# InGOS – Integrated non-CO2 Observing System

Detailed workplan, appendix to the online application. Request for access to an infrastructure (TNA1-TNA2-TNA3). The plan must not exceed 6 pages in 12 pt single line spacing, applications exceeding this limit will not be evaluated. The following information should be included in order to be evaluated:

1. **Project name (acronym), name and contact information of the researcher(s), duration of the project (dates, number of working days), type and name of the infrastructure requested**

Nitrous oxide flux inter-comparison campaign.

Period 15.4-29.4 2013

Name of applicant: Davide Continanza (West Systems)

Duration of visit: 22-23 of April, 2013

TNA-site: RISO Willow Field

1. **Background**

Measurements of greenhouse gas fluxes from soils are still associated with great uncertainty due to insufficient methodologies. GHG budgets are consequently inexact, and there’s a need for improved approaches to improve current estimates. Recent developments have led to new instruments for real-time determination N2O concentrations in air that opens for new approaches to determine surface N2O fluxes. Fast response and sensitive instruments (e.g. QCL and Off-axis instruments) have the potential to be used in combination with conventional flux chambers and thereby achieve significant reductions on chamber closure times combined with the use of a number of increased chambers to cover spatial variability. Moreover, the new instruments are also applicable for use with micro-meteorological techniques (EC, gradients) as means to determine fluxes at the field scale. Meanwhile, knowledge on the suitability for the different approaches and their performances under realistic, environmental conditions is sparse, and there is a need for more thorough method inter-comparison for verification and improvement.

1. **Objectives**

The proposed research activity has the objective to perform an inter-comparison of multiple chamber- and micro-meteorologically based techniques to study soil surface effluxes of nitrous oxide. The different combinations of analyzers and accessories included in the campaign are: chamber+GC – chamber+QCL – chamber+FTIR – EC+LGR – EC+QCL. Thus, the conventional chamber+GC method will be compared with more recent “state-of-the-art” methodologies, and the new generation of analyzers will be tested for performance both with chamber based approaches and micro-mets.

The activity conforms strictly with the several of the objectives of InGOS, i.e. to “Harmonize and standardize the measurements” and to “”Improve measurement methods by testing new innovative techniques and strategies”.

The RISO Willow super site has an excellent infrastructure to perform this campaign, and moreover the site will be managed accordingly to achieve expected high N2O effluxes during the campaign.

1. **Methods and materials (legal and ethical issues)**

West Systems will bring a portable instrument able to measure CO2 and CH4 soil fluxes with accumulation chamber. Both detectors are IR spectrometers; the methane detector uses a tunable laser diode.

The instrument is battery powered and doesn’t require installation.

The instrument is worn like a backpack by an operator. It takes 2-5 minutes to execute a single flux measurement, resulting on an average of about 100 points per day.

The objective is to perform flux measurement following a regular grid, depending on the area of the field. Common grid intervals are 10x10m or 20x20m.

In the post processing phase, the data will be processed with geostatistical methods (semi-variogram + Kriging) to obtain isoflux maps of the 2 target gases.

1. **Implementation: timetable, budget, distribution of work**

Davide Continanza (West Systems) will arrive in the afternoon of April 22nd, 2013 and will start carrying out flux measurements. The measurements will take place also on the 23rd, during the whole day if necessary.

The total cost estimate will be about 400 €, including costs for round trip flight Pisa-Copenhagen and hotel accommodation of one person for 2 nights.

1. **Expected results and possible risks**

Results from this campaign will foremost be applicable for the method inter-comparison as outlined above. Conclusions from this work will inevitably be useful for future development and fine-tuning of greenhouse gas flux methods, and will consequently contribute to improve current estimates of GHG balances.

The field-campaign will be followed up by a workshop hosted by Risø-DTU beginning 2014 when a more thorough plan for publication will be outlined. It is expected that at least one joint peer-reviewed publication will be developed from the campaign.

1. **Key literature**

Christensen, S., Ambus, P., Arah, J.R.M., Clayton, H., Galle, B., Griffith, D.W.T., Hargreaves, K.J., Klemedtsson, L., Lind, A.-M., Maag, M., Scott, A., Skiba, U., Smith, K.A., Welling, M., and Wienhold, F.G. 1996. Nitrous oxide emission from an agricultural field: Comparison between measurements by flux chamber and micrometeorological techniques. Atmospheric Environment. 30:4183-4190.

Hensen, A., Groot, T.T., van den Bulk, W.C.M., Vermeulen, A.T., Olesen, J.E. and Schelde, K. 2006. Dairy farm CH4 and N2O emissions, from one square metre to the full farm scale. Agriculture, Ecosystems & Environment 112: 146-152.

Venterea, R.T., Spokas, K.A. and Baker, J.M. 2009. Accuracy and precision analysis of chamber-based nitrous oxide gas flux estimates. Soil Science Society of America Journal 73: 1087-1093.