

Nitrous oxide skills workshop.

Abstract

In April 22nd to 24th 2013, the Technical University of Denmark conducted a N₂O skills workshop within the FP7-InGOS project. The workshop aimed at training master and Ph.D. students from Eastern Europe and developing countries who needs to achieve skills on measuring soil-atmospheric exchange of N₂O in the field using manual gas sampling in static gas-flux chambers. The workshop was conducted successfully with participation of ten students from developing countries that received financial support. In addition, one local student participated to the workshop. The program for the workshop included a mixture of lectures, practical and theoretical exercises, and demonstration of gas flux instruments and methods. The latter was accomplished by taking advantage of the InGOS instrument comparison campaign that took place at the host institute during the workshop period. The participants were invited to provide an evaluation of the workshop organization and content, and very positive feedbacks were received.

Scientific summary

The FP7 infrastructure project InGOS (Integrated non-CO₂ Greenhouse gas Observation System, coordinated by Stichting Energieonderzoek Centrum Nederland (ECN), The Netherlands has the overall objective to support and integrate the observing capacity of Europe for non-CO₂ greenhouse gases (NCGHG: CH₄, N₂O, SF₆, H₂ and halocarbons). The emissions of these gases are very uncertain and it is unknown how future climate change will affect the land-use-coupled emissions of CH₄ and N₂O. The NCGHG atmospheric abundances will increase further in future and the emissions of these gases are an attractive target for climate change mitigation policies. Training and capacity-building activities are vital parts of the InGOS infrastructure, thereby facilitating capacity building.

A N₂O skills training course was given in April 22nd to 24th, 2013 at DTU (Technical University of Denmark). The course had the objective to provide training for students from Eastern Europe and developing nations who needs to achieve skills in measuring soil-atmospheric exchange of N₂O in the field using manual gas sampling in static gas-flux chambers. The course included theoretical and practical activities (see program below). A key part of this task was to show new users the capabilities of new techniques, and the course was undertaken in parallel to a trans-national field campaign hosted by DTU with participants from research groups in Germany (Karlsruhe Institute of Technology; Thünen Institute; Universität Bremen), The Netherlands (ECN), Italy (West Systems) and Denmark (DTU). The campaign had the objective to compare different approaches for N₂O flux measurements including Eddy Covariance and static chambers by application of different analytical instruments (QCL; Off-axis ICOS; FTIR; GC). The participants in the course thus had an excellent opportunity for a demonstration of state-of-the-art technologies for N₂O GHG observations.

The workshop was announced in September 2012, and more than 50 applications was received. Based on the available funding within the InGOS project (10 kEUR) and the support from ESF (2 kEUR) a list of ten candidates were invited who all completed the course, one from African continent, four from S.-America, two from Asia, and three from Eastern Europe. In addition, 1 candidate participated at own expense (see list below).

The course was planned as a mixture of lectures given by researchers at the host institute on topics related to GHG flux measurements including theoretical background, design and construction of measurement programs and analytical equipment. We demonstrated multiple state-of-the-art instruments for GHG flux measurements that involved also in-field presentations by researchers from institutes involved in the InGOS field campaign. The course also included a hands-on exercise to collect own samples in the field, undertake lab-analysis and perform final data assessments and conclusions.

Upon the workshop the participants were asked to hand in an anonymous evaluation of the course, the result of which is shown below. In conclusion, we have derived from the general impression during the course combined with the feedbacks given by the participants that the N₂O skills training course was very successful.

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Program for N2O skills workshop

Day	Time (hh:mm)	Activity	Place
Monday 22 April	16:00	Arrival at the youth hostel and distribution of rooms	Danhostel Roskilde
	16:30	Welcome meeting, including practical information (Mette)	Danhostel Roskilde
	18:00	Dinner	Danhostel Roskilde
Tuesday 23 April	07:30	Breakfast buffet	Danhostel Roskilde
	08:15-09:00	Public bus transport to DTU Risø Campus	Bus line 203 and 600S
	09:30-10:00	Why measure N2O fluxes, and which factors influence the flux rate? (Mette)	DTU Risø Campus
	10:10-10:50	Self-introduction by workshop participants	DTU Risø Campus
	11:00-11:30	Chamber design, sampling frequency, and introduction to field work (Mette)	DTU Risø Campus
	11:30-11:45	More advanced N2O measurement equipment present at the willow field (Per)	DTU Risø Campus
	11:45-12:15	Lunch break	DTU Risø Campus
	12:15-12:30	Transport by car to local bio-energy willow field	
	12:30-17:00	N2O flux measurements in the field. The participants are split into 3 groups that work in 3 separate areas. Visit to advanced N2O equipment (Mette/Per/Klaus)	Willow field
	17:00	Public bus transport back to Roskilde and the youth hostel	Bus line 600S
	19:00	Dinner	Danhostel Roskilde
Wednesday 24 April	07:30	Breakfast buffet	Danhostel Roskilde
	08:15-09:00	Public bus transport to DTU Risø Campus	Bus line 203 and 600S
	09:15-10:15	N2O analysis by gas chromatography and other techniques, including visit to the lab (Per)	DTU Risø Campus
	10:30-12:00	N2O flux calculation using Microsoft Excel - introduction and exercise (Mette)	DTU Risø Campus
	12:00-13:00	Lunch break	DTU Risø Campus
	13:00-15:00	Calculation exercise continued (Mette)	DTU Risø Campus
	15:00-15:30	Coffee break	DTU Risø Campus
	15:30-16:15	N2O flux calculation using HMR script in the open source statistical software R (Klaus)	DTU Risø Campus
	17:00	Public bus transport back to Roskilde and the youth hostel	Bus line 600S
	19:00	Dinner	Danhostel Roskilde
Thursday 25 April	07:30	Breakfast buffet	Danhostel Roskilde
	08:15-09:00	Public bus transport to DTU Risø Campus	Bus line 203 and 600S
	09:15-12:00	N2O flux calculation on own data from the willow field (Mette)	DTU Risø Campus
	12:00-13:00	Lunch break	DTU Risø Campus
	13:00-14:30	Calculations continued (Mette)	DTU Risø Campus
	14:30-15:00	Coffee break	DTU Risø Campus
	15:00-16:00	Practical issues: Travel reimbursement, workshop evaluation, group photo etc. (Mette/Per)	DTU Risø Campus
16:00	End of workshop and departure	DTU Risø Campus	

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Summary of workshop evaluation

InGOS N2O skills workshop, 22-25 April 2013, DTU Risø Campus

Below is a summary of 11 evaluation forms returned by the workshop participants. The evaluation was anonymous.

Statement	Agree very much	Agree	Disagree	Disagree very much	Comments
I received sufficient information about the workshop before arrival (workshop program, travel reimbursement, visa application etc.)	9	2			Information about travel reimbursement was confusing. The organization of the workshop was excellent
The information I received Tuesday morning was interesting and useful (Why measure N2O, self-introduction, introduction to field work)	5	6			If we got much more time to explain our project it would be better to understand each other's project
Conducting field work was a useful experience	7	4			
It was interesting to learn about advanced N2O measurement equipment at the field site	7	4			I liked very much to know that equipment. Not enough!
The introduction to GC analysis Wednesday morning was useful	4	6	1		Not enough!
I plan to use my new skills in N2O flux calculation using Excel on data from my own project	7	3	1		I did my own Excel template. I had my own system but I really like to compare my system and your system of calculation.

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I plan to use the HMR script in R on data from my own project	1	5	4		It is new for me. Very interesting. I would like to learn more about it. It was difficult for me to understand it. It was very interesting but it was difficult. But maybe... Not application. Maybe I will use other software.
Thursday morning, I gained important knowledge on design of static chambers and measurement protocols	7	3	1		I gained knowledge but not too much. It would be helpful for me to design my chamber further.
Flux calculation based on area data from the GC was a useful exercise	6	5			
Accommodation at the youth hostel was appropriate	5	4	1		Excelent hostel except for the WiFi service. Maybe for the next time you should consider one with free WiFi. WiFi access was costly.
The bus transport between the youth hostel and DTU Risø Campus worked fine	9	1			
I liked the food we had during the workshop	6	3	1		Excelent food! Liked a lot
In general, the workshop met my expertations	8	3			It was much better than that I hoped! This workshop is very helpful for me. I learned much more about N2O measurement.

Other comments:

- The workshop matched perfectly well with the task I'm working in my project now! I am very happy of being invited!
- The disposition of the persons in charge was excelent, you made a great job transferring the information. It has been a really useful experiance. I don't know if it's possible, but when you have to send the e-mail saying to the participants that they have been accepted into the workshop, it could be sooner.

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- Now I am going to transmit all these knowledge to my partners in Uruguay. I have a lot of arrangements to do in the planning measuring of N2O. Thank you very much.
- Thank you for your work. Denmark and workshop was great.
- I like it very much. Thank you very much!

Participants receiving financial support		
<i>Name</i>	<i>Country</i>	<i>University</i>
Eric Koomson	Ghana	University of Ghana
Andrej Tarnik	Slovakia	Slovak University of Agriculture
Michal Galkowski	Poland	AGH University of Science and Technology, Kraków
Claudia Rojas	Chile	University of Chile
Melissa Lis-Gutiérrez	Colombia	Universidad Nacional de Colombia, Bogotá
Gabriela Illarze	Uruguay	Universidad de la República
Yanmeng Bi	China	China Agricultural University
Lora Naydenova	Bulgaria	Forest Research Institute
Tomas Della Chiesa	Argentina	University of Buenos Aires
Phuong Tran Thi Xuan	Vietnam	Hue university of agriculture and forestry
Self financed participant		
Niharika Rahman	Bangladesh, DK, NL	Bangladesh Agricultural University, Mymensingh