Monday July 20, 2009

09:00 Session 1. The Next U.S. Carbon Cycle Science Plan
Chair: *Chris Sabine (NOAA/PMEL)*

09:00 Overview of next CCSP (*Chris Sabine, NOAA/PMEL*)

09:20 How NACP and the terrestrial community see themselves fitting into the new science plan (Ken Davis)

09:40 Social sciences and decision support in the new science plan (Lisa Dilling)

10:00 Break

10:30 panel introduction and 5 min. max opening remarks (Paula Bontempi, Bob Anderson, Galen McKinley, Andy Jacobson, Ken Davis, Lisa Dilling, *Chris Sabine, moderator*)

11:00 Open panel discussion (*Chris Sabine, moderator*)

12:00 Lunch

Thursday July 23, 2009

08:30 Session 7. The Next U.S. Carbon Cycle Science Plan Revisited
Chair: *Chris Sabine (NOAA/PMEL)*

08:30 Agency updates
-NSF (*Rice, Garrison, Taylor*)
-NASA (*Lipschultz*)
-NOAA (*Mooney*)

09:15 Questions and Open Discussion

10:00 Break

Ocean Carbon and Biogeochemistry (OCB)

Science Focus: Bring together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry.

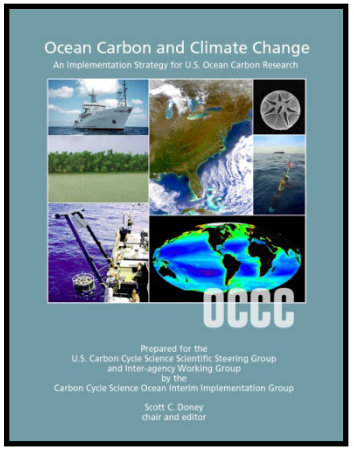
OCB will help coordinate and facilitate U.S. contributions to:

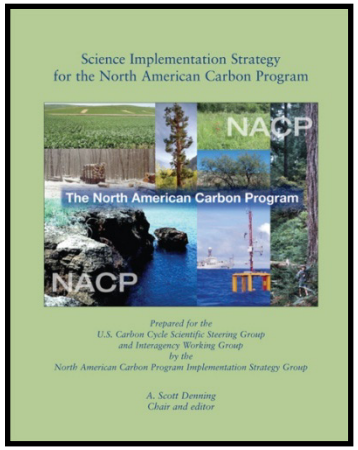
OCCC
Ocean Carbon & Climate Change

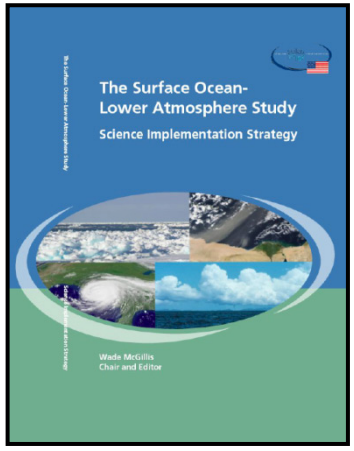
NACP
North American Carbon Program

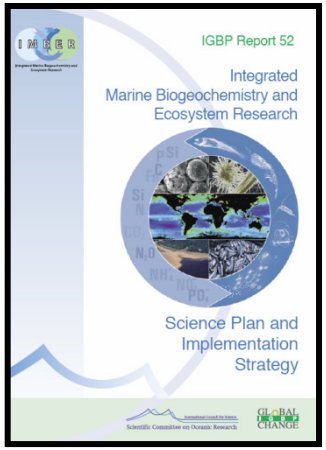
SOLAS
Surface-Ocean Lower Atmosphere Study

IMBER
Integrated Marine Biogeochemistry and Ecology



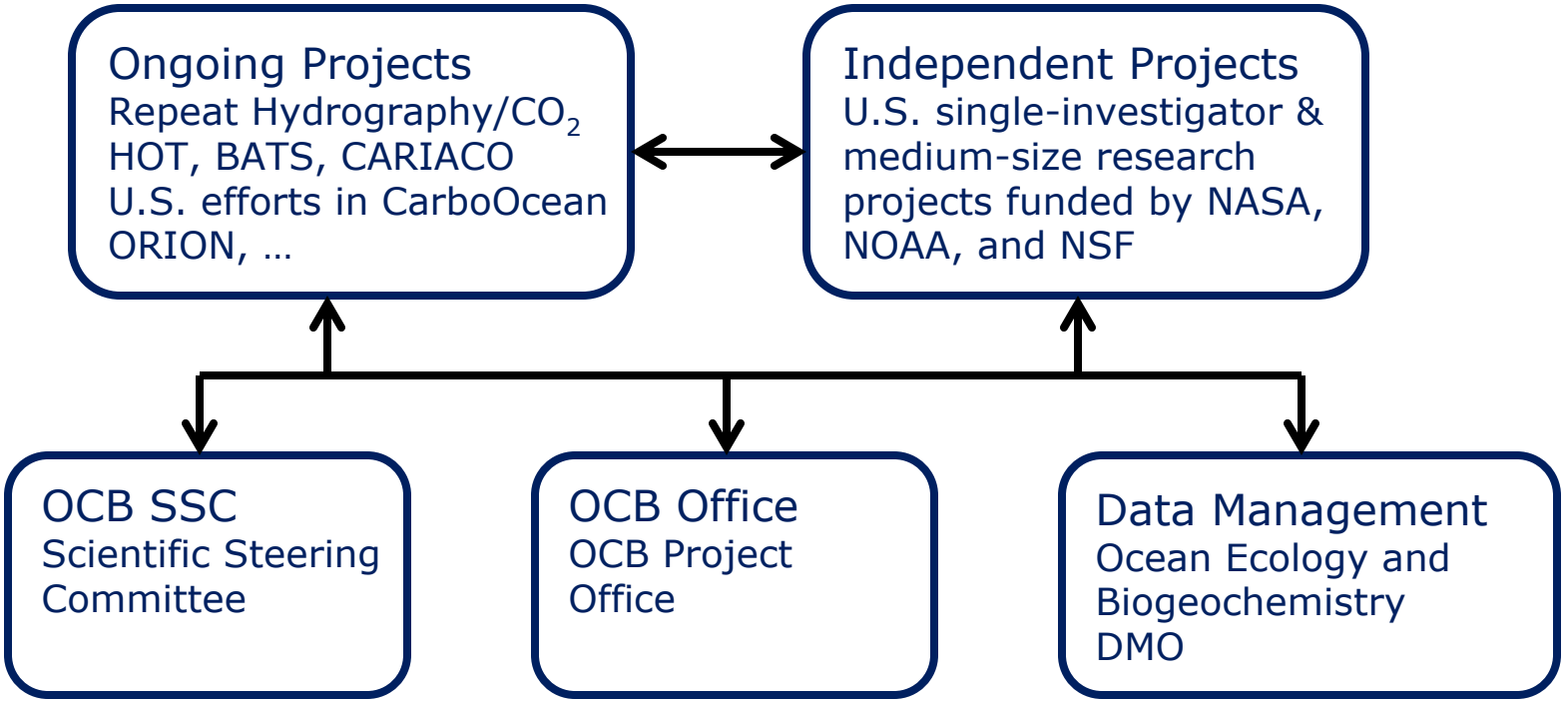






Comments / Updates: http://www.carboncyclescience.gov/carbonplanning.php

OCB Mission: "to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners."



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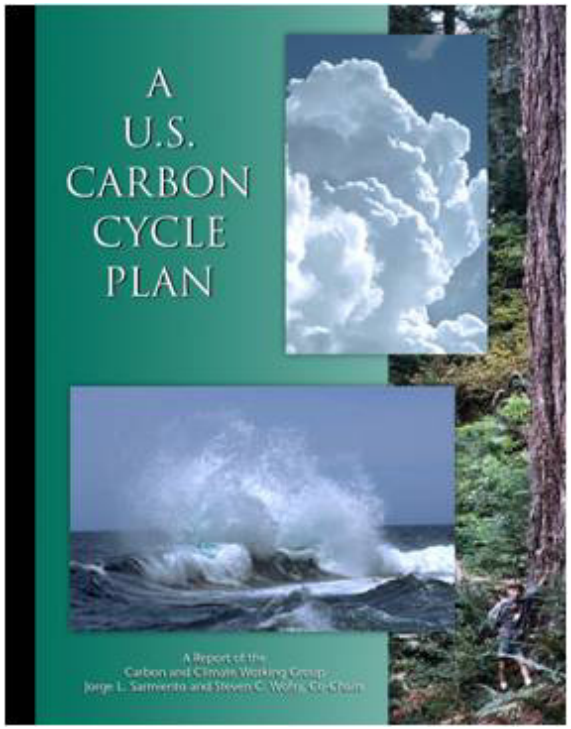
A New U.S. Carbon Cycle Science Plan

Anna Michalak[1], Gregg Marland[2],
Rob Jackson[3], Chris Sabine[4]
CCS WG Co-Leads

1 The University of Michigan
2 Oak Ridge National Laboratory
3 Duke University
4 NOAA PMEL

Rationale

- "A U.S. Carbon Cycle Science Plan" was developed by a committee of researchers chaired by Jorge Sarmiento and Steve Wofsy in 1998, published in 1999, and is now 10 years old
- The Carbon Cycle Science Working Group (CCS WG) was recently established to develop an updated, revised, or new science plan for U.S. carbon cycle science



- This plan will identify research challenges and priorities for the next decade (~2010-2020), with broad input from the community

Timeline to Date

- June/July 2008: 4 Co-leads of CCS WG appointed
- Sept/Oct 2008: 23 members of CCS WG appointed
- Nov 2008: First meeting of CCS WG
- Dec 2008: CCS WG co-leads report to CCSSG
- Feb 2009: NACP Investigators' Meeting and second meeting of CCS WG
- Mar 2009: Report from 1st meeting published in EOS
- Mar 2009: Scoping paper describing main thrusts of revised plan completed for Climate Change Prog.
- May 2009: Discussion of Plan at AGU Joint Assembly
- June 1-2 2009: Third meeting of CCS WG
- June 3-4 2009: CCS WG co-leads report to CCSSG
- July 20-23 2009: OCB Summer Workshop

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Working Group Membership

Rob Jackson – Co-lead (Duke U.)	Lisa Dilling (U. Colorado)	Brian O'Neill (NCAR)
Gregg Marland – Co-lead (ORNL)	Andy Jacobson (NOAA / U. Colorado)	Steve Pacala (Princeton)
Anna Michalak – Co-lead (U. Michigan)	Matthew Kahn (UCLA)	Jim Randerson (UC Irvine)
Chris Sabine – Co-lead (PMEL)	Steve Lohrenz (U. Mississippi)	Steve Running (U. Montana)
Bob Anderson (Columbia U.)	David McGuire (U. Alaska)	Brent Sohngen (Ohio State U.)
Deborah Bronk (Col. of William & Mary)	Galen McKinley (U. Wisconsin)	Pieter Tans (NOAA-ESRL)
Ken Davis (Penn State)	Charles Miller (JPL)	Peter Thornton (ORNL)
Ruth DeFries (Columbia U.)	Berrien Moore (Climate Central)	Steve Wofsy (Harvard)
Scott Denning (Colorado State U.)	Dennis Ojima (Heinz Center)	Ning Zeng (U. Maryland)

Shaded: Members who are attending this workshop

Fundamental Science Questions (2)

- 1999 U.S. Carbon Cycle Science Plan:
  - What has happened to the carbon dioxide that has already been emitted by human activities (past anthropogenic CO_2)?
  - What will be the future atmospheric CO_2 concentration trajectory resulting from both past and future emissions?

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1999 U.S. CCS Plan Goals (5)

1. Quantify and understand the Northern Hemisphere terrestrial carbon sink
2. Quantify and understand the uptake of anthropogenic CO_2 in the ocean
3. Determine the impacts of past and current land use on the carbon budget
4. Provide greatly improved projections of future atmospheric concentrations of CO_2
5. Develop the scientific basis for societal decisions about management of CO_2 and the carbon cycle

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1999 U.S. CCS Plan Program Elements (11)

- Expanded flux network
- Airborne CO_2 observation program
- Global CO_2 monitoring network
- Global terrestrial carbon and land use inventories
- Reconstruction of historical CO_2 emissions
- Regional observational experiments
- Long-term terrestrial observations
- Terrestrial process studies and manipulations
- Global ocean measurements (surveys, time series, remote sensing)
- Ocean process studies and manipulations
- Modeling and synthesis

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Summary of Scoping Paper Completed in March 2009

Overall Directions

- Many research priorities identified in the 1999 Plan remain important
- However, new priorities for carbon cycle research are also needed, including:

1. Effects of human activities on carbon cycling,
2. Vulnerability and resilience of ecosystems to changes in carbon cycling and associated changes in climate
3. Efficacy and environmental consequences of carbon management policies, strategies, and technologies

- Additional emphasis is also needed to evaluate uncertainties in our understanding of the global carbon cycle and to coordinate researchers from different scientific disciplines to study a common problem

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Fundamental Science Questions

- 1999 U.S. Carbon Cycle Science Plan (2):
  - What has happened to the carbon dioxide that has already been emitted by human activities (past anthropogenic CO_2)?
  - What will be the future atmospheric CO_2 concentration trajectory resulting from both past and future emissions?
- Current version for new Plan (3):
  - How do natural processes and human actions affect the carbon cycle, on land, in the atmosphere, and in the oceans?
  - How do policy and management decisions affect the levels of atmospheric carbon dioxide and methane?
  - How are ecosystems, species, and resources impacted by increasing greenhouse gas concentrations, the associated changes in climate, and carbon management decisions?

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Objectives for 2020

- Provide the public with a timely explanation for observed variations in atmospheric CO_2 and CH_4 growth, up to and including the present
- Convert the current ad-hoc carbon-cycle monitoring and observations into an optimally designed and integrated network of sustained physical, biological, and socio-economic measurements so that scientists can evaluate trends, feedbacks, and the possible occurrence of abrupt changes over the next 50 years
- Quantify which processes, ecosystems, and carbon reservoirs are most vulnerable and most resilient to changes in the carbon cycle and climate interactions and large-scale disturbances
- Develop quantitative measures for understanding the uncertainty of current and projected carbon flows

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Objectives for 2020

- Work with the integrated assessment community to verify regional carbon budgets and carbon contracts, and improve climate projections at scales of 10 to 100 km; work with the same community to explore the implications of projected trends and alternative socioeconomic futures - from emissions to land use - that will influence the overall carbon cycle
- Prioritize the socioeconomic, biological, and physical variables that will most determine whether the ocean and terrestrial biospheres will be a source or sink for carbon and methane in the future
- Provide the scientific understanding to evaluate the efficacy and potential environmental side effects of carbon management policies and technologies

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Enabling Contributions and Collaborations

- Carbon cycle observations are essential for global monitoring of CO_2 and CH_4
- Process experiments and manipulations provide a mechanistic understanding for changes observed
- Models of the processes, feedbacks and balances of carbon among the Earth reservoirs are needed
- There is a need to continue long-term measurements and to initiate new observations and manipulations
- The driving role of the human component of the carbon cycle is being increasingly recognized
- Substantial new resources will be required to pursue this multitude of aspects of the carbon cycle science

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Pathways and Options

- An established tradition of strong interdisciplinary collaboration exists within carbon cycle science
- North American Carbon Program (NACP) and Ocean Carbon and Climate Change (OCCC) programs established to address first 2 goals of 1999 plan
- Ocean acidification cuts across traditional disciplines
- Human contributions and responses have been an explicit component of previous efforts, but community has struggled with how to properly engage the social, political, and economic research communities
- Stronger links with related research programs on the global carbon cycle and with continental-scale carbon assessment programs are needed

Comments / Updates: http://www.carboncyclescience.gov/carbonplanning.php

Plan Outline

I. The need for a new plan
   A. Why the global carbon cycle is important
   B. Historical context for the carbon cycle today
   C. History of the first CCS Plan
   D. Why we need a new CCS Plan
II. Fundamental questions and goals of the new plan
III. Key components of a new plan
   A. Sustained observations
   B. Process studies and experiments
   C. Modeling, prediction, synthesis
   D. Communication dissemination
IV. Key partnerships for a successful science program
V. Budget and priorities for the next decade
VI. References
VII. Appendices

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Goals (6 – still preliminary)

- Provide clear and timely explanation of past and current variations observed in atmospheric CO_2 and CH_4 - and the uncertainties surrounding them. (Q1, Q2)
- Quantify and verify anthropogenic carbon emissions and sequestration using methods that are transparent and relevant to policymakers. (Q1, Q2)
- Determine and evaluate the carbon stocks and flows that are most vulnerable to change - emphasizing potential positive feedbacks to sources or sinks that make climate stabilization more critical or more difficult. (Q1, Q2)

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Goals (6 – still preliminary)

- Quantify how rising CO_2 and changing climate will separately or jointly affect ecosystems, biodiversity, and natural resources. (Q3)
- Determine the likelihood of success and the potential for unintended consequences of carbon-management pathways that might be undertaken to achieve a low carbon future. (Q1, Q2, Q3)
- Understand decision-maker needs for current and future carbon-cycle data and for sound projections of the behavior of the carbon cycle into the future; and provide information that is relevant, credible, and legitimate for their decisions. (Q1, Q2, Q3)

Comments / Updates: http://www.carboncyclescience.gov/carbonplanning.php

Goals (possible 7th Goal?)

- Develop an integrated monitoring system that commits to long-term monitoring of the essential atmospheric, oceanic, biological, demographic, and socioeconomic data that will be essential over time to establish baselines, evaluate change, understand processes, and monitor mitigation actions.

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Working Towards Program Elements

	Program Elements			
Goals	Sustained observations	Process studies and experiments	Modeling, prediction, synthesis	Communication dissemination
Explain observed variations	**X**	**X**	**X**	**X**
Quantify anthropogenic emissions	**X**		**X**	**X**
Evaluate vulnerable stocks and flows	**X**	**X**	**X**	**X**
Ecosystem impacts	**X**	**X**	**X**	**X**
Evaluate carbon management options	**X**	**X**	**X**	**X**
Decision support and information management	**X**		**X**	**X**
Integrated monitoring system	**X**			**X**

Comments / Updates: http://www.carboncyclescience.gov/carbonplanning.php

Future Timeline

- August 2009: Discussion of Plan at Ecological Society of American (ESA) meeting
- September 2009: Discussion of Plan at International Carbon Dioxide Conference (ICDC)
- Fall 2009: CCS WG workshop on stakeholder involvement
- Fall 2009: Full outline of revised U.S. CCS Plan
- Fall 2009: CCS WG Writing team meeting
- Summer 2010: New U.S. CCS Plan completed

Comments / Updates: http://www.carboncyclescience.gov/carbonplanning.php

Resources

- More information:
  - http://www.carboncyclescience.gov/carbonplanning.php
- Input and comments:
  - Blog: http://carboncyclescience.blogspot.com/
  - Email: CCSPlan@gmail.com
- Publications and resources:
  - 1999 CCS Plan
    http://www.carboncyclescience.gov/documents/cc_sp_1999.pdf
  - AGU EOS Vol. 90 No. 12, p. 102-103, 2009
    http://www.carboncyclescience.gov/documents/ccs-plan-eos-v90-n12-24Mar09.pdf
  - Scoping paper
    http://www.carboncyclescience.gov/documents/Carbon-Cycle-Scoping-Paper-27Mar09.pdf

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