MEMO²: MEthane goes MObile – MEasurements and MOdelling

MEMO² – 1st Intensive campaign, associated to the 1st MEMO² school

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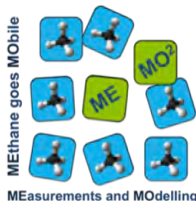
Milestone MS2

Delivery month Annex I	12		
Actual delivery month	12		
Lead participant: UU / ECN	Work package: 1	Nature: R	Dissemination level: PU
Version: 1			

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Executive Summary

Within MEMO2 several measurement and intercomparison campaigns are planned to obtain joint data. The first intensive campaign was associated to the 1st MEMO2 school. Both events were closely connected and will be reported together.

The school and the campaign, held from 5 to 16 February in Schoorl, The Netherlands (see circle, Figure 1), were organized by Arjan Hensen and his team from the partner organization ECN, supported by Utrecht University (UU) and the University of Groningen (RUG). All beneficiaries of MEMO2 and the partner organization Shell, Picarro, TNO, and OonKay were involved in the preparation and scientific program of the school, e.g. by giving lectures during the school or accompanying the field work and supporting data analyses at the end of the campaign.

This was the first MEMO2 network event after finishing the recruitment, and all ESRs presented their individual projects by posters to the group. The group of recruited ESRs has differing educational backgrounds and can be roughly divided into a modelling and a measuring group. During the project a close collaboration is expected from the ESRs, which requests a basic understanding of both, fieldwork and modelling.

Fig. 1: Location of the 1st MEMO2 school / campaign in the northern part of the Netherlands

So the first part of the activity aimed on imparting basic scientific knowledge of the project (MEMO2 school), including campaign planning and modelling. The second part aimed on the intercomparison of instruments of the measurement groups and introducing all students to fieldwork and data analysis methods (MEMO2 campaign), based on a learning-by-doing approach.

In total 8 teams from ECN, UU, AGH, UVSQ, LU, RHUL, UHEI, and RUG brought their measurement instruments and gathered data during the joint fieldwork. During the first week the ESRs followed theoretical lectures while the instruments ran together to obtain data for an intercomparison of instruments. After the theoretical part, the ESRs were introduced to the instruments and started first joint sampling along a dedicated transect. Also a joint tracer release experiment (CH_4, N_2O, C_2H_2) and a drone flight with AirCore sampling were conducted.

All teams sampled together along several distinct routes with different sources, including farms, biogas plants, gas installations, or landfills. Besides the joint activities, the ESRs got the opportunity to choose transects for measurements that are interesting for their individual projects. For isotopic analysis discrete bag samples were taken by RHUL, UU, and UHEI, to be analysed later in the home labs.

During the last days of the campaign the data were shared and the ESRs learned how to compile their data sets, how to analyse and evaluate data. They discussed data quality and required metadata. Based on the data from the campaign the ESRs operated and compared different models such as different Gaussian plume models, a 3-D CFD model, and a Lagrangian dispersion models (GRAL-GRAMM).

Due to the amount and complexity of the gathered data the data analyses will continue beyond the campaign. Selected results will be shown at the 1st Annual Meeting and included in the 1st Annual Progress Report.

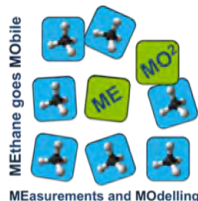The event was awarded 6 ECTS, and each ESR got a certificate of participation.
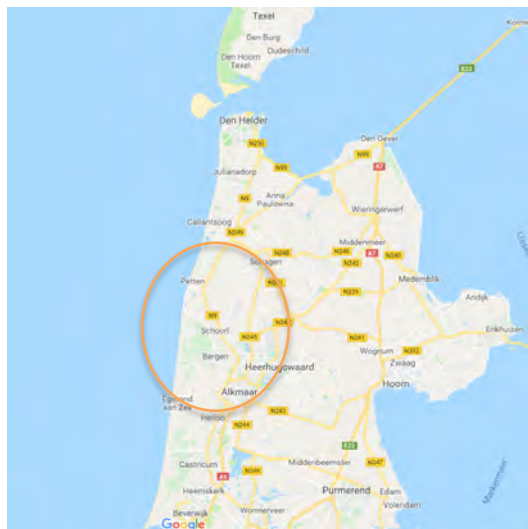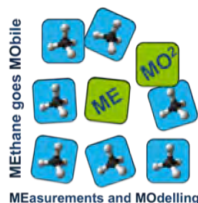
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MS2 - 1st Intensive campaign, associated to the 1st MEMO² school

1. Participants

The MEMO² school and the associated campaign were an obligatory network event for all ESRs. Besides them, participants from all beneficiaries of MEMO² and the partner organization Shell, Picarro, TNO, and OonKay were involved (Picture 1).

Table 1 gives an overview of participants (in alphabetical order):
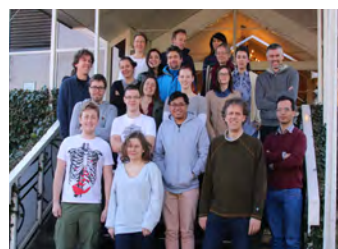
Pic. 1: Group of ESRs and some of the PIs during the school

Table 1: overview of participants of the 1st MEMO² school / campaign

Participant	Last name	First name	Affiliation	Participant	Last name	First name	Affiliation
1	Bakkaloglu*	Semra	RHUL	20	Lowry	Dave	RHUL
2	Bartyzel	Jakub	AGH	21	Maazallahi*	Hossein	UU
3	Bousquet	Philippe	UVSQ	22	Menout*	Malika	UU
4	Brunner	Dominik	EMPA	23	Morales*	Randulph	EMPA
5	Chen	Huilin	RUG	24	Necki	Jaroslaw	AGH
6	Defratyka*	Sara	UVSQ	25	Nisbet	Euan	RHUL
7	Denier v. Gon	Hugo	TNO	26	Oonk	Hans	OONKAY
8	Eckhardt	Henrik	UHEI	27	Raznjevic*	Anja	WU
9	Emmenegger	Lukas	EMPA	28	Rinne	Janne	LU
10	Fernandez*	Julianne	RHUL	29	Röckmann	Thomas	UU
11	Fisher	Rebecca	RHUL	30	Schmidt	Martina	UHEI
12	Hensen	Arjan	ECN	31	Stanicki*	Badrudin	EMPA
13	Hirst	Bill	SHELL	32	Stanisavljevi*	Mila	AGH
14	Hofmann	Magdalena	PICARRO	33	Szenasi*	Barbara	UVSQ
15	Holst	Jutta	LU	34	v.Heerwaarden	Chiel	WU
16	Korben*	Piotr	UHEI	35	Vinkovic*	Katarina	RUG
17	Krol	Maarten	WU	36	Walter	Sylvia	UU
18	Lakomiec*	Patryk	LU	37	Winkler	Renato	PICARRO
19	Lanoisellé	Mathias	RHUL	38	Yver-Kwok	Camille	UVSQ

*ESRs

2. Preparation

Both the school and the campaign were part of the proposal. The school was initially planned to be held in France, but it was decided during the Kickoff Meeting that it would be more beneficial for the ESRs to combine the 1st MEMO² school with the 1st intensive measurement campaign in the Netherlands, ensuring a closely related theoretical and practical introduction. The preparation started 10 months in advance and was continuously developed during regular tele-conferences within the consortium.

As ECN organised the practical part of the event and offered their lab facilities for the campaign, the area around Petten, NL, was chosen as sampling location (Figure 1). Thus, the lectures and data evaluation were planned close by, at the Slothotel Igesz in Schagen (www.igesz.nl). Due to bankruptcy, the hotel was closed with immediate effect one week before the school started, so the location changed short-term to the Jan van Scorel Hotel in Schoorl (www.hoteljanvanscorel.nl).
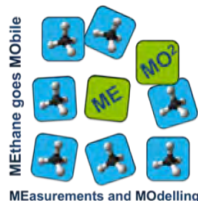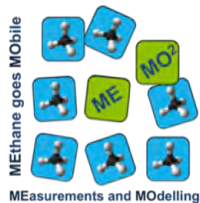
3. 1st MEMO² school

During the project a close collaboration is expected from the ESRs, which requests a basic understanding of both, fieldwork and modelling. The MEMO² school was scheduled for two weeks, divided in a theoretical part in the first week and a practical part in the second. As the group of recruited ESRs has different educational backgrounds, the first part of the activity aimed on imparting basic scientific knowledge relevant to the project. The school included general and specific scientific courses as well as lectures about complementary skills, a poster session, and informal discussion rounds to stimulate communication and networking (Table 2).

The second part aimed on the intercomparison of instruments of the measurement groups and introducing all students to fieldwork and data analyses (MEMO² campaign). During the first week available instruments were already running at ECN for intercomparison.

Table 2: Agenda of the 1st MEMO² school / campaign

	Mon., 5 Feb.	Tues., 6 Feb.	Wed., 7 Feb.	Thurs., 8 Feb.	Fri., 9 Feb.	Sat., 10 Feb.	Sun., 11 Feb.	Mon. 12 Feb.	Tues., 13 Feb.	Wed., 14 Feb.	Thurs., 15 Feb.	Fri., 16 Feb.
8.30 - 9.30		Atmospheric methane budget – Euan Nisbet	Atmospheric physics – Maarten Krol	Methane measurement techniques – Lukas Emmenegger	campaign	campaign	Day off Suggestions visit Texel Amsterdam musea Free day	campaign	Data evaluation	Data evaluation	Data evaluation	Presentation of results
9.30 - 10.30		Greenhouse effect and societal relevance – Euan Nisbet	Atmospheric chemistry – Thomas Röckmann									
10.30 - 11.00		coffee break	coffee break	coffee break								
11.00 - 12.00		Global biogeo-chemical cycles – Janne Rinne	Atmospheric methane modeling – Philippe Bousquet	Isotopes in atmospheric sciences – Dave Lowry								
12.00 - 13.00			Dispersion modeling – Chiel van Heerwaarden									Evaluation
13.00 - 14.00		lunch	lunch	lunch						lunch	lunch	lunch
14.00 - 15.00	poster presentation	Experimental design and sampling strategies – Bill Hirst	Metrology, statistics and uncertainties – Jarek Necki	Picarro training – Renato Winckler	3D modeling – Chiel van Heerwaarden				Data evaluation (using tracer method) – Camille Yver-Kwok	Data evaluation	Presentation of results	
15.00 - 16.00	poster presentation		Methane Inventories – Jarek Necki		Activity units for getting emission factors – Hugo Denier v.d. Gon, Hans Oonk							
16.00 - 16.30	poster presentation	coffee break	coffee break	coffee break	coffee break				coffee break	coffee break	coffee break	
16.30 - 17.30	poster presentation	Intellectual property rights – Bill Hirst	Application of mass-balance models to the global methane cycle – Maarten Krol	Harmonisation of measurement methods – Martina Schmidt	career planning, CDP discussion Time management, teaching skills – Philippe Bousquet				How to work with B2SHARE – Jutta Holst	Arduino platform - Jakub Bartyzel	Arduino platform - Jakub Bartyzel	
17.30 - 18.30												
18.30 - 20.00												
20.00 informal panel discussions			Ethics in science and good scientific practice, Research integrity and scientific misconduct - Maarten Krol, Philippe Bousquet	Gender issues in scientific collaboration – Martina Schmidt, Lukas Emmenegger								

4. 1st Intensive MEMO[2] campaign

The measurement campaign took place in the area of Petten and around Alkmaar. All teams performed mobile measurements together along several distinct routes with different sources, some examples are given in Figure 2. The transects were chosen based on the type and size of sources such as farms, biogas plants, peak gas installation, or landfills. For several sources it was possible to sample at different distances.

Besides the joint activities, the students got the opportunity to choose transects for measurements interesting for their individual projects. For isotopic analysis discrete bag samples were taken by RHUL, UU, and UHEI, to be analysed later in the home labs. Preliminary results were presented by the students during the last two half day sessions of the school. Further elaborated results will be presented at the 1st Annual Meeting and in individual progress reports of the ESR projects in the 1st Annual Progress Report.
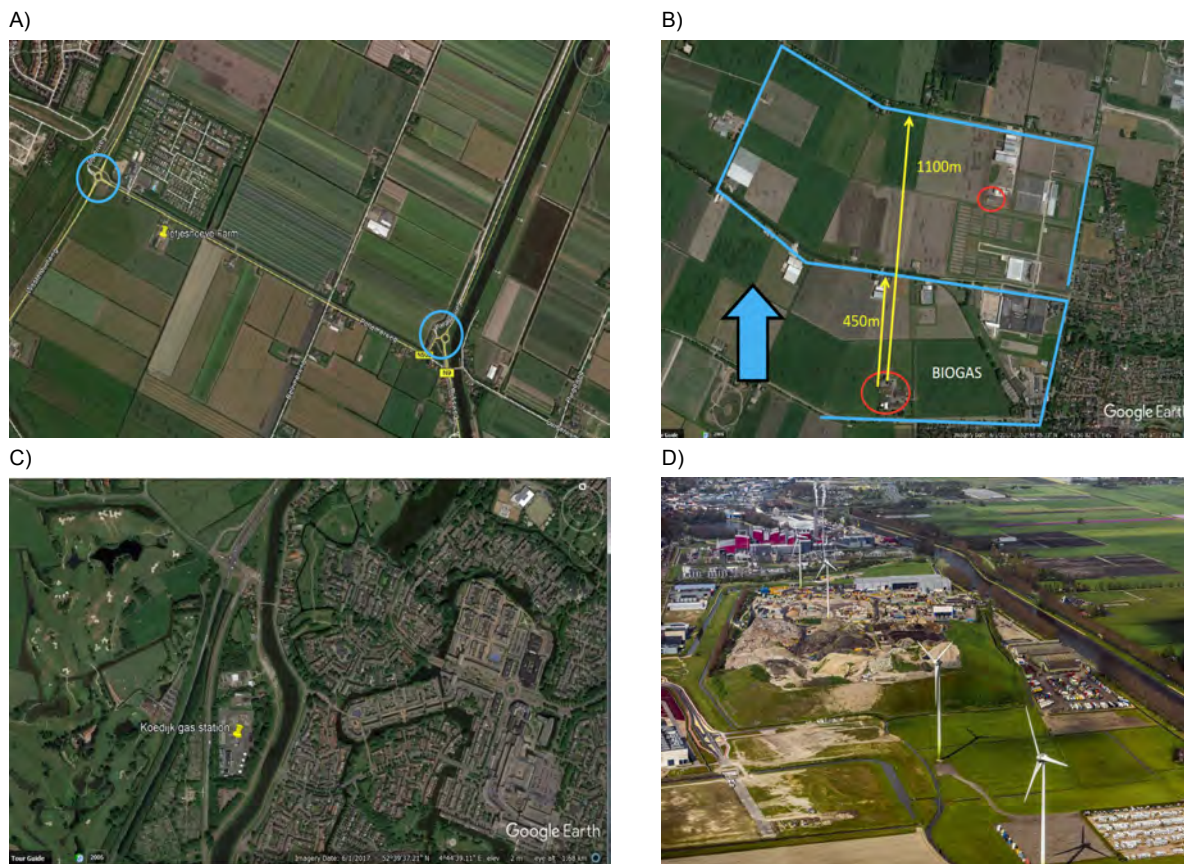
A)

B)

C)

D)

Fig. 2: Sampling transects – A) Lefjeshoeve - transect along a farm with cowhouse; B) Biogas - transect along a biogas plant and a farm; C) Gas station north of Alkmaar; D) Landfill south of Alkmaar

Most teams used Picarro analysers to measure methane, but also instruments from Los Gatos and Aerodyne. Besides methane, carbon dioxide (CO_2), carbon monoxide (CO), nitrous oxide (N_2O), water vapor (H_2O), ethene (C_2H_6) and acetylene (C_2H_2) were measured, as well as meteorological parameters necessary for data analyses.
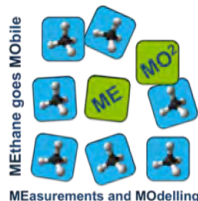
Table 3: overview of used instrumentation and measured species during the campaign

Partner	Mobile platform	Instrumentation	Measurement species
RUG	Drone DJI Inspire I	UAV AirCore & Picarro	CH_4, CO_2, CO, H_2O
UHEI	Van VW	Picarro G2201i	CH_4, CO_2, $^{13}CH_4$
LSCE	Van	Picarro G2201i and G2203	CH_4, CO_2, $^{13}CH_4$, $^{13}CO_2$, C_2H_2
RHUL	Car 4WD	Picarro G2301, LGR UMEA and bag sampling	CH_4, CO_2, C_2H_6/CH_4 ratios + $^{13}CH_4$ in lab
AGH	Car 4WD	Picarro G2201i, 2D wind, T,P,H, PM10, PM2.5	CH_4, CO_2, $^{13}CH_4$
ECN	Van	Aerodyne QCL & Ecophysics NOx & Lasx PM	CH_4, C_2H_6, CO_2, N_2O, CO, (NH_3), NO, NO_2, PM1-10
EMPA	Drone, not yet available	Homebuilt CH4 QCLAS	CH_4, H_2O
LU	aircraft not available	Picarro 13CH4 available	CH_4, $^{13}CH_4$
UU	Van	Picarro CO2 & CH4 and Picarro backpack. LGR	CH_4, CO_2
Other field equipment			
ECN	Meteo 1	wind profile 5 heights Gill 2 D, Vaiasla all weather station	ws,wd,rh,t,p,rain, H, u*
ECN	Meteo 2	sonic Gill - WMPro	ws,wd,H, u*
ECN	Trailer (mobile lab)	vaisala all weather station and space for instruments	ws,wd,rh,t,p,rain
UU	Meteo		

5. Evaluation

The ESRs were provided with templates to evaluate the individual lectures and also the whole school, including the practical campaign part and miscellaneous items such as accommodation, catering and networking. The feedback was anonymous.

Figure 3 shows the mean evaluation of the lectures and lecturers (18 lectures in total), ranking from 1 (not satisfying) to 4 (good). The overall mean ranking was 3.7 ± 0.8. The evaluation of the whole event is given in Figure 4. The ESRs evaluated separately the school in general, the theoretical and practical part, and the miscellaneous activities such as accommodation, catering and networking. The overall evaluation mean (green dot) is 3.2 ± 0.8.

For both, the evaluation of the lectures / lecturers and the evaluation of the whole event, the standard deviations reflect the different levels of the ESRs. As the group of recruited ESRs has differing educational backgrounds and can be roughly divided into a modelling and a measuring group, lectures were partly experienced as too low or too high level. Several ESRs gave individual comments, which will taken into account for the organisation of future events. The overall results and the individual comments clearly show, that the event in general was highly appreciated by the ESRs and experienced as interesting and useful for there projects and personal development.
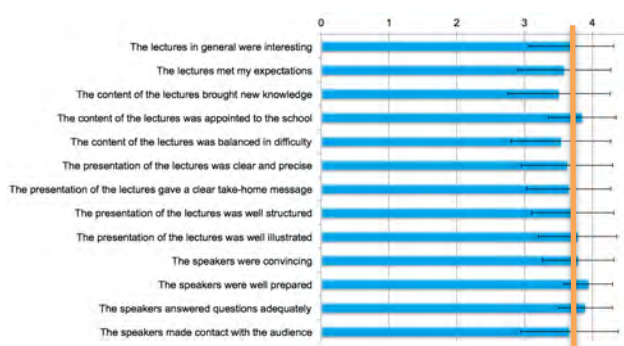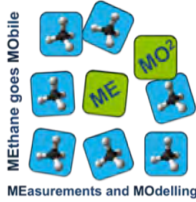

Fig. 3: ESR evaluation of in total 18 lectures. The orange line gives the overall mean ranking (3.7 out of 4) of the lectures and lecturers.

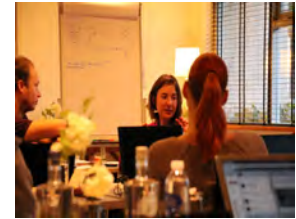Fig. 4: Evaluation of the school in total. The overall evaluation mean (green dot) is 3.2 ± 0.8.

7. Some impressions
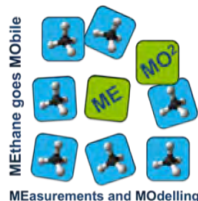
Poster session and lectures

Preparation for mobile CH_4 measurements

Set up of the tracer release experiment and miscellaneous meteorological equipment

Drone flight with AireCore sampling

6. History of the milestone

Table 4: Deliverable history

Version	Author(s)	Date	Changes
1		23-24 March 2017	Started discussion changing country for the school and combining school and campaign
		April - June 2017	Decision to go to Schagen, NL, as final location and start local organisation
		June – December 2017	Finalizing the core agenda and local organisation of the school, start campaign organisation
		December – February 2017 / 2018	Finalizing campaign preparation
		February 2018	Last organisational fine tuning, short-term change of location to Schoorl, NL
		5 – 16 February 2018	1st MEMO² school / intensive campaign held
		March 2018	Report submitted to EU