

Workshop of the GRA  
17-19 March 2014, Paris

**Experimental databases and model of N<sub>2</sub>O emissions by croplands:  
do we have what is needed to explore mitigation options?**

## Objectives and agenda

This workshop was co-organised by component 1 (Quantifying net greenhouse gases emissions in cropland systems) and component 3 (Modelling CN emissions) of the Cropland group.

## **Objectives**

The objective was to assess the ability of nitrous oxide emission models to account for the effect of agricultural management practices, especially those practices aiming to reduce emissions, and share information about experimental data available to evaluate the models in this respect. The workshop focused on nitrous oxide because of its major contribution to the net greenhouse gases budget of croplands. The number of participants was about 60. A major objective was to gather modellers and scientists in charge with experimental measurements and data collection. The expected output was recommendations for better synergy between the modelling and data collection effort.

## **General organization**

The workshop combined key notes, presentations by participants and open floor discussions. The opening session was based on three introductory lectures (basic processes of nitrous oxide emissions, state of the art of models, experimental measurements techniques and available databases). The following sessions examined four groups of management practices which influence nitrous oxide emissions and offer levers for mitigation: fertilisation techniques (e.g. mineral or organic fertilizers, application date, fertilizer incorporation, nitrification inhibitor,...), soil tillage (e.g. no-tillage or reduced tillage,...), cover crops (cover crops sown between two cash crops, permanent or temporary green cover in orchards,...) and Other management practices and combination of techniques (irrigation, amendments,...). Each session was introduced by a key note, followed by short presentations by participants. These short oral presentations were selected by the scientific committee. The common key question addressed in all sessions was the ability of current models to account for the effect of the studied management practice on N<sub>2</sub>O emissions. A cross-cutting session was dedicated to key compartments (e.g. microbial biomass...) and/or key processes that must be considered to account for the effect of management practices on N<sub>2</sub>O emissions.

## Agenda

**Monday 17 March 2014**

Registration/Welcome coffee: 9:00-9:30

### Morning - Opening session

Chair: **Alan Franzluebbers**  
Co-chair: **Raia Silvia Massad**

- 09:30-09:40** **Introduction** **Sylvain Pellerin & Pierre Cellier, INRA, France**
- 09:40-10:20** **Introductory lecture:** Basic processes of nitrous oxide emissions from agricultural soils (25 mn presentation + 15 mn discussion) **Klaus Butterbach-Bahl, KIT, Germany**
- 10:20-11:00** **Introductory lecture:** State of the art of nitrous oxide emission models (25 mn pres. + 15 mn discus.) **Pete Smith, Univ. of Aberdeen, UK**
- 11:00-11:20 Coffee break
- 11:20-12:00** **Introductory lecture:** Experimental measurements and databases (25 mn pres. + 15 mn discus.) **Mark Liebig, USDA-ARS, USA** **Pierre Cellier, INRA, France**
- 12:00-12:40** **Objectives of the workshop** **Pierre Cellier & Sylvain Pellerin, INRA, France**
- 13:00-14:00 Lunch

### Afternoon – Sessions 1 & 2

#### Session 1 - Fertilisation techniques

Chair: **Klaus Butterbach-Bahl**  
Co-chair: **Per Ambus**

- 14:00-14:30** **Key note lecture:** Fertilisation techniques and N<sub>2</sub>O emissions (20 mn pres. + 10 mn questions) **Philippe Rochette, AAC, Canada**
- 14:30-15:15** **Three selected short presentations:** (10 mn pres. + 5 mn questions each)
- Soil nitrous oxide emissions from fertilizer, organic residues and straw in sugarcane production in Brazil. **Marcelo Galdos, CTBE, Brazil**
  - The importance of accounting for soil thawing in quantifying N<sub>2</sub>O emissions from cropland in response to N fertilization. Comparison with DNDC predictions. **Elizabeth Pattey, AAC, Canada**
  - A budget of N<sub>2</sub>O emissions from fertilizer use over France: a comparison of three regional models. **Raia Silvia Massad, INRA, France**
- 15:15-16:00** **General discussion "Session 1"**

16:00-16:20 Coffee break

#### Session 2 - Soil tillage

Chair: **Pier Paolo Roggero**  
Co-chair: **Joël Léonard**

- 16:20-16:50** **Key note lecture:** Soil tillage and N<sub>2</sub>O emissions (20 mn pres. + 10 mn questions) **Bruno Mary, INRA, France**
- 16:50-17:35** **Three selected short presentations:** (10 mn pres. + 5 mn questions each)
- Nitrous Oxide emissions: Measurements in corn and simulations. **Charles Rice, K-State University, USA**
  - Large peaks of N<sub>2</sub>O emissions after grassland restoration. **Lutz Merbold, ETH Zurich, Switzerland**
  - Validation of the DNDC model in order to simulate nitrous oxide emissions and soil carbon changes from the Prairie-Pothole (PPR) region of North Dakota following conversion to agriculture. **Emma Suddick, WHRC, USA**
- 17:35-18:20** **General discussion "Session 2"**

## Tuesday 18 March 2014

### Morning – Sessions 3 & 4

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#### Session 3 - Cover crops, legumes and emissions at rotation scale

Chair: **Charles Rice**  
Co-chair: **Elizabeth Pattey**

**08:30-09:00** **Key note lecture:** Cover crops, legumes and N<sub>2</sub>O emissions at rotation scale (20 mn presentation + 10 mn questions) **Bob Rees**  
SRUC, UK

**09:00-09:45** **Three selected short presentations:** (10 mn pres. + 5 mn questions each)  
- Introducing pea crop in arable crop successions: an efficient way to decrease greenhouse gas emissions from cropping systems. **Pierre Cellier**  
INRA, France  
- Nitrous oxide emissions from an organic cropping system as affected by catch crop type and management. **Xiaoxi Li**  
Aarhus Univ., Denmark  
- Implications of introducing cover crops in a maize cropping system: N uptake, NO<sub>3</sub><sup>-</sup> and N<sub>2</sub>O losses. **Alberto Sanz-Cobeña**  
UPM, Spain

**09:45-10:30** **General discussion "Session 3"**

10:30-10:50 Coffee break

#### Session 4 - Other management practices and combination of techniques

Chair: **Alberto Sanz-Cobeña**  
Co-chair: **Bob Rees**

**10:50-11:20** **Key note lecture:** Other management practices and N<sub>2</sub>O emissions (20 mn presentation + 10 mn questions) **Per Ambus**  
DTU, Denmark

**11:20-12:05** **Three selected short presentations:** (10 mn pres. + 5 mn questions each)  
- Simulating the impacts of management practices on nitrous oxide emissions from cropland soils. **Abdalla Mohamed**  
Trinity Coll. Dublin, Ireland  
- An evaluation of the ability of the STICS model to simulate the effects of crop rotation and practices on N<sub>2</sub>O emissions. **Joël Leonard**  
INRA, France  
- Impacts of integrated weed management in cropping systems on N<sub>2</sub>O emissions from soil. **Catherine Hénault**  
INRA, France

**12:05-12:50** **General discussion "Session 4"**

13:00-14:00 Lunch

### Afternoon – Cross-cutting session

Chair: **Peter Grace**  
Co-chairs: **Emma Suddick & Ward Smith**

**14:00-14:45** **Key note lecture:** What are the key compartments and/or key processes which must be considered to account for the effect of management practices on N<sub>2</sub>O emissions? (30 mn pres. + 15 mn questions) **Steve Del Grosso**  
USDA, USA

**14:45-15:25** **1<sup>st</sup> cross-cutting issue:** Uncertainties in measured N<sub>2</sub>O emissions: How far can we trust reported measurements for model development, evaluation, calibration? (short introduction + discussion) **Chris Flechard & Pierre Cellier**

15:25-15:45 Coffee break

**15:45-16:25** **2<sup>nd</sup> cross-cutting issue:** Characterization of management practices; how to describe them in models? (short introduction + discussion) **Alan Franzluebbbers & Raia Silvia Massad**

**16:25-17:10** **3<sup>rd</sup> cross-cutting issue:** How far should we go with biotic pools and processes in N<sub>2</sub>O emission models? (short introduction + discussion) **Catherine Henault & Sylvie Recous**

**17:10-17:45** **General discussion on cross-cutting issues**

**19:00** – Dinner 35euros/pers (for registrated): Restaurant Au petit tonneau, 20 Rue Surcouf, 75007 Paris (see map)

## Wednesday 19 March 2014

### Morning – Final session

Chair: **Philippe Rochette**  
Co-chairs: **Pierre Cellier & Sylvain Pellerin**

**08:30-9:30**    **Wrap-up of Monday's and Tuesday's discussions**  
*(10 mn presentation from each co-chairs of the 6 previous sessions)*

**9:30-10:15**    **General discussion:** "How can we improve the ability of N<sub>2</sub>O emission models to account for the effect of management practices?"

**10:15-10:30**    **Conclusion of the workshop**

10:30-11:00    Coffee-break

The "projects kick-off sessions" of the Workshop II begin at 11:00 rue Jean Nicot (5 min walk, see map)

## Posters

### Session 1 - Fertilisation techniques

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<b>Jorge Alvaro-Fuentes</b>	Using Daycent to simulate nitrogen fertilization strategies in dryland conditions
<b>Charlotte Decock</b>	Mitigating nitrous oxide emissions from corn cropping systems in the Midwestern USA – Potential and data gaps
<b>Ayaka Kishimoto</b>	Field data reveal potential N <sub>2</sub> O emission linking to decomposed CO <sub>2</sub> and N Input
<b>Patricia Laville</b>	Valorization of biogas digestate in agriculture and effects on N <sub>2</sub> O soil emissions: Laboratory characterizations

### Session 2 - Soil tillage

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### Session 3 - Cover crops, legumes and emissions at rotation scale

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<b>Céline Peyrard</b>	Comparative analysis of the N <sub>2</sub> O emissions of three cropping systems relying on an increasing use of legumes to reduce dependency on fertilization
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### Session 4 - Other management practices and combination of techniques

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<b>Caroline Colnenne-David</b>	New Cropping Systems under Greenhouse Gas and Fossil Energy Constraints: Results of ex ante assessment
<b>Ward Smith</b>	Effects of agricultural management intensity on nitrous oxide emissions in Canada: measured and modeled comparisons at selected sites
<b>Mike Whitfield</b>	Scaling soil process modelling to the national level
<b>Cécile Le Gall</b>	Towards a tier 2 method based on a statistical approach to estimate French annual N <sub>2</sub> O emissions
<b>Marco Carozzi</b>	AEGES: Attenuation of greenhouse gas emissions in grasslands

### Others

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<b>Antonio Bispo &amp; Thomas Eglin</b>	REACTIF Program : Research on climate change mitigation by agriculture and forestry
<b>Eric Davidson</b>	Agriculture in the Global N <sub>2</sub> O Budget – Findings of a New UNEP Report
<b>Changsheng Li</b>	Understanding Microbe-Driven Greenhouse Gas Emissions with Biogeochemical Models

## **Workshop of the GRA**

**Experimental databases and models of N<sub>2</sub>O emissions from croplands:  
do we have what is needed to explore mitigation options?**

**17-19 March 2014**

**INRA, 147 rue de l'Université, Paris**

### **Scientific committee :**

Per Ambus, Klaus Butterbach-bahl, Nancy Cavallaro, Pierre Cellier, Alan Franzluebbers, Mark Liebig, Bruno Mary, Sylvain Pellerin, Sylvie Recous, Bob Rees, Guy Richard, Chuck Rice, Philippe Rochette, Pete Smith

### **Local organisation committee:**

Sylvain Pellerin, Antonio Bispo, Pierre Cellier, Chris Flechard, Joel Léonard, Catherine Hénault, Raia Massad, Sylvie Recous, Fiona Ehrhardt, Lénaïc Pardon

