Summary of the Second Workshop of Methane Working Group

(Toward an adequate quantification of CH_4 emissions from land ecosystems: Integrating field and in-situ observations, satellite data, and modeling)

March 15-16, 2007

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 planed in last year's workshop. Specifically, during the last year, (1) We have successfully organized a session, entitled "*Methane: Toward a Multiscale approach to Reducing Uncertainties in its Emissions--- Conveners: Crill, Dlugokencky, Turetsky, and Zhuang"* in the Fall AGU annual meeting in San Francisco, 45 papers contributed to the session; (2) We have proposed a special section, entitled "*Recent Field Observations and Modeling Studies on Methane*" for the *Journal of Geophysical Research - Biogeosciences* with 20 contributing manuscripts, about one-third of total number of manuscripts are ready to submit on April 1, 2007, which is the beginning of submission date we proposed. The manuscripts are directly derived from researches of methane Working Group members or are to certain extent benefited from activities related to our methane Working Group. The manuscript titles and authors for the section are listed in Appendix B; (3) We have designed a data structure to archive methane fluxes and their associated physical, chemical, and biological variables at the field sites; and (4) We have expanded our Working Group to include experts on satellite retrieval of atmospheric methane concentrations, atmospheric inverse and transport modeling, microbiology of methane emissions, and remote sensing of land-use and land-cover change, in particular, on delineation of wetland dynamics.

During the workshop, we identified three areas/regions as foci for next year's synthesis activity and they are the Arctic, tropics, and rice paddies. The research questions have been identified for each area / region. For the Arctic region, we will use the organized wetland data to explore the controls on methane emissions across different wetland types / landscapes with meta-data analysis and statistical approaches, the task will be led by Wickland and Turetsky. At the regional scale, Zhuang will lead the investigation of the uncertainty of methane emissions in the past several decades with a number of process-based biogeochemistry models including TEM, NASA-CASA, and UK methane emissions model and a number of wetland datasets. The regional inventory of methane emissions through both statistical and process-based modeling will be fed into the inverse and transport models of TM5 and MATCH to improve top-down estimates of methane fluxes in the region. For the tropical region, there is sufficient methane flux data on different habitats for modeling studies. In addition, the vegetation, wetland types, water table depths, and other auxiliary data are also available. The data and knowledge are sufficient enough to allow us use both process-based biogeochemistry models and inverse modeling for regional analyses. Potter and Melack will lead the regional synthesis for the Amazon Basin from 1980 to 2005 with joint forces from other modeling groups, such as TEM and TM5. For the rice paddies, the inventory of methane emissions considering fertilizations, management, and air quality impacts for the last three decades has been identified as a research topic, Khalil will lead this effort in collaboration with

other biogeochemistry modeling groups including DNDC,TEM, and others. The inventory of methane emissions will also contribute to atmospheric inverse and transport modeling of TM5 and MATCH. Using regional estimates from biogeochemistry modeling from three areas / regions, Meirink, Xiong, and Tan will lead a global inverse modeling study. In this study, the methane column concentrations retrieved with Atmospheric Infrared Sounder (AIRS) on the EOS/Aqua platform will be used for validating model results. Based on the discussion on each of our focus areas, we have identified a set of six manuscripts and we will propose a special section in *Global Change Biology* as avenue for these papers. Tentative contact person is Reeburgh. We list the current form of manuscript titles and authors in Appendix C.

During the workshop, we brainstormed and developed the Methane Working Group Data Policy, which is stipulated in Appendix D.

In addition, we have planned the following activities during the coming year before our third workshop: (1) To organize a session for Fall AGU, 2007 to bring methane scientists together to exchange their findings and progresses on methane cycling. Melack and Crill will lead this activity; (2) With the interaction and communication with participants in the last year's AGU methane session, we noticed the significant progress on understanding of mechanisms and processes of methane cycling has been made, Crill will lead an effort to summarize the state-of-the-art knowledge and understanding of methane cycling, and plan to submit a synthesis manuscript to *Bioscience*; (3) As we have realized that the availability of flux data still limits our synthesis studies, the group recommend a number of techniques to expand the observational sites to cover various wetland ecosystems types with new available technology (e.g., laser technology). Walter and Dlugokencky will lead to draft a manuscript to address the need and possibility to initiate a methane flux network. The manuscript is planned to submit to *EOS*. Along this line, they have been also actively seeking funding to support the new initiative; and (4) We have scheduled our third workshop, which will be held on March 13-14, 2008.

Appendix A. Agenda

Schedule for the Second Workshop of Methane Working Group

(Toward an adequate quantification of CH_4 emissions from land ecosystems: Integrating field and in-situ observations, satellite data, and modeling)

March 15-16, 2007

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

March 15, 2007

8:30 a.m.	Meeting goals and project overview (Zhuang)
9:00 a.m.	Report on data organization (Wickland and Turetsky)
9:30 a.m.	Group discussion on data archive
10:35 a.m.	Snack and Coffee Break
11:00 a.m.	Report on special issue of JGR-Biogeosciences (Reeburgh and Zhuang)
11:10 a.m.	Group Discussion on the special issue of JGR-B
12:00 -	Lunch
1:30 p.m.	Group discussion -- Data requirement toward regional estimates -- Fluxes from wetlands, rice paddies, lakes, and ponds -- Wetland dynamics -- Atmospheric concentrations
3:00 p.m.	Snack and Coffee Break
3.30 p.m.	Group Discussion -- Available tools toward regional estimates --- Top-down approach: Inverse and transport modeling --- Bottom-up: Process-based modeling
4:30 p.m.	Breakout groups to achieve our synthesis goal --- Data --- Tools
5:00 p.m.	adjourn
6:30 p.m.	Group Dinner

March 16, 2007

8:30 a.m. Identify Synthesis topics with models and data for three areas?

1. Tropical region
2. Temperate and arctic region
3. Rice paddies

9:45 a.m. Breakout groups discussion

1. Tropical region
2. Temperate and arctic region
3. Rice paddies

10:30 a.m. Snack and Coffee Break

10:50 a.m. Continue breakout groups discussion

(1) Tropical region
(2) Temperate and arctic region
(3) Rice paddies

12:00 - Lunch

1:30 p.m. Breakout group 1 summary to the workshop
2:00 p.m. Breakout group 2 summary to the workshop
2:30 p.m. Breakout group 2 summary to the workshop

3:00 p.m. Snack and Coffee Break

3:30 p.m. Wrap-up

--- Combine charges of groups 1, 2, and 3
--- Tasks between now and the third workshop
--- Products and deliverables (data organization, products etc.)

5:00 p.m. Adjourn

Appendix B. Proposed Special Section Contents:

Recent Field Observations and Modeling Studies on Methane

1) Zhuang, Qianlai and Reeburgh, W. S.
Introduction to Section.

2) Crill, Patrick, Keller, M., Silva, H., Dias, J. C., Neto, E. , Albuquerque, S., Czepiel, P., de Olivera, R. C.
Canopy Measurements in an Upland Forest of the Eastern Brazilian Amazon. A Source of Methane in Amazon Upland Forests.

3) Khalil, M. A. K., Shearer, M. J., Rasmussen, R. A., ChangLin, D., Lixin, R.
Production, Oxidation, and Emissions of Methane from Rice Fields in China.

4) Khalil, M. A. K., Shearer, M. J., Rasmussen, R. A., Li, Xu
Emission of Methane and Nitrous Oxide from Double Cropping Agricultural Systems.

5) Khalil, M. A., K. and Butenhoff, C. L.
Spatial Variability of Methane Emissions from Rice Fields.

6) White, J. R., Shannon, R. D., and Bridgham, S. D.
Effects of Soil Warming and Water Table Manipulation on Methane Cycling in Peatland Mesocosms.

7) Walter, K. M., Chanton, J., Schuur, E.., Zimov, S. A., Chapin, F. S. III
Methane Production and Bubble Emissions from Arctic Lakes: Implications for ^{14}C and Stable Isotope Compositions.

8) Zhuang, Q., Mialon, A., Mellilo, J., McGuire, A. D., Prinn, R., and Kicklighter, D.
The Influence of the Changes in Wetland Area Extent on Carbon Dioxide and Methane Dynamics over the Pan-Arctic from 1988 to 2000.

9) Kemenes, A., Forsberg, B. and Melack, J.
Factors Influencing CH_4 and CO_2 Emission from a Tropical Hydroelectric Dam, Central Amazon, Brazil.

10) Belger, L., Forsberg, B., and Melack, J.
Methane Emissions from the Upper Rio Negro Interfluvial Wetlands.

11) Lima, Ivan B. T., Mazzi, E., Novo, E. M., and Ometto, L. M.
Main Factors Controlling CH_4 and CO_2 Emissions at Corumbá Reservoir (Brazil).

12) Turetsky, M. R., Harden, J. H., McGuire, A. D., Waldrop, M., and Terat, C.
Soil Climate Controls on Methanogens and Methane Fluxes in Boreal Peatlends: Experimental Manipulation of Soil Temperature and Water Table Position in an Alaskan Rich Fen.

13) Sachs, T., Wille, C., Giebels, M, Boike, Kutzbach, L.
Environmental Controls of CH_4 Emission from Polygonal Tundra on Micro-site and Ecosystem Scale, Lena River Delta, Siberia.

14) Forbrich, I., Sachs, T., Giebels, M.,
Detection and Quantification of Methane Ebullition using a Continuously Sampling Photoacoustic Field Gas-Monitor.

15) Chanton, J., Chasar, Lia, and Prater, James
Natural Radiocarbon Abundance of Methane as a Function of Wetland Type.

16) Qian Tan and Ron Prinn
Estimates of Methane Emission by Process-Type Using Global Satellite and Ground-based Data and Inverse Modeling.

17) Gauci, V., Blake, S., Stevenson, Highwood, Ferretti, D.
Halving of the Northern Wetland CH_4 Source by a Large Icelandic Volcanic Eruption.

18) Gauci, V., Dise, N. B., Howell, G, and Jenkins, M
Suppression of Rice Methane Emission by Sulfate Deposition in Simulated Acid Rain.

19) Xiong, Xiaozhen, Barnet, C., Maddy, E., Sweeney, C., Liu, X., Zhou, L., Goldberg, M. Characterization and Validation of Methane Products from the Atmospheric Infrared Sounder (ARS).

20) Kutzbach, L., Schreiber, P., Forbrich, I., Wilmking, M.,
Spatial variability and Temporal Dynamics of CH_4 Fluxes during the Spring Thaw Period in North Karelia, Finland.

Appendix C. Tentative Titles and Authors for Proposed Special Section of Global Change Biology (Zero to first order draft ready on Feb. 1, 2008)

1. Introduction to the special section

2. Wickland/ Turesky et al.
   Controls on methane emissions across different wetland types/ landscapes

3. Zhuang, Gedney, and Potter et al.,
   Uncertainty of wetland emissions from northern peatland within multiple biogeochemistry models and multiple wetland databases

4. Potter, Zhuang, Melack, and Keller et al., Methane emissions dynamics with process-based and inverse models from 1980 to 2005 in Amazon Basin

5. Khalil et al., Global methane emissions from rice paddies: A synthesis study

6. Meirink et al., Validation of wetland models using atmospheric inverse and transport simulations at global scale

7. Zhuang and others, Global synthesis of methane emissions from natural and managed terrestrial ecosystems

Appendix D. Methane Working Group Data Policy

Data should be analyzed cooperatively by all scientists involved in the activity. Publications resulting from work by this group should be co-authored by all scientists who have participated substantially in the publication, unless some participants choose not to be on the authors list. The same applies to presentations at meetings. Users of unpublished data should contact the data providers well in advance of producing and submitting a manuscript, in order to inform the providers of intended use.