

MEMO²: MEthane goes MObile – MEasurements and MOdelling

Workshop on Gaussian plume and dispersion models

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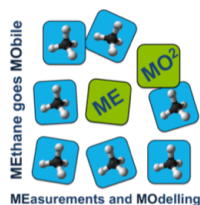
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Milestone MS3

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Actual delivery month	20		
Lead participant: UHEI	Work package: 1	Nature: R	Dissemination level: PU
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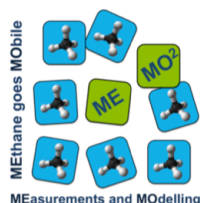


MEMO²: MEthane goes MObile – MEasurements and MOdelling

Milestone MS3: Workshop on Gaussian plume and dispersion models

Table of contents

1. Executive Summary	3
2. Aim and content of the workshop	3
3. Agenda.....	5
4. Participant list	5
5. History of the document.....	6



MEMO²: METHANE goes MOBILE – MEASUREMENTS and MODELLING

Milestone MS3: Workshop on Gaussian plume and dispersion models

1. Executive Summary

Within MEMO², Partner Heidelberg University organized a workshop on “Gaussian plume and dispersion models”, held from 9 to 10 October 2018 in Heidelberg (Germany).

Gaussian plume and dispersion models are useful tools to derive emissions rates from mobile CH₄ measurements performed within MEMO². The aim of the “Workshop on Gaussian plume and dispersion models” was to teach theoretical basics on plume dispersion, practice with two exercises and to discuss the measurement strategy for best model use.

The workshop was attended by 12 MEMO² ESRs, and 2 additional UHEI/DLR postgraduates. Presenters were partners from the MEMO² project, namely Dominik Brunner (EMPA), Bill Hirst (Shell), Gregoire Broquet (UVSQ) and Chiel van Heerwaarden (WU).

All students and presenters arrived already the afternoon/evening before the start of the workshop to join a shared dinner in the Hotel. During the first day, we had three lectures, followed by discussion of exercise 1, which the students had to solve as homework. In the afternoon, one ESRs present the progress of his modelling activity and the proposed the possibility for other students to make use of the GRAM/GRAL model. The second day was focused on exercise 2, which the students had to solve during the workshop.

On the evening of Tuesday 9th we walked along the famous philosophers walk to the Heidelberg old town, with a view of the castle before converging on the typical German restaurant for another enjoyable meal.

The workshop was held the week before start of semester. This facilitated the institute seminar room of appropriate size for the group. Coffee breaks and a sandwich lunch were prepared by group members of UHEI, to keep the costs down that no workshop fee was necessary.

2. Aim and content of the workshop

Within Work Package 1 (WP1) of the MEMO² project, ESRs are trained to identify and quantify CH₄ emissions by monitoring CH₄ plumes of major anthropogenic emitters in Europe from mobile platforms. The identifications of the sources are performed by mobile measurement of CH₄ from vehicles and plains or UAVs. Together with ESRs of WP3 (Modelling: A multi-scale interpretation framework for CH₄ observations, the measured plumes will be used to derive CH₄ emission factors with different dispersion and Gaussian models.

The aim of this workshop was to train the ESR in the use of simple Gaussian plume models and make them aware of several pitfalls. More complex dispersion models and tracer methods were presented and possibility of exchange of knowledge and accessibility of models were discussed.

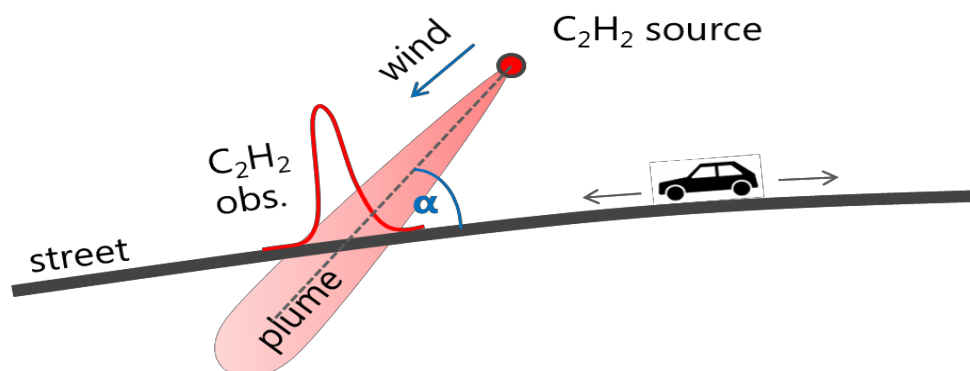
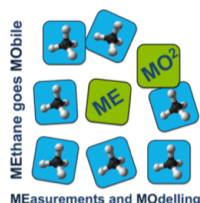


Fig. 1: Sketch of the situation for exercise 1 designed by Dominik Brunner (EMPA)



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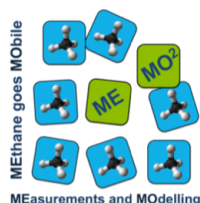
Milestone MS3: Workshop on Gaussian plume and dispersion models

The background knowledge on the use of models, as well as the programming skills differed much in this group of students. In order to overcome this and to make fully use of the two workshop days, an exercise was distributed as homework to all students prior to this workshop. This exercise refers to real data measured by LSCE. The tracer Acetylene (C_2H_2) was released at a constant rate and the plumes of methane and acetylene were intercepted multiple times downwind of the source. This exercise focused on the C_2H_2 measurements only to quantify the C_2H_2 source using a Gaussian plume model. The exercise was divided into several parts building on top of each other. It was recommended solving the exercise with a programming language such as python, R or Matlab. The solution exercise was discussed during the first day of the workshop.

During the lectures given by Dominik Brunner (EMPA), Bill Hirst (Shell), Gregoire Broquet (UVSQ) and Chiel van Heerwaarden (WU) more complicated dispersion models were introduced and discussed. Randolph Morales (ESR12, EMPA) presented the GRAL/GRAM model and showed the possibility for other ESRs to make use of this model. A second exercise was prepared by Chiel van Heerwaarden and the students had to work in small groups on the solution. The workshop ended with identification of important additional measurements in order to improve the use of mobile data in models. Here two aspects had a main focus: synchronisation of all clocks during measurements and the use of a 3-D sonic Anemometer to measure horizontal wind. The workshop closed with a coffee break and discussion in small groups for further cooperation and planning of secondments.



Fig. 2: Impressions of the workshop: Top left – ESR students following the morning presentation. Bottom left – Evening event philosophers walk with view to the castle and old town. Top right – Bill Hirst presenting basics of plume dispersion, Bottom right – lunch break on the university campus. Photos taken by Patryk Łakomiec.



MEMO²: MEthane goes MObile – MEasurements and MOdelling

Milestone MS3: Workshop on Gaussian plume and dispersion models

3. Agenda

Preparation before the workshop: Each student should solve Exercise 1, created by Dominik Brunner. The exercise is divided into several parts building on top of each other. The final results will depend on how carefully the individual steps are solved.

Monday, 8 October: arrival in Heidelberg and joint dinner

Tuesday, 9 October

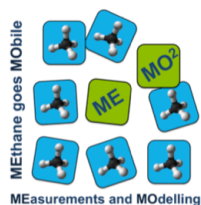
9:00 – 9:15 Welcome and logistics (Martina Schmidt)
 9:15 – 10:30 Lectures on atmospheric dispersion and Gaussian plume models
 Bill Hirst: Gas Dispersion modelling 101
 Chiel van Heerwaarden: Estimating dispersion from turbulence data
 10:30– 11:00 Coffee break
 11:00-13:00 Discussion and presentation of Exercise 1.
 13:00-14:00 Lunch break
 14:00-15:00 Presentation on more complex dispersion models and fitting methods
 Dominik Brunner: "Lagrangian particle dispersion models"
 Gregoire Broquet: Tracer release and statistical inversion of the atmospheric transport modelling
 15:00 – 15:45 Presentations by PhD students
 15:45-16:00 Coffee break
 16:00- 18:00 Start of Exercise 2 ("Synthetic data" from Chiel)
 18:15 Walk to the Heidelberg historic old town via Philosophenweg (4-5 km = 1 hour walk)
 19:30 Joint dinner

Wednesday, 10 October

9:00 – 10:30 Continuation of Exercise 2
 10:30 – 11:00 Coffee break
 11:00-13:00 Exercise 3: application to own case
 13:00-13:45 Lunch break
 13:45-16:00 Discussion of results and conclusion of workshop

4. Participant list

MEMO ² ESRs	External participants
ESR1: Piotr Korben	Johannes Kammerer (UHEI Master student)
ESR2: Katarina Vinkovic	Andreas Luther (DLR/UHEI PhD student)
ESR3: Mila Stanisavljevic	
ESR4: Patryk Lakomiec	Organisation
ESR5: Sara Defratyka	Martina Schmidt
ESR7: Semra Bakkaloglu	Dominik Brunner
ESR8: Malika Menoud	
ESR9: Julianne Fernandez	Referents
ESR10: Hossein Maazallahi	Dominik Brunner (EMPA)
ESR11: Anja Raznjevic	Chiel van Heerwaarden (WU)
ESR12: Randolph Morales	Gregoire Broquet (LSCE)
ESR13: Barbara Szenasi	Bill Hirst (Shell)



MEMO²: METHane goes MOBILE – MEasurements and MOdelling

Milestone MS3: Workshop on Gaussian plume and dispersion models

5. History of the document

Version	Author(s)	Date	Changes
1 st version	Martina Schmidt	15 November	