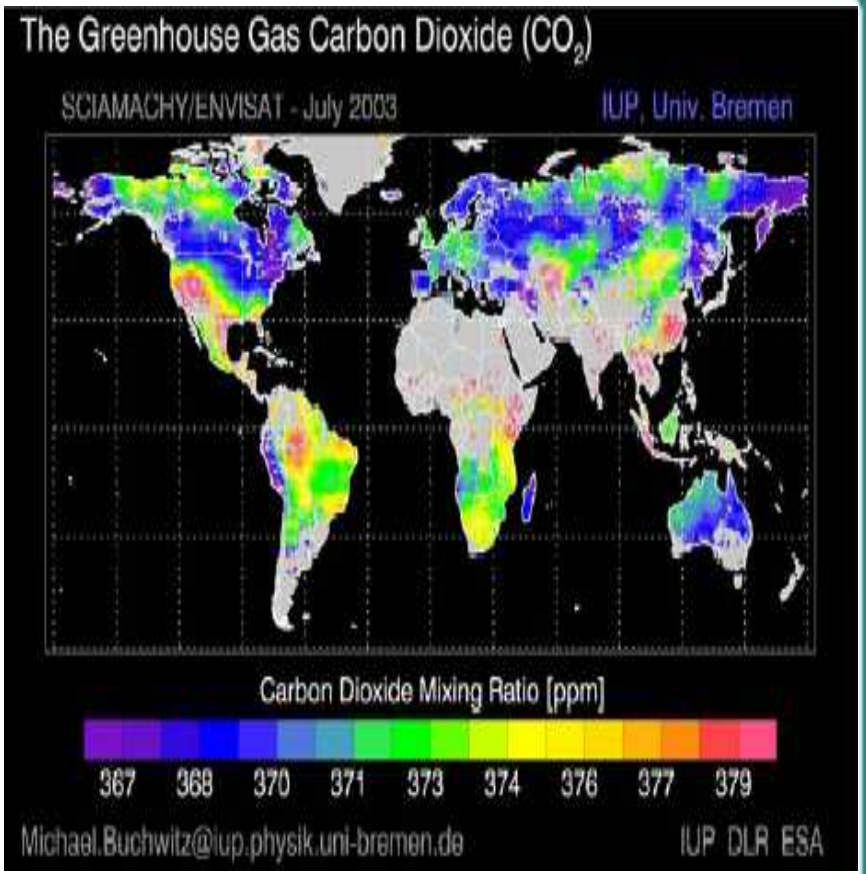
(8) Forest Perturbations and Protection (fire, insects, disease)

Forest CoP and Carbon CoP

- Observation type overlap is small
- But potential for larger overlap and mutual benefit of certain obs (ie. latent heat fluxes)
- Carbon CoP will continue to pursue Forest CoP to establish stronger links

Current remote sensing missions

- TOVS (NOAA) – upper tropospheric CO_2
- AIRS (NASA) – upper trop CO_2, CO and CH_4
- SCIAMACHY (ESA) CH_4 (some CO_2 and CO)
- MOPITT (NASA) – CO
- IMG (JAXA) CH_4
- IASI (EUMETSAT) – CO_2 CO, CH_4
- GOSAT (JAXA) - CO_2 retrivals just available



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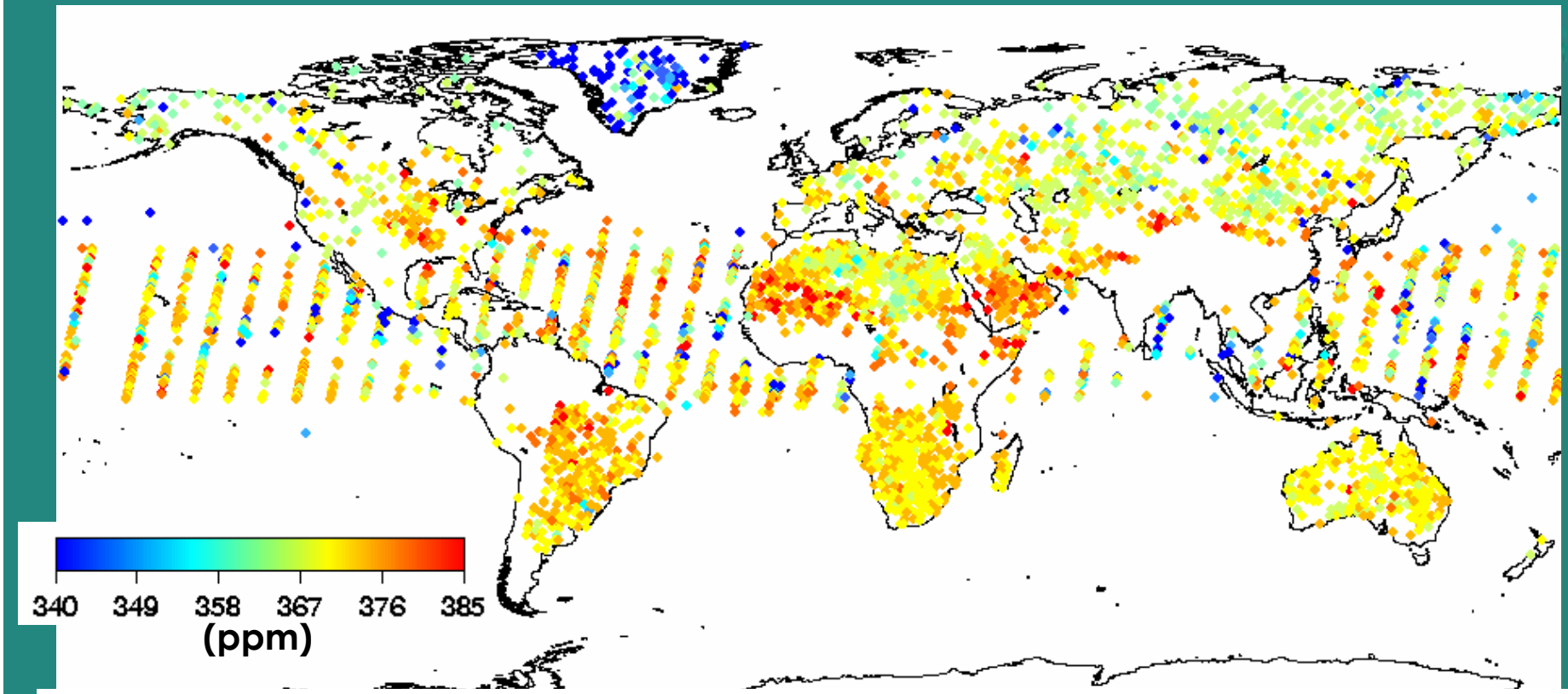
XCO_2 (Column averaged dry air mole fraction) (August 4-19 observation data)

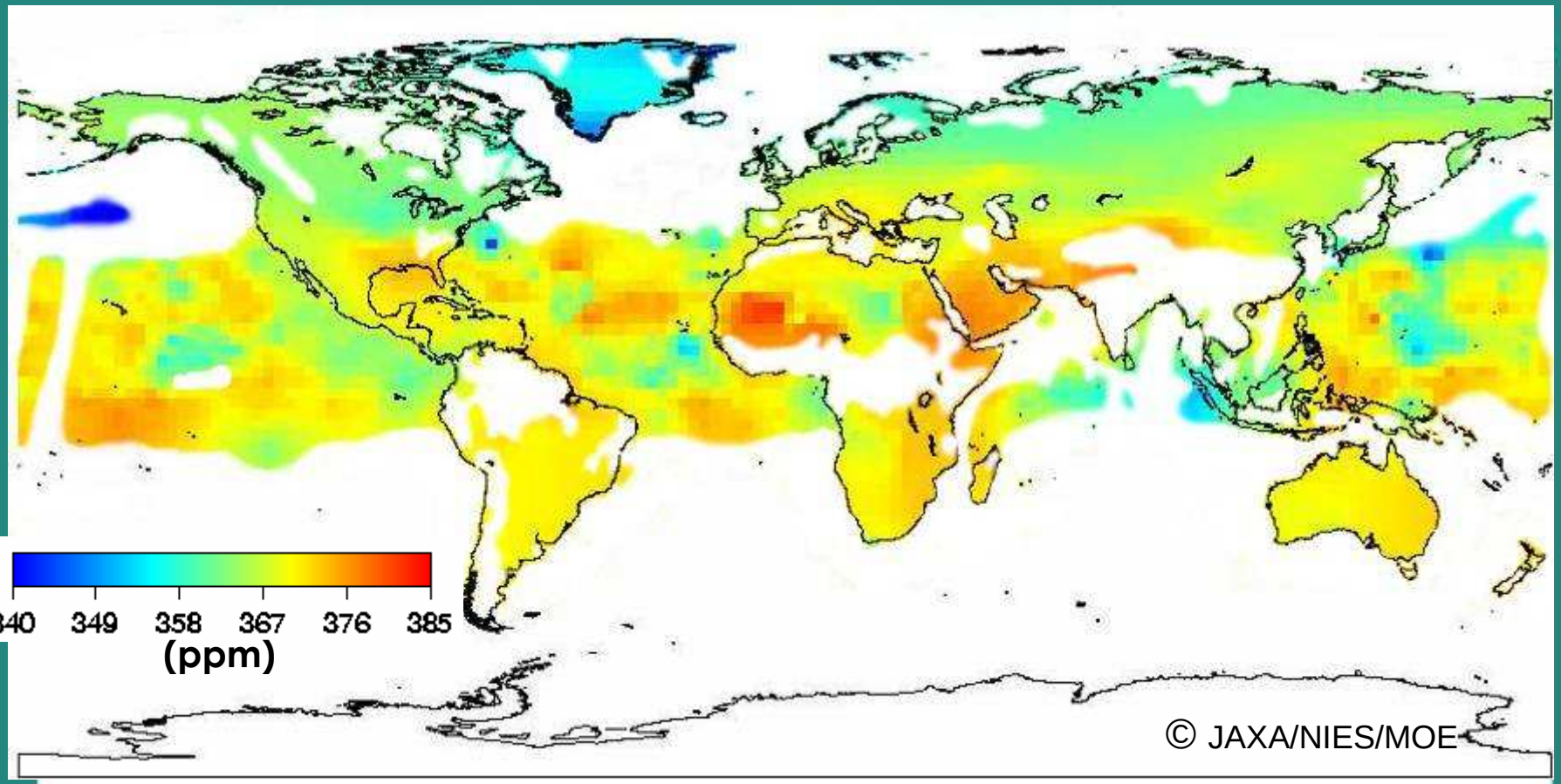


◎ Unvalidated XCO_2 derived from initial calibrated spectra

◎ The observation points which were hidden by cloud or S/N of the acquired data is low were excluded.

On the sea, it is shown that the sun glint region.

Estimated Carbon Dioxide Concentration Distribution (from Column averaged dry air mole fraction)



◎ Estimated from column averaged dry air mole fraction using Kriging method

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FCT progress

- Approved and initiated work Plan, including country, organisation or institute commitments
- Definition of the National Demonstrators
- GEO Document on Satellite Optical/ SAR Data Requirements and systematic acquisitions strategies released (June 2009), and relevant data acquired during 2009
- Satellite Data Processing mechanisms being established (release September 2009)

Landsat over Brazil
Status of acquisitions: GLS 2005

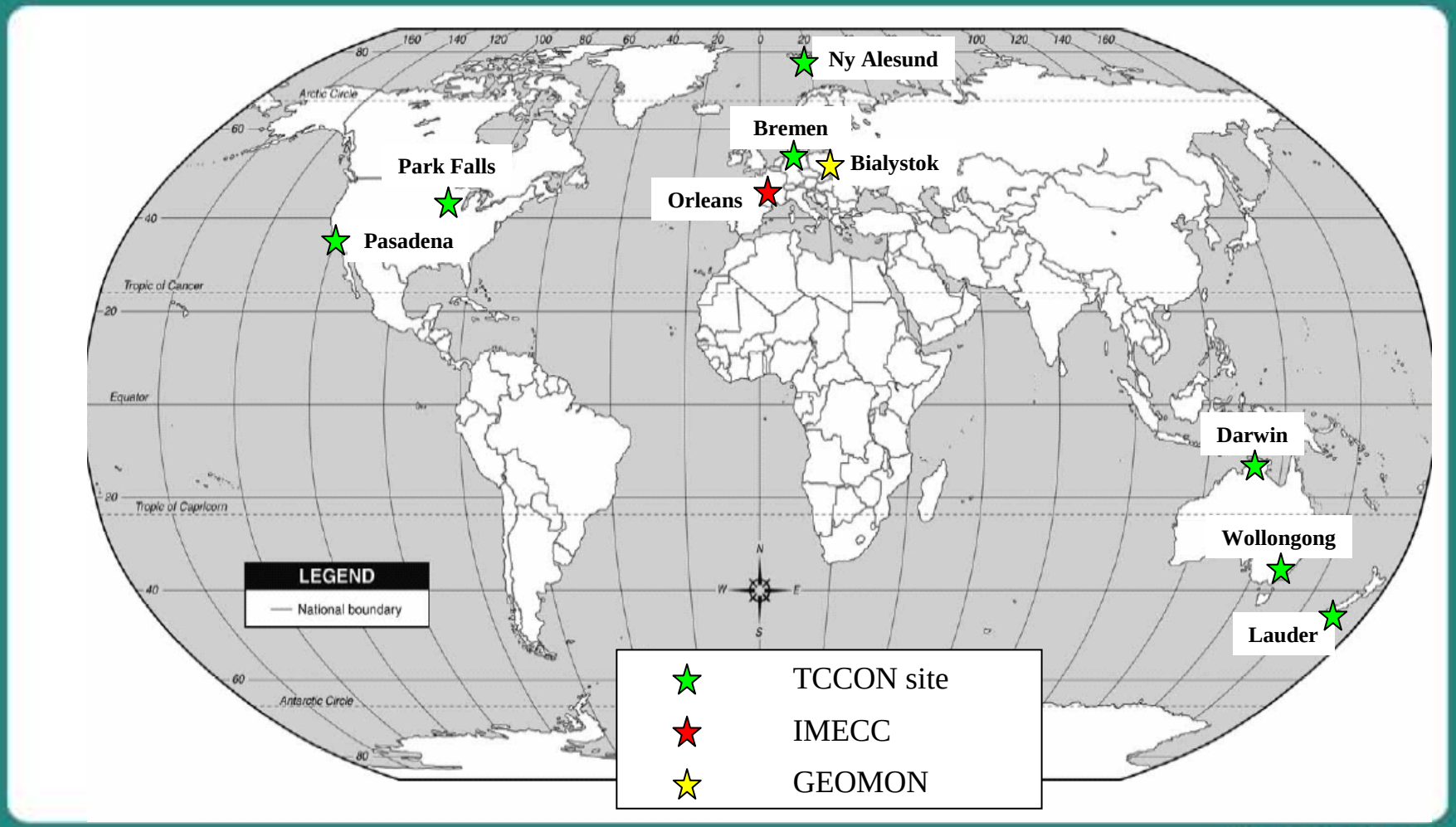
423 GLS 2005 TM Scenes in USGS Archive

173 2009 ETM+ acquisitions not plotted

Request for Landsat and CBERS support to Brazil (INPE).

Upward looking FTS network

Calibration for OCO



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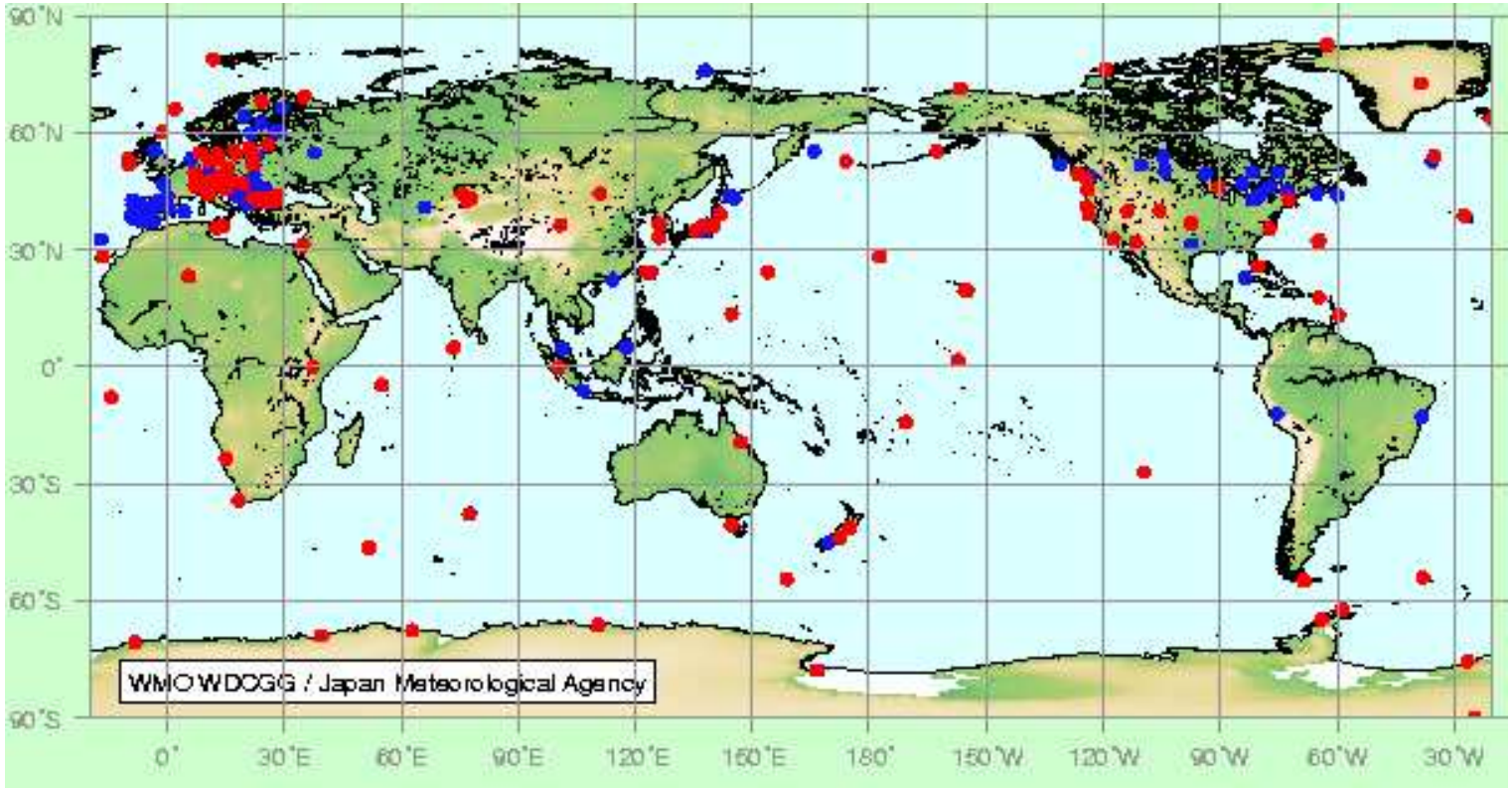
In situ atmospheric observations



Red dots denote stations where data has been contributed to the WDCGG in the last year

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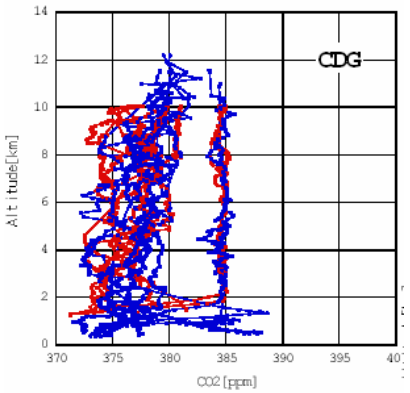
Aircraft in situ continuous observations

- Continuous *in situ* atmospheric samplers have been installed on several commercial aircraft (i.e. JAL, IAGOS, CARIBIC project))
- Routine collection of profiles over airports, plus upper troposphere horizontal transects



JAL CO_2 profiles over Paris

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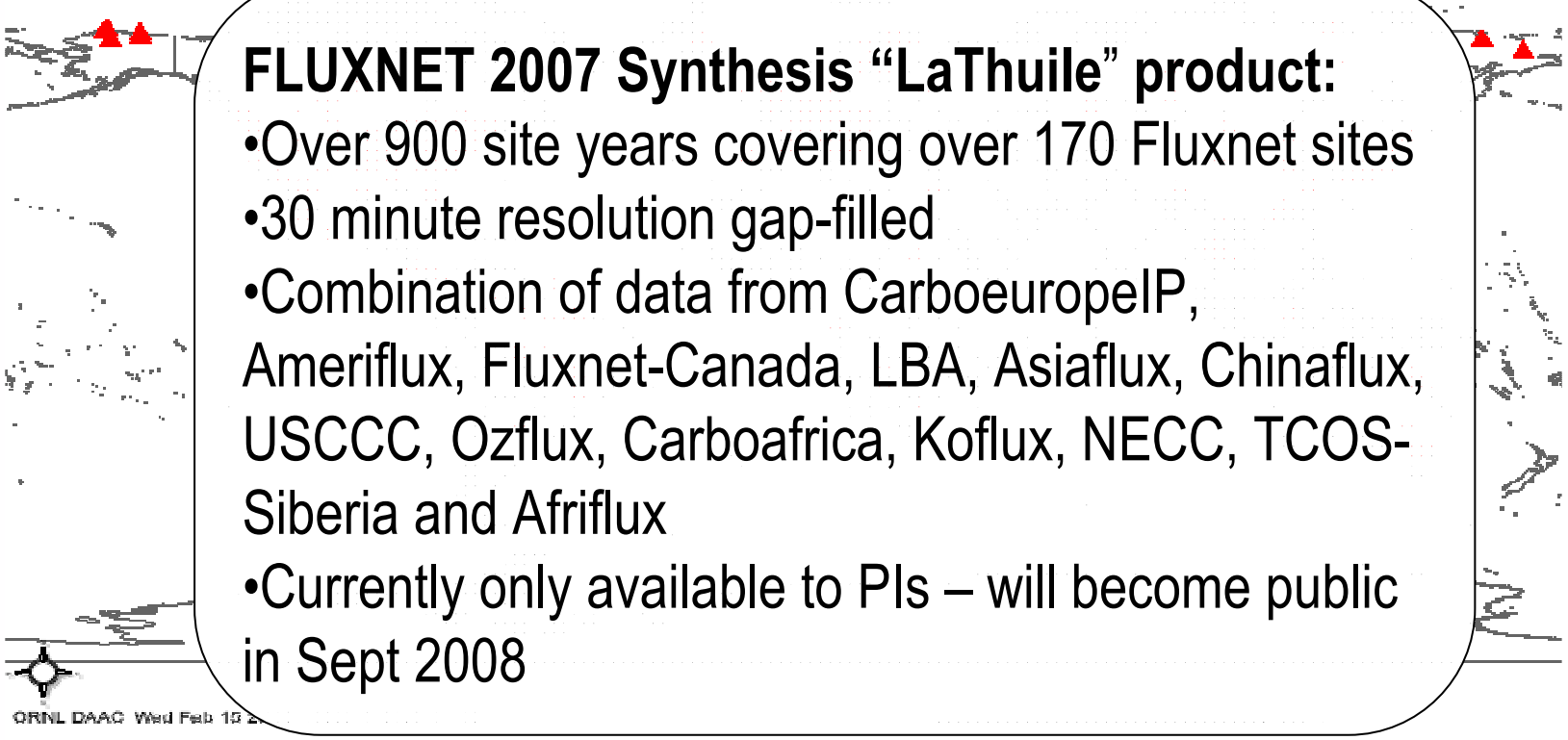
Global terrestrial flux observations



FLUXNET 2007 Synthesis "LaThuile" product:

- Over 900 site years covering over 170 Fluxnet sites
- 30 minute resolution gap-filled
- Combination of data from CarboeuropeIP, Ameriflux, Fluxnet-Canada, LBA, Asiaflux, Chinaflux, USCCC, Ozflux, Carboafrica, Koflux, NECC, TCOS-Siberia and Afriflux
- Currently only available to PIs – will become public in Sept 2008

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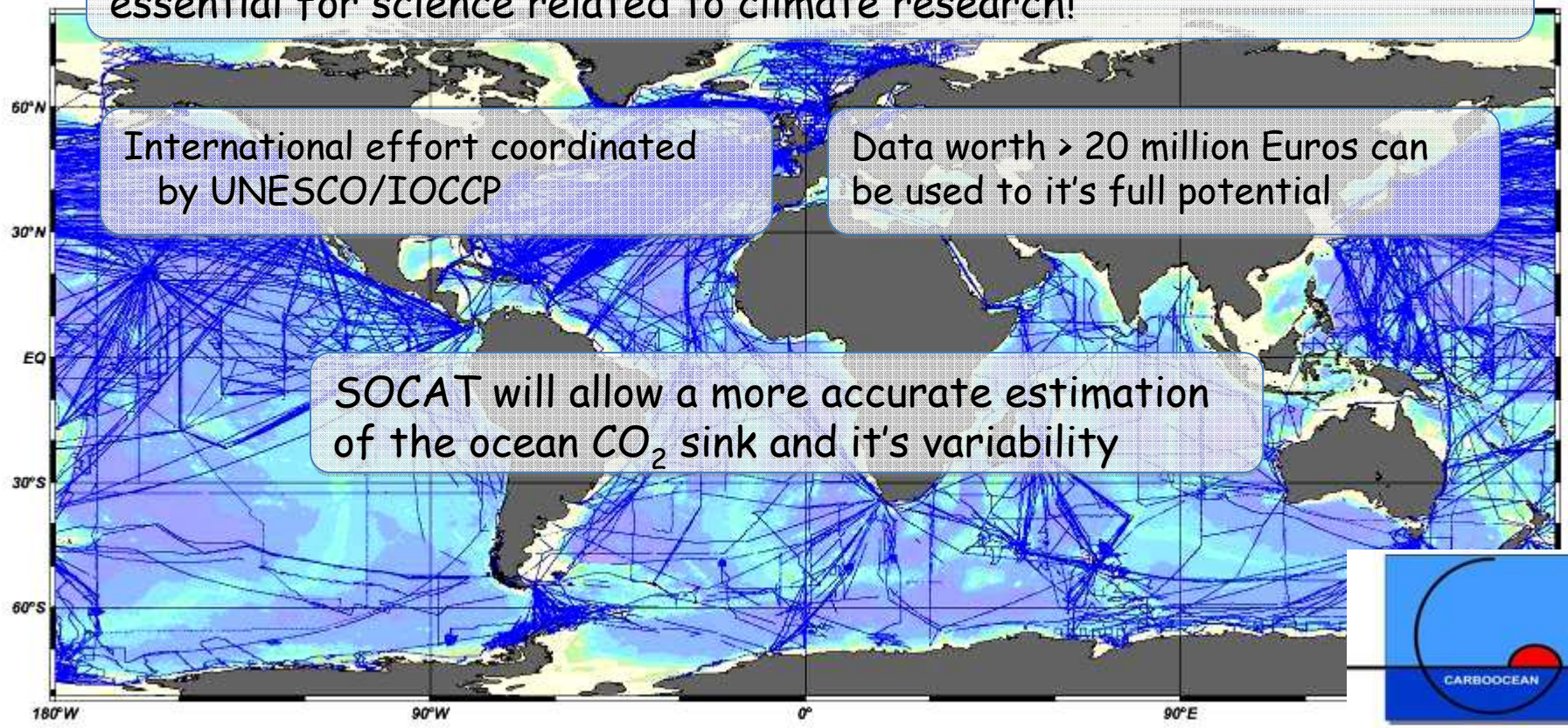
SOCAT – Surface Ocean CO_2 Atlas

World largest CO_2 database: covers 2150 cruises over 40 years
> 7,5 million CO_2, > 10 million temperature, > 9 million salinity measurements

Quality controlled by regional experts using state-of-the-art technology

All data is available in the same format for the first time which is essential for science related to climate research!



International effort coordinated by UNESCO/IOCCP

Data worth > 20 million Euros can be used to it's full potential

SOCAT will allow a more accurate estimation of the ocean CO_2 sink and it's variability

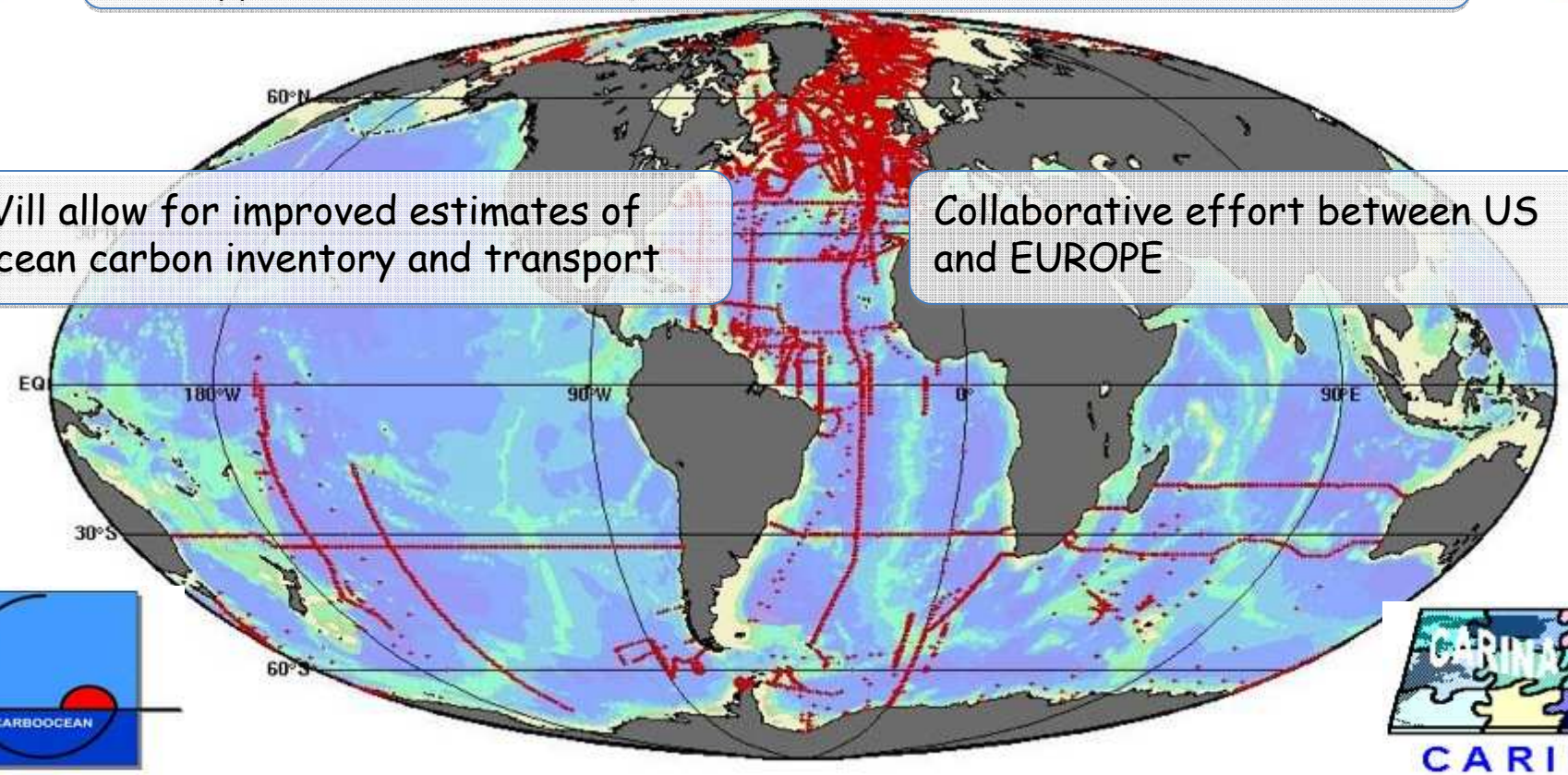
CARBOOCEAN

CARINA - Carbon dioxide in the Atlantic Ocean

Data rescue project for deep sea carbon dioxide and nutrients data

Data with an estimated value of > 50 million Euros was rescued

Largest high quality dataset of the entire Atlantic Ocean (188 cruises with approx. 16.000 stations)

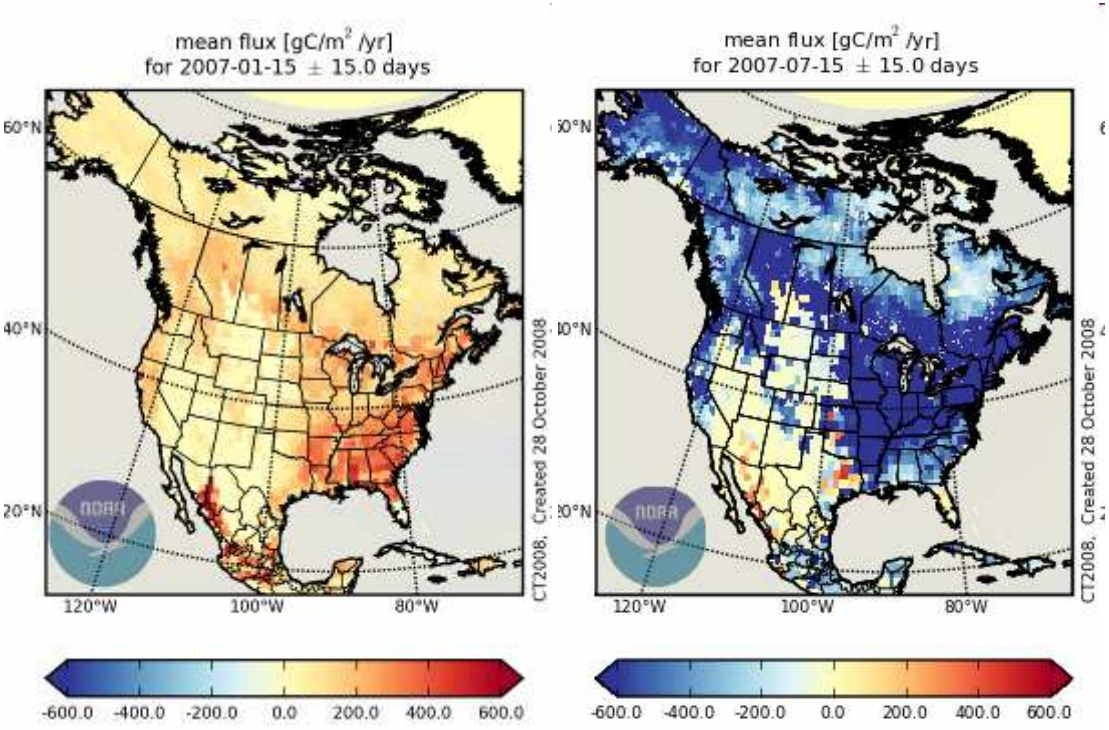


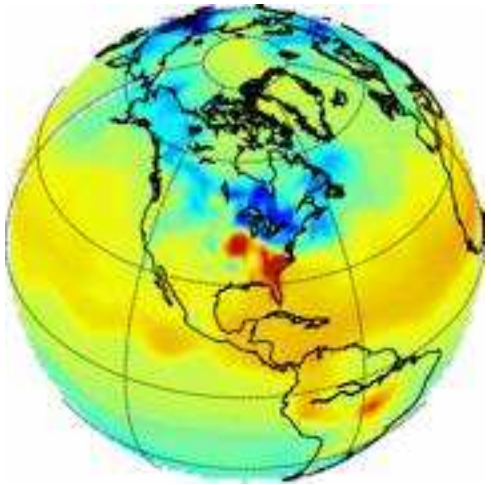
Will allow for improved estimates of ocean carbon inventory and transport

Collaborative effort between US and EUROPE

CARBOOCEAN

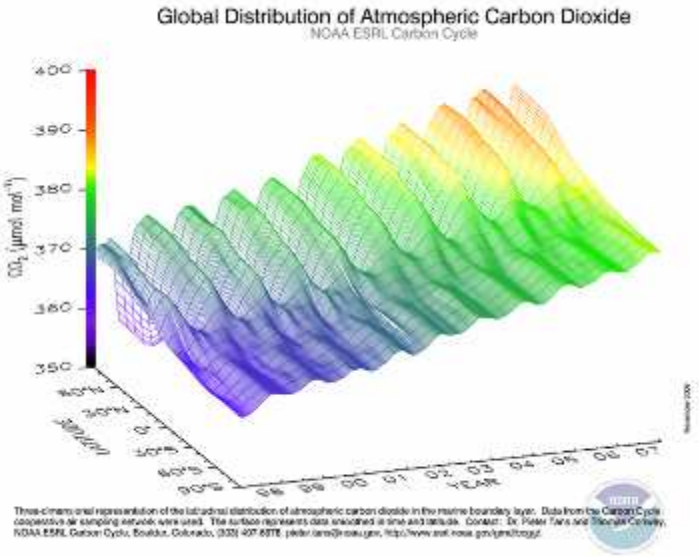
CARINA





CarbonTracker also produces "carbon weather", which shows the hourly distribution of CO2 in Earth's atmosphere.

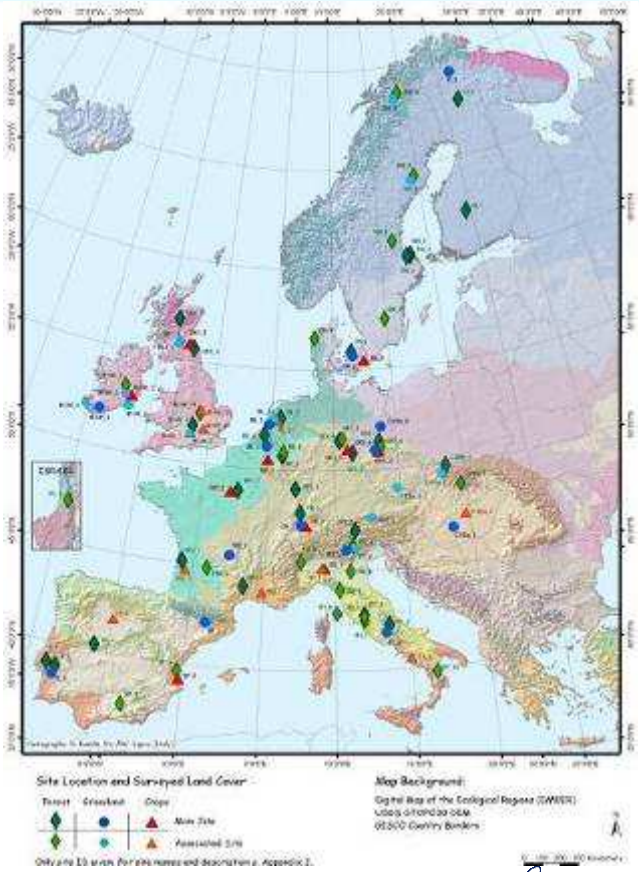
CarbonTracker is a reanlysis constrained by NOAA's global atmospheric observing network. CarbonTracker determines fluxes of CO_2 to and from the biosphere. Note that, in January, CO_2 is emitted into the atmosphere and, in July, the biosphere removes CO2 from the atmosphere.



3D-View of increasing carbon dioxide in the atmosphere

ICOS (Integrated Carbon Observation System)

- EU Research Infrastructure Priority to establish integrated carbon observations over the next 20 years
- Includes in situ atmospheric concentration network (inc. central calibration lab) and terrestrial eddy covariance network
- Proposed budget of 250 M€
- Preparatory phase 2008-2012



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Future activities

- Complete and publish the GEO Carbon Report
- Establish need and potential for integration activities
  - Workshop in November (at GEO IV)
- Highlight key outcomes for the GEO Plenary VI (2009) and Ministerial (2010)
  - Forest Carbon Tracking
  - Integration of remote sensing into data assimilation systems
- Stronger ties to the Forest Community of Practice
- Work with the UIC to optimize benefit of being part of GEOSS

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