“Examination of existing approaches for construction of regional carbon budgets for both land and ocean areas”

together with the 1st workshop of

REgional Carbon Cycle Assessment and Processes (RECCAP)

6-8 October 2010
Viterbo, Italy

COordination action Carbon Observation System (COCOS)
Global Carbon Project (GCP)

Objectives of the Workshop (i)

- To discuss methodological issues on how to use top-down and bottom-up observations and modeling output to establish regional carbon budgets.
- To assess progress towards the completion of a set of agreed regional carbon budgets and global syntheses.
- To discuss several global products, their availability and use for regional carbon budgets.

Objectives of the Workshop (ii)

- To resolve any region-boundary issues to ensure a consistent global picture.
- To advance on how we characterize and estimate uncertainty in the budgets.
- To identify gaps in our data sets or data streams .
- To address any practical issues to ensure the completion of complete drafts of the regional syntheses before the 2nd meeting in May 2011.

Objectives of the Workshop (iii)

- To begin discussions for the Syntheses of Syntheses that will be undertaken during the 2nd workshop.

- To discuss final products and publication outlets.

Structure of the Workshop

- Background Information.
- Methodology and Uncertainty.
- Global Modeling Products supporting Regional Budgets and Syntheses.
- Regional Budgets.
- Global Data Products supporting Regional Budgets and Syntheses.
- Practical matters (deadlines, journals, next meeting, etc)
- *Break out groups and plenary discussions throughout.*
- *Talks are 10 min. long + 10 min. for discussion.*

RECCAP

REgional Carbon Cycle Assessment and Processes

Version - 14 October 2010

Scope

- To establish the mean carbon balance of large regions of the globe at the scale of continents and large ocean basins, including attribution to main flux components.

- To do it by comparing and reconciling multiple bottom-up estimates with the results of regional top-down atmospheric inversions.

- 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 the carbon-climate feedback.
- 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 not 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.

How we expect to achieve it

- Establishing a large global coordination effort.
- Developing of a “soft protocol” to guide and ensure consistency among regional syntheses (so they can be compared and add up at the end).
- Relying primarily on:
  - existing analyses,
  - ongoing analyses from regional and national programs (eg, North American Carbon Plan, CarboEurope, Australian NCAS),
  - global modeling and assessment efforts (eg, GCP Carbon Budget, GCP-TRENDY, TRANSCOM, Takahashi’s, SOCAT).
- Relying secondarily on:
  - the establishment of new synthesis teams in regions where there is not an established carbon program.

The RECCAP Principle

Multiple Constraints to Understand One Carbon Budget

Top-down

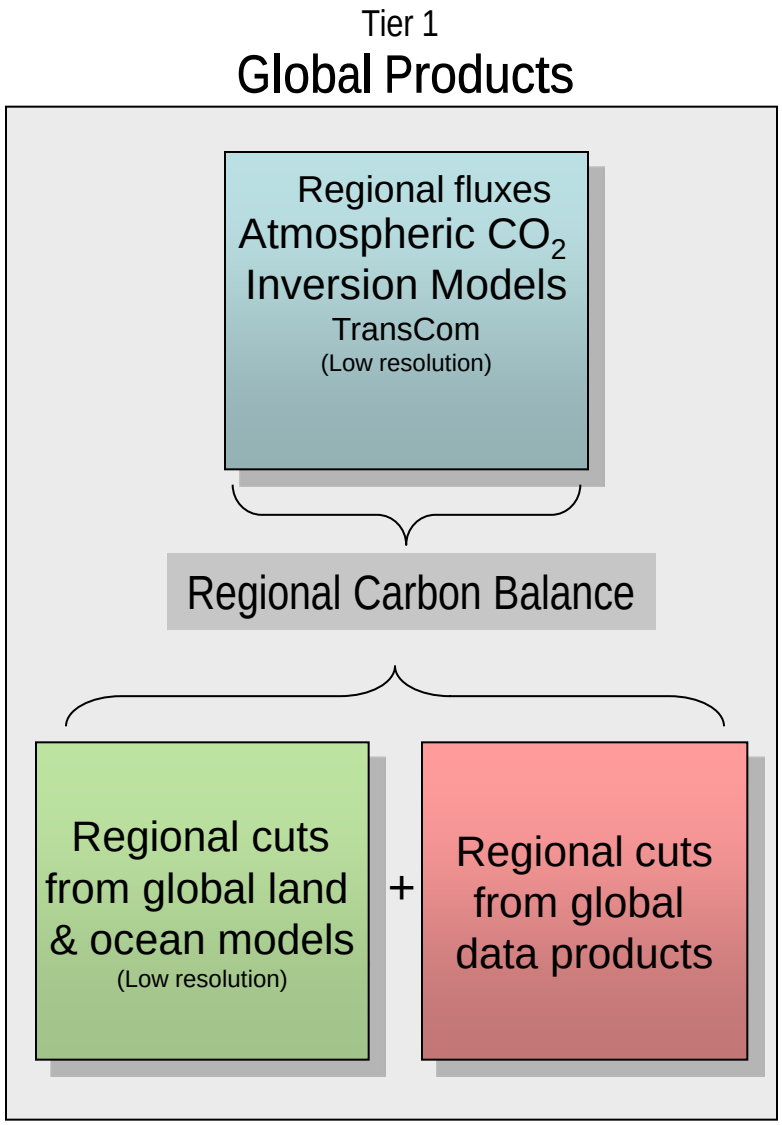
Atmospheric CO_2 Inversion Models + ghg observations

Regional Carbon Balance

Bottom-up

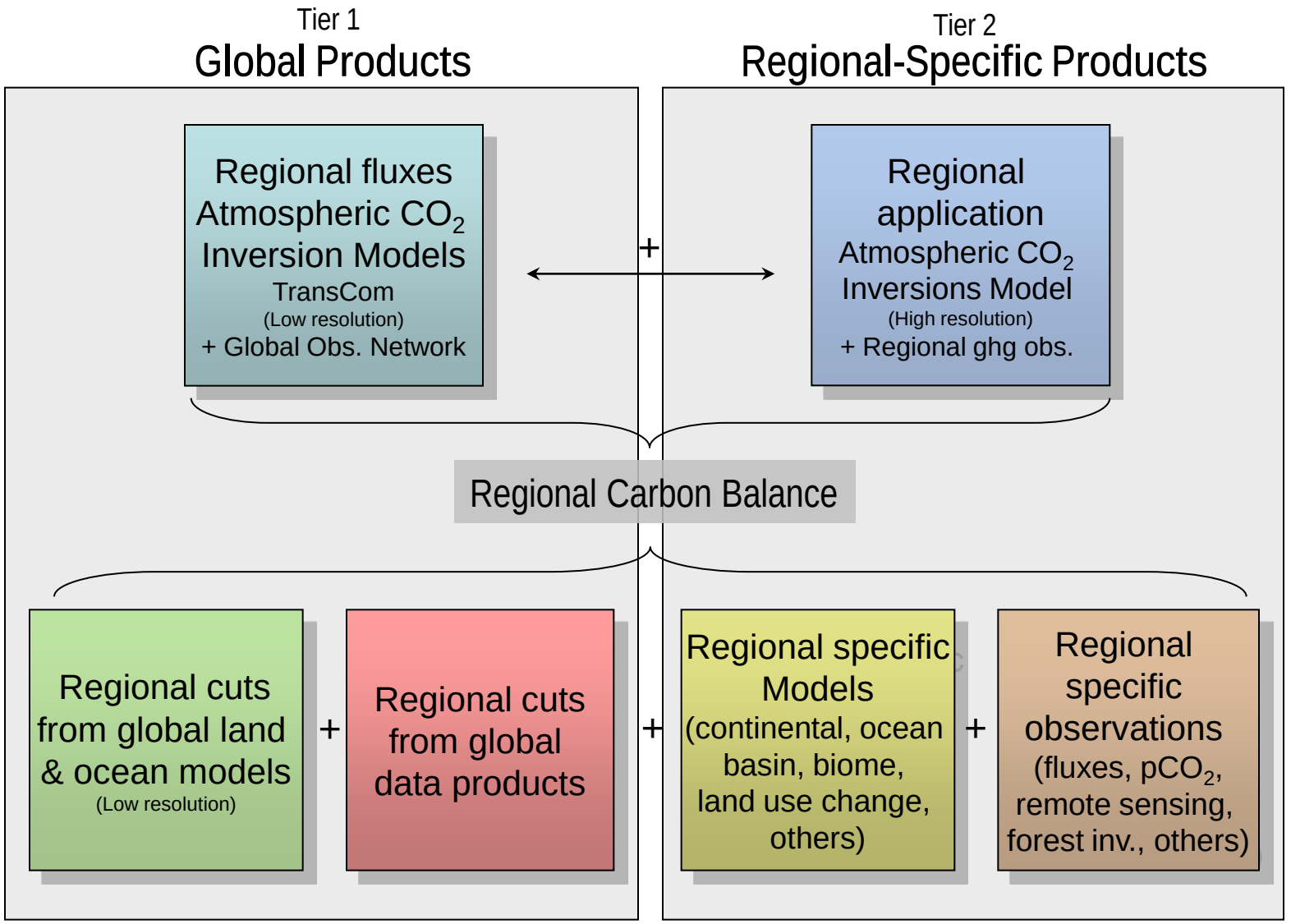
Land, Ocean models + Observations (in situ + remote sensing)

Components of Regional Syntheses



Tier 1 model outputs are coordinated by RECCAP

Components of Regional Syntheses



Tier 1 model outputs are coordinated by RECCAP

Synthesis Approach
(top-down and bottom-up)

- *Reconciliation of flux estimates* (independently assessed and often partially overlapping) as a means to build confidence in our understanding of the component fluxes, mean estimates, and inter-annual variability.
- Although we are ultimately interested in building a capacity for a mathematically-formalized multiple constraint approach, model data fusion or data assimilation, RECCAP is not necessarily pursing any of these approaches for this first effort.
- The quantification of uncertainties needs to be mathematically formalized.

Global Model Outputs for Regional Syntheses

Product	Specifications	Coordinator
Atmospheric CO_2 inversion models	TransCom (11 models), 1° x 1°, monthly gridded and regional integrated fluxes according to RECCAP mask. 1995-2008	Kevin Gurney, Rachel Law, Philippe Peylin
Ocean prognostic biogeochemistry models	Six global models gridded for all major flux components. To 1958-2009	Corinne Le Quere
Ocean inversion model	1 model.	Niki Grubber
Terrestrial biogeochemical models and NEP-flux model	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
Fire emissions	0.5° x 0.5°, monthly, burned area and fire emissions (C,CO_2,CO,CH_4,NOx, N_2O, BC others) 1997-2009.	Guido van Werf

Global Products → Regional Syntheses

Data Fair-Use Policy

- Inspired on the successful model of the AmeriFlux data policy (also used in FluxNet):
  - Request permission to use.
  - Assess possible clashes with other users.
  - Determine which arrangement are appropriate:
    - co-authorship
    - acknowledgements

Which ghgs?

Species:

- *Minimum requirement*: CO_2
- *Additiona*l: CH_4 (N_2O, others)

Spatially explicit:

- *Minimum requirement*: Biological fluxes of CO_2 (CH_4, N_2O, others)
- *Additional*: Fossil Fuel emissions

RECCAP period

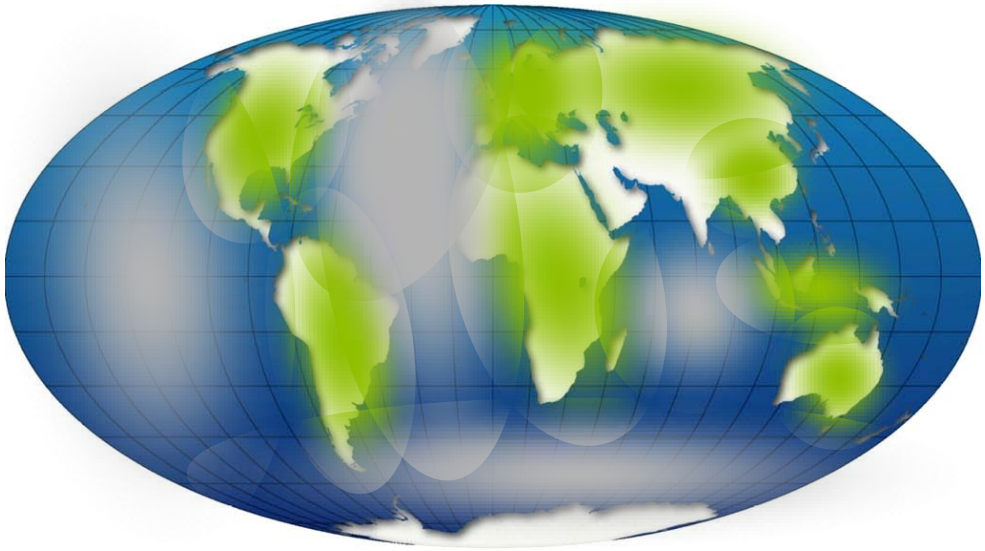
Variable but centered around:

- Budget period: 1990-2007/9
- Trend analyses: 1958-2007/9
- 1983-2007/9 (ocean trends observations)

Global Assessments

- Fossil fuel emissions
- Land use change emissions
- Global atmospheric budget
- Global ocean surface CO_2
- Global ocean storage
- Coastal Ocean

RECCAP (2008-2011)



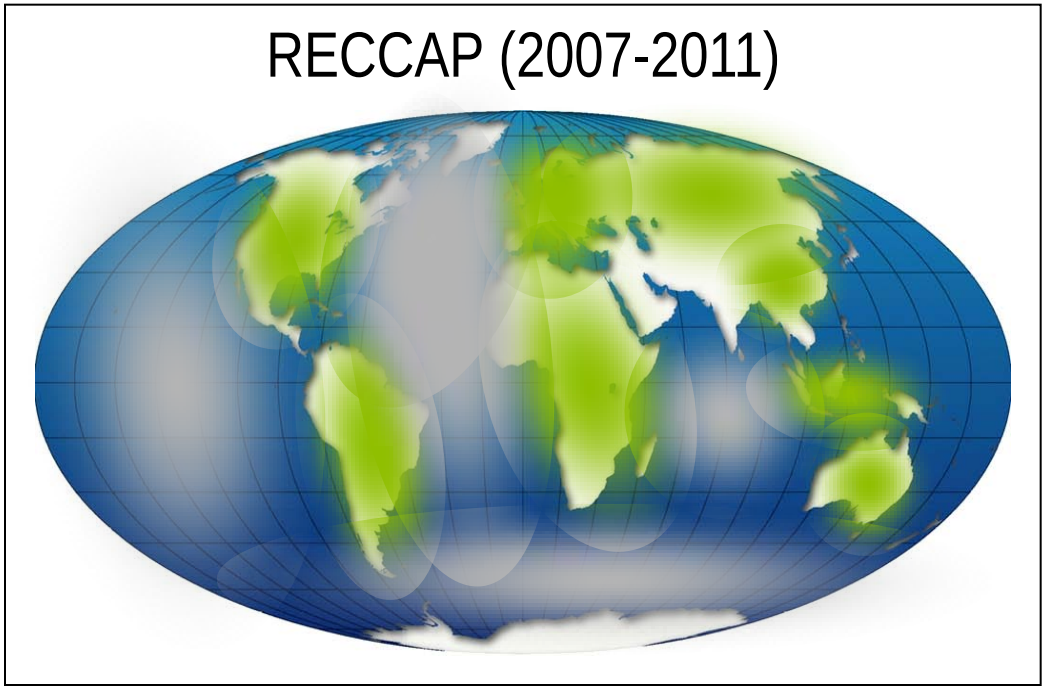
- Rivers fluxes
- Embedded fluxes in international trade

Global Syntheses ⇄ Regional Syntheses

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
10	South Asia

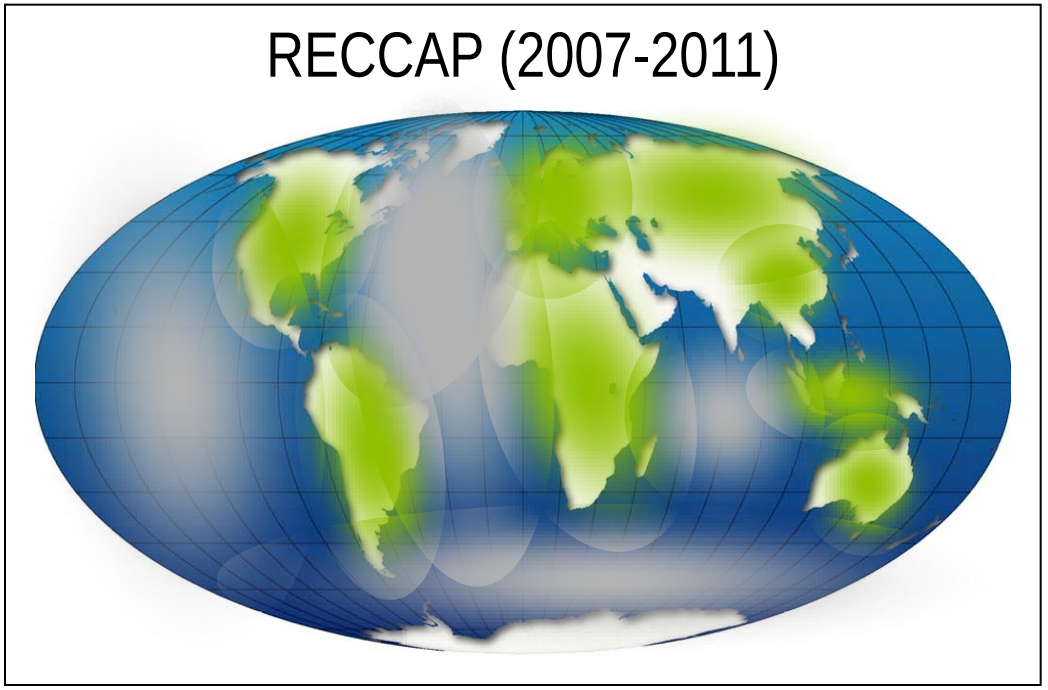


Oceans

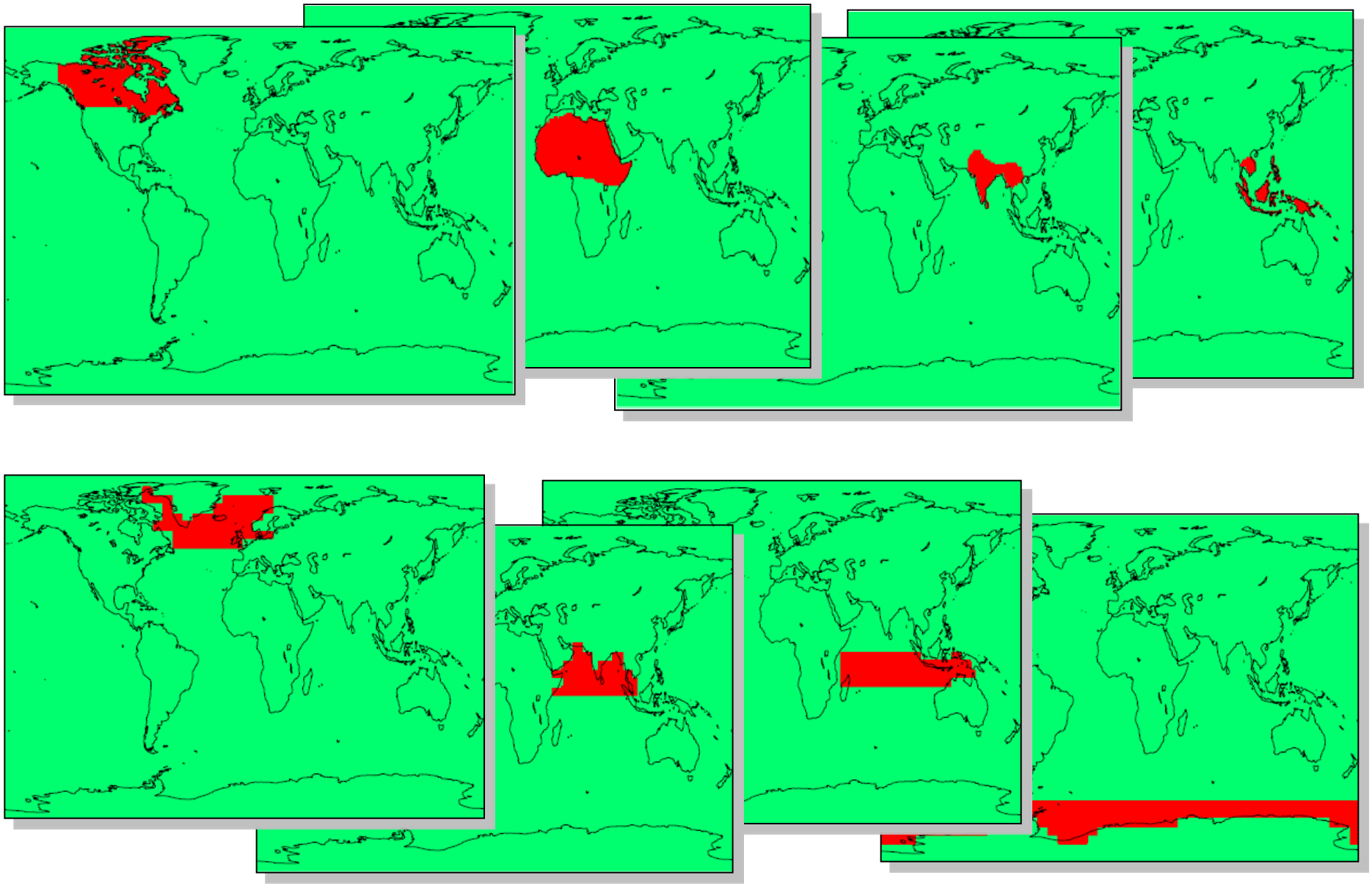
O2	Pacific
O3	Atlantic and Arctic
O4	Southern Ocean
O5	Indian

Global Syntheses of Syntheses

Ch-S1	Comparison of top & bottom up
Ch-S2	Inter-annual var. region.
Ch-S3	Attribution to regional processes
Ch-S4	Past and future trends in regional C budgets
Ch-S5	Final recommendations



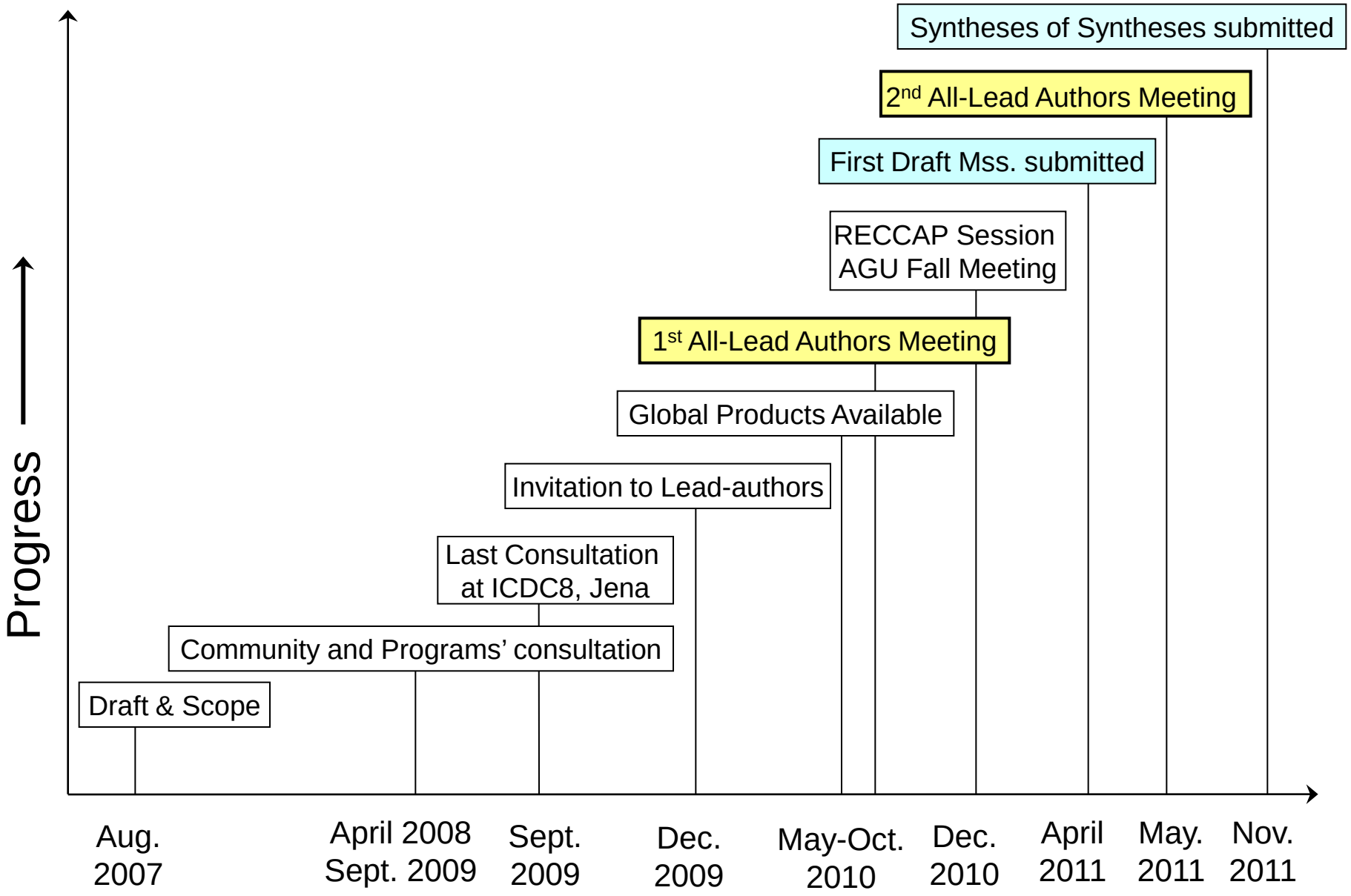
Regional Masks



Products

- Scoping paper for EOS or “News” in Science: 'An international endeavour to tackle regional carbon fluxes‘.
- Special Journal Issue/s (online eg, Biogeosciences, IF=3-4) with all regional and global syntheses.
- 2-4 high-level syntheses papers reporting key results (eg, Special feature in Nature-Geosciences, or Nature-Climate Change).
- Summary for Policy Makers.
- Distributed Data Repository (to be updated in the future) C fluxes from regional and global estimates available for further research and publications.

Timetable


Progress
Draft & Scope
Community and Programs' consultation
Last Consultation at ICDC8, Jena
Invitation to Lead-authors
Global Products Available
1st All-Lead Authors Meeting
RECCAP Session AGU Fall Meeting
First Draft Mss. submitted
2nd All-Lead Authors Meeting
Syntheses of Syntheses submitted
Aug. 2007
April 2008 Sept. 2009
Sept. 2009
Dec. 2009
May-Oct. 2010
Dec. 2010
April 2011
May. 2011
Nov. 2011

Manuscript Completion Process

For ALL Regional Budgets and Global Syntheses

1	**29 October 2010**	Submission of Outline (to Pep)
2	**25 April 2011**	Submission of 1st Complete Draft (to Pep)
3	**25 April to 25 May 2011**	Internal Review (RECCAP Steering Committee)
4	**June to November 2011**	Final Submission to Biogeosciences
5	**< 1 month after submission**	Publication in Biogeosciences Discussions

Objectives of 2nd Workshop

- To work towards a set of agreed high-level syntheses: “syntheses of syntheses”.
- It is an intense 5-day meeting modeled to the Dahlem conferences (eg, Ubatuba Carbon Cycle Scope Book, 2004).
- Background papers are written in advance, ie, all regional and global syntheses (and made available to participants).

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

- We produce 1st order drafts for all agreed “syntheses of syntheses”.
- Mss. to be completed and submitted over the following 6 months; individually submitted or as part of a set for a special feature in eg., Nature-Geo or Nature-Climate Change.

2nd Workshop: Syntheses of Syntheses

Initial Ideas

- Comparison of atmospheric and bottom up fluxes (mean decadal).
- Inter-annual variability at regional scale.
- Attribution to regional processes over the globe.
- Future regional carbon trends.
- Methods (protocols and uncertainty analyses).
- Final recommendations

Scientific Steering Committee

- Philippe Ciais, *Chair* (France)
- Pep Canadell, *Coordinator* (Australia)

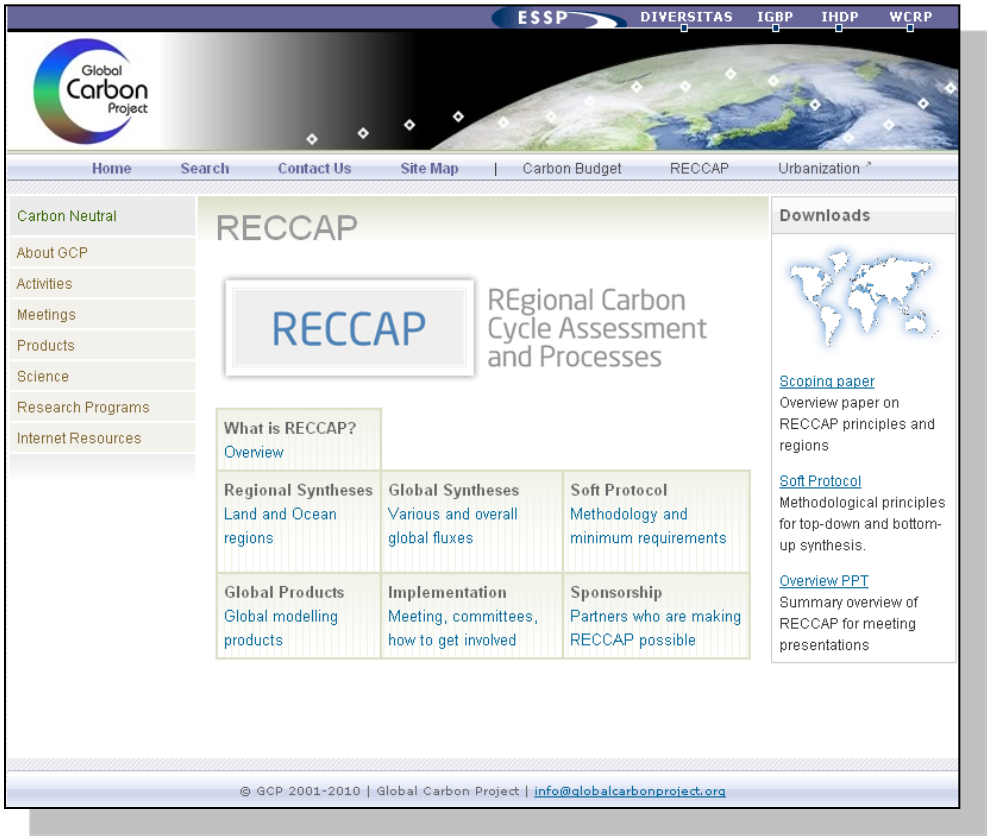
- Han Dolman (The Netherlands)
- Niki Gruber (Switzerland)
- Kevin Gurney (USA)
- Corinne Le Quere (UK)
- Mac Post (USA)
- Mike Raupach (Australia)
- Chris Sabine (USA)
- Piao Shilong (China)
- Stephen Sitch (UK)

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