

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

The planned visit is framed within **ClimaDat**, a Spanish project funded by the Social Foundation of La Caixa (2010-2015) that aims for *Monitoring climate and greenhouse gases emissions on a regional scale, within the framework of Climate Change and Global Warming and its impacts on critic, Spanish Natural Parks* (Rodo et al., 2012). It is coordinated by Ph.D. Xavi Rodó (xrodo@ic3.cat) and Josep-Anton Morgui (jamorgui@ic3.cat), from the Catalan Institute of Climate Sciences (IC3, Spain).

The visit will be made by one of the scientific members of the ClimaDat group, Ph.D. Paola Occhipinti (pocchipinti@ic3.cat), Post Doc with expertise in Organic Chemistry and Biophysics. The visit will consist of 3 full-time working days (26th to 28th of June, 2012) in the Earth Science Dept. at the Royal Holloway, University of London (RHUL). The aim of the visit is to learn the analytical routine of isotopic analysis of C-containing air components (i.e. CO₂, CH₄) developed at the Greenhouse Gas Laboratory (GGL) of the RHUL.

2. Background

- a. Significance of the research
- b. Previous research relevant to the topic and how the proposed project links to this
- c. Links with current research of the applicant

Greenhouse gases (GHG) come from varied natural (e.g. vegetation dynamics, biomass burning, ruminant emissions, bacteria activity) and anthropogenic (e.g. fossil fuel combustion, intensive cultures, etc) sources and they can be identified by isotopic signature. Isotopic analysis has great environmental potential, since some of the sources of GHG such as CO₂ and CH₄ respond quickly to temperature change, with strong positive feedbacks such that warming feeds warming. Isotopic techniques offer useful tools to identify major emissions of GHG and assess their relative inputs to local/regional budgets.

The host GGL has large experience on the application and development of gas isotopic analysis (e.g. Fisher et al., 2006, 2011; Grimes et al, 2004; Lowry et al., 2007). It is one of the leader isotopic-laboratories in Europe and counts on well-equipped infrastructures of Isotopic Analysis (Multi-Collector Inductively Coupled Plasma-Mass Spectrometry, Continuous



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Flow-Mass Spectrometry, Dual-Inlet Mass Spectrometry, Thermal Ionisation-Mass Spectrometry, etc). They offer analytical service to the European scientific community and participate in a number of research projects (e.g. InGOS). For InGOS they offer up to 180 days of analysis in daily units, which consist of up to 18 analyses of unknowns, plus standards for calibration purposes. They focus on a better understanding of methane sources and their contribution to background station measurements within Europe. They welcome proposals for measurements of samples from monitoring stations and flux campaigns in different parts of Europe, in particular the southern extremities. In this context, the analysis of air samples from the Spanish ClimaDat network offer a golden opportunity to contribute to their analytical programme.

The visitor's group (Laboratory of Atmosphere and Ocean, LAO, in IC3) has experience in the atmospheric field, wherein it has been involved since 2000 (formerly as the *Clima Research Laboratory* of Catalonia, LRC; nowadays as IC3). Since then, LAO has participated in about >10 atmospheric competitive projects of national and European funding, in which it has been involved in the study and gas analysis of samples from different background stations: continuous tall towers (La Muela and Ebro Delta) and discrete sampling sites (alpine: Pyrenees, urban: Barcelona, coastal: Begur-Cap de Creus-Roses). The LAO members have good expertise in collecting and analyzing air samples for their concentration in GHG (i.e. CO₂, CH₄, N₂O, and SF₆) and other environmentally relevant gases (i.e. CO) by using different instrumentation such as Non-Diffractive Infrared (NDIR), Cavity Ring-Down Spectrometry (CRDS), or Gas Chromatography-Mass Spectrometry (GC-MS). Since 2010, the group dedicates great part of its activity to the development of an ambitious project (ClimaDat), which aims to establish a well interconnected network of 8 sampling and online-analysis sites strategically distributed thorough the Iberian Peninsula, Balearic and Canarian Archipelago. Major objective is to characterize Clima-Biosphere interactions in the S-Europe/Mediterranean Framework through the monitoring of GHG and meteorological vectors. At this stage, sampling and quantification techniques (both discrete and in-continuous) are well covered within the group, whereas complementary techniques such as isotopic analysis are foreseen to be tackled in the middle-future.

In this context, visiting the GGL is a golden opportunity for the LAO members to have a first approach to isotopic analysis techniques and establish close contact with the isotopic-expert host group. It will provide a first approach to assess the feasibility and requirements for the future development of isotopic analyses at LAO. In order to gain knowledge of the instrumentation routine and to obtain complementary information to local GHG atmospheric concentration in Spain, the LAO visitor (P. Occhipinti) will bring air samples from regular ClimaDat collection sites for isotopic analysis in the host GGL.

3. Objectives

- a. Hypothesis and research objectives
- b. Connection with the InGOS objectives and the 'fitness' of the use of the requested infrastructure to the objectives

The major aim of the trip to the GGL is to visit the isotopic analysis facilities. The idea is to establish closer relationship with the host institute, which is one of the world leaders in the development of isotopic analysis, aiming for learning about the technique and applications of isotopic analysis on GHG source apportionment. The ultimate idea is to gain knowledge about the instrumentation and infrastructure needed for developing own analysis lines in the future. Main objectives are to:

- i) learn about the isotopic analysis routine;
- ii) gain analytical practice by measuring own air samples brought from Spain (previous agreement with the host group head); and
- iii) obtain good knowledge on the analytical needs and infrastructure required for the future set up of similar facilities, back in Spain.

4. Methods and materials (legal and ethical issues)

- a. Research method, explaining how to reach the objective
- b. Research materials, instrumentation
- c. Governance procedures, safety precautions, permit requirements and procedures

To reach the objectives, the visitor will perform isotopic analysis on air samples collected in Spain. Prior to the visit, the host institution will send Tedlar bags to the visitor institute to collect ~ 10 air samples from regular IC3 study places that the visitor will ship to the host institution prior to her arrival. Between 5-10 L of samples will be collected by pumping air from different sites in the NW of Spain in Tedlar bags. By recommendation of the host group, samples will be collected in triplicates to achieve good precision. Thus, the plan is to collect samples from three different heights over the Pyrenees area, specifically in the boundary layer, entrainment zone and free troposphere.

The first day at the GGL will be dedicated to visit the installations, learn the basics about the isotopic technique and analysis routine. Then, the visitor will gain practice and further knowledge of the technique by analyzing own material brought from Spain. This way, a double objective will be reached: 1) good learning of the analytical methods and 2) obtaining a first approach of the isotopic composition (and sources) of air samples from different heights in the Pyrenees area.

The procedure, permit requirements and safety precautions will be strictly followed according to routine good practices of the host institution (neither ethical issues nor controversial materials are foreseen for these experiments).

5. Implementaton: timetable, budget, distribution of work

- a. Timetable for the research including personnel efforts, favorably table wise
- b. Total budget for travel and logistical support as requested
- c. Plan for specific logistic needs like visa, import/export licenses etc.

Task-event	Details	People	Budget (€)*
Flights in/out BCN-LON	-	PO	450
Transport airport-GGL	-	PO	50 (25 €/way)
Accommodation	Campus B&B	PO	325 (108€/night)
Subsistence	3 full days + 2 half days	PO	160 (40€/day)
Work Day 1	Learning IRMS	PO & RF	-
Work Day 2	Sample analysis	PO & RF	-
Work Day 3	Sample analysis	PO & RF	-
Sample shipping	10 Tedlar bags (LON-BCN-LON)	PO & RF	-

PO stands for the visitor member Paola Occhipinti, and RF for the host Rebecca Fisher.

* The budget here reported is an estimation of the travel and living expenses and it might vary.

No extra logistical needs such as visa or import/export licenses are required for the success of this visit.

6. Expected results and possible risks

- a. Expected scientific impact of the research
- b. Applicability and feasibility of the research results
- c. Publication plan
- d. Data access plan

Two different kinds of results are expected from this visit to the host GGL: 1) detailed learning of the logistical needs and requirements to reproduce the GGL isotopic analysis infrastructure back at IC3, and 2) first approach to the air source apportionment of CO₂ and CH₄ in air samples from the Spanish sampling sites.

On the one hand, the first package of results is foreseen to obtain a detailed idea of the instrumentation and infrastructure needed to set up similar facilities back in the IC3 laboratories (how much space, time and budget are needed to reproduce the host analysis equipment), within the framework of the already funded and ongoing ClimaDat project. On the other hand, we expect to gain good learning of the analytical routine for regular isotopic performance on air samples.

The second package of results is expected to provide new information to that we have on the sites regularly studied since 2000 (atmospheric mean concentration, daily and seasonal variations, local activity responses, etc.) (e.g. Peters et al., 2009 ; Chevallier et al., 2010; Font et al, 2010a-b).

The publication of potential results derived from the visit is foreseen as part of the regular LAO publication program, within the ongoing ClimaDat project. In general, the idea is to produce a number of publications derived from the 8-sites setting-up, instrumentation comparison, and environmental description in terms of atmospheric composition and clima-

biosphere interactions. Any relevant information derived from the isotopic analysis carried out during or after the visit to the GGL is susceptible to be included in the ClimaDat-resulting publications and so it is of key interest.

In addition, all data generated within the ClimaDat project are meant to be completely open for access in the scientific community and so may be of great interest for InGOS and the scientific community.

7. Key literature

a. List of references used in the working plan

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