

# RECCAP

## REgional Carbon Cycle Assessment and Processes

Version: 6 October 2010



With updates and additions  
Galen McKinley  
OCB 2011

# Scope

- To establish the **mean carbon balance of large regions of the globe** at the scale of continents and large ocean basins, including their component fluxes (1990-2009).
- To do it by **comparing and reconciling** multiple bottom-up estimates with the results of regional top-down atmospheric inversions, with **attribution** to main flux components.
- To evaluate the **regional 'hot-spots' of interannual variability and possibly the trends** and underlying processes over the past two (or more) decades by combining available long-term observations and modeling.

# Why RECCAP?

- To provide **higher spatial resolution of the global carbon balance** with the aim to improve attribution to processes and hot-spots regions essential to understand the future evolution of carbon-climate feedbacks.
- To address a growing demand for a capacity to **Measure, Report, and Verify (MRV)** the evolution of regional fluxes and the outcomes of climate mitigation policies.
- To develop the **technical capacity** in regions with regional carbon balances of global significance but with little or no technical capabilities.
- To respond to the Group on Earth Observations (EOS) in establishing a **global carbon observatory** to track the evolution of natural and anthropogenic carbon sources and sinks.

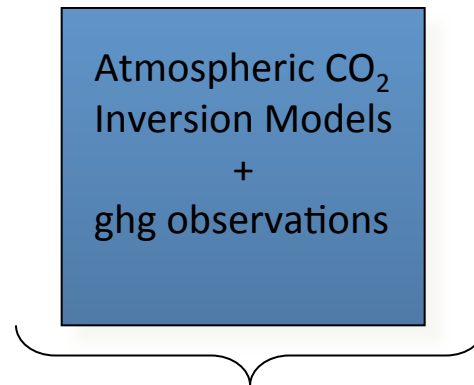
# RECCAP Final Products (by mid-2012)

- 28 peer-reviewed publications
  - Stage 1 (submit late 2011)
    - Regional syntheses for land and ocean regions (10 land, 4 ocean)
    - Global assessment of key processes (8)
  - Stage 2 (submit mid-2012)
    - Syntheses of Syntheses (6)
- Archive of global and regional models and data products

# RECCAP Principle

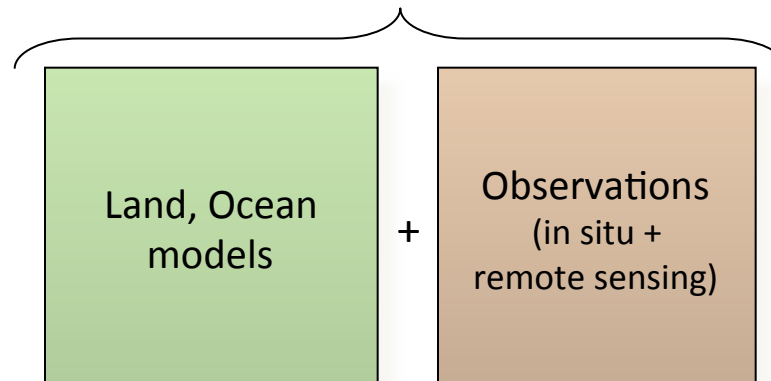
Multiple Constraints to Understand One Carbon Budget

Top-down

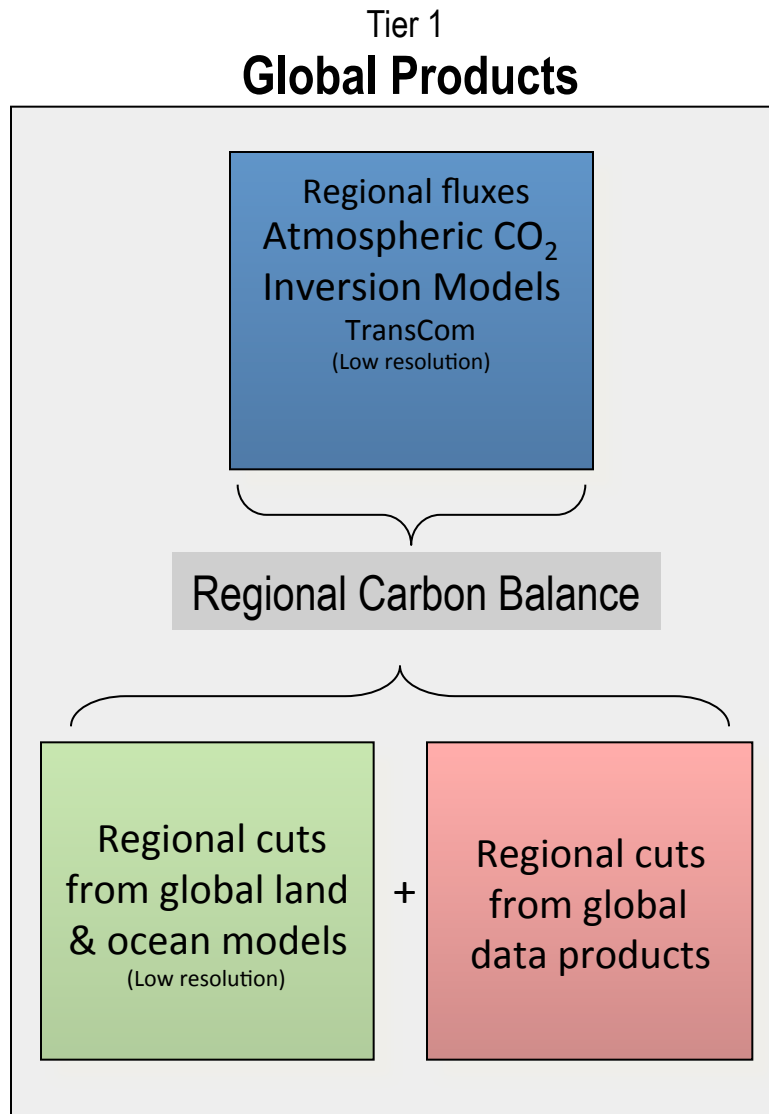


Regional Carbon Balance

Bottom-up



# Components of Regional Synthesis

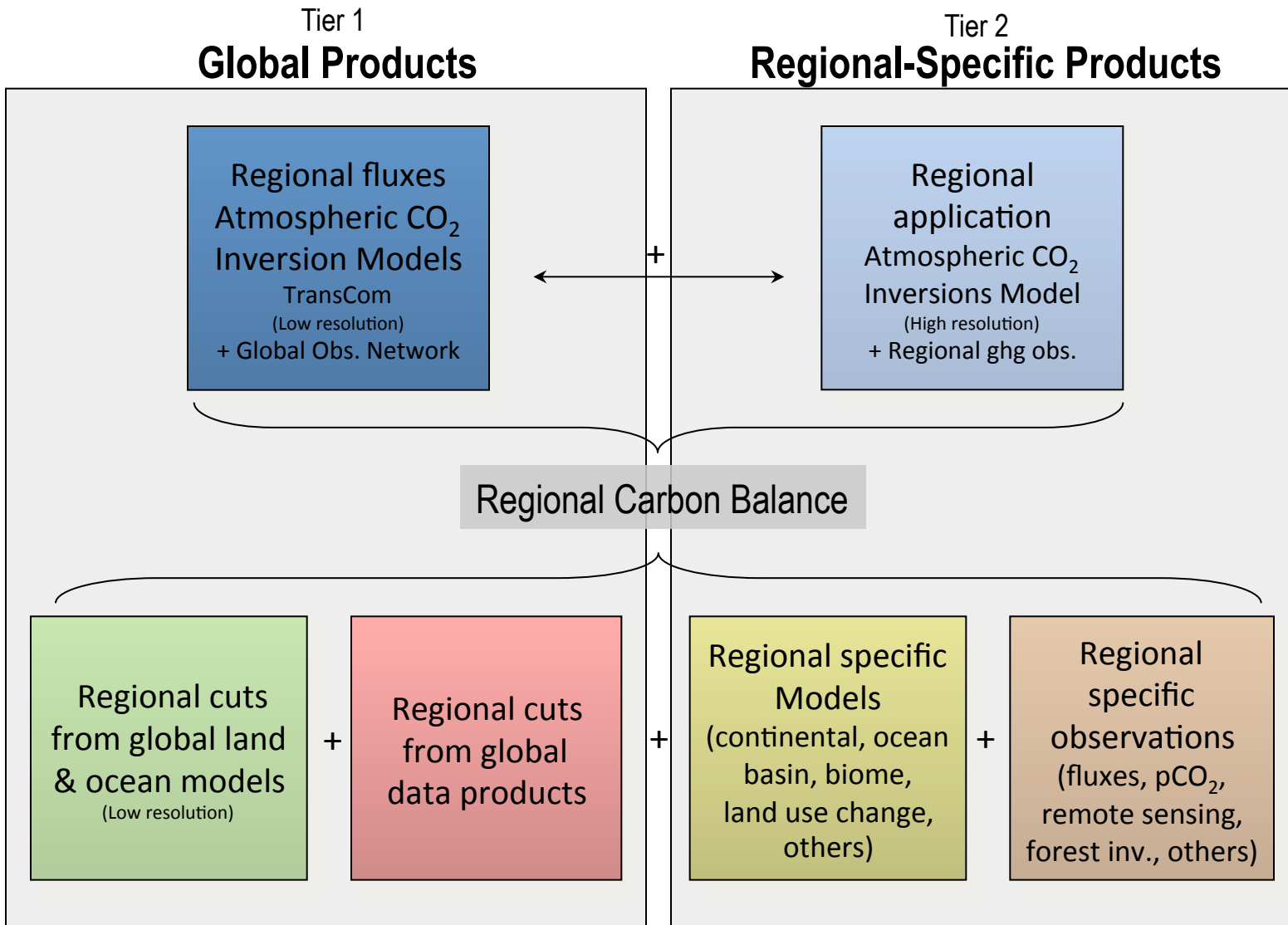


Tier 1 model outputs are coordinated by RECCAP

# Tier 1 Global Products for Regional Syntheses

Product	Specifications	Coordinator
<b>Atmospheric CO<sub>2</sub> inversions</b>	TransCom (11 models), 1° x 1° grid, regional integrated fluxes according to RECCAP mask. To 2008	Kevin Gurney, Rachel Law, Philippe Peylin
<b>Ocean forward biogeochemical models</b>	Nine global models at 1° x 1° for all major flux components.	Corinne Le Quere
<b>Ocean inversion</b>	1 model.	Niki Gruber
<b>pCO<sub>2</sub> flux Climatology</b>	Takahashi et al. 2009	Taro Takahashi
<b>Terrestrial biogeochemical models and NEP-flux model</b>	Five Dynamic Global Vegetation Models, gridded output for all major flux components. To 2009. GPP and NEP from eddy flux data-driven model	Stephen Sitch, Pierre Friedlingstein, Markus Reichstein
<b>Fire emissions</b>	0.5° x 0.5°, monthly, burned area and fire emissions (C, CO <sub>2</sub> , CO, CH <sub>4</sub> , NO <sub>x</sub> , N <sub>2</sub> O, BC others) 1997-2009.	Guido van Werf

# Components of Regional Synthesis



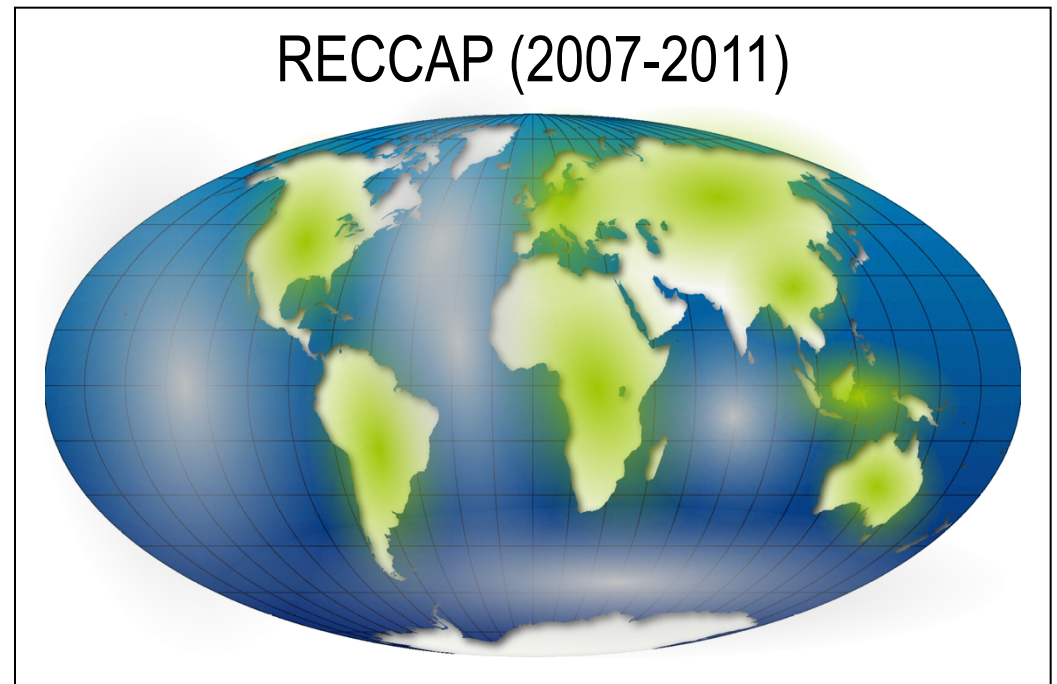
Tier 1 model outputs are coordinated by RECCAP



# Land and Ocean Regional Syntheses

## Land

- L1 Africa
- L2 Arctic tundra
- L3 Australia
- L4 Europe
- L5 North America
- L6 Russia
- L7 South America
- L8 East Asia
- L9 Southeast Asia
- L10 South Asia

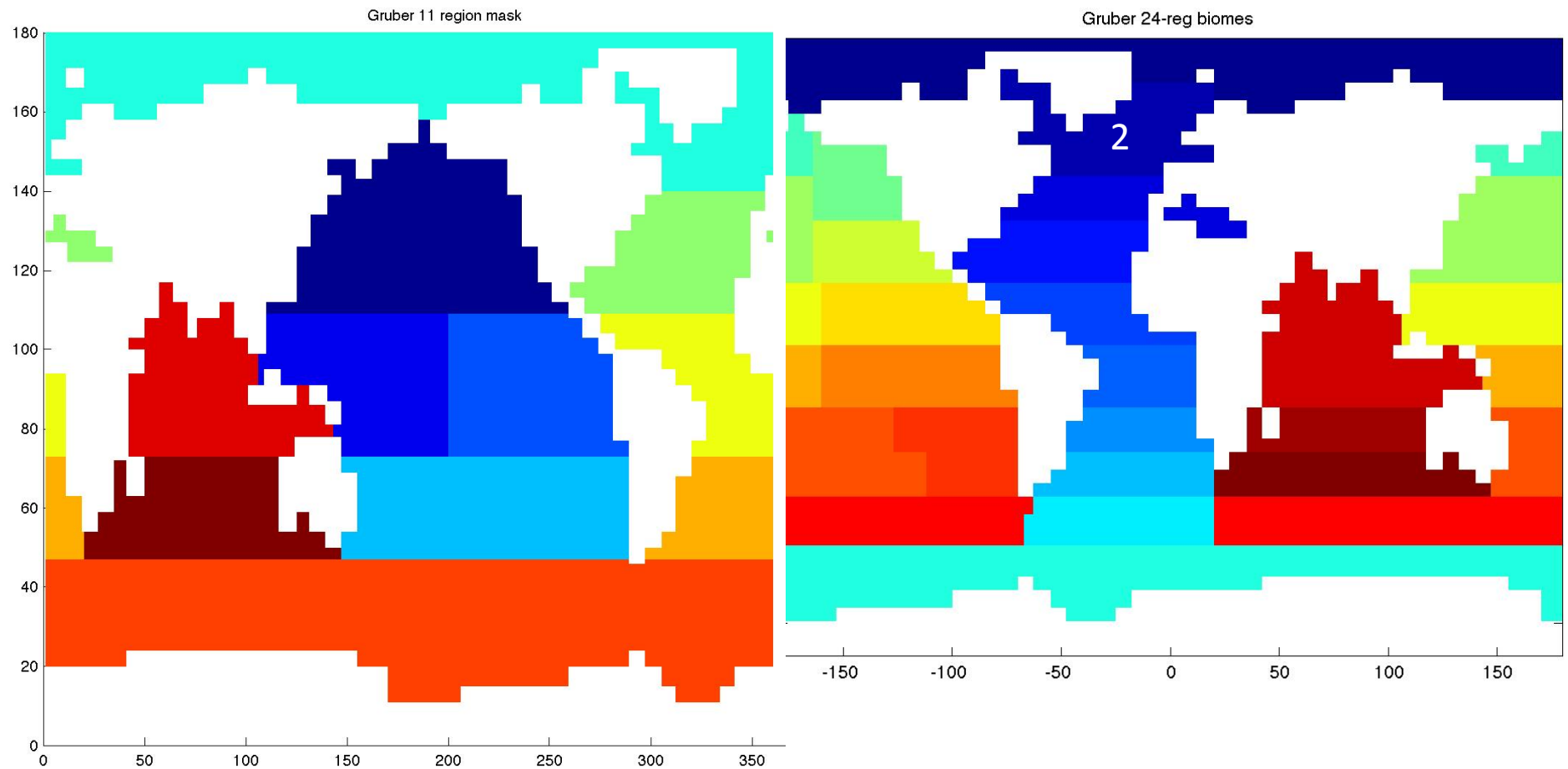


## Oceans (lead authors)

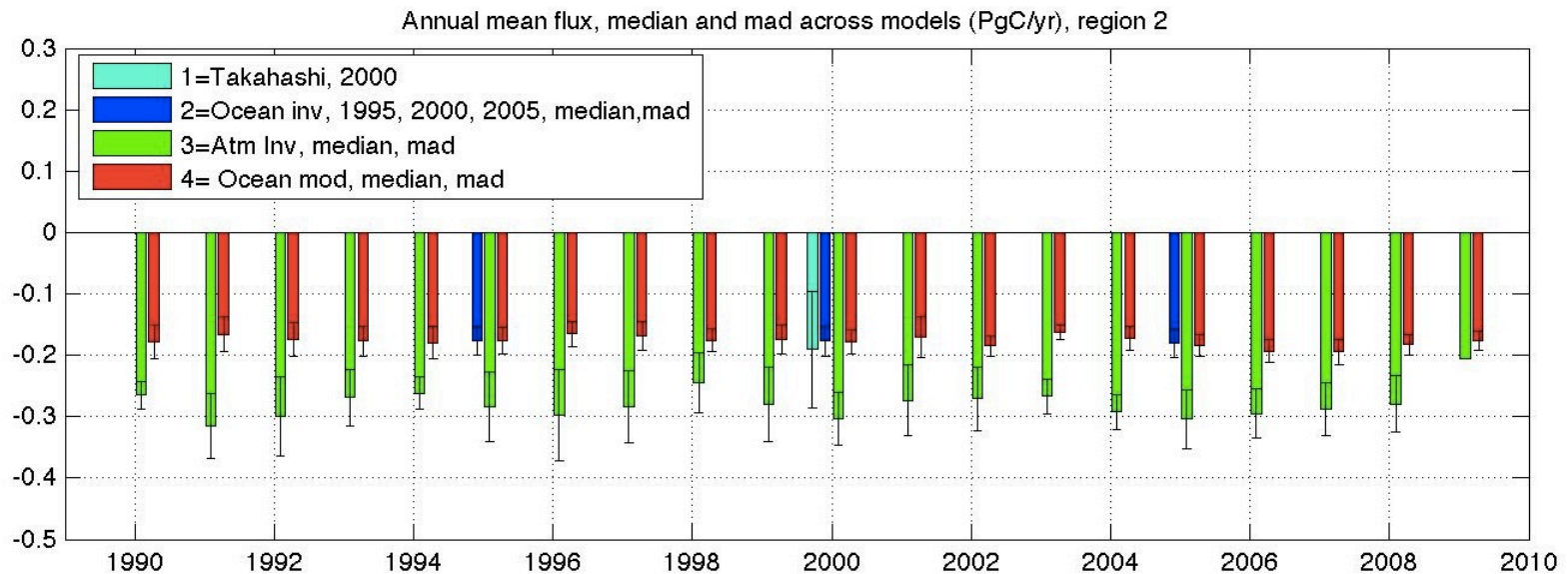
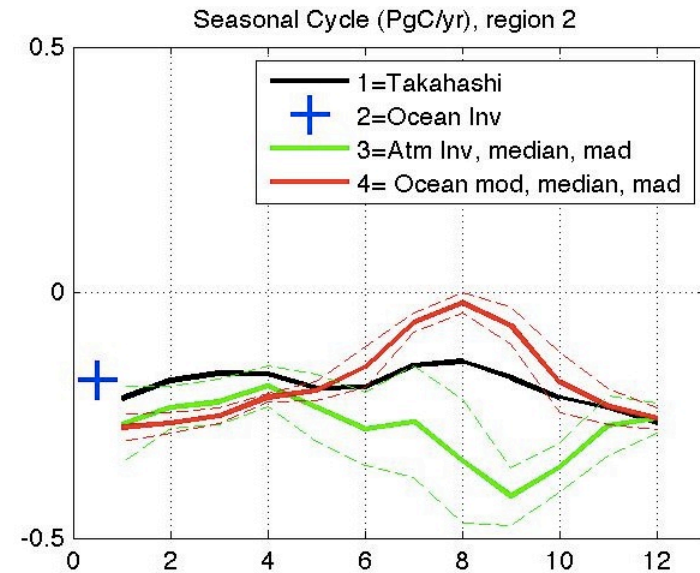
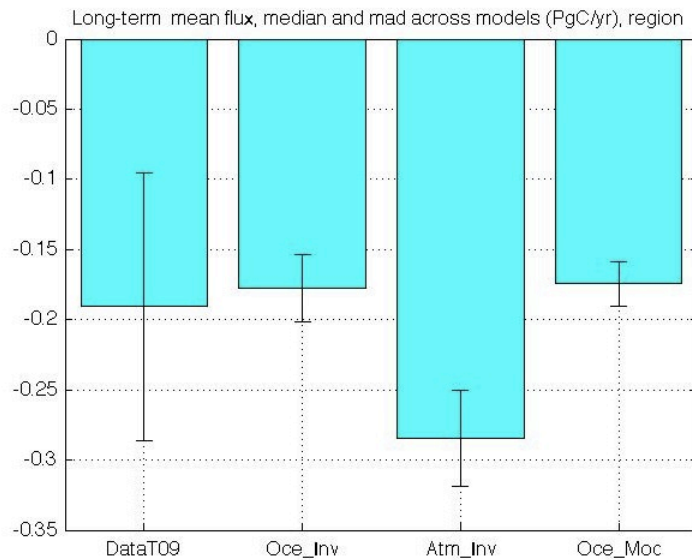
- O2 Pacific (M. Ishii, R. Feely)
- O3 Atlantic and Arctic (G. McKinley, U. Schuster)
- O4 Southern Ocean (A. Lenton, B. Tilbrook)
- O5 Indian (N. Metzl, V. Sharma)

# Ocean Regions

Primary is 11 region (Transcom), some use of 24 for detail



# N. Atlantic Subpolar Gyre



## 2<sup>nd</sup> Workshop, May 2011

### Notes on Ocean Coordination

- Air-sea CO<sub>2</sub> flux
  - Interior only in global chapter
- Common components
  - Long-term mean (90-09), decadal means
  - Seasonal cycle
  - Interannual variability
- If possible - trends

U.S. F&W National Conservation Training  
Center, West Virginia, USA  
23-27 May 2011



# Main table(s), each ocean region

	Observed	Ocean Inv	Atm Inv	Forward Model	Best estimate
Arctic					
>18N					
18S-18N					
18-44S					
S. Ocean					

In both PgC/yr and mol/m<sup>2</sup>/yr  
And for 1990-2009, 1990-1999, and 2000-2009

Author's  
Judgment

# Global Assessments (Lead Authors)

- Global ocean surface CO<sub>2</sub> flux (R. Wanninkhof, T. Takahashi)
- Global ocean interior C storage (T. Tanhua, S. Khatiwala)
- Coastal (A. Borges)
- Rivers fluxes (P. Raymond)
- Fossil fuel emissions
- Land use change emissions
- Global atmospheric budget
- Embedded fluxes in international trade

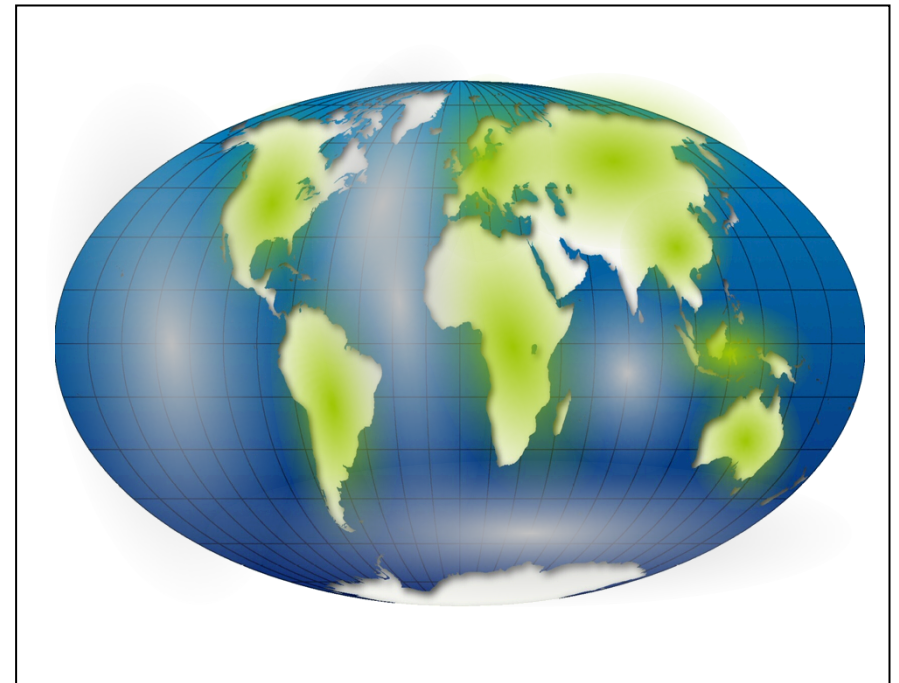


<http://www.globalcarbonproject.org/reccap/syntheses.htm>



# Global Syntheses of Syntheses (SoS)

- Ch-S1 Comparison of top & bottom up
- Ch-S2 Interannual variability
- Ch-S3 Attribution to regional processes
- Ch-S4 Trends
- Ch-S5 Uncertainty
- Ch-S6 Final recommendations



# Target Deadlines

- Submission of regional and global syntheses by December 15, 2011 (Biogeosciences)
- Complete 6 SoS chapters by Spring 2012
- Deadlines for IPCC AR5 is submission by July 31, 2012; Acceptance by March 31, 2013



# Atlantic / Arctic Status

U. Schuster, G. McKinley

- First Draft to co-authors (Sept 1)

- Tier 1 plots for regions
- Text outline

- Revised draft (Oct 15)

- Additional flux estimates
- Flesh out all text
- What is the Best Estimate?

- Final submission (Dec 15)

# Scientific Steering Committee

- Philippe Ciais, *Chair* (France)
- Pep Canadell, *Coordinator* (Australia)
- Han Dolman (The Netherlands)
- Niki Gruber (Switzerland)
- Kevin Gurney (USA)
- Corinne Le Quere (UK)
- Mac Post (USA)
- Mike Raupach (Australia)
- Chris Sabine (USA)
- Piao Shilong (China)
- Stephen Sitch (UK)

# Partners and Sponsors

- COordination action Carbon Observation System (COCOS), Europe
- Carbon Cycle Science Program - CCIWG, USA
- International Ocean Carbon Coordination Project (IOCCP)
- Chinese Science Academy (CAS), China
- CSIRO Marine and Atmospheric Research, Australia
- National Institute for Environmental Studies (NIES), Japan
- Carbo-Africa
- Quantifying and Understanding the Earth System (QUEST), UK



[www.globalcarbonproject.org/RECCAP](http://www.globalcarbonproject.org/RECCAP)