

Summary of the Third Workshop of Methane Working Group
*(Toward an adequate quantification of CH₄ emissions from land ecosystems:
Integrating field and in-situ observations, satellite data, and modeling)*

March 13-14, 2008

**National Center for Ecological Analysis and Synthesis
Santa Barbara, CA**

During the workshop (see Appendix A for the agenda), we first reported the progress on tasks planned in the last year's workshop. Specifically (1) We have successfully organized a session, entitled "*Methane: Recent Findings (and Surprises) at the Local and Regional Scale and Approaches to Reducing Uncertainty in the Global Budget - Conveners: Crill and Melack*" in the Fall AGU annual meeting in San Francisco, more than 40 papers contributed to the session; (2) With 10 accepted papers, we wrapped up the special section, entitled "*Recent Field Observations and Modeling Studies on Methane*" in the *Journal of Geophysical Research - Biogeosciences*. The paper titles and authors for the special section are listed in Appendix B; and (3) We have archived *in situ* measurement data of methane fluxes and auxiliary variables in NCEAS Data Repository website (<http://data.nceas.ucsb.edu>) for a number of sites. Second, we reported the progress on our planned regional synthesis for the Arctic, rice paddies, and tropical region. Specifically, for the Arctic region, our working group members, Melillo, Zhuang, McGuire, and Walter led publishing a chapter "*Methane from the Arctic: Global warming wildcard*" in 2008 United Nation Environment Program Yearbook. McGuire led and Zhuang, Walter, and Zimov are involved drafting an Arctic carbon synthesis paper, entitled "*Sensitivity of the Carbon Cycle in the Arctic to Climate Change*". For rice paddies, Khalil et al. published three papers in our organized special issue in addressing emissions from rice paddies (See Appendix B). For the tropics region, Potter and Melack made a significant progress on quantifying methane emissions in Amazonia Basin by combining wetland and vegetation data and flux measurements. In addition, a major instrumentation for observing methane fluxes in Siberia has been set up. Our Working Group members Walter, Dlugokencky, and Zimov led this effort for the implementation.

During the workshop, we planned the detail steps to achieve a new level of synthesis for the Arctic, rice paddies, and Amazonia Basin. Specifically, we planned (1) to use the organized wetland data to explore the controls on methane emissions across different wetland types / landscapes with meta-analysis and statistical approaches; (2) to synthesize global emissions from rice paddies by combining *in situ* measurements, top-down and bottom-up modeling approaches; (3) to investigate the methane emissions from Amazonia Basin using methane flux data on different habitats and vegetation and wetland inundation data; (4) to use satellite retrieval data and biogeochemistry and atmospheric chemistry transport models to reconcile methane emissions and atmospheric concentrations in the South Asia; and (5) to integrate wetland and lake methane emissions in the Arctic. We planned to organize these synthesis papers for a special issue in *Biogeochemistry* or *Global Biogeochemical Cycles*. Contact persons of the special issue are Melack, Zhuang, and Reeburgh. We list the tentative manuscript titles and

authors in Appendix C. We anticipate the first draft of these papers will be ready by December, 2008. In addition, we planned to organize a session for the 2008 Fall AGU annual meeting to exchange findings and progresses on methane cycling studies. Butenhoff, Zhuang, Dlugokencky, and Xiong will lead this activity.

Appendix A.

Schedule for the Third Workshop of Methane Working Group

*(Toward an adequate quantification of CH₄ emissions from land ecosystems:
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March 13-14, 2008

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- 8:30 a.m. Introduction and Meeting Goals (Zhuang)
1. Synthesis products and deliverables
(A grand synthesis paper, special issue of a set of synthesis paper, or individual papers)
 2. Data organization
 3. Final report of the project
- 9:00 a.m. Progress Report
- (1) 2007 AGU methane session (Melack)
 - (2) Data organization (Zhuang)
 - (3) Special issue of JGR-Biogeosciences (Reeburgh / Zhuang)
 - (4) Synthesis products
 1. Emissions from Rice paddies (Khalil)
 2. Emissions from permafrost region (Melillo, Zhuang, Walter and McGuire)
 - a. United Nation Environment Program 2008 year-book chapter
 - b. Carbon synthesis paper
 3. Others
- 10:15 a.m. Discussion and Question Period
- 10:35 a.m. Snack and Coffee Break
- 11:00 a.m. Presentation of Data and Model Preparation
- (1) Methane Flux and environmental data (Walter and others)
 - (2) Flask and other measurements (Dlugokencky and Fischer)
 - (3) Satellite retrievals (Xiong and Houweling)
 - (4) Wetland data (Matthews and McDonald)
- 11:40 a.m. Discussion and Question Period
- 12:00 - Lunch
- 1:30 p.m. Conti. Presentation of Data and Model Preparation

- (5) Bottom-up models (Zhuang)
 - a. Model-data fusion
 - b. Wetland inundation and spatial variation of moisture and water table depth
 - (6) Top-down models (Houweling and Tang)
- 2:00 p.m. Discussion on Breakout Groups (Two Groups)
- (1) Meta-data analysis;
 - (2) Bottom-up approaches
 - (3) Coupling Bottom-up and top-down approaches
 - (4) Rice paddies
 - (5) Northern wetland emissions
 - (6) Tropical wetland emissions
- Identifying what products we could come out with and how to wrap up -- workshop goals
- 3:00 p.m. Snack and Coffee Break
- 3.30 p.m. Presentation from each group
---Products and deliverables and how
- 4:30 p.m. Group discussion
---- Outline products
- 5:00 p.m. Adjourn
- 6:30 p.m. Group Dinner

March 14, 2008

- 8:30 a.m. Breakout Groups Discussion
- 1. Details of steps
 - 2. Products and deliverables
 - 3. Future data priority
- 10:30 a.m. Snack and Coffee Break
- 10:50 a.m. Cont. Breakout Groups Discussion
- 12:00 - Lunch
- 1:30 p.m. Breakout Group Summary to the Workshop
- 3:00 p.m. Snack and Coffee Break

- 3:30 p.m. Wrap-up
- (1) Synthesis products and deliverables (A grand synthesis paper, special issues of a set of synthesis papers, or individual papers)
 - (2) Data depository
 - (3) Final report of the project
- 4:30 p.m. Adjourn

Appendix B.

Accepted papers in Special Section of *Journal Geophysical Research - Biogeosciences*

Zhuang, Q., and W. S. Reeburgh (2008), Introduction to Special Section on Recent Field Observations and Modeling Studies on Methane, *J. Geophys. Res. - Biogeosciences*.

Turetsky, M. R., Treat, C. C., M. Waldrop, J. M. Waddington, J. W. Harden, A. D. McGuire (2008) Soil climate controls on methane fluxes and methanogen activity in an Alaskan peatland: short-term responses to *in situ* water table and soil warming manipulations, *J. Geophys. Res. -Biogeosciences*.

White, J. R., R. D. Shannon, S. D. Bridgham, J. F. Weltzin, J. Pastor (2008) Potential effects of soil warming and drying on methane cycling in northern peatlands, *J. Geophys. Res. - Biogeosciences*.

Khalil, M. A. K., and C. Butenhoff (2008) Spatial variability of methane emissions from rice fields and implications for experimental design, *J. Geophys. Res. - Biogeosciences*.

Khalil, M. A. K., M. J. Shearer, R. A. Rasmussen, X. Li, and J-L, Liu (2008a) Methane and nitrous oxide emissions from sub-tropical rice agriculture in China, *J. Geophys. Res.- Biogeosciences*.

Khalil, M. A. K., M. J. Shearer, R. A. Rasmussen, C. Duan, L. Ren, (2008b) Production, oxidation, and emissions of methane from rice fields in China, *J. Geophys. Res. - Biogeosciences*.

- Gauci, V., N. B. Dise, G. Howell, and M. E. Jenkins (2008a) Suppression of rice methane emission by sulfate deposition in simulated acid rain, *J. Geophys. Res. - Biogeosciences*.
- Walter, K. W., J. P. Chanton, E. A. Schuur, S. A. Zimov, and F. S. Chapin III (2008) Methane production and bubble emissions from arctic lakes: Isotopic implications from source pathways and ages, *J. Geophys. Res. -- Biogeosciences*.
- Sachs, T., C. Wille, J. Boike, L. Kutzbach, (2008) Environmental controls on ecosystem-scale CH₄ emission from polygonal tundra in the Lena River Delta, Siberia, *J. Geophys. Res. - Biogeosciences*.
- Gauci, V., S. Blake, D. S. Stevenson, and E. Highwood (2007b) Halving of the Northern wetland CH₄ source by a large Icelandic volcanic eruption, *J. Geophys. Res. - Biogeosciences*.
- Xiong, X., C. Barnet, E. Maddy, C. Sweeney, X. Liu, L. Zhou, and M. Goldberg (2008), Characterization and Validation of Methane Products from the Atmospheric Infrared Sounder (AIRS), *J. Geophys. Res. - Biogeosciences*

Appendix C.

Tentative Titles and Authors for Proposed Special Section of *Biogeochemistry* or *Global Biogeochemical Cycles*

1. Introduction to the special issue/section (Zhuang et al.)
2. Controls on methane emissions across different wetland types/ landscapes (Wickland/Turetsky et al.)
3. Global rice paddy emissions: A synthesis study (Khalil et al.)
4. Methane emissions dynamics with process-based and inverse models 2003 and 2004 in Amazon Basin (Zhuang, Potter, Melack, Houweling et al.)
5. Integration of Arctic emissions of permafrost land and lakes (Zhuang, Walter et al.)
6. Methane emissions and atmospheric concentrations in South Asia (Xiong et al.)