



Integrated non-CO₂ Greenhouse gas Observing System

InGOS - Integrated non-CO₂ Observing System

FP7 Integrating Activity

Grant agreement no 284274

Deliverable D1.12			
Title	Summerschool		
Delivery date Annex I	Month 36		
Actual delivery date	Month 34	14.08.2014	
Lead participant	Work package	Nature	Dissemination level
ECN (1)	1 (NA1)	Report	Restricted to Participants

„Flux measurement techniques for non-CO₂ GHG: methods, sensors, databases and modelling”

Period: 4 May – 12 May 2013

Location: Mierzecin Palace, Poland <http://www.palacmierzecin.pl/>

Local organizer: Poznan University of Life Sciences (PULS), Meteorology Department led by Prof. Janusz Olejnik

Summer school was coorganized/cosponsored by INGOS and COST Actions FP0903 (MAFor) and ES0804 (ABBA)



The nine-day summer school consisted of lectures/exercises (4 to 8 hours per day) in Mierzecin Palace Conference Centre, including on hand measurements of trace gases at Tuczno forest site and a visit to Rzecin wetland site, both operated by PULS.

The course addressed a variety of topics related to non-CO₂ GHG fluxes measurement techniques: e.g. eddy covariance technique, database and data post-processing, chamber measurements, air profile measurements, and modelling.

The cost of the summer school was about 800 Euro per trainee (excluding travel costs). We expected about 30-35 trainees, while finally there were 45 trainees taking part in

All lectures/exercises were prepared and given by 14 invited experts from 9 countries:

- 1) **Dennis Baldocchi**, University of California, USA,
- 2) **Monique Leclerc** University of Georgia, USA,
- 3) **Timo Vesala**, University of Helsinki, Finland,
- 4) **Mari Pihlatie**, University of Helsinki, Finland,
- 5) **Arjan Hansen**, ECN, The Netherlands,
- 6) **Werner Eugster**, ETH Zurich, Switzerland,
- 7) **Lutz Merbold**, ETH Zurich, Switzerland,
- 8) **Silvano Fares**, CRA, Italy,
- 9) **Dario Papale**, University of Tuscia, Italy
- 10) **Meelis Mölder**, Lund University, Sweden,
- 11) **Janusz Olejnik** PULS, Poland,
- 12) **Radek Juszczczak**, PULS, Poland,
- 13) **Bogdan Chojnicki**, PULS, Poland,
- 14) **Marek Urbaniak** PULS, Poland,

The topics addressed:

DAY 1.

- *Landscape-ecological impact of climate change* (**Janusz Olejnik** PULS, Poland)

DAY 2.

- *Role of atmospheric forcing on exchange measurements, treacherous caveats: short and long-range advection, mass conservation, normalization procedures* (**Monique Leclerc** University of Georgia, USA)
- *Biosphere-atmosphere interactions, forest, wetlands, lakes, fluxes, carbon, water and nitrogen cycles* (**Timo Vesala**, University of Helsinki, Finland)

DAY 3.

- *Nitrification, denitrification, N₂O fluxes from boxes and by eddy covariance, lasers* (**Lutz Merbold**, ETH Zurich, Switzerland)
- *EC and chamber technique of measurements - field exercises* (**Marek Urbaniak, Radoslaw Juszczak, Bogdan Chojnicki**, PULS, Poznan, Poland)

DAY 4.

- *Nitrification, denitrification, N₂O fluxes from boxes and by eddy covariance, lasers* (**Lutz Merbold**, ETH Zurich, Switzerland)
- *Methanogenesis/methanotrophy and CH₄ fluxes, plume emissions, eddy covariance, lasers* (**Arjan Hansen**, ECN, The Netherlands)

DAY 5.

- *Eddy covariance postprocessing, ustar filtering, gapfilling, partitioning, uncertainty analysis* (**Dario Papale**, University of Tuscia, Italy)
- *Excursion to Tuczno forest site* (PULS, Poznan, Poland)

DAY 6.

- *Chamber method, static chambers, chamber designs, operation, gas analysis, flux calculation, errors and uncertainties* (**Mari Pihlatie**, University of Helsinki, Finland)
- *Fast and slow ozone sensors, measuring ozone fluxes with eddy covariance, partitioning ozone fluxes between stomatal and non-stomatal* (**Silvano Fares**, CRA, Italy)

DAY 7.

- *Theoretical basics and problems with GHG measurements. Similarity theory, flux-profile relationships, roughness sublayer, stability, Bowen ratio, combined EC and profile* (**Meelis Mölder**, Lund University, Sweden)

- *Regression modeling, nonlinear models, dynamic models, prognostic models, diagnostic models, physical models. Energy budget, diurnal course, light-response curves, evapotranspiration models, simple models vs. complex models (Werner Eugster, ETH Zurich, Switzerland)*

DAY 8.

- *Regression modeling, nonlinear models, dynamic models, prognostic models, diagnostic models, physical models. Energy budget, diurnal course, light-response curves, evapotranspiration models, simple models vs. complex models (Werner Eugster, ETH Zurich, Switzerland)*
- *Summary lectures based on ESPM 228, ADVANCED TOPICS IN BIOMETOROLOGY (Dennis Baldocchi, University of California, USA)*

DAY 9.

- *Excursion to Rzecin (POLWET) wetland site (PULS, Poznan, Poland)*

There were **45 trainees** from 21 countries taking part in the Summer School. Three of them were financed by INGOS. 30 students were financed by COST Actions ABBA and MAFor. 12 students had no any support.

Detailed list of participants:

	NAME	FIRST NAME	COUNTRY
1	Cavalli	Daniela	Italy
2	Davidson	Scot	UK
3	Eyer	Simon	Switzerland
4	Franj	Ana	Serbia
5	Gelybo	Gyorgyi	Hungary
6	Hambley	Graham	UK
7	Hansen	Raili	Estonia

**COST Action FP0903 (MAFor)**

CLIMATE CHANGE AND FOREST MITIGATION
AND ADAPTATION IN A POLLUTED
ENVIRONMENT
Chair of the Action: Dr Elena Paoletti, IPP-CNR

**COST Action ES0804 (ABBA)**

ADVANCING THE INTEGRATED MONITORING
OF TRACE GAS EXCHANGE BETWEEN
BIOSPHERE AND ATMOSPHERE
Chair of the Action: Dr Lutz Merbold, ETH Zurich

**FP 7 Project:**

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Chair of the Project:
Dr Alex Vermeulen, ECN

**Poznan University
of Life Sciences**

Department of Meteorology
Chair of the Department:
Dr Janusz Olejnik

8	Hermans	Renee	UK
9	Jordan	Sabine	Sweden
10	Kasak	Kuno	Estonia
11	Kondrlova	Elena	Slovakia
12	Lyshede	Bjarne	Germany
13	Mari	Teresa	Spain
14	Nogu	Liisi	Sweden
15	Novotna	Beata	Slovakia
16	Osterwalder	Stefan	Switzerland
17	Panfil	Monika	Poland
18	Perez-Priego	Oscar	Spain
19	Pilipovic	Andrej	Serbia
20	Roland	Marilyn	Belgium
21	Sakowska	Karolina	Italy
22	Savi	Flavia	Italy
23	Szinyei	Dalma	Hungary
24	Tas	Eran	Israel
25	Tejedor	Javier	Germany
26	Toth	Eszter	Hungary
27	Tu	Sofia	Finland
28	Ziemblńska	Klaudia	Poland
29	Zięba	Damian	Poland
30	Sidabras	Nerijus	Lithuania
31	Helbig	Manuel	Canada
32	Li	Hong	China
33	Wilkman	Eric	USA
NO REIMBURSEMENT			
34	Dusek	Jiri	Czech Republik
35	Herrmann	Andreas	Germany
36	Nagy	Laura	Germany
37	Krisans	Oskars	Latvia
38	Goerres	Carolyn-Monika	Belgium
39	Kleniewska	Małgorzata	Poland
40	Bolewski	Tymoteusz	Poland
41	Jensen	Rasmus	Denmark

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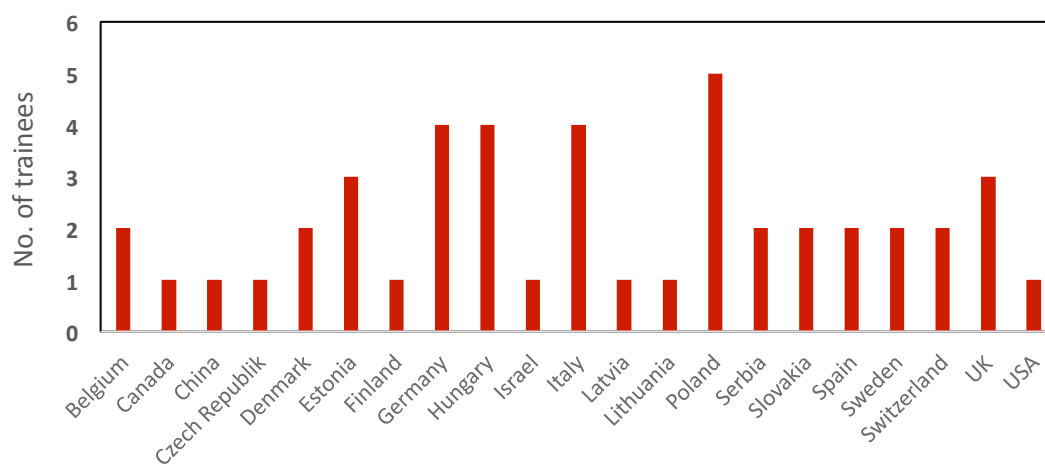
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42	Varolo	Elisa	Italy
43	Westergaard-Nielsen	Andreas	Denmark
44	Krzyszczak	Jaromir	Poland
45	Jarveoja	Jarvi	Estonia

Number of students per country



Gender balance: 24 female, 21 male



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Sumer School trainees at the Tuczno site



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Summer School program

	SAT	SUN	MON	TUE	WED	THU	FRI	SAT	SUN
	4 MAY	5 MAY	6 MAY	7 MAY	8 MAY	9 MAY	10 MAY	11 MAY	12 MAY
Breakfast		7:30 - 8:30	7:30 - 8:30	7:30 - 8:30	7:30 - 8:30	7:30 - 8:30	7:30 - 8:30	7:30 - 8:30	7:30 - 8:30
LECTURE / EXERCISE 1		9:00 - 10:30	9:00 - 10:30	9:00 - 10:30	9:00 - 10:30	9:00 - 10:30	9:00 - 10:30	9:00 - 10:30	9:00 - 10:30
Coffee break		10:30 - 11:00	10:30 - 11:00	10:30 - 11:00	10:30 - 11:00	10:30 - 11:00	10:30 - 11:00	10:30 - 11:00	10:30 - 11:00
LECTURE / EXERCISE 2		11:00 - 12:30	11:00 - 12:30	11:00 - 12:30	11:00 - 12:30	11:00 - 12:30	11:00 - 12:30	11:00 - 12:30	11:00 - 12:30
Lunch		12:30 - 13:30	12:30 - 13:30	12:30 - 13:30	12:30 - 13:30	12:30 - 13:30	12:30 - 13:30	12:30 - 13:30	12:30 - 13:30
LECTURE / EXERCISE 3		13:30 - 15:00	13:30 - 15:00	13:30 - 15:00	13:30 - 15:00	13:30 - 15:00	13:30 - 15:00	13:30 - 15:00	13:30 - 15:00
Coffee break		15:00 - 15:30	15:00 - 15:30	15:00 - 15:30	15:00 - 15:30	15:00 - 15:30	15:00 - 15:30	15:00 - 15:30	15:00 - 15:30
LECTURE / EXERCISE 4	17:00 - 18:30	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00	15:30 - 17:00
Free time	18:30 - 19:00	17:00 - 19:00	17:00 - 19:30	17:00 - 18:30	17:00 - 19:00	17:00 - 19:00	17:00 - 18:30	17:00 - 19:00	17:00 - 19:00
Suggestion of activity during free time		Private communication with trainer or/and walk around Mierzecin park	Private communication with trainer or/and 2 hrs. of saunas and swimming pool (free of charge)	Private communication with trainer or/and own activities	Private communication with trainer or/and own activities	Private communication with trainer or/and own activities	Private communication with trainer or/and own activities	Private communication with trainer or/and own activities	Private communication with trainer or/and own activities
Dinner	19:00 - 20:00	19:00 - 20:00	19:30 - 20:30	18:30 - 19:30	19:00 - 20:00	19:00 - 20:00	18:30 - 19:30	19:00 - 20:00	19:00 - 20:30
Place of dinner	Destylarnia restaurant	Gala Dinner, Palace Ballroom	Palace restaurant	ALTANA (outdoors)	Destylarnia restaurant	Billard Pub	ALTANA (outdoors)	Destylarnia restaurant	Destylarnia restaurant
Informal meeting and research discussions involving trainers and trainees	20:30 - 22:00	20:00 - 22:30	21:00 - 22:30	19:30 - 22:30	20:00 - 23:30	20:00 - 22:00	19:30 - 22:30	20:00 - 22:30	20:30 - 21:30
Place of informal meeting (leading person)	Let me introduce... yourself and "Solidarity for a change" (movie) Room SK (Janusz)	Palace Ballroom (Janusz)	Room SK (Klaudia)	ALTANA (outdoors) around the campfire (Bogdan)	Destylarnia restaurant (Janusz/Klaudia)	Billard Pub or interesting movies about climate change in Room SK (Radek)	ALTANA (outdoors) or Bowling Hall (Janusz)	Destylarnia restaurant (Klaudia / trainees)	Farewell meeting Room SK (Janusz)

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	Group A 15 trainees		Group B 15 trainees		Group C 15 trainees				Group D 22 trainees			Group E 23 trainees						
		Key words	Role of atmospheric forcing on exchange measurements, treacherous caveats: short and long-range advection, mass conservation, normalization procedures	Biosphere-atmosphere interactions, forest, wetlands, lakes, fluxes, carbon, water and nitrogen cycles	Nitrification, denitrification, N2O fluxes from boxes and by eddy covariance, lasers	Methanogenesis/ methanotrophy and CH4 fluxes, plume emissions, eddy covariance, lasers	Eddy covariance post processing, ustar filtering, gapfilling, partitioning, uncertainty analysis	Chamber method, static chambers, chamber designs, operation, gas analysis, flux calculation, errors and uncertainties	Fast and slow ozone sensors, measuring ozone fluxes with eddy covariance, partitioning ozone fluxes between stomatal and non-stomatal	Theoretical basics and problems with GHG measurements. Similarity theory, flux-profile relationships, roughness sublayer, stability, Bowen ratio, combined EC and profile method	Regression modeling, nonlinear models, dynamic models, prognostic models, diagnostic models, physical models. Energy budget, diurnal course, light-response curves, evapotranspiration models, simple models vs. complex models	Summary lectures based on ESPM 228, ADVANCED TOPICS IN BIOMETOROLGY	Landscape-ecological impact of climate change	EC and chamber technique of measurements field exercises	EC and chamber technique of measurements field exercises	EC and chamber technique of measurements field exercises		
		Subject	Introduction 1	Introduction 2	N2O processes	CH4 processes	Database and eddy data post-processing	measurements by chambers	Ozone measurement by eddy covariance	Air profiles method	Modelling	Summary lectures	FIRST: Welcome lecture LAST: Final lecture and survey	EC Measurement exercise and site visit	Chamber Measurement exercise and site visit	Hardware (radiation) exercise and site visit		
Morning	9:00 - 10:30																	
Noon	11:00 - 12:30	TRAINER Mierzecin	Monique Leclerc, University of Georgia, USA	Timo Vesala, Uni. of Helsinki, Finland	Lutz Merbold ETH Zurich, Switzerland	Arjan Hensen ECN, The Netherlands	Dario Papale University of Tuscia, Italy	Mari Pihlatie Uni. of Helsinki, Finland	Silvano Fares ARC, Italy	Meelis Mölder University of Lund, Sweden	Werner Eugster ETH, Zurich, Switzerland	Baldocchi Berkeley University, USA	Janusz Olejnik PULS, Poland	Marek Urbaniak PULS, Poland	Radek Juszczak PULS, Poland	Bogdan Chojnicki PULS, Poland		
Afternoon	13:30 - 15:00	Arrival/Departure	4.05 - 6.05	5.05 - 8.05	5.05 - 9.05	7.05 - 9.08	7.05 - 9.05	7.05 - 10.05	7.05 - 10.05	9.05 - 11.05	9.05 - 12.05	08.05 - 12.05	4.05 - 13.05	4.05 - 09.05	5.05 - 10.05	4.05 - 09.05		
Evening	15:30 - 17:00	Number of lecture/exercises	2	2	3 (4)	3 (4)	2	2	2	2	3 (4)	4	4	3 (5)	2 (4)	2 (4)		
Evening communication	17:00 - 17:45	Date of lecture/exercise	5 MAY	5 MAY	6, 7 MAY	7 MAY	8 MAY	9 MAY	9 MAY	10 MAY	11, 12 MAY	11, 12 MAY	4, 8, 12 MAY	6, 8, 12 MAY	6, 12 MAY	6, 8 MAY		
SAT	4 MAY	Evening											L1 Room SK					
SUN	5 MAY	Morning	L2 Room SK															
		Noon	L3 Room SK															
		Afternoon		L4 Room SK														
		Evening		L5 Room SK														
		PC	Room SK	Room A														
MON	6 MAY	Morning												E1 Park & Room B (Group A)	E2 Park & Room SK (Group B)	E3 Park & Room A (Group C)		
		Noon												E1 Park & Room B (Group A)	E2 Park & Room SK (Group B)	E3 Park & Room A (Group C)		
		Afternoon												E1 Park & Room B (Group A)	E2 Park & Room SK (Group B)	E3 Park & Room A (Group C)		
		Evening			L6 Room SK													
		PC													Room SK	Room A		
TUE	7 MAY	Morning				L7 Room SK												
		Noon			E4 Park (Group D)	E5 Stable (Group E)												
		Afternoon			E4 PARK (Group D)	E5 Stable (Group D)												
		Evening			E6 Room A (N2O)	E7 Room SK (CH4)												
		PC			Room A	Room SK								Room B				
WED	8 MAY	Morning					L8 Room SK											
		Noon					E8 Room SK											
		Afternoon											E9 Tuczno site (Group A)	E10 Tuczno site (Group B)		E11 Tuczno site (Group C)		
		Evening																
		PC					Room A											
THU	9 MAY	Morning					L9 Room SK											
		Noon					E11 Room SK											
		Afternoon							L10 Room SK									
		Evening							E10 Room SK									
		PC					Room SK	Room A										
FRI	10 MAY	Morning								L11 Room SK								
		Noon								E12 Room SK								
		Afternoon									L12 Room SK							
		Evening									L13 Room SK							
		PC								Room SK	Room A							
SAT	11 MAY	Morning									E13 Room SK (group D)							
		Noon									E13 Room SK (group E)							
		Afternoon										L14 Room SK						
		Evening										L15 Room SK						
		PC										Room SK						
SUN	12 MAY	Morning										L16 Room SK						
		Noon											E14 Rzeczn site (Group A)	E15 Rzeczn site (Group B)	E16 Rzeczn site (Group C)			
		Afternoon											L17 Room SK					
		Evening																
		PC										Room SK						