InGOS

Integrated non-CO_2 Greenhouse gas Observing System

General Project Meeting

12-14 March 2013

Bremen, Germany

@InGOS-EU

info@ingos-infrastructure.eu

http://www.ingos-infrastructure.eu

Coordinator: ECN - NL

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SEVENTH FRAMEWORK PROGRAMME

CONTENTS

About InGOS

InGOS is an EU funded IA (Integrating Activity) project targeted at improving and extending the European observation capacity for non-CO_2 greenhouse gases.

Funding scheme (FP7): Integrating Activities (IA)
EU financial contribution: €8.00 million
EU project officer: Anna Maria Johansson
Duration: 48 months
Start date: 1 October 2011
Completion date: 30 September 2015
Coordinator: Alex Vermeulen,
Email: info@ingos-infrastructure.nl
Project webpage: http://www.ingos-infrastructure.eu

Partners:

Stichting Energieonderzoek Centrum Nederland (NL)
Max-Planck-Gesellschaft zur Förderung der Wissenschaften (DE)
Eidgenössische Materialprüfungs- und Forschungsanstalt (CH)
Commissariat à l'Energie Atomique et aux Energies Alternatives (FR)
University of Bristol (GB)
University of East Anglia (GB)
Ruprecht-Karls-Universität Heidelberg (DE)
Utrecht University (NL)
Royal Holloway and Bedford New College (GB)
Universität Bremen (DE)
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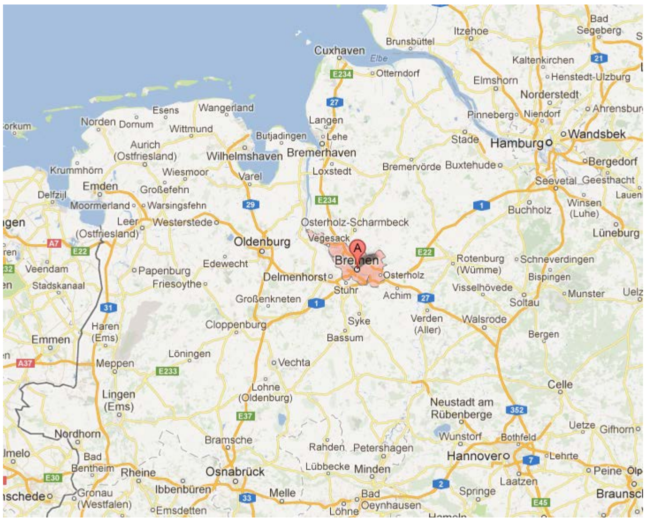
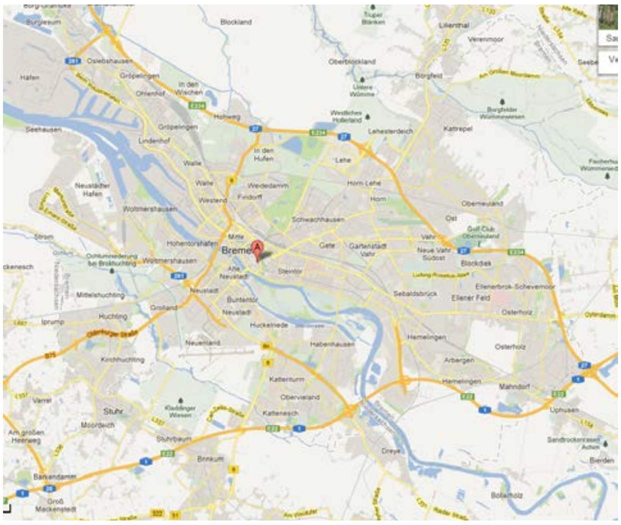
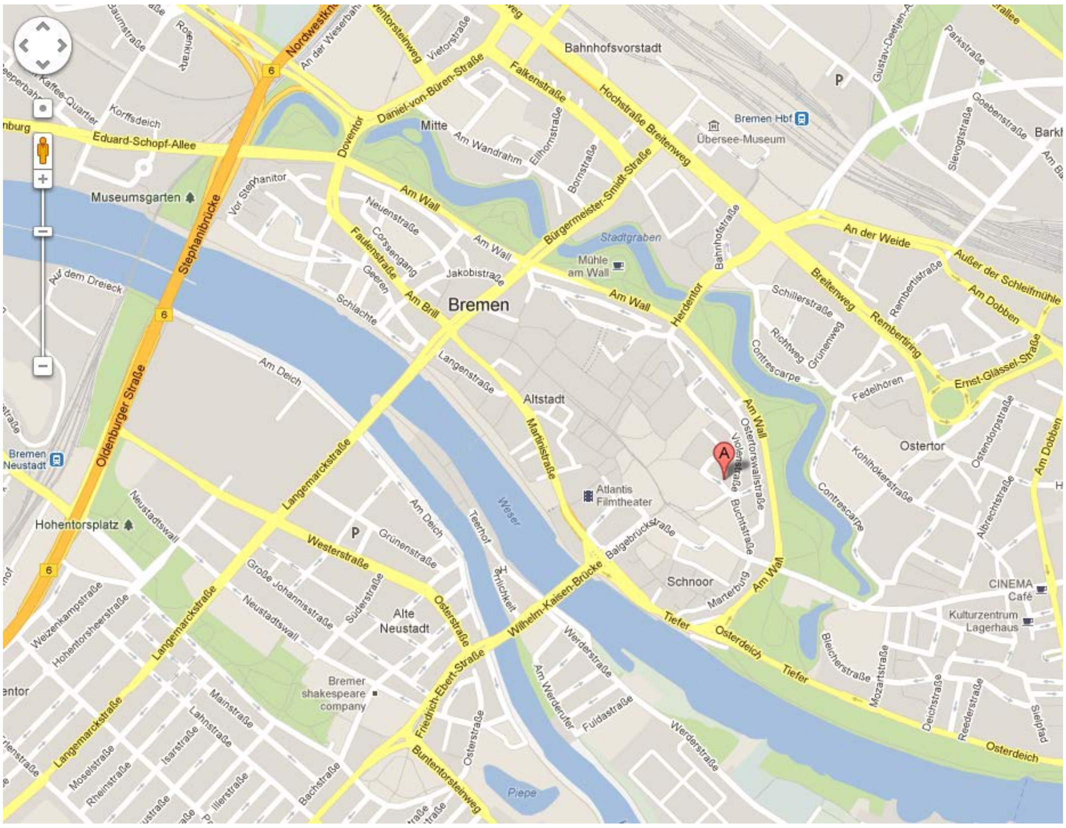
Agencia Estatal Consejo Superior de Investigaciones Cientí fi cas (ES)
Universitetet i Bergen (NO)
Stichting Dienst Landbouwkundig Onderzoek (NL)
Fundación Centro de Estudios Ambientales del Mediterráneo (ES)

MEETING INFORMATION

Meeting location





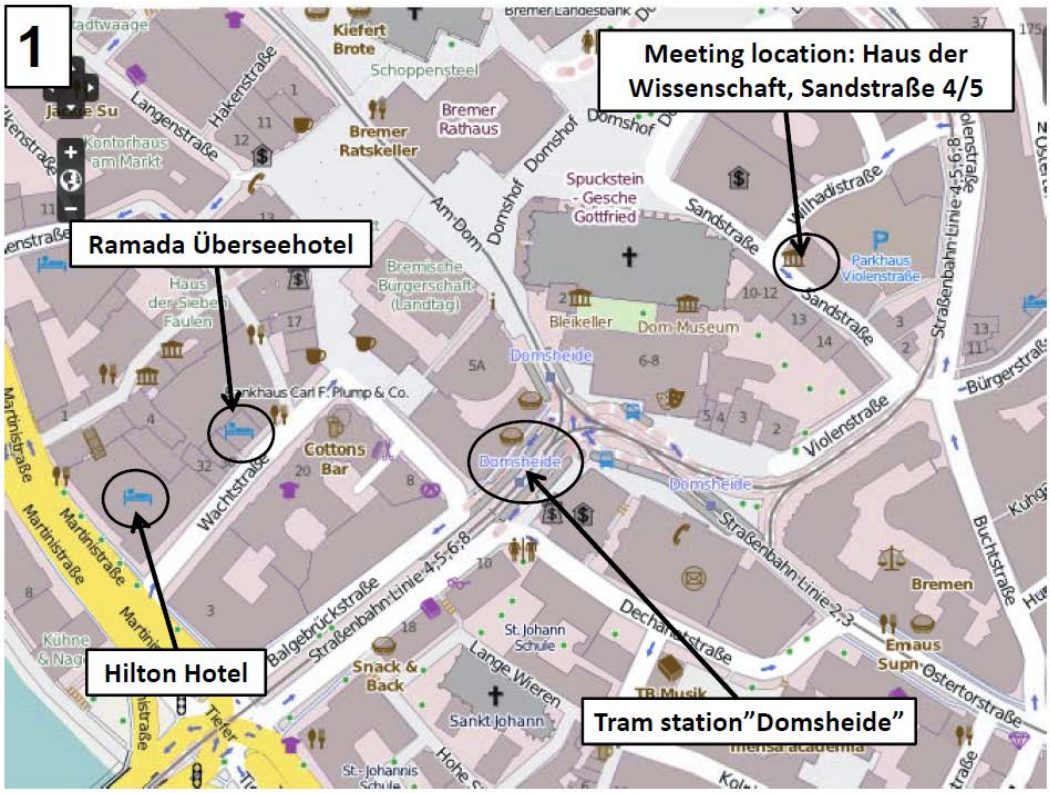


Venue:

Haus der Wissenschaft
Sandstraße 4/5
28195 Bremen

From central train station (Bremen HBF). Leave the train station direction "Zentrum".
Either walk to the city center (max 10 min) or take a tram/bus and get off at "Domsheide".

From airport (main airlines: Air France, KLM, Lufthansa, Ryanair):
On leaving Airport Bremen, take the tram No 6 in the direction of the university. Get off at the station "Domsheide



Prebooked Hotels

Ramada Überseehotel Bremen
www.ramada-bremen.de/
Wachtstraße 27, D-28195 Bremen
Phone: +49 (0)421 3601 0
Fax: +49 (0)421 3601 555
Email: reservierung@ramada-bremen.de

Hilton Bremen Hotel
http://www.hilton.de/bremen
Böttcherstraße 2, D-28195 Bremen
Phone: +49 (0)421 3696 0
Fax: +49 (0)421 3696 969
Email: reservations.bremen@hilton.com

Star Inn Hotel Bremen Columbus (opposite Central station at main square)
http://www.starinnhotels.com/de/bremen-columbus/index.php
Bahnhofsplatz 5-7, D-28195 Bremen
Phone: +49 421 30120
Fax: +49 421 30 12 123
Email:bremen.columbus@starinnhotels.com

PROGRAM

Program overview

	12 March	Day 1	13 March	Day 2	14 March	Day 3
9.00			JRA1	JRA2	JRA3	NA5
9.30			JRA4		JRA1	
10.00			Parallel sessions		Parallel Sessions	
10.30			Coffee Break		Coffee Break	
11.00			JRA3	JRA5	EU reporting	Reporting parallel
11.30	Registration	SAB Meeting	JRA6			
12.00			Parallel sessions		Plenary Session	II
12.30	Lunch Break.		Lunch Break		Lunch Break	
13.00	*Haus der Wissenschaft*		*Intermezzo*		*Intermezzo*	
13.30			NA23+JRA3			
14.00			NA4+JRA5			
14.30	Plenary Session I		JRA6		Plenary Session	III
15.00			Parallel sessions			
15.30	Coffee Break		Coffee Break		Coffee Break	
16.00			TNAs			
16.30	NA2+3	NA4	SA		Contractor Meeting	
17.00		NA6				
17.30	Parallel sessions		Parallel sessions		SAB Meeting	
18,00						
	Welcome Reception		Dinner		SAB Diner	
	Henry's Bar		*Ratskeller*		*Schröter's*	

Lunches will be served:

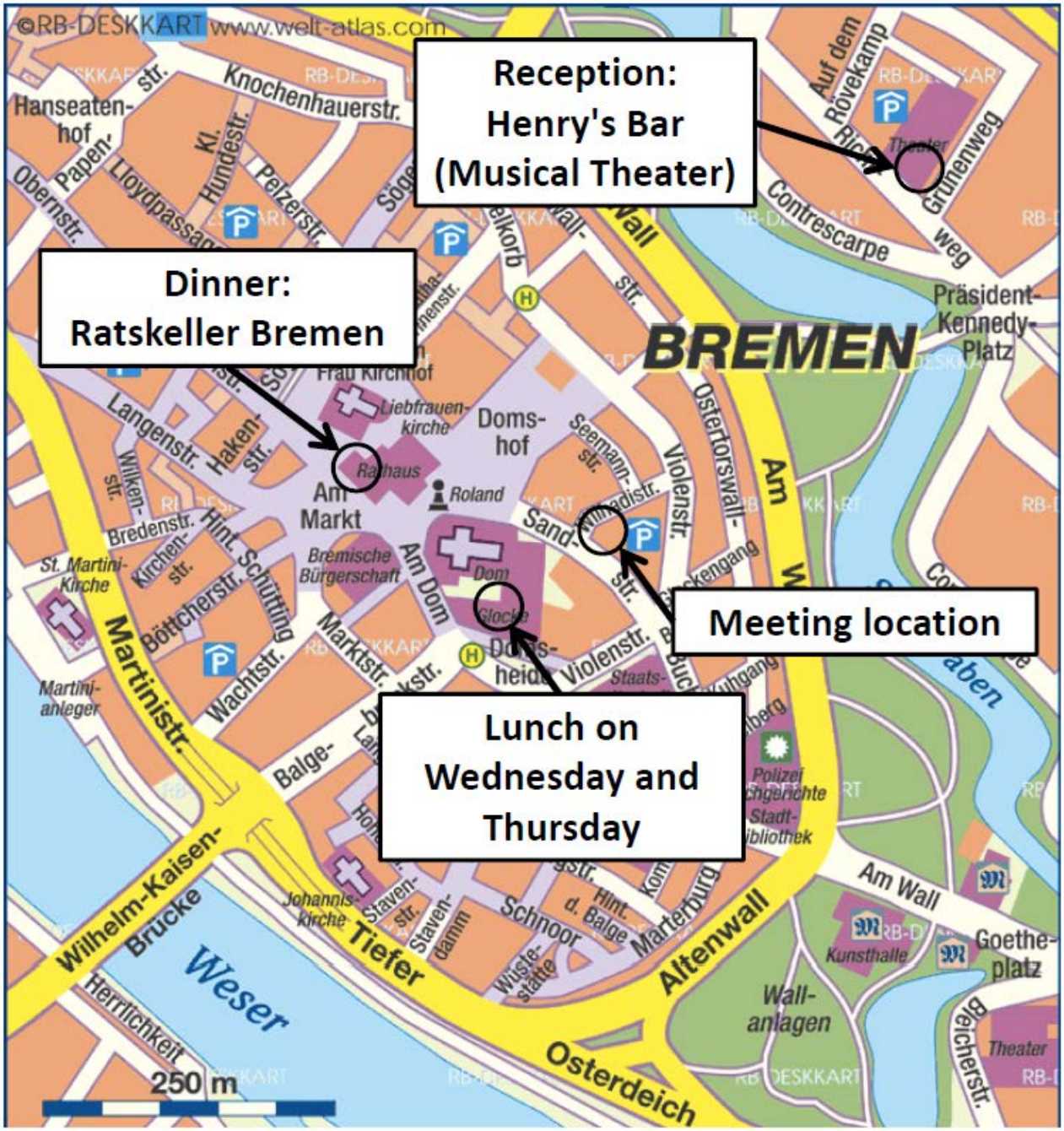
Tuesday 12/3: Haus der Wissenschaft
Wednesday 13/3: Intermezzo, Domsheide 6
Thursday 14/3: Intermezzo, Domsheide 6

Welcome reception:
Tuesday 12/3 18:00-19:00 Henry's Bar, in Musical Theater Bremen, Richtweg 7-13

Meeting Dinner:
Wednesday 13/3 19:15 Bremer Ratskeller, Am Markt

SAB Dinner:
Thursday 14/3 18:30 Schröters, Schnoor 13

For a map of the catering locations please turn over and see the next page.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Reception:
Henry's Bar
(Musical Theater)
Dinner:
Ratskeller Bremen
Meeting location
Lunch on
Wednesday and
Thursday
BREMEN
Am Markt
Rathaus
Roland
Dom
Bremische Bürgerschaft
Liebfrauenkirche
Domshof
Martinistr.
Wilhelm-Kaisen-Brücke
Weser
Tiefer
Altenwall
Am Wall
Osterdeich
Contrescarpe
Präsident-Kennedy-Platz
Wallanlagen
Kunsthalle
Goethe-platz
Theater
Schnoor
Herrlichkeit
250 m

Plenary sessions overview

Plenary session 1 12/3 13:30-15:00	Speaker	Title/subject Chair: Alex Vermeulen
13:30-14:15	James Elkins	Overview of Comprehensive Pacific Pole-to-Pole Airborne Survey of Non-Greenhouse Gases
14:15-15:00	Bill Hirst	Locating and quantifying gas emission sources using remotely obtained concentration data from aircraft and ground-based sensors
15:00-15:30	Rebecca Fisher	Tracking the Elgin methane blow-out

Plenary session 2 14/3 11:00-12:30	Speaker	Title/subject Chair: Arjan Hensen
11:00-11:15	Sylvia Walter	EU Reporting issues: procedures, deadlines financial and progress reports
11:15-11:20	Alex Vermeulen	Related events EGU 2013, ICDC8, WMO Expert, GHGEurope, ACCENT
11:20-11:30		Presentation new (associated) partner(s)
11:30-11:40	Lynn Hazan	SA Database progress report
11:40-12:30	WP leaders	Reporting of parallel sessions

Plenary session 3 14/3 13:30-15:30	Speaker	Title/subject Chair: Stefan Reimann
13:30-14:00	Jean Daniel Paris	ICOS InWire
14:00-14:30	Sander Houweling	Recent advances in satellite observations of non-CO2 GHGs
14:30-15:00	Sylvia Walter	The Beauty and the Beasts: The Sea, N2O and H2
15:00-15:30	Olli Peltola	CH4 flux campaign

Detailed program of the pre-meeting and the parallel sessions

	Monday 11 March	
	NA2/NA3 Pree-meeting 11 March	**Rapporteur:**
13:30-17:30	Remaining issues concerning CH4 data correction and submission to data base (1h) Discussion on systematic error estimates (inspection of prepared data sets from individual stations, adoption of final methodology) (1.5 h) Inspection of N2O data sets (1h)	
	Tuesday 12 March	
	NA2 premeeting session contd. 12/3 9:00 – 11:30	**Rapporteur:**
9:00-11:30	Presentation of possible non-linearity corrections for different cases, discussion and adoption of methodologies H2 data evaluation issues	
	NA3 Parallel session 12/3, 16:00-17:30	**Rapporteur:**
16:00-17:30	Evaluation of station questionnaires (task 3.1) Discussion and adoption of good practice	

	recommendations (task 3.1)	
	Database issues and NRT data transmission (task 3.2) Inter-comparison exercises (Cucumbers & Traveling FTIR) (tasks 3.3 & 3.4)	
	NA4 Parallel session 12/3, 15:30-17:30	**Rapporteur: Stefan Reimann**
15:30-17:30	Introduction Update of stations, measured halocarbons/new sites/campaigns (all) Concept and plans for improving the network/ additional sites (link to national networks)/campaigns/ etc	Stefan Reimann
	NA4 Quality assurance data review (all)	
	Data submission	Fiaeraa
	NA5 Parallel session	**Rapporteur:**
	NA 6 Parallel session 12/3 16:00-17:30	**Rapporteur:**
16:00-16:15h	Overview about ongoing activities of InGOS WP6	Hermann W Bange (GEOMAR, Kiel) and WP6 partners:
16:15-16:30h	N2O and CH4 measurements in the North Atlantic Ocean: OVIDE section and Gibraltar Strait	Mercedes de la Paz Arándiga (IIM-CSIC, Vigo, Spain) et al.:
16:30-16:45h	Towards N2O and CH4 measurements on VOS lines	Ute Schuster (UEA, Norwich, UK) et al.:
16:45-17:30h	Open discussion of WP6 activities	

Wednesday 13 March

	JRA1 parallel session 13/3 9:00-10:30	**Rapporteur: Hella van Asperen**
9:00-9:20	Presentations on Spectronus performance in mixing ratio measurements	
	- FTIR performance testing at IUP	Samuel Hammer
	- FTIR performance test at LSCE	Benoit Wastine
9:20-9:30	Results from DIAL development	Iain Robinson
9:30-9:50	FTIR flux systems developments - Results of field experiments with the Bremen FTIR flux system	Hella van Asperen
9:50-10:00	Discussion on the forthcoming JRA1 campaign	Lead: Alex
10:00-10:15	Evaluation of other analysers	Lead: Martina Schmidt
	- Results of N2O monitors performance testing at LSCE	Benoit Wastine
10:15:10:30	Conclusions and way forward	Lead: Alex
	JRA2 parallel session 13/3 9:00-10:30	**Rapporteur:**
9:00 – 9:10	Tropospheric XCH4 retrieval using a stratospheric correction based on N2O	Z. Wang, U. Bremen
9:10 - 9:25	Towards an InGOS retrieval method for XCH4 and tropospheric XCH4	A. Ostler, KIT-IMK-IFU Garmisch
9:25 – 9:35	Final discussion and agreement about the InGOS-TCCON retrieval approach	lead: R. Sussmann, KIT-IMK-IFU Garmisch

9:35 – 9:50	Characterization of instrumental comparability among the InGOS-TCCON sites using gas cell measurements	F. Hase, KIT-IMK-ASF Karlsruhe
9:50 – 9:55	Reserved for potential discussion on implementation of QA/QC	Lead:F. Hase, KIT-IMK-ASF Karlsruhe
9:55 – 10:10	Validation and bias correction of GOSAT XCH4 retrievals	K. Byckling, U. Leicester
10:10 – 10:20	Discussion about the upcoming work related to satellite validation / model comparison	lead: H. Boesch, U. Leicester
10:20 – 10:30	Discussion	lead: T. Warneke, U. Bremen
	- Short introduction to ICOS-InWIRE and potential synergies with TCCON-activities in InGOS - Database - Model comparisons - Next steps in InGOS	
	JRA3 parallel session 13/3 11:00-12:30	**Rapporteur:**
11:00-11:40	task 15.1/15.2 Modeling of CH4/N2O - EDGAR-INGOS inventory 2000-2010 - status observations - draft CH4 modeling protocol for 15.1 - how to treat random and systematic errors of observations - N2O soil inventory from ORCHIDEE (Marielle Saunois)	Peter B
11:40-11:50	Task 15.4 Link to remote sensing	Peter B
11:50-12:30	Task 15.3 Model validation - status 222Rn map - status BLH / report from TRANSCOM-BLH activities - draft modeling protocol for 15.3	Ute K
10:30-12:00	**JRA5 parallel session 13/3 11:00-12:30** - Detection of new halogenated greenhouse gases in the atmosphere - Implementation of new ToF-MS instrumentation: - Further development of the existing state-of-the art in GCMS technology	**Rapporteur: Martin Vollmer**
11:00-12:30	**JRA6 Parallel Session 13/3 11:00-12:30** Short introduction (Ivan Mammarella). Update on JRA6 activities from each group (short presentations 3-4 slides). Deliverables/milestones. Footprint. InGOS flux database. Detailed plan and time schedule for joint studies/papers. Other issues	**Rapporteur:**
13:30-15:00	**NA2-3/JRA3 combined parallel session 13/3 13:30-15:00** Availability of historical data, corresponding model results, and their access for modelers and experimentalists from InGOS database	**Rapporteur:**

	Error estimates and their inclusion into inverse models	
13:30-15:30	**JRA6 Parallel Session continued**	**Rapporteur:**
	NA4/JRA5 combined parallel session 13/3 13:30-15:00	**Rapporteur:**
13:30-15:00	Next steps deliverables, next meetings Outreach (internal: website /external: publications) (all) Data submission	Reimann
13:30-15:00	**TNA Parrallel session**	**Rapporteur:**
13:30-15:00	**SA parallel session**	**Rapporteur:**

Thursday 14 March

	JRA3 parallel session 14/3 9:00-10:30	
9:00-9:30	task 15.5 Modeling of halocarbons	Dominik Brunner
9:30-10:00	task 15.6 Modeling of d13CH4	Sander Houweling
10:00-10:30	task 15.7 Network analysis and optimization	Marielle Saunois
9:00-10:30	**NA5 Parallel session**	**Rapporteur:**
9:00-10:00	**JRA1 Discussion on 2014 N_2O comparison campaign**	

ABSTRACTS PLENARY

Abstract for InGOS annual meeting 2013. Plenary: 1

Overview of Comprehensive Pacific Pole-to-Pole Airborne Survey of non-CO_2 Greenhouse Gases

James W. Elkins[1], Steven C. Wofsy[2] and the HIPPO team[3]

[1]NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305 USA; +1 303-497-6224, E-mail: james.w.elkins@noaa.gov
[2]Harvard University, Cambridge, MA 02138 USA
[3]Many US university and government organizations sponsored by the National Science Foundation, Arlington, VA 22230 USA.

The collaborative research project: "HIAPER Pole-to-Pole Observations" of carbon cycle, greenhouse gases, and black carbon study (HIPPO) has measured cross sections of atmospheric concentrations approximately pole-to-pole, from the surface to the tropopause, five times during different seasons, that spanned 3 year period. A typical survey was composed of 10-12 flights over a 27-30 day period, traveling over 48,000 km, and sampling the air from ~150 meters to 13.6 km (500-45,000 feet). A comprehensive suite of tracers of climate-forcing and ozone-depleting species are measured including CO_2, O_2:N_2 ratio, CH_4, CO, N_2O, delta-^{13}C and delta-^{18}O in CO_2, Peroxyacetyl nitrate (PAN), H_2, SF_6, COS, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halogenated solvents, organic nitrates, and selected hydrocarbons from 24 different instruments. HIPPO transects the mid-Pacific ocean with some excursions to its eastern and western coasts. HIPPO provides a unique and comprehensive global survey of atmospheric trace gases and black carbon covering the full troposphere in all seasons and multiple years. This campaign has achieved a "snapshot" of the atmosphere through measurements of temperature, pressure, humidity, and aerosol, black carbon, water vapor and ice crystals, and chemical composition, dramatically enhancing our understanding of our changing atmosphere and that of our model representations. The airborne profiles generated by these surveys also bridge the information gap between ground-based networks and satellites. This presentation will highlight the non-CO_2 greenhouse gases.

For more information: http://hippo.ornl.gov

Abstract for InGOS annual meeting 2013. Plenary: 1

Locating and quantifying gas emission sources using remotely obtained concentration data from aircraft and ground-based sensors

Bill Hirst[1], Philip Jonathan, David Randell

[1] Shell Global Solutions International, BV; 1 Kesslerpark, 2288 GS Rijswijk, Netherlands

bill.hirst@shell.com

We will first describe a method for detecting, locating and quantifying sources of gas emissions to the atmosphere using remotely obtained gas concentration data from aircraft. The method has been developed for oil and gas exploration and maps natural methane seeps that confirm the presence of hydrocarbon systems. Clearly the same technique is directly applicable to detecting, locating and quantifying emissions of many other gases of environmental concern. We demonstrate our method's performance using test flight data collected from the vicinity of known methane sources, such as: landfills and flare-stacks. We describe the principles of how the data analysis works to provide a Split Bregman L2-L1 optimisation over a grid of potential source locations. We briefly outline recent advances that enable a fully Bayesian implementation of reversible jump Markov chain Monte Carlo inference. This provides estimated values and uncertainties for the number, emission rates and locations of sources -with source locations unconstrained by a grid.

Next we demonstrate that it is relatively straightforward to devise simpler, automated, ground-based sensing systems to remotely map gas fluxes over areas up to ~100km^2 by adapting our airborne method but using path-integrated gas sensors. We have developed a system for the continuous monitoring of onshore carbon storage systems. We consider this the first practically realisable system offering full area monitoring of sequestration projects for leaks to the atmosphere; a task we believe to be unfeasible for eddy covariance methods. The same method could be readily applied to monitoring other gases, and smaller areas of interest: landfills, process plant, fugitive emission and so on.

Abstract for InGOS annual meeting 2013. Plenary: 1

Tracking the Elgin methane March 2012 blow-out

R.E. Fisher, D. Lowry, M. E. Lanoisellé, J.L. France, S. J-B. Bauguitte, J. D Lee, A. Wellpott, A. C Lewis, J. R Hopkins, G. Allan, S. O'Shea, R.T. Lidster, S. Punjabi, T.B. Ryerson, R. Camilli, S. D Mobbs, M.Gallagher, H. Coe, J.A. Pyle, A.T. Vermeulen and E.G. Nisbet

On 25 March 2012 an uncontrolled gas and condensate leak led to evacuation of the Total Elgin platform in the North Sea, which shut down 9% of UK gas production. The exact source of the leak and whether it was above or below the water level was initially unknown. Continuous airborne methane mixing ratio measurements onboard the FAAM (Facility for Airborne Atmospheric Measurement) BAe 146 research aircraft during two air sampling flights were used to quantify the mass flow rate of the gas leak. Initially on 30 March 2012 the leak was estimated as in the range 1.3±0.4 kg s^{-1}, reducing to less than half that rate by 3 April 2012. Stable isotope analysis of methane in air samples showed that the emitted gas had $\delta^{13}C_{CH4}$ -43‰, implying that the gas source was not from the main high-pressure high-temperature Elgin gas field at 5.5 km depth, but more probably due to hydrocarbons leaking into the damaged well string from the overlying Hod Formation at 4.2 km depth. The first flight occurred within 5 days of the start of the leak, demonstrating a rapid-response capability. This approach is well suited for circumstances where direct access is difficult or dangerous, and permits unbiased regulatory assessment of potential impact, independent of the emitting party, on timescales that can inform industry decision makers and assist response-planning by government.

Abstract for InGOS annual meeting 2013. Plenary: 2

The Beauty and the Beasts: The Sea, N_2O and H_2

Sylvia Walter[1], Hermann Bange[2], Annette Kock[2], Tobias Steinhoff[2], Björn Fiedler[2], Peer Fietzek[2], Thomas Röckmann[1]

[1] Institute for Marine and Atmospheric Research Utrecht (IMAU), Faculty of Physics and Astronomy / Utrecht University, Utrecht, The Netherlands
[2] GEOMAR, Helmholtz-Centre for Ocean Research, Kiel, Germany

walter@ecn.nl

Nitrous oxide (N_2O) and molecular hydrogen (H_2) are climate relevant atmospheric trace gases. They act as direct and indirect greenhouse gases and have an impact on atmospheric chemistry. For both gases an increase in concentration is expected in the future. In order to assess the potential future impact to the atmosphere a fundamental understanding of the global cycles is indispensable.

The oceans are a modest but significant source of N_2O and H_2. Numerous studies in the past have addressed the global atmospheric budget of these trace gases, but still significant uncertainties remain.

To get a more detailed picture we investigated the distribution of dissolved and atmospheric N_2O and H_2 in the Atlantic Ocean and the Baltic Sea. Both gases show distinct spatial and temporal distributions, depending on region and season. Especially the Baltic Sea as a semi–enclosed sea shows extremely dynamic features regarding the N_2O distribution.

ABSTRACTS PARALLEL SESSIONS

Abstract for InGOS annual meeting 2013. Parallel Session: WP NA4

First experiments towards a VSMOW and VPDB isotope scale for CH_4 in air reference gas

P. Sperlich, J.M. Richter, W.A. Brand

Max-Planck-Institute for Biogeochemistry (MPI-BGC), Jena, Germany

Measurement accuracy offsets between laboratories and scale contraction effects are technical pitfalls that must be identified and corrected for when isotope data of atmospheric CH_4 that were measured by multiple laboratories are merged for analysis. Measurement agreement can generally be assured by referencing the measurements to certified standard material. Unfortunately, international isotope reference material for CH_4 does not exist, which challenges the compatibility prerequisite between laboratories measuring isotope ratios of CH_4 in atmospheric samples.

We are developing two methods to incorporate the hydrogen of VSMOW and the carbon of VPDB isotope scale material into CH_4, so the CH_4 is then itself representing the VSMOW and VPDB isotope reference scales for D^2H-CH_4 and $Đ^{13}C$-CH_4, respectively. This isotope scale holding CH_4 is then diluted with CH_4-free air to be used as an atmospheric isotope reference gas. We present our approach to produce isotope reference gas for D^2H-CH_4 and show our first results.

Abstract for InGOS annual meeting 2013. Parallel Session: WPNA5

Intercomparison of eight state-of-the-art eddy covariance methane gas analysers

O. Peltola[1], A. Hensen, C. Helfter, L. Belelli Marchesini, I. Mammarella, S. Haapanala, J. Holst, J. Elbers, F. Bosweld, W.C.M. van den Bulk, T. Röckmann, A. Lindroth, T. Laurila, A.T. Vermeulen & E. Nemitz

[1] Department of Physics, University of Helsinki, P.O. Box 48, Helsinki 00014, Finland

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During the last decade several gas analysers became available that are capable of measuring methane concentration with high sampling frequency needed for eddy covariance measurements. These new gas analysers require less maintenance compared with the models used in the 1990's and they give more reliable estimates for the ecosystem scale methane fluxes. However, with different instrument types available now, their performance should be crosscompared and validated.

A gas analyser intercomparison campaign was held at Cabauw measurement station in the Netherlands between 6th and 27th of June, 2012. The campaign was organized within the InGOS FP7 project. Cabauw is well-established site with a long history in greenhouse gas monitoring and the surrounding landscape is a considerable source of methane. In total eight methane gas analysers manufactured by Picarro Inc., Los Gatos Research, Aerodyne Research Inc. and LI-COR Inc. were used in the experiment.

Tentative results show relatively good agreement between the eight methane flux estimates and they also agree with previous studies done at the site. Magnitude and variation of the flux estimates are similar. Cumulative methane emissions calculated from not gapfilled data during a 10 day episode agree within 10 %, values ranging from 190 mg(CH_4) m^{-2} to 210 mg(CH_4) m^{-2}. Comparison of random errors of the measured methane fluxes did not reveal any big differences between the instruments. Some of the gas analysers measuring methane were also capable of measuring water vapour at the same time. This is a big asset during data processing, since effect of water vapour on methane concentration measurement can then be easily corrected without need of additional water vapour measurement. The presentation will discuss the intercomparison campaign setup, instrument performance and will provide recommendations for CH_4-EC measurements.

Abstract for InGOS annual meeting 2013. Parallel Session: WP6

N2O and CH4 measurements in the North Atlantic Ocean: Ovide Section and Gibraltar Strait (GIFT)

Mercedesde la Paz [1], Fiz F. Pérez[1] , Emma I. Huertas[2] ??

[1] Instituto de Investigaciones Marinas-CSIC (Vigo, Spain)
[2] Instituto de Ciencias Marinas de Andalucía-CSIC (Cádiz, Spain)

mercedes.delapaz@iim.csic.es

The contribution of the Spanish Research Council (CSIC) to the InGOS project is aimed at increasing the knowledge on the temporal variability of N_2O and CH_4 in the North Atlantic Ocean and to contribute to the harmonization of the measurements of those gases in the ocean. The first 18 months of the InGOS project have dedicated to two different task:
First, the CSIC took part of an intercomparison exercise between different partners integrated in the WP6. This exercise consisted in the simultaneous analysis of N_2O and CH_4 dissolved in water samples from a vertical profile collected in the Bocknis Eck. Additionally, certified gas standards for GC calibration were also exchanged. A second intercomparision exercise was carried out with seawater samples collected in the North Atlantic during the CATARINA cruise.
The second task that CSIC addressed during this InGOS first stage is the study of N_2O and CH_4 in the North Atlantic based on measurements in the GIFT station (Gibraltar Fixed Time Series), and in the OVIDE section during the CATARINA project. The GIFT station located in the channel that connects the Mediterranean Sea and Atlantic Ocean. The scientific interest of this spot is not only due to the variety of oceanographic processes occurring within the Strait itself, but also because of its relevant role in the control of the content and exchange of N_2O and CH_4 between the Mediterranean and Atlantic water masses.
Regarding the OVIDE repeated hydrography section, which connects the Portuguese coast with Greenland, this was monitored to assess the vertical distribution of N_2O and CH_4 along this south-north section. The resulting database is highly valuable to examine the decadal variability of the meridional overturning circulation (MOC) and the capacity of the North Atlantic Ocean to take up and store greenhouse gases. The cruise was carried out from June 22 to July 23, 2012 under the umbrella of the CATARINA project, and N_2O and CH_4 were collected by first time in this section. The database generated for N_2O and CH_4, along with ancillary biogeochemical measurements, constitutes the perfect framework to resolve the controlling mechanisms behind the N_2O and CH_4 variability in the North Atlantic. Both dissolved gases will be analytically determined in seawater using the gas chromatographic technique. The analytical system device was developed recently in the Department of Oceanography of the IIM-CSIC, N_2O and CH_4 are measured using single phase equilibration gas chromatography, with electron capture detection (ECD) for N_2O and flame ionization detection (FID) for CH_4

Abstract for InGOS annual meeting 2013. Parallel Session: TNA5

Carbon Isotope Measurements of Methane in Europe Through INGOS TNA Activities

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Isotopic measurement of atmospheric methane is informative at a variety of scales from process studies at small scale, such as wetland chambers, through upwind and downwind measurements of point and area sources, regional measurements using moving platforms (vehicle, ship and aeroplane), to the monitoring of seasonal and inter-annual changes at background stations. Data from all scales help to understand the sources, distribution and transport of methane.

So far the INGOS TNA activities have facilitated measurements including wetlands and thawing sediment at the process scale, through to North Atlantic ship transects, Pyrenean aircraft samples, diurnal cycles in NE Italy, plus daily to weekly sampling at a Hungarian tall tower, in Lapland and Svalbard. So far there are very few measurements outside of SE England in the heavily populated regions of Europe and this needs to be addressed in the remaining 2.5 years of INGOS. Proposals for regular or diurnal sampling in these regions are actively encouraged.

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Abstract for InGOS annual meeting 2013. Please select: Parallel Session: WP14

Validation and bias correction of GOSAT XCH4 retrievals

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The first dedicated greenhouse gas sensor GOSAT was launched in 2009 and currently we have global GOSAT soundings of CO_2 and CH_4 columns for a time period of 4 years. Much progress has been achieved in instrument calibration, spectroscopy and retrieval algorithm development and retrievals of CO_2 and CH_4 approach accuracies of around 0.3% when compared to ground-based validation sites, but some regions that lack validation sites such as deserts tend to show somewhat larger biases. The GOSAT column data has now sufficient accuracy to provide constraints on surface fluxes especially when used in combination with surface data.

We present recent updates to the CH_4 retrievals from GOSAT carried out at University of Leicester and we will show the results of the validation work of GOSAT XCH4 retrievals over the European TCCON (Total Carbon Column Observing Network) sites. We also discuss our bias correction strategy for the GOSAT XCH4 retrievals. The bias correction strategy includes regression analysis together with comparisons between GOSAT data with the ground-based column measurements and comparisons of satellite and model data across Europe.

POSTERS

Abstract for InGOS annual meeting 2013. Poster

Co-located station Košetice – Kešín u Pacova

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The CzechGlobe project (operated by theGlobal Change Research Centre, Academy of Sciences of the Czech Republic) aims towards the construction of a spatially distributed research infrastructure, including atmospheric station (AS) Kešín u Pacova, consisting of 250 m high atmospheric mast. AS starts operation in 2013 and is located right next to the Košetice Observatory (49°35´ N; 15°05´E; 534 m a.s.l.), operated by the Czech Hydrometeorological Institute. The Observatory was established in 1988 as a background station specialized in air quality monitoring and research and represents Czech Republic in activities under CLRTAP (EMEP, ICP-IM) and WMO (GAW) and in several international monitoring and research projects (EUSAAR, ACTRIS). The most important research and monitoring activities of the AS Kešín u Pacova will include long-term measurement of greenhouse gases concentrations and their exchange dynamics under the Integrated Carbon Observation System (ICOS) project. The monitoring programme will include continuous measurements of CO_2, CO, CH_4, episodic measurements of other species (e.g. N_2O, C and O isotopes in CO_2 and 222-Rn), meteorological parameters and planetary boundary layer height. Besides ICOS, the co-located station will be also used for investigating the impacts of global climate change on air quality and long-range transport of air pollution. The research will be focused on pollutants with a high potential for hemispheric transport and special attention will be devoted to atmospheric aerosols. Co-located station Košetice Observatory (ACTRIS) – Kešín u Pacova (ICOS) has very good potential for successful participation in the planned network of European superstations covering both climate and air quality issues.

Abstract for InGOS annual meeting 2013. Poster WT3: WP6

Underway N_2O and CO_2 measurements in the equatorial Atlantic Ocean

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A new underway system combining a non-dispersive infrared analyzer (NDIR) and the off-axis integrated cavity output spectroscopy (OA-ICOS) technique was coupled to a continuous "Weiss-type" equilibrator in order to perform highly-resolved atmospheric and oceanic measurements of N_2O and CO_2 in the equatorial Atlantic Ocean during the MSM 18-2 and 18-3 cruises. The performance of the system was tested by comparing the results with discrete measurements using GC/ECD and an overall agreement between both methods suggests a reliable operation of the underway setup. Distinct phases on the seasonal progression of the equatorial upwelling were detected: stable conditions were found on May whereas increasing levels of N_2O and CO_2 were consistent with the start of the upwelling season on early June as inferred by the decrease in sea surface temperature (SST). N_2O and CO_2 maxima were found on July when the intensity of upwelling was the highest. Elevated N_2O supersaturations (up to 160%) led to high positive sea-air differences with the strongest source located in the vicinity of 10°W. Observed values are considerably higher than previous estimates using automated shipboard GC.

Abstract for InGOS annual meeting 2013. Poster

Stability in time of CFCs and SF_6 concentration of primary standard during their long-term measurements in air of Krakow, Poland.

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The concentrations of CFCs and sulphur hexafluoride (SF_6) in the atmosphere are on the ppt level. The CFCs are synthetic, stable, and they contribute to ozone depletion in the stratosphere. The CFCs and SF_6 also participate in intensification of the greenhouse effect.

On account of international agreements, the measurements of CFCs and SF6 in air were started. Measurement "clean" stations were situated at places outside of urban areas influence and gathered on world program – AGAGE (Advanced Global Atmospheric Gases Experiment). One of these stations is Mace Head (Ireland, 53o N, 10o W), which participates in AGAGE since 1987 (Prinn R.G. et al.) and in European InGOS (Integrated non-CO2 Greenhouse gas Observing System) program since 2011. Similar research is also conducted in Central Europe, in urban area of Krakow (Poland, 50o N, 19o E) since 1997 (Sliwka I., et al.).

The work discusses results of INP (Institute of Nuclear Physics PAN, Krakow, Poland) primary standard (USA, SIO 1993) calibration against Mace Head standard (H-184, SIO 2005) and AGH (University of Science and Technology, Krakow, Poland) standards (TA-AGH-2011-5, TA-AGH-2011-6, SIO 2005). In particular it presents, as example F-11, F-12 and SF_6 concentration stability in time (in 15 years period where at this time 11 secondary working standards have been used). Moreover comparison was made and results from INP were compared to Mace Head data. Additionally, using temporary measurement data were determined daily arithmetic means and their standard deviations. Then cut-off filtration method was used to estimate trend of the base line of F-11, F-12 and SF_6.

The authors wish to acknowledge Prof. R. Weiss from Scripts Oceanography Institute (CA, USA) for preparing of the CFC's primary standard (SIO1993) and Dr M. Maiss from Max-Planck Institute (Germany) for SF_6 calibration. Autors also thanks Prof. S. O'Doherty from University of Bristol (England) and Prof K. Rozanski from AGH University of Krakow (Poland) for calibration of the CFC's standard (SIO2005). The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) in the InGOS project under grant agreement n° 284274. The project is financed by the Polish National Science Center on the basis of Decision No. DEC-2011/01/N/ST10/07621.

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Abstract for InGOS annual meeting 2013. Poster: WP JRA1

A lidar instrument with a wavelength-tunable laser and high-sensitivity detector

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We report progress in the development of our lidar instrument. Our aim is to make vertical profile measurements of greenhouse gases using the differential absorption lidar (DIAL) technique.

The lidar transmitter provides nanosecond-duration laser pulses of 0.8 mJ energy. The wavelength is tunable over the range 1.6 to 3.1 μm, providing the flexibility to target specific absorption features in a range of gases. The receiver is a 38 cm diameter Newtonian telescope with an avalanche photodiode detector, providing high sensitivity over the wavelength range 1.1 to 1.7 μm. Atmospheric scattering by molecules and aerosols was detected to a maximum altitude of 2 km. Echoes from cloud were received from altitudes up to 6 km.

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Abstract for InGOS annual meeting 2013. Poster Session: WP JRA1

Performance of the LSCE's FTIR: Comparison with GC and CRDS analyzer.

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In October 2011, a Fourier Transform Infrared (FTIR) spectrometer has been purchased by the LSCE to measure atmospheric CO_2, CH_4, N_2O, CO mole fractions. In this poster, the FTIR performances and cross sensitivity tests will be presented as well as the current state of the $\delta^{13}CO_2$ measurements. The performances are in line with those announced by the constructor Ecotech. Several comparisons have been performed with others instruments, used by the RAMCES team at Gif-sur-Yvette's station (ICOS network), such as a Gas Chromatograph or CRDS analyzers (for the comparison of CO, CO_2, CH_4 and N_2O).

Abstract for InGOS annual meeting 2013. Poster Session

Measurements of methane emission from a temperate peatland by eddy covariance method

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Methane is one of the most important greenhouse gases and peatlands are one of the major source of this gas into the atmosphere. The measurements of the CH_4 exchange between peatlands and the atmosphere is crucial for the parameterization of the global atmospheric changes processes. The eddy covariance (EC) method is currently the most common measuring technique that enables the gas exchange measurements at the ecosystem scale. The common methane EC systems are mainly consisted of the sonic anemometer, close-path gas analyzer and dry scroll pump. The other type of pump (oil recirculating vane pump (R5 0021B, Busch, USA)) was applied for CH_4 EC system that is consisted of sonic anemometer (R3-100, Gill Instruments Ltd., Lymington, UK) and a closed-path gas analyzer (DLT-100 Los Gatos Research Inc., Mountain View, CA, USA). This system has been developed in cooperation between Poznan University of Life Sciences scientists and University of Helsinki and it has been operated since June 2012. This equipment has been installed at Rzecin peatland that is located 70km NW of Poznan, Western Poland (52° 45'N, 16° 18'E, 54 m a.s.l.). The initially obtained values have been compared with carbon dioxide fluxes and yearly carbon budget of will be analyzed at the end of 2013 after 1 year of CH4 EC operation. The initial results of the field testing of the newly developed methane eddy covariance system are presented in this poster.

Abstract for InGOS annual meeting 2013. Please select: Poster: WP14

Space-based CH_4 Column Retrievals from GOSAT

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The first observations of greenhouse gases from a dedicated satellite sensor are now available with the launch of the Japanese Greenhouse gas Observing SATellite (GOSAT) on 23 January 2009. GOSAT provides global measurements of total column CO2 and CH4 from its shortwave infrared (SWIR) bands, which are well suited to improve our knowledge of greenhouse gas surface fluxes, specifically for regions, which are poorly sampled by surface sites.

In this presentation, we will give an overview of the CH_4 retrievals from GOSAT and the validation against ground-based column observations from the Total Carbon Column Observing Network (TCCON). We report regional monthly CH_4 fluxes from GOSAT column data using an ensemble Kalman filter (EnKF) and the GEOS-Chem chemistry transport model and compare these posterior values against those inferred from surface mole fraction data.

Abstract for InGOS annual meeting 2013. Poster: WP14

FTIR observations of methane at Sodankylä

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A new FTIR spectrometer was installed at Sodankylä in February 2009. The instrument has been optimized to measure abundances of the key greenhouse gases in the atmosphere. Here we report the measured GHG time series with a focus on methane measurements and provide an overview of the upgrades of the FTIR system. Our instrument is based on Bruker IFS 125HR spectrometer and the detecting system was originally designed to contribute to the TCCON FTIR network. The detectors currently installed in our system are InGaAs (involved in TCCON network), InSb and Si. The InGaAs detector allows measurements in the 12800 - 4000 cm^{-1} spectral region, spectral windows near 6000 cm^{-1} are used for the detection of methane molecules in the atmospheric column. The processing algorithm is GFIT, which is commonly used in the TCCON network. Recently we have been able to recalculate the time series using an updated version of the GFIT software. In addition to the TCCON measurements we have also started measurements in mid infrared region as a new initiative in Sodankylä. For this purpose the data have been recorded by an InSb detector and the spectral windows around 2800 cm^{-1} have been used in the methane retrieval. These two detection systems allow comparisons of the methods and would result in a better estimate of atmospheric methane. One of the remaining challenges in the data retrieval is to separate stratospheric and tropospheric methane. HF measurements by the FTIR instrument itself are a useful indicator of stratospheric variability. In order to investigate HF and methane correlations we have involved calculations of the stratospheric methane by FinROSE, which is a middle atmospheric chemistry transport model. Finally we study possibilities to improve our methane retrieval during the time of measurements taken inside the Arctic stratospheric vortex or at the vicinity of the vortex.

Abstract for InGOS annual meeting 2013. Poster Session: WP15

Towards methane surface flux estimations by using a CarbonTracker Data Assimilation Shell

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An inverse model based on ensemble data assimilation system, CarbonTracker Data Assimilation Shell (CTDAS), has been further developed to derive optimized methane surface fluxes. It contains the latest version of TM5 chemistry-transport model driven by ERA-Interim ECMWF meteorological fields. TM5 with a two-way nested European domain and 1°x1° grid over high Northern latitudes (up to 70°N) is used to focus the estimates over Europe and European Boreal regions. EDGAR v4.2, GFED, LPJ-WhyMe and NOAA GMD Carbon Cycle GHG MBL References are used as the prior emissions for anthropogenic, fire, biosphere and ocean, respectively. Further, prior for termites is added. Atmospheric methane sink with OH is included with contributions from tropospheric and stratospheric OH. The forward model result for year 2007 is compared to the atmospheric observations in Europe in order to prepare and validate the modelling system for inverse approach.

Abstract for InGOS annual meeting 2013. Please select: Plenary/Poster/Parallel Session: WP JRA1

A survey of urban and suburban methane hotspots across five European capitals

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A growing awareness that urban and suburban areas are greenhouse gas emissions hotspots has resulted in calls to quantify and study the primary sources from cities. Of especial focus is methane, which is 25 times more potent as a greenhouse gas than CO2. Early studies have hinted at obvious sources of methane, such as industrial sites, landfills and waste water treatment plants. However, the size, density and diversity of urban and suburban areas suggest that these cannot be the only significant sources of methane emissions. Recent work has revealed that leaks from natural gas distribution networks are a major source of methane emissions in Boston, the totality of which has the potential to swamp all other sources of urban methane in accounting schemes. Such a result also indicates that not all methane sources are obvious, and that in-depth on-site investigation across large swaths of urban areas will be needed to properly appreciate the full magnitude of methane emissions from urban and suburban areas across the globe. The challenge of measuring methane emissions from large urban areas is partially mitigated by the ability to accurately and precisely quantify gas concentrations and isotopes through the use of cavity ring-down spectroscopy in a simplified mobile kit. In this presentation, we will show results of such investigations conducted between November 2011 to December 2012 in and around Amsterdam, Geneva, Istanbul, London, and Paris. A number of significant sources were common to all locations including the obvious (landfills, industrial sites and waste water treatment plants), the disconcerting (natural gas leaks at street level) and unexpected (recreational marinas, "green" public transport). The overall view from the surveys show that even though emissions sources in and around major European cities are highly diverse, they share much commonality, suggesting harmonized emissions reductions schemes across borders are possible. The results also clearly indicate that the infrastructural problems that give rise to natural gas leaks from distribution networks are very real across Europe.

Determining Methane Emissions From the Elgin North Sea Rig Using Ship-track Measurements and High Resolution Mesoscale Models

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On 27 March 2012 the natural gas exploitation rig "Elgin" on the North Sea, operated by Total, started leaking considerable amounts (company estimate 200 000 m3 per day) of methane to the atmosphere. A passenger ferry, daily sailing between IJmuiden (Netherlands) and Newcastle upon Tyne (United Kingdom) on a track just South of the Elgin rig was equipped with a high precision CRDS CH4/CO2 monitor. During April 2012 several cruises were made where the Elgin methane plume could be identified next to methane plumes from other rigs on the North Sea. Also at some land based observatories in NW Europe the Elgin methane plume could be detected. In this paper we deploy two high resolution models, WRF V3 and Flexpart, to derive emission estimates based on the observations. Despite the unique opportunity of trying to detect a single large point source on a relatively homogeneous surface, considerable model uncertainties remain; implications for inverse emission verification on more complex surface (land) areas will be discussed.

Abstract for InGOS annual meeting 2013. Poster Session

N_2O fluxes from urban soils under strong anthropopression: a case study from Kraków (Southern Poland).

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The recent advances in knowledge on global biogeochemical cycles and their feedback on the climate have resulted in growth of attention given by the scientific community to the nitrous oxide. As an important ozone-depleting and greenhouse gas, N_2O influence on the climate will rise in the future, following the predicted increase in the demand of nitrogen fertilizers – main source of nitrous oxide on a global scale. High – quality information about variability of N_2O in the atmosphere across diverse spatial and temporal scales, as well as about typical levels of emissions of this gas from natural ecosystems and anthropogenic sources, is necessary to predict the future scenarios for climate change, and, if necessary, to develop emission mitigation policies.

Currently there is still a lack of information about emissions of N_2O from both natural and human-influenced ecosystems in the region of Central Europe. To fill this gap in knowledge, a short – term measurement campaign series was devised at the University of Science and Technology in Kraków, Southern Poland, in order to quantify the N_2O emissions from the region.

Here we present the results obtained during a first two – week campaign performed on an urban grass field site of Błonia, approximately 2 km west from downtown Kraków. 5 measurements were performed with the use of well-established static – chamber techniques coupled with the GC measurements of the collected samples. In parallel to the flux measurements, selected physical properties of the ecosystem were measured in order gain knowledge on the main drivers of the emissions in this environment.

The flux values measured during this short campaign were between 0.5 – 2.7 kg $N\text{-}N_2O$ ha^{-1} y^{-1}. Higher values can be generally associated with the rainfall events occurring 1-3 days before the measurement, most probably due to the increased WFPS values inside the soil.

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